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DEPARTMENT OF DEFENSE HANDBOOK

RESISTORS,

SELECTION AND USE OF

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FOREWORD

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

2. This handbook provides selected standard resistors for use in the design of Department of Defense equipment. This handbook is for guidance only. This handbook cannot be cited as a requirement. If it is, the contractor does not have to comply.

    a. The application information and performance characteristics contained in this handbook are offered for guidance and are not to be considered as mandatory. Additional application information will be added when coordinated with the Department of Defense.

    b. Additional resistor types of this handbook will be developed as standard resistors of a given specification family are selected and coordinated with the Department of Defense.

3. Comments, suggestions, or questions on this document should be addressed to: DLA Land and Maritime, ATTN: VAT, Post Office Box 3990, Columbus, Ohio 43218-3990 or by email Resistor@dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at https://assist.dla.mil.

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1. SCOPE

1.1 Scope. This handbook is for guidance only. This handbook cannot be cited as a requirement. If it is, the contractor does not have to comply. This handbook consists of the following:

a. Selected standard resistor types, for use in the design and manufacturer of Department of Defense equipment under the jurisdiction of the Department of Defense.
b. Guides for the choice and application of resistors for use in Department of Defense equipment.

Requirements for resistors listed in this handbook are covered in the applicable specification (see 2.1). When it has been determined that circuit requirements cannot be met by using resistor styles or characteristics listed in the applicable specifications, the design engineer should, with the approval of the cognizant activity, select from the applicable resistor specification styles or characteristics not listed herein.

1.2 Purpose of handbook.

a. To provide the equipment designer with a selection of standard resistors for use in most Department of Defense applications.
b. To control and minimize the variety of resistors used in Department of Defense equipment in order to facilitate logistic support of equipment in the field.
c. To outline criteria pertaining to the use, choice, and application of resistors in Department of Defense equipment.

1.3 DLA Land and Maritime SpecFinder. DLA Land and Maritime SpecFinder is an online tool that can be used in conjunction with this handbook. The SpecFinder is a search tool to help you find standardization documents by selecting device characteristics. If you require certain performance features but don't know which documents might meet your needs, the Specification Finder will help you narrow your search down to a few candidate documents. The tool can be found at: https://landandmaritimeapps.dla.mil/Programs/SpecFind/default.aspx.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed below are not necessarily all of the documents referenced herein, but are those needed to understand the information provided by this handbook.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-PRF-19	-	Resistor, Variable, Wirewound, Low operating Temperature, General Specification For.
MIL-PRF-22	-	Resistor, Variable, Wirewound, Power Type, General Specification For.
MIL-PRF-26	-	Resistor, Fixed, Wirewound, Power Type, General Specification For.
MIL-PRF-29	-	Resistor, Fixed, Meter Multiplier, External, High Voltage, Ferrule Terminal Type, General Specification For
MIL-PRF-94	-	Resistor, Variable, Composition, General Specification For

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DEPARTMENT OF DEFENSE SPECIFICATIONS (continued)

MIL-PRF-914	-	Resistor Network, Fixed, Film, Surface Mount, Nonestablished Reliability, and Established Reliability, General Specification For
MIL-PRF-12934	-	Resistor, Variable, Precision, General Specification For
MIL-PRF-18546	-	Resistor, Fixed, Wirewound, Power Type, Chassis Mounted, General Specification For.
MIL-PRF-22097	-	Resistor, Variable, Nonwirewound, Adjustment Type, General Specification For
MIL-PRF-22684	-	Resistor, Fixed, Film, Insulated, General Specification For
MIL-PRF-23648	-	Resistor, Thermal (Thermistor) Insulated, General Specification For
MIL-PRF-27208	-	Resistor, Variable, Wirewound, Nonprecision, General Specification For
MIL-PRF-32159	-	Resistor, Chip, Fixed, Film, Zero Ohm, Industrial, High Reliability, Space Level, General Specification For
MIL-PRF-32192	-	Resistor, Chip, Thermal (Thermistor), General Specification For
MIL-PRF-39002	-	Resistor, Variable, Wirewound, Semi-Precision, General Specification For
MIL-PRF-39005	-	Resistor, Fixed, Wirewound, Accurate, Nonestablished Reliability, Established Reliability, General Specification For
MIL-PRF-39007	-	Resistor, Fixed, Wirewound, Power Type, Nonestablished Reliability, Established Reliability, and Space Level, General Specification For
MIL-PRF-39009	-	Resistor, Fixed, Wirewound, Power Type, Chassis Mounted, Nonestablished Reliability, and Established Reliability, General Specification For
MIL-PRF-39015	-	Resistor, Variable, Wirewound, Nonestablished Reliability, and Established Reliability, General Specification For
MIL-PRF-39017	-	Resistor, Fixed, Film, Insulated, Nonestablished Reliability, and Established Reliability, General Specification For
MIL-PRF-39023	-	Resistor, Variable, Nonwirewound, Precision, General Specification For
MIL-PRF-39035	-	Resistor, Variable, Nonwirewound, Adjustment Type, Nonestablished Reliability, and Established Reliability, General Specification For
MIL-PRF-49462	-	Resistor, Fixed, Film, High Voltage, General Specification For
MIL-PRF-49465	-	Resistor, Fixed, Metal Element, Power Type, Very Low Resistance Values, General Specification For
MIL-PRF-55182	-	Resistor, Fixed, Film, Nonestablished Reliability, Established Reliability, and Space Level, General Specification For
MIL-PRF-55342	-	Resistor, Chip, Fixed, Film, Nonestablished Reliability, Established Reliability, Space Level, General Specification For
MIL-PRF-83401	-	Resistor Network, Fixed, Film, and Capacitor-Resistor Networks, Ceramic Capacitor and Fixed Film Resistor, General Specification For
MIL-PRF-83530	-	Resistor, Voltage Sensitive, Varistor, Metal-Oxide, General Specification For

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DEPARTMENT OF DEFENSE SPECIFICATIONS (continued)

MIL-R-93	-	Resistor, Fixed, Wirewound, Accurate, General Specification For (Inactive for New Design)
MIL-R-10509	-	Resistor, Fixed, Film, High Stability, General Specification For (Inactive for New Design)
MIL-R-39008	-	Resistor, Fixed, Composition, Insulated, Established Reliability, General Specification For (CANCELLED)

(Copies of these documents are available online at http://quicksearch.dla.mil).

2.3 Order of precedence Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein (except for related specification sheets), the text of this document takes precedence unless otherwise noted. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. DEFINITIONS

3.1 Rating and design application terms. A list of common terms used in rating and design application of resistors is as follows:

a. Ambient operating temperature. The temperature of the air surrounding an object, neglecting small localized variations.

b. Contact resistance variation. The apparent resistance seen between the wiper and the resistance element when the wiper is energized with a specified current and moved over the adjustment travel in either direction at a constant speed. The output variations are measured over a specified frequency bandwidth, exclusive of the effects due to roll-on or roll-off of the terminations and is expressed in ohms or percent of total nominal resistance.

c. Critical value of resistance. For a given voltage rating and a given power rating, there is only one value of resistance that will dissipate full rated power at rated voltage. This value of resistance is commonly referred to as the "critical value of resistance." For values of resistance below the critical value, the maximum (element) voltage is never reached and, for values of resistance above critical value, the power dissipated becomes lower than rated. Figure 1 shows this relationship.

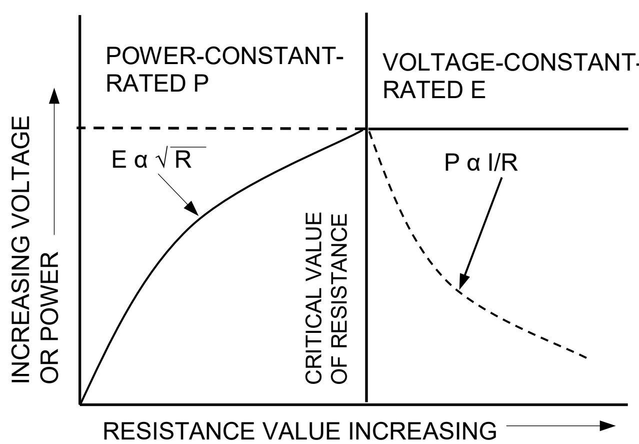

FIGURE 1. Maximum working voltage and critical value of resistance.

d. Resistance value deviations. From its nominal value; it is the percent change from normal resistor tolerance + percent change from TCR + percent change from self-heating.

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e. Dielectric strength. The ultimate breakdown voltage of the dielectric or insulation of the resistor when the voltage is applied between the case and all terminals tied together. Dielectric strength is usually specified at sea level and simulated high altitude air pressures.

f. Hot-spot temperature. As defined in Department of Defense specifications, the maximum temperature measured on the resistor due to both internal heating and the ambient operating temperature. Maximum hot-spot temperature is predicated on thermal limits of the materials and the design. The hot-spot temperature is also usually established as the top temperature on the derating curve at which the resistor is derated to zero power.

g. Insulation resistance. The dc resistance measured between all terminals connected together and the case, exterior insulation, or external hardware.

h. Maximum (element) working voltage ($E = \sqrt{PR}$). The maximum voltage stress (dc or rms) that may be applied to the resistor (resistance element) is a function of (1) the materials used, (2) the required performance, and (3) the physical dimensions. (See figure 1)

i. Noise. An unwanted voltage fluctuation generated within the resistor. Total noise of a resistor always includes Johnson noise 1/ which is dependent only on the resistance value and temperature of the resistance element. Depending on the type of element and construction, total noise may also include noise caused by current flow, and noise caused by cracked bodies and loose end caps or leads. For variable resistors, noise may also be caused by jumping of contact over turns of wire and by an imperfect electrical path between the contact and resistance element.

j. Resistance temperature characteristic (temperature coefficient). The magnitude of change in resistance due to temperature, usually expressed in percent per degree Celsius or parts per million per degree Celsius (ppm/^{O}C). If the changes are linear over the operating temperature range, the parameter is known as “temperature coefficient”.

k. Resistance tolerance. The permissible deviation of the manufactured resistance value (expressed in percent) from the specified nominal resistance value at standard (or stated) environmental conditions.

l. Stability. The overall ability of a resistor to maintain its initial resistance value over extended periods of time when subjected to any combination of environmental conditions and electrical stresses.

4. GENERAL REQUIREMENTS

4.1 Choice of resistor types. The variety of resistor types used in any particular equipment should be the minimum necessary to obtain satisfactory performance. Where more than one type of resistor may be used in a given application (such as, fixed, film, insulated versus fixed, film, insulated (high stability)), consideration should be given to cost and availability (use of strategic materials, multiple sources). The resistors identified in this handbook meet all the criteria for standard types (see 1.1 and 4.4).

4.1.1 Reliability. Where quantitative reliability requirements specified as part of the equipment requirements are such that the use of parts with established reliability is dictated, such parts should be selected from the established reliability specification.

4.1.2 Qualified sources. After a preliminary selection of the desired resistor has been made, reference should be made to the applicable qualified products list for listing of qualified sources.

4.2 Item identification. A type designation for any resistor referenced herein may be constructed as indicated in the example given in the applicable section. The Part Identification Number (PIN) designations are depicted in the applicable specification.

4.3 Conflict of requirements. This handbook provides selected standard resistors for use in the design of Department of Defense equipment. This handbook is for guidance only. This handbook cannot be sited as a requirement.

1/ Johnson, J. B., “Thermal Agitation of Electricity in Conductors,” Physical Review, volume 32 (July, 1928, 97-109).

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4.4 Criteria for inclusion in this handbook. The criteria for the inclusion of resistor types in this handbook are as follows:

a. The resistor should be the best type available for general use in military equipment.
b. Coordinated Department of Defense specifications should be available (see 2.1).
c. Resistors should be in production, or should have been in production.

5. DETAILED REQUIREMENTS

5.1 Detailed requirements. The detailed requirements for standard resistor types are contained in the applicable specification of this handbook.

6. NOTES

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

6.1 Intended use. General application notes are as indicated in the appendix.

6.2 Subject term (key word) listing.

Adjustable
Chip
Established reliability
Film
Fixed
Lead-screw
Network
Nonestablished reliability
Nonwirewound
Space level
Surface mount
Thermistor
Trimmer
Variable
Varistor
Wirewound

6.3 Tin whisker growth. The use of alloys with tin content greater than 97 percent, by mass, may exhibit tin whisker growth problems after manufacture. Tin whiskers may occur anytime from a day to years after manufacture and can develop under typical operating conditions, on products that use such materials. Conformal coatings applied over top of a whisker-prone surface will not prevent the formation of tin whiskers. Alloys of 3 percent lead, by mass, have shown to inhibit the growth of tin whiskers. For additional information on this matter, refer to ASTM-B545 (Standard Specification for Electrodeposited Coatings of Tin).

6.4 Change from previous issue. The margins of this specification are marked with vertical lines to indicate modifications generated by this amendment. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations.

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APPENDIX A

GENERAL APPLICATION INFORMATION

A.1 SCOPE

A.1.1 Scope. The application information in this handbook is designed to help in the selection of specified resistors (application information pertaining to specific resistors types is contained in the applicable sections). As with other types of components, the most important thing a user must decide is which of the numerous types of resistors will be best for use in the military equipment being designed. Proper selection in its broadest sense is the first step in building reliable equipment. To properly select the resistors to be used, the user must know as much as possible about the types from which to choose. The advantages and disadvantages should be known, as well as their behavior under various environmental conditions, their construction, and their effect on circuits and the effect of circuits on them, and a knowledge of what makes resistors fail. This appendix is not a mandatory part of the handbook. The information contained herein is intended for guidance only.

A.1.1.1 Resistor types. All variable and fixed resistors, of the types widely used in electronic equipment, can be grouped into one of three basic types. They are “composition” types, “film” types, or “wirewound” types. As the name indicates, the “composition” type is made of a mixture of resistive material and a binder which are molded into the proper shape and resistance value. The “film” type is composed of a resistive film deposited on, or inside of, an insulating cylinder or filament. The “wirewound” type is made up of resistance wire, wound on an insulated form. These basic types differ from each other in size, cost, resistance range, power rating, and general characteristics. Some are better than others for particular purposes; no one type has all of the best characteristics. The choice among them, therefore, depends on the requirements, both initial and long-term; the environment in which they must exist; and numerous other factors which the designer must understand. The designer must realize that the summaries of the requirements of a particular application must be taken into consideration and compared with the advantages and drawbacks of each of the several types, before a final choice is made. Tables A-I, A-II, A-III, A-IV, A-V and A-VI provide a selection guide for fixed and variable resistors included in this handbook.

The Department of Defense resistor specification categories are shown in figure A-1.

A.1.1.2 Resistance Tolerances. Resistance tolerances will be coded as follows:

Code	Tolerance	Code	Tolerance	Code	Tolerance
V	0.0005	B	0.1	H	3.0
T	0.01	D	0.5	J	5.0
Q	0.02	F	1.0	K	10.0
A	0.05	G	2.0		

A.2 APPLICABLE DOCUMENTS.

A.2.1 General. The documents listed below are not necessarily all of the documents referenced herein, but are those needed to understand the information provided by this handbook.

A.2.2 Non-Government publications. The following documents form a part of this document to the extent specified herein

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B545 - Standard Specification for Electrodeposited Coatings of Tin

(Copies of this document are available from at http://www.astm.org/)

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A.3 GENERAL CHARACTERISTICS OF RESISTORS

A.3.1 General characteristics of fixed resistors.

A.3.1.1 Fixed, Film Resistors. See table A-I.

A.3.1.1.1 MIL-PRF-22684, RL42...TX, Resistor, Fixed, Film, Insulated. These fixed, film, resistors have semi-precision characteristics and small sizes. The sizes and wattage rating are comparable to those of MIL-R-39008 (cancelled) and stability is between MIL-R-39008 and MIL-PRF-55182. Design parameter tolerances are looser than those of MIL-PRF-55182 but good stability makes them desirable in most electronic circuits. These resistors are capable of full load operation at an ambient temperature of +70^{O}C and have a resistance-temperature characteristic of ±200 parts per million per degree Celsius (ppm/^{O}C). See MIL-PRF-39017, RLR, Resistor, Fixed, Film, Insulated, Nonestablished Reliability and Established Reliability.

NOTE: MIL-PRF-22684 designers are cautioned in using these resistors in pulse application. The usage requirements for the resistor must be evaluated for each application. See Appendix E.

A.3.1.1.2 MIL-PRF-32159, RCZ, Resistor, Chip, Fixed, Film, Zero Ohm, Industrial, High Reliability, Space Level. These fixed, film, chip resistors are primarily intended for incorporation into surface mount applications. This specification has three product levels, a space level “T” part number with 100 percent burn-in and screening, a high reliability 100 percent burn-in screened “M” part number level, and a part level “C” using the manufacturer’s inspection system to validate conformance.

NOTE:
1. FR level is in percent per 1000 hours.
2. MIL-PRF-32159 designers are cautioned in using these resistors in pulse application. The usage requirements for the resistor must be evaluated for each application. See Appendix E.

A.3.1.1.3 MIL-PRF-39017, RLR, Resistor, Fixed, Film, Insulated, Nonestablished Reliability and Established Reliability. These fixed, film, resistors have semi-precision characteristics and small sizes. The sizes and wattage rating are comparable to those of MIL-R-39008 (cancelled) and stability is between MIL-R-39008 and MIL-PRF-55182. Design parameter tolerances are looser than those of MIL-PRF-55182 but good stability makes them desirable in most electronic circuits. These resistors are capable of full load operation at an ambient temperature of +70^{O}C and have a resistance-temperature characteristic of ±100 ppm/^{O}C and ±350 ppm/^{O}C. The resistors have product levels ranging from Non-ER, and a life failure rate (FR) 1.0 percent to 0.001 percent per 1,000 hours. The FR levels are established at a 60 percent confidence level on basis of life tests.
Replaces MIL-PRF-22684 RL42...TX, Resistor, Fixed, Film, Insulated inactive specification sheets.

NOTE:
1. FR level is in percent per 1000 hours.
2. MIL-PRF-39017 designers are cautioned in using these resistors in pulse application. The usage requirements for the resistor must be evaluated for each application. See Appendix E.

A.3.1.1.4 MIL-PRF-49462, RHV, Resistor, Fixed, Film, High Voltage. These resistors are intended for use in electronic circuits where high voltages and high resistance values are used.

NOTE: MIL-PRF-49462 designers are cautioned in using these resistors in pulse application. The usage requirements for the resistor must be evaluated for each application. See Appendix E.

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A.3.1.1.5 MIL-PRF-49465, RLV, Resistor, Fixed, Metal Element, Power Type, Very Low Resistance Value. These are power type, very low resistance values (1 ohm and below), fixed resistors (2 terminal and 4 terminal) for use in electrical, electronic, communications, and associated equipment. Included are precision resistors of 1, 3, and 5 percent, and 5 and 10 percent initial resistance tolerances with power ratings ranging from 2 watts to 10 watts at +25^{O}C derated to 0 watts at +275^{O}C

NOTE: MIL-PRF-49465 designers are cautioned in using these resistors in pulse application. The usage requirements for the resistor must be evaluated for each application. See Appendix E.

A.3.1.1.6 MIL-PRF-55182, RNC, RNN, or RNR, Resistor, Fixed, Film, Nonestablished Reliability, Established Reliability, and Space Level. These fixed, film resistors including both hermetically and nonhermetically sealed types possess a high degree of stability, with respect to time, under severe environmental conditions, with an established reliability. Use in circuits requiring higher stability than provided by composition resistors or film, insulated, resistors, and where ac frequency requirements are critical. Operation is satisfactory from dc to 100 megahertz (MHz). Metal films are characterized by low temperature coefficients and are usable for ambient temperatures of +125^{O}C or higher with small degradation. The resistors have product levels ranging from Non-ER (C), a life failure rate (FR) 1.0 (M) percent to 0.001 (S) percent per 1,000 hours and space level (T). The FR levels are established at a 60 percent confidence level on basis of life tests. Replaces MIL-R-10509 RN, Resistor, Fixed, Film (High Stability) inactive specification sheets.

NOTE:
1. FR level is in percent per 1000 hours.
2. MIL-PRF-55182 designers are cautioned in using these resistors in pulse application. The usage requirements for the resistor must be evaluated for each application. See Appendix E.

A.3.1.1.7 MIL-PRF-55342, RM, Resistor, Chip, Fixed, Film, Nonestablished Reliability, Established Reliability, and Space Level. These chip resistors are primarily intended for incorporation into hybrid microelectronic circuits. They are designed for use in critical circuitry where stability, long life, reliable operation, and accuracy are of prime importance. These resistors are uncased, leadless chip devices and possess a high degree of stability with respect to time, under severe environmental conditions. The resistors have product levels ranging from Non-ER (C), a life failure rate (FR) 1.0 (M) percent to 0.001 (S) or (V) and space level (T). The FR levels are established at a 60 percent confidence level on basis of life tests.

NOTE:
1. FR level is in percent per 1000 hours.
2. MIL-PRF-55342 designers are cautioned in using these resistors in pulse application. The usage requirements for the resistor must be evaluated for each application. See Appendix E.

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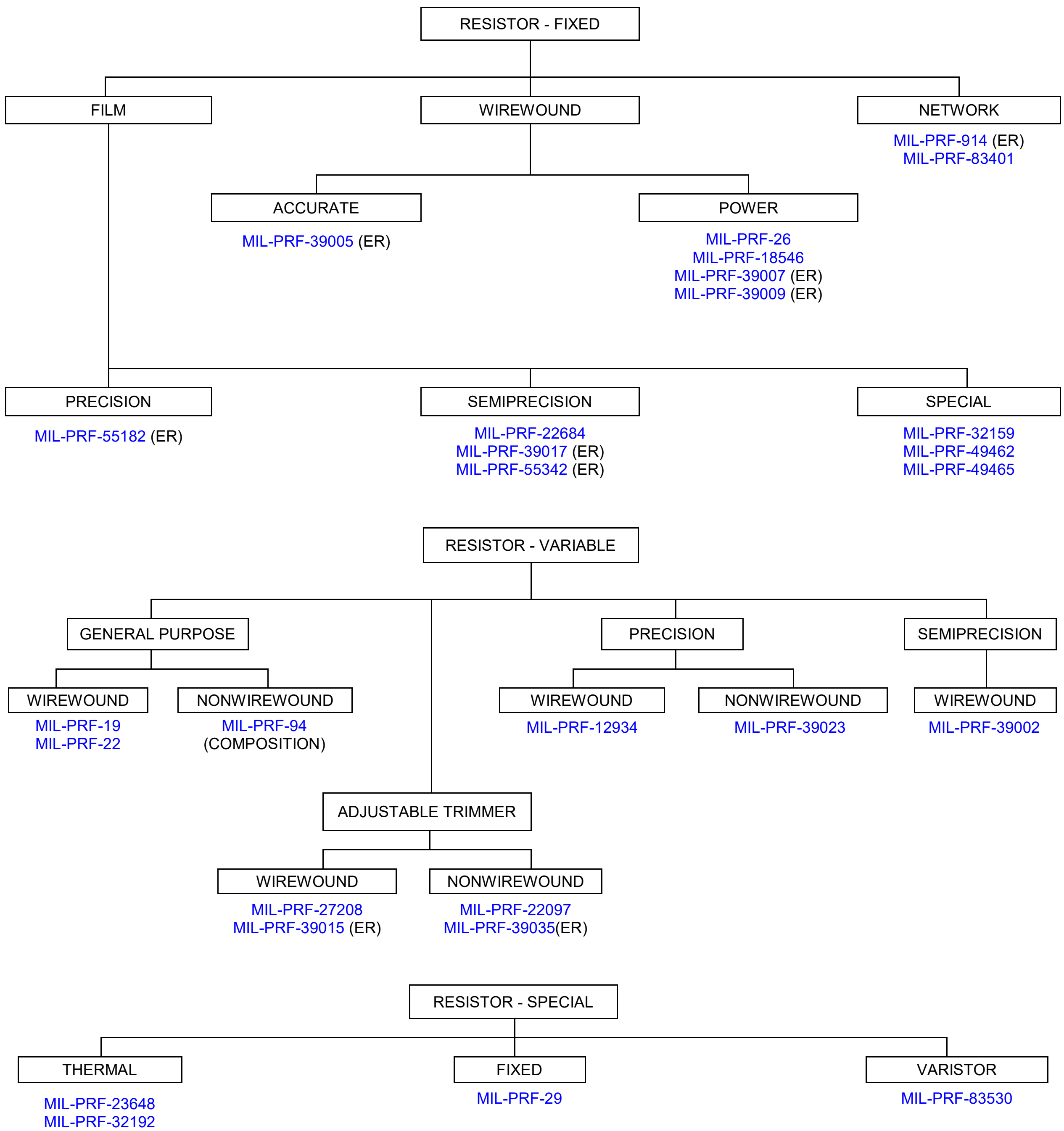

FIGURE A-1. Department of Defense resistor specification categories.

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TABLE A-I. Fixed film resistor selection guidance table.

MIL-PRF-22684 - Resistor, Fixed, Film, Insulated							
Specification sheet	Styles available	Power and max voltage ratings	Resistance tolerance (± percent) (see A.1.1.2)	Resistance range (ohms)	Resistance temperature coefficient (ppm/°C)	Maximum body size (inches) and Configuration (see figure A-2)	
MIL-PRF-22684/8	RL42…TX	2 W 500 V	G and J	10 to 1.5 M	±200	0.728 x 0.336	A

MIL-PRF-32159 - Resistor, Chip, Fixed, Film, Zero Ohm, Industrial, High Reliability, Space Level							
Specification sheet	Styles available	Power ratings	Termination	Current rating (in amps)	Max resistance value (in ohms)	Maximum body size (inches) and Configuration (see figure A-2)	
MIL-PRF-32159/1	RCZ0502	0.050	B,G,W C,D U,T	1.30 0.91 0.58	0.030 0.060 0.150	0.061 X 0.030	T
MIL-PRF-32159/2	RCZ0505	0.100	B,G,W C,D U,T	2.20 1.80 1.00	0.020 0.030 0.100	0.061 X 0.055	
MIL-PRF-32159/3	RCZ1005	0.200	B,G,W C,D U,T	2.80 2.20 1.30	0.025 0.040 0.125	0.112 X 0.055	
MIL-PRF-32159/4	RCZ1505	0.150	B,G,W C,D U,T	2.10 1.70 0.93	0.035 0.050 0.175	0.162 X 0.055	
MIL-PRF-32159/5	RCZ2208	0.225	B,G,W C,D U,T	2.50 2.10 1.10	0.035 0.050 0.175	0.237 X 0.080	
MIL-PRF-32159/6	RCZ0705	0.150	B,G,W C,D U,T	2.70 2.20 1.20	0.020 0.030 0.100	0.086 X 0.055	
MIL-PRF-32159/7	RCZ1206	0.225	B,G,W C,D U,T	3.20 2.50 1.40	0.025 0.040 0.125	0.134 X 0.068	
MIL-PRF-32159/8	RCZ2010	0.800	B,G,W C,D U,T	5.70 4.50 2.50	0.025 0.040 0.125	0.218 X 0.103	
MIL-PRF-32159/9	RCZ2512	1.000	B,G,W C,D U,T	6.30 5.00 2.80	0.025 0.040 0.125	0.268 X 0.129	
MIL-PRF-32159/10	RCZ1010	0.500	B,G,W C,D U,T	5.00 4.10 2.20	0.020 0.030 0.100	0.112 X 0.105	
MIL-PRF-32159/11	RCZ0402	0.040	B,G,W C,D U,T	1.20 0.82 0.52	0.030 0.060 0.150	0.050 X 0.027	
MIL-PRF-32159/12	RCZ0603	0.070	B,G,W C,D U,T	1.50 1.10 0.68	0.030 0.060 0.150	0.070 X 0.037	
MIL-PRF-32159/13	RCZ0302	0.035	B,G,W C,D U,T	1.10 0.76 0.48	0.030 0.060 0.150	0.038 X 0.027	

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TABLE A-I. Fixed film resistor selection guidance table - Continued.

MIL-PRF-39017 - Resistor, Fixed, Film, Insulated, Nonestablished Reliability and Established Reliability,

Specification sheet	Styles available	Power and max voltage ratings	Resistance tolerance (± percent) (see A.1.1.2)	Resistance range (ohms)	Resistance temperature coefficient (ppm/°C)	Maximum body size (inches) and Configuration (see figure A-2)	
MIL-PRF-39017/5	RLR05	0.125 W 200 V	F, G, J and K	2.7 to 1 M 1.1 M to 22 M	±100 ±350	0.170 x 0.074	A
MIL-PRF-39017/1	RLR07	0.25 W 250 V		1 to 10 M 11 M to 22 M		0.281 x 0.098	
MIL-PRF-39017/2	RLR20	0.5 W 350 V		1 to 3.01 M 3.3 M to 22 M		0.416 x 0.161	
MIL-PRF-39017/3	RLR32	1 W 500 V		1 to 2.7 M 3.0 M to 22 M		0.593 x 0.205	

MIL-PRF-49462 - Resistors, Fixed, Film, High Voltage

Specification sheet	Styles available	Power and max voltage ratings	Resistance tolerance (± percent) (see A.1.1.2)	Resistance range (ohms)	Resistance temperature coefficient (ppm/°C)	Maximum body size (inches) and Configuration (see figure A-2)	
MIL-PRF-49462/3	RHV30 RHV31 RHV32 RHV33 RHV34 RHV35	0.25 W / 750 V 0.5 W / 1.5 kV 1.0 W / 3.0 kV 2.0 W / 5.0 kV 3.0 W / 10.0 kV 5.0 W / 20.0 kV	F, G, J and K	100 k to 100 M 100 k to 392 M 49.9 k to 499 M 100 k to 499 M 200 k to 1 G 330 k to 1 G	R < 500 MΩ RTC ≤ 200 R ≥ 500 MΩ RTC ≤ 500	0.306 x 0.098 0.431 x 0.154 0.752 x 0.328 1.124 x 0.328 2.124 x 0.328 3.124 x 0.328	A

MIL-PRF-49465 - Resistor, Fixed, Metal Element, Power Type, Very Low Resistance Values

Specification sheet	Styles available	Power ratings	Resistance tolerance (± percent) (see A.1.1.2)	Resistance range (ohms)	Resistance temperature coefficient (ppm/°C)	Maximum body size (inches) and Configuration (see figure A-2)	
MIL-PRF-49465/1	RLV10	5 W	F, H and J	0.01 to 0.0249 0.025 to 0.0499 0.05 to 0.0749 0.075 to 0.099 0.1 to 0.5	±150 ±125 ±100 ±50 ±50	0.999 x 0.406	O
MIL-PRF-49465/6	RLV30	3 W		0.01 to 0.0249 0.025 to 0.0499 0.05 to 0.0749 0.075 to 0.099 0.1 to 0.2	±350 ±200 ±125 ±75 ±50	0.591 x 0.236	A
MIL-PRF-49465/7	RLV31	5 W		0.01 to 0.0249 0.025 to 0.0499 0.05 to 0.0749 0.075 to 0.099 0.1 to 0.3	±250 ±150 ±100 ±75 ±50	0.956 x 0.361	

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TABLE A-I. Fixed film resistor selection guidance table - Continued.

MIL-PRF-55182 - Resistor, Fixed, Film, Nonestablished Reliability, Established Reliability, and Space Level							
Specification sheet	Styles available	Power and max voltage ratings	Resistance tolerance (± percent) (see A.1.1.2)	Resistance range (ohms)	Resistance temperature coefficient (ppm/°C)	Maximum body size (inches) and Configuration (see figure A-2)	
MIL-PRF-55182/1	RNR/N/C50	0.05 W 200 V	B, D and F	10 to .796 M	±25, ±50, ±100	0.180 x 0.080	A
MIL-PRF-55182/3	RNR/N/C55	0.1 W 200 V		10 to 2.0 M		0.281 x 0.140	
MIL-PRF-55182/5	RNR/N/C60	0.125 W 250 V		1.0 to 4.02 M		0.437 x 0.165	
MIL-PRF-55182/6	RNR/N/C65	0.25 W 300 V		1.0 to 8.06 M		0.656 x 0.250	
MIL-PRF-55182/7	RNR/N/C70	0.5 W 350 V		1.0 to 15 M		0.875 x 0.328	
MIL-PRF-55182/9	RNR/C75	1 W 750 V		10 to 20 M	±25	1.24 x 0.437	
MIL-PRF-55182/10	RNC90	0.3 W 300 V	V, T, A, B, D and F	4.99 to 200k	±5 ±10	0.320 x 0.336 x 0.120	K

MIL-PRF-55342 - Resistor, Chip, Fixed, Film, Nonestablished Reliability, Established Reliability, Space Level							
Specification sheet	Styles available	Power and max voltage ratings	Resistance tolerance (± percent) (see A.1.1.2)	Resistance range (ohms)	Resistance temperature coefficient (ppm/°C)	Maximum body size (inches) and Configuration (see figure A-2)	
MIL-PRF-55342/13	RM0302	0.040 W 15 V	B, F, G, J and K	1 to 22M	±25, ±50, ±100, ±200, ±300	0.032 x 0.022 x 0.010/0.025	T
MIL-PRF-55342/11	RM0402	0.050 W 25 V				0.041 x 0.022 x 0.010/0.033	
MIL-PRF-55342/1	RM0502	0.05 W 40 V				0.055 x 0.035 x 0.010/0.030	
MIL-PRF-55342/2	RM0505	0.125W 40 V				0.05 x 0.05 x 0.012/0.033	
MIL-PRF-55342/12	RM0603	0.1 W 50 V				0.060 x 0.032 x 0.010/0.033	
MIL-PRF-55342/6	RM0705	0.150 W 50V				0.075 x 0.05 x 0.015/0.033	
MIL-PRF-55342/3	RM1005	0.2 W 50 V				0.10 x 0.05 x 0.015/0.033	
MIL-PRF-55342/10	RM1010	0.5 W 75 V				0.100 x 0.100 x 0.015/0.033	
MIL-PRF-55342/7	RM1206	0.25 W 100V				0.126 x 0.063 x 0.015/0.033	
MIL-PRF-55342/4	RM1505	0.150 W 40 V				0.15 x 0.05 x 0.015/0.033	
MIL-PRF-55342/8	RM2010	0.8 W 150 V				0.206 x 0.098 x 0.015/0.033	
MIL-PRF-55342/5	RM2208	0.225 W 40 V				0.230 x 0.085 x 0.015/0.033	
MIL-PRF-55342/9	RM2512	1 W 200 V				0.248 x 0.124 x 0.015/ .033	

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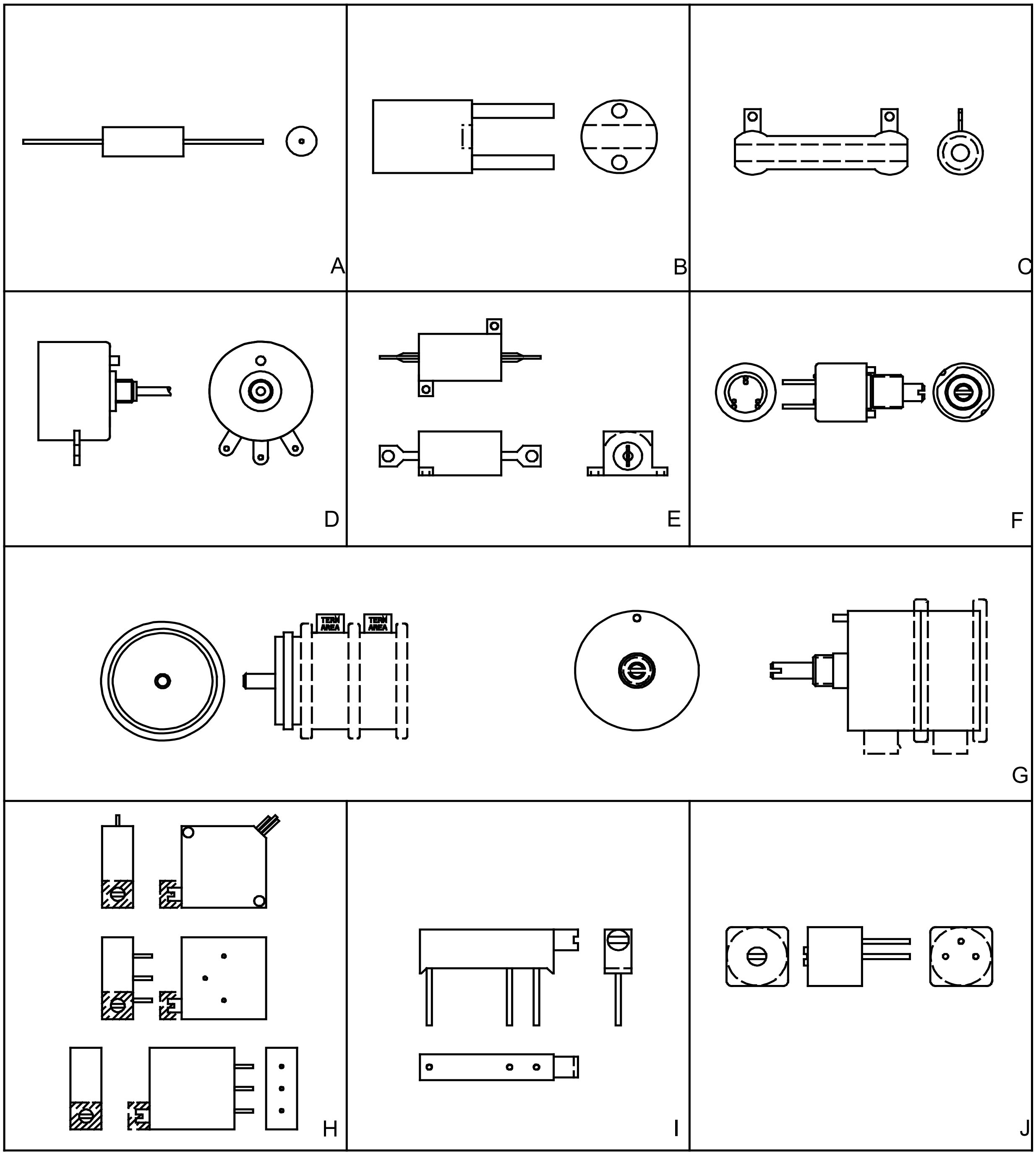

FIGURE A-2. Configurations.

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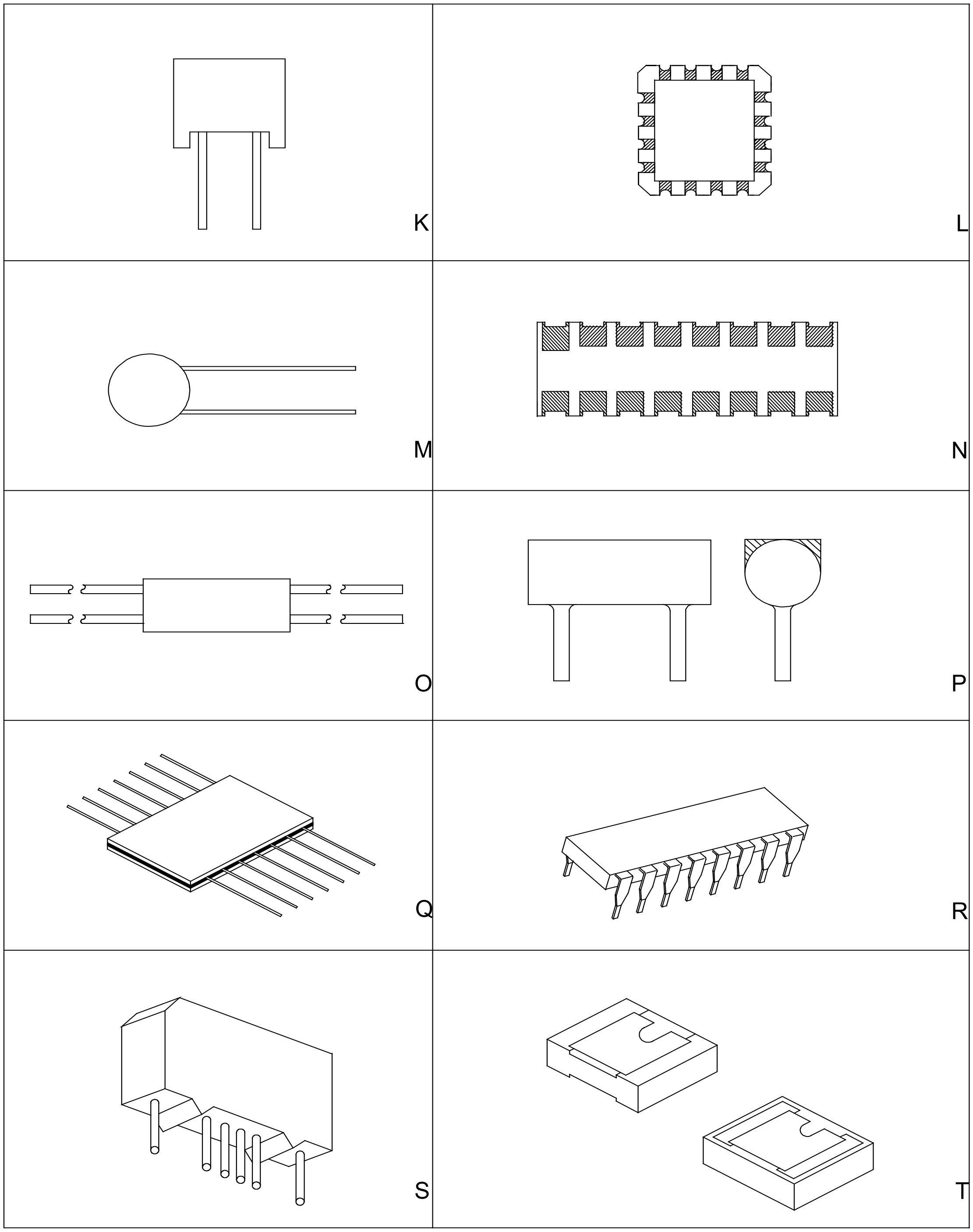

FIGURE A-2. Configurations. - Continued.

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A.3.1.2 Fixed Wirewound Resistors. See table A-II.

A.3.1.2.1 MIL-PRF-26, RW, Resistor, Fixed, Wirewound, Power Type. These power type, wirewound fixed resistors are for use in electrical, communication and associated equipment. Included are general purpose styles of 5 percent initial resistance tolerance with power ratings ranging from 3 watts to 240 watts at +25°C, derated to 0 power at 350°C and precision axial lead types of 0.1 percent, 0.5 percent, and 1 percent initial resistance tolerance with power ranging from 1 watt to 10 watts at +25°C, derated to 0 power at +275°C. Use where large power dissipation is required and where ac performance is relatively unimportant (such as, when used as voltage divider or bleeder resistors in dc power supplies, or for series dropping). They are generally satisfactory for use at frequencies up to 20 kilohertz (kHz) even though the ac characteristics are controlled. Neither the wattage rating nor the rated continuous working voltage may be exceeded. See MIL-PRF-39007, RWR, Resistor Fixed, Wirewound, Power Type, Nonestablished Reliability, Established Reliability, and Space Level.

A.3.1.2.2 MIL-PRF-18546, RE, Resistor, Fixed, Wirewound, Power Type, Chassis Mounted. These fixed, wirewound resistors are established reliability chassis mounted, power type units. They utilize the principle of heat dissipation through a metal mounting surface. These resistors are capable of full load operation at an ambient temperature of +25°C when mounted on a specified chassis area. Use where power tolerance and relatively large power dissipation is required for a given unit size than is provided by MIL-PRF-26 resistors, where ac performance is noncritical (such as, voltage divider or bleeder resistors in dc power supplies or series-dropping circuits). See MIL-PRF-39009, RER, Resistor, Fixed, Wirewound, Power Type, Chassis Mounted, Nonestablished Reliability, Established Reliability.

A.3.1.2.3 MIL-PRF-39005, RBR, Resistor, Fixed, Wirewound, Accurate, Nonestablished Reliability, Established Reliability. These nonestablished reliability, established reliability, accurate, wirewound fixed resistors that have a maximum resistance tolerance of 1 percent and a high degree of stability with respect to time under specified environmental conditions. These resistors are suitable for continuous full load (or voltage) operation at any ambient temperature up to +125°C, and when properly derated to +145°C. Use in circuits requiring higher stability than provided by composition or film resistors, and where ac frequency performance is not critical. Operation is satisfactory from dc to 50 kHz. The resistors have product levels ranging from Non-ER, and a life failure rate (FR) 1.0 percent to 0.001 percent per 1,000 hours. The FR levels are established at a 60 percent confidence level on basis of life tests. Replaces MIL-R-93, RB Resistors, Fixed, Wire-Wound (Accurate) inactive specification sheets.

NOTE:
1. FR level is in percent per 1000 hours.

A.3.1.2.4 MIL-PRF-39007, RWR, Resistor Fixed, Wirewound, Power Type, Nonestablished Reliability, Established Reliability, and Space Level. These nonestablished reliability, established reliability, or space level, axial leaded precision power type, wirewound fixed resistors having a +25°C ambient operating temperature derated to 0 load at +250°C. Use where large power dissipation is required and where ac performance is relatively unimportant (such as, when used as voltage divider or bleeder resistors in dc power supplies, or for series dropping). They are generally satisfactory for use at frequencies up to 20 kilohertz (kHz) even though the ac characteristics are controlled. Neither the wattage rating nor the rated continuous working voltage may be exceeded. The resistors have product levels ranging from Non-ER (C), a life failure rate (FR) 1.0 (M) percent to 0.001 (S) percent per 1,000 hours and space level (T) The FR levels are established at a 60 percent confidence level on basis of life tests. Replaces MIL-PRF-26, RW, Resistor, Fixed, Wirewound, Power Type inactive specification sheets.

NOTE:
1. FR level is in percent per 1000 hours.

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A.3.1.2.5 MIL-PRF-39009, RER, Resistor, Fixed, Wirewound, Power Type, Chassis Mounted, Nonestablished Reliability, Established Reliability. These fixed, wirewound resistors are established reliability chassis mounted, power type units. They utilize the principle of heat dissipation through a metal mounting surface with full rated wattage at +25°C. These resistors should not be used in circuits where their ac performance is of critical importance, although provision have been made, in particular styles, to minimize inductance. The resistors have product levels ranging from Non-ER, and a life failure rate (FR) 1.0 percent to 0.001 percent per 1,000 hours. The FR levels are established at a 60 percent confidence level on basis of life tests. Replaces MIL-PRF-18546, RE, Resistor, Fixed, Wirewound, Power Type, Chassis Mounted inactive specification sheets.

NOTE:
1. FR level is in percent per 1000 hours.

TABLE A-II. Fixed wirewound resistor selection guidance table.

MIL-PRF-26 - Resistor, Fixed, Wirewound, Power Type

Specification sheet	Styles available	Power ratings (in Watts)	Resistance tolerance (± percent) (see A.1.1.2)	Resistance range (ohms)	Resistance temperature coefficient (ppm/°C)	Maximum body size (inches) and configuration (see figure A-2)	
MIL-PRF-26/3	RW29	11	J and K	0.1 to 5.6 k	±650 (.1 ≤ R < .499) ±500 (.499 ≤ R < 1) ±400 (1 ≤ R < 20) ±10 (R ≥ 20)	1.812 x 0.500	C
	RW31	14		0.1 to 6.8 k		1.562 x 0.594	
	RW33	26		0.1 to 18 k		3.062 x 0.594	
	RW35	55		0.1 to 43 k		4.062 x 0.906	
	RW37	113		0.1 to 91 k		6.062 x 1.312	
	RW38	159		0.1 to 0.15 M		8.062 x 1.312	
	RW47	210		0.1 to 0.18 M		10.562 x 1.312	
MIL-PRF-26/4	RW56	14		0.1 to 9.1 k	±400 (R < 20Ω) ±260 (R ≥ 20Ω)	2.094 x .563	A

MIL-PRF-18546 - Resistor, Fixed, Wire-Wound, Power Type, Chassis Mounted

Specification sheet	Styles available	Power ratings (in Watts)	Resistance tolerance (± percent) (see A.1.1.2)	Resistance range (ohms)	Resistance temperature coefficient (ppm/°C)	Maximum body size (inches) and configuration (see figure A-2)	
MIL-PRF-18546/2	RE77	75	F	0.05 to 29.4 k	±30 (R ≥ 2k)	3.594 x 1.781 x 2.843	E
	RE80	120		0.1 to 35.7 k	±50 (R < 2k)	4.594 x 2.219 x 3.031	

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TABLE A-II. Fixed wirewound resistor selection guidance table - Continued.

MIL-PRF-39005 - Resistor, Fixed, Wirewound, Accurate, Nonestablished Reliability, Established Reliability

Specification sheet	Styles available	Power and max voltage ratings	Resistance tolerance (± percent) (see A.1.1.2)	Resistance range (ohms)	Resistance temperature coefficient (ppm/°C)	Maximum body size (inches) and configuration (see figure A-2)	
MIL-PRF-39005/1	RBR52 1/	0.5 W 600 V	T, Q, A, B and F	0.1 to 1.21 M	±90 (R < 1) ±30 (1 ≤ R < 10) ±15 (10 ≤ R < 100) ±10 (R ≥ 100)	1.020 x 0.390	A
MIL-PRF-39005/2	RBR53 2/	0.33 W 300 V		0.1 to 1.1 M		0.770 x 0.390	
MIL-PRF-39005/3	RBR54 3/	0.25 W 300 V		0.1 to .562 M		0.770 x 0.265	
MIL-PRF-39005/4	RBR55 4/	0.15 W 200 V		0.1 to .332 M		0.520 x 0.265	
MIL-PRF-39005/5	RBR56 5/	0.125 W 150 V		0.1 to .220 M		0.364 x 0.265	
MIL-PRF-39005/6	RBR71 6/	0.125 W 150 V		0.1 to .15 M		0.343 x 0.281	B
MIL-PRF-39005/11	RBR80 7/ RBR81 8/	0.1 W 100 V		10 to .120 M 10 to .250 M	±5 (R ≥ 100) ±10 (R < 100)	0.325 x 0.160	P

1/ Suggested replacement use DLA Land and Maritime drawing 14006 (Non ER)
2/ Suggested replacement use DLA Land and Maritime drawing 15002 (Non ER)
3/ Suggested replacement use DLA Land and Maritime drawing 14007 (Non ER)
4/ Suggested replacement use DLA Land and Maritime drawing 15003 (Non ER)
5/ Suggested replacement use DLA Land and Maritime drawing 14008 (Non ER)
6/ Suggested replacement use DLA Land and Maritime drawing 15004 (Non ER)
7/ Suggested replacement use DLA Land and Maritime drawing 15007 (Non ER)
8/ Suggested replacement use DLA Land and Maritime drawing 09008 (Non ER)

MIL-PRF-39007 - Resistor, Fixed, Wirewound, Power Type, Nonestablished Reliability, Established Reliability, and Space Level

Specification sheet	Styles available	Power rating (in Watts)	Resistance tolerance (± percent) (see A.1.1.2)	Resistance range (ohms)	Resistance temperature coefficient (ppm/°C)	Maximum body size (inches) and configuration (see figure A-2)	
MIL-PRF-39007/7	RWR78	10	B, D and F	0.1 to 39.2 k	±650 (.1 ≤ R ≤ .499) ±400 (.499 < R ≤ 1) ± 50 (1 < R ≤ 10) ± 20 (R >10)	1.842 x 0.406	A
MIL-PRF-39007/8	RWR80	2		0.1 to 3.16 k		0.437 x 0.125	
MIL-PRF-39007/9	RWR81	1		0.1 to 1 k		0.281 x 0.105	
MIL-PRF-39007/12	RWR82	1.5		0.1 to 1.3 k		0.328 x 0.101	
MIL-PRF-39007/10	RWR84	7		0.1 to 12.4 k		0.937 x 0.343	
MIL-PRF-39007/11	RWR89	3		0.1 to 4.12 k		0.622 x 0.218	

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TABLE A-II. Fixed wirewound resistor selection guidance table - Continued.

MIL-PRF-39009 - Resistor, Fixed, Wirewound, Power Type, Chassis Mounted, Nonestablished Reliability, and Established Reliability							
Specification sheet	Styles available	Power rating (in Watts)	Resistance tolerance (± percent) (see A.1.1.2)	Resistance range (ohms)	Resistance temperature coefficient (ppm/°C)	Maximum body size (inches) and configuration (see figure A-2)	
MIL-PRF-39009/2	RER40	5	F	1 to 1.65 k	±100 (R < 1) ± 50 (1 ≤ R < 19.6) ± 30 (R ≥ 20)	0.662 x 0.677 x 0.351	E
	RER45	10		1 to 2.80 k		0.812 x 0.843 x 0.437	
	RER50	20		1 to 6.04 k		1.124 x 1.125 x 0.593	
	RER55	30		1 to 19.6 k		2.000 x 1.187 x 0.656	
MIL-PRF-39009/1	RER60	5		0.1 to 3.32 k		0.662 x 0 .677 x 0.351	
	RER65	10		0.1 to 5.62 k		0.812 x 0.843 x 0.437	
	RER70	20		0.1 to 12.1 k		1.124 x 1.125 x 0.593	
	RER75	30		0.1 to 39.2 k		2.000 x 1.187 x 0.656	

A.3.1.3 Fixed Film Networks. See table A-III.

A.3.1.3.1 MIL-PRF-914, RNS, Resistor, Network, Fixed, Film, Surface Mount, Nonestablished Reliability, and Established Reliability. These networks are primarily intended for use in surface mount applications where space is a major concern. These resistors can either be hermetically or nonhermetically sealed and consist entirely of fixed, film resistors. The resistors have product levels ranging from Non-ER, and a life failure rate (FR) 1.0 percent to 0.001 percent per 1,000 hours. The FR levels are established at a 60 percent confidence level on basis of life tests.

NOTE:
1. FR level is in percent per 1000 hours.
2. MIL-PRF-914 designers are cautioned in using these resistors in pulse application. The usage requirements for the resistor must be evaluated for each application. See Appendix E.

A.3.1.3.2 MIL-PRF-83401, RZ, Resistor Network, Fixed Film, and Capacitor-Resistor Networks, Ceramic Capacitor and Fixed Film Resistor. These networks are designed for use in critical circuitry where stability, long life, reliable operation, and accuracy are of prime importance. They are particularly desirable for use where miniaturization is important and ease of assembly is desired. They are useful where a number of resistors of the same resistance value are required in the circuit.

NOTE: MIL-PRF-83401 designers are cautioned in using these resistors in pulse application. The usage requirements for the resistor must be evaluated for each application. See Appendix E.

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TABLE A-III. Fixed film network resistor selection guidance table.

MIL-PRF-914 - Resistor Network, Fixed, Film, Surface Mount, Nonestablished Reliability, and Established Reliability									
Specification sheet	Styles available	Schematic	Power ratings Characteristics K and M	 C, R, H, and V	Resistance tolerance (± percent) (see A.1.1.2)	Resistance range (ohms)	Resistance temperature coefficient (ppm/°C)	Maximum body size (inches) and configuration (see figure A-2)	
MIL-PRF-914/3	RNS030	W	0.10/0.80	0.050/0.40	B, D, F, G and J	10 to 2.2 M	±25, ±50, ±100, ±300	.300 x .300 x .050 .300 x .300 x .085 .300 x .300 x .090	L
		M	0.05/0.75	0.025/0.40					
		E	0.10/0.80	0.050/0.40					
		S	0.05/0.70	0.025/0.35					
MIL-PRF-914/4	RNS040	P	0.10/1.0	0.050/0.50				.350 x .350 x .050 .350 x .035 x .085 .350 x .350 x .090	L
		M	0.05/0.95	0.025/0.475					
		E	0.10/1.0	0.050/0.50					
		S	0.05/1.0	0.025/0.50					
MIL-PRF-914/5	RNS050	A	0.10/0.80	0.050/0.40				.150 x .410 x.035	N
		B	0.055/0.80	0.025/0.375					
		C	0.050/0.80	0.100/0.40					
		J	0.030/0.80	0.015/0.40					

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TABLE A-III. Fixed film network resistor selection guidance table. Continued

<table>
<tr><td colspan="10">MIL-PRF-83401 - Resistor Network, Fixed, Film, and Capacitor-Resistor Networks, Ceramic Capacitor and Fixed Film Resistor</td></tr>
<tr><th rowspan="3">Specification sheet</th><th rowspan="3">Styles available</th><th rowspan="3">Schematic</th><th colspan="2">Power ratings</th><th rowspan="3">Resistance tolerance (± percent) (see A.1.1.2)</th><th rowspan="3">Resistance range (ohms)</th><th rowspan="3">Resistance temperature coefficient (ppm/°C)</th><th colspan="2" rowspan="3">Maximum body size (inches) and configuration (see figure A-2)</th></tr>
<tr><th colspan="2">Characteristics</th></tr>
<tr><th>H, K and M</th><th>C and V</th></tr>
<tr><td>MIL-PRF-83401/1</td><td>RZ010</td><td>A
B
J</td><td>0.2/1.4
0.1/1.3
0.050/1.2</td><td>0.1/0.7
0.05/0.65
0.025/0.6</td><td rowspan="3">B, D, F, G and J</td><td rowspan="15">10 to 1 M</td><td rowspan="15">±50, ±100, ±300</td><td>.785 x .305 x .200</td><td rowspan="2">R</td></tr>
<tr><td>MIL-PRF-83401/2</td><td>RZ020</td><td>A
B
J</td><td>0.2/1.6
0.1/1.5
0.050/1.4</td><td>0.1/0.8
0.05/0.75
0.025/0.7</td><td>.876 x .305 x .200</td></tr>
<tr><td>MIL-PRF-83401/3</td><td>RZ030</td><td>A
B
J</td><td>0.05/0.35</td><td>0.025/0.325
0.015/0.35</td><td>.385 x .305 x .075</td><td>Q</td></tr>
<tr><td>MIL-PRF-83401/4</td><td>RZ040</td><td>C
G
H</td><td>0.2/1.0
0.2/0.6
0.11/0.88</td><td>0.1/0.5
0.1/0.3
0.06/0.48</td><td rowspan="3">F, G and J</td><td>.598 x .098 x .350</td><td rowspan="6">S</td></tr>
<tr><td>MIL-PRF-83401/5</td><td>RZ050</td><td>C
G
H</td><td>0.2/1.4
0.2/0.8
0.11/1.32</td><td>0.1/0.7
0.1/0.4
0.06/0.72</td><td>.798 x .098 x .350</td></tr>
<tr><td>MIL-PRF-83401/6</td><td>RZ060</td><td>C
G
H</td><td>0.2/1.8
0.2/1.0
0.11/1.8</td><td>0.1/0.9
0.1/0.5
0.06/0.9</td><td>.998 x .098 x .352</td></tr>
<tr><td>MIL-PRF-83401/7</td><td>RZ070</td><td>C
G
H</td><td>0.12/0.6
0.12/0.36
0.07/0.6</td><td>0.06/0.3
0.06/0.18
0.04/0.3</td><td rowspan="9">B, D, F, G and J</td><td>.598 x .098 x .197</td></tr>
<tr><td>MIL-PRF-83401/8</td><td>RZ080</td><td>C
G
H</td><td>0.12/0.84
0.12/0.48
0.07/0.84</td><td>0.06/0.42
0.06/0.24
0.04/0.42</td><td>.798 x .098 x .197</td></tr>
<tr><td>MIL-PRF-83401/9</td><td>RZ090</td><td>C
G
H</td><td>0.12/1.08
0.12/0.60
0.07/1.08</td><td>0.06/0.54
0.06/0.30
0.04/0.54</td><td>798 x .098 x .197</td></tr>
<tr><td>MIL-PRF-83401/10</td><td>RZ100</td><td>A
B
J</td><td colspan="2">0.05/0.4
0.025/0.375
0.015/0.42</td><td>.410 x .305 x .075</td><td>Q</td></tr>
<tr><td>MIL-PRF-83401/13</td><td>RZ130</td><td>A
B
J</td><td>0.2/1.4
0.1/1.3
0.050/1.2</td><td>0.1/0.7
0.05/0.65
0.025/0.6</td><td>.785 x .305 x .200</td><td rowspan="2">R</td></tr>
<tr><td>MIL-PRF-83401/14</td><td>RZ140</td><td>A
B
J</td><td>0.2/1.6
0.1/1.5
0.050/1.4</td><td>0.1/0.8
0.05/0.75
0.025/0.7</td><td>.876 x .305 x .200</td></tr>
<tr><td>MIL-PRF-83401/15</td><td>RZ150</td><td>A
B
J</td><td colspan="2">0.05/0.35
0.025/0.325
0.015/0.35</td><td>.385 x .305 x .075</td><td>Q</td></tr>
</table>

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TABLE A-III. Fixed film network resistor selection guidance table - Continued.

MIL-PRF-83401 - Resistor Network, Fixed, Film, and Capacitor-Resistor Networks, Ceramic Capacitor and Fixed Film Resistor - Continued

Specification sheet	Styles available	Schematic	Power ratings Characteristics H, K and M	Power ratings Characteristics C and V	Resistance tolerance (± percent) (see A.1.1.2)	Resistance range (ohms)	Resistance temperature coefficient (ppm/°C)	Maximum body size (inches) and configuration (see figure A-2)	
MIL-PRF-83401/18	RZ180	A001	0.10	0.40	G	See Schematics per specification sheet	±50, ±100, ±300	.598 x .098 x .350	S
		A002		0.50					
MIL-PRF-83401/19	RZ190	1/	0.10 4/	0.06				.798 x .098 x .197	
		2/		0.05					
		3/		0.04					
MIL-PRF-83401/21	RZ210	C	0.12/0.6	0.06/0.3	B, D, F, G and J			.598 x .098 x .197	
		G	0.12/0.36	0.06/0.18					
		H	0.07/0.6	0.04/0.3					
MIL-PRF-83401/22	RZ220	C	0.12/0.84	0.06/0.42				.798 x .098 x .197	
		G	0.12/0.48	0.06/0.24					
		H	0.07/0.84	0.04/0.42					
MIL-PRF-83401/23	RZ230	C	0.12/1.08	0.06/0.54				.998 x .098 x .197	
		G	0.12/0.60	0.06/0.30					
		H	0.07/1.08	0.04/0.54					
MIL-PRF-83401/24	RZ240	C	0.12/1.08	0.06/0.54					
		G	0.12/0.60	0.06/0.30					
		H	0.07/1.08	0.04/0.54					

1/ A001-A006, A011-A012
2/ A007-A009
3/ A010
4/ A001-A0012

A.3.1.4 Variable Wirewound Resistors. (See table A-IV)

A.3.1.4.1 MIL-PRF-19, RA, Resistor, Variable, Wirewound, Low Operating Temperature. These variable resistors having a resistance element of Wirewound on an insulating strip shaped in an arc, so that a contact bears uniformly on the resistance element when adjusted by a control shaft. These resistors are capable of full load operation at an ambient temperature of +40°C and are suitable for continuous operation when properly derated, at a maximum temperature of +105°C. Use primarily for noncritical, low power, low frequency applications where characteristics of Wirewound resistors are more desirable than those of composition resistors.

A.3.1.4.2 MIL-PRF-22, RP, Resistor, Variable, Wirewound, Power Type. These resistors have a resistance element of wire, wound linearly on an insulted strip shaped in an arc, such that a contact bears uniformly on the resistance element when adjusted by a control shaft. The power ratings cover a range from 6.25 watts to 1,000 watts, inclusive. Use in such applications as motor speed control, generator field control, lamp dimming, heater and oven control, potentiometer uses, and applications where variations of voltage and current are expected.

A.3.1.4.3 MIL-PRF-12934, RR, Resistor, Variable, Wirewound, Precision. These precision, wirewound, variable resistors whose electrical output (in terms of percent of applied voltage) are linear or nonlinear with respects to the angular position of the shaft. These resistors are capable of full-load operation at maximum ambient temperatures of +70°C and +85°C and are suitable for continuous operation, when properly derated, to maximum temperatures of +125°C and +150°C. Use in servo mounting applications requiring precise electrical and mechanical output and performance. Used in computer, antenna, flight control, and bomb navigation systems.

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A.3.1.4.4 MIL-PRF-27208, RT, Resistor, Variable, Wirewound, Nonprecision. These wirewound variable resistors with a contact bearing uniformly over the entire surface of the entire resistive element, wound linearly, when positioned by an multiturn lead screw actuator. These resistors are capable of full-load operation at maximum ambient temperatures of +85°C and are suitable for continuous operation, when properly derated, to maximum temperatures of +150°C. Use for matching, balancing, and adjusting circuit variables in computers, telemetering equipment, and other critical applications. See MIL-PRF-39015, RTR, Resistor, Variable, Wirewound, Lead Screw Actuated, Nonestablished Reliability and Established Reliability.

A.3.1.4.5 MIL-PRF-39002, RK, Resistor, Variable, Wirewound, Semi-Precision. These semi-precision, wirewound, variable resistors have a resistance element of wire, wound linearly on an insulated form shaped in an arc, so that a contact bears uniformly on the resistance element when adjusted by a contact shaft. The electrical output (in terms of percent of applied voltage) is linear with respect to angular position of the contact arm. These resistors are capable of full-load operation at maximum ambient temperatures of +85°C and are suitable for continuous operation, when properly derated, to maximum temperatures of +135°C. Use for matching, balancing, and adjusting circuit variables in computers, telemetering equipment, and other critical applications.

A.3.1.4.6 MIL-PRF-39015, RTR, Resistor, Variable, Wirewound, Lead Screw Actuated, Nonestablished Reliability and Established Reliability. These nonestablished and established reliability lead screw actuated, wirewound variable resistors with a contact bearing uniformly over the surface of the entire resistive element, wound linearly, when position by a multiturn lead screw actuator. These resistors are capable of full load operation (when the maximum resistance is engaged), at maximum ambient temperature of +85°C and are suitable for continuous operation, when properly derated, at a maximum ambient temperature of +150°C. Use for matching, balancing, and adjusting circuit variables in computers, telemetering equipment, and other critical applications. The resistors have product levels ranging from Non-ER, and a life failure rate (FR) 1.0 percent to 0.001 percent per 1,000 hours. The FR levels are established at a 60 percent confidence level on basis of life tests. Replaces MIL-PRF-27208, RT, Resistor, Variable, Wirewound, Nonprecision inactive specification sheets.

NOTE:
1. FR level is in percent per 1000 hours.

TABLE A-IV. Variable wirewound resistor selection guidance table.

MIL-PRF-19 - Resistor, Variable, Wirewound, Low Operating Temperature					
Specification sheet	Styles	Power rating (Watts)	Resistance range (ohms)	Maximum body size (inches) Configuration (see figure A-2)	
MIL-PRF-19/2	RA20	2, 1	3 to 15k	1.310 x .700	D
MIL-PRF-19/3	RA30	4, 2.2	3 to 25k	1.710 x .810	

MIL-PRF-22 - Resistor, Variable, Wirewound, Power Type					
Specification sheet	Styles	Power rating (Watts)	Resistance range (ohms)	Maximum body size (inches) Configuration (see figure A-2)	
MIL-PRF-22/15	RP05	5	10 to 5k	0.525 x 0.687	D
MIL-PRF-22/1	RP06	12.5	1 to 3.5k	0.906 x 0.751	
MIL-PRF-22/2	RP07	6.25	1 to 3.5k	1.094 x 1.126	
MIL-PRF-22/3	RP10	25	1 to 5k	1.680 x 1.410	
MIL-PRF-22/4	RP11	12.5	2 to 5k	1.880 x 1.750	
MIL-PRF-22/5	RP15	50	1 to 10k	2.410 x 1.440	
MIL-PRF-22/6	RP16	25	1 to 10k	2.750 x 1.750	

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TABLE A-IV. Variable wirewound resistor selection guidance table. Continued

MIL-PRF-22 - Resistor, Variable, Wirewound, Power Type Continued

Specification sheet	Styles	Power rating (Watts)	Resistance range (ohms)	Maximum body size (inches) Configuration (see figure A-2)	
MIL-PRF-22/7	RP20	75	2 to 10k	2.810 x 1.780	D
MIL-PRF-22/8	RP25	100	2 to 10k	3.190 x 1.780	
MIL-PRF-22/9	RP30	150	2 to 10k	4.060 x 2.030	
MIL-PRF-22/10	RP35	225	2 to 2.5k	5.090 x 2.160	
MIL-PRF-22/11	RP40	300	2 to 2.5k	6.090 x 2.410	
MIL-PRF-22/12	RP45	500	2 to 2.5k	8.090 x 2.250	
MIL-PRF-22/13	RP50	750	2 to 2.5k	10.090 x 3.030	
MIL-PRF-22/14	RP55	1,000	2 to 2.5k	12.310 x 3.250	

MIL-PRF-12934 - Resistor, Variable, Wirewound, Precision

Specification sheet	Styles	Power rating (Watts)	Resistance range (ohms)	Maximum body size (inches) Configuration (see figure A-2)	
MIL-PRF-12934/1	RR0900	1.25	100 to 10K	0.880 x 0.812	G
MIL-PRF-12934/2	RR1000	2.0	100 to 50K	0.880 x 1.625	
MIL-PRF-12934/4	RR1100	1.5	100 to 20K	1.067 x 0.812	
MIL-PRF-12934/5	RR1300	2.0	100 to 40K	1.468 x 1.062	
MIL-PRF-12934/6	RR1400	3.0	200 to 200K	1.468 x 2.250	
MIL-PRF-12934/9	RR2000	4.0	100 to 60K	2.031 x 1.312	
MIL-PRF-12934/10	RR2100	5.0	200 to 250K	2.031 x 2.250	
MIL-PRF-12934/15	RR3000	6.0	200 to 100K	3.031 x 1.312	
MIL-PRF-12934/16	RR3100	1.25	100 to 10K	0.906 x 0.750	
MIL-PRF-12934/17	RR3200	1.5	100 to 20K	1.093 x 0.750	
MIL-PRF-12934/18	RR3300	2.0	100 to 40K	1.468 x 1.062	
MIL-PRF-12934/19	RR3400	4.0	100 to 60K	2.031 x 1.156	
MIL-PRF-12934/20	RR3500	6.0	200 to 100K	3.031 x 1.156	
MIL-PRF-12934/27	RR3600	1.5	100 to 50K	0.906 x 1.076	
MIL-PRF-12934/28	RR3700	1.5	100 to 50K	0.906 x 1.076	
MIL-PRF-12934/29	RR3800	1.5	100 to 100K	0.906 x 1.219	
MIL-PRF-12934/30	RR3900	1.5	100 to 100K	0.906 x 1.219	
MIL-PRF-12934/31	RR4000	2.0	100 to 50K	0.890 x 1.500	
MIL-PRF-12934/32	RR4100	5.0	200 to 250K	1.844 x 2.094	
MIL-PRF-12934/33	RR2002	4.0	20K	2.005 x 1.781	
MIL-PRF-12934/34	RR1004	2.0	100K	0.880 x 1.580	
MIL-PRF-12934/35	2RR2104	5.0	20K / 20K	2.005 x 4.311	
MIL-PRF-12934/36	RR3601	1.5	10K	0.922 x 0.875	
MIL-PRF-12934/37	2RR3100	0.25mW	665 / 665	1.062 x 0.765	

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TABLE A-IV. Variable wirewound resistor selection guidance table. - Continued.

MIL-PRF-27208 - Resistor, Variable, Wirewound, Nonprecision					
Specification sheet	Styles	Power rating (Watts)	Resistance range (ohms)	Maximum body size (inches) (configuration) (see figure A-2)	
MIL-PRF-27208/8	RT12	0.75	10 to 20K	1.250 x 0.315 x 0.190	I
MIL-PRF-27208/9	RT24		10 to 10K	0.375 x 0.375 x0.195	H
MIL-PRF-27208/10	RT26	0.25	10 to 5K	0.250 x 0.250 x 0.165	

MIL-PRF-39002 - Resistor, Variable, Wirewound, Semi-Precision					
Specification sheet	Styles	Power rating (Watts)	Resistance range (ohms)	Maximum body size (inches) (configuration) (see figure A-2)	
MIL-PRF-39002/1	RK09	1.21.5	10 to 100k	0.515 x 0.650	F
MIL-PRF-39002/3	RK11		5k	0.615 x 0.315	

MIL-PRF-39015 - Resistor, Variable, Wirewound, Lead Screw Actuated, Nonestablished Reliability and Established Reliability					
Specification sheet	Styles	Power rating (Watts)	Resistance range (ohms)	Maximum body size (inches) (configuration) (see figure A-2)	
MIL-PRF-39015/1	RTR12	0.75	10 to 20K	1.250 x 0.315 x 0.190	I
MIL-PRF-39015/2	RTR22			0.500 x 0.500 x 0.235	H
MIL-PRF-39015/3	RTR24		10 to 10K	0.375 x 0.375 x0.195	

A.3.1.5 Variable Nonwirewound Resistors. See table A-V.

A.3.1.5.1 MIL-PRF-94, RV, Resistor, Variable Composition. These variable resistors have a composition resistance element shaped in an arc, and a contact bearing uniformly thereon, so that a change in resistance is produced between the terminal of the contact and the terminal of either end of the resistance element when the operating shaft is turned. These resistors are capable of full load operation (where maximum resistance is engaged) at a maximum ambient temperature of +70°C, and suitable for continuous operation when properly derated, at a maximum temperature of +120°C. Use where initial setting stability is not critical and long-term stability needs to be no better than ±20 percent.

A.3.1.5.2 MIL-PRF-22097, RJ, Resistor, Variable, Nonwirewound, Adjustment Type. These multiturn lead screw actuated and single-turn nonwirewound variable resistors with a contact bearing uniformly over the entire surface of the entire resistive element, when positioned by the actuator. These resistors are capable of full load operation (where maximum resistance is engaged) at a maximum ambient temperature of +70°C and +85°C, and are suitable for continuous operation when properly derated, at a maximum temperature of +120°C and +150°C, respectively. Use for matching, balancing, and adjusting circuit variables in computers, telemetering equipment, and other critical applications. See MIL-PRF-39035, RJR, Resistor, Variable, Nonwirewound, Adjustment Type, Nonestablished Reliability and Established Reliability.

A.3.1.5.3 MIL-PRF-39023, RQ, Resistor, Variable, Nonwirewound Precision. These precision, nonwirewound, variable resistors whose electrical output (in terms of percent of applied voltage) are linear or nonlinear with respect to the angular position of the operating shaft. These resistors have a resistance tolerance of ±10 percent. These resistors are capable of full-load operation at maximum ambient temperatures of +70°C and are suitable for continuous operation, when properly derated, to maximum temperatures of +125°C. Use in servo mounting application requiring precise electrical and mechanical output and performance. Used in computer, antenna, flight control, and bomb navigation systems.

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A.3.1.5.4 MIL-PRF-39035, RJR, Resistor, Variable, Nonwirewound, Adjustment Type, Nonestablished Reliability and Established Reliability. These nonestablished and established reliability multiturn lead screw actuated, and single-turn nonwirewound variable resistors with a contact bearing uniformly over the surface of the entire resistive element, when position by an actuator. These resistors are capable of full load operation (when the maximum resistance is engaged), at maximum ambient temperature of +85^{O}C and are suitable for continuous operation, when properly derated, at a maximum ambient temperature of +150^{O}C. Use for matching, balancing, and adjusting circuit variables in computers, telemetering equipment, and other critical applications. The resistors have product levels ranging from Non-ER, and a life failure rate (FR) 1.0 percent to 0.001 percent per 1,000 hours. The FR levels are established at a 60 percent confidence level on basis of life tests. Replaces MIL-PRF-22097, RJ, Resistor, Variable, Nonwirewound, Adjustment Type, inactive specification sheets.

NOTE:
1. FR level is in percent per 1000 hours.

TABLE A-V. Variable nonwirewound resistor selection guidance table.

MIL-PRF-94 - Resistor, Variable Composition

Specification sheet	Styles available	Power and max voltage ratings	Resistance tolerance (± percent) (see A.1.1.2)	Resistance Range (ohms)	Maximum body size (inches) and configuration (see figure A-2)	
MIL-PRF-94/4	RV2	1.0/0.5*	±10/±20	100 to 2.5M	0.453 x 0.906	F
MIL-PRF-94/5	RV4	2.0/1.0*		50 to 2.5M	0.609 x 1.094	
MIL-PRF-94/2	RV5	0.5/0.25*		250 to 2.5M	0.375 x 0.750	
MIL-PRF-94/3	RV6	0.5/0.25*		100 to 5M	0.453 x 0.500	
MIL-PRF-94/6	2RV7	various		50 to 5M	1.266 x 1.094	
MIL-PRF-94/7	RV8	0.5/0.25*		100 to 5M	0.581 x 0.500	

* - A taper/C and F taper

MIL-PRF-22097 - Resistor, Variable, Nonwirewound, Adjustment Type

Specification sheet	Styles available	Power and max voltage ratings	Resistance tolerance (± percent) (see A.1.1.2)	Resistance Range (ohms)	Maximum body size (inches) and configuration (see figure A-2)	
MIL-PRF-22097/2	RJ12	0.75	±10	10 to 1M	1.250 x 0.190 x 0.315	I
MIL-PRF-22097/4	RJ24	0.50			0.375 x 0.150 x 0.375	H

MIL-PRF-39023 - Resistor, Variable, Nonwirewound Precision

Specification sheet	Styles available	Power and max voltage ratings	Resistance tolerance (± percent) (see A.1.1.2)	Resistance Range (ohms)	Maximum body size (inches) and configuration (see figure A-2)	
MIL-PRF-39023/10	RQ051	0.50	±10	5000	0.9644 x 0.550	H
MIL-PRF-39023/1	RQ090	1.00		100 to 1M	0.906 x 0.810	
MIL-PRF-39023/9	RQ091	1.00		100 to 1M	0.906 x 0.750	
MIL-PRF-39023/6	RQ100	2.50		1000 to 1M	0.906 x 1.880	
MIL-PRF-39023/2	RQ110	1.25		100 to 1M	1.125 x 0.810	
MIL-PRF-39023/3	RQ150	1.50		100 to 1M	1.500 x 1.060	
MIL-PRF-39023/7	RQ160	3.50		1000 to 3M	1.468 x 2.500	
MIL-PRF-39023/4	RQ200	2.00		100 to 1M	2.031 x 1.310	
MIL-PRF-39023/8	RQ210	4.50		1000 to 3M	2.031 x 2.900	
MIL-PRF-39023/5	RQ300	3.00		100 to 1M	3.031 x 1.310	

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TABLE A-V. Variable nonwirewound resistor selection guidance table. Continued

MIL-PRF-39035 - Resistor, Variable, Nonwirewound, Adjustment Type, Nonestablished Reliability and Established Reliability						
Specification sheet	Styles available	Power and max voltage ratings	Resistance tolerance (± percent) (see A.1.1.2)	Resistance Range (ohms)	Maximum body size (inches) and configuration (see figure A-2)	
MIL-PRF-39035/1	RJR12 1/	0.75	±10	10 to 1M	1.000 x 0.190 x 0.315	H
MIL-PRF-39035/2	RJR24	0.50			0.375 x 0.150 x 0.375	
MIL-PRF-39035/3	RJR26	0.25			0.270 x 0.165 x 0.250	
MIL-PRF-39035/4	RJR50				0.25* x 0.25	J

1/ Inactive for new design
* Diameter

A.3.1.6 General terms for variable resistors.

a. Precision potentiometer. A mechanical-electrical transducer dependent upon the relative position of a moving contact (wiper) and a resistance element for its operation. It delivers to a high degree of accuracy a voltage output that is some specified function of applied voltage and shaft position, (see figure A-3).

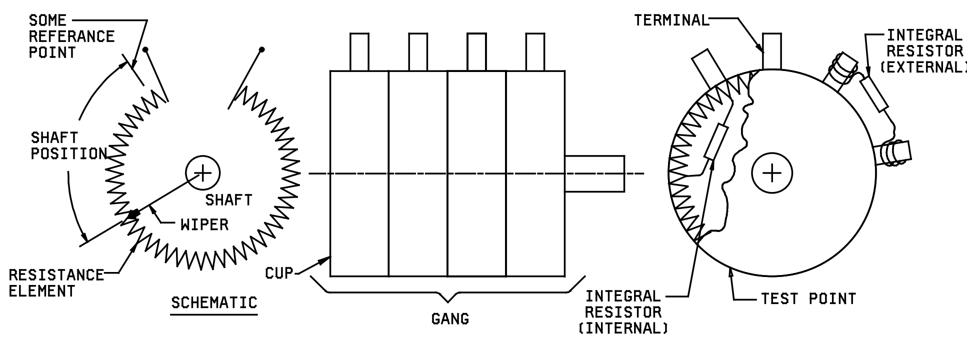

FIGURE A-3. Precision potentiometer.

b. Cup. A single mechanical section of a potentiometer which may contain one or more electrical resistance elements.

c. Gang. An assembly of two or more cups on a common operating shaft.

d. Shaft. The mechanical input element of the potentiometer.

e. Shaft position: An indication of the position of the wiper relative to a reference point.

f. Terminal. An external member that provides electrical access to the potentiometer resistance element and wiper.

g. Integral resistor. An internal or external resistor preconnected to the electrical element and forming an integral part of the cup assembly to provide a desired electrical characteristic. The resistor may be a separate entity, a part of the wirewound or nonwirewound resistance element, or a layer type resistor formed on the same insulating substrate as the resistance element.

h. Test point. An additional terminal used only to facilitate measurement.

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i. Tap. An electrical connection fixed to the resistance element and capable of carrying rated element current.

NOTE: Certain types of taps (minimum width) essential for tighter conformities may require lower current limits. These taps are referred to as voltage taps.

j. Dead space. A region of the resistance element constructed to provide a discontinuity in the output. The dead space is usually found between the input terminals of a continuous rotation single turn potentiometer.

k. Total applied voltage (E). The total voltage applied between the designated input terminals, (see figure A-4).

NOTE: When plus (+) and minus (-) voltages are applied to the potentiometer, the total applied voltage (commonly called peak-to-peak applied voltage) is equal to the sum of the two voltages. Each individual voltage is referred to as zero-to-peak applied voltage

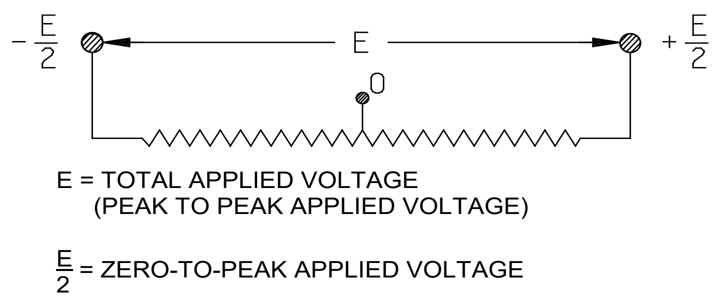

FIGURE A-4. Total applied voltage.

l. Output voltage. The voltage between the wiper and the designated reference point. Unless otherwise specified, the designated reference point is the CCW terminal.

m. Output ratio. The ratio of the output voltage to the designated input reference voltage is the total applied voltage.

n. Total variable output. The difference between the maximum and minimum output ratios. These ratios correspond to the minimum voltages at each input terminal. (see figure A-5).

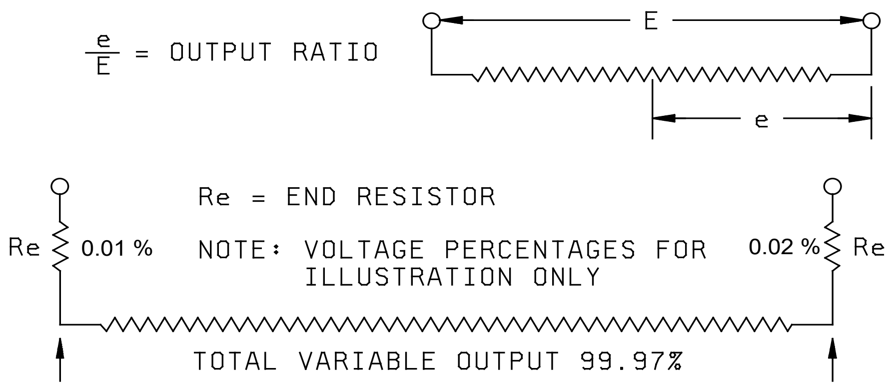

FIGURE A-5. Total variable output.

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o. End voltage. The voltage between the wiper terminal and an end terminal when the shaft is positioned at the corresponding theoretical end point. End voltage is expressed as a percent of the total applied voltage.

p. Minimum voltage. The smallest or lowest voltage between the wiper terminal and an end terminal when the shaft is positioned near the corresponding end of electrical continuity travel. Minimum voltage is expressed as a percent of the total applied voltage.

q. Shorted segment. A portion of the resistance element over which the output ratio remains constant within specified limits as the wiper traverses the segment with a specified load resistance.

r. Output slope. The ratio between the rate of change of output ratio and the rate of change of shaft travel.

$$\text{MATHEMATICALLY:} \quad A = \frac{\Delta \frac{e}{E}}{\Delta \frac{\theta}{\theta_T}}$$

θ_A may be substituted for θ_T where applicable.

NOTE: The theoretical output slope is the first derivative of the normalized theoretical function characteristic.

$$\text{MATHEMATICALLY:} \quad A = \frac{df\left[\frac{\theta}{\theta_T}\right]}{d\left[\frac{\theta}{\theta_T}\right]} = \frac{d\left[\frac{e}{E}\right]}{d\left[\frac{\theta}{\theta_T}\right]}$$

s. Slope ratio. The ratio of the largest to the smallest output slopes of a monotonic theoretical function characteristic.

t. Gradient. The rate of change of output ratio relative to shaft travel.

$$\text{MATHEMATICALLY:} \quad G = \frac{d\left[\frac{e}{E}\right]}{d\theta}$$

u. Load resistance (RL). The external resistance as seen by the output voltage; (connected between the wiper and the designated reference point).

NOTE: No load means an infinite load resistance.

v. Loading error. The difference between the output ratio with an infinite load resistance and the output ratio with a specified finite load resistance, at any shaft position as long as it is the same position for both output ratio measurements, (see figure A-6).

NOTE: Elimination of loading error, by compensating the resistance element to give the desired output with a specified load resistance, is referred to as “load compensation.”

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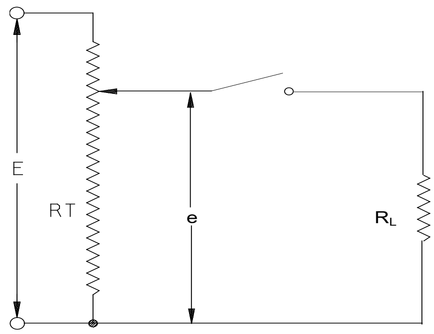

FIGURE A-6. Loading error.

w. Direction of travel. For rotary potentiometers, CW or CCW when viewing the specified mounting end of the potentiometer. The designation of terminals in the figure corresponds to the direction of shaft travel. Unless otherwise specified (see figure A-7), the output ratio and shaft position increase with CW (or extending) direction of travel.

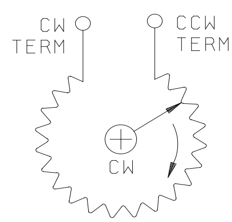

FIGURE A-7. Direction of travel.

x. Total mechanical travel. The total travel of the shaft between integral stops, under specified stop load. In potentiometers without stops, the mechanical travel is continuous.

y. Mechanical overtravel. The shaft travel between each theoretical end point and its adjacent corresponding limit of total mechanical travel, (see figure A-8).

NOTE: The relationship of the electrical travels to each other and to the input terminals shown above is given for illustration only and may vary from one potentiometer to another.

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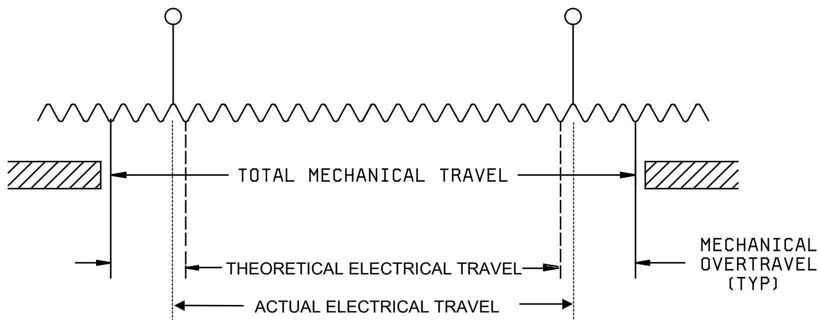

FIGURE A-8. Mechanical overtravel.

z. Backlash. the maximum difference in shaft position that occurs when the shaft is moved to the same actual output ratio point from opposite directions. (see figure A-9)

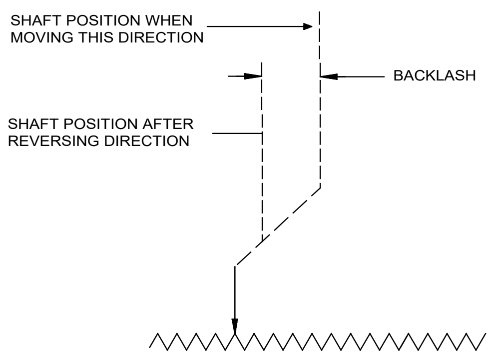

FIGURE A-9. Backlash.

aa. Theoretical end point. The shaft positions corresponding to the end of the theoretical electrical travel as determined from the index point.

ab. Index point. A point of reference fixing the relationship between a specified shaft position and the output ratio. It is used to establish a shaft position reference, (see figure A-10).

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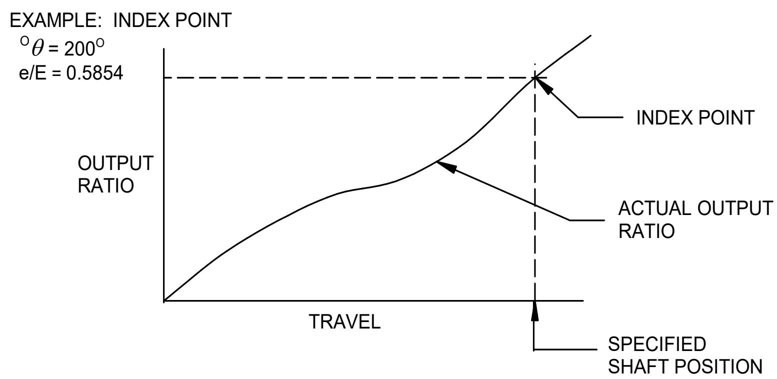

FIGURE A-10. Index point.

ac. Theoretical electrical travel. The specified shaft travel over which the theoretical function characteristic extends between defined output ratio limits, as determined from the index point. (see figure A-11)

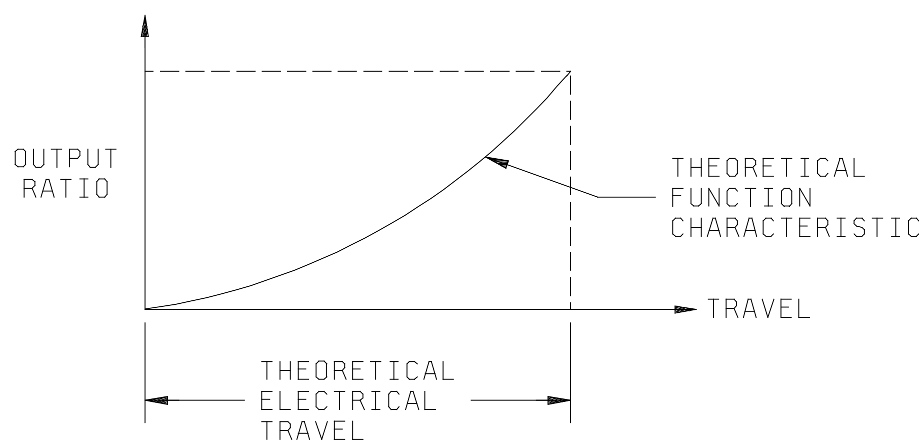

FIGURE A-11. Theoretical electrical travel.

ad. Electrical overtravel. The shaft travel over which there is continuity between the wiper terminal and the resistance element beyond each end of the theoretical electrical travel. (In cases where absolute linearity or absolute conformity is specified, theoretical electrical travel should be substituted for actual electrical travel in this definition.)

ae. Electrical continuity travel. The total travel of the shaft over which electrical continuity is maintained between the wiper and the resistance element. (see figure A-12)

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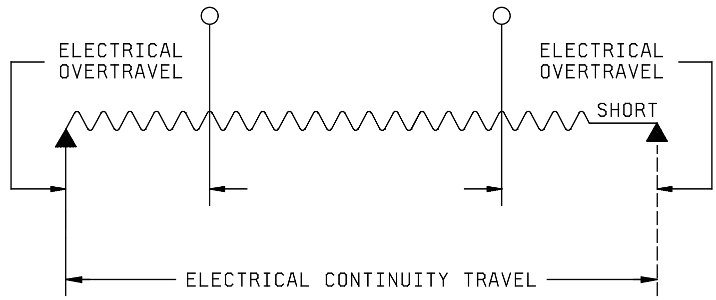

FIGURE A-12. Electrical continuity travel.

af. Tap location. The position of a tap relative to some reference. This is commonly expressed in terms of an output ratio and a shaft position. When a shaft position is specified, the tap location is the center of the effective tap width.

ag. Effective tap width. The travel of the shaft during which the voltage at the wiper terminal and the tap terminal are the same, as the wiper is moved past the tap in one direction. (see figure A-13)

NOTE: In some instances, the tap width may be essentially zero (i.e., no flat zone), but the tap may have a significant effect on conformity. In these cases the term "effective tap width" should not be applied. Instead, the effect of the tap on the output characteristics should be considered in terms of conformity.

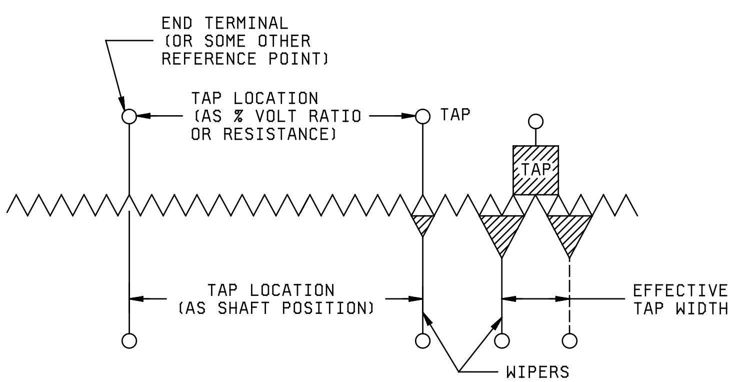

FIGURE A-13. Effective tap width.

ah. Phasing. The relative alignment of the phasing points of each cup of a gang potentiometer.

NOTE: Unless otherwise specified, phasing requirements apply to a single specified phasing point in each cup, and all cups are aligned to the phasing point of the first cup.

ai. Total resistance (dc input impedance). The dc resistance between the input terminals with the shaft positioned so as to give a maximum resistance value.

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aj. DC output impedance. The maximum dc resistance between the wiper and either end terminal with the input shorted.

ak. Minimum resistance. Refer to tap resistance or minimum voltage for applicable definition

al. End resistance. Refer to end voltage for applicable definition.

am. Tap resistance. The minimum resistance obtainable between a tap terminal and a wiper position on the resistance element, measured without drawing wiper current.

an. Temperature coefficient of resistance. The temperature coefficient of resistance is the unit change in resistance per degree centigrade change from a reference temperature and expressed in parts per million per degree centigrade as follows:

$$TC = \frac{R_2 - R_1}{R_1(T_2 - T_1)} \times 10^6$$

Where:
R_1 = Resistance at reference temperature in ohms.
R_2 = Resistance at test temperature in ohms
T_1 = Reference temperature in degrees centigrade (^{O}C)
T_2 = Test temperature in degrees centigrade (^{O}C)

ao. Apparent contact resistance. Refer to output smoothness.

ap. Equivalent noise resistance. Refer to output smoothness.

aq. Function characteristic. The relationship between the output ratio and the shaft position.

MATHEMATICALLY: $\frac{e}{E} = f(\theta)$

ar. Conformity. The fidelity of the relationship between the actual function characteristic and the theoretical function characteristic. (see figure A-14)

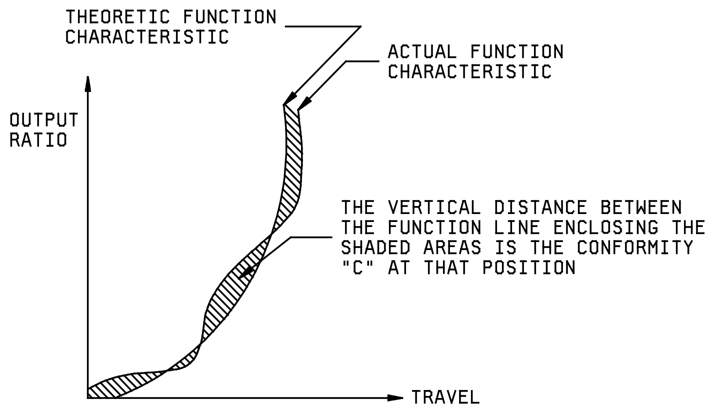

FIGURE A-14. Conformity

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as. Absolute conformity. The maximum deviation of the actual function characteristic from a fully defined theoretical function characteristic. It is expressed as a percentage of the total applied voltage and measured over the theoretical electrical travel. An index point on the actual output is required (see figure A-15).

$$\text{MATHEMATICALLY: } \frac{e}{E} f\left[\frac{\theta}{\theta_T}\right] \pm C; 0 \le \theta \le \theta_T$$

NOTE: The theoretical function characteristic is assumed to be a smooth curve when it can be described by a mathematical expression. When empirical data are provided, the points are assumed to be joined by straight line segments.

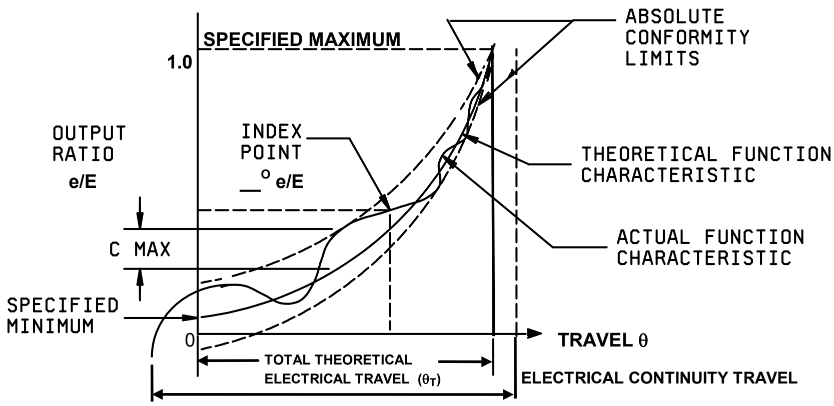

FIGURE A-15. Absolute conformity.

at. Linearity. A specific type of conformity where the theoretical function characteristic is a straight line. (see figure A-16).

$$\text{MATHEMATICALLY: } \frac{e}{E} = f(\theta) \pm C = A(\theta) + B \pm C$$

Where:
A = given slope
B = given intercept at θ = 0

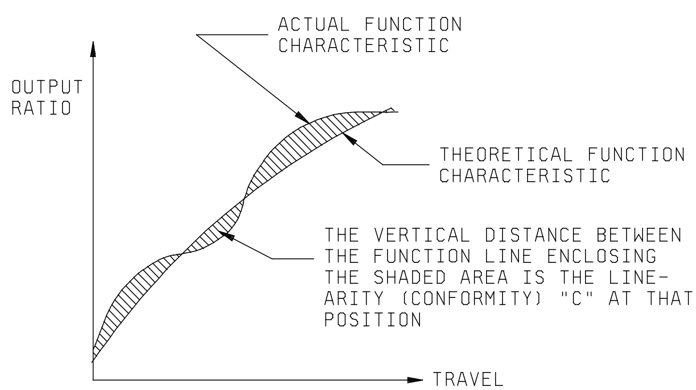

FIGURE A-16. Linearity

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au. Absolute linearity. The maximum deviation of the actual function characteristic from a fully defined straight reference line. It is expressed as a percentage of the total applied voltage and measured over the theoretical electrical travel. An index point on the actual output is required. The straight reference line maybe fully defined by specifying the low and high theoretical end output ratios separated by the theoretical electrical travel. Unless otherwise specified, these end output ratios are 0.0 and 1.0, respectively (see figure A-17).

$$\text{MATHEMATICALLY: } \frac{e}{E} = A\left[\frac{\theta}{\theta_T}\right] + B \pm C$$

Where:

A = given slope
B = given intercept at $\theta = 0$.

Unless otherwise specified: A = 1; B = 0.

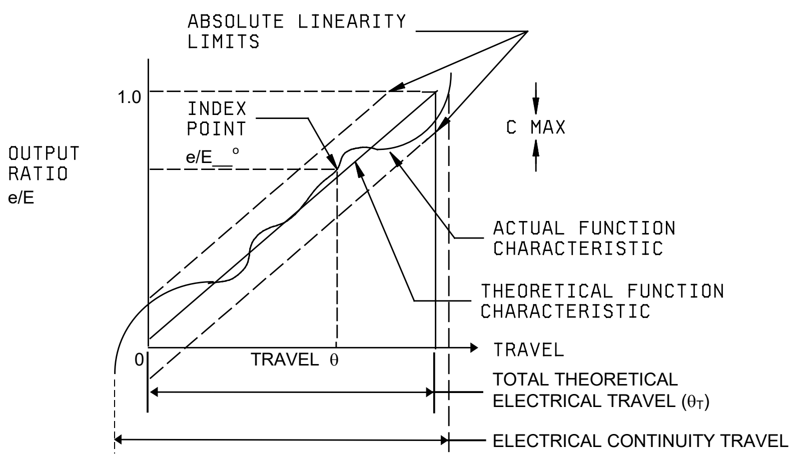

FIGURE A-17. Absolute linearity.

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av. Terminal based linearity. Terminal based linearity is the maximum deviation, expressed as a percent of the applied voltage, of the actual function characteristic from a straight reference line drawn through its specified minimum and maximum output ratios which are separated by the actual electrical travel. Unless otherwise specified, minimum and maximum output ratios are respectively zero and 100 percent of the total applied voltage (see figure A-18).

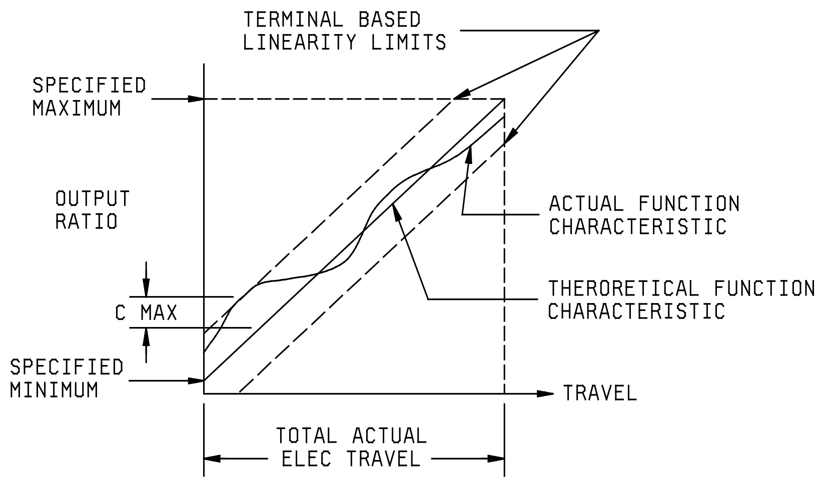

FIGURE A-18. Terminal based linearity.

aw. Zero based linearity. Zero based linearity is the maximum deviation expressed as a percentage of the total applied voltage of the actual function characteristic from a straight reference line drawn through the specified minimum output ratio, extended over the actual electrical travel and rotated to minimize the maximum deviations. Any specified end voltage requirements limits the rotation of the reference line. Unless otherwise specified, the specified minimum output will be zero (see figure A-19).

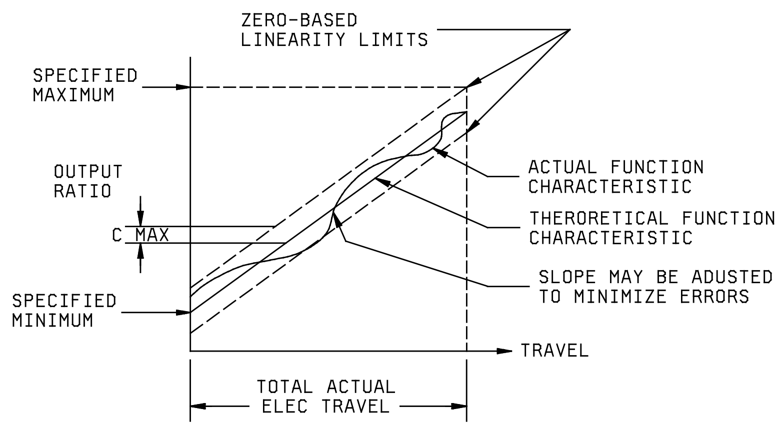

FIGURE A-19. Zero based linearity

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ax. Independent linearity. The maximum deviation of the actual function characteristics from a straight reference line with its slope and position chosen to minimize the maximum deviations. It is expressed as a percentage of the total applied voltage and is measured over the specified theoretical electrical travel. The slope of the reference line, if limited, must be separately specified. An index point on the actual output is required. Unless otherwise specified, the index point will be at θ = 180 degrees (see figure A-20).

$$\text{MATHEMATICALLY: } \frac{e}{E} = P\left[\frac{\theta}{\theta_T}\right] + Q \pm C$$

Where:
P = unspecified slope;
Q = unspecified intercept at θ = 0.

And both are chosen to minimize C but are limited by the end voltage requirements.

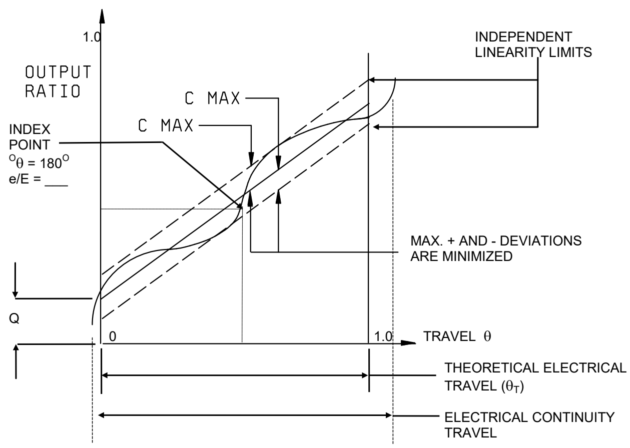

FIGURE A-20. Independent linearity.

ay. Constant limits. Permissible conformity deviations specified as a percentage of the total applied voltage (see figure A-21).

NOTE: Unless otherwise specified, all definitions in this document employ constant limits.

az. Zero-to-peak constant limits. Permissible conformity deviations specified as a percentage of zero-to-peak applied voltage (see figure A-21).

NOTE: The numerical value of zero-to-peak errors is double that of equal peak-to-peak errors, because the reference zero-to-peak applied voltage is one-half of the total (peak-to-peak) applied voltage.

ba. Proportional limits. Permissible conformity deviations specified as a percentage of the theoretical output ratio at the point of measurement (see figure A-21).

NOTE: Proportional limits may become impossibly restrictive in the vicinity of zero theoretical output and should be modified to provide a practical tolerance in that region, if the theoretical output ratio approaches zero.

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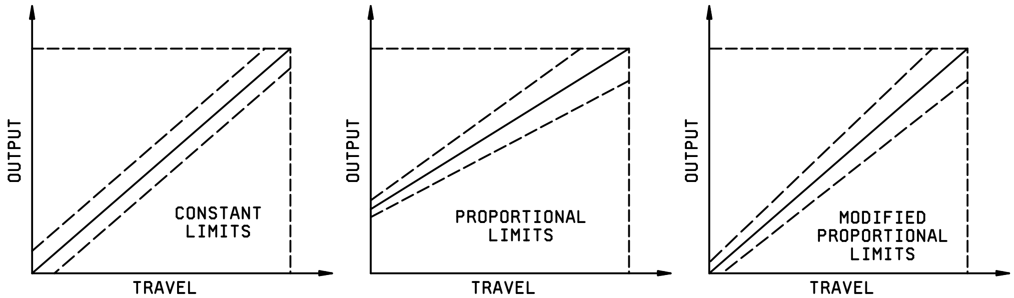

FIGURE A-21. Tolerance limits.

bb. Modified proportional limits. Any combination of constant and proportional limits (see figure A-21).

bc. Phasing point. The phasing point is a point of reference on each electrical element used to describe the relative alignment of the cups and for electrical elements of a gang with respect to the portion of the wipers on their relative electrical elements.

bd. Phasing. Phasing is the relative alignment of the cups and for electrical elements of a gang with respect to the position of the wipers on their respective electrical elements (see figure A-22).

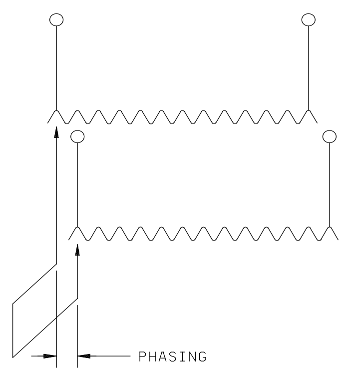

FIGURE A-22. Phasing.

be. Simultaneous conformity phasing. The relative alignment of the cups of a gang potentiometer, from a common index point, such that the output ratios of all cups fall within their respective conformity limits over the theoretical electrical travel.

bf. Voltage tracking error. The difference, at any shaft position, between the output ratios of any two commonly actuated similar electrical elements, expressed as a percentage of the single total voltage applied to them.

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bg. Output smoothness. Output smoothness is a measurement of any spurious variation in the electrical output not present in the input. It is expressed as a percentage of the total applied voltage and measured for specified travel increments over the theoretical electrical travel. Output smoothness includes effects of contact resistance variations, resolution, and other micro-nonlinearities in the output.

bh Noise. Noise is any spurious variation in the electrical output not present in the input, defined quantitatively in terms of an equivalent parasitic, transient resistance in ohms, appearing between the contact and the resistance element when the shaft is rotated or translated. The equivalent noise resistance is defined independently of the resolution, the functional characteristics, and the total travel. The magnitude of the equivalent noise resistance is the maximum departure from a specified reference line. The wiper of the potentiometer is required to be excited by a specified current and moved at a specified speed.

bi. Resolution. A measure of the sensitivity to which the output ratio of the potentiometer may be set.

bj Theoretical resolution. Theoretical resolution is used in wirewound linear potentiometers only. It is the reciprocal of the number of turns of wire in resistance winding in the actual electrical travel and is expressed as a percentage.

$$\frac{1}{N} \times 100 \quad = \text{Theoretical resolution percent}$$

Where:
N = Total number of resistance wire turns

bk Travel resolution. Travel resolution is the maximum value of shaft travel in one direction per increased voltage step in any specified portion of the resistance element.

bl. Voltage resolution. The maximum incremental change in output ratio with shaft travel in one direction in any specified portion of the resistance element. (see figure A-23)

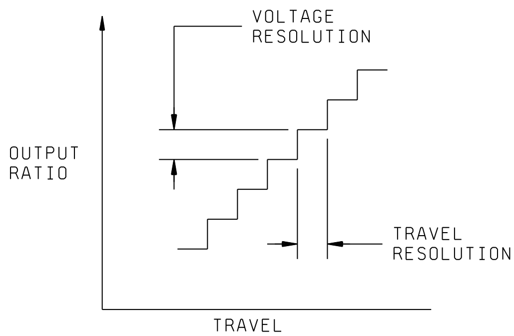

FIGURE A-23. Voltage Resolution.

bm. End voltage. End voltage is the voltage between the wiper terminal and an end terminal when the shaft is positioned at the corresponding end point. It is usually expressed as a percentage of the total applied voltage.

bn Jumpoff voltage. The jumpoff voltage is the magnitude of the first measurable voltage change as the wiper moves from the overtravel region onto the actual electrical travel region. It is usually expressed as a percentage of the total applied voltage (see figure A-24).

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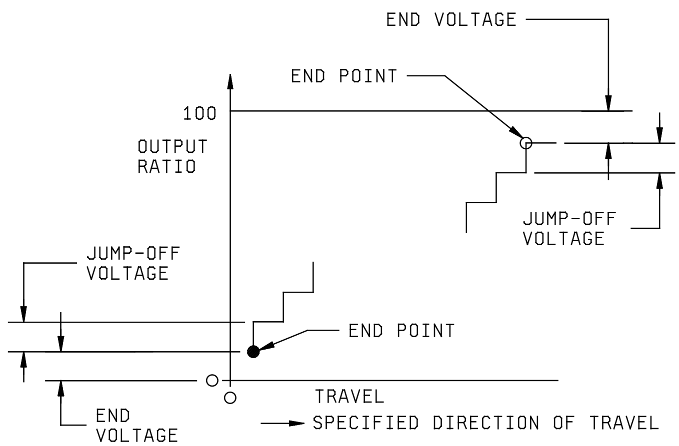

FIGURE A-24. Jumpoff voltage.

bo. Dielectric strength. Ability to withstand under prescribed conditions, a specified potential of a given characteristic between the terminals of each cup and the exposed conducting surfaces of the potentiometer, or between the terminals of each cup and the terminals of every other cup in the gang without exceeding a specified leakage current value.

bp. Insulation resistance. The resistance to a specified impressed dc voltage between the terminals of each cup and the exposed conducting surfaces of the potentiometer, or between the terminals of each cup and the terminals of every other cup in the gang, under prescribed conditions.

bq. Power rating. The maximum power that a potentiometer can dissipate under specified conditions while meeting specified performance requirements.

br. Power derating. The modification of the nominal power rating for various considerations such as load resistance, output slopes, ganging, nonstandard environmental conditions, and other factors.

bs. Life. The number of shaft revolutions or translations obtainable under specific operating conditions and within specified allowable degradation of specific characteristics.

bt. Total input impedance. The impedance between the two input terminals with open circuit between output terminals, and measured at a specified voltage and frequency with the shaft positioned to give a maximum value (see figure A-25).

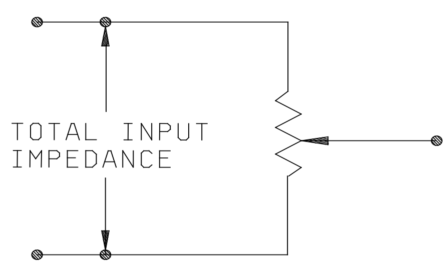

FIGURE A-25. Total input impedance.

bu. Output impedance. Maximum impedance between slider and either end terminal with the input shorted, and measured at a specified voltage and frequency (see figure A-26).

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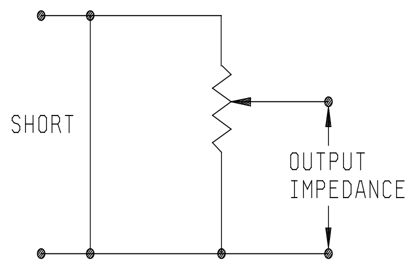

FIGURE A-26. Output impedance.

bv. Quadrature voltage. The maximum value of that portion of the output voltage which is $\pm 90^O$ out of time phase with the input voltage, expressed as volts-per-volt applied, measured at a specified input voltage and frequency.

bw. Phase shift. The phase difference, expressed in degrees, between the sinusoidal input and output voltages measured at a specified input voltage and frequency with the shaft at a specified position.

$$\text{MATHEMATICALLY: } \Phi = SIN^{-1}\left[\frac{e_q}{e}\right] = TAN^{-1}\left[\frac{e_q}{e_1}\right]$$

Where:

ϕ	=	Phase shift in degrees
e_q	=	Quadrature voltage
e_1	=	Inphase output voltage
e	=	Output voltage

bx. Shaft runout. The eccentricity of the shaft diameter with respect to the rotational axis of the shaft, measured at a specified distance from the end of the shaft. The body of the potentiometer is held fixed, and the shaft is rotated with a specified load applied radially to the shaft. The eccentricity is expressed in inches, TIR.

by. Lateral runout. The perpendicularly of the mounting surface with respect to the rotational axis of the shaft, measured on the mounting surface at a specified distance from the outside edge of the mounting surface. The shaft is held fixed, and the body of the potentiometer is rotated with specified loads applied radially and axially to the body of the pot. The lateral runout is expressed in inches, TIR.

bz. Pilot diameter runout. The eccentricity of the pilot diameter with respect to the rotational axis of the shaft, measured on the pilot diameter. The shaft is held fixed, and the body of the potentiometer is rotated with a specified load applied radially to the body of the pot. The eccentricity is expressed in inches, TIR.

ca. Shaft radial play. The total radial excursion of the shaft, measured at a specified distance from the front surface of the unit. A specified radial load is applied alternately in opposite directions at a specified point. Shaft radial play is expressed in inches.

cb. Shaft end play. The total axial excursion of the shelf, measured at the end of the shaft with a specified axial load supplied alternately in opposite directions. Shaft end play is expressed in inches.

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cc. Starting torque. The maximum moment in the clockwise and counterclockwise directions required to initiate shaft rotation anywhere in the total mechanical travel.

cd. Running torque. The maximum moment in the clockwise and counterclockwise directions required to sustain uniform shaft rotation at a specified speed throughout the total mechanical travel.

ce. Moment of inertia. The mass moment of inertia of the rotating elements of the potentiometer about their rotational axis.

cf. Static stop strength. The maximum static load that can be applied to the shaft at each mechanical stop for a specified period of time without permanent change of the stop positions greater than specified.

cg. Dynamic stop strength. The inertia load, at a specified shaft velocity and a specified number of impacts, that can be applied to the shaft at each stop without a permanent change of the stop position greater than specified.

A.3.1.7 Special Resistors. See table A-VI.

A.3.1.7.1 MIL-PRF-29, MF, Resistor, Fixed, Meter Multiplier, External, High Voltage, Ferrule Terminal Type. These resistors are used for high-voltage, external, meter-multiplier, fixed resistors of the ferrule-terminal type for use with direct-current (dc) instruments drawing 1 milliampere at full-scale deflection.

A.3.1.7.2 MIL-PRF-23648, RTH, Resistor, Thermal (Thermistor) Insulated. These resistors exhibit a rapid change in resistance for a relative small temperature change. These resistors are used to measure temperature or to compensate for changes in temperature.

A.3.1.7.3 MIL-PRF-32192, RCTP and RCTN, Resistor Chip, Thermal. These thermistors exhibit a positive temperature coefficient (PTC) or a negative temperature coefficient (NTC) and are primarily intended for incorporation into surface mount applications. These devices are to be used for temperature control, temperature compensation, sensing, and frequency compensation over the temperature range specified.

A.3.1.7.4 MIL-PRF-83530, RVS, Resistor, Voltage Sensitive Resistor, (Varistor), Metal-Oxide. These devices function as a nonlinear variable impedance dependent on voltage. They are designed to protect a circuit from a surge in voltage. (Inactive for new design)

TABLE A-VI. Special resistors selection guidance table.

MIL-PRF-29 - Resistor, Fixed, Meter Multiplier, External, High Voltage, Ferrule Terminal Type			
Styles available	Resistance range (in megohms)	Voltage ratings	Maximum body size (inches)
MFA	3.5, 4.0, 5.0, 6.0	3.5, 4.0, 5.0, 6.0	9.781 x 1.312
MFB	1.0, 1.5, 2.0, 2.5, 3.0, 3.5	1.0, 1.5, 2.0, 2.5, 3.0, 3.5	5.281 x 1.312
MFC	0.5, 0.8, 1.0	0.5, 0.8, 1.0	2.937 x 1.000
MFD	10	10	16.500 x 1.312
MFE	15	15	23.500 x 1.312
MFF	20	20	30.500 x 1.312

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MIL-PRF-23648 - Resistor, Thermal (Thermistor) Insulated										
Specification sheet	Styles available	Power rating (Watts)	Thermal time constant (Seconds)	Dissipation Constant mW/°C	Resistance tolerance (percent) see A.1.1.2	Resistance Ratio 1/	Resistance range (ohms)		Maximum body size (inches) and configuration (see figure A-2)	
							min	max		
MIL-PRF-23648/1	RTH06	0.05	80	5	F, G, J, K	A, B, C	68	75k	0.30 D.	M
MIL-PRF-23648/9	RTH22	0.5	60	15	J, K	E	10	39k	0.43 x 0.16	A
MIL-PRF-23648/19	RTH42	0.25	60	2.5				10k	0.30 x 0.11	
MIL-PRF-23648/20	RTH44	0.2	25	2.0	F, G, J, K	A, B, C	300	500k	0.25 x 0.13 x 0.135	M

1/ A - 19.8
B - 29.4
C - 48.7
E - 0.55

TABLE A-VI. Special resistors selection guidance table. Continued

MIL-PRF-32192 - Resistor, Chip, Thermal (Thermistor)								
Specification sheet	Styles available	Power rating (Watts)	Thermal time constant (Seconds)	Dissipation constant mW/°C	Resistance tolerance (percent) see A.1.1.2	Resistance ratio (ohms)	Maximum body size (inches) (L x W x H) and configuration (see figure A-2)	
MIL-PRF-32192/1	RCTP0303	.125	30	1.25	F, G, J, K	0.53	0.048 x 0.048 x .082	T
MIL-PRF-32192/2	RCTP0805	.25	30	2.5			0.086 x 0.057 x 0.055	
MIL-PRF-32192/3	RCTN0404	.0625	10	.625		Variable (based on resistance)	0.050 x 0.050 x .020	
MIL-PRF-32192/4	RCTN0805	.125	8	2.0			0.086 x 0.057 x 0.055	
MIL-PRF-32192/5	RCTN1206	.250	8	2.0			0.134 x 0.068 x 0.055	

MIL-PRF-83530 - Resistor, Voltage Sensitive (Varistor), Metal Oxide 1/										
Specification sheet	Styles available	Nominal varistor voltage (V)	Voltage rating (V)		Energy rating (joules)	Clamping voltage at 100 A (V)	Capacitance at 1 MHz (pF)	Clamping voltage at peak current rating (V)	Max body size (inches) A x D x E configuration (see figure A-2)	
			rms	dc						
MIL-PRF-83530/1	RVS10	200	130	175	50	325	3800	570	0.110 x 0.95 x 0.32	M
		220	150	200	55	360	3200	650		
		430	275	369	100	680	1800	1200		
		510	320	420	120	810	1500	1450		

1/ Inactive for new design

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A.3.2 Mounting guide.

A.3.2.1 Stress mounting. Improper heat dissipation is the predominant contributing cause of failure for any resistor type; consequently, the lowest possible resistor surface temperature should be maintained. Figure A-27 illustrates the manner in which heat is dissipated from fixed resistors in free air. The intensity of radiated heat varies inversely with the square of the distance from the resistor. Maintaining maximum distance between heat generating components serves to reduces cross radiation heating effects and promotes better convection by increasing air flow. For optimum cooling without a heat sink, small resistors should have large diameter leads of minimum length terminating in tie points of sufficient mass to act as heat sinks. All resistors have a maximum surface temperature which should never be exceed. Any temperature beyond maximum can cause the resistor to malfunction. Resistors should be mounted so that there are no abnormal hot spots on the resistor surface. When mounted, resistor should not come in contact with heat insulating surfaces.

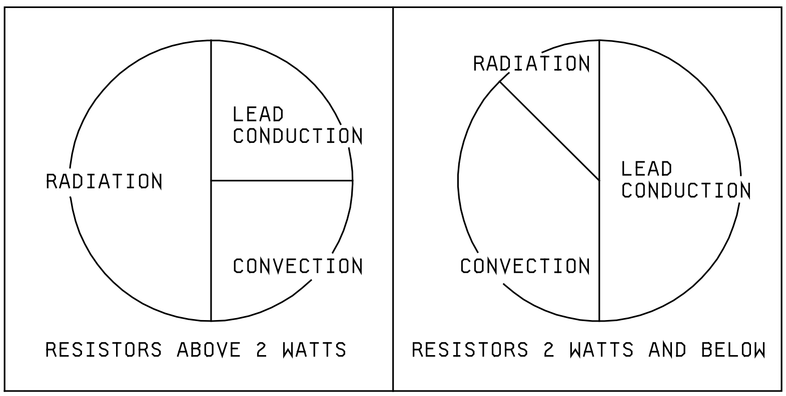

FIGURE A-27. Heat dissipation of resistors under room conditions.

A.3.2.2 Resistor mounting for vibration. Resistors should be mounted so resonance does not occur within the frequency spectrum of the vibration environment to which the resistors may be subjected. Some of the most common resistor packaging methods result in large resistor noise. Resistor mounting for vibration should provide (1) the least tension or compression between the lead and body, (2) the least excitation of the resistor in relation with any other surface, and (3) no bending or distortion of the resistor body.

A.3.2.3 Circuit packaging. Resistors that are crowed together and come into contact with each other can provide leakage paths (even well insulated parts) for external current passage. This can change the resultant resistance in the circuit. Moisture traps and dirt traps are easily formed by crowding. Moisture and dirt eventually form corrosive materials which can deteriorate the resistors and other electronic parts. Moisture can accumulate around dirt even in an atmosphere of normal humidity. Planning should be done to eliminate crowding of parts. Proper space utilization of electronic parts can reduce the package size and still provide adequate spacing of parts.

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A.3.2.4 Summary. The following is a guide for resistor mounting:

a. Maintain lead length to a minimum. The mass of the point acts as a heat sink. (NOTE: Where low temperatures are present, leads should be offset (bent slightly) to allow for thermal contraction).
b. Close tolerance and low value resistors require special precautions (such as short leads and good soldering techniques) since the resistance of the leads and the wiring may be as much as several percent of the resistance of the resistor.
c. Maintain maximum spacing between resistors.
d. For resistors mounted in series, consider the heat being conducted through the leads to the next resistor.
e. Large power units should be mounted to the chassis.
f. Do not mount high power units directly on terminal boards or printed circuits.
g. To provide for the most efficient operation and even heat distribution, power resistors should be mounted in a horizontal position.
h. Select mounting materials that will not char and can withstand strain due to expansion.
i. Consider proximity to other heat sources as well as self-heat.
j. Consider levels of shock and vibration to be encountered. Where large body mass is present, the body should be restrained from movement.

A.3.3 Effects of circuit usage. Resistors must be selected to be compatible with the conditions to which they are exposed. Numerous matters must be considered in this selection process. The most important are noted in the following.

A.3.3.1 Resistance value. This is initially determined by the circuit requirements, and may seem a trivial thing to mention. However, most resistor calculations that are made without reference to available resistors come out to a resistance value that are not standard. The design engineer should be aware of the standard resistance values that are available from manufacturers who adhere to this handbook and various Department of Defense specifications for resistors. These differ somewhat with the various types of resistors. It is a usually a fairly simple thing to bring the exact calculated value in line with a standard value. In the case where this cannot be done, a parallel or series combination of resistors can usually be used. The design engineer should also remember that the resistance value of the resistor that gets into the physical circuit will differ from the value that is stated on the circuit schematic, and that this difference will change as time goes by. The purchase tolerance of the resistor to be used will allow it to differ from the nominal stated value, depending on the type of resistor specified. Furthermore, the temperature at which the resistor works, the voltage across it, and the environment in which it lives will affects the actual value at particular times. For example, the designer should allow for a possible variation of ±15 percent from the nominal value of a purchased ±5 percent composition resistor, for the circuit to continue to operate satisfactorily over a very long time under moderate ambient conditions. Such a figure is a rule of thumb, based on many tests, and many resistors will remain much nearer their starting value; but if many are used, chance will ensure that some will go near this limit. A similar figure can be deduced from each variety of resistor used.

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A.3.3.1.1 Summary.

a. Select a resistor for each circuit application from the lists of standard types and values.
b. Be sure that the circuit being designed will work with any resistor whose resistance value is within the limits set by tolerance plus voltage coefficient plus temperature coefficient plus drift with time. Failure to take these precautions can possibly mean that in equipment produced in quantity for the armed services, there may be some circuits that will not work under extreme conditions.
c. Various initial tolerances are available depending on the type of resistor. It should be remembered that initial accuracies become meaningless if the inherent stability of the resistor does not support the initial accuracy.
d. During shelf life, as well as during operational life, any characteristic (such as resistance, power rating, dielectric strength, or size) of any part may change value due to stresses caused by environmental changes of temperature , humidity, pressure or vibration. Changes of characteristic caused by environmental stresses may be linear or nonlinear, reversible or nonreversible (permanent), or combinations thereof. Where a characteristic of the part undergoes a linear change during environmental stress, and the change reverses itself linearly when the environmental stress is removed so that characteristic returns to its normal value, this rate of change in characteristic value (per unit change in stress value) is designated (x) coefficient, and is usually expressed in percent or ppm/^{O}C.

A.3.3.2 Power rating. The minimum required power rating of a resistor is another factor that is initially set by the circuit usage, but is markedly affected by other conditions of use. As mentioned previously, the power rating is based on the hot spot temperature the resistor will withstand, while still meeting its other requirements of resistance variation, accuracy, and life. For derating information see A.3.3.2.2.

A.3.3.2.1 Self-generated heat. Self-generated-heat in a resistor is, of course, calculated as $P = I^2R$. This figure, in any circuit, must be less than the actual power rating of the resistor used. It is the usual practice to calculate this value and to use the next larger power rating available in the handbook. This calculation should, however, be considered only as a first approximation of the actual rating to be used.

A.3.3.2.2 Rating versus ambient conditions. The power rating of a resistor is based on a certain temperature rise from an ambient temperature of a certain value. If the ambient temperature is greater than this value, the amount of heat that the resistor can dissipate is correspondingly reduced, and therefore it must be derated because of temperature. The applicable section of this handbook and all of the Department of Defense specifications contain derating curves to be applied to the resistors covered.

A.3.3.2.3 Rating versus accuracy. Because of temperature coefficient of resistance that all resistors possess, a resistor which is expected to remain near its measured value under conditions of operation must remain cool. For this reason, all resistors designated as “accurate” are very much larger physically for a certain power rating than are ordinary “nonaccurate” resistors. In general, any resistor, “accurate” or not, must be derated to remain very near its original measured value when it is being operated.

A.3.3.2.4 Rating versus life. If especially long life is required of a resistor, particularly when “life” means remaining within a certain limit of resistance drift, it is usually necessary to derate the resistor, even if ambient conditions are moderate and if accuracy by itself is not important. A good rule to follow when choosing a resistor size for equipment that must operate for many thousands of hours is to derate it to one half of its nominal power rating. Thus, if the self-generated heat in the resistor is one third watt, do not use a one half watt resistor, but rather 1 watt size. This will automatically keep the resistor cooler, will reduce the long term drift, and will reduce the effect of the temperature coefficient. In equipment that need not live so long and must be small in size, this rule may be impractical, and the engineer should adjust the dependence on the rules to the circumstances at hand. A “cool” resistor will generally last longer than a “hot” one, and can absorb transient overloads that might permanently damage a “hot” resistor.

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A.3.3.2.5 Rating under pulsed conditions and under intermittent loads. When a resistor is used in circuits where power is drawn intermittently or in pulses, the actual power dissipated with safety during the pulses can sometimes be much more than the maximum rating of the resistor. For short pulses, the actual heating is determined by the duty factor and the peak power dissipated. Before approving such a resistor application, however, the engineer should be sure (1) that the maximum voltage applied to the resistor during the pulses is never greater than the permissible maximum voltage for the resistor be used, (2) that the circuit cannot fail in such a way that continuous excessive power can be through the resistor and cause it to fail also, (3) that the average power being drawn is well within the agreed on rating of the resistor, and (4) that continuous steep wavefronts applied to the resistor do not cause any unexpected troubles.

A.3.3.3 High frequency. For most resistors, the lower the resistance value, the less total impedance it exhibits at high frequency. Resistors are not generally tested for total impedance at frequencies above 120 Hz. Therefore, this characteristic is not controlled. The dominating conditions for good high frequency resistor performance are geometric considerations and minimum dielectric losses. For the best high frequency performance, the ratio of resistor length to the cross sectional area should be a maximum. Dielectric losses are kept low by proper choice of the resistor base material, and when dielectric binders are used, their total mass is kept to a minimum. The following is a discussion of the high frequency merits of these major resistor types:

a. Film type. Film type resistors have the best high frequency performance. The effective dc resistance for most resistance values remains fairly constant up to 100 MHz and decreases at higher frequencies. In general, the higher the resistance value the greater the effect of frequency.
b. Wirewound. Wirewound resistors have inductive and capacitive effects and are unsuited for use above 50kHz, even when specially wound to reduce the inductance and capacitance. Wirewound resistors usually exhibit an increase in resistance with high frequencies because of “skin” effect.

A.3.4 Effects of mechanical design and ambient conditions. Since the operation of a circuit cannot be divorced from the physical configuration it assumes when assembled, some of the points that apply herein have already been discussed. It is well, however, to check this aspect of equipment design several times, so redundancies in the following paragraphs are deliberate for the sake of emphasis.

A.3.4.1 Mechanical design of resistors. Much trouble during the life of the equipment can be eliminated if the design engineer can be sure that the resistors he is specifying for his circuits are soundly constructed and proper equipment assembly techniques are utilized. The resistor types listed in this handbook provide a great measure of this assurance and, in general, assure a uniform quality of workmanship. The areas defined in A.3.4.1.1 through A.3.4.1.7 are included as indicators of sound product construction.

A.3.4.1.1 End caps or terminations. The connection between the resistor element itself and the pigtails or leads that connect it into the circuit must be so good that no possible combination of conditions met in the proposed service can cause an intermittent connection. The Department of Defense specifications cover this point, and provide tests to check for it. When resistors are handled in automatic assembly machines, this precaution is particular important.

A.3.4.1.2 Effect of soldering. There are assembly techniques that affect resistor reliability. Resistors should never be overheated by excessive soldering iron applications, and the resistor leads should not be abraded by assembly tools. No normal soldering practice, either manual or dip soldering, should damage the resistor physically or change its resistance value appreciably.

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A.3.4.1.3 Moisture resistance. Moisture is the greatest enemy of components and electronic equipment. Usually a resistor will keep itself dry because of its own self-generated heat; this is, of course, only true when the equipment is turned on. If the equipment must stand for long periods under humid conditions without power applied, the engineer should determine whether his circuits will operate with resistance values which have changed from the “hot” condition, and whether the retrace of the resistance value during the warm up period will allow the equipment to work satisfactorily during this period. If it will not, the resistor must be adequately protected against moisture absorption. The resistor cannot be blamed for performing improperly if it is not designed for the use to which it is put. It is therefore up to the design engineer to analyze what is needed and to provide the resistor to meet these conditions. This handbook and the applicable Department of Defense specifications constitute a guide as to what various kinds of resistors will do under humid conditions.

A.3.4.1.4 Method of mounting. Large resistors that are not provided with adequate means of mounting should not be considered, under conditions of vibration or shock. Lead failure can occur, and the larger the mass supported by the leads the more probable a failure will be. Even when vibration or shock will not be a serious problem, ease of assembly and replaceability suggest that large components be mounted individually.

A.3.4.1.5 Resistor body. The body of the resistor must be sufficiently strong to withstand any handling it is likely to get. The specifications call out, through workmanship and packaging requirements, that it be shown by the manufacturer that the product will not crack, chip, or break in transit, on the shelf, or in the normal assembly process.

A.3.4.1.6 Insulation or coating. All resistors intended for use in reliable electronic equipment must be protected by an insulating coating. Sometimes this is a molded phenolic case, epoxy coating, or ceramic or glass sleeves. Wirewound power resistors use various cement and vitreous enamel coatings to protect the windings, and to insulate and provide moisture barriers. Not all of the coatings and insulations applied to commercial resistors are satisfactory for extreme variations in ambient conditions; the various Department of Defense specifications include test used to qualify the various manufacturer’s products thus providing a greater confidence in the coating used.

A.3.4.1.7 Pure tin. The use of pure tin, as an underplate or final finish, is prohibited both internally and externally. Tin content of resistor components and solder will not exceed 97 percent, by mass. Tin will be alloyed with a minimum of 3 percent lead, by mass.

A.3.4.2 Effects of ambient conditions. In the establishment of rating for resistors, the design engineer has implicitly considered the mechanical design of the equipment. This may not have been realized, but it is so because the ambient conditions in which the resistor must operate determine to a large degree the power rating and mechanical construction of the resistor if long life, or any life, under extreme conditions is desired.

A.3.4.2.1 Resistor heating. A very important question in the application of resistors is how hot will they get in service. In a piece of equipment the heat in a resistor comes from several sources; namely, (1) self-generated heat, and is the thing that can be easily calculated, and (2) the heat that the resistor receives from other resistors or other heat producing components in the same immediate neighborhood by radiation, and is not so easily calculated. The important thing to remember is under these conditions each resistor will be heated more than I^2R would suggest; when much heat is produced, as in stacked Wirewound resistors, the design engineer would do well not to freeze his design until he has measured a typical assembly with power on to see just how hot the resistor gets. The same thing is true of the extra heating given the resistors by convection. This is another way of saying that high ambient temperature will reduce the actual power rating of the resistor by reducing permissible temperature rise, a point that has been made several times before. The equipment designer must realize also that the heat being produced by “hot” resistors can injure other components. This is a very important point to remember; capacitors, diodes, and other resistors usually do not fail immediately when overheated. The effect of too much heat is a deteriorating one, weakening the component until at a later date it will unexpectedly fail. It is very easy to put a “heat bomb” in a piece of equipment that will not go off in normal production testing but will do its duty. It is also very easy to eliminate such troubles by strict and thoughtful attention to the problem of heating. A few rules have been given for use as guides to protect against these factors. (See A.3.3.2)

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A.3.4.2.2 High altitude. With the exception of the dielectric withstanding voltage test at reduced barometric pressure, all tests in Department of Defense specifications referenced herein are performed at ambient atmospheric pressure. This fact should be considered when the use of these resistors for high altitude conditions is contemplated.

A.3.4.2.3 Flammability. It should be noted that Department of Defense specifications referenced herein contain no requirements concerning the flammability of the materials used in the construction of these resistors. Users should take this into consideration when a particular application involves this requirement.

A.4 SUPPLEMENTAL INFORMATION

A.4.1 Reliability. The established reliability specification provides for the establishment of a failure rate figure through the single parameter of load life only. Although, in most instances, the established reliability specification provides for more frequent moisture resistance, burn in, and other types of screening tests on a 100 percent basis, the failure rate (in percent per 1,000 hours) is based only on load life test results.

A.4.2 Metric equivalent. The metric equivalents (to the nearest 0.01 mm) which are provided in the individual sections are for general information only and are based upon 1 inch = 25.4 mm.

A.4.3 International standardization agreements. Certain provisions of the specifications referenced in this handbook are subjected on international standardization agreements. When amendment, revision, or cancellation of any of these specification is proposed which will affect or violate the international agreement concerned, the preparing activity will take appropriate reconciliation action through international standardization channels including departmental standardization offices, if required.

A.4.4 Cross reference. A cross reference of section number, Department of Defense specification numbers, associated specification numbers, and style numbers are included for reference (see table A-VII).

A.4.5 Tin whisker growth. The use of alloys with tin content greater than 97 percent, by mass, may exhibit tin whisker growth problems after manufacture. Tin whiskers may occur anytime from a day to years after manufacture and can develop under typical operating conditions, on products that use such materials. Conformal coatings applied over top of a whisker-prone surface will not prevent the formation of tin whiskers. Alloys of 3 percent lead, by mass, have shown to inhibit the growth of tin whiskers. For additional information on this matter, refer to ASTM-B545 (Standard Specification for Electrodeposited Coatings of Tin).

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APPENDIX A

TABLE A-VII. Detailed specification by style number.

DoD specification	Style
MIL-PRF-19	
MIL-PRF-19/2	RA20
MIL-PRF-19/3	RA30
MIL-PRF-22	
MIL-PRF-22/1	RP06
MIL-PRF-22/2	RP07
MIL-PRF-22/3	RP10
MIL-PRF-22/4	RP11
MIL-PRF-22/5	RP15
MIL-PRF-22/6	RP16
MIL-PRF-22/7	RP20
MIL-PRF-22/8	RP25
MIL-PRF-22/9	RP30
MIL-PRF-22/10	RP35
MIL-PRF-22/11	RP40
MIL-PRF-22/12	RP45
MIL-PRF-22/13	RP50
MIL-PRF-22/14	RP55
MIL-PRF-22/15	RP05
MIL-PRF-26	
MIL-PRF-26/2	RW20
	RW21
	RW22
	RW23
	RW24
MIL-PRF-26/3	RW29
	RW31
	RW33
	RW35
	RW37
	RW38
	RW47
MIL-PRF-26/4	RW55
	RW56
	RW67
	RW68
	RW69
MIL-PRF-26/5	RW70
	RW74
	RW78
	RW79
MIL-PRF-26/6	RW80
	RW81
MIL-PRF-29	
	MFA
	MFB
	MFC
	MFD
	MFE
	MFF

DoD specification	Style
MIL-PRF-94	
MIL-PRF-94/2	RV5
MIL-PRF-94/3	RV6
MIL-PRF-94/4	RV2
MIL-PRF-94/5	RV4
MIL-PRF-94/6	2RV7
MIL-PRF-94/7	RV8
MIL-PRF-914	
MIL-PRF-914/3	RNS030
MIL-PRF-914/4	RNS040
MIL-PRF-914/5	RNS050
MIL-PRF-12934	
MIL-PRF-12934/1	RR0900
MIL-PRF-12934/2	RR1100
MIL-PRF-12934/4	RR2000
MIL-PRF-12934/5	RR3000
MIL-PRF-12934/6	RR1000
MIL-PRF-12934/9	RR2100
MIL-PRF-12934/10	RR3100
MIL-PRF-12934/15	RR3200
MIL-PRF-12934/16	RR3300
MIL-PRF-12934/17	RR3400
MIL-PRF-12934/18	RR3500
MIL-PRF-12934/19	RR1300
MIL-PRF-12934/20	RR1400
MIL-PRF-12934/27	RR3600
MIL-PRF-12934/28	RR3700
MIL-PRF-12934/29	RR3800
MIL-PRF-12934/30	RR3900
MIL-PRF-12934/31	RR4000
MIL-PRF-12934/32	RR4100
MIL-PRF-12934/33	RR2002
MIL-PRF-12934/34	RR1004
MIL-PRF-12934/35	2RR2104
MIL-PRF-12934/36	RR3601
MIL-PRF-12934/37	2RR3100
MIL-PRF-18546	
MIL-PRF-18546/2	RE77
	RE80
MIL-PRF-22097	
MIL-PRF-22097/2	RJ12
MIL-PRF-22097/4	RJ24
MIL-PRF-22684	
MIL-PRF-22684/8	RL42...TX

DoD specification	Style
MIL-PRF-23648	
MIL-PRF-23648/1	RTH06
MIL-PRF-23648/9	RTH22
MIL-PRF-23648/19	RTH42
MIL-PRF-23648/20	RTH44
MIL-PRF-27208	
MIL-PRF-27208/8	RT12
MIL-PRF-27208/9	RT24
MIL-PRF-27208/10	RT26
MIL-PRF-32159	
MIL-PRF-32159/1	RCZ0502
MIL-PRF-32159/2	RCZ0505
MIL-PRF-32159/3	RCZ1005
MIL-PRF-32159/4	RCZ1505
MIL-PRF-32159/5	RCZ2208
MIL-PRF-32159/6	RCZ0705
MIL-PRF-32159/7	RCZ1206
MIL-PRF-32159/8	RCZ2010
MIL-PRF-32159/9	RCZ2512
MIL-PRF-32159/10	RCZ1010
MIL-PRF-32159/11	RCZ0402
MIL-PRF-32159/12	RCZ0603
MIL-PRF-32159/13	RCZ0302
MIL-PRF-32192	
MIL-PRF-32192/1	RCTP0303
MIL-PRF-32192/2	RCTP0805
MIL-PRF-32192/3	RCTN0404
MIL-PRF-32192/4	RCTN0805
MIL-PRF-32192/5	RCTN1206
MIL-PRF-39002	
MIL-PRF-39002/1	RK09
MIL-PRF-39002/3	RK11
MIL-PRF-39005	
MIL-PRF-39005/1	RBR52
MIL-PRF-39005/2	RBR53
MIL-PRF-39005/3	RBR54
MIL-PRF-39005/4	RBR55
MIL-PRF-39005/5	RBR56
MIL-PRF-39005/6	RBR71
MIL-PRF-39005/7	RBR57
MIL-PRF-39005/8	RBR74
MIL-PRF-39005/9	RBR75
MIL-PRF-39005/11	RBR80
	RBR81*

* Inactive for new design

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TABLE A-VII. Detailed specification number by style number - Continued.

DoD specification	Style
MIL-PRF-39007	
MIL-PRF-39007/5	RWR71
MIL-PRF-39007/6	RWR74
MIL-PRF-39007/7	RWR78
MIL-PRF-39007/8	RWR80
MIL-PRF-39007/9	RWR81
MIL-PRF-39007/10	RWR84
MIL-PRF-39007/11	RWR89
MIL-PRF-39007/12	RWR82
MIL-PRF-39009	
MIL-PRF-39009/1	RER60 RER65 RER70 RER75
MIL-PRF-39009/2	RER40 RER45 RER50 RER55
MIL-PRF-39015	
MIL-PRF-39015/1	RTR12
MIL-PRF-39015/2	RTR22
MIL-PRF-39015/3	RTR24
MIL-PRF-39017	
MIL-PRF-39017/1	RLR07
MIL-PRF-39017/2	RLR20
MIL-PRF-39017/3	RLR32
MIL-PRF-39017/5	RLR05
MIL-PRF-39023	
MIL-PRF-39023/1	RQ090
MIL-PRF-39023/2	RQ110
MIL-PRF-39023/3	RQ150
MIL-PRF-39023/4	RQ200
MIL-PRF-39023/5	RQ300
MIL-PRF-39023/6	RQ100
MIL-PRF-39023/7	RQ160
MIL-PRF-39023/8	RQ210
MIL-PRF-39023/9	RQ091
MIL-PRF-39023/10	RQ051
MIL-PRF-39035	
MIL-PRF-39035/1	RJR12*
MIL-PRF-39035/2	RJR24
MIL-PRF-39035/3	RJR26
MIL-PRF-39035/4	RJR50

DoD specification	Style
MIL-PRF-49462	
MIL-PRF-49462/3	RHV30 RHV31 RHV32 RHV33 RHV34 RHV35
MIL-PRF-49465	
MIL-PRF-49465/1	RLV10
MIL-PRF-49465/6	RLV30
MIL-PRF-49465/7	RLV31
MIL-PRF-55182	
MIL-PRF-55182/1	RNC/N/R55
MIL-PRF-55182/3	RNC/N/R60
MIL-PRF-55182/5	RNC/N/R65
MIL-PRF-55182/6	RNC/N/R70
MIL-PRF-55182/7	RNC/N/R50
MIL-PRF-55182/9	RNC/N90
MIL-PRF-55182/10	RNC/N/R75
MIL-PRF-55342	
MIL-PRF-55342/1	RM0502
MIL-PRF-55342/2	RM0505
MIL-PRF-55342/3	RM1005
MIL-PRF-55342/4	RM1505
MIL-PRF-55342/5	RM2208
MIL-PRF-55342/6	RM0705
MIL-PRF-55342/7	RM1206
MIL-PRF-55342/8	RM2010
MIL-PRF-55342/9	RM2512
MIL-PRF-55342/10	RM1010
MIL-PRF-55342/11	RM0402
MIL-PRF-55342/12	RM0603
MIL-PRF-55342/13	RM0302

DoD Specification	Style
MIL-PRF-83401	
MIL-PRF-83401/1	RZ010
MIL-PRF-83401/2	RZ020
MIL-PRF-83401/3	RZ030
MIL-PRF-83401/4	RZ040
MIL-PRF-83401/5	RZ050
MIL-PRF-83401/6	RZ060
MIL-PRF-83401/7	RZ070
MIL-PRF-83401/8	RZ080
MIL-PRF-83401/9	RZ090
MIL-PRF-83401/10	RZ100
MIL-PRF-83401/13	RZ130
MIL-PRF-83401/14	RZ140
MIL-PRF-83401/15	RZ150
MIL-PRF-83401/18	RZ180
MIL-PRF-83401/19	RZ190
MIL-PRF-83401/21	RZ210
MIL-PRF-83401/22	RZ220
MIL-PRF-83401/23	RZ230
MIL-PRF-83401/24	RZ240
MIL-PRF-83530	
MIL-PRF-83530/1*	RVS10

* Inactive for new design

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APPENDIX B

COMMERICAL ITEM DESCRIPTIONS (CIDs)

B.1 SCOPE

B.1.1 Scope. The following appendix includes all active Commercial Item Descriptions (CIDs). These drawings are used to supplement Military Specifications.

B.2 APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

B.3 COMMERICAL ITEM DESCRIPTIONS (CIDs)

B.3.1 Commercial Item Descriptions (CIDs). Table B-I show a listing of Commercial Item Descriptions (CIDs) available for use.

TABLE B-I. List of Commercial Item Descriptions (CIDs).

CID Number	Title
A-A-55088	Resistor, Flameproof, Fusible
A-A-55501	Resistor, Fixed, Zero Ohm, 1/4 Watt
A-A-55502	Resistor, Fixed, Zero Ohm, 1/8 Watt
A-A-55512	Resistor, Thermally Sensitive (Thermistor)
A-A-55517	Resistor, Fixed, Carbon Film, General Requirements For
A-A-55517/1	Resistor, Fixed, Carbon Film, 1/8 Watt
A-A-55517/2	Resistor, Fixed, Carbon Film, 1/4 Watt
A-A-55517/3	Resistor, Fixed, Carbon Film, 1/2 Watt
A-A-55517/4	Resistor, Fixed, Carbon Film, 1 Watt
A-A-55517/5	Resistor, Fixed, Carbon Film, 2 Watt
A-A-55534	Resistor, Fixed, Power Type, Very Low Resistance Values, General Requirements For
A-A-55534/1	Resistor, Fixed, Wirewound or Metal Element, Power Type, Style VLV1
A-A-55534/2	Resistor, Fixed, Wirewound or Metal Element, Power Type, Style VLV1206
A-A-55534/3	Resistor, Fixed, Wirewound or Metal Element, Power Type, Style VLV3
A-A-55534/4	Resistor, Fixed, Wirewound or Metal Element, Power Type, Style VLV5
A-A-55534/5	Resistor, Fixed, Wirewound or Metal Element, Power Type, Style VLV7
A-A-55534/6	Resistor, Fixed, Wirewound or Metal Element, Power Type, Style VLV10
A-A-55534/7	Resistor, Fixed, Wirewound or Metal Element, Power Type, Style VLV2010
A-A-55534/8	Resistor, Fixed, Wirewound or Metal Element, Power Type, Style VLV2512
A-A-55534/9	Resistor, Fixed, Wirewound or Metal Element, Power Type, Style VLV2
A-A-55562	Resistor, Chip, Voltage Sensitive (Varistor), Metal Oxide,
A-A-55562/1	Resistor, Chip, Voltage Sensitive (Varistor), Metal Oxide, Style 0603
A-A-55562/2	Resistor, Chip, Voltage Sensitive (Varistor), Metal Oxide, Style 0805
A-A-55562/3	Resistor, Chip, Voltage Sensitive (Varistor), Metal Oxide, Style 1206
A-A-55562/4	Resistor, Chip, Voltage Sensitive (Varistor), Metal Oxide, Style 1210
A-A-55562/5	Resistor, Chip, Voltage Sensitive (Varistor), Metal Oxide, Style 0402

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TABLE B-I. List of Commercial Item Descriptions (CIDs). - Continued

CID Number	Title
A-A-55564	Resistor, Voltage Sensitive (Varistor), General Specification for
A-A-55564/1	Resistor, Voltage Sensitive (Varistor), Base Mount
A-A-55564/2	Resistor, Voltage Sensitive (Varistor), Metal Oxide, High Energy
A-A-55564/3	Resistor, Voltage Sensitive (Varistor), Metal Oxide, Radial Lead
A-A-59496	Resistor, Variable, Trimmer Nonwirewound, and Wirewound General Requirements for
A-A-59496/1	Resistor, Variable, Trimmer Nonwirewound, 4 mm Square, J-Hook Leads
A-A-59496/2	Resistor, Variable, Trimmer Nonwirewound, 4 mm Square, Gull Wing Leads
A-A-59497	Resistor, Variable, Nonwirewound, Wirewound, Precision, Nonprecision, General Requirements for
A-A-59497/1	Resistor, Variable, Nonwirewound, Nonprecision, 1 Watt
A-A-59497/2	Resistor, Variable, Nonwirewound, Precision, Linear Motion Position Sensor
A-A-59714	Resistor, Resettable Fuses (Non-Linear Thermistor) General Requirements for
A-A-59714/1	Resistor, Resettable Fuses (Non-Linear Thermistor) Radial Leaded, Style RXE
A-A-59714/2	Resistor, Resettable Fuses (Non-Linear Thermistor) Radial Leaded, Style RUE
A-A-59714/3	Resistor, Resettable Fuses (Non-Linear Thermistor) Radial Leaded, Style TR
A-A-59715	Resistor, Fixed and Adjustable, Wirewound, Power Type, General Requirements for
A-A-59715/1	Resistor, Fixed, Wirewound, Power Type, Lead Terminal
A-A-59715/2	Resistor, Adjustable, Wirewound, Power Type
A-A-59715/3	Resistor, Fixed, Wirewound, Power Type
A-A-59715/4	Resistor, Fixed, Wirewound, Power Type, Tab Terminals
A-A-59715/5	Resistor, Fixed and Adjustable, Wirewound, Power Type
A-A-59769	Resistor Networks, Ball Grid Array Terminators General Requirements for
A-A-59769/1	Resistor Networks, Ball Grid Array Terminators Thevenin Termination

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APPENDIX C

DLA LAND AND MARITIME DRAWINGS

C.1 SCOPE

C.1.1 Scope. The following appendix includes all active DLA Land and Maritime and Defense Supply Center, Columbus Drawings. These drawings are used to supplement Military Specifications.

C.2 APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

C.3 DLA LAND AND MARITIME DRAWINGS

C.3.1 DLA LAND AND MARITIME Drawings. Table C-I show a listing of DLA Land and Maritime Drawings available for use.

TABLE C-I. List of DLA Land and Maritime Drawings

Drawing Number	Title
00001	Resistor, Variable, Wirewound, Nonprecision, Trimmer, 3/8 Inch, Square, 1 Watt, Flexible Leads
01002	Resistor, Fixed, Chip, 1.5 Watt (MELF - 2512), Flat Ceramic Package
01032	Resistor, Fixed, Film, Chip, Beryllia Substrate, High Power, Style 1206
01033	Resistor, Fixed, Film, Chip, Voltage Divider, Style 1206
02001	Resistor, Fixed, Film, Precision, Chip 1/8 Watt, Style 2012
02005	Resistors, Variable, Nonwirewound (Adjustment Type, Lead-Screw Actuated) 1/2" Rectangular, 0.3 Watts
02008	Resistor, Fixed, Film, Chip, Low and High Values, Style 1206
02009	Resistors, Fixed, Film, Flip Chip, Ultra Precision, Style 1206 - (Cancellation Notice)
02010	Resistor, Chip, Fixed, Film, Values Less Than 1 Ohm, Style 1206
03002	Resistor, Chip, Fixed, Film, Zero-Ohm, Style 0505 - (Inactive for new design, use MIL-PRF-32159/2)
03003	Resistor, Fixed, Carbon Film, High Pulse Voltage, 1/8 Watt
03004	Resistor, Fixed, Carbon Film, High Pulse Voltage, 1/4 Watt
03005	Resistor, Fixed, Carbon Film, High Pulse Voltage, 1/2 Watt
03006	Resistor, Fixed, Carbon Film, High Pulse Voltage, 1 Watt
03007	Resistor, Fixed, Carbon Film, High Pulse Voltage, 3/4 Watt
03008	Resistor, Fixed, Carbon Film, High Pulse Voltage, 2 Watt
03009	Resistor, Fixed, Carbon Film, High Pulse Voltage, 3 Watt
03010	Resistor, Fixed, Film, Chip, Surface Mounted, Ultra Precision, Style 1506
03011	Resistor, Fixed, Film, Chip, Zero-Ohm, Style 0201
03012	Resistor, Chip, Fixed, Film, Zero-Ohm, Style 0302 - (Inactive for new design, use MIL-PRF-32159/13)
03013	Resistor, Chip, Fixed, Film, Zero-Ohm, Style 0603 - (Inactive for new design, use MIL-PRF-32159/12)
03014	Resistor, Chip, Fixed, Film, Zero-Ohm, Style 0402 - (Inactive for new design, use MIL-PRF-32159/11)
03015	Resistor, Chip, Fixed, Film, Zero-Ohm, Style 2010 - (Inactive for new design, use MIL-PRF-32159/8)
03016	Resistor, Chip, Fixed, Film, Zero-Ohm, Style 2512 - (Inactive for new design, use MIL-PRF-32159/9)
03017	Resistor, Thermal, (Thermistor), Die Chip, Positive Temperature Coefficient (PTC) (Inactive for new design, use MIL-PRF-32192/1)
03018	Resistor, Thermal, (Thermistor), Die Chip, Negative Temperature Coefficient (NTC), Style 0404 (Inactive for new, design, use MIL-PRF-32192/3)
03022	Resistor, Chip, Fixed, Film, Values Less Than 1 Ohm, Style 0603
03025	Resistor, Chip, Fixed, Film, High Voltage, Style 1206
03026	Resistor, Chip, Fixed, Film, High Voltage, Style 2010
03027	Resistor, Chip, Fixed, Film, High Voltage, Style 2512
04007	Resistor, Chip, Fixed, Film, Moisture Resistant, Military and Space Level, Style 0302

TABLE C-I. List of DLA Land and Maritime Drawings (continued)

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Drawing Number	Title
04008	Resistor, Chip, Fixed, Film, Moisture Resistant, Military and Space Level, Style 0402
04009	Resistor, Chip, Fixed, Film, Moisture Resistant, Military and Space Level, Style 0603
04025	Resistor, Chip, Fixed, Film, Surface Mount, 5 Watts (Up to 25 Watts with Heatsink)
04032	Resistor, Fixed, Film, Chip, Low Values, High Power, Style 2512
05009	Resistor, Fixed, Film, Chip (MELF), 1/4 Watt, Style 0204
05015	Resistor, Chip, Fixed, Film, Surface Mount, 2.25 Watts (Up to 20 Watts With Heatsink) - (Cancellation Notice) Suggested replacement use 04025
05016	Resistor, Fixed, Film, Radial Lead, 2.25 Watts (Up to 20 Watts with Heatsink)
06001	Resistor, Chip, Fixed, Bulk Metal Foil, Ultra Precision, Style 2010
06002	Resistor, Chip, Fixed, Bulk Metal Foil, Ultra Precision, Style 2512
06003	Resistor, Chip, Fixed, Power Metal Strip, Surface Mount, Low Value (2 Watt)
06006	Resistor, Chip, Fixed, Power Metal Strip, Surface Mount, Low Value (3 Watt), Style 4527
06007	Resistor, Chip, Fixed, Power Metal Strip, Surface Mount, Low Value (.1 Watt), Style 0603
06008	Resistor, Chip, Fixed, Power Metal Strip, Surface Mount, Low Value (.125 Watt), Style 0805
06009	Resistor, Chip, Fixed, Power Metal Strip, Surface Mount, Low Value (.25 Watt), Style 1206
06010	Resistor, Chip, Fixed, Power Metal Strip, Surface Mount, Low Value (.5 Watt), Style 2010
06011	Resistor, Chip, Fixed, Power Metal Strip, Surface Mount, Low Value (1.0 Watt), Style 2512
06012	Resistor, Chip, Fixed, Power Metal Strip, Surface Mount, Low Value (2.0 Watt), Style 2816
06018	Resistor Network, Fixed, Film, Surface Mount, Voltage Divider, 3 Pin
06020	Resistor, Fixed, Bulk Metal Foil, High Precision, Surface-Mount, Molded .25/.16 Watt
06021	Resistor, Fixed, Bulk Metal Foil, High Precision, Surface Mount, Molded 0.6/0.4 Watts
07002	Resistor, Fixed, Wirewound, Surface Mount, Power Type (3 Watt)
07005	Resistor, Chip, Fixed, Film, 8 Pin Array, Style 1206
07009	Resistor, Chip, Fixed, Film, Style 0201
07010	Resistor, Chip, Fixed, Film, Moisture Resistant, Military and Space Level, Style 0201
07011	Resistor, Fixed, Current Sensing, Metal Strip, High Precision, Surface Mount, Style 2512
07012	Resistor, Fixed, Current Sensing, Metal Strip, High Precision, Surface Mount, Style 3637
07017	Resistor, Fixed, Film, Radial Lead, 1 Watt (Up to 35 Watts with Heatsink)
07018	Resistor, Fixed, Film, Radial Lead, 1 Watt (Up to 50 Watts with Heatsink)
07019	Resistor, Fixed, Film, Radial Lead, 3 Watts (Up to 100 Watts with Heatsink)
07024	Resistor, Chip, Fixed, Bulk Metal Foil, Ultra Precision, Style 0805
07025	Resistor, Chip, Fixed, Bulk Metal Foil, Ultra Precision, Style 1206
08003	Resistor, Chip, Fixed, Current Sensing, Ultra Precision, Style 1625
09002	Resistor, Fixed, Film, Precision, High Ohmic Values
09004	Resistor, Chip, Fixed, Film, Precision, Top Contact, Style 2020
09008	Resistor, Fixed, Wirewound, (Accurate), Radial Leaded, 0.1 Watt (RBR81)
09011	Resistor Network, Fixed Film, Precision 8 Pad, Ball Grid Array
09012	Resistor Network, Fixed Film, Precision 16 Pad, Ball Grid Array
09013	Resistor Network, Fixed Film, 10 Pad, Ball Grid Array
09014	Resistor Network, Fixed Film, 32 Pad, Ball Grid Array
09015	Resistor Network, Fixed Film, 40 Pad, Ball Grid Array
09016	Resistor Network, Fixed Film, 27 Pad, Ball Grid Array
09017	Resistor Network, Fixed Film, 36 Pad, Ball Grid Array
10005	Resistor, Precision Current Sensor, 100 Watts
10006	Resistor, Current Sense, Open Air, Standard Leads, 1 Watt
10007	Resistor, Current Sense, Open Air, Standard Leads, 3 Watt

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TABLE C-I. List of DLA Land and Maritime Drawings (continued)

Drawing Number	Title
10008	Resistor, Current Sense, Open Air, Standard Leads, 5 Watt
10009	Resistor, Variable, Surface Mount, 4MM, Multiturn Trimmer, 1/4 Watt
10010	Resistor, Current Sense, Open Air, Metal Alloy Strip, 5 Watts
11007	Resistor, Chip, Fixed, Current Sense, Ultra Precision, Style 1206
11008	Resistor, Chip, Fixed, Current Sense, Ultra Precision, Style 2010
11009	Resistor, Chip, Fixed, Current Sense, Ultra Precision, Style 2512
12002	Resistor, Variable, Wirewound, (Low Operating Temperature) 1.0 Watt
12003	Resistor, Chip, Fixed, Film, Values Less Than 1 Ohm, Style 0502
12004	Resistor, Chip, Fixed, Film, Values Less Than 1 Ohm, Style 0505
12005	Resistor, Chip, Fixed, Film, Values Less Than 1 Ohm, Style 1005
12006	Resistor, Chip, Fixed, Film, Values Less Than 1 Ohm, Style 1505
12007	Resistor, Chip, Fixed, Film, Values Less Than 1 Ohm, Style 2208
12008	Resistor, Chip, Fixed, Film, Values Less Than 1 Ohm, Style 0705
12009	Resistor, Chip, Fixed, Film, Values Less Than 1 Ohm, Style 2010
12010	Resistor, Chip, Fixed, Film, Values Less Than 1 Ohm, Style 2512
12011	Resistor, Chip, Fixed, Film, Values Less Than 1 Ohm, Style 1010
12012	Resistor, Chip, Fixed, Film, Values Less Than 1 Ohm, Style 0402
12013	Resistor, Chip, Fixed, Film, Values Less Than 1 Ohm, Style 0302
12014	Resistor, Chip, Fixed, Film, Values Less Than 1 Ohm, Style 0201
13003	Resistor Network, 8 Pin, Dual-in-Line Package (DIP), Multi Resistance Values
13019	Resistor, Fixed, High Surge, 1/8 Watt
13020	Resistor, Fixed, High Surge, 1/4 Watt
13021	Resistor, Fixed, High Surge, 1/2 Watt
13022	Resistor, Fixed, High Surge, 1 Watt
13023	Resistor, Fixed, High Surge, 2 Watt
13024	Resistor, Fixed, High Surge, 5 Watt
13025	Resistor, Fixed, High Surge, 10 Watt
14006	Resistor, Fixed, Wirewound, (Accurate), 0.5 Watt (RBR52)
14007	Resistor, Fixed, Wirewound, (Accurate), 0.25 Watt (RBR54)
14008	Resistor, Fixed, Wirewound, (Accurate), 0.125 Watt (RBR56)
15002	Resistor, Fixed, Wirewound, (Accurate), 0.33 Watt (RBR53)
15003	Resistor, Fixed, Wirewound, (Accurate), 0.15 Watt (RBR55)
15004	Resistor, Fixed, Wirewound, (Accurate), 0.125 Watt (RBR71)
15006	Resistor, Fixed, Wirewound, (Accurate), Lug Precision, Radial Leaded, 0.5 Watt (RB17)
15007	Resistor, Fixed, Wirewound, (Accurate), Radial Leaded, 0.1 Watt (RBR80)
16001	Resistor, Fixed, Wirewound, (Accurate), 0.125 Watt (RBR75)
16002	Resistor, Fixed, Wirewound, (Accurate), Lug Precision, Radial Leaded, 0.25 Watt (RB08)
17003	Resistor, Fixed, High Resistance values, Glass Encapsulated
17005	Resistor, Fixed, Thick Film, High Voltage, High Resistance, Axial Terminal, 2 Watts
17006	Resistor, Fixed, Thick Film, High Voltage, High Resistance, Axial Terminal, 3 Watts
17007	Resistor, Fixed, Thick Film, High Voltage, High Resistance, Axial Terminal, 4 Watts
17008	Resistor, Fixed, Thick Film, High Voltage, High Resistance, Axial Terminal, 5 Watts
17009	Resistor, Fixed, Thick Film, High Voltage, High Resistance, Axial Terminal, 6 Watts
84146	Resistor, Antenna Termination Kit, Receive 2-30 Mhz - (Cancellation Notice)
85083	Resistor, Fixed, Chip
85085	Resistor, Variable, Nonwirewound, Adjustment Type
85095	Resistor, Coil Strip - (Cancellation Notice)

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TABLE C-I. List of DLA Land and Maritime Drawings (continued)

Drawing Number	Title
89005	Resistor, Variable, 25 Turn, Multiple Tap - (Cancellation Notice)
86097	Resistor, Variable, Panel Mounted
87009	Resistor, Fixed, Zero Ohm, 1/4 Watt - (Cancellation Notice)
87010	Resistor, Fixed, Zero Ohm, 1/8 Watt - (Cancellation Notice)
87011	Resistor, Chip, Zero-Ohm, Style 1010 - (Inactive for new design, use MIL-PRF-32159/10)
87012	Resistor Network, Fixed, Film, Surface Mount, Gull Wing, 16 Pin
87013	Resistor Network, Fixed, Film, Surface Mount, Gull Wing, 14 Pin
87014	Resistor Network, 16 Pin, Leadless Chip Carrier
87015	Resistor Network, 28-Pin, Leadless Chip Carrier
87016	Resistor Network, 20-Pin, Leadless Chip Carrier
87017	Resistor Network, Fixed, Film, Surface Mount, 20 Pin Leadless Chip Carrier
87018	Resistor Network, 16-Pin Leadless Chip Carrier
87025	Resistor Network, 8 Pin, Dual-in-Line Package (DIP)
87026	Resistor Network, Fixed, Film, 3-Pin
87027	Resistor Network, Fixed, Film, 3-Pin - (Cancellation Notice)
87030	Resistor Network, 6-Pin, Single-in-Line Package (SIP)
87031	Resistor Network, 8-Pin, Single-in-Line Package (SIP)
87032	Resistor Network, 10-Pin, Single-in-Line Package (SIP)
87033	Resistor Network, 10-Pin, Single-in-Line Package (SIP)
87037	Resistor Chip, 1 Watt (MELF)
87041	Resistor, Variable, Concentric Shaft, Dual (Cancellation Notice)
87045	Resistor Network, Fixed, Film, 20 Pin, Hermetically Sealed, Dual-in-Line Package (DIP)
87053	Resistor Network, 14-Pin, Flat Pack
87063	Resistor, Voltage Sensitive (Varistor) - (Cancellation Notice)
87064	Resistor Network, 16-Pin, Surface Mount - (Cancellation Notice)
87067	Resistor Network, Fixed, Film, 7-Pin Sip (Low Profile), Multiple Schematics
87068	Resistor Network, Fixed, Film, 7-Pin Sip (High Profile), Multiple Schematics
87071	Resistor Network, Fixed, Film, 10-Pin Sip, Multiple Resistance Values, Multiple Schematics, (Low Profile)
87072	Resistor Network, Fixed, Film, 10-Pin Sip, Multiple Resistance Values, Multiple Schematics and Multiple Tolerances.
87073	Resistor Network, Fixed, Film, Eight Pin SIP, Multiple Resistance Values, Multiple Schematics, (Low Profile)
87074	Resistor Network, Fixed, Film, Eight Pin SIP, Multiple Resistance Values, Multiple Schematics, (High Profile)
87075	Resistor, Fixed, Film, Chip, Flange Mount, Double Tab, High Power
87078	Resistor, Hot Molded, Panel, Variable, Dual Section (Cancellation Notice)
87103	Resistor Network, 9-Pin, SIP Multiple Values, Multiple Tolerances, (Low Profile)
87105	Resistor Network, 9-Pin, SIP Multiple Values, Multiple Tolerances, (High Profile)
87126	Resistor, Variable, Nonwirewound (Adjustment Type, Lead Screw Actuated)
88008	Resistor, Tantalum Nitride, Chip
88009	Resistor, Fixed, Film, Chip, Tantalum Nitride
88014	Resistor Network, 12-Pin, Single-in-Line Package (SIP)
88015	Resistor Network, 8-Pin, Single Inline Package
88016	Resistor Network, 20 Pin Leadless Chip Carrier
88018	Resistor, Chip, Fixed, Film, .200 Watt, Style 0705
88020	Resistor Network, 6-Pin, Leadless Chip Carrier
88027	Resistor, Chip, Fixed, Film, Style 0504
88030	Resistor, Chip, Fixed, Film, Style 1005
88031	Resistor, Chip, Fixed, Film, .330 Watt, Style 1505
88032	Resistor, Chip, Fixed, Film, Zero-Ohm, Style RM0502 - (Inactive for new design, use MIL-PRF-32159/1)

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TABLE C-I. List of DLA Land and Maritime Drawings (continued)

Drawing Number	Title
88033	Resistor, Chip, Fixed, Film, Style 1010 - (Inactive for new design, use MIL-PRF-32159/10)
88034	Resistor, Fixed, Film, Chip, Low Values, High Power, Style 2512
88036	Resistor Network, 10 Pin, Leadless Chip Carrier
88039	Resistor, Variable, Nonwirewound, Trimmer, 4mm, J-Hook Leads - (Cancellation Notice)
88040	Resistor, Variable, Surface Mount, Nonwirewound, Trimmer
88057	Resistor, Voltage Sensitive (Varistor) - (Cancellation Notice)
88063	Resistor, Voltage Sensitive (Varistor), Base Mount Metal-Oxide
89004	Resistor-Capacitor Network, 16 Pin DIP
89005	Resistor, Variable, 25 Turn, Multiple Tap - (Cancellation Notice)
89023	Resistor-Capacitor Network, 16 Pin Flat Pack
89039	Resistor, Fixed, Film, Precision
89040	Resistor, Fixed, Wire Wound, Surface Mount, Power Type (2.5 Watts)
89088	Resistor, Fixed, Film, Precision, 0.1 Watt, Power Curve C
89097	Resistor Network, Fixed, Film, 3 Pin - (Cancellation Notice)
89099	Resistor, Fixed, Film, Chip, Flange Mount, Single Tab, High Power
90027	Resistor, Variable, Nonwirewound, Trimmer, 4mm, Gull-Wing Leads
90038	Resistor, Fixed, Film, Precision, 0.25 Watt, Power Curve C
90039	Thermistor, Thermally Sensitive Resistor - (Cancellation Notice)
90047	Resistor, Chip, Fixed, Zero-Ohm, Style RM2208 - (Inactive for new design, use MIL-PRF-32159/5)
90048	Resistor, Chip, Fixed, Film, Zero-Ohm, Style 0705 - (Inactive for new design, use MIL-PRF-32159/6)
90049	Resistor, Chip, Fixed, Film, Zero-Ohm, Style 1005 - (Inactive for new design, use MIL-PRF-32159/3)
90065	Resistor, Voltage Sensitive (Varistor) - (Cancellation Notice)
90092	Resistor, Chip, Fixed, Film, Zero-Ohm, Style RM1505 - (Inactive for new design, use MIL-PRF-32159/4)
90096	Resistor, Voltage Sensitive, Chip, Metal Oxide Varistor
91017	Resistor, Variable, Nonwirewound, Trimmer 1/4 Watt - (Cancellation Notice)
91018	Resistor, Variable, Wirewound, Trimmer 3/4 Watt
92013	Resistor Network, 10-Pin, SIP, Extended Lead Length
92021	Resistor, Variable, Surface Mount, 4MM, Multiturn Trimmer, 1/4 Watt
93030	Resistor, Chip, Fixed, Bulk Metal Foil, Ultra Precision, Style 2018
93073	Resistor, Chip, Thermally Sensitive, (Thermistor), NTC, Style 0805 (Inactive for new design, use MIL-PRF-32192/4)
93074	Resistor, Chip, Thermally Sensitive, (Thermistor), NTC, Style 1206 (Inactive for new design, use MIL-PRF-32192/5)
93075	Resistor, Fixed, Wirewound, Surface Mount, Power Type (½ Watt)
93076	Resistor, Fixed, Wirewound, Surface Mount, Power Type (1 Watt)
93077	Resistor, Fixed, Wirewound, Surface Mount, Power Type (2 Watt)
93078	Resistor, Chip, Fixed, Bulk Metal Foil, Ultra Precision, Style 2110 - (Inactive for new design, use 06001)
93079	Resistor, Chip, Fixed, Bulk Metal Foil, Ultra Precision, Style 1505 - (Inactive for new design, use 03010)
94011	Resistor, Chip, Fixed, Film, Zero-Ohm, Style RM1206 - (Inactive for new design, use MIL-PRF-32159/7)
94012	Resistor, Chip, Fixed, Film, Moisture Resistant, Military and Space Level, Style 0505
94013	Resistor, Chip, Fixed, Film, Moisture Resistant, Military and Space Level, Style 1005
94014	Resistor, Chip, Fixed, Film, Moisture Resistant, Military and Space Level, Style 2208
94015	Resistor, Chip, Fixed, Film, Moisture Resistant, Military and Space Level, Style 0705
94016	Resistor, Chip, Fixed, Film, Moisture Resistant, Military and Space Level, Style 1206
94017	Resistor, Chip, Fixed, Film, Moisture Resistant, Military and Space Level, Style 2010
94018	Resistor, Chip, Fixed, Film, Moisture Resistant, Military and Space Level, Style 2512
94019	Resistor, Chip, Fixed, Film, Moisture Resistant, Military and Space Level, Style 1010

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TABLE C-I. List of DLA Land and Maritime Drawings (continued)

Drawing Number	Title
94025	Resistor, Chip, Fixed, Film, Moisture Resistant, Military and Space Level, Style 0502
94026	Resistor, Chip, Fixed, Film, Moisture Resistant, Military and Space Level, Style 1505
94047	Resistor, Fixed, Film, Chip, (MELF), 2 Watt, Style 3610
95006	Resistor, Fixed, Film, Chip (MELF), 1 Watt, Style 2512
95011	Resistor, Fixed, Film, Chip (MELF), 1/8 Watt, Style 1206
95013	Resistor, Chip, Fixed, Film, Style 0302 - (Inactive for new design, use MIL-PRF-32159/13)
95014	Resistor, Chip, Fixed, Film, Style 0402 - (Inactive for new design, use MIL-PRF-32159/11)
97004	Resistor, Fixed, Film (Insulated), 2 Watt
97008	Resistor, Chip, Fixed, 1/4 Watt, MELF (Inactive for new design, use 05009)
97009	Resistor, Fixed, Film, Precision, 0.3 Watt, Power Curve A - (Inactive for new design, use 89039)
97010	Resistor, Fixed, Film, Precision, 0.3 Watt, Power Curve B - (Inactive for new design, use 89039)
97011	Resistor, Fixed, Film, Precision, 0.15 Watt, Power Curve B - (Inactive for new design, use 89039)
97012	Resistor, Variable, Nonwirewound, Trimmer, 3/4 Watt, Flexible Leads (Reactivation)
98018	Resistor, Chip, Thermally Sensitive (Thermistor), Positive Temperature Coefficient (PTC), Style 0805 - (Inactive for new design, use MIL-PRF-32159/2)
98020	Resistor, Fixed, Film (Insulated), 1/8 Watt
98021	Resistor, Fixed, Film (Insulated), 1/2 Watt
98022	Resistor, Fixed, Film (Insulated), 1 Watt
99001	Resistor, Fixed, Ceramic Composition (Insulated)
99004	Resistor, Fixed, Film, Chip, 4 Pin Array
99005	Resistor, Fixed, Film, Chip, 8 Pin Array
99006	Resistor, Fixed, Film, Chip, 10 Pin Array
99007	Resistor, Fixed, Film, Chip, 16 Pin Array
99011	Resistor, Fixed, Film (Insulated), ¼ Watt

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C.3.1.1 Resistor, Chip. Table C-II show a breakdown listing of Chip Resistors

TABLE C-II. Resistor, Chip.

Drawing number	Title
01002	Resistor, Chip, Fixed,1.5 Watt, MELF, Style 2512, Flat Ceramic Package
05009	Resistor, Chip, Fixed, Film, MELF, 1/4 Watt, Style 0204
94047	Resistor, Chip, Fixed, 2 Watt, MELF, Style 3610
94048	Resistor, Chip, Fixed, 1/2 Watt, MELF, Style 2010
95006	Resistor, Chip, Fixed, 1 Watt, MELF, Style 2512
95011	Resistor, Chip, Fixed, 1/8 Watt, MELF, Style 1206
97008	Resistor, Chip, Fixed, 1/4 Watt, MELF - (Inactive for new design, use 05009)
06001	Resistor, Chip, Fixed, Bulk Metal Foil, Ultra Precision, Style 2010
06002	Resistor, Chip, Fixed, Bulk Metal Foil, Ultra Precision, Style 2512
07024	Resistor, Chip, Fixed, Bulk Metal Foil, Ultra Precision, Style 0805
07025	Resistor, Chip, Fixed, Bulk Metal Foil, Ultra Precision, Style 1206
93030	Resistor, Chip, Fixed, Bulk Metal Foil, Ultra Precision, Style 2018
93078	Resistor, Chip, Fixed, Bulk Metal Foil, Ultra Precision, Style 2110 - (Inactive for new design, use 06001)
93079	Resistor, Chip, Fixed, Bulk Metal Foil, Ultra Precision, Style 1505 - (Inactive for new design, use 03010)
08003	Resistor, Chip, Fixed, Current Sensing, Ultra Precision, Style 1625
11007	Resistor, Chip, Fixed, Current Sense, Ultra Precision, Style 1206
11008	Resistor, Chip, Fixed, Current Sense, Ultra Precision, Style 2010
11009	Resistor, Chip, Fixed, Current Sense, Ultra Precision, Style 2512
07005	Resistor, Chip, Fixed, Film, 8 Pin Array, Style 1206
99004	Resistor, Chip, Fixed, Film, 4 Pin Array
99005	Resistor, Chip, Fixed, Film, 8 Pin Array
99006	Resistor, Chip, Fixed, Film, 10 Pin Array
99007	Resistor, Chip, Fixed, Film, 16 Pin Array - (Inactive for new design)
87075	Resistor, Chip, Fixed, Film, Flange Mount, Double Tab, High Power
89099	Resistor, Chip, Fixed, Film, Flange Mount, Single Tab, High Power
03025	Resistor, Chip, Fixed, Film, High Voltage, Style 1206
03026	Resistor, Chip, Fixed, Film, High Voltage, Style 2010
03027	Resistor, Chip, Fixed, Film, High Voltage, Style 2512
02008	Resistor, Chip, Fixed, Film, Low and High Values, Style 1206
04032	Resistor, Chip, Fixed, Film, Low Values, High Power, Style 2512
88034	Resistor, Chip, Fixed, Film, Low Values, High Power, Style 2512
04007	Resistor, Chip, Fixed, Film, Moisture Resistant, Military and Space Level, Style 0302
04008	Resistor, Chip, Fixed, Film, Moisture Resistant, Military and Space Level, Style 0402
04009	Resistor, Chip, Fixed, Film, Moisture Resistant, Military and Space Level, Style 0603
07010	Resistor, Chip, Fixed, Film, Moisture Resistant, Military and Space Level, Style 0201
94012	Resistor, Chip, Fixed, Film, Moisture Resistant, Military and Space Level, Style 0505
94013	Resistor, Chip, Fixed, Film, Moisture Resistant, Military and Space Level, Style 1005

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TABLE C-II. Resistor, Chip. Continued

Drawing number	Title
94014	Resistor, Chip, Fixed, Film, Moisture Resistant, Military and Space Level, Style 2208
94015	Resistor, Chip, Fixed, Film, Moisture Resistant, Military and Space Level, Style 0705
94016	Resistor, Chip, Fixed, Film, Moisture Resistant, Military and Space Level, Style 1206
94017	Resistor, Chip, Fixed, Film, Moisture Resistant, Military and Space Level, Style 2010
94018	Resistor, Chip, Fixed, Film, Moisture Resistant, Military and Space Level, Style 2512
94019	Resistor, Chip, Fixed, Film, Moisture Resistant, Military and Space Level, Style 1010
94025	Resistor, Chip, Fixed, Film, Moisture Resistant, Military and Space Level, Style 0502
94026	Resistor, Chip, Fixed, Film, Moisture Resistant, Military and Space Level, Style 1505
09004	Resistor, Chip, Fixed, Film, Precision, Top Contact, Style 2020
07009	Resistor, Chip, Fixed, Film, Style 0201
88018	Resistor, Chip, Fixed, Film, Style 0705
88027	Resistor, Chip, Fixed, Film, Style 0504
88030	Resistor, Chip, Fixed, Film, Style 1005
88031	Resistor, Chip, Fixed, Film, Style 1505
88033	Resistor, Chip, Fixed, Film, Style 1010 - (Inactive for new design, use MIL-PRF-32159/10)
95013	Resistor, Chip, Fixed, Film, Style 0302 - (Inactive for new design, use MIL-PRF-32159/13)
95014	Resistor, Chip, Fixed, Film, Style 0402 - (Inactive for new design, use MIL-PRF-32159/11)
03010	Resistor, Chip, Fixed, Film, Surface Mounted, Ultra Precision, Style 1506
04025	Resistor, Chip, Fixed, Film, Surface Mount, 5 Watts (Up to 25 Watts with Heatsink)
88009	Resistor, Chip, Fixed, Film, Tantalum Nitride
02010	Resistor, Chip, Fixed, Film, Values Less Than 1 Ohm, Style 1206
03022	Resistor, Chip, Fixed, Film, Values Less Than 1 Ohm, Style 0603
12003	Resistor, Chip, Fixed, Film, Values Less Than 1 Ohm, Style 0502
12004	Resistor, Chip, Fixed, Film, Values Less Than 1 Ohm, Style 0505
12005	Resistor, Chip, Fixed, Film, Values Less Than 1 Ohm, Style 1005
12006	Resistor, Chip, Fixed, Film, Values Less Than 1 Ohm, Style 1505
12007	Resistor, Chip, Fixed, Film, Values Less Than 1 Ohm, Style 2208
12008	Resistor, Chip, Fixed, Film, Values Less Than 1 Ohm, Style 0705
12009	Resistor, Chip, Fixed, Film, Values Less Than 1 Ohm, Style 2010
12010	Resistor, Chip, Fixed, Film, Values Less Than 1 Ohm, Style 2512
12011	Resistor, Chip, Fixed, Film, Values Less Than 1 Ohm, Style 1010
12012	Resistor, Chip, Fixed, Film, Values Less Than 1 Ohm, Style 0402
12013	Resistor, Chip, Fixed, Film, Values Less Than 1 Ohm, Style 0302
12014	Resistor, Chip, Fixed, Film, Values Less Than 1 Ohm, Style 0201
01033	Resistor, Chip, Fixed, Film, Voltage Divider, Style 1206
03002	Resistor, Chip, Fixed, Film, Zero-Ohm, Style 0505 - (Inactive for new design, use MIL-PRF-32159/2)
03011	Resistor, Chip, Fixed, Film, Zero-Ohm, Style 0201
03012	Resistor, Chip, Fixed, Film, Zero-Ohm, Style 0302 - (Inactive for new design, use MIL-PRF-32159/13)
03013	Resistor, Chip, Fixed, Film, Zero-Ohm, Style 0603 - (Inactive for new design, use MIL-PRF-32159/12)

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TABLE C-II. Resistor, Chip. Continued

Drawing number	Title
03014	Resistor, Chip, Fixed, Film, Zero-Ohm, Style 0402 - (Inactive for new design, use MIL-PRF-32159/11)
03015	Resistor, Chip, Fixed, Film, Zero-Ohm, Style 2010 - (Inactive for new design, use MIL-PRF-32159/8)
03016	Resistor, Chip, Fixed, Film, Zero-Ohm, Style 2512 - (Inactive for new design, use MIL-PRF-32159/9)
87011	Resistor, Chip, Zero-Ohm, Style 1010 - (Inactive for new design, use MIL-PRF-32159/10)
88032	Resistor, Chip, Fixed, Film, Zero-Ohm, Style RM0502 - (Inactive for new design, use MIL-PRF-32159/1)
90047	Resistor, Chip, Fixed, Zero-Ohm, Style RM2208 - (Inactive for new design, use MIL-PRF-32159/5)
90048	Resistor, Chip, Fixed, Film, Zero-Ohm, Style 0705 - (Inactive for new design, use MIL-PRF-32159/6)
90049	Resistor, Chip, Fixed, Film, Zero-Ohm, Style 1005 - (Inactive for new design, use MIL-PRF-32159/3)
90092	Resistor, Chip, Fixed, Film, Zero-Ohm, Style RM1505 - (Inactive for new design, use MIL-PRF-32159/4)
94011	Resistor, Chip, Fixed, Film, Zero-Ohm, Style RM1206 - (Inactive for new design, use MIL-PRF-32159/7)
01032	Resistor, Chip, Fixed, Film, Beryllia Substrate, High Power, Style 1206
06003	Resistor, Chip, Fixed, Power Metal Strip, Surface Mount, Low Value (2 Watt)
06006	Resistor, Chip, Fixed, Power Metal Strip, Surface Mount, Low Value (3 Watt), Style 4527
06007	Resistor, Chip, Fixed, Power Metal Strip, Surface Mount, Low Value (.1 Watt), Style 0603
06008	Resistor, Chip, Fixed, Power Metal Strip, Surface Mount, Low Value (.125 Watt), Style 0805
06009	Resistor, Chip, Fixed, Power Metal Strip, Surface Mount, Low Value (.25 Watt), Style 1206
06010	Resistor, Chip, Fixed, Power Metal Strip, Surface Mount, Low Value (.5 Watt), Style 2010
06011	Resistor, Chip, Fixed, Power Metal Strip, Surface Mount, Low Value (1.0 Watt), Style 2512
06012	Resistor, Chip, Fixed, Power Metal Strip, Surface Mount, Low Value (2.0 Watt), Style 2816
88008	Resistor, Chip, Tantalum Nitride
93073	Resistor, Chip, Thermally Sensitive, (Thermistor), NTC, Style 0805 - (Inactive for new design, use MIL-PRF-32192/4)
93074	Resistor, Chip, Thermally Sensitive, (Thermistor), NTC, Style 1206 - (Inactive for new design, use MIL-PRF-32192/5)
98018	Resistor, Chip, Thermally Sensitive (Thermistor), Positive Temperature Coefficient (PTC), Style 0805 - (Inactive for new design, use MIL-PRF-32192/2)
87037	Resistor Chip, 1 Watt (MELF)

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C.3.1.2 Resistor, Network. Table C-III show a breakdown listing of Network Resistors.

TABLE C-III. Resistor, Network.

Drawing number	Title
89004	Resistor-Capacitor, Network, 16 Pin, Dual-in-Line Package (DIP)
89023	Resistor-Capacitor, Network, 16 Pin, Flat Pack
87014	Resistor Network, 16 Pin, Leadless Chip Carrier
87015	Resistor Network, 28-Pin, Leadless Chip Carrier
87016	Resistor Network, 20-Pin, Leadless Chip Carrier
87017	Resistor Network, 20-Pin, Leadless Chip Carrier
87018	Resistor Network, 16-Pin Leadless Chip Carrier
88016	Resistor Network, 20-Pin Leadless Chip Carrier
88020	Resistor Network, 6-Pin, Leadless Chip Carrier
88036	Resistor Network, 10 Pin, Leadless Chip Carrier
87026	Resistor Network, Fixed, Film, 3-Pin, Single-in-Line Package (SIP)
87030	Resistor Network, 6-Pin, Single-in-Line Package (SIP)
87031	Resistor Network, 8-Pin, Single-in-Line Package (SIP)
87032	Resistor Network, 10-Pin, Single-in-Line Package (SIP)
87067	Resistor Network, Fixed, Film, 7-Pin, Single-in-Line Package (SIP), Low Profile, Multiple Schematics
87068	Resistor Network, Fixed, Film, 7-Pin, Single-in-Line Package (SIP), High Profile, Multiple Schematics
87071	Resistor Network, Fixed, Film, 10-Pin, Single-in-Line Package (SIP), Multiple Resistance Values, Multiple Schematics, Low Profile
87072	Resistor Network, Fixed, Film, 10-Pin, Single-in-Line Package (SIP), Multiple Resistance Values, Multiple Schematics and Multiple Tolerances.
87073	Resistor Network, Fixed, Film, 8-Pin, Single-in-Line Package (SIP), Multiple Resistance Values, Multiple Schematics, Low Profile
87074	Resistor Network, Fixed, Film, 8-Pin, Single-in-Line Package (SIP), Multiple Resistance Values, Multiple Schematics, High Profile
87103	Resistor Network, 9-Pin, Single-in-Line Package (SIP), Multiple Values, Multiple Tolerances, Low Profile
87105	Resistor Network, 9-Pin, Single-in-Line Package (SIP), Multiple Values, Multiple Tolerances, High Profile
88014	Resistor Network, 12-Pin, Single Inline Package (SIP)
88015	Resistor Network, 8-Pin, Single Inline Package (SIP)
92013	Resistor Network, 10-Pin, Single-in-Line Package (SIP), Extended Lead Length
87053	Resistor Network, 14-Pin, Flat Pack
13003	Resistor Network, 8 Pin, Dual-in-Line Package (DIP), Multi Resistance Values
87025	Resistor Network, 8 Pin, Dual-in-Line Package (DIP)
87045	Resistor Network, Fixed, Film, 20 Pin, Hermetically Sealed, Dual-in-Line Package (DIP)
09011	Resistor Network, Fixed Film, 8 Pad, Ball Grid Array, Precision
09012	Resistor Network, Fixed Film, 16 Pad, Ball Grid Array, Precision
09013	Resistor Network, Fixed Film, 10 Pad, Ball Grid Array
09014	Resistor Network, Fixed Film, 32 Pad, Ball Grid Array
09015	Resistor Network, Fixed Film, 40 Pad, Ball Grid Array
09016	Resistor Network, Fixed Film, 27 Pad, Ball Grid Array
09017	Resistor Network, Fixed Film, 36 Pad, Ball Grid Array
06018	Resistor Network, Fixed, Film, Surface Mount, Voltage Divider, 3 Pin

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TABLE C-III. Resistor, Network. Continued

Drawing number	Title
87012	Resistor Network, Fixed, Film, Surface Mount, Gull Wing, 16 Pin
87013	Resistor Network, Fixed, Film, Surface Mount, Gull Wing, 14 Pin

C.3.1.3 Resistor, Current Sensing. Table C-IV show a breakdown listing of Current Sensing Resistors.

TABLE C-IV. Resistor, Current Sensing.

Drawing number	Title
07011	Resistor, Fixed, Current Sensing, Metal Strip, High Precision, Surface Mount, Style 2512
07012	Resistor, Fixed, Current Sensing, Metal Strip, High Precision, Surface Mount, Style 3637
10005	Resistor, Fixed, Current Sensing, 100 Watts, Precision
10006	Resistor, Fixed, Current Sensing, Open Air, Standard Leads, 1 Watt
10007	Resistor, Fixed, Current Sensing, Open Air, Standard Leads, 3 Watt
10008	Resistor, Fixed, Current Sensing, Open Air, Standard Leads, 5 Watt
10010	Resistor, Fixed, Current Sensing, Open Air, Metal Alloy Strip, 5 Watts
08003	Resistor, Chip, Fixed, Current Sensing, Ultra Precision, Style 1625
11007	Resistor, Chip, Fixed, Current Sensing, Ultra Precision, Style 1206
11008	Resistor, Chip, Fixed, Current Sensing, Ultra Precision, Style 2010
11009	Resistor, Chip, Fixed, Current Sensing, Ultra Precision, Style 2512

C.3.1.4 Resistor, Carbon Film. Table C-V show a breakdown listing of Carbon Film Resistors.

TABLE C-V. Resistor, Carbon Film.

Drawing number	Title
03003	Resistor, Fixed, Carbon Film, High Pulse Voltage, 1/8 Watt
03004	Resistor, Fixed, Carbon Film, High Pulse Voltage, 1/4 Watt
03005	Resistor, Fixed, Carbon Film, High Pulse Voltage, 1/2 Watt
03006	Resistor, Fixed, Carbon Film, High Pulse Voltage, 1 Watt
03007	Resistor, Fixed, Carbon Film, High Pulse Voltage, 3/4 Watt
03008	Resistor, Fixed, Carbon Film, High Pulse Voltage, 2 Watt
03009	Resistor, Fixed, Carbon Film, High Pulse Voltage, 3 Watt

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C.3.1.5 Resistor, Fixed. Table C-VI show a breakdown listing of Fixed Resistors.

TABLE C-VI. Resistor, Fixed.

Drawing number	Title
96002	Resistor, Fixed, Film, Insulated, Low Inductance
97004	Resistor, Fixed, Film, Insulated, 2 Watt
98020	Resistor, Fixed, Film, Insulated, 1/8 Watt
98021	Resistor, Fixed, Film, Insulated, 1/2 Watt
98022	Resistor, Fixed, Film, Insulated, 1 Watt
99011	Resistor, Fixed, Film, Insulated, 1/4 Watt
02001	Resistor, Fixed, Film, Precision, Chip 1/8 Watt, Style 2012
89039	Resistor, Fixed, Film, Precision
89088	Resistor, Fixed, Film, Precision, 0.1 Watt, Power Curve C
90038	Resistor, Fixed, Film, Precision, 0.25 Watt, Power Curve C
97009	Resistor, Fixed, Film, Precision, 0.3 Watt, Power Curve A - (Inactive for new design, use 89039)
97010	Resistor, Fixed, Film, Precision, 0.3 Watt, Power Curve B - (Inactive for new design, use 89039)
97011	Resistor, Fixed, Film, Precision, 0.15 Watt, Power Curve B - (Inactive for new design, use 89039)
09002	Resistor, Fixed, Film, Precision, High Ohmic Values
05016	Resistor, Fixed, Film, Radial Lead, 2.25 Watts (Up to 20 Watts with Heatsink)
07017	Resistor, Fixed, Film, Radial Lead, 1 Watt (Up to 35 Watts with Heatsink)
07018	Resistor, Fixed, Film, Radial Lead, 1 Watt (Up to 50 Watts with Heatsink)
07019	Resistor, Fixed, Film, Radial Lead, 3 Watts (Up to 100 Watts with Heatsink)
17003	Resistor, Fixed, High Resistance values, Glass Encapsulated
17005	Resistor, Fixed, Thick Film, High Voltage, High Resistance, Axial Terminal, 2 Watts
17006	Resistor, Fixed, Thick Film, High Voltage, High Resistance, Axial Terminal, 3 Watts
17007	Resistor, Fixed, Thick Film, High Voltage, High Resistance, Axial Terminal, 4 Watts
17008	Resistor, Fixed, Thick Film, High Voltage, High Resistance, Axial Terminal, 5 Watts
17009	Resistor, Fixed, Thick Film, High Voltage, High Resistance, Axial Terminal, 6 Watts
09008	Resistor, Fixed, Wirewound, Accurate, Radial Leaded, 0.1 Watt (RBR81)
14006	Resistor, Fixed, Wirewound, (Accurate), 0.5 Watt (RBR52)
14007	Resistor, Fixed, Wirewound, (Accurate), 0.25 Watt (RBR54)
14008	Resistor, Fixed, Wirewound, (Accurate), 0.125 Watt (RBR56)
15002	Resistor, Fixed, Wirewound, (Accurate), 0.33 Watt (RBR53)
15003	Resistor, Fixed, Wirewound, (Accurate), 0.15 Watt (RBR55)
15004	Resistor, Fixed, Wirewound, (Accurate), 0.125 Watt (RBR71)
15006	Resistor, Fixed, Wirewound, (Accurate), Lug Precision, Radial Leaded, 0.5 Watt (RB17)
15007	Resistor, Fixed, Wirewound, (Accurate), Radial Leaded, 0.1 Watt (RBR80)
16001	Resistor, Fixed, Wirewound, (Accurate), 0.125 Watt (RBR75)
16002	Resistor, Fixed, Wirewound, (Accurate), Lug Precision, Radial Leaded, 0.25 Watt (RB08)

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TABLE C-VI. Resistor, Fixed. Continued

07002	Resistor, Fixed, Wirewound, Surface Mount, Power Type, 3 Watt
89040	Resistor, Fixed, Wirewound, Surface Mount, Power Type, 2.5 Watts
93075	Resistor, Fixed, Wirewound, Surface Mount, Power Type, 1/2 Watt
93076	Resistor, Fixed, Wirewound, Surface Mount, Power Type, 1 Watt
93077	Resistor, Fixed, Wirewound, Surface Mount, Power Type, 2 Watt
13019	Resistor, Fixed, High Surge, 1/8 Watt
13020	Resistor, Fixed, High Surge, 1/4 Watt
13021	Resistor, Fixed, High Surge, 1/2 Watt
13022	Resistor, Fixed, High Surge, 1 Watt
13023	Resistor, Fixed, High Surge, 2 Watt
13024	Resistor, Fixed, High Surge, 5 Watt
13025	Resistor, Fixed, High Surge, 10 Watt

C.3.1.6 Resistor, Variable. Table C-VII show a breakdown listing of Variable Resistors.

TABLE C-VII. Resistor, Variable.

Drawing number	Title
02005	Resistor, Variable, Nonwirewound, Adjustment Type, Lead-Screw Actuated, 1/2" Rectangular, 0.3 Watts
85085	Resistor, Variable, Nonwirewound, Adjustment Type
87126	Resistor, Variable, Nonwirewound, Adjustment Type, Lead Screw Actuated
97012	Resistor, Variable, Nonwirewound, Trimmer, 3/4 Watt, Flexible Leads
86097	Resistor, Variable, Nonwirewound, Panel Mounted
10009	Resistor, Variable, Nonwirewound, Surface Mount, 4MM, Multiturn Trimmer, 1/4 Watt
88040	Resistor, Variable, Nonwirewound, Surface Mount, Trimmer
00001	Resistor, Variable, Wirewound, Nonprecision, Trimmer, 3/8 Inch, Square, 1 Watt, Flexible Leads
12002	Resistor, Variable, Wirewound, Low Operating Temperature, 1.0 Watt
91018	Resistor, Variable, Wirewound, Trimmer 3/4 Watt

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C.3.1.7 Resistor, Thermal. Table C-VIII show a breakdown listing of Thermal Resistors.

TABLE C-VIII. Resistor, Thermal.

Drawing number	Title
93073	Resistor, Chip, Thermally Sensitive, (Thermistor), NTC, Style 0805 - (Inactive for new design, use MIL-PRF-32159/4)
93074	Resistor, Chip, Thermally Sensitive, (Thermistor), NTC, Style 1206 - (Inactive for new design, use MIL-PRF-32159/5)
98018	Resistor, Chip, Thermally Sensitive (Thermistor), Positive Temperature Coefficient (PTC), Style 0805 - (Inactive for new design, use MIL-PRF-32159/2)
03017	Resistor, Thermal, (Thermistor), Die Chip, Positive Temperature Coefficient (PTC) - (Inactive for new design, use MIL-PRF-32159/1)
03018	Resistor, Thermal, (Thermistor), Die Chip, Negative Temperature Coefficient (NTC), Style 0404 - (Inactive for new, design, use MIL-PRF-32159/3)

C.3.1.8 Resistor, Bulk Metal. Table C-IX show a breakdown listing of Bulk Metal Resistors.

TABLE C-IX. Resistor, Bulk Metal.

Drawing number	Title
06001	Resistor, Chip, Fixed, Bulk Metal Foil, Ultra Precision, Style 2010
06002	Resistor, Chip, Fixed, Bulk Metal Foil, Ultra Precision, Style 2512
07024	Resistor, Chip, Fixed, Bulk Metal Foil, Ultra Precision, Style 0805
07025	Resistor, Chip, Fixed, Bulk Metal Foil, Ultra Precision, Style 1206
93030	Resistor, Chip, Fixed, Bulk Metal Foil, Ultra Precision, Style 2018
93078	Resistor, Chip, Fixed, Bulk Metal Foil, Ultra Precision, Style 2110 - (Inactive for new design, use 06001)
93079	Resistor, Chip, Fixed, Bulk Metal Foil, Ultra Precision, Style 1505 - (Inactive for new design, use 03010)
06020	Resistor, Fixed, Bulk Metal Foil, High Precision, Surface-Mount, Molded .25/.16 Watt
06021	Resistor, Fixed, Bulk Metal Foil, High Precision, Surface Mount, Molded 0.6/0.4 Watts

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C.3.1.9 Cancelled Documents. Table C-X show cancelled drawing that have replacements

TABLE C-X. Cancelled drawings with replacement.

Drawing number	Title	Replacement Document
85083	Resistor, Fixed, Chip	95011*
87033	Resistor Network, 10-Pin, Single-in-Line Package (SIP)	MIL-PRF-83401/24
87063	Resistor, Voltage Sensitive (Varistor)	A-A-55564/3
88063	Resistor, Voltage Sensitive (Varistor), Base Mount Metal-Oxide	A-A-55564/1
90065	Resistor, Voltage Sensitive (Varistor)	A-A-55562/2
90096	Resistor, Voltage Sensitive, Chip, Metal Oxide	A-A-55562/3
90027	Resistor, Variable, Non-Wirewound, Trimmer, 4mm, Gull-Wing Leads	A-A-59496/2
92021	Resistor, Variable, Surface Mount, 4MM, Multiturn Trimmer, ¼ Watt	10009*

* DLA Land and Maritime Drawing

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APPENDIX D

INACTIVE FOR NEW DESIGN DoD SPECIFICATIONS,
COMMERCIAL ITEM DESCRIPTIONS (CIDs) and DLA LAND AND MARITIME DRAWINGS

D.1 SCOPE

D.1.1 Scope. The following appendix includes all inactive for new design DoD Specifications, Commercial Item Descriptions (CIDs) and DLA LAND AND MARITIME Drawings. These specifications are used for replacement purposes only.

D.2 APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

D.3 INACTIVE DoD SPECIFICATIONS, COMMERCIAL ITEM DESCRIPTIONS (CIDs) AND DLA LAND AND MARITIME DRAWINGS.

D.3.1 INACTIVE DoD SPECIFICATIONS.

D.3.1.1 Inactive DoD Specifications. Table D-I contains a listing of Inactive for new design DoD specifications.

TABLE D-I. Inactive DoD specifications.

Specification number	Title
MIL-R-26/2	Resistor, Fixed, Wirewound (Power Type), Styles RW20, RW21, RW22, RW23, and RW24
MIL-R-26/5	Resistor, Fixed, Wirewound (Power Type), Styles RW70, RW74, RW78, and RW79
MIL-R-26/6	Resistor, Fixed, Wirewound (Power Type), Styles RW80 and RW81
MIL-R-93	Resistor, Fixed, Wirewound (Accurate), General Specification for
MIL-R-93/10	Resistor, Fixed, Wirewound (Accurate), Style RB52
MIL-R-93/11	Resistor, Fixed, Wirewound (Accurate), Style RB53
MIL-R-93/12	Resistor, Fixed, Wirewound (Accurate), Style RB54
MIL-R-93/13	Resistor, Fixed, Wirewound (Accurate), Style RB55
MIL-R-93/14	Resistor, Fixed, Wirewound (Accurate), Style RB56
MIL-R-93/19	Resistor, Fixed, Wirewound (Accurate), Style RB70
MIL-R-93/20	Resistor, Fixed, Wirewound (Accurate), Style RB71
MIL-DTL-6749	Resistor, Variable, Wirewound, Nonprecision, Aircraft Power
MIL-DTL-7790	Resistor, Thermocouple Lead Spool
MIL-R-10509	Resistor, Fixed, Film (High Stability), General Specification For
MIL-R-10509/1	Resistor, Fixed, Film (High Stability), Style RN60
MIL-R-10509/2	Resistor, Fixed, Film (High Stability), Style RN65
MIL-R-10509/3	Resistor, Fixed, Film (High Stability), Style RN70
MIL-R-10509/7	Resistor, Fixed, Film (High Stability), Style RN55
MIL-R-10509/8	Resistor, Fixed, Film (High Stability), Style RN50
MIL-R-18546/1	Resistor, Fixed, Wirewound (Power Type, Chassis Mounted), Styles RE60, RE65, RE70, and RE75
MIL-R-19365	Resistor, Adjustable, Wirewound, Power
MIL-PRF-22097/1	Resistor, Variable, Nonwirewound (Adjustment Type, Lead-Screw Actuated), Style RJ11
MIL-PRF-22097/3	Resistor, Variable, Nonwirewound (Adjustment Type, Lead-Screw Actuated), Style RJ22
MIL-PRF-22097/5	Resistor, Variable, Nonwirewound (Adjustment Type, Lead-Screw Actuated), Style RJ26
MIL-PRF-22097/6	Resistor, Variable, Nonwirewound (Adjustment Type, Single Turn), Style RJ50

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TABLE D-I. Inactive DoD specifications. - Continued

Specification number	Title
MIL-PRF-22684/1	Resistor, Fixed, Film, Insulated, Style RL07
MIL-PRF-22684/2	Resistor, Fixed, Film, Insulated, Style RL20
MIL-PRF-22684/3	Resistor, Fixed, Film, Insulated, Style RL32
MIL-PRF-22684/4	Resistor, Fixed, Film, Insulated, Style RL42
MIL-PRF-23648/2	Resistor, Thermal (Thermistor), Insulated, Negative Temperature Coefficient, Style RTH08
MIL-PRF-23648/3	Resistor, Thermal (Thermistor), Insulated, Negative Temperature Coefficient, Style RTH10
MIL-PRF-27208/4	Resistor, Variable, Wirewound (Adjustment Type, Lead- Screw Actuated) Style RT22
MIL-PRF-39005/7	Resistor, Fixed, Wirewound (Accurate), Nonestablished Reliability, and Established Reliability, Style RBR57
MIL-PRF-39005/8	Resistor, Fixed, Wirewound (Accurate), Nonestablished Reliability, and Established Reliability, Style RBR74
MIL-PRF-39005/9	Resistor, Fixed, Wirewound (Accurate), Nonestablished Reliability, and Established Reliability, Style RBR75
MIL-PRF-39007/5	Resistor, Fixed, Wirewound (Power Type), Nonestablished Reliability, Established Reliability, and Space Level, Style RWR71
MIL-PRF-39007/6	Resistor, Fixed, Wire-Wound (Power Type), Nonestablished Reliability, Established Reliability, and Space Level, Style RWR74
MIL-PRF-39015/1	Resistor, Variable, Wirewound (Lead Screw Actuated), Nonestablished Reliability and Established Reliability, Style RTR12
MIL-PRF-39035/1	Resistor, Variable, Nonwirewound (Adjustment Type, Lead-Screw Actuated), Nonestablished Reliability, and Established Reliability Style RJR12
MIL-PRF-55182/2	Resistor, Fixed, Film, Nonestablished Reliability, Established Reliability, and Space Level, Style RNR57
MIL-R-55182/11	Resistor, Fixed, Film, Established Reliability Style RNR51
MIL-R-55182/12	Resistor, Fixed, Film, Established Reliability Style RNR56
MIL-PRF-83530/1	Resistors, Voltage Sensitive (Varistors) Style RVS10

D.3.2 INACTIVE COMMERCIAL ITEM DESCRIPTIONS (CIDs)

D.3.2.1 Inactive Commercial Item Descriptions (CIDs). Table D-II contains a listing of Inactive Commercial Item Descriptions (CIDs) At this time there are no inactive Commercial Item Descriptions (CIDs).

D.3.3 INACTIVE DLA LAND AND MARITIME DRAWINGS

D.3.3.1 Inactive DLA Land and Maritime Drawings. Table D-II contains a listing of Inactive DLA Land and Maritime Drawings with supersession data.

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TABLE D-II. Inactive DLA LAND AND MARITIME Drawings.

Drawing Number	Title	Superseding document
03012	Resistor, Chip, Fixed, Film, Zero-Ohm, Style 0302	MIL-PRF-32159/13
03013	Resistor, Chip, Fixed, Film, Zero-Ohm, Style 0603	MIL-PRF-32159/12
03014	Resistor, Chip, Fixed, Film, Zero-Ohm, Style 0402	MIL-PRF-32159/11
03015	Resistor, Chip, Fixed, Film, Zero-Ohm, Style 2010	MIL-PRF-32159/8
03016	Resistor, Chip, Fixed, Film, Zero-Ohm, Style 2512	MIL-PRF-32159/9
88032	Resistor, Chip, Fixed, Film, Zero-Ohm, Style RM0502	MIL-PRF-32159/1
90048	Resistor, Chip, Fixed, Film, Zero-Ohm, Style 0705	MIL-PRF-32159/6
90049	Resistor, Chip, Fixed, Film, Zero-Ohm, Style 1005	MIL-PRF-32159/3
90092	Resistor, Chip, Fixed, Film, Zero-Ohm, Style RM1505	MIL-PRF-32159/4
94011	Resistor, Chip, Fixed, Film, Zero-Ohm, Style RM1206	MIL-PRF-32159/7
87011	Resistor, Chip, Fixed, Zero-Ohm, Style 1010	MIL-PRF-32159/10
90047	Resistor, Chip, Fixed, Zero-Ohm, Style RM2208	MIL-PRF-32159/5
93078	Resistor, Chip, Fixed, Bulk Metal Foil, Ultra Precision, Style 2110	06001*
93079	Resistor, Chip, Fixed, Bulk Metal Foil, Ultra Precision, Style 1505	03010*
95013	Resistor, Chip, Fixed, Film, Style 0302	MIL-PRF-32159/13
95014	Resistor, Chip, Fixed, Film, Style 0402	MIL-PRF-32159/11
97008	Resistor, Chip, Fixed, 1/4 Watt, MELF	05009*
97009	Resistor, Fixed, Film, Precision, 0.3 Watt, Power Curve A	89039*
97010	Resistor, Fixed, Film, Precision, 0.3 Watt, Power Curve B	89039*
97011	Resistor, Fixed, Film, Precision, 0.15 Watt, Power Curve B	89039*
99007	Resistor, Chip, Fixed, Film, 16 Pin Array	No replacement
88033	Resistor, Chip, Fixed, Film, Style 1010	MIL-PRF-32159/10
03017	Resistor, Thermal, (Thermistor), Die Chip, Positive Temperature Coefficient (PTC)	MIL-PRF-32192/1
03018	Resistor, Thermal, (Thermistor), Die Chip, Negative Temperature Coefficient (NTC), Style 0404	MIL-PRF-32192/3
93073	Resistor, Chip, Thermally Sensitive, (Thermistor), NTC, Style 0805	MIL-PRF-32192/4
93074	Resistor, Chip, Thermally Sensitive, (Thermistor), NTC, Style	MIL-PRF-32192/5
98018	Resistor, Chip, Thermally Sensitive (Thermistor), Positive Temperature Coefficient (PTC), Style 0805	MIL-PRF-32192/2

* DLA Land and Maritime Drawing

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APPENDIX E

REPLACEMENT PARTS FOR MIL-R-11 and MIL-R-39008

E.1 SCOPE

E.1.1 Scope. The military specifications MIL-R-11 (Resistor, Fixed, Composition, Insulated) and MIL-R-39008 (Resistor, Fixed, Composition, Insulated) Established Reliability, General Specification For)have been cancelled. There are no direct replacements available. The following suggested substitutes do not meet all of the requirements of MIL-R-11 and MIL-R-39008.

E.2 APPLICABLE DOCUMENTS. This section is not applicable to this section.

E.3 SUGGESTED REPLACEMENTS

E.3.1 Replacement for general applications. The following specifications are considered acceptable substitutes for general applications of the MIL-R-39008 and MIL-R-11.

Department of Defense Specifications:

MIL-PRF-22684/8	-	Resistor, Fixed, Film, Insulated, Style RL42….TX.
MIL-PRF-39017/1	-	Resistor, Fixed, Film, Insulated, Nonestablished Reliability, and Established Reliability, Style RLR07.
MIL-PRF-39017/2	-	Resistor, Fixed, Film, Insulated, Nonestablished Reliability, and Established Reliability, Style RLR20.
MIL-PRF-39017/3	-	Resistor, Fixed, Film, Insulated, Nonestablished Reliability, and Established Reliability, Style RLR32.
MIL-PRF-39017/5	-	Resistor, Fixed, Film, Insulated, Nonestablished Reliability, and Established Reliability, Style RLR05.

DLA LAND AND MARITIME drawings:

97004	-	Resistor, Fixed, Film, Insulated, 2 Watt
98020	-	Resistor, Fixed, Film, Insulated, 1/8 Watt
98021	-	Resistor, Fixed, Film, Insulated, 1/2 Watt
98022	-	Resistor, Fixed, Film, Insulated, 1 Watt
99011	-	Resistor, Fixed, Film, Insulated, 0.25 Watt

Designers are CAUTIONED on using these resistors in pulse applications. See E.4.1

E.3.2 Replacement for pulse applications. The following specifications are considered acceptable substitutes for pulse applications for MIL-R-11 and MIL-R-39008.

Designers are CAUTIONED on using these resistors in high power pulse applications. Since they have not been qualified nor tested for such applications, damage and premature failure are possible. These resistors only see a one-time pulse when Short-time overload testing is performed.

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APPENDIX E

REPLACEMENT PARTS FOR MIL-R-39008 AND MIL-R-11

Designers MAY CONSIDER using the following DLA Land and Maritime drawings for high power pulse applications.

DLA LAND AND MARITIME drawings:

03003	-	Resistor, Fixed, Carbon Film, High Pulse Voltage, 1/8 Watt
03004	-	Resistor, Fixed, Carbon Film, High Pulse Voltage, 1/4 Watt
03005	-	Resistor, Fixed, Carbon Film, High Pulse Voltage, 1/2 Watt
03006	-	Resistor, Fixed, Carbon Film, High Pulse Voltage, 1 Watt
03007	-	Resistor, Fixed, Carbon Film, High Pulse Voltage, 3/4 Watt
03008	-	Resistor, Fixed, Carbon Film, High Pulse Voltage, 2 Watt
03009	-	Resistor, Fixed, Carbon Film, High Pulse Voltage, 3 Watt

NOTE: These alternative resistors do not have the geometry (form, fit) of the MIL-PRF-39017 resistors, nor are they subject to the same qualification/verification and periodic Group C inspection requirements as the RLR style resistors. Additionally, Group B for the DLA Land and Maritime drawings parts may be satisfied by providing generic data.

E.4 ADDITIONAL INFORMATION

E.4.1 Fixed film resistors. Designers are CAUTIONED on using these resistors in pulse applications. These resistors only see a one-time pulse when Short-time overload testing is performed. These resistors are subject to damage and premature failures when they see excessive pulsing.

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Custodians:
Army - CR
Navy - EC
Air Force - 85
DLA - CC

Preparing activity:
DLA - CC

(Project 5905-2017-142)

Review activities:
Army - AR, AT, AV, CR4, MI
Navy - AS, CG, MC, OS, SH
Air Force - 19, 99

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at https://assist.dla.mil.