

REVISIONS			
LTR	DESCRIPTION	DATE (YR-MO-DA)	APPROVED
A	Corrected the lead diameter tolerance in figure 1 .	13-09-09	Michael A. Radecki
B	Added new ratings.	13-12-16	Michael A. Radecki
C	Added new ratings and updated vendor offerings.	14-08-05	Michael A. Radecki
D	Updated shock and reverse voltage tests (see 3.6.1 and 3.6.11). Replaced DF with ESR (see 3.2). Added an approved source of supply.	16-02-09	Michael A. Radecki
E	Updated vendor offerings.	19-01-16	Michael A. Radecki
F	Add an approved source of supply.	23-04-05	Michael A. Radecki
G	Updated vendor offerings.	24-02-22	Michael A. Radecki
H	Updated vendor offerings and added limits for the reverse voltage test.	24-12-05	Mark A. Rush



Prepared in accordance with [ASME Y14.100](#)

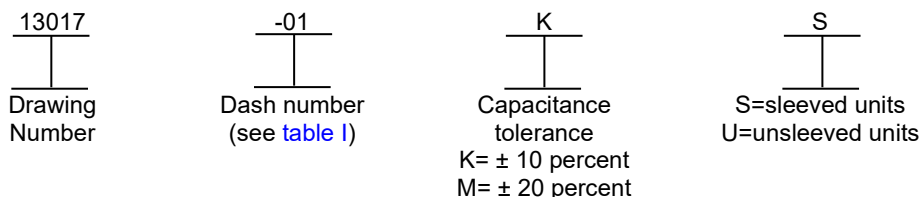
Selected item drawing

REV STATUS OF PAGES	REV	H	H	H	H	H	H	H	H	H	H							
	PAGES	1	2	3	4	5	6	7	8	9	10							
PMIC N/A	PREPARED BY John Bonitatibus						DESIGN ACTIVITY DLA LAND AND MARITIME COLUMBUS, OH 43218-3990											
Original date of drawing YR-MO-DA 13-06-20	CHECKED BY Andrew R. Ernst						TITLE CAPACITOR, FIXED, ELECTROLYTIC (NONSOLID ELECTROLYTE), TANTALUM (POLARIZED SLUG)											
	APPROVED BY Michael A. Radecki																	
	SIZE A			CAGE CODE 037Z3			DWG NO. 13017											
	SCALE N/A			REV H			PAGE 1 OF 10											

1. SCOPE

1.1 Scope. This drawing describes the complete requirements for tantalum electrolytic (nonsolid) electrolyte, fixed capacitors, in tantalum cases, insulated and uninsulated. These capacitors are similar to [DLA Land and Maritime drawing 93026](#) capacitors with improved reverse voltage, vibration, shock, and thermal shock capabilities.

1.2 Part or Identifying Number (PIN). The complete PIN is as follows:



2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this drawing. This section does not include documents cited in other sections of this drawing or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents in sections 3 and 4 of this drawing, whether or not they are listed here.

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. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract (see [6.2](#)).

DEPARTMENT OF DEFENSE SPECIFICATIONS

[MIL-PRF-39006](#) - Capacitors, Fixed, Electrolytic (Non-Solid Electrolyte), Tantalum Established Reliability, General Specification for

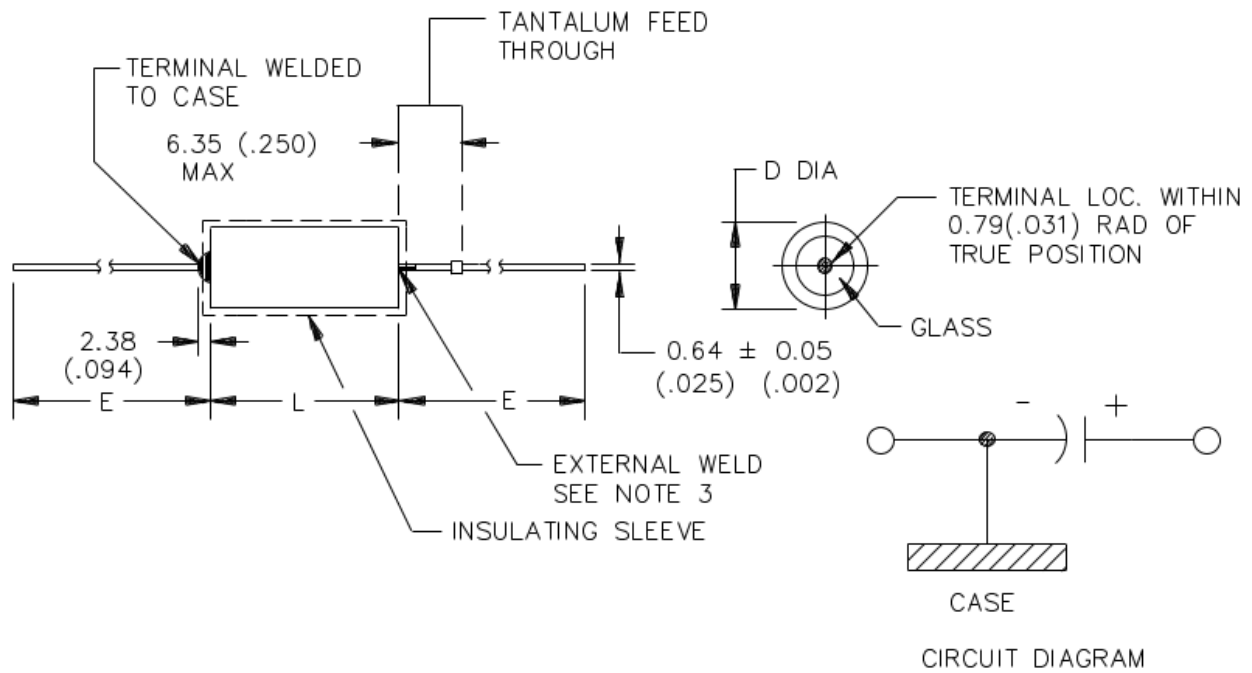
DEPARTMENT OF DEFENSE STANDARDS

[MIL-STD-202-204](#) - Method 204, Vibration, High Frequency
[MIL-STD-202-213](#) - Method 213, Shock (Specified Pulse)
[MIL-STD-202-214](#) - Method 214, Random Vibration
[MIL-STD-790](#) - Standard Practice for Established Reliability and High Reliability Qualified Products List (QPL) Systems for Electrical, Electronic, and Fiber Optic Parts Specifications
[MIL-STD-1276](#) - Leads for Electronic Component Parts
[MIL-STD-1285](#) - Marking of Electrical and Electronic Parts

(Copies of these documents are available online at <https://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, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

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Case size	Dimensions mm (inches)			
	Basic case		Insulated case	
	L + 0.79 (.031) - 0.41 (.016)	D ± 0.41 (.016)	D Max	E ± 6.35 (.250)
T1	11.51 (.453)	4.78 (.188)	5.56 (.219)	38.10 (1.500)
T2	16.28 (.641)	7.14 (.281)	7.92 (.312)	57.15 (2.250)
T3	19.46 (.766)	9.52 (.375)	10.31 (.406)	57.15 (2.250)
T4	26.97 (1.062)	9.52 (.375)	10.31 (.406)	57.15 (2.250)

NOTES:

1. Dimensions are in millimeters.
2. Inches are in parentheses and are given for general information only.
3. The weld shall not be enclosed in the end seal.

FIGURE 1. Dimensions and configuration.

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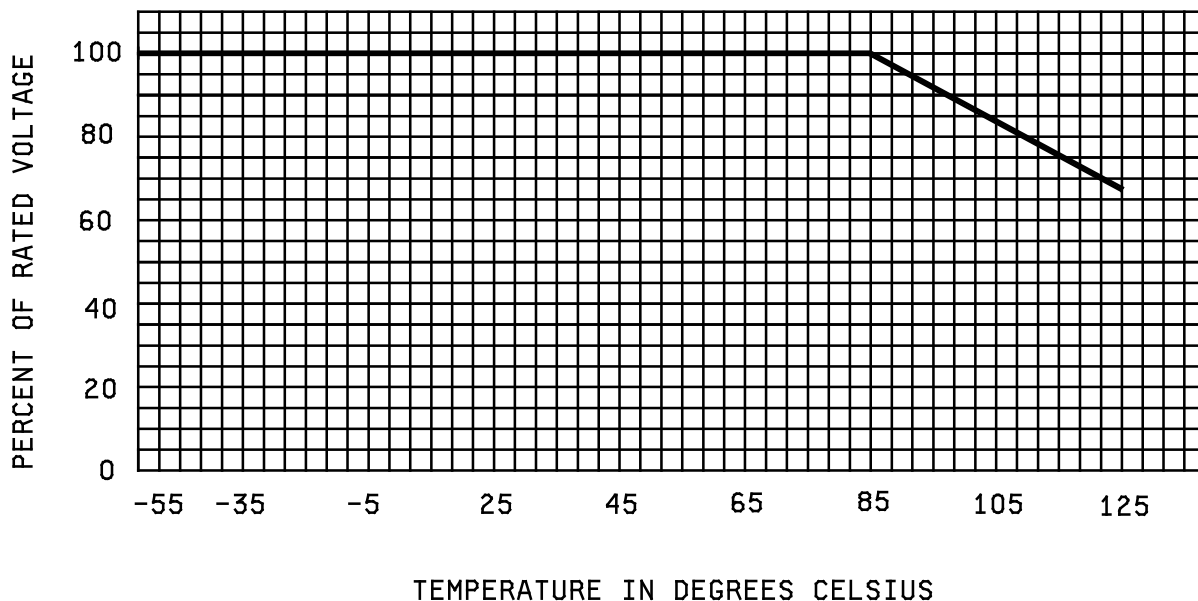


FIGURE 2. Voltage derating with temperature.

3. REQUIREMENTS

3.1 Design and physical dimensions. The design and physical dimensions shall be as specified herein (see [figure 1](#)).

3.1.1 Terminals. All terminals shall be permanently secured internally and externally, as applicable. All external joints shall be welded. Terminals shall be tin-lead coated with a minimum lead content of 3 percent and conform to type N32, N51, or N52 as specified in [MIL-STD-1276](#). The length and diameter of the terminals shall be as specified in [figure 1](#).

3.1.2 Pure tin. The use of pure tin, as an underplate or final finish is prohibited both internally and externally. Tin content of capacitor components and solder shall not exceed 97 percent, by mass. Tin shall be alloyed with a minimum of 3 percent lead, by mass (see [6.3](#)).

3.1.3 Case. The case shall be made of tantalum.

3.1.4 Sleeving (when applicable). Shrink fitted insulation shall be used for the sleeving, and it shall lap over the ends of the capacitor body.

3.1.5 Capacitor element. The capacitor element shall consist of an anode of a sintered tantalum slug.

3.1.6 Rated temperature. The capacitor is rated for its given voltage from -55°C to +85°C. It is derated to two thirds of its given voltage at +125°C. See [figure 2](#) for voltage derating with temperature.

3.2 Electrical characteristics. The electrical characteristics shall be as shown in [table I](#) and [table II](#). Dissipation factor measurements as specified in [MIL-PRF-39006](#) shall be replaced by ESR, where applicable.

3.3 Seal. When the capacitors are tested as specified in [MIL-PRF-39006](#), there shall be no evidence of leakage.

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3.4 Solderability. Solderability shall be in accordance with [MIL-PRF-39006](#).

3.5 Stability at high and low temperature. Stability at high and low temperature shall be in accordance with [MIL-PRF-39006](#).

3.6 Additional tests. The capacitors specified herein are designed to meet the following requirements. Whether the tests are actually performed or not shall be at the option of the acquiring activity (see [6.2c](#)) and shall be negotiable with the manufacturer.

3.6.1 Shock. The capacitors shall meet the requirements of [MIL-PRF-39006](#) when tested in accordance with [MIL-STD-202-213](#), test condition D.

3.6.2 Vibration.

3.6.2.1 Vibration, high frequency. The capacitors shall meet the requirements of [MIL-PRF-39006](#) when tested in accordance with [MIL-STD-202-204](#), test condition E (50 g).

3.6.2.2 Vibration, random. The capacitors shall meet the requirements of [MIL-PRF-39006](#) when tested in accordance with [MIL-STD-202-214](#), test condition II-G (27.78 g).

3.6.3 Thermal shock. Thermal shock shall be in accordance with [MIL-PRF-39006](#) when tested for 300 cycles.

3.6.4 Salt atmosphere (corrosion). Salt atmosphere shall be in accordance with [MIL-PRF-39006](#).

3.6.5 Terminal strength. Terminal strength shall be in accordance with [MIL-PRF-39006](#).

3.6.6 Surge voltage. Surge voltage shall be in accordance with [MIL-PRF-39006](#) and [table II](#) of this drawing.

3.6.7 Moisture resistance. Moisture resistance shall be in accordance with [MIL-PRF-39006](#).

3.6.8 Dielectric withstanding voltage. Dielectric withstanding voltage shall be in accordance with [MIL-PRF-39006](#).

3.6.9 Insulation resistance. Insulation resistance shall be in accordance with [MIL-PRF-39006](#).

3.6.10 Low temperature storage. Low temperature storage shall be in accordance with [MIL-PRF-39006](#).

3.6.11 Reverse voltage. Reverse voltage shall be in accordance with [MIL-PRF-39006](#).

- a. DC leakage: Shall not exceed the specified value (see [table I](#)).
- b. Capacitance: Shall be within tolerance of the specified value (see [table I](#)).
- c. Dissipation factor: Shall not exceed the specified value (see [table I](#)).

3.6.12 Life. The capacitors shall be capable of withstanding a 2,000 hour life test at +85°C at rated voltage, or a 1,000 hour life test at +125°C test at derated voltage. After the test, the capacitors shall meet the following requirements:

- a. DC leakage at (+85°C and +125°C) shall not exceed 125 percent of the specified value (see [table I](#)).
- b. DC leakage at (+25°C) shall not exceed the specified value (see [table I](#)).
- c. Capacitance shall be within +10, -20 percent of initial value.
- d. ESR shall not exceed 200 percent of the specified value (see [table I](#)).
- e. Dielectric withstanding voltage in accordance with [MIL-PRF-39006](#).
- f. Insulation resistance in accordance with [MIL-PRF-39006](#).
- g. Visual examination shall show no damage, obliteration of marking, or leakage of electrolyte.

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3.6.13 AC ripple life. AC ripple life shall be in accordance with [MIL-PRF-39006](#) and shall not exceed the specified value (see [table I](#) and [table III](#)).

3.6.13.1 AC ripple current multipliers vs. frequency, temperature, and applied voltage. See [table III](#).

3.6.14 Impedance. Impedance shall be in accordance with [MIL-PRF-39006](#) and shall not exceed the specified value (see [table I](#)).

3.6.15 Barometric pressure (reduced). Barometric pressure shall be in accordance with [MIL-PRF-39006](#).

3.6.16 Resistance to solvents. Resistance to solvents shall be in accordance with [MIL-PRF-39006](#).

3.6.17 Resistance to soldering heat. Resistance to soldering heat shall be in accordance with [MIL-PRF-39006](#).

3.7 Marking. Marking shall be in accordance with [MIL-STD-1285](#), except the PIN shall be as specified in [1.2](#) with the manufacturers name or CAGE code, date code, lot symbol, capacitance (in μF), and rated voltage.

3.8 Manufacturer Eligibility. To be eligible to be listed as an approved source of supply, a manufacturer shall be listed on the [MIL-PRF-39006 Qualified Products List](#) for at least one style or perform all testing specified herein on a sample of parts agreed upon by the manufacturer and DLA Land and Maritime - VAT.

3.9 Certificate of compliance. A certificate of compliance shall be required from manufacturers requesting to be an approved source of supply.

3.10 Recycled, recovered, environmentally preferable, or biobased materials. Recycled, recovered, environmentally preferable, or biobased materials should be used to the maximum extent possible provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.11 Workmanship. Capacitors shall be uniform in quality and free from any defects that will affect life, serviceability, or appearance.

4. VERIFICATION

4.1 Product assurance program. The product assurance program specified in [MIL-PRF-39006](#) and maintained in accordance with [MIL-STD-790](#) is not applicable to this document.

4.2 Qualification inspection. Qualification inspection is not applicable to this document.

4.3 Failure rate qualification. The failure rate qualification specified in [MIL-PRF-39006](#) is not applicable to this document.

4.4 Conformance inspections.

4.4.1 Inspection of product for delivery. Inspection of product for delivery shall consist of the group A inspection and subgroup 1 of the group B inspection of [MIL-PRF-39006](#).

4.5 Visual and mechanical examination. Capacitors shall be examined to verify that the materials, design, construction, physical dimensions, marking, and workmanship are in accordance with applicable requirements of [MIL-PRF-39006](#).

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

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TABLE I. Electrical characteristics.

DLA Land and Maritime drawing PIN 13017- 1/	Cap. (µF) at +25°C and 120 Hz	Case size	Dissipation factor 3/ (max) %	Max ESR Ohms 120 Hz	Max DCL uA		Max impedance ohms at -55°C and +125°C 120 Hz	Maximum capacitance change in percent			AC ripple +85°C 40 KHz mA rms 2/
					+25°C	+85°C and +125°C		-55°C	+85°C	+125°C	
25 V dc at +85°C					15 V dc at +125°C						
01 --	120	T1	14.1	1.30	1	5	25	-42	8	12	1250
02 --	560	T2	42.1	0.83	2	10	12	-65	14	18	2000
03 --	1200	T3	70.6	0.65	5	20	7	-70	15	20	2400
04 --	1800	T4	81.4	0.50	6	25	7	-72	15	20	3000
30 V dc at +85°C					20 V dc at +125°C						
05 --	100	T1	11.8	1.30	1	5	25	-38	8	12	1200
06 --	470	T2	36.1	0.85	2	10	15	-65	14	18	1800
07 --	1000	T3	63.3	0.70	7	25	7	-70	15	25	2200
08 --	1500	T4	81.4	0.60	12	35	6	-72	15	25	2900
50 V dc at +85°C					30 V dc at +125°C						
09 --	68	T1	9.2	1.50	1	5	35	-25	8	15	1050
10 --	220	T2	17.9	0.90	2	10	17.5	-50	8	15	1800
11 --	470	T3	31.9	0.75	3	25	10	-45	8	15	2100
12 --	680	T4	43.1	0.70	5	40	8	-58	10	20	2700
60 V dc at +85°C					40 V dc at +125°C						
13 --	47	T1	8.5	2.00	1	5	44	-25	8	12	1050
14 --	150	T2	14.9	1.10	2	10	20	-40	8	15	1800
15 --	390	T3	31.8	0.90	3	25	15	-45	8	15	2100
16 --	560	T4	40.5	0.80	5	40	10	-58	8	15	2700
75 V dc at +85°C					50 V dc at +125°C						
17 --	33	T1	7.5	2.50	1	5	66	-25	5	9	1050
18 --	110	T2	12.9	1.30	2	10	24	-35	6	10	1650
19 --	330	T3	29.9	1.00	3	30	12	-45	6	10	2100
20 --	470	T4	38.3	0.90	5	50	12	-50	6	10	2700
100 V dc at +85°C					65 V dc at +125°C						
21 --	15	T1	4.8	3.50	1	5	125	-18	3	10	1050
22 --	68	T2	12.9	2.10	2	10	37	-30	4	12	1650
23 --	150	T3	21.7	1.60	3	25	22	-35	6	12	2100
24 --	220	T4	23.9	1.20	5	50	15	-40	6	12	2700
125 V dc at +85°C					85 V dc at +125°C						
25 --	10	T1	5.0	5.50	1	5	175	-15	3	10	1050
26 --	47	T2	9.8	2.30	2	10	47	-25	5	12	1650
27 --	82	T3	13.3	1.80	3	25	40	-35	5	12	1950
28 --	100	T3	16.3	1.80	3	25	35	-35	5	12	2100
29 --	150	T4	21.7	1.60	5	50	20	-35	6	12	2700

1/ The complete PIN number shall include symbols to indicate capacitance tolerance and sleeved or unsleeved units (see 1.2).

2/ For ripple current limits at various temperatures, voltages, and frequencies see table III.

3/ Maximum dissipation factor is calculated from ESR by the equation:

$$DF_{(max)} = (ESR_{(max)})(2\pi fC)$$

Where:

$ESR_{(max)}$ = Maximum ESR from table I

2π = 6.28

f = 120 Hz;

C = Maximum allowable capacitance.

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TABLE II. Voltage.

Voltage		
Rated (+85°C) Volts, dc.	Derated (+125°C) Volts, dc.	Surge (+85°C) Volts, dc.
25	15	28.8
30	20	34.5
50	30	57.5
60	40	69.0
75	50	86.3
100	65	115.0
125	85	144.0

TABLE III. Ripple current multipliers vs. Frequency, temperature and applied voltage. 1/ 2/

Frequency of applied ripple current		120 Hz				800 Hz				1 kHz			
Ambient still air temperature in °C		≤+55	+85	+105	+125	≤+55	+85	+105	+125	≤+55	+85	+105	+125
% of	100%	.60	.39	-	-	.71	.43	-	-	.72	.45	-	-
+85°C	90%	.60	.46	-	-	.71	.55	-	-	.72	.55	-	-
rated	80%	.60	.52	.35	-	.71	.62	.42	-	.72	.62	.42	-
peak	70%	.60	.58	.44	-	.71	.69	.52	-	.72	.70	.52	-
voltage	66-2/3%	.60	.60	.46	.27	.71	.71	.55	.32	.72	.72	.55	.32
Frequency of applied ripple current		10 kHz				40 kHz				100 kHz			
Ambient still air temperature in °C		≤+55	+85	+105	+125	≤+55	+85	+105	+125	≤+55	+85	+105	+125
% of	100%	.88	.55	-	-	1.0	.63	-	-	1.1	.69	-	-
+85°C	90%	.88	.67	-	-	1.0	.77	-	-	1.1	.85	-	-
rated	80%	.88	.76	.52	-	1.0	.87	.59	-	1.1	.96	.65	-
peak	70%	.88	.85	.64	-	1.0	.97	.73	-	1.1	1.07	.80	-
voltage	66-2/3%	.88	.88	.68	.40	1.0	1.0	.77	.45	1.1	1.1	.85	.50

1/ At +125°C, the rated voltage of the capacitors decreases to 66 2/3 of the +85°C rated voltage.

2/ The peak of the applied ac ripple voltage plus the applied dc voltage must not exceed the dc voltage rating of the capacitors.

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5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

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

6.1 Intended use. Capacitors conforming to this drawing are intended for use when military specifications do not exist and qualified military devices that will perform the required function are not available for OEM application. This drawing is intended exclusively to prevent the proliferation of unnecessary duplicate specifications, drawings, and stock catalog listings. When a military specification exists and the product covered by this drawing has been qualified for listing, this drawing becomes obsolete and will not be used for new design.

6.2 Ordering data. The contract or purchase order should specify the following:

- a. Complete DLA Land and Maritime CAGE code and PIN (see 1.2).
- b. Requirements for delivery of one copy of the quality conformance inspection data or certificate of compliance that parts have passed quality conformance inspection with each shipment of parts by the manufacturer.
- c. Additional required tests, if applicable (see 3.6).
- d. Requirements for packaging and packing.

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 manufacturer. Tin whiskers may occur anytime from a day to years after manufacturer 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 on tin whiskers. Alloys of 3 percent by mass, have been 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 Users of record. Coordination of this document for future revisions is coordinated only with the approved source(s) of supply and the users of record of this document. Requests to be added as a recorded user of this drawing may be achieved online at capacitorfilter@dla.mil or in writing to: DLA Land and Maritime, ATTN: VAT, Post Office Box 3990, Columbus, OH 43218-3990 or by telephone (614) 692-4709 or DSN 850-4709.

6.5 Changes from previous issue. The margins of this drawing are marked with vertical lines to indicate where changes from the previous issue were made. 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 and relationship to the last previous issue.

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6.6 Approved sources of supply. Approved sources of supply are listed herein. Additional sources will be added as they become available. For assistance in the use of this drawing, contact DLA Land and Maritime, ATTN: VAT, P. O. Box 3990, Columbus, OH 43218-3990, by e-mail to capacitorfilter@dla.mil, or by telephone (614) 692-4709 or DSN 850-4709.

1/ DLA Land and Maritime drawing PIN 13017-	Vendor A Similar type	Vendor B Similar type	Vendor C Similar type
01 --		TWSA127-025	
02 --		TWSB567-025	TWSB567-025
03 --		TWSD128-025	TWSD128-025
04 --		TWSE188-025	TWSE188-025
05 --		TWSA107-030	
06 --		TWSB477-030	TWSB477-030
07 --		TWSD108-030	TWSD108-030
08 --		TWSE158-030	TWSE158-030
09 --	T16A686*050EZ*S	TWSA686-050	
10 --	T16B227*050EZ*S	TWSB227-050	
11 --	T16C477*050EZ*S		TWSD477-050
12 --	T16D687*050EZ*S	TWSE687-050	TWSE687-050
13 --	T16A476*060EZ*S		
14 --	T16B157*060EZ*S	TWSB157-060	
15 --	T16C397*060EZ*S	TWSD397-060	TWSD397-060
16 --	T16D567*060EZ*S	TWSE567-060	TWSE567-060
17 --	T16A336*075EZ*S	TWSA336-075	
18 --	T16B117*075EZ*S	TWSB117-075	
19 --	T16C337*075EZ*S		TWSD337-075
20 --	T16D477*075EZ*S	TWSE477-075	TWSE477-075
21 --	T16A156*100EZ*S	TWSA156-100	
22 --	T16B686*100EZ*S	TWSB686-100	
23 --	T16C157*100EZ*S	TWSD157-100	TWSD157-100
24 --	T16D227*100EZ*S	TWSE227-100	TWSE227-100
25 --	T16A106*125EZ*S		
26 --	T16B476*125EZ*S		
27 --	T16C826*125EZ*S	TWSD826-125	TWSD826-125
28 --	T16C107*125EZ*S	TWSD107-125	TWSD107-125
29 --	T16D157*125EZ*S	TWSE157-125	TWSE157-125

1/ Parts must be purchased to the DLA Land and Maritime CAGE code and PIN to assure that all the performance requirements and tests are met.

Vendor	Vendor CAGE	Vendor name and address
A	2800A	Vishay Israel, Ltd. Dr. Felix Zandman, 3; Industrial Park Dimona 8622704 Israel
B	17554	KYOCERA AVX Components (Biddeford) Corporation 401 Hill Street Biddeford, ME 04005-4327
C	1154G	KYOCERA AVX Components s.r.o. Dvorakova 328 563 01 Lanskroun Czech Republic

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