TYPE 131P

PAPER / POLYESTER DIELECTRIC EXTENDED FOIL ELECTRODES

FEATURES

- Moderate cost
- Small size
- High peak current ratings
- High corona starting voltage
- Approved to MIL-PRF-19978

MAJOR APPLICATIONS:
High voltage, high current, high pulse operations, protection circuits, and snubber applications.

PHYSICAL CHARACTERISTICS

CONSTRUCTION:
Non-inductive wound paper / polyester dielectric with extended foil electrodes. Impregnated with vitamin Q.

CASE:
Hermetically sealed metal enclosure. Styles and dimensions are in Guide to Ordering section in the front of the catalog.

LEAD MATERIAL:
Solder coated solid wire.

LEAD WIRE SIZES:

Case Dia.	Lead AWG
0.235 and 0.312	No. 22
0.400 and over	No. 20

LEAD PULL:
5 lbs (2.3 kg) for one minute. No physical damage.

LEAD BEND:
After three complete consecutive bends. No damage.

MARKING:
Dearborn trademark, type or catalog number, capacitance, tolerance, and voltage.

ELECTRICAL SPECIFICATIONS

CAPACITANCE RANGE:
0.001 µF to 1.0 µF

VOLTAGE RATING:
200 VDC to 1,000 VDC

CAPACITANCE TOLERANCE:
±20%, ±10%, ±5%

OPERATING TEMPERATURE:
-65°C to +125°C

VOLTAGE DERATING:
At +125°C, 50% of the 85°C rating

DISSIPATION FACTOR:
1.0% maximum

DC VOLTAGE TEST:
200% of rated voltage for 2 minutes

INSULATION RESISTANCE:
Measure at rated VDC or 500 V, whichever is less, after a 2 minute charge.

- At +25°C, 20,000 Megaohm-Microfarads, need not exceed 30,000 Megaohms
- At +125°C, 20 Megaohm-Microfarads, need not exceed 250 Megaohms

MAXIMUM PULSE RISE TIME

Capacitor Length (inch)	Rise Time dv / dt (V / µs)			
	200 VDC	400 VDC	600 VDC	1,000 VDC
0.750	1600	1600	4500	-
0.875	1000	1400	1500	2500
1.125	500	800	1000	1500
1.375	350	500	800	1000
1.625	250	350	500	800
1.875	-	-	-	550
2.125	200	300	400	500
2.375	-	-	300	450

STANDARD RATINGS

Capacitance		Voltage Code 200 200 VDC		Voltage Code 400 400 VDC		Voltage Code 600 600 VDC		Voltage Code 1K0 1,000 VDC	
µF	Code	D	L	D	L	D	L	D	L
0.0010	102	-	-	-	-	0.235	0.750	0.400	0.875
0.0015	152	-	-	-	-	0.235	0.750	0.400	0.875
0.0022	222	-	-	-	-	0.235	0.750	0.400	0.875
0.0033	332	-	-	0.235	0.750	0.312	0.875	0.400	0.875
0.0047	472	0.235	0.750	0.235	0.750	0.312	0.875	0.400	0.875
0.0068	682	0.235	0.750	0.235	0.750	0.312	0.875	0.400	0.875
0.010	103	0.235	0.750	0.235	0.750	0.312	0.875	0.400	0.875
0.015	153	0.312	0.875	0.312	0.875	0.400	0.875	0.400	1.125
0.022	223	0.312	0.875	0.400	0.875	0.400	0.875	0.400	1.375
0.033	333	0.312	0.875	0.400	0.875	0.400	1.125	0.562	1.125
0.047	473	0.400	0.875	0.400	1.125	0.400	1.375	0.562	1.375
0.068	683	0.400	0.875	0.400	1.375	0.562	1.125	0.562	1.625
0.10	104	0.400	1.125	0.562	1.125	0.562	1.375	0.670	1.625
0.15	154	0.400	1.375	0.562	1.375	0.562	1.625	0.670	1.875
0.22	224	0.562	1.125	0.562	1.625	0.670	1.625	0.750	2.125
0.33	334	0.562	1.375	0.670	1.625	0.750	2.125	1.000	2.125
0.47	474	0.562	1.625	0.750	2.125	0.750	2.375	1.000	2.375
0.68	684	0.670	1.625	-	-	-	-	-	-
1.00	105	0.750	2.125	-	-	-	-	-	-

Additional capacitance values, voltages, and tolerances are available upon request.

* The dimensions shown are for style 02. The dimensions for other styles are included in the general section in the front of the catalog.

TYPE 132P

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CONSTRUCTION:
Non-inductive wound paper / polyester dielectric with extended foil electrodes. Impregnated with vitamin Q.

CASE:
Hermetically sealed metal enclosure. Styles and dimensions are in Guide to Ordering section in the front of the catalog.

LEAD MATERIAL:
Solder coated solid wire.

LEAD WIRE SIZES:

Case Dia.	Lead AWG
< 0.235	No. 24
< 0.235 and 0.312	No. 22
0.400 and over	No. 20

LEAD PULL:
5 lbs (2.3 kg) for one minute. No physical damage.

LEAD BEND:
After three complete consecutive bends. No damage.

MARKING:
Dearborn trademark, type or catalog number, capacitance, tolerance, and voltage.

ELECTRICAL SPECIFICATIONS

CAPACITANCE RANGE:
0.001 µF to 1.0 µF

VOLTAGE RATING:
100 VDC to 1,000 VDC

CAPACITANCE TOLERANCE:
±20%, ±10%, ±5%

OPERATING TEMPERATURE:
-65°C to +125°C

VOLTAGE DERATING:
At +125°C, 50% of the 85°C rating

DISSIPATION FACTOR:
1.0% maximum

DC VOLTAGE TEST:
200% of rated voltage for 2 minutes

INSULATION RESISTANCE:
Measure at rated VDC or 500 V, whichever is less, after a 2 minute charge.

- At +25°C, 20,000 Megaohm-Microfarads, need not exceed 30,000 Megaohms
- At +125°C, 20 Megaohm-Microfarads, need not exceed 250 Megaohms

MAXIMUM PULSE RISE TIME

Capacitor Length (inch)	Rise Time dv / dt (V / µs)					
	100 VDC	200 VDC	300 VDC	400 VDC	600 VDC	1,000 VDC
0.687 / 0.750	800	1600	2000	3000	4500	-
0.812 / 0.875	700	1000	1000	1000	1500	2500
1.062 / 1.125	400	500	650	800	1000	1500
1.312 / 1.375	300	350	425	500	800	1000
1.562 / 1.625	200	250	300	350	500	800
1.812 / 1.875	-	-	-	-	-	550
2.062 / 2.125	-	200	250	300	400	500
2.312 / 2.375	-	-	-	-	300	450

STANDARD RATINGS

Capacitance		Voltage Code 100 100 VDC		Voltage Code 200 200 VDC		Voltage Code 300 300 VDC		Voltage Code 400 400 VDC		Voltage Code 600 600 VDC		Voltage Code 1000 1,000 VDC	
µF	Code	D	L	D	L	D	L	D	L	D	L	D	L
0.0010	102	0.175	0.687	0.235	0.687	0.235	0.687	0.235	0.687	0.235	0.687	0.400	0.812
0.0015	152	0.175	0.687	0.235	0.687	0.235	0.687	0.235	0.687	0.235	0.687	0.400	0.812
0.0022	222	0.175	0.687	0.235	0.687	0.235	0.687	0.235	0.687	0.235	0.687	0.400	0.812
0.0033	332	0.175	0.687	0.235	0.687	0.235	0.687	0.235	0.687	0.312	0.812	0.400	0.812
0.0047	472	0.175	0.687	0.235	0.687	0.235	0.687	0.312	0.812	0.312	0.812	0.400	0.812
0.0068	682	0.195	0.687	0.235	0.687	0.312	0.812	0.195	0.812	0.312	0.812	0.400	0.812
0.010	103	0.235	0.687	0.312	0.812	0.312	0.812	0.312	0.812	0.312	0.812	0.400	0.812
0.015	153	0.235	0.687	0.312	0.812	0.312	0.812	0.312	0.812	0.400	0.812	0.400	1.062
0.022	223	0.312	0.812	0.312	0.812	0.312	0.812	0.400	0.812	0.400	0.812	0.400	1.312
0.033	333	0.312	0.812	0.312	0.812	0.400	0.812	0.400	0.812	0.400	1.062	0.562	1.062
0.047	473	0.312	0.812	0.400	0.812	0.400	0.812	0.400	1.062	0.400	1.312	0.562	1.312
0.068	683	0.400	0.812	0.400	0.812	0.400	1.062	0.400	1.312	0.562	1.062	0.562	1.562
0.10	104	0.400	0.812	0.400	1.062	0.400	1.312	0.562	1.062	0.562	1.312	0.670	1.562
0.15	154	0.400	1.062	0.400	1.312	0.562	1.062	0.562	1.312	0.562	1.562	0.670	1.812
0.22	224	0.400	1.062	0.562	1.062	0.562	1.312	0.562	1.562	0.670	1.562	0.750	2.062
0.33	334	0.562	1.062	0.562	1.312	0.562	1.562	0.670	1.562	0.750	2.062	1.000	2.062
0.47	474	0.562	1.312	0.562	1.562	0.670	1.562	0.750	2.062	0.750	2.312	1.000	2.312
0.68	684	0.562	1.562	0.670	1.562	0.750	2.062	-	-	-	-	-	-
1.00	105	0.670	1.562	0.750	2.062	-	-	-	-	-	-	-	-

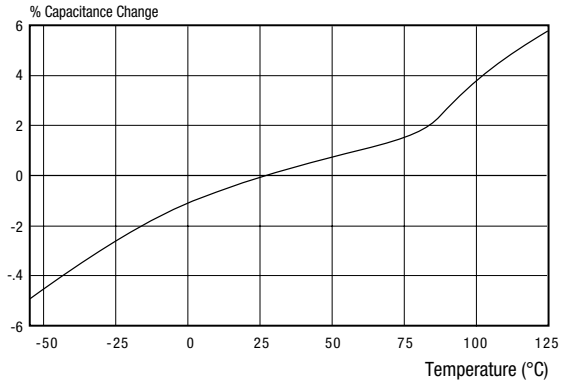
Additional capacitance values, voltages, and tolerances are available upon request.

* The dimensions Tabulated above are for styles 01, 03, and 12. Add 0.062" to the length for styles 02, 04, and 13.

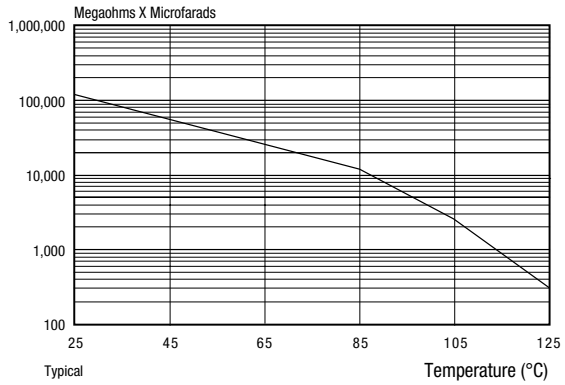
TYPICAL CHARACTERISTICS POLYESTER FILM / FOIL TYPES

TYPICAL CHARACTERISTICS

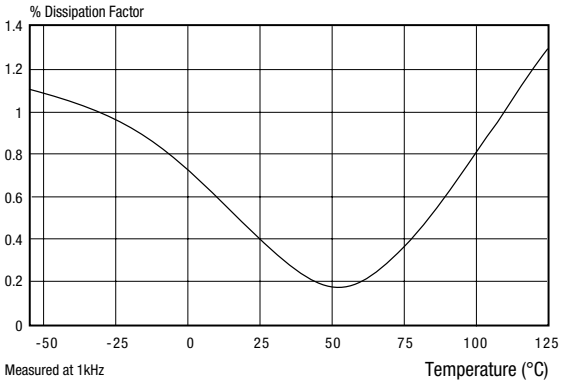
CAPACITANCE CHANGE VS. TEMPERATURE



INSULATION RESISTANCE VS. TEMPERATURE



DISSIPATION FACTOR VS. TEMPERATURE



PROPERTIES OF DIELECTRIC FILMS

POLYESTER (Polyethylene Terephtalate, P.E.T.)

Capacitors with smaller dimensions can be manufactured due to the high dielectric constant and excellent electrical performance of this film. Metalized polyester capacitors also have outstanding self-healing properties.

POLYPROPYLENE (P.P.)

This film features very low dielectric losses, low dielectric adsorption, high dielectric strength, very high insulating strength and a practically linear temperature coefficient in all temperature ranges.

All these properties make this film suitable for the manufacturing of power electronics capacitors.

However, the operating temperature is limited to 105°C.

POLYPHENYLENE SULFIDE (P.P.S.)

The properties of this film are as follows: very low dielectric losses, low temperature coefficient, high stability of the capacitance value, resistant to humidity and a high melting point. This material is suited for surface mounted precision capacitors (SMD). This film also has high temperature advantages and can be used for temperature up to 150°C.

PROPERTIES OF METALIZED FILM CAPACITORS

The metalized film consists of an extremely thin layer (some hundredths µm) of zinc or aluminum deposited by evaporation under vacuum on the dielectric. The nature, thickness and geometry of the metalized layer modify the properties of the capacitors, especially as far as permissible peak or effective current is concerned.

Metalized film capacitors are smaller than film-foil capacitors.

Self-healing is a fundamental property of these capacitors. When a dielectric breakdown occurs between the metal layers, due to a dielectric failure, an electrical arc causes local vapor deposition of the metallization which results in an insulating metallic oxide. Thus regenerated, the capacitor is once again operational.

The self-healing operation generally requires only a very small amount of energy (5 to 15 µJoules) and is performed in several µseconds (< 50). However, a minimum amount of energy is required below which self-healing operations are unpredictable. This energy is calculated in relation to the capacitance value and the load voltage: $E = 1 / 2\ CV^2$.

PROPERTIES OF FILM-FOIL CAPACITORS

Film Foil capacitors are especially recommended to meet high voltage or current and / or power stresses.

The thickness of the metal foil enables the reduction of the series resistance and improves the general performance of the capacitors. These improvements are made to the detriment of the volume of the capacitor which also loses its self-healing properties. Composite dielectrics combine films of different types with complementary specific characteristics.

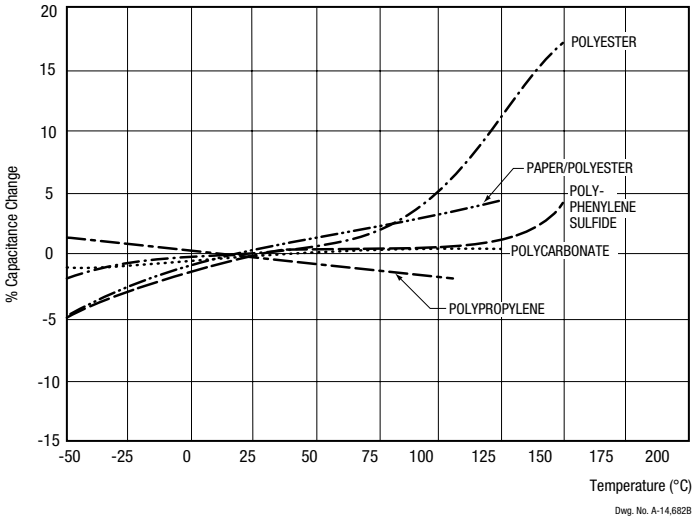
For high voltage and power electronics applications, these capacitors are usually impregnated with impregnating fluids or solid substances.

CAPACITOR PERFORMANCE VS. TEMPERATURE

The capacitors' performance versus temperature essentially depends upon the dielectric type.

The figure below shows ranges of operating temperatures.

% OF CAPACITANCE CHANGE VS. TEMPERATURE (°C)

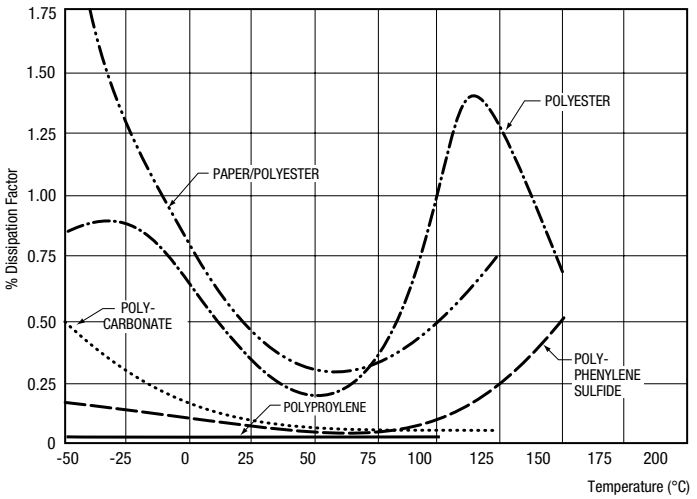


Dwg. No. A-14,682B

Important differences affect the laws governing the changes of the main electrical characteristics.

They are highlighted by the following curves:

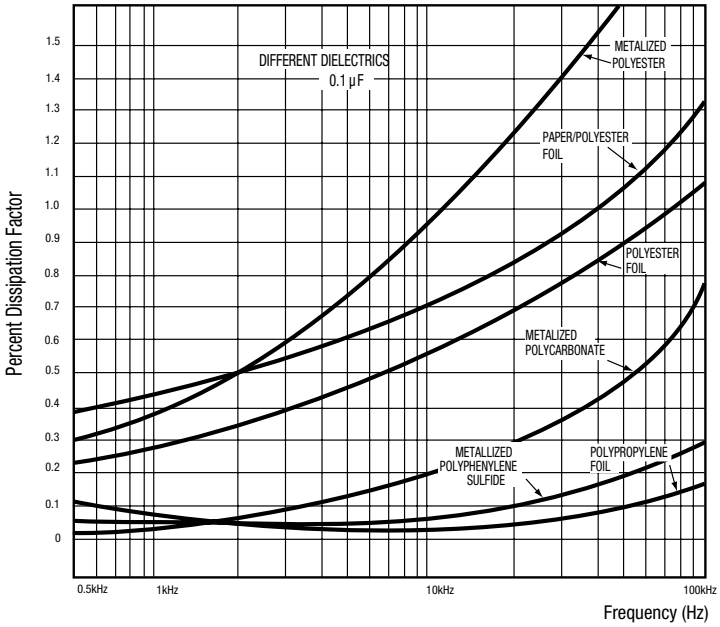
% OF DISSIPATION FACTOR (DF) VS. TEMPERATURE (°C)



Dwg. No. A-14,683C

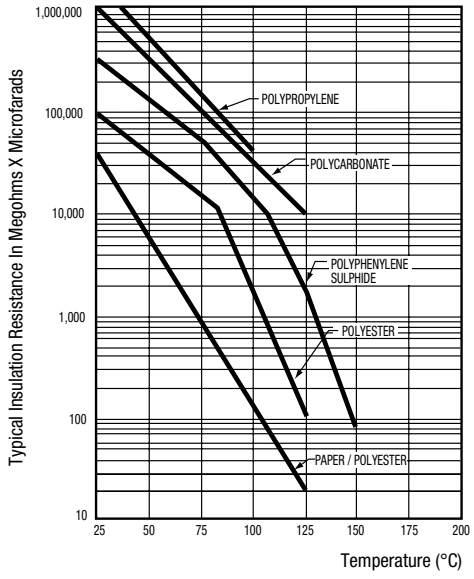
PROPERTIES OF DIELECTRIC FILMS

% OF DISSIPATION FACTOR (DF) VS. FREQUENCY (HZ)



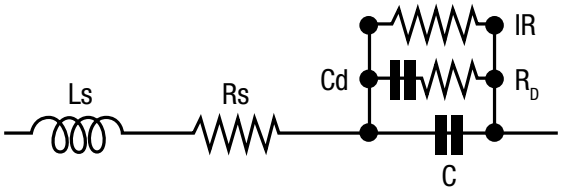
Dwg. No. A-14,684B

IR VS. TEMPERATURE (°C)



Dwg. No. A-14,687B

A REAL CAPACITOR MAY BE REPRESENTED BY THE FOLLOWING DIAGRAM:



Series Inductance	Ls
Resistance of metal foil & connections	Rs
Insulation Resistance	IR
Dielectric Absorption	Cd
Resistance equivalent to the dielectric losses	R_D
Capacitance	C

Resistive terms generate temperature rises when the capacitors carry AC current (I_{rms}). Depending upon the frequency range, they may be more or less preponderant.

THE EQUIVALENT SERIES RESISTANCE (ESR) IS THE SUM OF THE FOLLOWING TERMS:

$$ESR = Rs + DF / C\omega + 1 \ / \ IR\ C^2\ \omega^2$$

When the frequency increases, the term $1 / IRC^2\omega^2$ becomes rapidly insignificant.

For plastic dielectrics, losses remain constant within a wide range of frequencies and the affect of the term: $DF / C\omega$ decreases: $ESR = Rs + DF / C\omega$

The metal foil and the connections are designed to obtain a resistance value (Rs) as low as possible. This value is dependent on the capacitors' technology and geometry.

Inductance (Ls) also disturbs the equation of the capacitors at high frequencies.

IMPEDANCE (Z) IS STATED AS FOLLOWS:

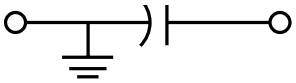
$$Z = Rs^2 + (Ls\omega - 1 / C\omega)^2$$

When frequency increases, the affect of Ls will gradually cancel the capacitance component of the capacitors until it reaches the resonance frequency where:

$$Z = Rs \text{ and } LC\omega^2 = 1$$

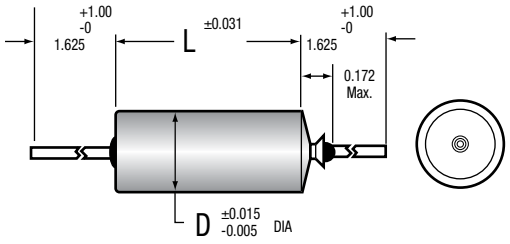
GUIDE TO ORDERING

SECTION GROUNDED TO CASE

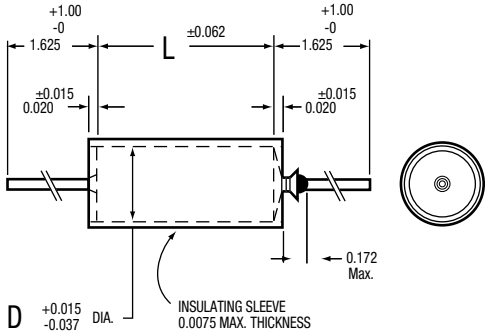


DIMENSIONS (in inches)

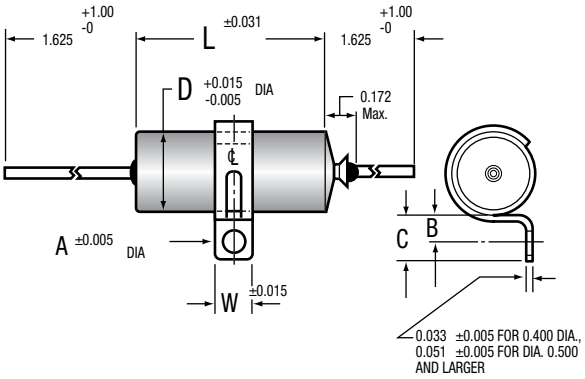
CASE STYLE 01



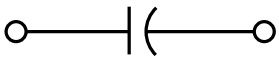
CASE STYLE 03



CASE STYLE 12

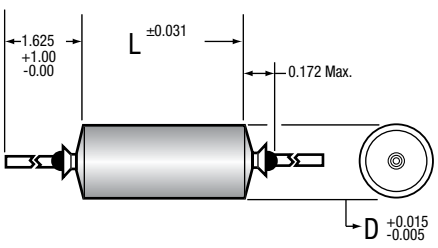


SECTION INSULATED FROM CASE

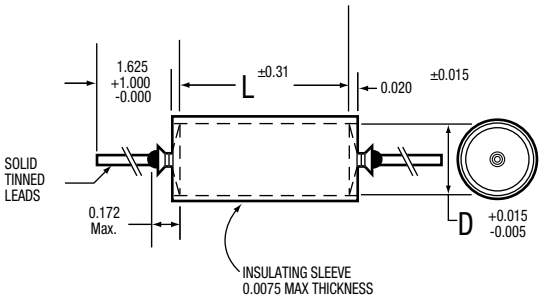


DIMENSIONS (in inches)

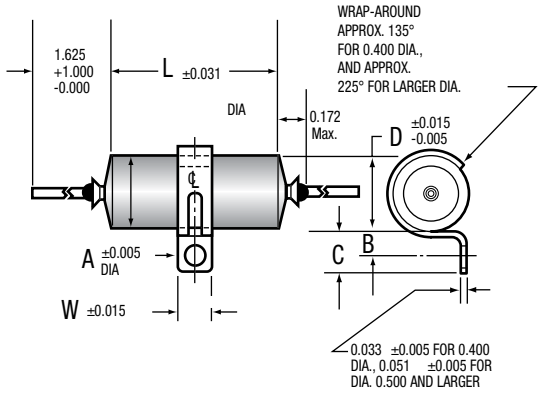
CASE STYLE 02



CASE STYLE 04



CASE STYLE 13



The length of grounded styles is 0.062" shorter than the length shown in tabulations in the catalog.

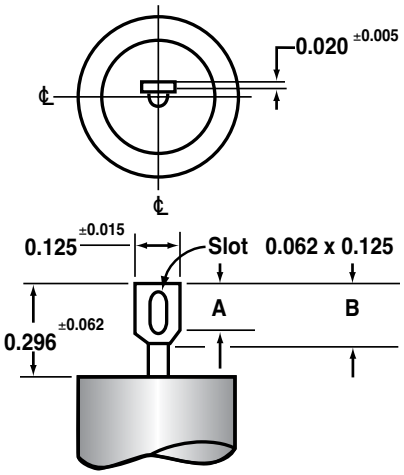
GUIDE TO ORDERING

BRACKET DIMENSIONS (Style 12 & 13 / in inches)

D	W	A	B	C
0.400	0.250	0.144	0.187±0.015	0.312±0.031
0.500	0.500	0.156	0.250±0.031	0.437±0.062
0.562	0.500	0.156	0.250±0.031	0.437±0.062
0.670	0.500	0.156	0.250±0.031	0.437±0.062
0.750	0.500	0.156	0.250±0.031	0.437±0.062
1.000	0.500	0.156	0.250±0.031	0.437±0.062

*Based on 1 in. = 25.4 mm

TYPICAL TAB TERMINAL DIMENSIONS



Dwg. No A-9525

A = 0.156 ± 0.015" (3.96 ± 0.38 mm)

B = 0.187 ± 0.015" (4.75 ± 0.38 mm)

Tab Terminal available only on case diameters equal to or greater than 0.400 inches.

T1 & T3 styles are supplied with one tab terminal on the insulated end and a ground lead on the opposite end.

ORDERING TABLES

METAL CASE

EXAMPLE:

218P 223 X9 100 S 02

CATALOG NUMBERING SYSTEM

Case style

Terminal: S = Wire leads T = Soldering tab*.

DC Voltage rating: Expressed in volts.
See standard ratings charts for voltage code.

Capacitance Tolerance: X0 = ±20%
X9 = ±10%
X5 = ±5%
X2 = ±2%

Capacitance: Expressed in picofarads, the first two digits are significant figures; the third is the number of zeros following. See standard ratings tables for capacitance code.

Dearborn type number: Identifies the basic capacitor.

* Soldering tabs are available only on case diameters equal to or greater then 0.400 inches.

WRAP AND FILL

EXAMPLE:

430P 183 X9 100 X F

CATALOG NUMBERING SYSTEM

"F" applies only to "ROHS" compliant parts.

Terminal: No suffix required unless specified on applicable specification sheet (Terminal style).

DC Voltage rating: Expressed in volts.
See standard ratings charts for voltage code.

Capacitance Tolerance: X0 = ±20%
X9 = ±10%
X5 = ±5%
X2 = ±2%

Capacitance: Expressed in picofarads, the first two digits are significant figures; the third is the number of zeros following. See standard ratings tables for capacitance code.

Dearborn type number: Identifies the basic capacitor.