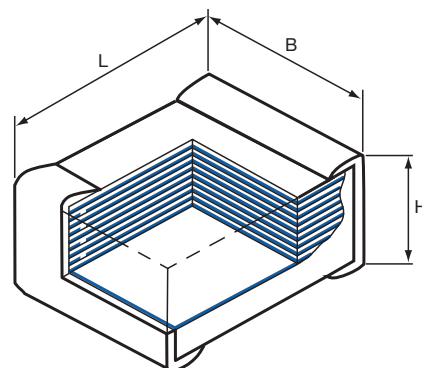


TYPICAL APPLICATIONS

General purpose coupling, bypass, filtering, timing, time constant, oscillation circuits. Suitable for filters in PLL circuits.

CONSTRUCTION

Metallized polyphenylene sulphide (PPS) non-encapsulated stacked film capacitor.



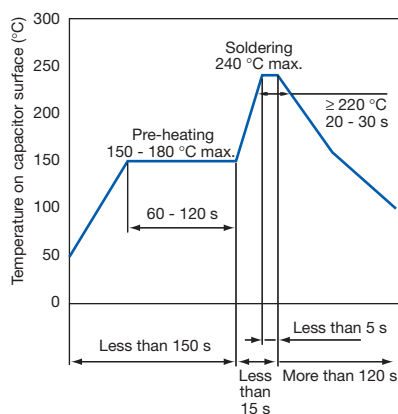
TECHNICAL DATA

Rated voltage U_R VDC U_R VAC	10	16	50
	7	11	30
Capacitance range, μF	0.0033 - 0.027	0.0001 - 0.1	0.0001 - 0.039
Capacitance tolerance	$\pm 2\%$, $\pm 5\%$		
Rated temperature	$+125^\circ\text{C}$		
Category temperature range	-55 to $+125^\circ\text{C}$		
Test voltage	$1.75 \times U_R$, 1 to 5 s, between terminals		
Insulation resistance	$C \leq 0.33 \mu\text{F}$ $\geq 3\,000\text{ M}\Omega$		
	Measured at 20°C , 10 VDC, 60 s for $U_R = 10\text{ VDC}$		
	$U_R = 16\text{ VDC}$ and at 50 VDC for $U_R = 50\text{ VDC}$		
Dissipation factor	$\leq 0.6\%$ at 20°C , 1 kHz		

RECOMMENDED SOLDERING CONDITIONS

Reflow soldering

The recommended soldering conditions are given in the figure to the right. Two consecutive soldering steps are allowed when the capacitors are cooled down to room temperature between the steps. Maximum limits are 260°C max. and 30 seconds max. at more than 230°C ; temperature at capacitor surface.



Recommended reflow soldering profile

ORDERING INFORMATION

See article table and page 10 for article code construction.

ARTICLE TABLE

Capacitance μF	Size code	Dimensions in mm			Quantity per package Reel	Max dU/dt V/ μs	Article code
		B	H	L			
10 VDC							
0.0033	0603	0.8	0.7	1.6	4000	47	ERS0603HUX332J105
0.0039	0603	0.8	0.7	1.6	4000	44	ERS0603HUX392J105
0.0047	0603	0.8	0.7	1.6	4000	40	ERS0603HUX472J105
0.0056	0603	0.8	0.7	1.6	4000	37	ERS0603HUX562J105
0.0068	0805	1.25	0.9	2.0	3000	34	ERS0805HUX682J105
0.0082	0805	1.25	0.9	2.0	3000	31	ERS0805HUX822J105
0.010	0805	1.25	0.9	2.0	3000	28	ERS0805HUX103J105

ARTICLE TABLE

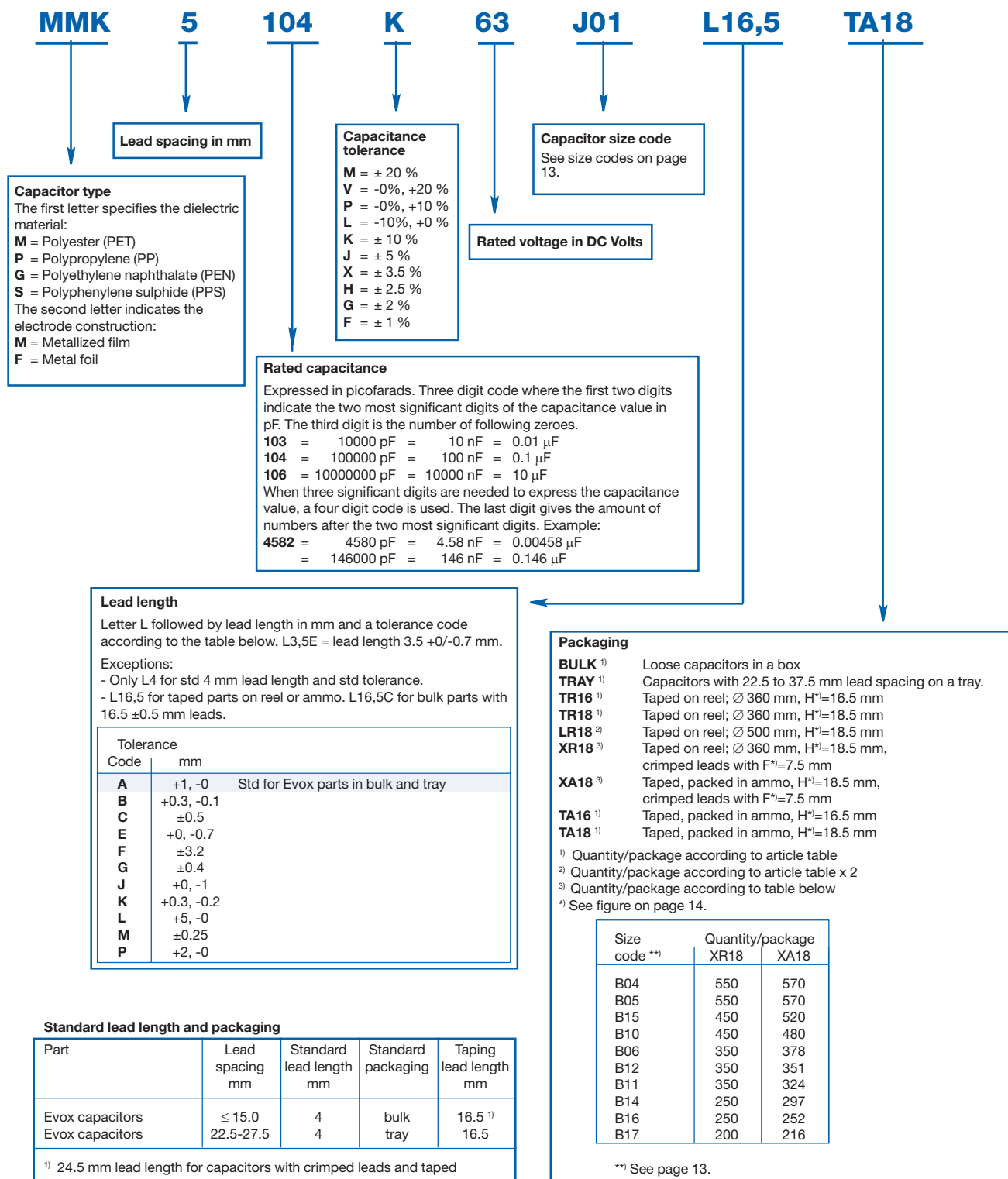
Capacitance	Size code	Dimensions in mm			Quantity per package	Max dU/dt	Article code
μF		B	H	L	Reel	V/μs	
10 VDC							
0.012	0805	1.25	0.9	2.0	3000	26	ERS0805HUX123J105
0.015	0805	1.25	0.9	2.0	3000	24	ERS0805HUX153J105
0.018	0805	1.25	0.9	2.0	3000	22	ERS0805HUX183J105
0.022	0805	1.25	1.1	2.0	3000	20	ERS0805HUX223J105
0.027	0805	1.25	1.1	2.0	3000	18	ERS0805HUX273J105
16 VDC							
0.00010	0603	0.8	0.7	1.6	4000	420	ERS0603HUX101J165
0.00012	0603	0.8	0.7	1.6	4000	390	ERS0603HUX121J165
0.00015	0603	0.8	0.7	1.6	4000	350	ERS0603HUX151J165
0.00018	0603	0.8	0.7	1.6	4000	325	ERS0603HUX181J165
0.00022	0603	0.8	0.7	1.6	4000	295	ERS0603HUX221J165
0.00027	0603	0.8	0.7	1.6	4000	270	ERS0603HUX271J165
0.00033	0603	0.8	0.7	1.6	4000	245	ERS0603HUX331J165
0.00039	0603	0.8	0.7	1.6	4000	225	ERS0603HUX391J165
0.00047	0603	0.8	0.7	1.6	4000	205	ERS0603HUX471J165
0.00056	0603	0.8	0.7	1.6	4000	193	ERS0603HUX561J165
0.00068	0603	0.8	0.7	1.6	4000	175	ERS0603HUX681J165
0.00082	0603	0.8	0.7	1.6	4000	160	ERS0603HUX821J165
0.0010	0603	0.8	0.7	1.6	4000	150	ERS0603HUX102J165
0.0012	0603	0.8	0.7	1.6	4000	135	ERS0603HUX122J165
0.0015	0603	0.8	0.7	1.6	4000	123	ERS0603HUX152J165
0.0018	0603	0.8	0.7	1.6	4000	115	ERS0603HUX182J165
0.0022	0603	0.8	0.7	1.6	4000	105	ERS0603HUX222J165
0.0027	0603	0.8	0.7	1.6	4000	95	ERS0603HUX272J165
0.0033	0805	1.25	0.9	2.0	3000	86	ERS0805HUX332J165
0.0039	0805	1.25	0.9	2.0	3000	80	ERS0805HUX392J165
0.0047	0805	1.25	0.9	2.0	3000	74	ERS0805HUX472J165
0.0056	0805	1.25	0.9	2.0	3000	68	ERS0805HUX562J165
0.0068	0805	1.25	0.9	2.0	3000	62	ERS0805HUX682J165
0.0082	0805	1.25	1.1	2.0	3000	58	ERS0805HUX822J165
0.010	0805	1.25	1.1	2.0	3000	52	ERS0805HUX103J165
0.012	1206	1.6	0.9	3.2	3000	48	ERS1206HUX123J165
0.015	1206	1.6	0.9	3.2	3000	43	ERS1206HUX153J165
0.018	1206	1.6	0.9	3.2	3000	40	ERS1206HUX183J165
0.022	1206	1.6	0.9	3.2	3000	37	ERS1206HUX223J165
0.027	1206	1.6	1.1	3.2	3000	33	ERS1206HUX273J165
0.033	1206	1.6	1.1	3.2	3000	31	ERS1206HUX333J165
0.039	1206	1.6	1.5	3.2	2000	28	ERS1206HUX393J165
0.047	1206	1.6	1.5	3.2	2000	26	ERS1206HUX473J165
0.056	1210	2.5	1.5	3.2	2000	24	ERS1210HUX563J165
0.068	1210	2.5	1.5	3.2	2000	22	ERS1210HUX683J165
0.082	1210	2.5	2.1	3.2	2000	20	ERS1210HUX823J165
0.10	1210	2.5	2.1	3.2	2000	19	ERS1210HUX104J165
50 VDC							
0.0001	0805	1.25	0.9	2.0	3000	1100	ERS0805HUX101J505
0.00012	0805	1.25	0.9	2.0	3000	1050	ERS0805HUX121J505
0.00015	0805	1.25	0.9	2.0	3000	940	ERS0805HUX151J505
0.00018	0805	1.25	0.9	2.0	3000	890	ERS0805HUX181J505
0.00022	0805	1.25	0.9	2.0	3000	800	ERS0805HUX221J505
0.00027	0805	1.25	0.9	2.0	3000	730	ERS0805HUX271J505
0.00033	0805	1.25	0.9	2.0	3000	690	ERS0805HUX331J505
0.00039	0805	1.25	0.9	2.0	3000	610	ERS0805HUX391J505
0.00047	0805	1.25	0.9	2.0	3000	580	ERS0805HUX471J505
0.00056	0805	1.25	0.9	2.0	3000	520	ERS0805HUX561J505
0.00068	0805	1.25	0.9	2.0	3000	480	ERS0805HUX681J505
0.00082	0805	1.25	0.9	2.0	3000	440	ERS0805HUX821J505
0.0010	0805	1.25	0.9	2.0	3000	400	ERS0805HUX102J505
0.0012	0805	1.25	0.9	2.0	3000	370	ERS0805HUX122J505
0.0015	0805	1.25	0.9	2.0	3000	340	ERS0805HUX152J505

ARTICLE TABLE

Capacitance	Size code	Dimensions in mm			Quantity per package	Max dU/dt	Article code
μF		B	H	L	Reel	V/μs	
50 VDC							
0.0018	0805	1.25	0.9	2.0	3000	310	ERS0805HUX182J505
0.0022	0805	1.25	0.9	2.0	3000	270	ERS0805HUX222J505
0.0027	0805	1.25	0.9	2.0	3000	260	ERS0805HUX272J505
0.0033	1206	1.6	0.9	3.2	3000	240	ERS1206HUX332J505
0.0039	1206	1.6	0.9	3.2	3000	220	ERS1206HUX392J505
0.0047	1206	1.6	0.9	3.2	3000	200	ERS1206HUX472J505
0.0056	1206	1.6	0.9	3.2	3000	190	ERS1206HUX562J505
0.0068	1206	1.6	0.9	3.2	3000	170	ERS1206HUX682J505
0.0082	1206	1.6	1.1	3.2	3000	160	ERS1206HUX822J505
0.010	1206	1.6	1.1	3.2	3000	145	ERS1206HUX103J505
0.012	1210	2.5	1.1	3.2	2000	135	ERS1210HUX123J505
0.015	1210	2.5	1.1	3.2	2000	120	ERS1210HUX153J505
0.018	1210	2.5	1.5	3.2	2000	110	ERS1210HUX183J505
0.022	1210	2.5	1.5	3.2	2000	100	ERS1210HUX223J505
0.027	1210	2.5	1.5	3.2	2000	94	ERS1210HUX273J505
0.033	1210	2.5	2.1	3.2	2000	86	ERS1210HUX333J505
0.039	1210	2.5	2.1	3.2	2000	78	ERS1210HUX393J505

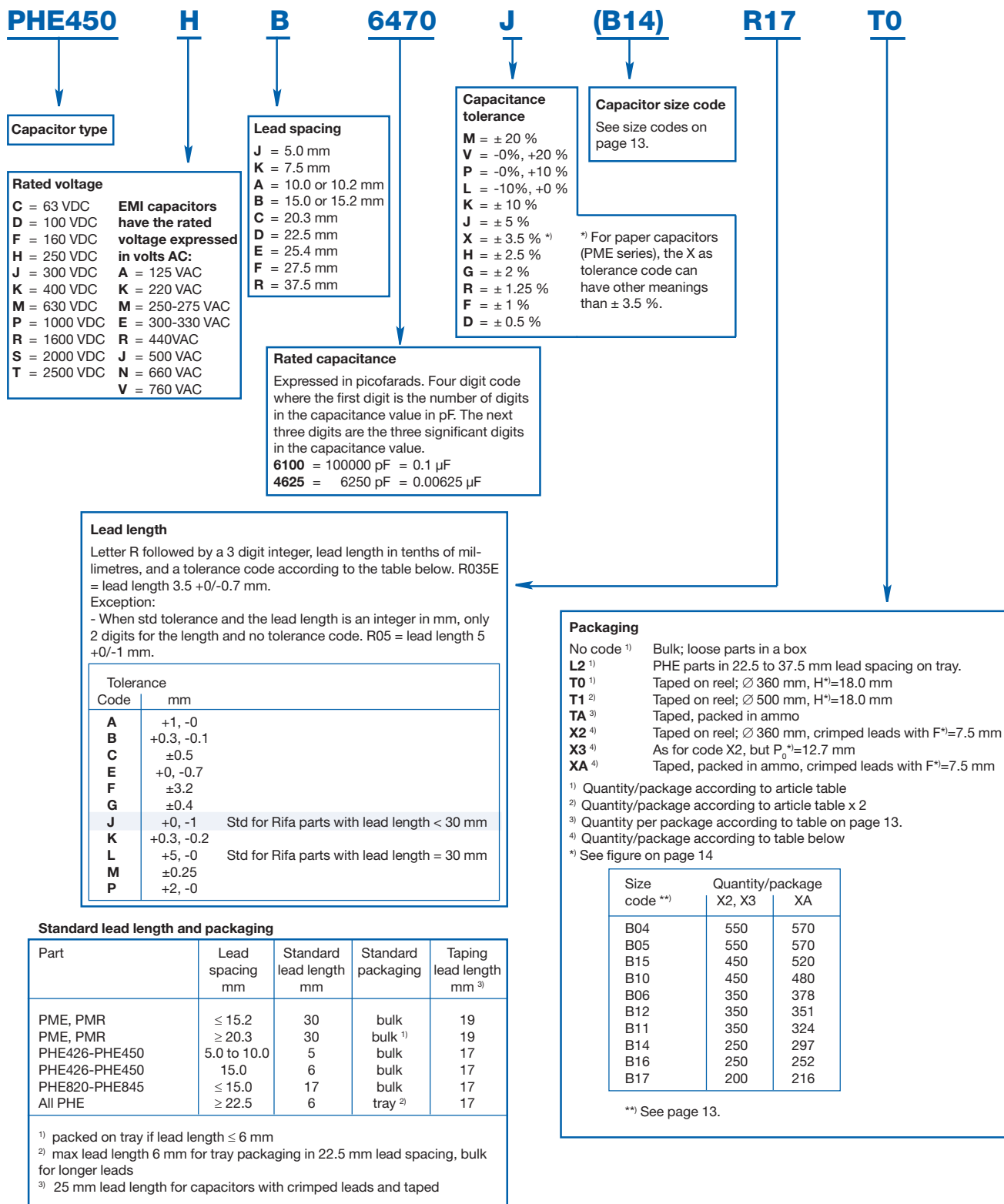
HOW TO ORDER EVOX CAPACITORS

The **Evox** article code includes all the information needed to specify the product characteristics and type of packing. This article code construction applies for the following products in this catalogue: **MMK**, **SMR** and **PFR**. The following articles have the same article code system except for the size code: **CQ**, **SCQ**.



HOW TO ORDER RIFA CAPACITORS

The **Rifa** article code includes all the information needed to specify the product characteristics and type of packing. This article code construction applies for the following products in this catalogue: **PHE820, PHE840E, PHE840M, PHE841, PHE844, PHE845, PHE846, PHE850, PME261, PME264, PME271, PME278, PME295, PZB300, PMZ2074, PHZ9004, PMR205, PMR209, PMR210, PMZ2035, PHE426, PHE448, PHE450.**



SIZE CODES OF LEADED CAPACITORS

A size code has been added to the following leaded Evox Rifa capacitors: **MMK, SMR, PHE840E, PHE840M, PHE846, PHE850, PFR**. The size code determines the size of the component and the packing quantities. The size codes are as follows:

Size code in Article Code	Box dimensions in mm			p	Typical weight ¹⁾ g	Quantity per package			Tray	Reel Ø360	Reel Ø500	Ammo ⁴⁾
	B _{max}	H _{max}	L _{max}			Bulk ¹⁾	Bulk ²⁾	Bulk ³⁾				
A01	4.0	9.0	13.0	10.0	0.6	1000	1000			900	1800	
A02	4.5	10.5	13.0	10.0	0.9	1000	1000			800	1600	
A03	5.0	11.0	13.0	10.0	1.0	800	800			700	1400	
A04	6.0	12.0	13.0	10.0	1.3	600	600			500	1000	
A05	9.5	7.5	13.0	10.0	1.2	600	600			350	700	
A06	4.0	8.0	13.0	10.0	0.5	1000	1000			900	1800	
B01	5.5	10.5	18.0	15.0	1.7 ³⁾			500				
B02	5.5	14.0	18.0	15.0	1.9 ³⁾			500				
B03	6.5	12.5	18.0	15.0	2.2 ³⁾			250				
B04	5.5	10.5	18.0	15.0	1.5	1000	800			600	1200	
B05	5.5	12.5	18.0	15.0	1.7	1000	800			600	1200	
B06	7.5	14.5	18.0	15.0	2.7	800	400			400	800	
B07	8.5	14.5	18.0	15.0	2.8 ³⁾			250				
B10	6.5	12.5	18.0	15.0	2.0	1000	600			500	1000	
B11	8.5	16.0	18.0	15.0	3.4	600	400			400	800	
B12	8.0	15.0	18.0	15.0	3.0	600	400			400	800	
B14	9.5	17.5	18.0	15.0	4.2	500	300			350	700	
B15	6.0	12.0	18.0	15.0	1.7	1000	800			500	1000	
B16	11.0	19.0	18.0	15.0	4.4	450	250			300	600	
B17	13.0	12.5	18.0	15.0	3.4	400	300			250	500	
D01	7.5	15.5	26.5	22.5	3.6 ³⁾			250				
D02	8.5	16.5	26.5	22.5	4.2 ³⁾			200				
D03	10.5	18.5	26.5	22.5	6.2 ³⁾			200				
D13	6.5	14.5	26.0	22.5	2.7				234	300	600	
D14	8.0	16.0	26.0	22.5	3.8				186	250	500	
D15	9.0	18.5	26.0	22.5	5.0				308	250	500	
D16	11.0	21.5	26.0	22.5	6.6				253			
D17	7.0	16.5	26.0	22.5	3.2				216	300	600	
D18	10.5	19.0	26.0	22.5	5.8				264			
D19	15.5	24.5	26.0	22.5	10.0				176			
D20	13.5	23.0	26.0	22.5	8.2				209			
F03	13.5	23.0	31.5	27.5	10.8				171			
F11	10.5	20.5	31.5	27.5	8.0				216			
F12	11.5	22.5	31.5	27.5	9.1				198			
F13	14.5	24.5	31.5	27.5	14.5				153			
F14	17.5	28.0	31.5	27.5	17.0				126			
F15	19.0	29.0	31.5	27.5	19.5				117			
F16	21.0	30.0	31.5	27.5	22.6				108			
F17	21.0	12.5	31.5	27.5	9.0				108			
F18	31.0	18.5	31.5	27.5	20.0				72			
F19	27.5	16.0	31.5	27.5	17.0				81			
J01	2.5	6.5	7.2	5.0	0.2	2000	2000			2500	5000	3000
J02	3.5	8.0	7.2	5.0	0.3	2000	2000			2000	4000	2000
J03	4.5	9.0	7.2	5.0	0.4	1000	1000			1500	3000	1700
J04	5.0	10.0	7.2	5.0	0.5	1000	1000			1300	2600	1500
J05	6.0	11.0	7.2	5.0	0.6	1000	1000			1000	2000	1200
J06	7.2	13.0	7.2	5.0	0.9	1000	1000			800	1600	
J11	4.5	6.0	7.2	5.0	0.3	1000				1500	3000	1700
J12	5.5	7.0	7.2	5.0	0.4	1000				1200	2400	1300
J13	6.5	8.0	7.2	5.0	0.5	1000				900	1800	1100
K00	2.5	6.0	10.0	7.5	0.3	2000	2000			2500	5000	3000
K01	4.0	8.0	10.0	7.5	0.5	1000	1000			1700	3400	1900
K03	5.0	11.0	10.0	7.5	0.8	1000	1000			1300	2600	1500
K04	6.0	12.0	10.5	7.5	1.0	1000	1000			1000	2000	1200
R02	16.5	32.0	41.0	37.5	23.0				105			
R03	19.0	36.0	41.0	37.5	28.5				91			
R04	15.0	26.0	41.0	37.5	17.0				119			
R05	13.0	24.0	41.0	37.5	14.0				140			
R06	21.0	38.0	41.0	37.5	34.4				84			
R08	28.0	43.0	41.0	37.5	53.0				54 ¹⁾			

¹⁾ Capacitors with lead length of 4 to 6 mm according to the data sheet.

²⁾ Capacitors with lead length of 16.5 mm or 17.0 mm according to the data sheet.

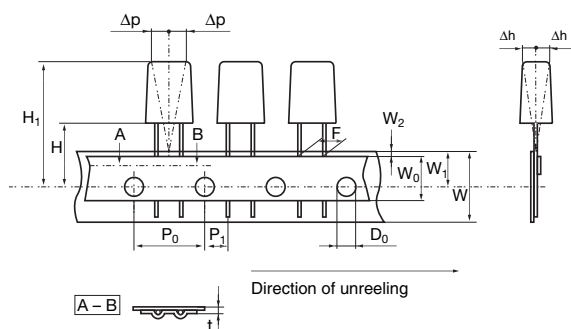
³⁾ Capacitors with lead length of 30 mm and insulated leads.

⁴⁾ For Ammo packaging of parts in 10 mm and 15 mm lead spacing, please ask Evox Rifa Customer Service.

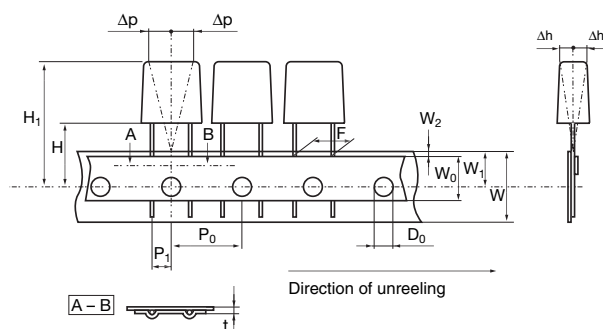
TAPING OF EVOX RIFA RADIAL CAPACITORS

The taping is carried out in accordance with IEC 60286-2.

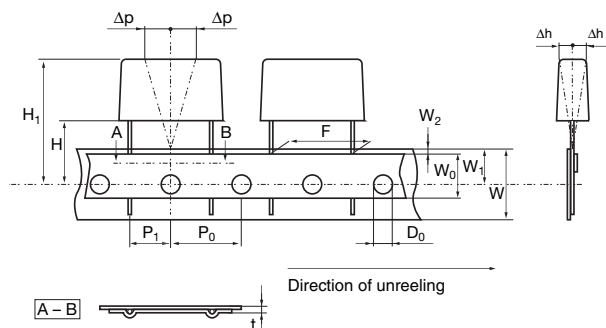
Lead spacing 5 mm



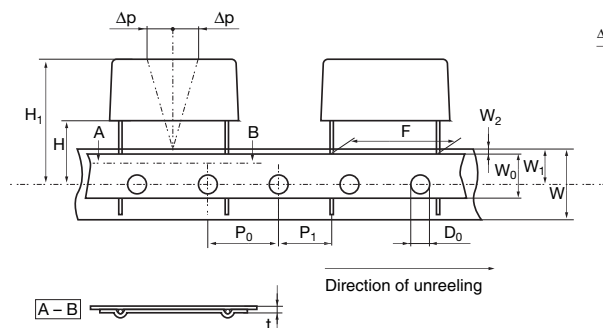
Lead spacing 7.5 mm



Lead spacing 10 and 15 mm



Lead spacing 22.5 and 27.5 mm



Taping specification						Standard IEC 60286-2
Dimensions in mm						
Lead spacing, $^{+0.6}_{-0.1}$	F	5.0/7.5 ⁴⁾	10.0/15.0	22.5/27.5	10.2/15.2/20.3 Paper capacitors	F
Carrier tape width, ± 0.5	W	18	18	18	18	18 $^{+1.0}_{-0.5}$
Hold-down tape width, ± 0.3	W ₀	9	12	12	12	
Position of sprocket hole, ± 0.5	W ₁	9	9	9	9	9 $^{+0.75}_{-0.5}$
Distance between tapes, max	W ₂	3	3	3	3	3
Sprocket hole diameter, ± 0.2	D ₀	4	4	4	4	4
Feed hole pitch, ± 0.3	P ₀ ¹⁾	12.7	12.7	12.7	12.7	12.7
Distance lead - feed hole, ± 0.7	P ₁	3.85/3.75	7.7/5.2	5.3	7.6/5.1/8.9	P ₁
Max deviation tape - plane	Δp	1.3	1.3	1.3	1.3	1.3
Max lateral deviation	Δh	2	2	2	2	2
Total thickness, ± 0.2	t	0.7	0.7	0.9 max	0.7	0.9 max
Sprocket hole/cap body	H ²⁾	18.5 ± 0.5 16.5 ± 0.5	18.5 ± 0.5 16.5 ± 0.5	18.5 ± 0.5	18.0 $^{+2}_{-0}$	18.0 $^{+2}_{-0}$
Sprocket hole/top of cap body, max	H ₁ ³⁾	32/31 max	43 max	58	35 max	58 max

¹⁾ Cumulative pitch error

²⁾ Alternatives for different insertion machines

³⁾ Depending on case size

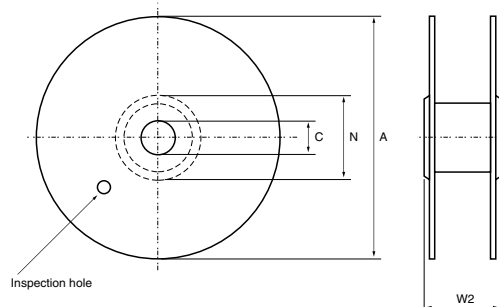
⁴⁾ Crimped leads available on request

TAPING OF EVOX RIFA RADIAL CAPACITORS

Reel specification

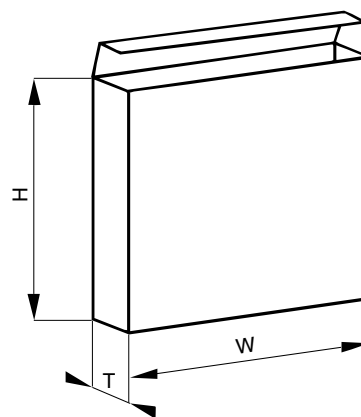
Reel dimensions in mm			Tol.
Reel diameter	A	360/500	max
Hub diameter	N	80	min
Arbor hole	C	30	± 1
Total reel width measured at hub	W2	58	max

The standard packing for lead space ≤ 15 mm is 360 mm reel and for lead space > 15 mm 500 mm reel.



Ammo pack specification

Ammo pack dimensions in mm		Lead spacing, mm	
		5, 7.5 10	15, 22.5, 27.5, 37.5
Height	H	330	(135 or 200 for CQ/SCQ depending on capacitance value)
Width	W	330	(335 for CQ/SCQ)
Thickness	T	50	



THE MANUFACTURING CODE Y Z, ACCORDING TO IEC 60062

where Y = year, Z = month.

Year	Code	Year	Code	Year	Code	Month	Code	Month	Code
1990	A	1997	J	2004	S	Jan	1	July	7
1991	B	1998	K	2005	T	Febr	2	Aug	8
1992	C	1999	L	2006	U	March	3	Sept	9
1993	D	2000	M	2007	V	April	4	Oct	O
1994	E	2001	N	2008	W	May	5	Nov	N
1995	F	2002	P	2009	X	June	6	Dec	D
1996	H	2003	R	2010	Y				

TERMS AND DEFINITIONS

Rated capacitance (C_R)

The rated capacitance of a capacitor is the value which is indicated upon it. The capacitance is measured at 1 kHz and +23°C.

Rated voltage (U_R)

The rated voltage is the maximum direct voltage or the maximum RMS alternating voltage which may be applied continuously to the terminals of the capacitor at any temperature within the rated temperature range.

Rated temperature

The rated temperature is the maximum ambient temperature at which the rated voltage can be continuously applied.

Climatic category

The climatic category states the category temperature range and the humidity class. For example 40/085/56 stands for -40°C to +85°C; 56 states that the steady state humidity test should take 56 days.

Tangent of the loss angle (Dissipation factor, $\tan\delta$)

The tangent of the loss angle is the power loss of the capacitor divided by the reactive power of the capacitor at a sinusoidal voltage of specified frequency. The tangent of loss angle is given in percent (Eg 0.01 $\tan\delta=1\%$).

The dissipation factor is of interest especially when the capacitor is operated on AC. The dielectric loss causes heating of the capacitor which under unfavourable circumstances may lead to a destructive breakdown. This will not happen if the capacitor is used within specified limits. The ability to withstand short duration thermal and voltage overload is greater for small capacitors than for large ones.

Insulation resistance

The values given in the catalogue indicate the insulation resistance after one minute of electrification at +23°C with the following voltages: 100 VDC for capacitors rated at 100 to 500 VDC and 500 VDC for capacitors rated at 500 VDC. Insulation resistance is temperature dependent and is approximately halved for each 7 °C of temperature rise. Multilayer construction provides insulation resistance higher than that of single-layer types.

Temperature derated voltage

For any temperature between the rated temperature and the upper category temperature, the temperature derated voltage is the maximum voltage that may be applied continuously to the terminals of the capacitor.

Pulse operation

Capacitors loaded with pulses with fast rise or fall times (high dU/dt) will be exposed to high current pulses. In order not to overload the internal connections the current must be limited. The current limits for a specific type are dependent upon:

- Amplitude and form of the pulse
- Rated voltage of the capacitor
- Capacitance
- Geometrical configuration of the winding

$$dU/dt = U_R / (R \times C)$$

U_R = Rated voltage
 R = Discharge resistor
 C = Rated capacitance

At repeated pulse operation, self-heating, ambient temperature and cooling set the load limit.

Pulse current limits are commonly expressed in the form of maximum permitted dU/dt in volts per microsecond. The figures stated in the type specifications refer to an unlimited number of pulses charging or discharging from rated voltage U_R .

Self-healing

A break-through in a plastic film/foil capacitor leads to a permanent short circuit of the capacitor due to a carbon bridge which is built up in the break-down channel due to the high temperature rise and carbon content of the dielectric. A metallized capacitor can withstand a break-through without a permanent short circuit because of its self-healing ability. The metallized layer is between 0.02 – 0.1 µm. At a weak point in the dielectric, or because of a transient, a break-down may occur. The thin metal layer around the weak point is evaporated and the weak point is isolated. The capacitor has self-healed thereby.

Active flammability

The ability of a capacitor to burn with a flame as a consequence of electrical loading.

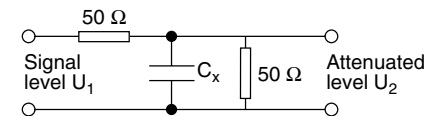
Passive flammability

The ability of a capacitor to burn with a flame as a consequence of the application of an external source of heat.

Attenuation

The attenuation of a capacitor is measured in a 50 Ω system.

The highest attenuation is achieved at the resonant frequency.



$$\text{Attenuation } a = 20 \log U_1/2U_2 \text{ dB}$$

Resonance frequency

The resonance frequency of a capacitor is reached when

$$\omega L = 1/\omega C$$

$$\omega = 2\pi f \text{ (f = frequency)}$$

L = inductance caused by the winding

and the length of the leads

C = the capacitance at f.

Dielectric absorption (DA)

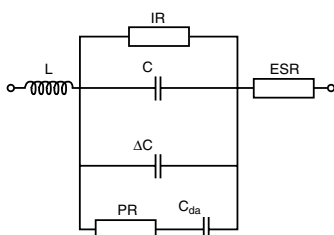
Dielectric absorption describes the dielectric material's properties to "remember" the applied voltage. One method to define DA is:

The capacitor is to be charged for one hour at rated voltage DC (U_R) then discharged through a resistor of 5 ohms for 10 seconds. The discharge resistor must then be disconnected and the recovery voltage U_1 measured 15 minutes after disconnection. The dielectric absorption is defined by:

$$DA = (U_1/U_R) \times 100\%$$

More specific terms and definitions for EMI, RC and Pulse capacitors can be found in the beginning of respective sections.

CAPACITOR EQUIVALENT DIAGRAM



C = nominal value of the capacitor
 L = inductance (leads, metallization, winding)
 ESR = equivalent series resistance (leads, metallization, metal spraying)
 IR = insulation resistance (properties of the dielectric material)

ΔC = capacitance change (depending on changes in temperature, DC voltage and/or frequency)
 PR = dielectric polarization resistance
 C_{da} = dielectric absorption

PROPERTIES OF DIELECTRICS

POLYESTER
(Polyethylene Terephthalate, PET)
Metallized and Film/foil

High dielectric constant and high dielectric strength provides good volumetric efficiency for metallized polyester film capacitors. Metallized polyester film has excellent self-healing properties.

Typical applications: Bypassing, coupling, filtering.

POLYESTER
(Polyethylene Naphthalate, PEN)
Metallized

High temperature Polyester. Relatively high dielectric constant and dielectric strength,

and availability of thin films, provide good volumetric efficiency for metallized construction. High melting point allows SMD constructions and service in high ambient temperatures. General purpose capacitor.

POLYPROPYLENE (PP)
Metallized and Film/foil

Very low losses, low dielectric absorption, high dielectric strength, very high insulation resistance, and negative temperature coefficient.

Typical applications: Stable oscillators and filters. Sample & hold circuits, pulse handling circuits, AC applications and mains filtering.

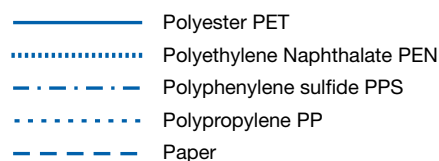
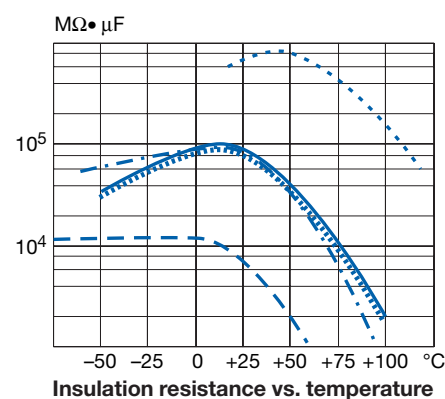
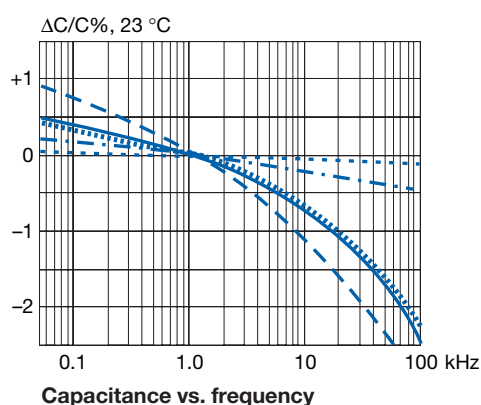
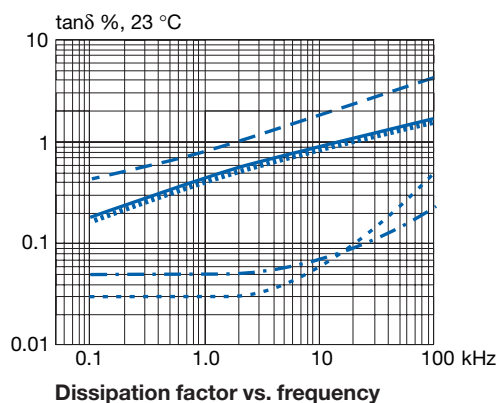
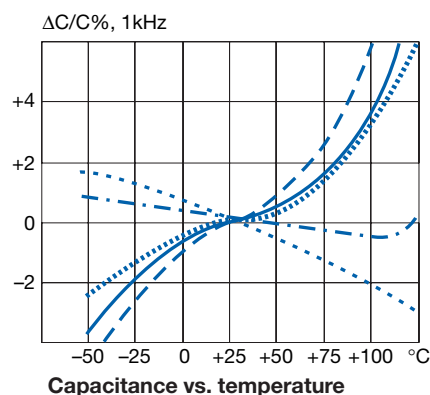
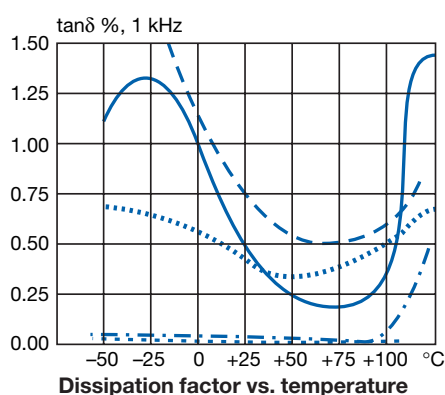
POLYPHENYLENE SULPHIDE (PPS)
Metallized

Low losses, wide operating temperature range, low temperature coefficient, good stability.

Typical applications: Timers and filters. Automotive and other applications in high ambient temperatures.

PAPER
Metallized

High dielectric constant. Excellent self-healing properties and transient handling capability. High ionisation level due to impregnated dielectric material. Outstanding reliability in mains connected and other low frequency applications.



RELIABILITY

The reliability of a capacitor is mainly a function of:

- The construction; dielectric material and its thickness
- The manufacturing process
- The application; electrical stress and temperature

The failure rate, λ , vs. voltage and temperature for the most common dielectric materials is shown in the diagrams below. U_R = rated voltage.

The operating life (L) can be calculated as:

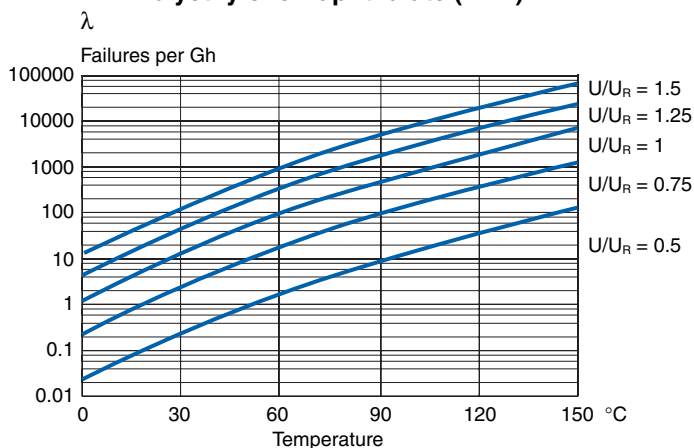
$$L = \frac{1}{\lambda} \times \ln \frac{1}{1-F}$$

where F is the expected probability of failures.

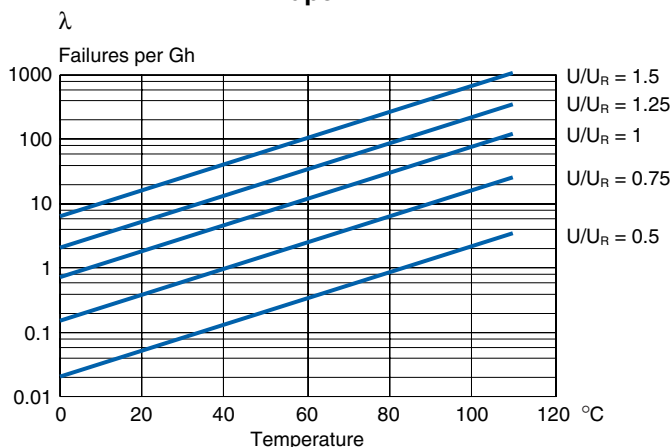
Example: If $\lambda = 20 \times 10^{-9}$ it takes 6 years to have
 $F = 0.001$ (0.1% failures)
 and 300 years to have
 $F = 0.05$ (5% failures)

MTBF (mean time between failures) = $1 / \lambda$

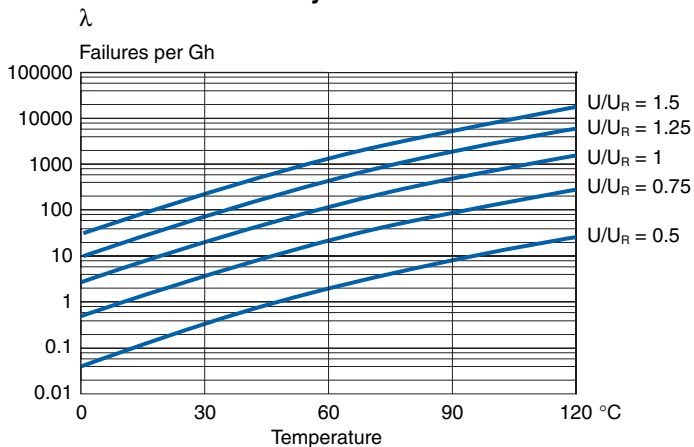
**Failure rates vs. temperature and voltage
Polyethylene Naphthalate (PEN)**



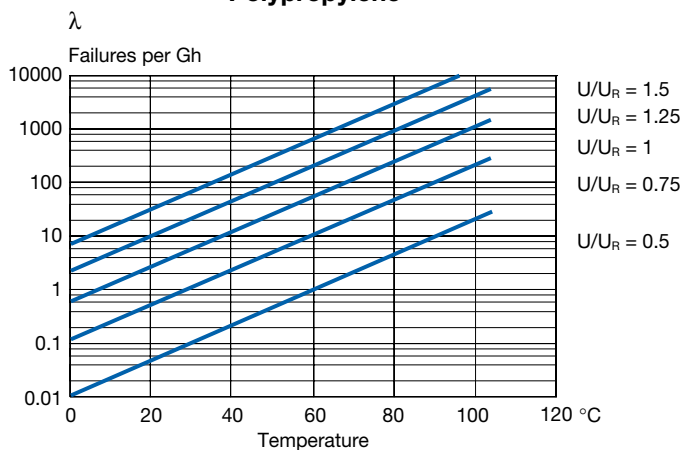
**Failure rates vs. temperature and voltage
Paper**



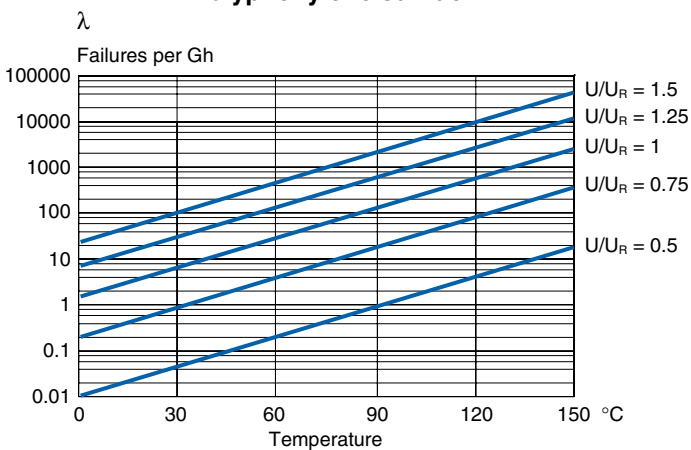
**Failure rates vs. temperature and voltage
Polyester**



**Failure rates vs. temperature and voltage
Polypropylene**



**Failure rates vs. temperature and voltage
Polyphenylene sulfide**



NUMERICAL COMPARISON OF FILM MATERIALS

Material (Trade names)	Abbreviation	Min. film thickness (μm)	Dielectric constant at 1 kHz, +23°C	Operating temperature (°C)	Temperature coefficient (ppm/°C)	Dissipation factor at 1 kHz, +23°C	Insulation time constant (s) at +23°C	Dielectric absorption %
Polyester (Mylar, Lumirror, Hostaphan, Diafoil)	PET	0.9	3.3	-55 ... +100 (... +125)	+400 (± 200)	0.5%	25 000	0.5
Polyethylene Naphthalate (Teonex)	PEN	1.4	3.0	-55 ... +125 (... +150)	+200 (± 150)	0.4%	25 000	1.2
Polyphenylene sulfide (Torelina)	PPS	1.2	3.0	-55 ... +125 (... +150)	0 (-50) up to +100 °C	0.06%	25 000	0.05
Polypropylene (Torayfan, Trespaphan)	PP	3.0	2.2	-55 ... +110	-200 almost linear	0.03% (-100, +50)	100 000	0.01
Paper Impregnated	P	7.0	5.5	-40 ... +115	+1200 (± 200)	0.8%	15 000	

ENVIRONMENTAL COMMITMENT

As an environmentally conscious company, Evox Rifa (including BHC Components) is working continuously with improvements concerning the environmental effects of both our capacitors and the production of them.

In Europe (RoHS Directive) and in some other geographical areas like China, legislation has been put on place to prevent the use of some hazardous materials, like Lead (Pb), in electronic equipment. All products in this catalogue are produced to help our customer's obligations to guarantee their products to fulfil these legislative requirements. The only material of concern in our products has been Lead (Pb), which has been removed from all designs to fulfil the requirement of containing less than 0,1% of

Lead in any homogeneous material.

Evox Rifa will follow closely any changes in legislation world wide, and makes any necessary changes in its products, whenever needed.

Some customer segments like Medical, Military and Automotive Electronics may still require e.g. the use of Lead in electrode coatings. To clarify the situation, and to distinguish products from each other, a special symbol is used on the packaging labels for RoHS compatible capacitors. See pictures to the right.

Because of customer requirements there may appear additional markings like LF = Lead Free or LFW = Lead Free Wires on the label.

RoHS
Compliant



RoHS Compliant

Examples of RoHS Compliance markings on packaging labels

WARNING

The implementation of RoHS Directive has forced to select SnAuCu (SAC) alloys or SnCu alloys as primary solder. This has increased the liquidus temperature from that of 183 °C for SnPb eutectic alloy to 217 – 221 °C for the new alloys. This means that the heat stress to components, even in Wave Soldering, has increased considerably due to higher pre-heat and wave temperatures.

The Polypropylene Capacitors are especially sensitive to heat (melting point of Polypropylene is 160 – 170 °C). The Wave Soldering can be destructive especially for mechanically small Polypropylene Capacitors (Lead spacings 5-10 mm), and great care has to be taken when soldering them. The recommended solder profiles from Evox Rifa should be used. In case of doubt, Evox Rifa should be consulted. In general the Wave Soldering curve from IEC Publ. 61760-1 edition 2 gives a good guideline for successful soldering. See Figure 1.

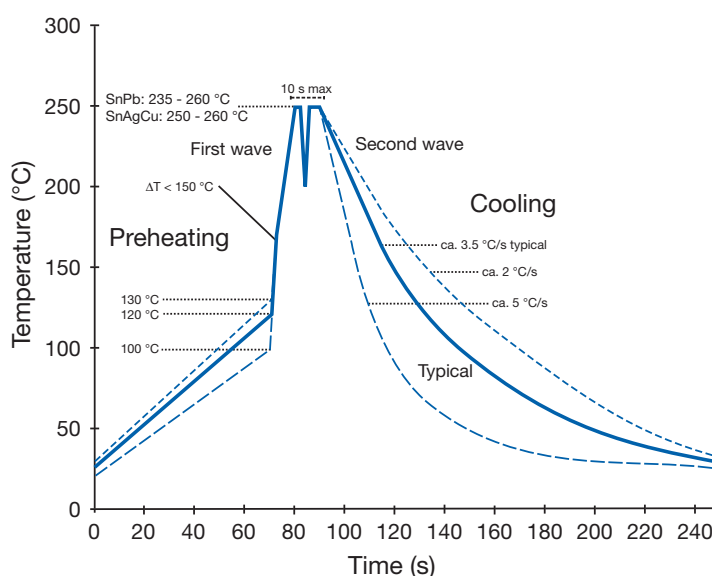


Figure 1

EVOK RIFA QUALITY

The quality of Evox Rifa's products and services is based on a continuous strive towards excellency throughout the whole organization. Skilled and motivated personnel, technical know-how and modern equipment combined with extensive quality assurance make Evox Rifa the supplier of components of the highest quality.

The up-to date quality tools like Statistical Process Control (SPC) in various forms, Failure Mode and Effect Analysis (FMEA), Accelerated Reliability Testing and Zero Defect Acceptance concept in final testing are the corner stones of the every day quality work. Cross-functional teams are routinely used in Problem Solving (8D method) with effective Failure Analysis support.

As a visible evidence of our quality, all the manufacturing units world wide are certified according to ISO 9001. In addition to that, the relevant factories have the automotive industry's QS9000 certifications, which is in process to be upgraded to ISO TS 16949

during 2006. The Finnish factory has also IECQ approval. Our well known EMI suppression capacitors carry the important safety marks for world wide applications.

Evox Rifa companies have the following certificates:

ISO 14001

P.T. Evox Rifa, Batam, Indonesia

ISO 9001

BHC Components

Evox Rifa AB, Gränna, Sweden

Evox Rifa Oy, Suomussalmi, Finland

Nantong Evox Rifa Electrolytics, P.R. China

P.T. Evox Rifa, Batam, Indonesia

ISO TS 16949

Evox Rifa AB, Gränna, Sweden

QS9000 (TS 16949 pending at the time of printing of this catalogue)

Evox Rifa Oy, Suomussalmi, Finland

Nantong Evox Rifa Electrolytics, P.R. China

P.T. Evox Rifa, Batam, Indonesia

IECQ

Evox Rifa Oy, Suomussalmi Finland

Customer in Focus

The only real measure of our total quality performance is the acceptance of our customers.

Evox Rifa's quality work has always been focused on the customer. We have actively made quality agreements with ambitious goal settings with World-Class Companies – small and large.

This active quality cooperation has been most fruitful to Evox Rifa by bringing in most modern quality tools, but especially by providing us with reliable feedback on the performance quality of our products and services.

The cooperation has not only lead to continuous improvement of the quality of our products, but sometimes also helped our customers to spot some weaknesses in their designs. A visible sign of these close links between Evox Rifa and various customers is the numerous prestigious customer approvals and the performance awards addressed to Evox Rifa and BHC Components.

IN-HOUSE RESEARCH AND DEVELOPMENT FOR TOMORROW'S NEEDS

Evox Rifa has over sixty years accumulated experience in developing a wide range of world-class capacitor products. Our leading position in the market with a wide product range is based on our deep knowledge of the materials and ways in which they can be used in capacitor designs to provide the best possible solutions.

Evox Rifa invests substantial human and financial resources in finding new highly reliable

and cost effective solutions for today's and tomorrow's needs. Our R&D department can simulate most operational conditions and apply our products to the envisaged working environment, giving to the customer optimized capacitors for a particular specification.

The simulation capabilities substantially shorten the design cycle of capacitors.

To assist in shortening the design cycle of

our customers, we have brought our R&D department to our customers by providing them with a CAD software, which allows them to select the most suitable capacitors for their application (Fig. 1). For easy calculation of signal stresses, there is also a fast Fourier transform software available. In this software complicated signal forms can easily be simulated and analysed (Fig. 2 and 3).

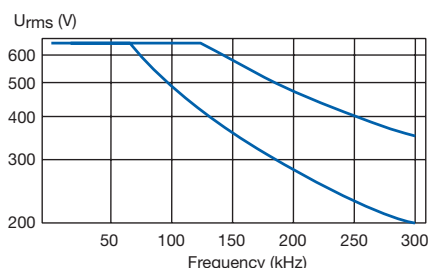


Fig. 1. From CAD software, showing max U_{rms} vs. frequency for two different capacitors

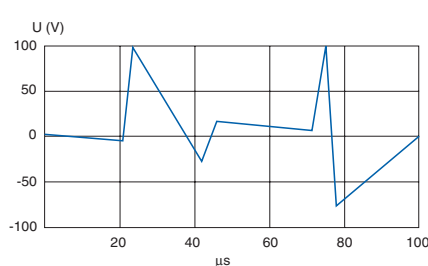


Fig. 2. Signal $s(t)$

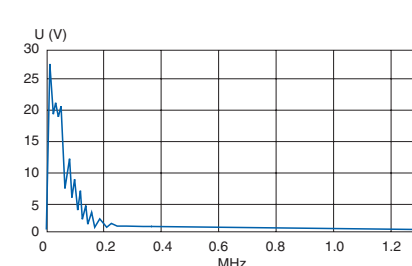


Fig. 3. Frequency spectrum

PRODUCT SPECIFICATION

All descriptions, drawings and other particulars (including dimensions, materials and performance data) given by Evox Rifa are as accurate as possible but, being given for general information, are not binding on Evox Rifa unless specifically agreed in writing. All dimensions and materials are, unless otherwise stated, subject to reasonable variations resulting from the raw material available or arising in the ordinary course of manufacture. Any performance data are based upon Evox Rifa's experience and are such as Evox Rifa normally expects to achieve.

WARRANTY, PRODUCT LIABILITY

Evox Rifa warrants that the goods manufactured by Evox Rifa are free from defects in design, material and workmanship.

Evox Rifa's liability under this warranty shall be limited to replacement or repair free of charge, at one of Evox Rifa's factories selected by Evox Rifa, provided that notification of such failure or defect is given to Evox Rifa immediately upon the same becoming apparent and that on Evox Rifa's request and instruction the goods are promptly returned to Evox Rifa carriage paid by buyer.

In case the goods thus returned as defective, prove to be without fault or defect, Evox Rifa is entitled to charge buyer 100% of the value of the returned goods.

If the goods supplied or part thereof are not manufactured by or branded Evox Rifa, Evox Rifa will only extend to the buyer the benefit of the warranty granted by the manufacturer of the goods.

Evox Rifa's liability is further limited to a period of 12 months from the date of shipment

to buyer.

Evox Rifa shall not be liable for any defect which is due to accident, fair wear and tear, negligent use, tampering, improper handling, improper use, improper operation or improper storage or any other default on the part of any person other than Evox Rifa.

Evox Rifa shall have no other liabilities in case of defective goods than those stated above and shall under no circumstances be liable for any consequential loss or damage arising from the use of goods sold by Evox Rifa. Liability under paragraph 823 BGB is expressly excluded.

The above limitations of Evox Rifa's liability for defective goods shall apply also with regard to product liability, and Evox Rifa shall have no responsibility for injury to persons or for damage to goods or property of any kind.

In case of product liability claims from third parties against Evox Rifa, not falling within Evox Rifa's liability in accordance with the above, buyer shall hold Evox Rifa harmless.