SIEMENS

Data Book 1978/79

Metallized Plastic Capacitors

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1978/79

Contents · Summary of Types

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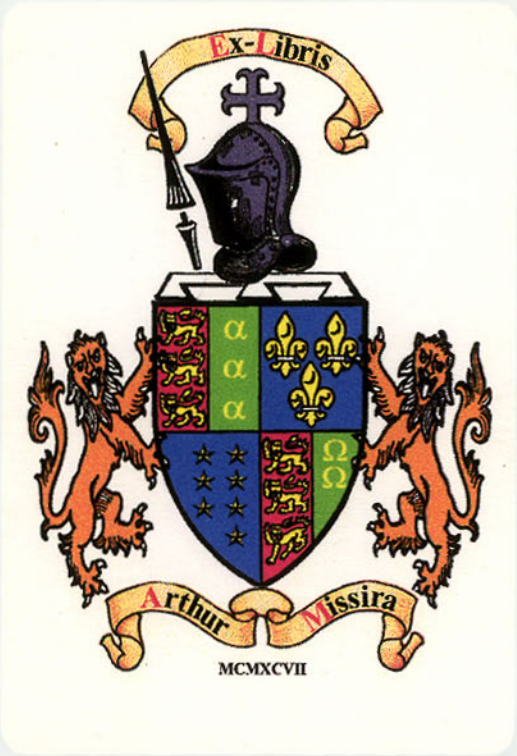

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The German specifications (DIN and VDE) have been used for reference purposes in this data book.

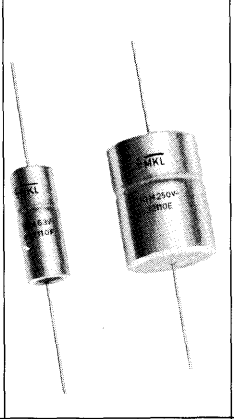
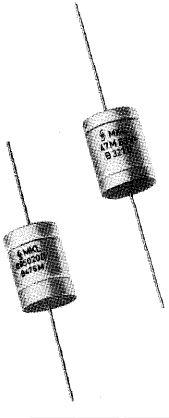
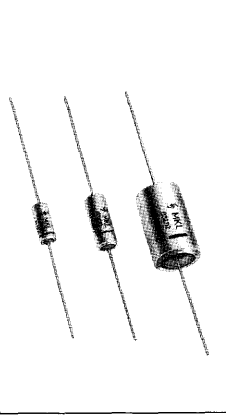
The sign ∅ on drawings denotes diameter.

A comma in the outline drawings and tables represents the decimal point.

Contents

Summary of Types

MKL Capacitors

Type	B 32 110	B 32 111	B 32 112
Rated capacitance (μF)	0.1 to 10	22 to 100	0.033 to 4.7
Rated voltage (V dc)	25 to 250	63	630
Climatic category as to DIN 40 040	FPE/LR	FPE/LR	FPE/LR
Test category as to IEC 68	55/085/56	55/085/56	55/085/56
Dimensions $d \times l$ in mm (inches)	5.4 × 18.5 (0.21 × 0.73) to 25.9 × 34 (1.02 × 1.34)	16.7 × 34 (0.66 × 1.34) to 25.9 × 46 (1.02 × 1.81)	8.4 × 18.5 (0.33 × 0.73) to 25.9 × 34 (1.02 × 1.34)
Lead spacing in mm	22.5 to 40	40 to 52.5	22.5 to 40
Design	Tubular winding in metal tube with insulating sleeve. Epoxy resin sealed face ends.		
Particular features	The capacitors are also available with quality assessment for Space applications as type B 95 020 (see section "Qualified Types") meeting the GfW specification CF 100, CF 101 and CF 104, respectively. They have the electronic test symbol ⚠.		
Figure			
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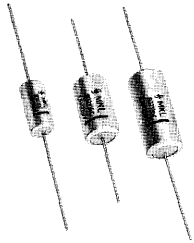
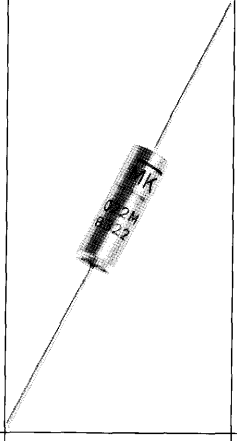
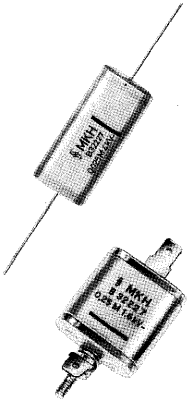
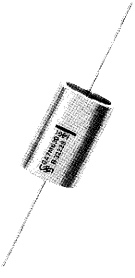
MKL Capacitors

B 32 120	B 32 121	B 32 122
0.1 to 10	22 to 100	0.033 to 3.3
63 to 250	100	630
FPC/LR	FPC/LR	FPC/LR
55/085/56	55/085/56	55/085/56
6.2 × 17.5 (0.24 × 0.69) to 25.8 × 35.5 (1.02 × 1.40)	25 × 38 (0.98 × 1.50) to 40 × 50 (1.57 × 1.97)	8.2 × 21 (0.32 × 0.83) to 25.8 × 35.5 (1.02 × 1.40)
25 to 45	–	30 to 45
Tubular winding, hermetically enclosed in non-magnetic metal case with insulating sleeve. B 32 121: Closed by a metal cover with ceramic lead-throughs and solder tag connections.		
Available as "Quality assessed capacitors ⚠ B 95 017" (see section "Qualified Types").	High reliability at high climatic requirements	
		
47	54	58

Summary of Types

MKT Capacitors

Type	B 32 220	B 32 227	B 32 229
Rated capacitance (µF)	0.0068 to 0.1	0.01 to 0.25	0.1 to 1
Rated voltage (V dc)	250 to 630	1 kV to 6.3 kV	250 to 630
Climatic category as to DIN 40 040	FME/LR	GMG/MS	FME/LR
Test category as to IEC 68	55/100/56	40/100/21	55/100/56
Dimensions *d* × *l* or *b* × *h* × *l* in mm (inches)	5 × 17.5 (0.20 × 0.69) to 10.3 × 33 (0.41 × 1.29)	6.5 × 12.5 × 33 (0.26 × 0.49 × 1.30) to 19 × 44 × 46 (0.75 × 1.73 × 1.81)	5 × 11.3 × 25 (0.20 × 0.44 × 0.98) to 16.2 × 31.9 × 34 (0.64 × 1.26 × 1.34)
Lead spacing in mm	22.5 to 37.5	40 to 50	27.5 to 37.5
Design	Tubular winding in metal tube with insulating sleeve, epoxy resin closed face ends	Flat winding with insulating sleeve, epoxy resin sealed face ends. Axial leads or threaded bolts with flat plugs	Flat winding in metal tube cementing film coated, Epoxy resin sealed face ends; central axial leads.
Particular features	High reliability version	Available as "quality assessed capacitors B 95 042" (see section "Qualified Types")	High reliability version
Figure			
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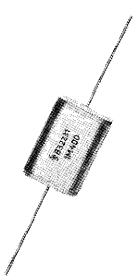
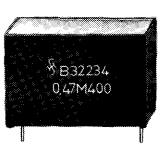
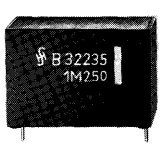
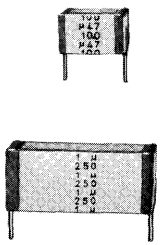
MKT Capacitors

B 32 231	B 32 234	B 32 235[1]
0.01 to 10	0.01 to 6.8	0.01 to 6.8
100 to 630	100 to 630	100 to 400
GMG	GME	FME/LR
40/100/04	40/100/21	55/100/56
4.5 × 7.5 × 14 (0.18 × 0.30 × 0.55) to 17.5 × 32.5 × 44 (0.69 × 1.28 × 1.73)	4 × 9.5 × 13 (0.16 × 0.37 × 0.51) to 13 × 22.5 × 32 (0.51 × 0.89 × 1.26)	4 × 9.5 × 13 (0.16 × 0.37 × 0.51) to 13 × 22.5 × 32 (0.51 × 0.89 × 1.26)
20 to 50	10 to 27.5	10 to 27.5
Flat winding with insulating coating, epoxy resin closed face ends, central axial leads	Flat winding in rectangular plastic case, epoxy resin sealed to ensure resistance to humidity; leads plug-in in the lead spacing.	Flat winding in rectangular plastic case, epoxy resin sealed to ensure resistance to humidity; leads plug-in in the lead spacing.
Standard version	Standard version. See preferred type B 32 510 to B 32 513	High reliability version
		
82	89	96

[1] Not for new equipment. Proposed replacement: B 32 535.

Summary of Types

MKT Capacitors

Type	B 32 237	B 32 509	B 32 510 to B 32 513
Rated capacitance (µF)	680 pF to 0.025 µF	0.0047 to 0.47	0.001 to 6.8
Rated voltage (V dc)	1 kV to 12.5 kV	63	100 to 400
Climatic category as to DIN 40 040	GMG/MS	FME/LR	FME/LR
Test category as to IEC 68	40/100/21	55/100/21	55/100/21
Dimensions $d \times l$ or $b \times h \times l$ in mm (inches)	7.5 × 24 (0.30 × 0.94) to 16.5 × 45/12.5 × 56 (0.65 × 1.77/ 0.49 × 2.20)	3 × 6.7 × 7.2 (0.12 × 0.26 × 0.28) to 6.5 × 13 × 7.2 (0.26 × 0.51 × 0.28)	3 × 8.5 × 10 (0.12 × 0.33 × 0.39) to 13 × 19.5 × 25 (0.51 × 0.77 × 0.98)
Lead spacing in mm	27.5 to 60	5	7.5; 10; 15; 22.5
Design	Tubular winding in plastic tube, epoxy resin sealed face ends; central axial leads.	Miniature type in layer construction, fully insulated to ensure reliable contacts; tinned leads, plug-in in the lead spacing	Layer construction, fully insulated ensuring reliable contacts, tinned leads, plug-in in the lead spacing
Particular features	Available as "quality assessed capacitors ⚠ B 95 050" (see section "Qualified Types")	Quality assessment as to CECC pending. For high packing density. Application: Semiprofessional and professional systems.	Quality assessment as to CECC pending. For high packing density. Application: Semiprofessional and professional systems.
Figure			
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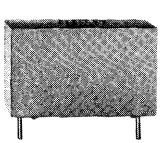
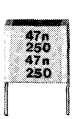
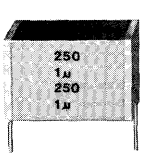
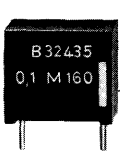
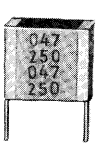
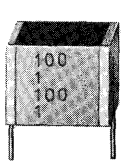
MKT Capacitors		MKC Capacitors	
B 32 535	B 32 560 to B 32 563	B 32 435	B 32 540 B 32 541
0.001 to 6.8	0.001 to 3.3	0.01 to 1.0	0.001 to 1.0
100 to 400	100 to 400	160	100 to 250
FMD/LR	FME/LR	GPE/LR	FME
55/100/56	55/100/21	40/085/21	55/100/21
4 × 10 × 10 (0.16 × 0.39 × 0.39) to 13.5 × 23 × 32 (0.53 × 0.91 × 1.26)	2.3 × 7.3 × 9 (0.09 × 0.29 × 0.35) to 10.4 × 17.5 × 24 (0.41 × 0.69 × 0.94)	5 × 10.5 × 13 (0.20 × 0.41 × 0.51) to 8.5 × 18.5 × 27 (0.33 × 0.73 × 0.11)	2.3 × 7.3 × 9 (0.09 × 0.29 × 0.35) to 8 × 13 × 9 (0.31 × 0.51 × 0.35)
7.5; 10; 15; 22.5; 27.5	7.5; 10; 15; 22.5	10; 15; 22.5	7.5; 10
Layer construction, resistant to humidity in epoxy resin sealed and flame retardent case; tinned leads, plug-in in the lead spacing	Layer construction, protected by small insulating plates; tinned leads, plug-in in the lead spacing	Flat winding resistant to humidity in plastic case, epoxy resin sealed; leads plug-in in the lead spacing	Layer construction protected by insulating plates; leads plug-in in the lead spacing
High reliability version	Quality assessed type as to CECC 30 401/001. Space saving mounting at high packing density	High reliability version	Standard version
	 		 
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Summary of Types

MKC Capacitors

Type	B 32 545	B 32 892
Rated capacitance (µF)	0.001 to 0.1	0.1 to 1.0
Rated voltage (V dc) (V ac)	100 to 400	400 to 630 V dc (220 to 250 V ac)
Climatic category as to DIN 40 040	FME/LR	FME/MS
Test category as to IEC 68	55/100/21	55/100/21
Dimensions $b \times h \times l$ in mm (inches)	4 × 10 × 10.5 (0.16 × 0.39 × 0.41)	6.5 × 15 × 27 (0.26 × 0.59 × 1.06) to 13 × 22.5 × 32 (0.51 × 0.89 × 1.26)
Lead spacing in mm	7.5	22.5; 27.5
Design	Resistant to humidity in plastic case, epoxy resin sealed, leads plug-in in the lead spacing	Flat windings, resistant to humidity in plastic case, epoxy resin sealed, leads plug-in in the lead spacing
Particular features	High reliability version	Suitable for use at sinusoidal and non-sinusoidal ac voltage load
Figure		
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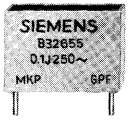
MKP Capacitors

Type	B 32 650	B 32 655	B 32 656
Rated capacitance (µF)	0.0012 to 3.3	0.047 to 1.5	0.0022 to 0.12
Rated voltage U_R AC voltage U ac	400 to 1 500 V dc 500 to 1 500 V_{pp}	630 V dc 250 V ac	1 000 V dc 400 V ac
Climatic category as to DIN 40 040	GPE	GPE	FPD/LR
Test category as to IEC 68	40/085/21	40/085/21	40/085/56
Dimensions $b \times h \times l$ in mm (inches)	7.3 × 13 × 18 (0.29 × 0.51 × 0.71) to 18 × 27.5 × 31.5 (0.71 × 1.08 × 1.24)	7.3 × 13 × 18 (0.29 × 0.51 × 0.71) to 18 × 27.5 × 31.5 (0.71 × 1.08 × 1.24)	7.3 × 13 × 18 (0.29 × 0.51 × 0.71) to 18 × 27.5 × 31.5 (0.71 × 1.08 × 1.24)
Lead spacing in mm	15; 22.5; 27.5	15; 22.5; 27.5	15; 22.5; 27.5
Design	Flat winding, resistant to humidity in plastic case, epoxy resin sealed, flame-retardant, leads plug-in in the lead spacing		
Particular features	Pulse-proof, for TV, deflection and high voltage stages, thyristor deflection circuits, etc.	Suitable for mains ac voltage load and pulse circuits	For high reliability applications, in particular suitable for mains ac voltage load and pulse operation
Figure	 		
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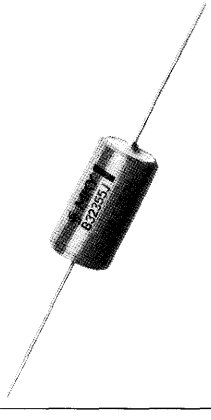
Summary of Types

MKY Capacitors

Type	B 32 355 with leads	B 32 355 with tags	
Rated capacitance (μF)	0.1 to 0.5	>0.5 to 10	
Rated voltage (V dc)	250	250	
Climatic category as to DIN 40 040	FSC/LR	FSC/LR	
Test category as to IEC 68	40/100/56	40/100/56	
Dimensions $d \times l$ in mm (inches)	11.2 × 29 (0.44 × 1.14) to 18.2 × 29 (0.72 × 1.14)	25 × 29 (0.98 × 1.14) to 40 × 50 (1.57 × 1.97)	
Lead spacing in mm	35		
Design	Tubular windings, hermetically enclosed in metal case, with insulating sleeve, central axial leads at both ends	Tubular windings, hermetically enclosed in metal case, closed by a metal cover with low loss ceramic lead-throughs, single-ended solder tag connections	
Particular features	Very close capacitance tolerances, very low dissipation factor, suitable for resonant circuit applications		
Figure			
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General

List of Part Numbers

(in numerical order)

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1. General

Metallized plastic capacitors – briefly MK capacitors – are outstanding for their self-healing property. The dielectric of these capacitors consists of plastic films onto which metal layers of approximately 0.02 to 0.05 µm are vacuum-deposited. The metallized films are either wound constructions in tubular or flattened form or arranged in the more recent stacked construction.
The metal spray method used for joining the winding face ends ensures that all the windings are connected. Hence, the capacitors feature low inductance and low loss characteristics. MK capacitors comply with VDE specification 0560, part 1, and DIN standard 44 110 as well as with the standard sheets for the individual capacitor types.

2. Self-healing

The electric arc, which arises with breakdown, evaporates the metal layer in the region affected without impairing the dielectric. In this way failures in the dielectric can be effectively isolated. The time necessary for the self-healing process is less than 10 µsec. Since only fractions of the energy stored in the capacitor are dissipated in the self-healing process, the potential drop remains accordingly low. The capacitor design ensures that self-healing processes occur only occasionally, even when the parameters of continuous maximum voltage and maximum limit temperature apply; statistical measurements with MKL capacitors reveal that approx. 0.18 self-healing processes are to be expected per year and per µF. The capacitance variation of MK capacitors would therefore be less than 1% after 10^3 breakdowns. The self-healing characteristic of MK capacitors is independent of maintaining specified limit conditions, and can even be effective at low voltage ratings where electro-chemical action takes presidence.

3. Types

Metallized plastic – MK – capacitors are distinguished by their dielectric materials:

MKL capacitors	comprising lacquer films (cellulose acetate) as dielectric and vacuum deposited metal layers. In accordance with DIN 41 379 these are designated MKU[1] capacitors.
MKT[1] capacitors	(previous designation: MKH capacitors) comprising polyethyleneterephthalate (trade name e.g. Hostaphan®, Mylar®, etc.) as dielectric and vacuum deposited metal layers.
MKC[1] capacitors	(previous designation: MKM capacitors) comprising polycarbonate (trade name Makrofol®) as dielectric and vacuum deposited metal layers.
MKP[1] capacitors	comprising polypropylene dielectric and vacuum deposited metal layers.
MKY capacitors	comprising polystyrene as dielectric and metallized lacquer films (cellulose acetate) as electrodes. In accordance with DIN 41 379 these are designated MKS[1] capacitors.

[1] Designation in accordance with the German DIN standard 41 379.

4. Constructional design

4.1. Contacting

The large area metallization over the winding face ends ensures good contact between the layers and the connecting elements. Hence, capacitors with low-inductance, low loss characteristics are obtained.
The capacitors in rectangular plastic cases and the epoxy resin sealed types are provided with spacers in order to improve the solderability in the solder bath. These capacitors are thus particularly suited for use on printed circuit boards.

4.2. Dimensions

The main dimensions stated for MK capacitors are maximum dimensions including the insulating sleeve (for details refer to the individual data sheets).

5. Electrical properties

5.1. Capacitance

5.1.1. Rated capacitance

The capacitance ratings available for the individual capacitor types range from 680 pF to 100 µF. The capacitance values are graded according to the E standard. The actually available values of the E standard (E6, E12, E24, E48, E96) are contained in the individual data sheets.

5.1.2. Tolerances available

MKL capacitors	±20, ±10%
MKT capacitors	±20, ±10, ±5%
MKC capacitors	±20, ±10, ±5%
MKP capacitors	±10, ±5%
MKY capacitors	±5, ±2, ±1%

The rated capacitances and appropriate tolerances are indicated on the individual data sheets. The capacitance tolerances are coded by the following letters (in accordance with IEC recommendation 62/1968):

Code letter	M	K	J	G	F
Capacitance tolerance	±20%	±10%	±5%	±2%	±1%
E standard	E6	E12	E24	E48	E96

5.1.3. Temperature dependence

The variation of the capacitance with respect to the permissible temperature range (see climatic category) is not linear, but reversible.
In the range of −20 to +70 °C, (−4 to +158 °F), however, an approximately linear run of the temperature can be assumed.

Figure 1 shows characteristic curves of the main MK capacitors.

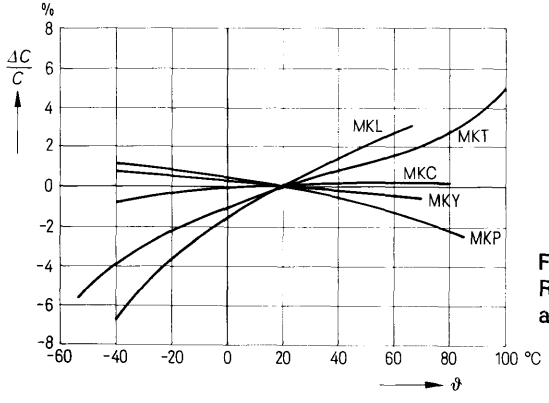


Fig. 1
Relative variation of capacitance $\frac{\Delta C}{C}$ as a function of temperature ϑ

5.1.4. Moisture dependence

The capacitance of sealed capacitors is not subject to moisture under environmental climatic conditions.

With non-hermetically sealed capacitors the operation at high relative humidity causes an increase in capacitance and a decrease in insulation since the capacitor or the layer package has absorbed moisture, particularly when the relative humidity of the permitted climatic category is prolonged. These variations due to moisture are reversible.

5.1.5. Frequency dependence

Since the dielectric constant of the plastic films is frequency dependent, the capacitance decreases with increasing frequency. An example of this interdependence is shown for MKT capacitors in Fig. 2.

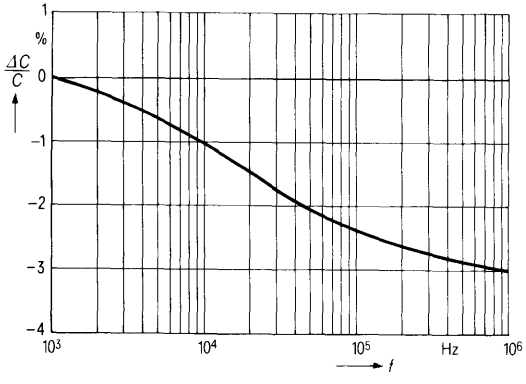


Fig. 2
Relative variation of capacitance $\frac{\Delta C}{C}$ as a function of frequency f, at 20 °C/68 °F

5.1.6. Capacitance drift i_z

Apart from reversible changes, the capacitance is also subject to irreversible changes which are summarized under the term "maximum capacitance drift i_z". The values refer to +40 °C/+104 °F and to the load duration stated for each capacitor type on the appropriate data sheets. The values are typical values. The service life for standard type capacitors is not indicated, since here the capacitance drift applies to a period of two years. Frequent and large temperature changes within the fringe area of the permissible temperature and relative humidity can cause the stated drift values to rise. In accordance with DIN 44 110 typical values for a storage time of two years are also given. The storage conditions stated under item 3.5.3. are applicable.

5.2. Voltage and current operation

5.2.1. Rated voltage U_R

The rated voltage is the direct operating voltage which may be applied continuously to the terminals of a capacitor at an ambient temperature of 40 °C (104 °F).

When the capacitor is operated within the permissible climatic category, the following limiting conditions are to be taken into account:

5.2.2. Category voltage U_c (at dc operation)

The category voltage U_c is the maximum dc voltage, which may be applied continuously to the capacitor and is dependent upon the ambient temperature. The resulting voltage drop at higher temperatures is covered by outline drawings on the appropriate data sheets (definition in accordance with DIN 44 110).

5.2.3. Category voltage U_c (at ac operation)

The category voltage U_c is referred to 50 Hz which may be applied continuously to the capacitor (see individual types).

When an additional dc voltage is superimposed to the ac voltage, the sum of the applied dc voltage and the amplitude of the ac voltage should not exceed the category voltage U_c.

MK capacitors are generally not intended for technical ac applications. In exceptional cases, references are given to possible operation indicating the permissible rated voltage U_{ac}.

For operation at higher frequencies and for non-sinusoidal ac voltage load see para. 5.2.5.

5.2.4. Peak voltage

The peak voltage is the maximum voltage which may be applied to the capacitor for a short period, e. g. with non-periodic switchings. The peak voltage is particularly specified in addition.

5.2.5. Inherent temperature rise, permissible efficiency

When capacitors are operated at non-sinusoidal ac voltage or at sine voltage load of higher frequency, the inherent temperature rise and the pulse loading capability (see para 5.2.6.) must be taken into account. The limit requirements are given in the nomogram for the permissible peak voltage $\hat{U}$, indicating:

- Repetition frequency
- Pulse shape
- Rise and / or fall time of the voltage edges
- Inherent temperature rise by about 10 °C (18 °F)

5.2.6. Pulse handling capability (current carrying capacity)

The data previously given on the max. permissible pulse rise time was referred to rated voltage, thus limiting the use of Siemens capacitors unnecessarily, mainly at low operating voltages. The new data sheets therefore contain a pulse characteristic k_o that takes into account the interdependence between the permissible voltage rate of rise U_{pp}/τ and the voltage swing U_{pp}.

The pulse characteristic $k_ó$ that is decisive for the capacitor loading can be calculated for a given application as follows:

For pulse-shaped voltages with straight-line pulse edges (trapezoidal, sawtooth) applies: $k_ó = 2 \times U_{pp}^2/\tau$ [V²/µs]

For spontaneous and short-circuit like discharges and charges applies: $k_ó = U_L^2/RC$ [V²/µs]

The $k_ó$ value determined by the circuit data has to be lower than or at the utmost equal to that k_o value given for the individual capacitor types.
The k_o values refer to ambient temperatures of up to 50 °C (122 °F).
K_o values for higher temperatures are available on request.

The terms used in the preceding paragraph are:

Voltage swing (operating voltage)	U_{pp}	[V]
Charging voltage	U_L	[V]
Ohmic resistance in the charging and / or recharging circuit	R	[Ω]
Capacitance of capacitors	C	[µF]
Voltage rise time	τ	[µs]
Permissible pulse characteristic of the capacitor	k_o	[V²/µs]
Pulse characteristic calculated from circuit data	$k_ó$	(V²/µs]

5.3. Dissipation factor

The dissipation factor tan δ is temperature and frequency dependent and rises with increasing frequency and increasing capacitance. It mainly depends on the dielectric losses of the plastic films and the resistance of the supply lines (layer losses and contacts).

The ohmic resistance of the supply lines is kept especially low and constant due to the contacting method used. For detailed data refer to the individual data sheets.

5.4. Insulation resistance

The insulation of a capacitor is indicated either as a resistance value R_{is} in MΩ or as a time constant τ in seconds = MΩ × μF.

It consists of the insulation resistance of the dielectric (layer/layer) and the insulation resistance between layer and case, which is determined by the quality of the insulating material (plastic case, moulding material, lead-throughs etc.) and by the length of the surface leakage paths.

Because of the high quality of the insulating materials used for MK capacitors the insulation resistance of the dielectric materials is unaffected.

The insulation resistance is the ratio of dc voltage applied to the current, flowing after a defined period. The current flowing after a constant dc voltage has been applied, is dependent on temperature, voltage, and time. It is made up from the charging, recharging and leakage currents (definition in accordance with VDE 0560, part 1, § 11).

In order to determine the limit values the following conditions are specified: The current shall be measured after the voltage has been applied for 1 minute with 23 °C/73.4 °F and a relative humidity ≦65%. The voltage is 100 V dc.

Measuring voltage for:

Capacitors with U_R	25 V dc	63 V dc
Measuring voltage	10 V dc	50 V dc

More than 95% of all capacitors lie far above the stated minimum value at delivery. The average value is, therefore, also indicated on the data sheets.

During the service life the insulation resistance can temporarily decrease to about 10% of the values at delivery, especially when the maximum permissible humidity (according to the climatic category) applies over a longer period or when the capacitor is used continuously in the range of the maximum operating temperature.

5.5. Self inductance and impedance

The self inductance of MK capacitors depends on the inductance of their connecting leads and the winding. Because of the large-area contacting, by which all turns are connected, the self inductance is especially low.

The resonant frequency of a capacitor results from its self-inductance and its capacitance.

Typical impedance characteristics of MK capacitors are shown in Fig. 3, demonstrated on the MKT capacitor. The measuring conditions comply with DIN 41 328, sheet 2.

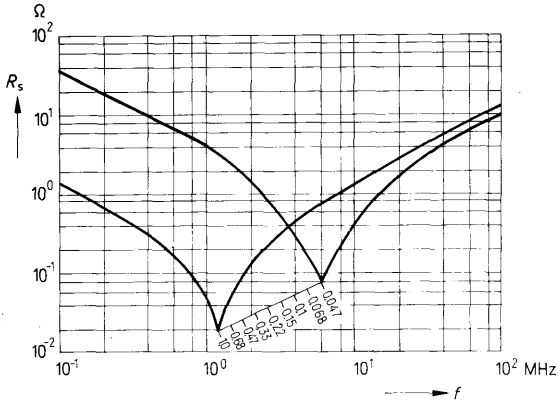


Fig. 3
Impedance Z
as a function of frequency f

6. Climatic and mechanical characteristics

6.1. Permitted temperature and humidity

The permitted temperature and humidity depend on the individual capacitor types and are identified in accordance with DIN 40 040 as follows:

1st code letter	G	F	–	–
Minimum temperature	−40 °C/ −40 °F	−55 °C/ −67 °F	–	–
2nd code letter	S	P	M	–
Maximum temperature	+70 °C/ +158 °F	+85 °C/ +185 °F	+100 °C/ +212 °F	–
3rd code letter humidity category	G	F (E[3])	D	C
Average relative humidity	≦65%	≦75%	≦80%	≦95%
30 days per year, continuously[1]	–	95%	100%	100%
60 days per year, continuously	85%	–	–	–
for the remaining days, occasionally[2]	75%	85%	90%	100%

6.1.1. Test categories in accordance with DIN 40 045 and IEC 68

MK capacitors are graded according to defined test categories which result from the test conditions according to which the capacitors have been tested. The test categories comprise three parameters:

Example:

Test category **55/085/56**

Test A: Cold
−55 °C/−67 °F
(in accordance with DIN 40 046, sheet 3 / or IEC 68-2-1)

Test B: Dry heat
+85 °C/+185 °F
(in accordance with DIN 40 046, sheet 4 / or IEC 68-2-2)

Test C: Damp heat (steady state)
56 days
(in accordance with DIN 40 046, sheet 5 / or IEC 68-2-3)

[1] These days should suitably be distributed throughout the year.
[2] Keeping the annual average.
[3] For humidity category E, rare and slight dew precipitation is additionally permitted, e.g. during short openings of outdoor equipment.

6.2. Mechanical robustness of terminations

The connecting leads are permitted to be bent at a distance not less than 1 mm from face ends of the capacitor, unless limitations for particular capacitor types are indicated on the appropriate data sheets.

The terminals meet the requirements of DIN specification 40 046, part 19, Jan. 1978.

Test Ua – Tensile	Cross-sectional area of the wire mm^2	Load N[1]
up to and including	0.8	10
exceeding	0.8	20

Test Ub – Bending	Two bendings through 90° in the opposite direction. The loading weight shall be 5 N at $\leqq 0.8$ mm^2 10 N at > 0.8 mm^2
Test Uc – Torsion of axial wires	Condition 2
Test Ud – Torque of threaded bolts	Condition 1 M 3 ≙ 0.5 Nm M 4 ≙ 1.2 Nm M 5 ≙ 2 Nm

For cube-shaped types with parallel leads, the termination tests Ub and Uc are not applicable.

6.3. Soldering

MK capacitors meet the **soldering requirements** of DIN 40 046, sheet 18, When MK capacitors are subjected to the soldering procedure, care should be taken that they will not be damaged because of the heating effect. Special solder conditions for mounting purposes are contained on the data sheets. For a **heat stability test** (260±5) °C (500±9) °F and (10 ± 1) sec. are generally permitted.
(Exception: see type B 32 540/541).

6.4. Resistance to vibration

The ability of MK capacitors to withstand specified vibration loads as specified in the DIN standard 40 046, sheet 8, test F_c, partial test B 1 and in the IEC recommendation 68-2-6:

Duration of endurance conditioning	6 hours
Frequency range	10 to 55 Hz
Displacement amplitude	0.75 mm
This vibration load complies with maximum	98.1 m/sec^2 or 10 g

6.5. Low air pressure

Test in accordance with DIN 40 046, sheet 13, or the IEC recommendation 68-2-3 providing a degree condition of severity of 44 mbar.

[1] 10 N = 1 kp

7. Reliability (in accordance with DIN 40 040, Febr. 1973)

The reliability (operational reliability) of a component is determined by the failures expected out of a sufficiently large batch after a defined period of time.

Data on reliability and failure rate is only given for high reliability versions.

Data on load duration and failure quota is used for characterization.

7.1. Reference reliability of MK capacitors

The reference reliability is the reliability for a particularly defined requirement (reference requirement).

The reference reliability given for MK capacitors, refers to 40 °C (104 °F) and to the annual average humidity admitted for the particular type. Here, the diagrams of apendix 2, DIN 40 040, page 7, are to be taken into account for a reduced relative humidity at temperatures above room temperature.

7.2. Load duration

The load duration is the sum of:

- Working time
- Intermittent time
- Storage, testing and checking time at the user
- Transport time

and is identified by the 5th code letter (see table).

4th code letter				**5th code letter**			
Failure quota given in failures per 10^9 components hours				Load duration in hours			
K	100	L	300	R	100 000	S	30 000
M	1 000	N	3 000	T	10 000	U	3 000

7.3. Relative failure rate

The relative failure rate is the ratio of the number of failed to the total number of components and applies to the load duration indicated. It is the product of failure quota and load duration.

The value quoted in the data sheets is an average value from investigations of a sufficiently large number of components.

7.4. Failure quota

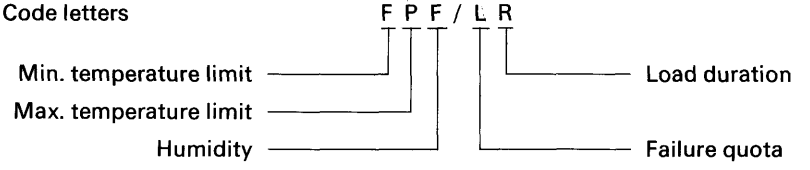
The failure quota is the ratio of failure rate and associated load duration and is indicated in failures per 10^9 component hours. It is identified by the 4th code letter (see table in section 7.2).

7.4.1. Failure criteria

For MK capacitors the following failure criteria are decisive.

Total failure:	Short or open circuit
Failure due to variations	exceeding or falling below the limit values given in the data sheets for: ● capacitance change $\frac{\Delta C}{C}$ ● dissipation factor change $\Delta \tan \delta$ ● insulation resistance

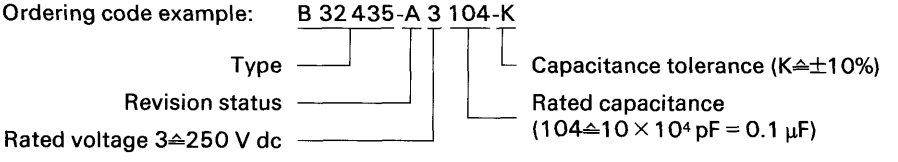
7.5. Example of coding the climatic category and reliability



8. Ordering codes

Siemens has introduced part numbercs for all its technical products in order to expedite procedures such as ordering and supplying, by means of data processing equipment. These part numbers clearly identify any deliverable component.

The ordering codes (Siemens part numbers) for MK capacitors are contained on every data sheet. They are in accordance with the Siemens standard SN 01001.



Improvements and technical advance are expressed by changing the code letter for the revision status. It is reserved to deliver MK capacitors with a revision status later than that ordered.

MKL Capacitors
Metallized Lacquer Film Capacitors

Metallized lacquer film capacitors

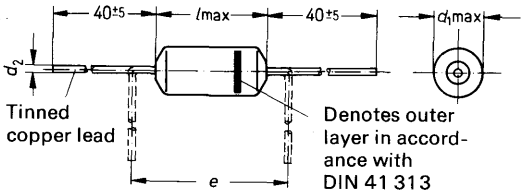
High reliability version

Designation in accordance with DIN 41 379: MKU capacitors. Self-healing tubular capacitor winding with cellulose acetate dielectric. Enclosed in tubular metal case, shrunk sleeve insulated, epoxy resin sealed face ends. Central axial leads.

MKL capacitors with quality assessment

Capacitors of the type series B 32 110 are permitted for Space applications (see B 95 020 in the section "Qualified Types"). They comply with the GfW specifications CF 100, CF 101 and have the electronic test symbol.

GfW = Gesellschaft für Weltraumforschung (German Space Agency).



Denotes outer layer in accordance with DIN 41 313

Dimensions in mm

l	18.5	21	25	34
e	22.5	25	30	40
d_1	≦7.4	≧8.4		
$diad_2$	0.6	0.8		

Minimum lead bend: 1 mm from face ends

Ordering code example B 32 110-E0225-M

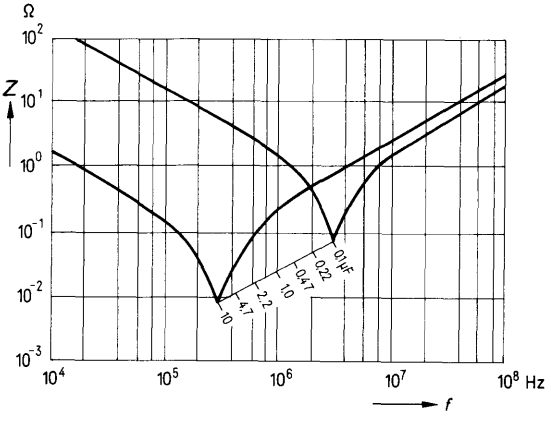
Type — Code according to table

Rated voltage		25 Vdc[1]	63 Vdc	100 Vdc	160 Vdc	250 Vdc
Rated capacitance µF	Tolerance	Dimensions $d_1 \times l$ Code				
0,1	±20% ≙ M			5,4 × 18,5 -E0104-M	6,4 × 18,5 -E1104-M	7,4 × 18,5 -E2104-M
0,15			5,4 × 18,5 -F9154-M	6,4 × 18,5 -E0154-M	7,4 × 18,5 -E1154-M	8,4 × 18,5 -E2154-M
0,22			5,4 × 18,5 -F9224-M	6,4 × 18,5 -E0224-M	7,4 × 21 -E1224-M	8,4 × 21 -E2224-M
0,33			6,4 × 18,5 -F9334-M	7,4 × 18,5 -E0334-M	8,4 × 21 -E1334-M	9,4 × 21 -E2334-M
0,47		5,4 × 18,5 -D3474-M	7,4 × 18,5 -F9474-M	7,4 × 21 -E0474-M	9,4 × 21 -E1474-M	10,7 × 21 -E2474-M
0,68		6,4 × 18,5 -D3684-M	7,4 × 18,5 -F9684-M	8,4 × 21 -E0684-M	9,4 × 25 -E1684-M	10,7 × 25 -E2684-M
1	(±10% ≙ K)[2] ±20% ≙ M	7,4 × 18,5 -D3105-M	7,4 × 21 -F9105-M	9,4 × 21 -E0105-M	10,7 × 25 -E1105-M	11,7 × 25 -E2105-M
1,5		7,4 × 18,5 -D3155-M	8,4 × 21 -F9155-M	9,4 × 25 -E0155-M	12,7 × 25 -E1155-M	13,7 × 25 -E2155-M
2,2		7,4 × 21 -D3225-M	10,7 × 21 -F9225-M	10,7 × 25 -E0225-M	11,7 × 34 -E1225-M	12,7 × 34 -E2225-M
3,3		8,4 × 21 -D3335-M	9,4 × 25 -F9335-M	9,4 × 34 -E0335-M	13,7 × 34 -E1335-M	15,7 × 34 -E2335-M
4,7		9,4 × 21 -D3475-M	10,7 × 25 -F9475-M	11,7 × 34 -E0475-M	15,7 × 34 -E1475-M	17,7 × 34 -E2475-M
6,8		10,7 × 25 -K3685-M	10,7 × 34 -F9685-M	12,7 × 34 -E0685-M	18,7 × 34 -E1685-M	20,7 × 34 -E2685-M
10		11,7 × 25 -D3106-M	12,7 × 34 -F9106-M	16,7 × 34 -E0106-M	20,7 × 34 -E1106-M	25,9 × 34 -E2106-M

[1] Tolerance of the 25 Vdc series: only ±20%.
[2] Closer tolerances available upon request.

Climatic category in accordance with DIN 40040	**F P F / L R**
Minimum limit temperature	**F** −55 °C/−67 °F
Maximum limit temperature	**P** +85 °C/+185 °F
Humidity category	**F**[1] average relative humidity ≦ 75%; 95% for 30 days per year; continuously 85% for the remaining days; occasionally
Failure quota	**L** 300 failures per 10^9 component hours
Load duration	**R** 10^5 h
Relative failure rate	$300 \times 10^{-9} \times 10^5 = 3\%$ At a load generally occurring in practice a failure quota of 2×10^{-9}/h can be assumed
Failure criteria	
Total failure	Short or open circuit
Failure due to variations	Capacitance change $\frac{\Delta C}{C}$ $> {}^{+18}_{-9}\%$
	Dissipation factor tan δ > 1.5 × max. limit value
	Insulation resistance < 150 MΩ (≦0.33 µF) < 50 s (>0.33 µF)
Test category in accordance with DIN 40045, or IEC publication 68-1	**55/085/21** or **55/085/56**[2], respectively
	Conditions
Damp heat test in accordance with DIN 40046, sheet 5 or IEC publication 68-2-3	Test temperature +40 °C/+104 °F Relative humidity $(93 \pm \frac{2}{3})$ % Test duration 21 days (56 days)
	Test criteria
	Capacitance change $\frac{\Delta C}{C}$ ≦ ±3% (5%)
	Dissipation factor change $\Delta \tan\delta$ ≦ 3×10^{-3} at 1 kHz ≦ 5×10^{-3} at 10 kHz
	Insulation resistance ≧ 50% (10%) of the minimum value at delivery
Resistance to vibration Test F_C: Vibration partial test B 1 in accordance with DIN 40046, sheet 8 and IEC publication 68-2-6	Duration of endurance conditioning 6 hours Frequency range 10 to 55 Hz Displacement amplitude 0.75 mm (conforming to max. 10 g)
Solder conditions	Temperature of the solder bath max. 260 °C (500 °F) Soldering duration max. 10 s Distance to the soldering joint min. 6 mm

[1] The capacitors also meet the test conditions of humidity category E as to DIN 40040.
[2] For these increased requirements the values in parentheses apply.

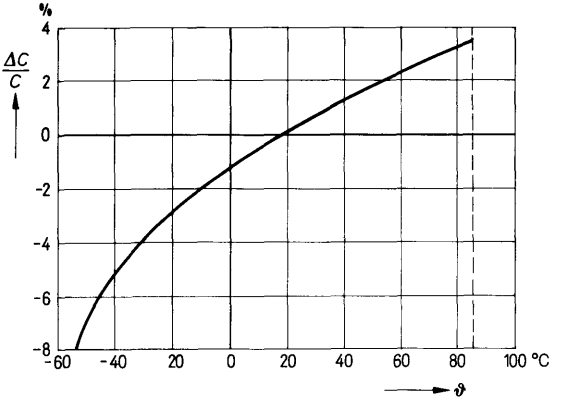
Maximum capacitance drift i_z	$+6_{\%}$ -3
Dissipation factor tan δ measured at 20 °C (68 °F) at 1 kHz at 10 kHz	Maximum values / Average values 20×10^{-3} for $C > 1.0\ \mu F$ / 15×10^{-3} for $C > 1.0\ \mu F$ 36×10^{-3} for $C \leqq 1.0\ \mu F$ / 25×10^{-3} for $C \leqq 1.0\ \mu F$
Self inductance	approx. 20 nH (for 6 mm lead length at both ends)
Impedance Z as a function of frequency f (typical values)	
Category voltage U_c at dc operation	$1.0 \times U_R$ $1.5 \times U_R$ peak voltage[1] $2.0 \times U_R$ up to max. 1 hour $2.5 \times U_R$ up to max. 1 min. $3.0 \times U_R$ up to max. 1 sec } for inevitable exceptions only, not for systematic switchings[2] U_R = rated voltage
Category voltage U_c at ac operation	Rated voltage / U_c[3] perm. Vac rms at 50 Hz / Peak voltage[1] 25 Vdc / 10 Vac / 15 Vac 63 Vdc / 20 Vac / 25 Vac 100 Vdc / 35 Vac / 50 Vac 160 Vdc / 60 Vac / 80 Vac 250 Vdc / 90 Vac / 125 Vac $1.5 \times U_c$ for milliseconds (e.g. switchings)

For use in pulse discharge circuits (VDE 0560, part 1 and 2, § 51) MKL capacitors are not suitable. In place of that Siemens MPS and MKV capacitors (B25***) are recommended.

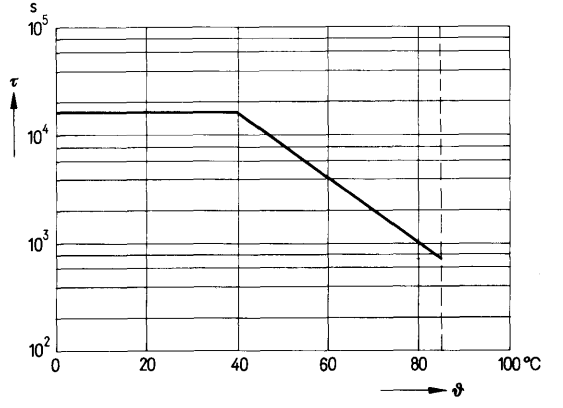
1) The peak voltage refers to 2000 hours at +20 °C/68 °F or 200 hours at +85 °C (185 °F).
2) Throughout the entire load duration, the times are summed up thereby permitting the electrical values to deviate up to the limit indicated for failures due to variations.
3) The sum of the dc voltage and the peak value of an ac voltage superimposed on the dc voltage shall not exceed the rated voltage.

Reversible capacitance change $\frac{\Delta C}{C}$

as a function of temperature at 1 kHz (typical values)



Insulation
(time constant τ)
as a function of temperature



Minimum value[1]	
for $C \leqq 0.33$ µF	15 000 MΩ
for $C > 0.33$ µF	5 000 s
Average value	>15 000 s

[1] The indicated values are applicable at the time of delivery. During operational life the insulation may decrease for a short period to about 10% of the values at the time of delivery, especially when the maximum permissible humidity of 95% is applied for a long period.

Pulse handling capability (voltage rate of rise U_{pp}/τ and pulse characteristic k_o).

Maximum permissible voltage change per time unit with non-sinusoidal voltages (pulse, sawtooth).

Rated voltage U_R		Capacitor length 18.5 mm	21 mm	25 mm	34 mm
25 Vdc	U_{pp}/τ k_O	2,5 V/µs 125 V²/µs	1,5 V/µs 75 V²/µs	1,0 V/µs 50 V²/µs	– –
63 Vdc	U_{pp}/τ k_O	4,5 V/µs 570 V²/µs	3,0 V/µs 380 V²/µs	2,0 V/µs 250 V²/µs	1,2 V/µs 150 V²/µs
100 Vdc	U_{pp}/τ k_O	6,5 V/µs 1300 V²/µs	4,5 V/µs 900 V²/µs	3,0 V/µs 600 V²/µs	1,7 V/µs 340 V²/µs
160 Vdc	U_{pp}/τ k_O	10 V/µs 3200 V²/µs	6,0 V/µs 1920 V²/µs	4,0 V/µs 1300 V²/µs	2,3 V/µs 750 V²/µs
250 Vdc	U_{pp}/τ k_O	11,5 V/µs 5750 V²/µs	8,0 V/µs 4000 V²/µs	5,0 V/µs 2500 V²/µs	2,7 V/µs 1400 V²/µs

For a voltage swing $U_{pp} < U_R$ the value of the permissible voltage rate of rise U_{pp}/τ can be multiplied with the factor U_R/U_{pp}. The data of the nomogram must be accounted for periodic pulses. See also "General Technical Data" para 5.2.6.

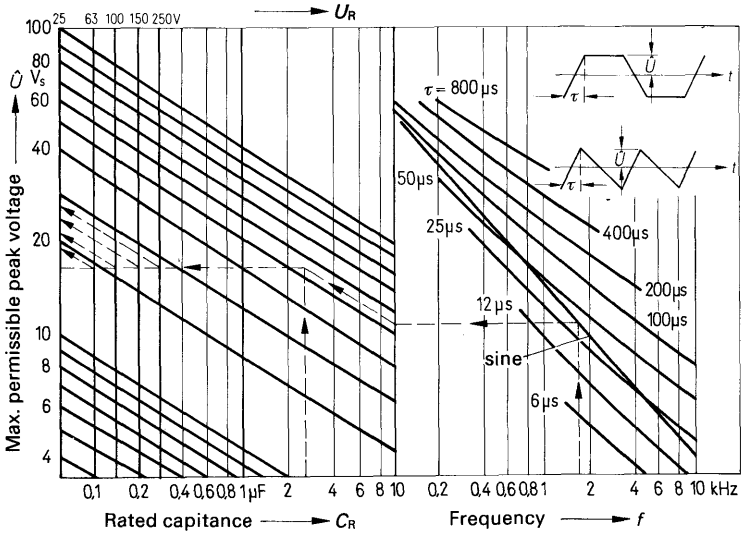
Ac power handling capacity at higher frequencies

The maximum permissible peak voltage $\hat{U}$ for sinusoidal and non-sinusoidal voltages (pulse, sawtooth, trapezoidal voltages) can be obtained from the nomogram, where the following limit values $\hat{U}_l$ are not allowed to be exceeded.

Rated voltage U_R	25 V	63 V	100 V	160 V	250 V
Limit voltage $\hat{U}_l$	14 V	28 V	50 V	80 V	125 V

The nomogram is based on 10 °C (18 °F) inherent temperature rise of the capacitor; this must be taken into account when considering the permissible max. temperature.

With trapezoidal load the second harmonic frequency must be assumed.



Example given:

f = 1.7 kHz (repetition frequency)
τ = sine (rise time)
C = 2.5 µF (capacitance)

According to the dashed line on the graph above this gives:

for the 25 V dc type a max. peak voltage $\hat{U}$ of about 17 V (not permissible)
for the 63 V dc type a max. peak voltage $\hat{U}$ of about 19 V
for the 100 V dc type a max. peak voltage $\hat{U}$ of about 21 V
for the 160 V dc type a max. peak voltage $\hat{U}$ of about 24 V
for the 250 V dc type a max. peak voltage $\hat{U}$ of about 26 V

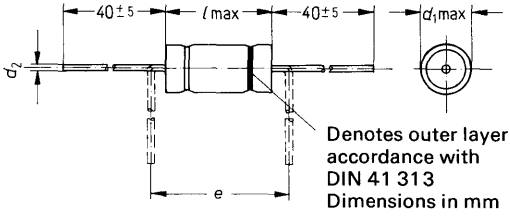
Metallized lacquer film capacitors

High reliability version

Designation in accordance with DIN 41 379: MKU capacitors. Self-healing tubular capacitor winding with cellulose acetate dielectric. In tubular metal case, shrunk sleeve insulated, epoxy resin sealed face ends. Central axial leads.

MKL capacitors with quality assessment

Capacitors of the type series B 32 111 are permitted for Space applications (see B 95 020 in the section "Qualified Types"). They comply with the GfW specifications CF 100, CF 101 and have the electronic test symbol.
GfW = Gesellschaft für Weltraumforschung (German Space Agency).



Denotes outer layer in accordance with DIN 41 313
Dimensions in mm

l	*e*	*dia* d_2
34	40	0.8
46	52.5	1.0

Minimum lead bend:
1 mm from face ends.

Rated capacitance µF	Tolerance	Rated voltage	Dimensions $d_1 \times l$	Ordering code
22	±10%≙K	63 V dc	16.7×34	B32111-A9226-*
47	±20%≙M		23.7×34	B32111-A9476-*
100			25.9×46	B32111-A9107-*

* When ordering the code letter for the requested tolerance must be substituted for *.

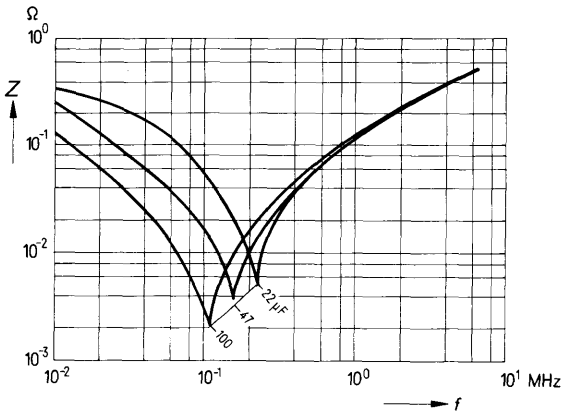
Climatic category in accordance with DIN 40 040	**F P F / L R**
Minimum limit temperature	**F** −55 °C/−67 °F
Maximum limit temperature	**P**[1] +85 °C/+185 °F
Humidity category	**F**[2] average relative humidity ≦ 75%; 95% for 30 days per year; continuously 85% for the remaining days; occasionally
Failure quota	**L** 300 failures per 10^9 component hours
Load duration	**R** 10^5 h
Relative failure rate	$300 \times 10^{-9} \times 10^5 = 3\%$ At a load generally occurring in practice a failure quota of 2×10^{-9}/h can be assumed

[1] Shelf and service life at temperatures > +85 to 100 °C/+185 to 212 °F max. 2,000 hours.
[2] The capacitors also meet the test conditions of humidity category E as to DIN 40 040.

Failure criteria	
Total failure	Short or open circuit Capacitance change $\frac{\Delta C}{C}$ $> \pm \frac{18}{9}\%$
Failure due to variation	Dissipation factor tan δ $> 1.5 \times$ max. limit value Insulation resistance < 50 s
Test category in accordance with DIN 40 045, or IEC publication 68-1	**55/085/21 or 55/085/56**[1], respectively
Damp heat test in accordance with DIN 40 046, sheet 5 or IEC publication 68-2-3	**Conditions** Test temperature +40 °C/+104 °F Relative humidity $(93 \pm \frac{2}{3})$ % Test duration 21 days (56 days) **Test criteria** Capacitance change $\frac{\Delta C}{C}$ $\leqq \pm 3\%$ ($\pm 5\%$) Dissipation factor change Δ tan δ $\leqq 3 \times 10^{-3}$ at 50 Hz Insulation resistance $\geqq 50\%$ (10%) of the minimum value at delivery
Resistance to vibration Test F_C: Vibration partial test B 1 in accordance with DIN 40 046, sheet 8 and IEC publication 68-2-6	Duration of endurance conditioning 6 hours Frequency range 10 to 55 Hz Displacement amplitude 0.75 mm (conforming to max. 10 g) For this test the capacitors must be fixed by clamps
Solder conditions	Temperature of the solder bath max. 260 °C (500 °F) Soldering duration max. 10 s Distance to the soldering joint min. 6 mm
Maximum capacitance drift i_z	$+6$ -3 %
Dissipation factor tan δ measured at 20 °C (68 °F) and 50 Hz	Maximum value 20×10^{-3} Average value 15×10^{-3}
Self inductance	approx. 20 nH (for 6 mm lead length at both ends)

[1] For these increased requirements the values in parentheses apply.

Impedance Z
as a function of frequency f
(typical values)



Category voltage U_C
at dc operation

$1.0 \times U_R$
$1.5 \times U_R$ peak voltage[1]
$2.0 \times U_R$ up to max. 1 hour
$2.5 \times U_R$ up to max. 1 min.
$3.0 \times U_R$ up to max. 1 s
} for inevitable exceptions only, not for systematic switchings[2]

U_R = rated voltage

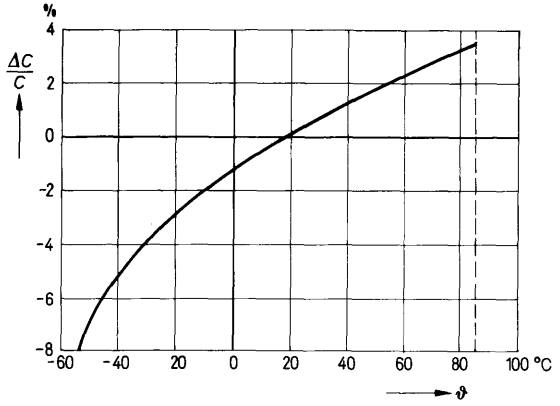
Category voltage U_C
at ac operation

perm. Vac_{rms}; 50 Hz	Peak voltage
20 Vac	25 Vac

For use in pulse discharge circuits (VDE 0560, part 1 and 2, § 51) MKL capacitors are not suitable. In place of that Siemens MPS and MKV capacitors (B 25***) are recommended.

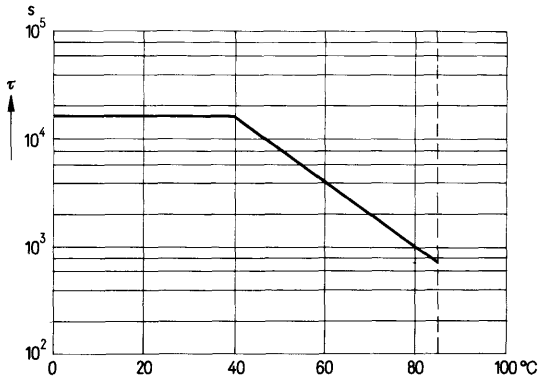
Reversible capacitance change $\frac{\Delta C}{C}$

as a function of temperature
at 1 kHz (typical values)



[1] This peak voltage refers to 2,000 hours at +20 °C (68 °F) or 200 hours at +85 °C (185 °F).
[2] Throughout the entire load duration, the times are summed up thereby permitting the electrical values to deviate up to the limit indicated for failures due to variations.
[3] The sum of the dc voltage and the peak value of an ac voltage superimposed on the dc voltage shall not exceed the rated voltage.

Insulation
(time constant τ)
as a function of temperature



Minimum value[1]	5 000 s
Average value	>15 000 s

Pulse handling capability (voltage rate of rise U_{pp}/τ and pulse characteristic k_O). Maximum permissible voltage change per time unit with non-sinusoidal voltages (pulse, sawtooth).

Rated voltage U_R		Capacitor length 34 mm	Capacitor length 46 mm
63 V	U_{pp}/τ	1.5 V/µs	1.0 V/µs
	k_O	190 V²/µs	126 V²/µs

For a voltage swing $U_{pp} < U_R$ the value of the permissible voltage rate of rise U_{pp}/τ can be multiplied with the factor U_R/U_{pp}. The data of the nomogram must be accounted for periodic pulses. See also "General Technical Data", para 5.26.

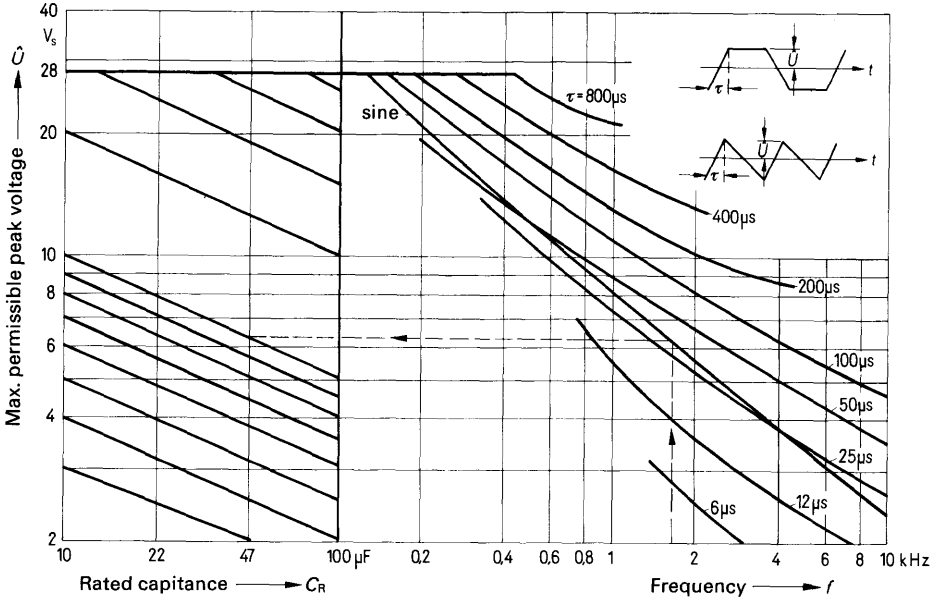
[1] The indicated values are applicable at the time of delivery. During operational life the insulation may decrease for a short period to about 10% of the values at the time of delivery, especially when the max. permissible humidity of 95% is applied for a long period.

Ac power handling capacity at higher frequencies

The maximum permissible peak voltage $\hat{U}$ for sinusoidal and non-sinusoidal voltage (pulse, sawtooth, trapezoidal voltages) can be obtained from the nomogram, where the following limit values $\hat{U}_l$ are not allowed to be exceeded.

Rated voltage U_R	63 V
Max. ac voltage $\hat{U}_l$	28.5 V

The nomogram is based on 10 °C (18 °F) inherent temperature rise of the capacitor; this must be taken into account when considering the permissible max. temperature.
With trapezoidal voltage load the second harmonic frequency must be assumed.



Example given:

f = 1.7 kHz (repetition frequency)
τ = sine (rise time)
C = 47 µF (capacitance)

According to the dashed line on the graph above this gives a max. peak voltage $\hat{U}$ of about 10 V.

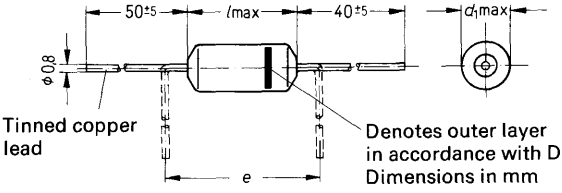
Metallized lacquer film capacitors

High reliability version

Designation in accordance with DIN 41 379: MKU capacitors. Self-healing tubular capacitor winding with cellulose acetate dielectric. Enclosed in tubular metal case, shrunk sleeve insulated, epoxy resin sealed face ends. Central axial leads.

MKL capacitors with quality assessment

Capacitors of the type series B 32 112 are permitted for Space applications (see B 95 020 in the section "Qualified Types"). They comply with the GfW specifications CF 100, CF 104 and have the electronic test symbol.
GfW = Gesellschaft für Weltraumforschung (German Space Agency).



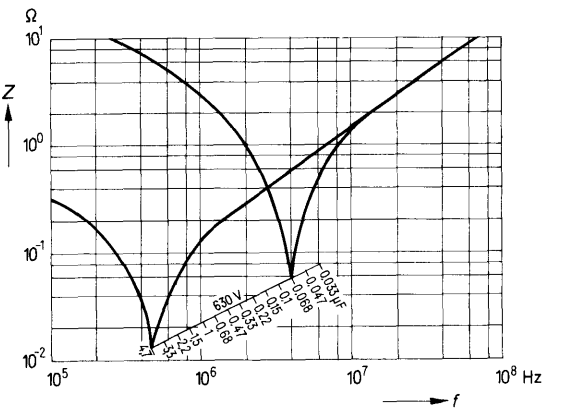
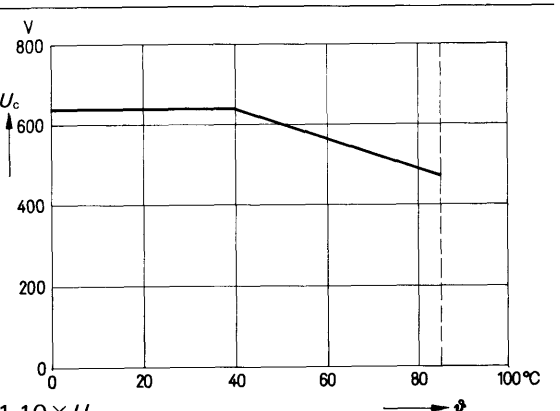
l	e
18.5	22.5
21	25
25	30
34	40

Minimum lead bend: 1 mm from face ends.

Rated capacitance µF	Tolerance	Rated voltage	Dimensions d×l	Ordering code
0,033	±20%≙M	630 Vdc	8,4×18,5	B32112-A2333-M
0,047			8,4×18,5	B32112-A2473-M
0,068			8,4×21	B32112-A2683-M
0,1			8,4×21	B32112-A2104-M
0,15			9,4×25	B32112-A2154-M
0,22			9,4×25	B32112-A2224-M
0,33			11,7×25	B32112-A2334-M
0,47			12,7×25	B32112-A2474-M
0,68			11,7×34	B32112-A2684-M
1			13,7×34	B32112-A2105-M
1,5			16,7×34	B32112-A2155-M
2,2			18,7×34	B32112-A2225-M
3,3			23,7×34	B32112-A2335-M
4,7			25,9×34	B32112-A2475-M

Climatic category in accordance with DIN 40 040	**F P F / L R**
Minimum limit temperature	**F** −55 °C/−67 °F
Maximum limit temperature	**P** +85 °C/+185 °F
Humidity category	**F**[1] average relative humidity ≦75%; 95% for 30 days per year; continuously 85% for the remaining days; occasionally
Failure quota	**L** 300 failures per 10^9 component hours
Load duration	**R** 10^5 h
Relative failure rate	$300 \times 10^{-9} \times 10^5 = 3\%$
Failure criteria	
Total failure	Short or open circuit
Failure due to variations	Capacitance change $\frac{\Delta C}{C}$ $> {}^{+18}_{-9}\%$
	Dissipation factor tan δ > 1.5 × max. limit value
	Insulation resistance < 150 MΩ (≦0.33 µF)
	< 50 s (>0.33 µF)
Test category in accordance with DIN 40 045, or IEC publication 68-1	**55/085/21** or **55/085/56**[2], respectively
	Conditions
	Test temperature +40 °C/+104 °F
	Relative humidity $(93 \pm \frac{2}{3})$ %
Damp heat test in accordance with DIN 40 046, sheet 5 or IEC publication 68-2-3	Test duration 21 days (56 days)
	Test criteria
	Capacitance change $\frac{\Delta C}{C}$ ≦±3% (5%)
	Dissipation factor change Δ tan δ ≦3×10^{-3} at 1 kHz
	≦5×10^{-3} at 10 kHz
	Insulation resistance ≧50% (10%) of the minimum value at delivery
Resistance to vibration Test F_C: Vibration partial test B 1 in accordance with DIN 40 046, sheet 8 and IEC publication 68-2-6	Duration of endurance conditioning 6 hours Frequency range 10 to 55 Hz Displacement amplitude 0.75 mm (conforming to max. 10 g) Capacitors with a diameter > 15 mm must be fixed by clamps for this test
Solder conditions	Temperature of the solder bath max. 260 °C (500 °F) Soldering duration max. 10 s Distance to the soldering joint min. 6 mm

[1] The capacitors also meet the test conditions of humidity category E as to DIN 40 040.
[2] For these increased requirements the values in parentheses apply.

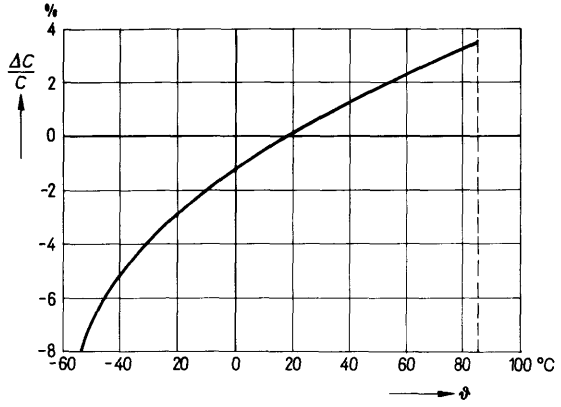
Maximum capacitance drift i_Z	$+6$ -3 %
Dissipation factor tan δ measured at at 1 kHz 20 °C (68 °F) at 10 kHz	Maximum values 15×10^{-3} for $C > 1$ µF 25×10^{-3} for $C \leqq 1$ µF Average values 12×10^{-3} for $C > 1$ µF 20×10^{-3} for $C \leqq 1$ µF
Self inductance	approx. 20 nH (for 3 mm lead length at both ends)
Impedance Z as a function of frequency f (typical values)	
Category voltage U_C at dc operation	
max. 2000 h	$1.10 \times U_C$
max. 1 h	$1.25 \times U_C$
max. 1 min	$1.50 \times U_C$
Category voltage U_C[1)] at ac operation for milliseconds (e. g. switchings)	200 Vac permissible Vac_{rms} at 50 Hz $1.5 \times U_C$

[1)] The sum of the dc voltage and the peak value of an ac voltage superimposed on the dc voltage shall not exceed the rated voltage.

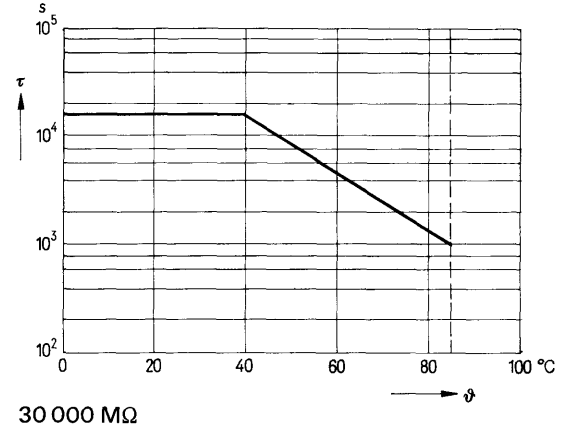
For use in pulse discharge circuits (VDE 0560, part 1 and 2, § 51) MKL capacitors are not suitable. In place of that Siemens MPS and MKV capacitors (B 25***) are recommended.

Reversible capacitance change $\frac{\Delta C}{C}$

as a function of temperature at 1 kHz (typical values)



Insulation
(time constant τ)
as a function of temperature



Minimum value[1]	
for $C \leqq 0.33$ µF	30 000 MΩ
for $C > 0.33$ µF	10 000 s
Average value	>20 000 s

[1] The indicated values are applicable at the time of delivery. During operational life the insulation may decrease for a short period to about 10% of the values at the time of delivery especially when the max. permissible humidity of 95% is applied for a long period, or when the capacitor is operated close to the maximum limit temperature.

Pulse handling capability (voltage rate of rise U_{pp}/τ and pulse characteristic k_O). Maximum permissible voltage change per time unit with non-sinusoidal voltages (pulse, sawtooth).

Rated voltage U_R		Capacitor length			
		18.5 mm	21 mm	25 mm	34 mm
630 V	U_{pp}/τ	20 V/µs	13 V/µs	9 V/µs	5 V/µs
	k_O	25 000 V²/µs	16 400 V²/µs	11 400 V²/µs	6 300 V²/µs

For a voltage swing $U_{pp} < U_R$ the value of the permissible voltage rate of rise U_{pp}/τ can be multiplied with the factor U_R/U_{pp}. See also "General Technical Data", para 5.2.6.

Ac power handling capacity at higher frequencies

Values upon request; a voltage/time diagram is requested.

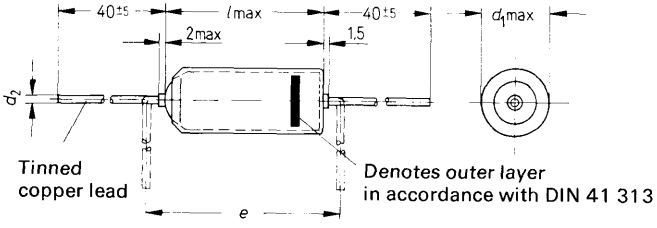
Metallized lacquer film capacitors

High reliability version

Designation in accordance with DIN 41 379: MKU capacitors.
Self-healing tubular capacitor winding with plastic films as dielectric. Hermetically sealed in tubular, non-magnetic metal case (cartridge), shrunk sleeve insulated.
Leads: Insulated lead-in wire at one end and centrally soldered in cartridge at the other.

MKL capacitors with quality assessment

Capacitors of the type series B 32 120 are available on request as "quality assessed component" under the ordering code B 95 017 (refer to section "Qualified Types"). They are subject to quality supervision and have the electronic test symbol.



Dimensions in mm

l	17.5	21.5	25.5	35.5
e	25	30	35	45

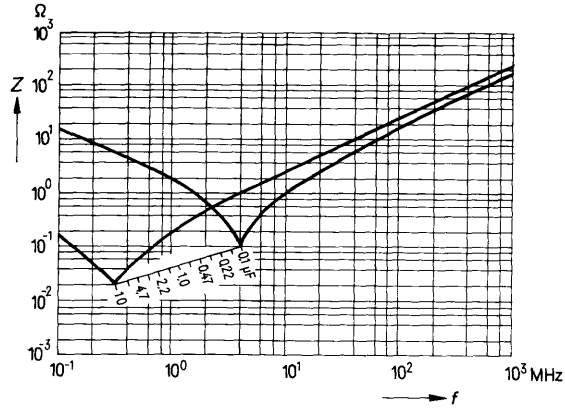
d_1	≦8.2	≥11.2
dia d_2	0.6	0.8

Minimum lead bend: 2 mm from face ends.

Rated voltage		63 Vdc	100 Vdc	160 Vdc	250 Vdc
Rated capacitance		Dimensions $d_1 \times l$			
µF	Tolerance	Ordering code			
0,1	±20%≙M	–	6,2×17,5 B32120-E0104-M	8,2×17,5 B32120-D1104-M	8,2×21,5 B32120-D2104-M
0,15		6,2×17,5 B32120-F9154-M	6,9×17,5 B32120-D0154-M	8,2×17,5 B32120-D1154-M	11,2×21,5 B32120-D2154-M
0,22		6,2×17,5 B32120-F9224-M	6,9×17,5 B32120-D0224-M	8,2×21,5 B32120-D1224-M	11,2×21,5 B32120-D2224-M
0,33		6,9×17,5 B32120-E9334-M	8,2×17,5 B32120-D0334-M	8,2×21,5 B32120-D1334-M	11,2×21,5 B32120-D2334-M
0,47		8,2×17,5 B32120-E9474-M	8,2×21,5 B32120-D0474-M	11,2×21,5 B32120-D1474-M	11,2×21,5 B32120-D2474-M
0,68		8,2×17,5 B32120-E9684-M	8,2×21,5 B32120-D0684-M	11,2×25,5 B32120-D1684-M	11,2×25,5 B32120-D2684-M
1	(±10%≙K)[1] ±20%≙M	8,2×21,5 B32120-E9105-M	11,2×21,5 B32120-D0105-M	11,2×25,5 B32120-D1105-M	15 ×25,5 B32120-D2105-M
1,5		8,2×21,5 B32120-E9155-M	11,2×25,5 B32120-D0155-M	15 ×25,5 B32120-D1155-M	15 ×25,5 B32120-D2155-M
2,2		11,2×21,5 B32120-E9225-M	11,2×25,5 B32120-D0225-M	11,2×35,5 B32120-D1225-M	15 ×35,5 B32120-D2225-M
3,3		11,2×25,5 B32120-E9335-M	11,2×35,5 B32120-D0335-M	15 ×35,5 B32120-D1335-M	16,5×35,5 B32120-D2335-M
4,7		11,2×25,5 B32120-E9475-M	11,2×35,5 B32120-D0475-M	16,5×35,5 B32120-D1475-M	21 ×35,5 B32120-D2475-M
6,8		11,2×35,5 B32120-E9685-M	15 ×35,5 B32120-D0685-M	18,2×35,5 B32120-D1685-M	21 ×35,5 B32120-D2685-M
10		15 ×35,5 B32120-E9106-M	16,5×35,5 B32120-D0106-M	21 ×35,5 B32120-D1106-M	25,8×35,5 B32120-D2106-M

[1] Closer capacitance tolerances upon request.

Climatic category in accordance with DIN 40 040	**F P C / L R**
Minimum limit temperature	**F** −55 °C/−67 °F
Maximum limit temperature	**P** +85 °C/+185 °F
Humidity category	**C** average relative humidity ≦95%; max. value 100% including dew precipitation
Failure quota	**L** 300 failures per 10^9 component hours
Load duration	**R** 10^5 h
Relative failure rate	$300 \times 10^{-9} \times 10^5 = 3\%$
	At a load generally occurring in practice a failure quota of 2×10^{-9}/h can be assumed
Failure criteria	
Total failure	Short or open circuit
Failure due to variation	Capacitance change $\frac{\Delta C}{C}$ $>\pm 4\%$
	Dissipation factor tan δ $>$ 1.5 × max. limit value
	Insulation resistance $<$ 150 MΩ (≦0.33 µF)
	$<$ 50 s (>0.33 µF)
Test category in accordance with DIN 40 045, or IEC publication 68-1	**55/085/56**
	Conditions
	Test temperature +40 °C/+104 °F
Damp heat test in accordance with DIN 40 046, sheet 5 or IEC publication 68-2-3	Relative humidity $(93\pm\frac{2}{3})$ %
	Test duration 56 days
	Test criteria
	Capacitance change $\frac{\Delta C}{C}$ ≦±2%
	Dissipation factor change Δ tan δ ≦3×10^{-3} at 1 kHz ≦5×10^{-3} at 10 kHz
	Insulation resistance ≧50% of the minimum value at delivery
Resistance to vibration Test F_C: Vibration partial test B 1 in accordance with DIN 40 046, sheet 8 and IEC publication 68-2-6	Duration of endurance conditioning 6 hours Frequency range 10 to 55 Hz Displacement amplitude 0.75 mm (conforming to max. 98.1 m/s² or 10 g)
Solder conditions	Temperature of the solder bath max. 260 °C (500 °F) Soldering duration max. 10 s Distance to the soldering joint min. 6 mm
Max. capacitance drift i_Z	±2%

Dissipation factor tan δ measured at 20 °C/68 °F	Maximum values / Average values
at 1 kHz	20×10^{-3} for $C > 1.0$ µF / 15×10^{-3} for $C > 1.0$ µF
at 10 kHz	36×10^{-3} for $C \leqq 1.0$ µF / 25×10^{-3} for $C \leqq 1.0$ µF
Self inductance	approx. 20 nH (for 6 mm lead length at both ends)
Impedance Z as a function of frequency f (typical values)	
Category voltage U_C at dc operation	$1.0 \times U_R$ $1.5 \times U_R$ peak voltage[1] $2.0 \times U_R$ up to max. 1 hour $2.5 \times U_R$ up to max. 1 min. $3.0 \times U_R$ up to max. 1 sec. } for inevitable exceptions only, not for systematic switchings[2] U_R = rated voltage

[1] The peak voltage refers to 2,000 hours at +20 °C (68 °F) or 200 hours at +85 °C (185 °F).
[2] Throughout the entire load duration, the times are summed up thereby permitting the electrical values to deviate up to the limit indicated for failures due to variations.

Category voltage U_C[1]
at ac operation

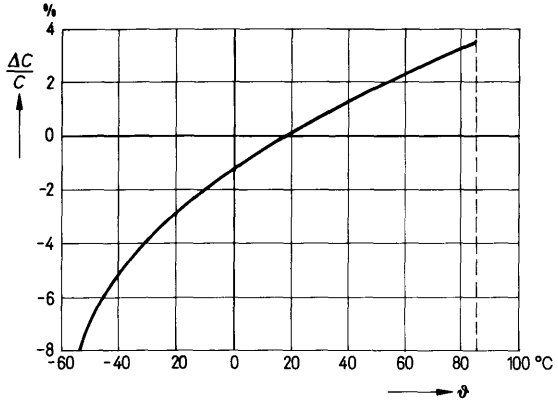
Rated voltage	U_C perm. Vac$_{rms}$ at 50 Hz	Peak voltage[2]
63 Vdc	20 Vac	25 Vac
100 Vdc	35 Vac	50 Vac
160 Vdc	60 Vac	80 Vac
250 Vdc	90 Vac	125 Vac

$1.5 \times U_C$ for milliseconds

For use in pulse discharge circuits (VDE 0560, part 1 and 2, § 51) MKL capacitors are not suitable. In place of that Siemens MPS and MKV capacitors (B 25***) are recommended.

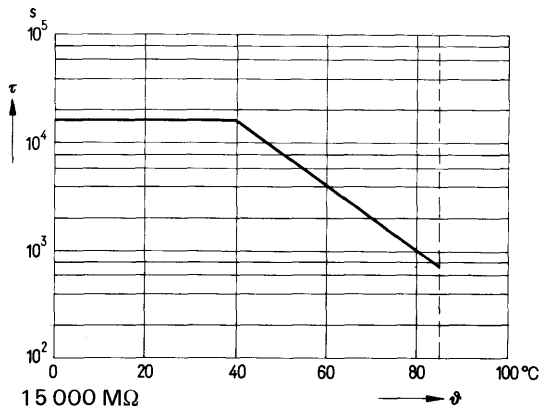
Reversible capacitance change $\frac{\Delta C}{C}$

as a function of temperature at 1 kHz (typical values)



[1] The sum of the dc voltage and the peak value of an ac voltage superimposed on the dc voltage shall not exceed the rated voltage.
[2] The peak voltage refers to 2,000 hours at +20 °C (68 °F) and 200 hours at +85 °C (185 °F).

Insulation
(time constant τ)
as a function of temperature



Minimum value[1]	
$C \leqq 0.33$ µF	15 000 MΩ
$C > 0.33$ µF	5 000 s
Average value	>15 000 s

Pulse handling capability (voltage rate of rise U_{pp}/τ and pulse characteristic k_O). Maximum permissible voltage change per time unit with non-sinusoidal voltages (pulse, sawtooth).

Rated voltage U_R		Capacitor length			
		17.5 mm	21.5 mm[2]	25.5 mm	35.5 mm
63 Vdc	U_{pp}/τ	4.5 V/µs	3.0 V/µs	2.0 V/µs	1.2 V/µs
	k_O	567 V²/µs	378 V²/µs	252 V²/µs	151 V²/µs
100 Vdc	U_{pp}/τ	6.5 V/µs	4.5 V/µs	3.0 V/µs	1.7 V/µs
	k_O	1 300 V²/µs	900 V²/µs	600 V²/µs	340 V²/µs
160 Vdc	U_{pp}/τ	10.0 V/µs	6.0 V/µs	4.0 V/µs	2.3 V/µs
	k_O	3 200 V²/µs	1 920 V²/µs	1 280 V²/µs	736 V²/µs
250 Vdc	U_{pp}/τ	–	8.0 V/µs	5.0 V/µs	2.7 V/µs
	k_O		4 000 V²/µs	2 500 V²/µs	1 350 V²/µs

For a voltage swing $U_{pp} < U_R$ the value of the permissible voltage rate of rise U_{pp}/τ can be multiplied with the factor U_R/U_{pp}. The data of the nomogram must be accounted for periodic pulses. See also "General Technical Data", para 5.2.6.

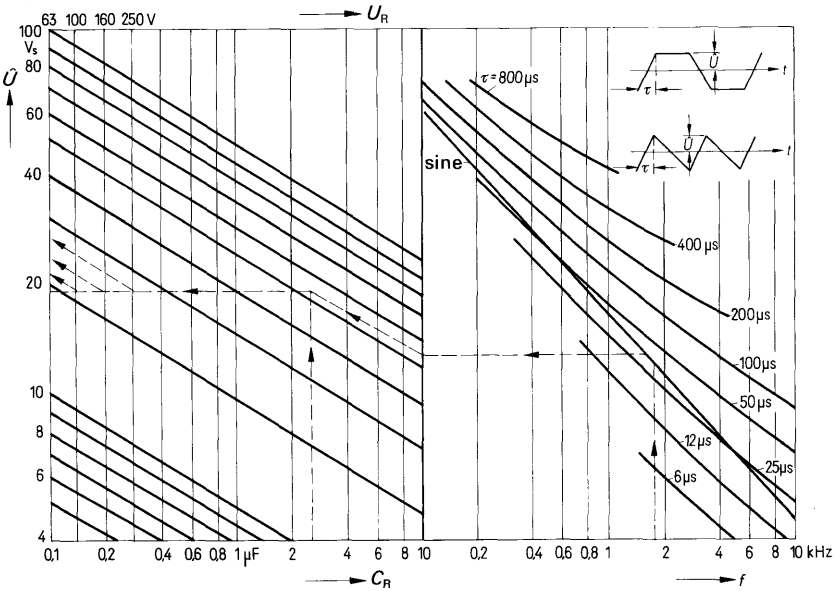
[1] The indicated values are applicable at the time of delivery. During operational life the insulation may decrease for a short period to about 10% of the values at the time of delivery, especially when the max. permissible humidity of 100% is applied for a long period, or when the capacitor is operated close to the maximum limit temperature.
[2] The capacitors 0.1 µF 250 Vdc and 0.15 µF 250 Vdc may be loaded as 17.5 mm long capacitors.

Ac power handling capacity at higher frequencies

The maximum permissible peak voltage $\hat{U}$ for sinusoidal and non-sinusoidal voltage load (pulse, sawtooth, trapezoidal voltages) can be obtained from the nomogram, where the following limit values $\hat{U}_l$ are not allowed to be exceeded.

Rated voltage U_R	63 V	100 V	160 V	250 V
Limit voltage $\hat{U}_l$	28 V	50 V	80 V	125 V

The nomogram is based on 10 °C (18 °F) inherent temperature rise of the capacitor; this must be taken into account when considering the permissible max. temperature.
With trapezoidal voltage load the second harmonic frequency must be assumed.



Example given:

f = 1.7 kHz (repetition frequency)
τ = sine (rise time)
C = 2.5 µF (capacitance)

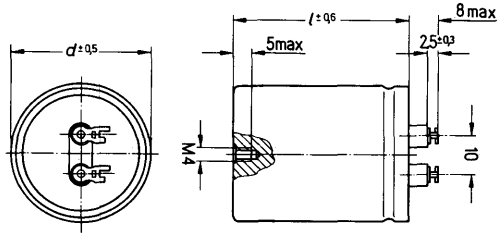
According to the dashed line on the graph above this gives:

for the 63 Vdc type a max. peak voltage $\hat{U}$ of about 19 V
for the 100 Vdc type a max. peak voltage $\hat{U}$ of about 21 V
for the 160 Vdc type a max. peak voltage $\hat{U}$ of about 24 V
for the 250 Vdc type a max. peak voltage $\hat{U}$ of about 26 V

Metallized lacquer film capacitors

High reliability version

Designation in accordance with DIN 41 379: MKU capacitors. Self-healing tubular capacitor winding with cellulose acetate dielectric. Hermetically sealed in tubular case, metal cover with ceramic lead-throughs and solder tag connections.

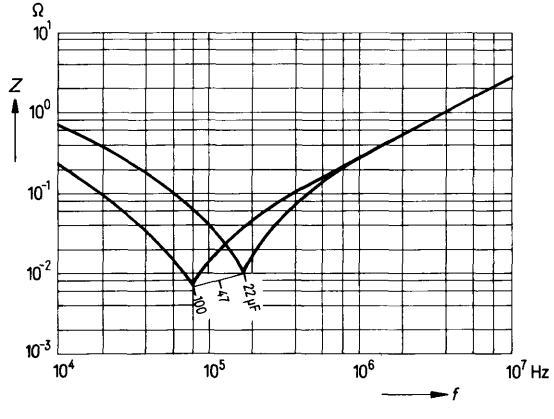


Dimensions in mm

Rated capacitance µF	Tolerance	Rated voltage	Dimensions $d \times l$	Ordering code
22	±20%≙M	100 Vdc	25 × 38	B32121-J0226-*
47	±10%≙K		32 × 38	B32121-J0476-*
100			40 × 50	B32121-J0107-*

When ordering, the code letter for the requested tolerance must be substituted for *

Climatic category in accordance with DIN 40 040	**F P C / L R**
Minimum limit temperature	**F** −55 °C/ −67°F
Maximum limit temperature	**P** +85 °C/ +185°F
Humidity category	**C** average relative humidity ≦95% max. value 100% including dew precipitation
Failure quota	**L** 300 failures per 10^9 component hours
Load duration	**R** 10^5 h
Relative failure rate	$300 \times 10^{-9} \times 10^5 = 3\%$ At a load generally occurring in practice a failure quota of 2×10^{-9}/h can be assumed
Failure criteria	
Total failure	Short or open circuit
Failure due to variation	Capacitance change $\frac{\Delta C}{C}$ >±4% Dissipation factor tan δ >1.5 × max. limit value Insulation resistance <50 s

Test category in accordance with DIN 40 045 and IEC publ. 68-1 Damp heat test in accordance with DIN 40 046, sheet 5, or IEC publ. 68-2-3	**55/085/56** **Conditions** Test temperature +40 °C/+104 °F Relative humidity $(93\pm\frac{2}{3})$ % Test duration 56 days **Test criteria** Capacitance change $\frac{\Delta C}{C}$ $\leqq\pm 2\%$ Dissipation factor change $\Delta \tan\delta$ $\leqq 3\times10^{-3}$ (at 50 Hz) Insulation resistance $\geqq$ 50% of the minimum value at delivery
Resistance to vibration Test F_C: Vibration partial test B 1 in accordance with DIN 40 046, sheet 8 and IEC publ. 68-2-6	Duration of endurance conditioning 6 hours Frequency range 10 to 55 Hz Displacement amplitude 0.75 mm (conforming to max. 10 g)
Solder conditions	Temperature of the solder bath max. 260 °C (500 °F) Soldering duration max. 10 s
Maximum capacitance drift i_z	$\pm 2\%$
Dissipation factor tan δ measured at 20 °C/68 °F and 50 Hz	Maximum value 20×10^{-3} Average value 15×10^{-3}
Self inductance	approx. 40 nH
Impedance Z as a function of frequency f (typical values)	

Category voltage U_C
at dc operation

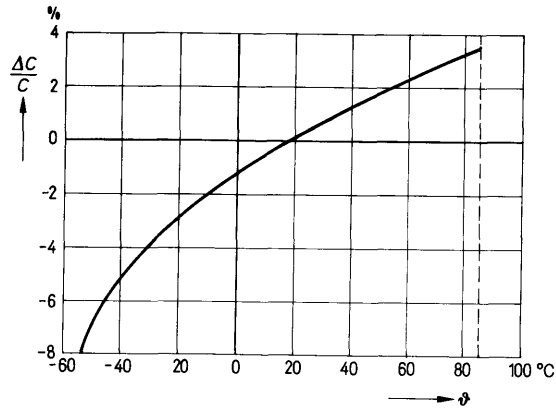
$1.0 \times U_R$
$1.5 \times U_R$ peak voltage[1]
$2.0 \times U_R$ up to max. 1 hour
$2.5 \times U_R$ up to max. 1 min
$3.0 \times U_R$ up to max. 1 sec.
} for inevitable exceptions only, not for systematic switchings[2]
(U_R = rated voltage)

Category voltage U_C
at ac operation

Rated voltage	U_C perm. Vac $_{rms}$[3] at 50 Hz	Peak voltage
100 Vdc	35 Vac	50 Vac
1.5 × U_c for milliseconds (e. g. switchings)		

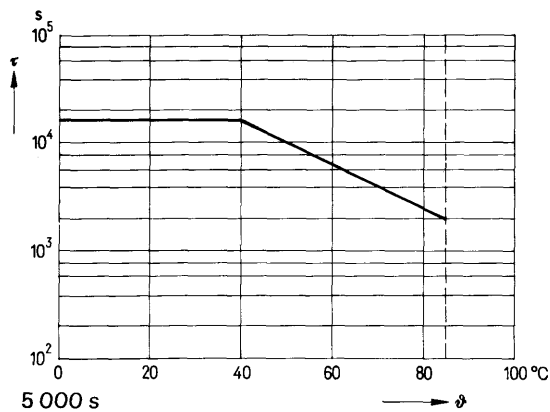
For use in pulse discharge circuits (VDE 0560, part 1 and 2, § 51) MKL capacitors are not suitable. In place of that Siemens MPS and MKV capacitors (B 25***) are recommended.

Reversible capacitance change $\frac{\Delta C}{C}$
as a function of temperature
at 1 kHz (typical values)



[1] The peak voltage refers to 2,000 hours at +20 °C (68 °F) and 200 hours at +85 °C (185 °F).
[2] Throughout the entire load duration, the times are summed up thereby permitting the electrical values to deviate up to the limit indicated for failures due to variations.
[3] The sum of the dc voltage and the peak value of an ac voltage superimposed on the dc voltage shall not exceed the rated voltage.

Insulation
(time constant τ)[1)]
as a function of temperature



Minimum value 5 000 s
Average value >15 000 s
measured at 20 °C (68 °F)

Pulse handling capability (voltage rate of rise U_{pp}/τ and pulse characteristic k_O).
Maximum permissible voltage change per time unit with non-sinusoidal voltages (pulse, sawtooth).

Rated voltage U_R		Capacitor length 38 mm	Capacitor length 50 mm
100 Vdc	U_{pp}/τ k_O	2 V/µs 400 V²/µs	1.2 V/µs 250 V²/µs

For a voltage swing $U_{pp} < U_R$ the value of the permissible voltage rate of rise U_{pp}/τ can be multiplied with the factor U_R/U_{pp}. See also "General Technical Data", para 5.2.6.

Ac power handling capacity at higher frequencies

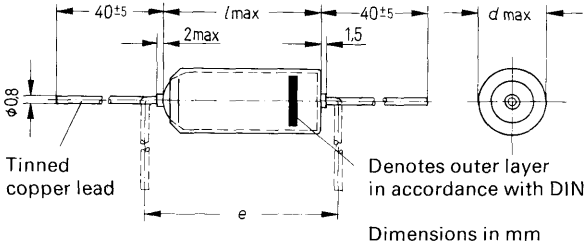
Values upon request; a voltage/time diagram is requested.

[1)] The indicated values are applicable at the time of delivery. During operational life the insulation may decrease for a short period to about 10% of the values at the time of delivery, especially when the max. permissible humidity of 100% is applied for a long period, or when the capacitor is operated close to the maximum limit temperature.

Metallized lacquer film capacitors

High reliability version

Designation in accordance with DIN 41 379: MKU capacitors.
Self-healing tubular capacitor winding with plastic film as dielectric. Hermetically sealed in tubular non-magnetic metal case (cartridge), shrunk sleeve insulated. Leads: insulated lead-in wire at one end, centrally soldered in cartridge at the other. For capacitors with a low rated voltage see B 32 120.



Dimensions in mm

l	*e*
21	30
25	35
25.5	35
29	37.5
35.5	45

Minimum lead bend: 2 mm from face ends.

Rated capacitance µF	Tolerance	Rated voltage	Dimensions *d*×*l*	Ordering code
0,033	±20%≙M	630 Vdc	8,2×21	B32122-A2333-M
0,047			8,2×21	B32122-A2473-M
0,068			8,2×25	B32122-A2683-M
0,1			11,2×21	B32122-A2104-M
0,15			11,2×29	B32122-A2154-M
0,22			11,2×29	B32122-A2224-M
0,33			11,2×29	B32122-A2334-M
0,47			15 ×25,5	B32122-A2474-M
0,68			15 ×25,5	B32122-A2684-M
1			15 ×35,5	B32122-A2105-M
1,5			16,5×35,5	B32122-A2155-M
2,2			21 ×35,5	B32122-A2225-M
3,3			25,8×35,5	B32122-A2335-M

Climatic category in accordance with DIN 40 040	**F P C / L R**
Minimum limit temperature	**F** −55 °C/−67 °F
Maximum limit temperature	**P** +85 °C/+185 °F
Humidity category	**C** average relative humidity ≦95%; max. value 100% including dew precipitation
Failure quota	**L** 300 failures per 10^9 component hours
Load duration	**R** 10^5 h
Relative failure rate	$300 \times 10^{-9} \times 10^5 = 3\%$
Failure criteria	
Total failure	Short or open circuit
Failure due to variation	Capacitance change $\frac{\Delta C}{C}$ $> \pm 4\%$
	Dissipation factor tan δ $>$ 1.5 × max. limit value
	Insulation resistance $<$ 150 MΩ (≦0.33 µF)
	$<$ 50 s (>0.33 µF)
Test category in accordance with DIN 40 045, or IEC publication 68-1	**55/085/56**
	Conditions
	Test temperature +40 °C/+104 °F
Damp heat test in accordance with DIN 40 046, sheet 5 or IEC publication 68-2-3	Relative humidity $(93 \pm \frac{2}{3})$ %
	Test duration 56 days
	Test criteria
	Capacitance change $\frac{\Delta C}{C}$ ≦±2%
	Dissipation factor ≦3×10^{-3} at 1 kHz
	change Δ tan δ ≦5×10^{-3} at 10 kHz
	Insulation resistance ≧50% of the minimum value at delivery
Resistance to vibration Test F_C: Vibration partial test B 1 in accordance with DIN 40 046, sheet 8 and IEC publication 68-2-6	Duration of endurance conditioning 6 hours Frequency range 10 to 55 Hz Displacement amplitude 0.75 mm (conforming to max. 10 g)
Solder conditions	Temperature of the solder bath max. 260 °C (500 °F) Soldering duration max. 10 s Distance to the soldering joint min. 6 mm

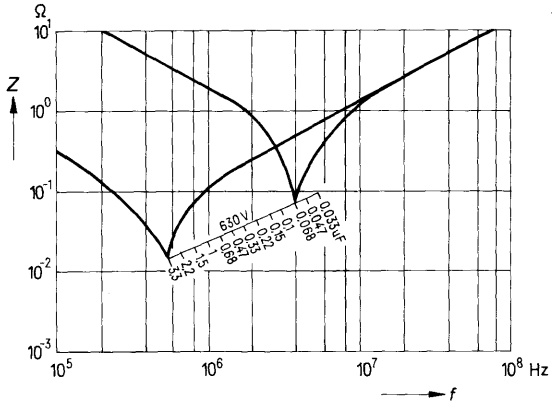
Maximum capacitance drift i_z	±2%

Dissipation factor tan δ
measured at 20 °C (68 °F)

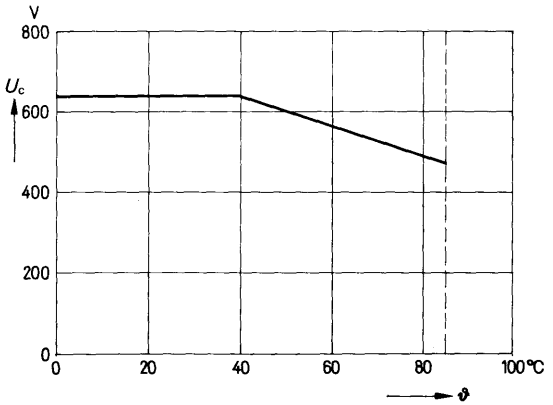
	Maximum values	Average values
at 1 kHz	15×10^{-3} for $C > 1.0$ µF	12×10^{-3} for $C > 1.0$ µF
at 10 kHz	25×10^{-3} for $C \leqq 1.0$ µF	20×10^{-3} for $C \leqq 1.0$ µF

Self inductance: approx. 20 nH (for 3 mm lead length at both ends)

Impedance Z
as a function of frequency f
(typical values)



Category voltage U_C
at dc operation
as a function of ambient temperature



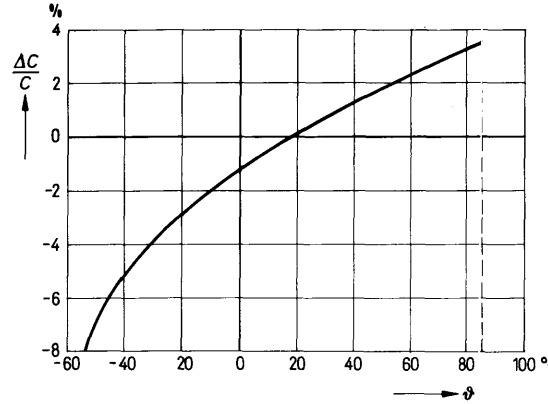
max. 2000 hours	$1.10 \times U_C$
max. 1 hour	$1.25 \times U_C$
max. 1 min.	$1.50 \times U_C$

Category voltage U_C[1]	
at ac operation at 50 Hz	200 Vac
for milliseconds (e. g. switchings)	$1.5 \times U_C$

For use in pulse discharge circuits (VDE 0560, part 1 and 2, § 51) MKL capacitors are not suitable. In place of that Siemens MPS and MKV capacitors (B 25***) are recommended.

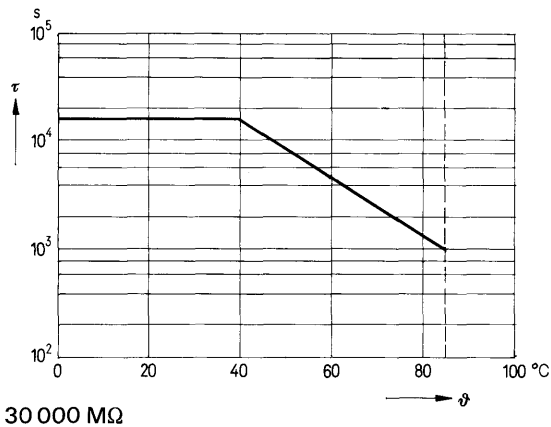
Reversible capacitance change $\frac{\Delta C}{C}$

as a function of temperature at 1 kHz (typical values)



[1] The sum of the dc voltage and the peak value of an ac voltage superimposed on the dc voltage shall not exceed the rated voltage.

Insulation
(time constant τ)
as a function of temperature



Minimum value[1]	
for $C \leqq 0.33$ µF	30 000 MΩ
for $C > 0.33$ µF	10 000 s
Average value	>20 000 s

Pulse handling capability (voltage rate of rise U_{pp}/τ and pulse characteristic k_O). Maximum permissible voltage change per time unit with non-sinusoidal voltages (pulse, sawtooth).

Rated voltage U_R		Capacitor length 21 mm	25 mm	25.5 mm	29 mm	35.5 mm
630 Vdc	U_{pp}/τ	20 V/µs	9 V/µs	9 V/µs	9 V/µs	5 V/µs
	k_O	25 000 V²/µs	11 400 V²/µs	11 400 V²/µs	11 400 V²/µs	6 300 V²/µs

For a voltage swing $U_{pp} < U_R$ the value of the permissible voltage rate of rise U_{pp}/τ can be multiplied with the factor U_R/U_{pp}. See also "General Technical Data", para 5.2.6.

Ac power handling capacity at higher frequencies

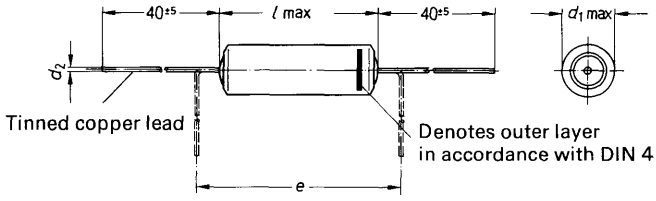
Values upon request; a voltage/time diagram is requested.

[1] The indicated values are applicable at the time of delivery. During operational life the insulation may decrease for a short period to about 10% of the values at the time of delivery, especially when the max. permissible humidity of 100% is applied for a long period, or when the capacitor is operated close to the maximum limit temperature.

MKT Capacitors
Metallized Polyester Capacitors

Metallized polyester capacitors – High reliability version
(previous designation: MKH capacitors)

Self-healing tubular capacitor winding with polyethyleneterephthalate dielectric.Enclosed in metal tube, shrunk sleeve insulated, epoxy resin sealed face ends. Central axial leads.



d_1	≦7	≧8
dia d_2	0.6	0.8

l	e
17.5	22.5
21	25
24	30
33	37.5

Dimensions in mm

Minimum lead bend: 1 mm from face ends.

Rated voltage		250 Vdc	400 Vdc	630 Vdc
Rated capacitance		Dimensions $d_1 \times l$		
µF	Tolerance	Ordering code		
6800 pF	± 10% ≙ K ± 20% ≙ M		5 × 17,5 B32220–L6682–*	8 × 17,5 B32220–K8682–*
0,01		5 × 17,5 B32220–K3103–*	6 × 17,5 B32220–K6103–*	8 × 17,5 B32220–K8103–*
0,015		6 × 17,5 B32220–K3153–*	7 × 21 B32220–K6153–*	8 × 21 B32220–K8153–*
0,022		6 × 17,5 B32220–K3223–*	7 × 21 B32220–K6223–*	8 × 21 B32220–K8223–*
0,033		6 × 17,5 B32220–K3333–*	8 × 24 B32220–K6333–*	8 × 24 B32220–K8333–*
0,047		8 × 17,5 B32220–K3473–*	8 × 24 B32220–K6473–*	10,3 × 24 B32220–K8473–*
0,068		8 × 21 B32220–K3683–*	10,3 × 24 B32220–K6683–*	10,3 × 24 B32220–K8683–*
0,1		8 × 21 B32220–K3104–*	10,3 × 24 B32220–K6104–*	10,3 × 33 B 32220–K8104–*

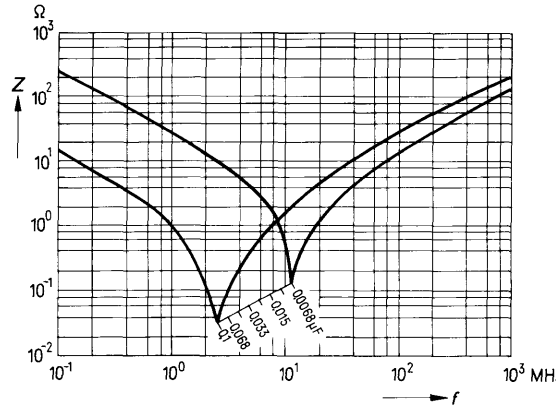
* When ordering, the code letter for the requested tolerance must be substituted for *.

Climatic category in accordance with DIN 40040	**F M F / L R**
Minimum limit temperature	**F** − 55 °C/− 67 °F
Maximum limit temperature	**M**[1] +100 °C/ 212 °F
Humidity category	**F**[2] average relative humidity ≦75%; 95% for 30 days per year; continuously 85% for the remaining days; occasionally
Failure quota	**L** 300 failures per 10^9 component hours
Load duration Relative failure rate	**R** 10^5 hours $300 \times 10^{-9} \times 10^5 = 3\%$
Failure criteria Total failure	Short or open circuit
Failure due to variation	Capacitance change $\frac{\Delta C}{C}$ $>\pm 10\%$ Dissipation factor tan δ $>2 \times$ max. limit value Insulation resistance <150 MΩ
Test category in accordance with DIN 40045 and IEC publ. 68-1	**55/100/21 or 55/100/56**[3]
Damp heat test in accordance with DIN 40046, sheet 5, or IEC publ. 68-2-3	**Conditions** Test temperature +40 °C/104 °F Relative humidity $(93 \pm \frac{2}{3})$ % Test duration 21 days (56 days) **Test criteria** Capacitance change $\frac{\Delta C}{C}$ $\leqq \pm 5\%$ Dissipation factor change $\Delta \tan \delta$ $\leqq 3 \times 10^{-3}$ at 1 kHz $\leqq 5 \times 10^{-3}$ at 10 kHz Insulation resistance ≧50% (20%) of the minimum value at delivery
Resistance to vibration Test F_C: Vibration partial test B 1 in accordance with DIN 40046, sheet 8 and IEC publ. 68-2-6	Duration of endurance conditioning 6 hours Frequency range 10 to 55 Hz Displacement amplitude 0.75 mm (conforming to max. 10 g)

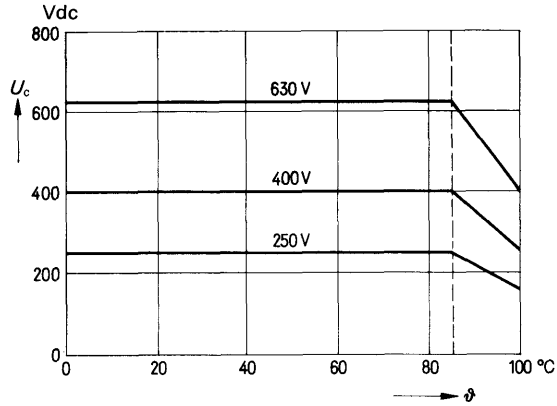
[1] Shelf and service lifet at temperatures >100 to 125 °C / 212 to 257 °F max. 1,000 hours.
[2] The capacitors also meet the test conditions of humidity category E as to DIN 40040.
[3] For these increased requirements the values in parentheses apply.

Solder conditions	Temperature of the solder bath max. 260 °C/500 °F Soldering duration max. 10 s Min. distance to the soldering joint min. 6 mm
Maximum capacitance drift i_z	±3%
Dissipation factor tan δ typical values measured at 20 °C/68 °F	

	Maximum value	Average value
for 1 kHz	8×10^{-3}	5×10^{-3}
for 10 kHz	15×10^{-3}	13×10^{-3}
for 100 kHz	30×10^{-3}	25×10^{-3}

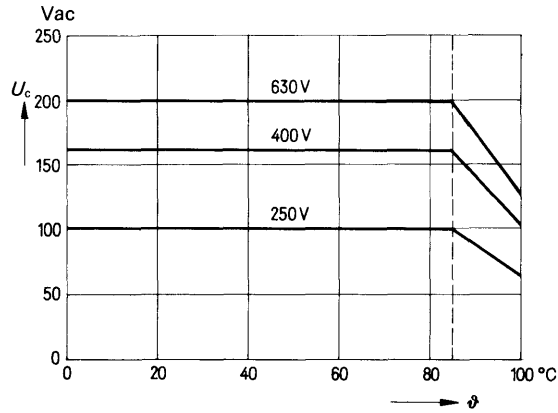
Self inductance	approx. 20 nH (for 3 mm lead length at both ends)
Impedance Z as a function of frequency f (typical values)	

Category voltage U_C
at dc operation
as a function of ambient temperature



2,000 hours at 40 °C/104 °F	$1.25 \times U_C$
for milliseconds (e. g. switchings)	$1.50 \times U_C$

Category voltage U_C
at ac operation
as a function of ambient temperature

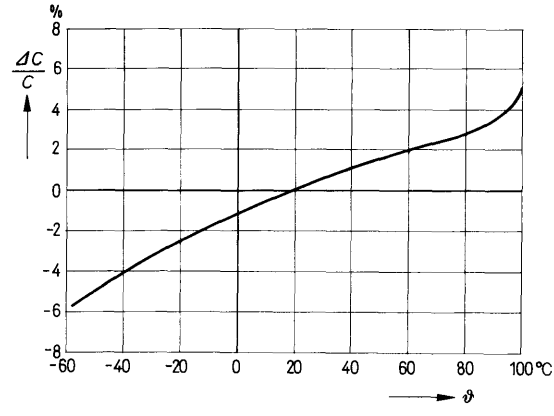


for milliseconds (e. g. switchings)	$1.50 \times U_C$

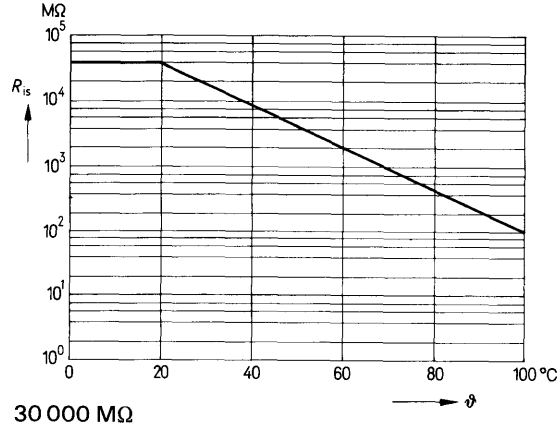
For use in pulse discharge circuits (VDE 0560, part 1 and 2, § 51) MKT capacitors are not suitable. In place of that Siemens MPS and MKV capacitors (B 25***) are recommended.

Reversible capacitance change $\frac{\Delta C}{C}$

as a function of temperature at 1 kHz (typical values)



Insulation resistance
as a function of temperature



Minimum value[1]	30 000 MΩ
Average value	>75 000 MΩ

[1] The indicated values are applicable at the time of delivery. During operational life the insulation may decrease for a short period to about 10% of the values at the time of delivery, especially when the max. permissible humidity of 95% is applied for a long period, or when the capacitor is operated close to the maximum limit temperature.

Pulse handling capability (voltage rate of rise U_{pp}/τ and pulse characteristic k_O). Maximum permissible voltage change per time unit with non-sinusoidal voltages (pulse, sawtooth).

Rated voltage U_R		Capacitor length			
		17.5 mm	21 mm	24 mm	33 mm
250 Vdc	U_{pp}/τ	10 V/µs	6 V/µs	–	–
	k_O	5 000 V²/µs	3 000 V²/µs	–	–
400 Vdc	U_{pp}/τ	14 V/µs	8 V/µs	7 V/µs	–
	k_O	11 200 V²/µs	6 400 V²/µs	5 600 V²/µs	–
630 Vdc	U_{pp}/τ	20 V/µs	12 V/µs	10 V/µs	6 V/µs
	k_O	25 200 V²/µs	15 120 V²/µs	12 600 V²/µs	7 560 V²/µs

For a voltage swing $U_{pp} < U_R$ the value of the permissible voltage rate of rise U_{pp}/τ can be multiplied with the factor U_R/U_{pp}. See also "General Technical Data", para 5.2.6.

Ac power handling capacity at higher frequencies

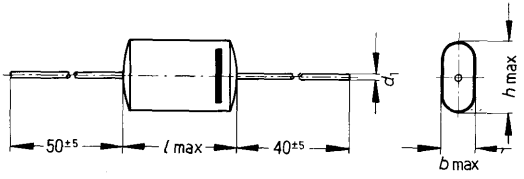
Values upon request; a voltage/time diagram is requested.

Metallized polyester capacitors – High reliability version
(previous designation: MKH capacitors)

Self healing flat capacitor winding with polyethyleneterephthalate dielectric. Insulating film encapsulated capacitor windings, epoxy resin sealed face ends. Central axial leads. Larger types are also available with threaded bolts and/or flat plugs, as required.

MKT capacitors with quality assessment
Axial-leaded capacitors of the type series B 32 227 are permitted for Space applications, (see B 95 042 in the section "Qualified Types"). They comply with the GfW specifications CF 100, CF 102 and have the electronic test symbol.
GfW = Gesellschaft für Weltraumforschung (German Space Agency).

Axial-leaded version



Dimensions in mm

b	≦6	>6 to 8.5	>8.5
dia. d_1	0.6	0.8	1.0

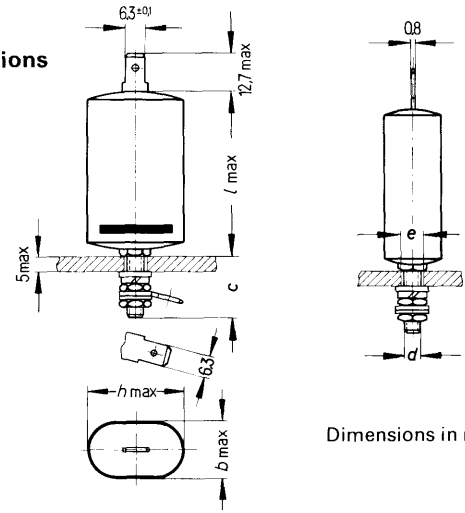
Rated voltage		1 kVdc	1.6 kVdc	2.5 kVdc	4 kVdc	6.3 kVdc
Rated capacitance µF	Tolerance	Dimensions $b \times h \times l$ Code				
0,01		–	–	–	9,5 × 22 × 33 –A4103–M	9 × 21,5 × 45 –A6103–M
0,025		–	6 × 12,5 × 33 –A1253–M	8,5 × 18 × 33 –A2253–M	10 × 22,5 × 45 –A4253–M	13,5 × 32,5 × 46 –J6253–M
0,05	±20% ≙ M	6,5 × 13 × 33 –A0503–M	7 × 16,5 × 33 –A1503–M	12,5 × 25,5 × 34 –J2503–M	12,5 × 31 × 46 –J4503–M	19 × 44 × 46 –J6503–M
0,1		7 × 19,5 × 33 –A0104–M	9,5 × 22 × 33 –A1104–M	10,5 × 26,5 × 46 –J2104–M	16,5 × 42 × 46 –J4104–M	–
0,25		10,5 × 26,5 × 33 –J0254–M	15,5 × 31 × 34 –J1254–M	15,5 × 40,5 × 46 –J2254–M	–	–

Ordering code example B32227–A4103–M

Type — Code according to table

Version with screw connections

h	d	c_{-1}	$e^{+0,5}$
25,5 26,5	M3	11	3,3
31 32,5 40,5	M4	14	4,3
42 44	M5	15	5,3



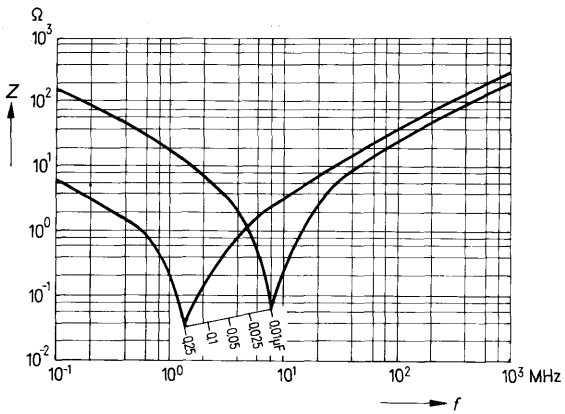
Dimensions in mm

Rated voltage		1 kVdc	1.6 kVdc	2.5 kVdc	4 kVdc	6.3 kVdc
Rated capacitance µF	Tolerance	Dimensions $b \times h \times l$ Code				
0,025	± 20% ≙ M	–	–	–	–	13,5 × 32,5 × 46 –A6253–M
0,05		–	–	12,5 × 25,5 × 34 –A2503–M	12,5 × 31 × 46 –A4503–M	19 × 44 × 46 –A6503–M
0,1		–	–	10,5 × 26,5 × 46 –A2104–M	16,5 × 42 × 46 –A4104–M	–
0,25		10,5 × 26,5 × 33 –A0254–M	15,5 × 31 × 34 –A1254–M	15,5 × 40,5 × 46 –A2254–M	–	–

Climatic category in accordance with DIN 40 040	**G M G / M S**
Minimum limit temperature	**G** – 40 °C/– 40 °F
Maximum limit temperature	**M** +100 °C/ 212 °F
Humidity category	**G** average relative humidity ≦ 65%; 85% for 60 days per year; continuously 75% for the remaining days; occasionally
Failure quota	**M** 1000 failures per 10^9 component hours
Load duration	**S** 3×10^4 hours
Relative failure rate	$1000 \times 10^{-9} \times 3 \times 10^4 = 3\%$
Failure criteria	
Total failure	Short or open circuit
Failure due to variations	Capacitance change $\frac{\Delta C}{C}$ $> \pm 10\%$ Dissipation factor tan δ $> 2 \times$ max. limit value Insulation resistance < 150 MΩ

Test category in accordance with DIN 40045 or IEC publication 68-1 Damp heat test in accordance with DIN 40046, sheet 5 or IEC publication 68-2-3	**40/100/21** **Conditions** Test temperature Relative humidity Test duration **Test criteria** Capacitance change $\frac{\Delta C}{C}$ Dissipation factor change $\Delta \tan \delta$ Insulation resistance	 +40 °C/104 °F $(93 \pm \frac{2}{3})$ % 21 days $\leqq \pm 3\%$ (>0.1 µF) $\leqq \pm 5\%$ ($\leqq 0.1$ µF) $\leqq 3 \times 10^{-3}$ at 1 kHz $\leqq 5 \times 10^{-3}$ at 10 kHz $\geqq 20\%$ of the minimum value at delivery
Resistance to vibration Test F_C: Vibration partial test B 1 in accordance with DIN 40046, sheet 8 and IEC publication 68-2-6	Duration of endurance conditioning Frequency range Displacement amplitude	6 hours 10 to 55 Hz 0.75 mm (conforming to max. 10 g)
Solder conditions	Temperature of the solder bath Soldering duration	max. 260 °C (500 °F) max. 10 s
Maximum capacitance drift i_z	$\pm 3\%$	
Dissipation factor tan δ measured at 20 °C (68 °F)	Maximum values for 1 kHz for 10 kHz	Average values 8×10^{-3} 15×10^{-3}
Self inductance	approx. 30 to 50 nH (for 3 mm lead length at both ends)	

Impedance Z
as a function of frequency f
(typical values)



Category voltage U_C
at dc operation

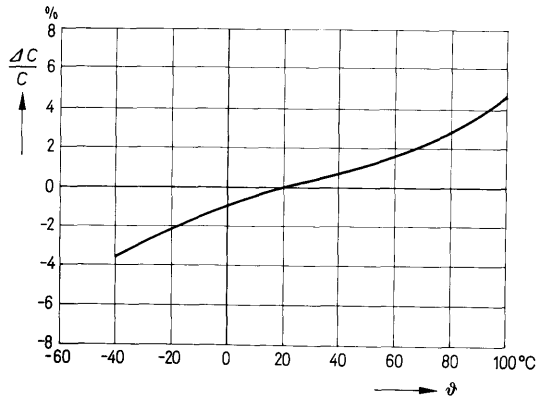
$1.05 \times U_R$	up to	40 °C/104 °F	in accordance with VDE 0560, part 11 (U_R = rated voltage)
$1.04 \times U_R$	up to	50 °C/122 °F	
$1.00 \times U_R$	up to	60 °C/140 °F	
$0.93 \times U_R$	up to	70 °C/158 °F	
$0.64 \times U_R > 70$	up to	85 °C/185 °F	
$0.55 \times U_R > 85$	up to	100 °C/212 °F	

Category voltage U_C
at ac operation

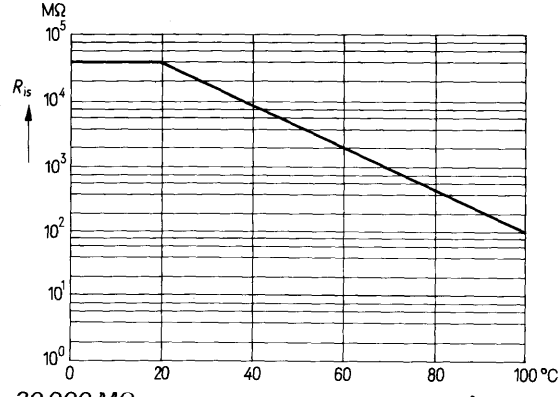
220 Vac up to 70 °C/158 °F
150 Vac > 70 to 100 °C/>158 to 212 °F

For use in pulse discharge circuits (VDE 0560, part 1 and 2, § 51) MKT capacitors are not suitable. In place of that Siemens MPS and MKV capacitors (B 25***) are recommended.

Reversible capacitance change $\frac{\Delta C}{C}$
as a function of temperature
at 1 kHz (typical values)



Insulation resistance
as a function of temperature



Minimum value[1)] 30 000 MΩ
Average value >75 000 MΩ
measured at 20 °C (68 °F)
100 Vdc, 1 min

Pulse handling capability (voltage rate of rise U_{pp}/τ and pulse characteristic k_O).
Maximum permissible voltage change per time unit with non-sinusoidal voltage load (pulse, sawtooth).

Rated voltage U_R		Capacitor length 33 mm / 34 mm	Capacitor length 45 mm / 46 mm
1.0 kVdc	U_{pp}/τ k_O	10 V/µs 20 000 V²/µs	–
1.6 kVdc	U_{pp}/τ k_O	15 V/µs 48 000 V²/µs	–
2.5 kVdc	U_{pp}/τ k_O	25 V/µs 125 000 V²/µs	12.5 V/µs 62 500 V²/µs
4.0 kVdc	U_{pp}/τ k_O	40 V/µs 320 000 V²/µs	20 V/µs 160 000 V²/µs
6.3 kVdc	U_{pp}/τ k_O	–	40 V/µs 500 000 V²/µs

For a voltage swing $U_{pp} < U_R$ the value of the permissible voltage rate of rise U_{pp}/τ can be multiplied with the factor U_R/U_{pp}. See also "General Technical Data", para 5.2.6.

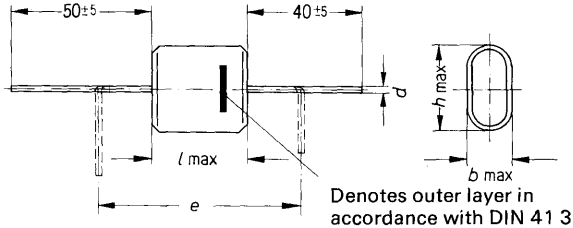
Ac power handling capacity at higher frequencies

Values upon request; a voltage/time diagram is requested.

[1)] The indicated values are applicable at the time of delivery. During operational life the insulation may decrease for a short period to about 10% of the values at the time of delivery, especially when the max. permissible humidity of 85% is applied for a long period, or when the capacitor is operated close to the maximum limit temperature.

Metallized polyester capacitors – High reliability version
(previous designation: MKH capacitors)

Self-healing flat capacitor winding with polyethyleneterephthalate dielectric. Enclosed in oval metal tube, coated with a cementing Makrofol® film, expoxy resin sealed face ends. Central axial leads.



Denotes outer layer in accordance with DIN 41 313

Dimension in mm

b	dia. *d*	*l*	*e*
≦5	0.6	25	27.5
>5	0.8	34	37.5

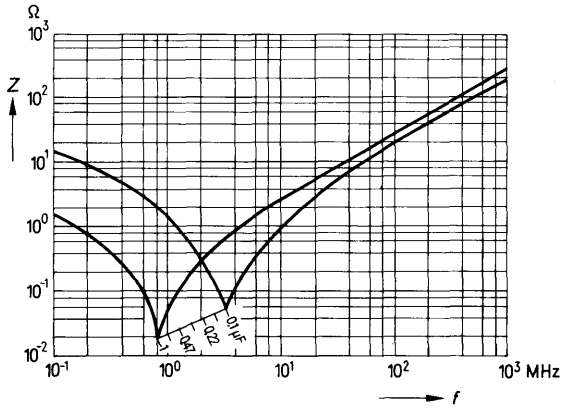
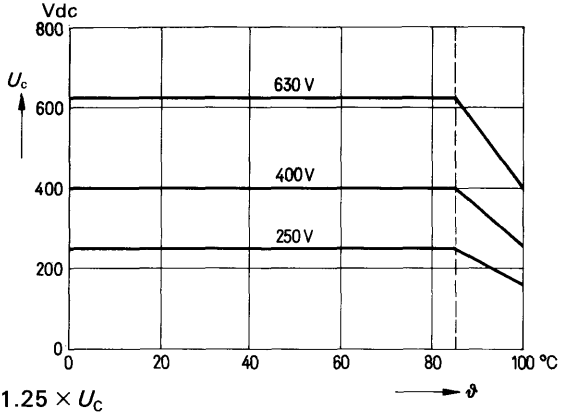
Minimum lead bend: 1 mm from face ends.

Rated voltage perm. Vac_{rms} at 50 Hz		250 Vdc 100 Vac	400 Vdc 160 Vac	630 Vdc 200 Vac
Rated capacitance		Dimensions $b \times h \times l$		
µF	Tolerance	Ordering code		
0,1		5 × 11,3 × 25 B32229-A2104-•	–	–
0,15		5 × 11,3 × 25 B32229-A2154-•	6 × 15,4 × 34 B32229-A4154-•	7,9 × 17,3 × 34 B32229-A6154-•
0,22	± 20% ≙ M	6 × 15,4 × 25 B32229-A2224-•	6 × 15,4 × 34 B32229-A4224-•	7,9 × 17,3 × 34 B32229-A6224-•
0,33	± 10% ≙ K	7,9 × 17,3 × 25 B 32229-A2334-•	7,9 × 17,3 × 34 B32229-A4334-•	10,2 × 19,6 × 34 B32229-A6334-•
0,47	± 5% ≙ J	6 × 15,4 × 34 B32229-A2474-•	10,2 × 19,6 × 34 B32229-A4474-•	12,7 × 22,2 × 34 B32229-A6474-•
0,68		7,9 × 17,3 × 34 B32229-A2684-•	12,7 × 22,2 × 34 B32229-A4684-•	13,8 × 26,4 × 34 B32229-A6684-•
1		7,9 × 17,3 × 34 B32229-A2105-•	13,8 × 26,4 × 34 B32229-A4105-•	16,2 × 31,9 × 34 B32229-A6105-•

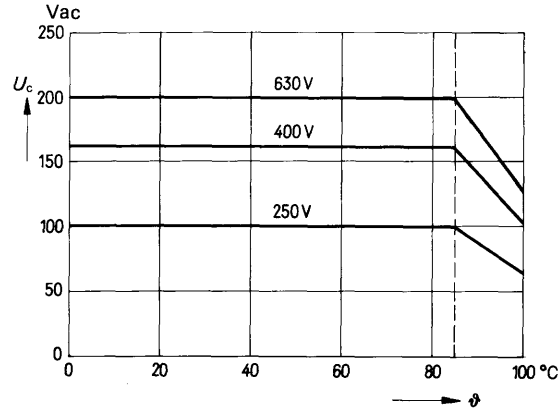
*When ordering, the code letter for the requested tolerance must be substituted for •.

Climatic category in accordance with DIN 40 040	**F M F / L R**
Minimum limit temperature	**F** − 55 °C/− 67 °F
Maximum limit temperature	**M** +100 °C/+212 °F
Humidity category	**F**[1] average relative humidity ≦ 75%; 95% for 30 days per year; continuously 85% for the remaining days; occasionally
Failure quota	**L** 300 failures per 10^9 component hours
Load duration	**R** 10^5 hours
Relative failure rate	$300 \times 10^{-9} \times 10^5 = 3\%$
Failure criteria	
Total failure	Short or open circuit
Failure due to variation	Capacitance change $\frac{\Delta C}{C}$ $> \pm 10\%$
	Dissipation factor tan δ $> 2 \times$ max. limit value
	Insulation resistance < 150 MΩ ($\leqq 0.33$ µF)
	< 50 s (> 0.33 µF)
Test category in accordance with DIN 40 045 and IEC publ. 68-1	**55/100/21 or 55/100/56**[2] respectively
	Conditions
Damp heat test in accordance with DIN 40 046, sheet 5, or IEC publ. 68-2-3	Test temperature +40 °C/104 °F
	Relative humidity $(93 \pm \frac{2}{3})$ %
	Test duration 21 days (56 days)
	Test criteria
	Capacitance change $\frac{\Delta C}{C}$ $\leqq \pm 3\%$ ($\pm 5\%$)
	Dissipation factor change $\Delta \tan \delta$ $\leqq 3 \times 10^{-3}$ at 1 kHz
	$\leqq 5 \times 10^{-3}$ at 10 kHz
	Insulation resistance ≧ 50% of the minimum value at delivery
Resistance to vibration Test F_C: Vibration partial test B 1 in accordance with DIN 40 046, sheet 8 and IEC publ. 68-2-6	Duration of endurance conditioning 6 hours
	Frequency range 10 to 55 Hz
	Displacement amplitude 0.75 mm (conforming to max. 10 g)

[1] The capacitors also meet the test conditions of humidity category E as to DIN 40 040.
[2] For these increased requirements the values in parentheses apply.

Solder conditions	Temperature of the solder bath max. 260 °C/500 °F Soldering duration max. 10 s Distance to the soldering joint min. 6 mm
Capacitance drift i_Z	±3%
Dissipation factor tan δ measured at 23 °C (73.4 °F) for 1 kHz for 10 kHz	Maximum value / Average value 8×10^{-3} / 5×10^{-3} 15×10^{-3} / 13×10^{-3}
Self inductance	approx. 20 nH (per cm lead length and capacitor length)
Impedance Z as a function of frequency f (typical values)	
Category voltage U_C at dc operation as a function of ambient temperature	
2,000 hours at 40 °C/104 °F for milliseconds (e. g. switchings)	$1.25 \times U_C$ $1.50 \times U_C$

Category voltage U_C
at ac operation
as a function of ambient temperature



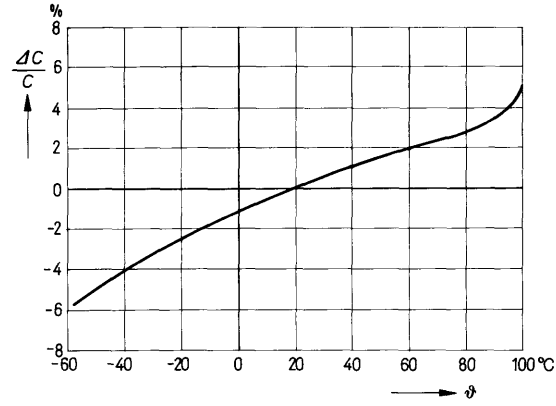
for milliseconds
(e. g. switchings)

$1.50 \times U_C$

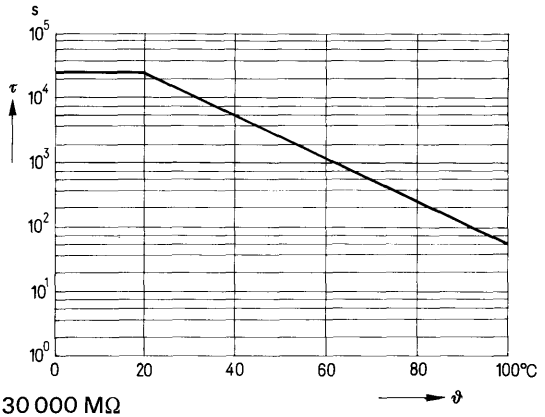
For use in pulse discharge circuits (VDE 0560, part 1 and 2, § 51) MKT capacitors are not suitable. In place of that Siemens MPS and MKV capacitors (B 25***) are recommended.

Reversible capacitance change $\frac{\Delta C}{C}$

as a function of temperature at 1 kHz (typical values)



Insulation
(time constant τ)
as a function of temperature



Minimum value[1]	
for $C \leqq 0.33$ µF	30 000 MΩ
for $C > 0.33$ µF	10 000 s
Average value	
for $C \leqq 0.33$ µF	>90 000 MΩ
for $C > 0.33$ µF	>30 000 s

Pulse handling capability (voltage rate of rise U_{pp}/τ and pulse characteristic k_O).
Maximum permissible voltage change per time unit with non-sinusoidal voltage load (pulse, sawtooth).

Rated voltage U_R		Capacitor length 25 mm	Capacitor length 34 mm
250 Vdc	U_{pp}/τ k_O	5 V/µs 2500 V²/µs	3 V/µs 1500 V²/µs
400 Vdc	U_{pp}/τ k_O	–	5 V/µs 4000 V²/µs
630 Vdc	U_{pp}/τ k_O	–	7 V/µs 8820 V²/µs

For a voltage swing $U_{pp} < U_R$ the value of the permissible voltage rate of rise U_{pp}/τ can be multiplied with the factor U_R/U_{pp}. The data of the nomogram must be accounted for periodic pulses. See also "General Technical Data", para 5.2.6.

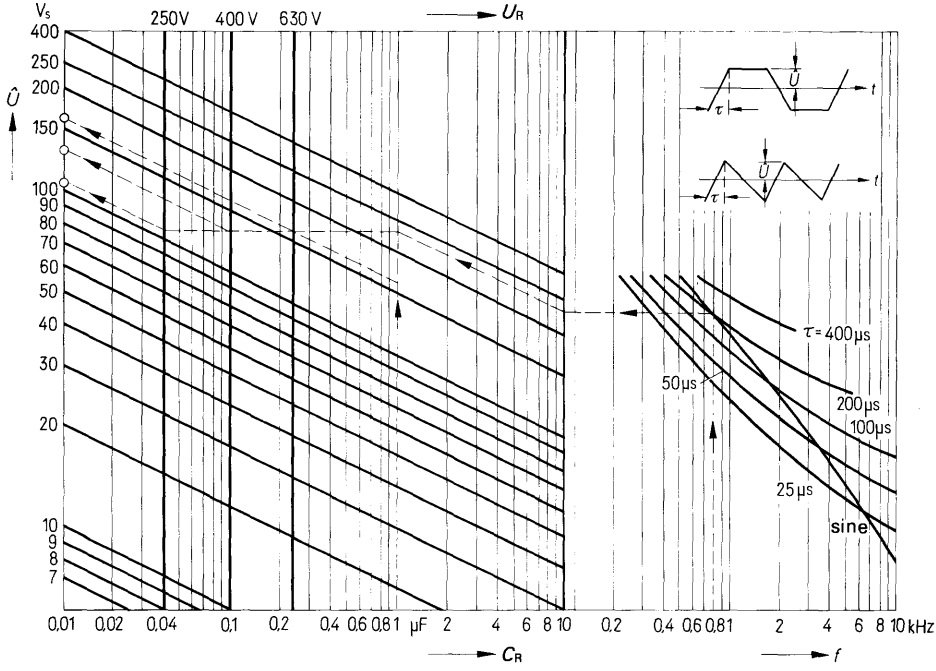
[1] The indicated values are applicable at the time of delivery. During operational life the insulation may decrease for a short period to about 10% of the values at the time of delivery, especially when the max. permissible humidity of 95% is applied for a long period, or when the capacitor is operated close to the maximum limit temperature.

Ac power handling capacity at higher frequencies

The maximum permissible peak voltage $\hat{U}$ for sinusoidal and non-sinusoidal voltages (pulse, sawtooth, trapezoidal voltages) can be obtained from the nomogram, where the following limit values $\hat{U}_l$ are not allowed to be exceeded.

Rated voltage U_R	250 V	400 V	630 V
Limit voltage $\hat{U}_l$	140 V	224 V	280 V

The nomogram is based on 10 °C (18 °F) inherent temperature rise of the capacitor; this must be taken into account when considering the permissible max. temperature. With trapezoidal voltage load the second harmonic frequency must be assumed.



Example given:

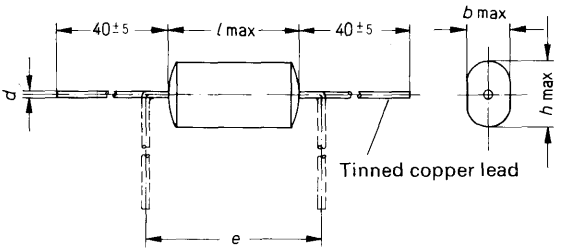
f = 800 Hz (repetition frequency)
τ = 200 µs (rise time)
C = 1 µF (capacitance)

According to the dashed line on the graph above this gives:

for the 250 Vdc type a max. peak voltage $\hat{U}$ of about 105 V
for the 400 Vdc type a max. peak voltage $\hat{U}$ of about 135 V
for the 630 Vdc type a max. peak voltage $\hat{U}$ of about 160 V

Metallized polyester capacitors – Standard version
(previous designation: MKH capacitors)

Self-healing flat capacitor winding with polyethyleneterephthalate dielectric. Capacitor winding coated with insulating material, epoxy resin sealed face ends.
Central axial leads.



l	e	b	dia. d
14	20	≦6	0.6
19	25	>6	0.8
26.5	32.5		
32	37.5		
44	50		

Dimensions in mm

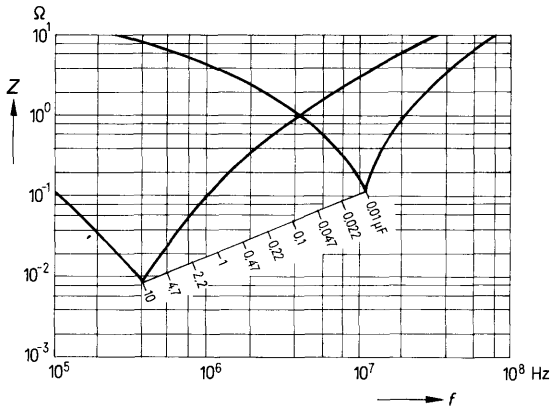
Minimum lead bend: 1 mm from face ends.

Climatic category in accordance with DIN 40 040	**G M G**
Minimum limit temperature	**G** – 40 °C/– 40 °F
Maximum limit temperature	**M** +100 °C/+212 °F
Humidity category	**G** average relative humidity ≦65%; 85% for 60 days per year; continuously 75% for the remaining days, occasionally
Test category in accordance with DIN 40 045 or IEC publication 68-1	**40/100/04**
	Conditions
Damp heat test in accordance with DIN 40 046, sheet 5 or IEC publication 68-2-3	Test temperature +40 °C/104 °F
	Relative humidity $(93 \pm \frac{2}{3})$ %
	Test duration 4 days
	Capacitance change $\frac{\Delta C}{C}$ ≦±5% (≦0.1 µF) ≦±3% (>0.1 µF)
	Dissipation factor change $\Delta \tan \delta$ ≦5×10^{-3} (at 1 kHz) ≦7×10^{-3} (at 10 kHz)
	Insulation resistance ≧20% of the minimum value at delivery

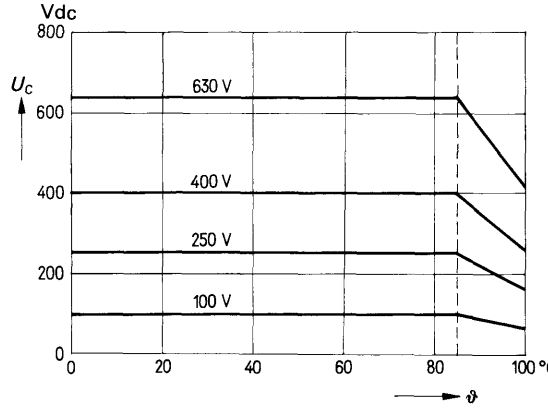
Rated voltage		100 Vdc	250 Vdc	400 Vdc	630 Vdc
Rated capacitance		Dimensions $b \times h \times l$			
µF	Tolerance	Ordering code			
0,01	± 20% ≙ M (± 10% ≙ K)[1]	–	–	–	4,5 × 8 × 14 B32231-C8103-•
0,015		–	–	–	4,5 × 8 × 14 B32231-C8153-•
0,022		–	–	4,5 × 7,5 × 14 B32231-C6223-•	5 × 8,5 × 14 B32231-C8223-•
0,033		–	–	4,5 × 7,5 × 14 B 32231-C6333-•	4,5 × 8 × 19 B32231-C8333-•
0,047		–	4,5 × 8,5 × 14 B32231-A3473-•	4,5 × 8 × 19 B32231-C6473-•	5 × 10,5 × 19 B32231-C8473-•
0,068		–	5,5 × 9 × 14 B32231-A3683-•	4,5 × 8 × 19 B32231-C6683-•	6 × 12 × 19 B32231-C8683-•
0,1		–	4,5 × 8,5 × 14 B32231-A3104-•	5,5 × 8,5 × 19 B32231-C6104-•	5 × 12,5 × 26,5 B32231-C8104-•
0,15		4,5 × 8 × 14 B32231-A1154-•	4,5×8×19 B32231-A3154-•	6,5 × 10 × 19 B32231-C6154-•	6,5 × 14 × 26,5 B32231-C8154-•
0,22		5 × 9 × 14 B32231-A1224-•	4,5×10×19 B32231-A3224-•	5 × 12 × 26,5 B32231-C6224-•	7,5 × 16,5 × 26,5 B32231-C8224-•
0,33		4,5 × 8,5 × 14 B32231-A1334-•	6×10,5× B32231-S3334-•	6 × 13,5 × 26,5 B32231-C6334-•	9 × 16,5 × 32 B32231-J8334-•
0,47		5 × 9 × 19 B32231-A1474-•	4,5 × 11,5 × 26,5 B32231-A3474-•	7 × 16 × 26,5 B32231-C6474-•	11 × 18,5 × 32 B32231-J8474-•
0,68		6 × 10 × 19 B32231-A1684-•	6× ×26,5 B32231-A3684-•	8 × 15,5 × 32 B32231-J6684-•	–
1		7,5×11×19 B32231-A1105-•	6,5×16×26,5 B32231-A3105-•	10,5 × 17,5 × 32 B32231-J6105-•	– –
1,5		6 × 13 × 26,5 B32231-A1155-•	8 × 16 × 32 B32231-J3155-•	8,5 × 24 × 44 B32231-C6155-•	–
2,2		7 × 15,5 × 26,5 B32231-A1225-•	9,5 × 18 × 32 B32231-J3225-•	10 × 25,5 × 44 B32231-C6225-•	–
3,3		9,5 × 16,5 × 26,5 B32231-A1335-•	10,5 × 22 × 32 B32231-J3335-•	14 × 29 × 44 B32231-C6335-•	–
4,7		9 × 18 × 32 B32231-A1475-•	10×25×44 B32232-A3475-•	17,5 × 32,5 × 44 B32231-C6475-•	–
6,8		12,5 × 20 × 32 B32231-A1685-•	12,5×27,5×44 B32231-A3685-•	–	–
10		13,5 × 25 × 32 B32231-A1106-•	16,5×31×44 B32231-A3106-•	–	–

*When ordering, the code letter for the requested tolerance must be substituted for •.

[1] Closer capacitance tolerances available on request.

Resistance to vibration Test F_C: Vibration partial test B 1 in accordance with DIN 40 046, sheet 8, and IEC publication 68-2-6	Duration of endurance conditioning 6 hours Frequency range 10 to 55 Hz Displacement amplitude 0.75 mm (conforming to max. 10 g)
Solder conditions	Temperature of the solder bath max. 260 °C (500 °F) Soldering duration max. 10 s Distance to the soldering joint min. 6 mm
Capacitance drift i_Z	±3%
Dissipation factor tan δ in 10^{-3} measured at 20 °C (68 °F) (typical values)	Maximum value / Average value for $C \leqq 0.047$ µF: at 1 kHz 10/5, at 10 kHz 20/15 $C > 0.047$ to 1 µF: at 1 kHz 10/6, at 10 kHz 25/17 $C > 1$ µF: at 1 kHz 10/7, at 10 kHz –
Self inductance	approx. 10 nH (per cm lead and capacitor length)
Impedance Z as a function of frequency f (typical values)	

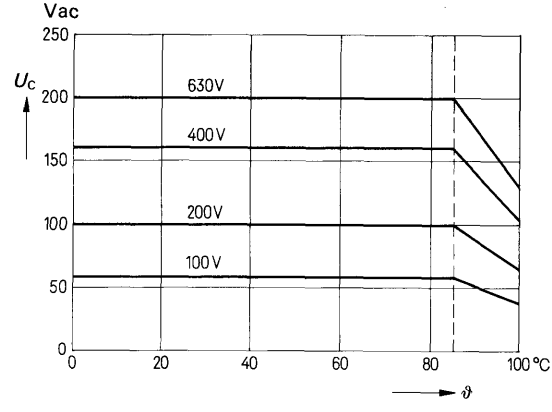
Category voltage U_C
at dc operation
as a function of ambient temperature



2,000 hours at 85 °C/185 °F
for milliseconds
(e. g. switchings)

$1.25 \times U_C$
$1.50 \times U_C$

Category voltage U_C[1)2)]
at ac operation
as a function of ambient temperature



for milliseconds
(e. g. switchings)

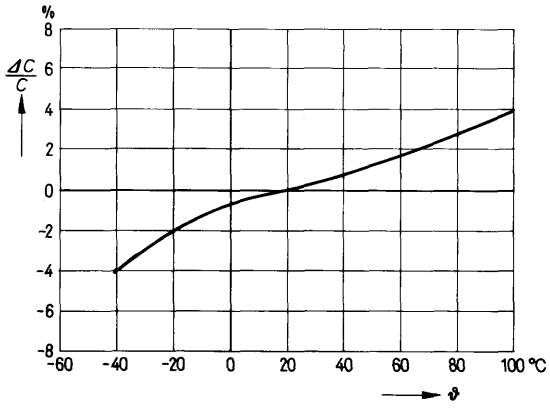
$1.50 \times U_C$

For use in pulse discharge circuits (VDE 0560, part 1 and 2, § 51) MKT capacitors are not suitable. In place of that Siemens MPS and MKV capacitors (B 25***) are recommended.

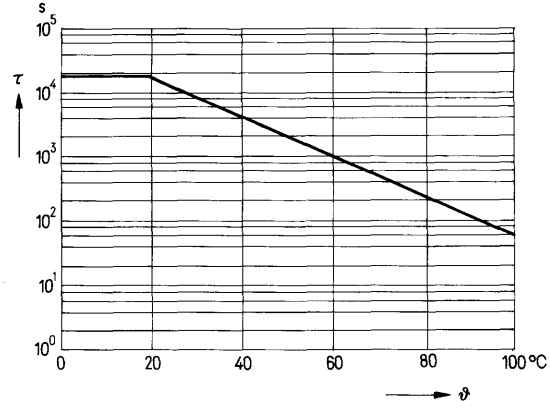
1) The sum of the dc voltage and the peak value of an ac voltage superimposed on the dc voltage shall not exceed the rated voltage.
2) Capacitors of the 630 Vdc series can be used as 250 Vac mains parallel capacitors if it is ensured that voltage peaks occasionally occurring during operation do not exceed peaks of 1000 V.

Reversible capacitance change $\frac{\Delta C}{C}$

as a function of temperature
at 1 kHz (typical values)



Insulation
(time constant τ)
as a function of temperature



	for U_R = 100 Vdc	for U_R > 100 Vdc
Minimum value[1]		
$C \leqq 0.33$ µF	3 000 MΩ	7 500 MΩ
$C > 0.33$ µF	1 000 s	2 500 s
Average value		
$C \leqq 0.33$ µF	>30 000 MΩ	>75 000 MΩ
$C > 0.33$ µF	>10 000 s	>25 000 s

[1] The indicated values are applicable at the time of delivery. During operational life the insulation may decrease for a short period to about 10% of the values at the time of delivery, especially when the maximum permissible humidity of 85% is applied for a long period, or when the capacitor is operated close to the maximum limit temperature.

Pulse handling capability (voltage rate of rise U_{pp}/τ and pulse characteristic k_O). Maximum permissible voltage change per time unit with non-sinusoidal voltage load (pulse, sawtooth).

Rated voltage U_R		Capacitor length 14 mm	19 mm	26.5 mm	32 mm	44 mm
100 Vdc	U_{pp}/τ k_O	6 V/µs 1 200 V²/µs	3 V/µs 600 V²/µs	2 V/µs 400 V²/µs	1.5 V/µs 300 V²/µs	–
250 Vdc	U_{pp}/τ k_O	10 V/µs 5 000 V²/µs	5 V/µs 2 500 V²/µs	3 V/µs 1 500 V²/µs	2.5 V/µs 1 250 V²/µs	2 V/µs 1 000 V²/µs
400 Vdc	U_{pp}/τ k_O	14 V/µs 11 200 V²/µs	7 V/µs 5 600 V²/µs	4 V/µs 3 200 V²/µs	3 V/µs 2 400 V²/µs	2.5 V/µs 2 000 V²/µs
630 Vdc	U_{pp}/τ k_O	20 V/µs 25 000 V²/µs	10 V/µs 12 600 V²/µs	7 V/µs 8 800 V²/µs	5 V/µs 6 300 V²/µs	–

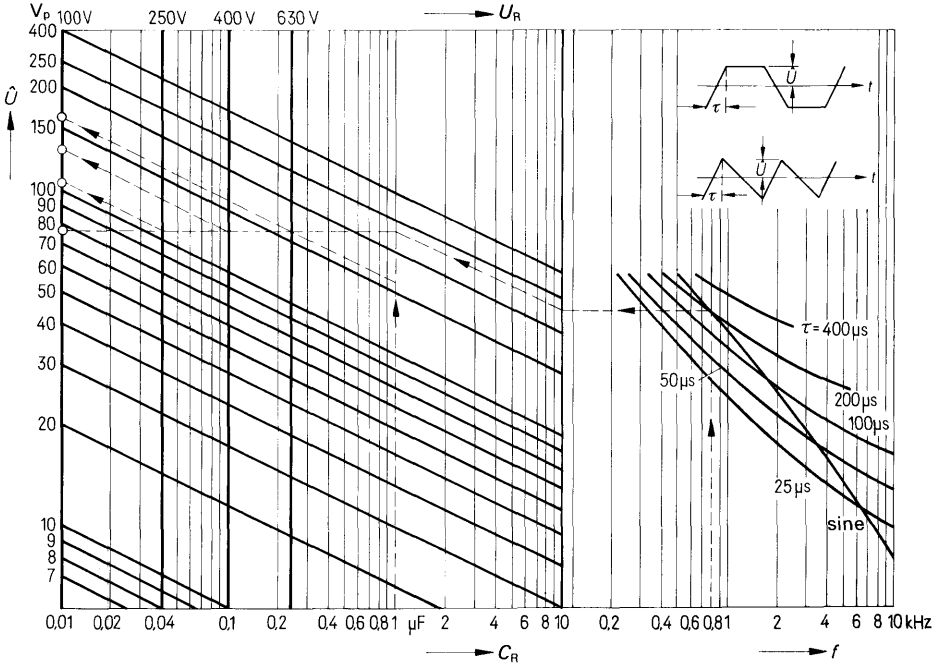
For a voltage swing $U_{pp} < U_R$ the value of the permissible voltage rate of rise U_{pp}/τ can be multiplied with the factor U_R/U_{pp}. The data of the nomogram must be accounted for periodic pulses. See also "General Technical Data", para 5.2.6.

Ac power handling capacity at higher frequencies

The maximum permissible peak voltage $\hat{U}$ for sinusoidal and non-sinusoidal voltage load (pulse, sawtooth, trapezoidal voltages) can be obtained from the nomogram, where the following limit values $\hat{U}_l$ are not allowed to be exceeded.

Rated voltage U_R	100 V	250 V	400 V	630 V
Limit voltage $\hat{U}_l$	84 V	140 V	224 V	280 V

The nomogram is based on 10 °C (50 °F) inherent temperature rise of the capacitor; this must be taken into account when considering the permissible max. temperature.
With trapezoidal voltage load, the second harmonic frequency must be assumed.



Example given:

f = 800 Hz (repetition frequency)
τ = 200 µs (rise time)
C = 1 µF (capacitance)

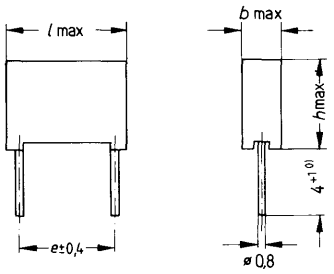
According to the dashed line on the graph above this gives:

for the 100 Vdc type a max. peak voltage $\hat{U}$ of about 75 V
for the 250 Vdc type a max. peak voltage $\hat{U}$ of about 105 V
for the 400 Vdc type a max. peak voltage $\hat{U}$ of about 135 V
for the 630 Vdc type a max. peak voltage $\hat{U}$ of about 160 V

Metallized polyester capacitors – Standard version

(previous designation: MKH capacitors)

Self-healing flat capacitor winding with polyethyleneterephthalate dielectric. Encapsulated in rectangular plastic case, epoxy resin sealed. The case is provided with spacers to improve solderability in the solder bath.
Parallel leads, plug-in. Suitable for use in printed circuits.



Dimensions in mm

l	*e*
13	10
18	15
27	22.5
32	27.5

Rated voltage		100 Vdc	250 Vdc	400 Vdc	630 Vdc
Rated capacitance		Dimensions *b* × *h* × *l*			
µF	Tolerance	Ordering code			
0,01		–	–	4 × 9,5 × 13 B32234-B6103-•	5 × 10,5 × 13 B32234-A8103-•
0,015		–	–	4 × 9,5 × 13 B32234-B6153-•	6 × 11,5 × 13 B32234-A8153-•
0,022	(± 10% ≙ K)[1]	–	–	4 × 9,5 × 13 B32234-B6223-•	6 × 11,5 × 13 B32234-A8223-•
0,033	± 20% ≙ M	–	4 × 9,5 × 13 B32234-B3333-•	5 × 10,5 × 13 B32234-B6333-•	5,5 × 11 × 18 B32234-A8333-•
0,047		–	4 × 9,5 × 13 B32234-B3473-•	5,5 × 11 × 18 B32234-B6473-•	7 × 13 × 18 B32234-A8473-•
0,068		4 × 9,5 × 13 B32234-B1683-•	5 × 10,5 × 13 B32234-A3683-•	5,5 × 11 × 18 B32234-B6683-•	9 × 14,5 × 18 B32234-A8683-•

When ordering the code letter for the requested tolerance must be substituted for•.
[0] available upon request also with 26 ± 4; ordering code: B••••-••••-•2.
[1] Closer capacitance tolerances available upon request.

Rated voltage		100 Vdc	250 Vdc	400 Vdc	630 Vdc
Rated capacitance		Dimensions $b \times h \times l$			
µF	Tolerance	Ordering code			
0,1	(± 5% ≙ J)[1] ± 10% ≙ K ± 20% ≙ M	4 × 9,5 × 13 B32234-B1104-•	5,5 × 11 × 18 B32234-A3104-•	7 × 13 × 18 B32234-B6104-•	7 × 16,5 × 27 B32234-B8104-•
0,15		5 × 10,5 × 13 B32234-A1154-•	5,5 × 11 × 18 B32234-A3154-•	7 × 13 × 18 B32234-B6154-•	8,5 × 18,5 × 27 B32234-B8154-•
0,22		6 × 11,5 × 13 B32234-A1224-•	7 × 13 × 18 B32234-A3224-•	6,5 × 15 × 27 B32234-B6224-•	8,5 × 18,5 × 27 B32234-B8224-•
0,33		5,5 × 11 × 18 B32234-A1334-•	9 × 14,5 × 18 B32234-A3334-•	7 × 16,5 × 27 B32234-B6334-•	11 × 20 × 32 B32234-A8334-•
0,47		5,5 × 11 × 18 B32234-A1474-•	6,5 × 15 × 27 B32234-A3474-•	8,5 × 18,5 × 27 B32234-B6474-•	13 × 22,5 × 32 B32234-A8474-•
0,68		7 × 13 × 18 B32234-A1684-•	7 × 16,5 × 27 B32234-A3684-•	11 × 20 × 32 B32234-B6684-•	–
1		9 × 14,5 × 18 B32234-A1105-•	8,5 × 18,5 × 27 B32234-A3105-•	13 × 22,5 × 32 B32234-B6105-•	–
1,5		7 × 16,5 × 27 B32234-A1155-•	11 × 20 × 32 B32234-A3155-•	–	–
2,2		8,5 × 18,5 × 27 B32234-A1225-•	13 × 22,5 × 32 B32234-A3225-•	–	–
3,3		10,5 × 19 × 27 B32234-S1335-•	–	–	–
4,7		11 × 20 × 32 B32234-A1475-•	–	–	–
6,8		13 × 22,5 × 32 B32234-A1685-•	–	–	–

When ordering, the code letter for the requested tolerance must be substituted for •.
[1] Closer capacitance tolerances available upon request.

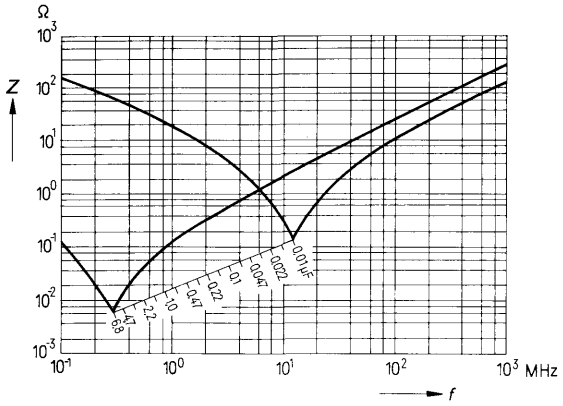
Climatic category in accordance with DIN 40 040 Minimum limit temperature Maximum limit temperature Humidity category	**G M F** **G** – 40 °C/– 40 °F **M** +100 °C/+212 °F **F**[1] average relative humidity ≦75%; 95% for 30 days per year; continuously 85% for the remaining days; occasionally
Test category in accordance with DIN 40 045 or IEC publication 68-1 Damp heat test in accordance with DIN 40 046, sheet 5 or IEC publication 68-2-3	**40/100/21** **Conditions** Test temperature +40 °C/104 °F Relative humidity $(93 \pm \frac{2}{3})$ % Test duration 21 days **Test criteria** Capacitance change $\frac{\Delta C}{C}$ ≦±3% (>0.1 µF) ≦±5% (≦0.1 µF) Dissipation factor change $\Delta \tan \delta$ ≦5×10^{-3} (at 1 kHz) ≦7×10^{-3} (at 10 kHz) Insulation resistance ≧50% of the minimum value at delivery
Resistance to vibration Test F_C: Vibration, partial test B 1 in accordance with DIN 40 046, sheet 8 and IEC publication 68-2-6	Duration of endurance conditioning 6 hours Frequency range 10 to 55 Hz Displacement amplitude 0.75 mm (conforming to max. 10 g)
Solder conditions	Temperature of the solder bath max. 260 °C (500 °F) Soldering duration max. 10 s
Capacitance drift i_z	±3%
Dissipation factor tan δ in 10^{-3} measured at 20 °C (68 °F)	Maximum value / Average value

	for $C \leqq 0.047$ µF	$C > 0.047$ to 1 µF	$C > 1$ µF
at 1 kHz	10/5	10/6	10/7
at 10 kHz	20/15	25/17	–

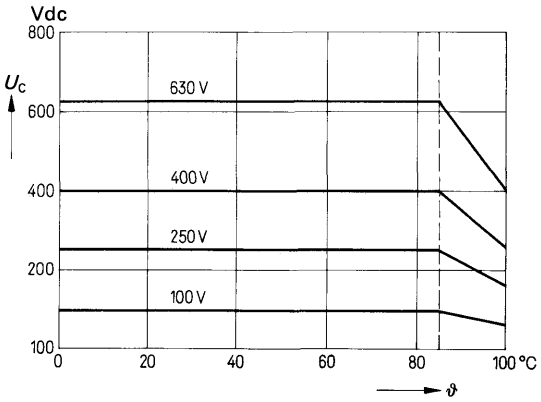
Self inductance	approx. 20 nH (for 3 mm lead length at both ends)

[1] The capacitors also meet the test conditions of humidity category E as to DIN 40040.

Impedance Z
as a function of frequency f
(typical values)

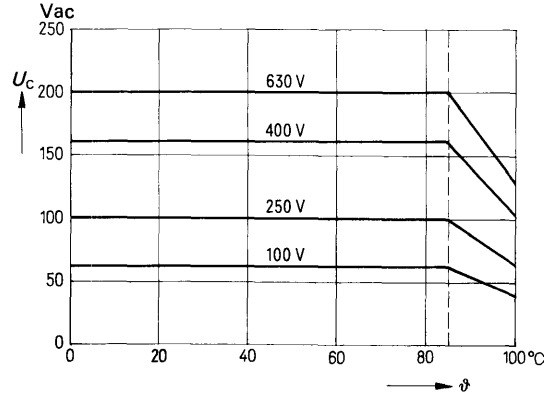


Category voltage U_C
at dc operation
as a function of ambient temperature



2,000 hours at 85 °C/185 °F	$1.25 \times U_C$
for milliseconds	$1.50 \times U_C$
(e. g. switchings)	

Category voltage U_C[1)2)]
at ac operation
as a function of ambient temperature

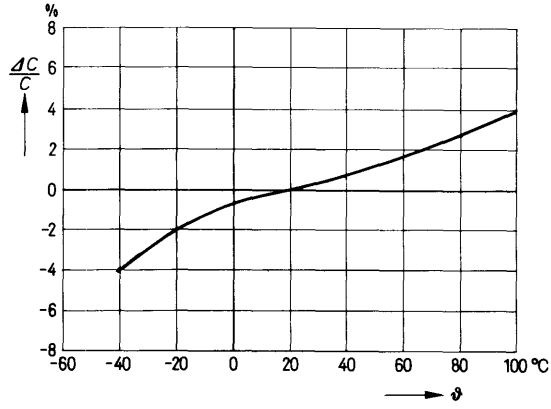


for milliseconds
(e. g. switchings)

$1.50 \times U_C$

For use in pulse discharge circuits (VDE 0560, part 1 and 2, § 51) MKT capacitors are not suitable. In place of that Siemens MPS and MKV capacitors (B 25***) are recommended.

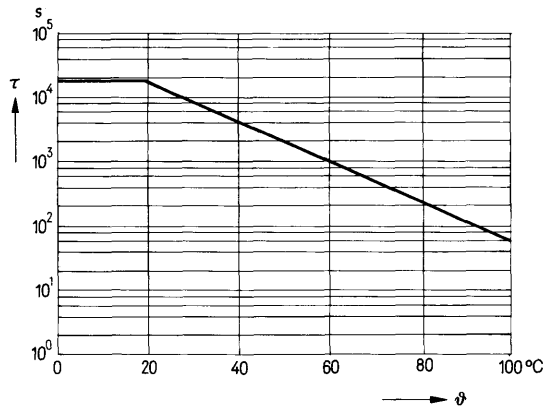
Reversible capacitance change $\frac{\Delta C}{C}$
as a function of temperature at 1 kHz (typical values)



[1)] The sum of dc voltage and peak value of an ac voltage superimposed on a dc voltage shall not exceed the rated voltage.

[2)] Capacitors of the 630 Vdc series can be used as 250 Vac mains parallel capacitors if it is ensured that voltage peaks occasionally occurring during operation do not exceed peaks of 1000 V.

Insulation
(time constant τ)
as a function of temperature



	for U_R = 100 Vdc	for U_R > 100 Vdc
Minimum value[1]		
$C \leqq 0.33$ µF	3 000 MΩ	7 500 MΩ
$C > 0.33$ µF	1 000 s	2 500 s
Average value		
$C \leqq 0.33$ µF	>30 000 MΩ	>75 000 MΩ
$C > 0.33$ µF	>10 000 s	>25 000 s

Pulse handling capability (voltage rate of rise U_{pp}/τ and pulse characteristic k_O). Maximum permissible voltage change per time unit with non-sinusoidal voltages (pulse, sawtooth).

Rated voltage U_R		Capacitor length 13 mm	18 mm	27 mm	32 mm
100 Vdc	U_{pp}/τ	6 V/µs	3 V/µs	2 V/µs	1.5 V/µs
	k_O	1 200 V²/µs	600 V²/µs	400 V²/µs	300 V²/µs
250 Vdc	U_{pp}/τ	10 V/µs	5 V/µs	3 V/µs	2.5 V/µs
	k_O	5 000 V²/µs	2 500 V²/µs	1 500 V²/µs	1 250 V²/µs
400 Vdc	U_{pp}/τ	14 V/µs	7 V/µs	4 V/µs	3 V/µs
	k_O	11 200 V²/µs	5 600 V²/µs	3 200 V²/µs	2 400 V²/µs
630 Vdc	U_{pp}/τ	20 V/µs	10 V/µs	7 V/µs	5 V/µs
	k_O	25 200 V²/µs	12 600 V²/µs	8 820 V²/µs	6 300 V²/µs

For a voltage swing $U_{pp} < U_R$ the value of the permissible voltage rate of rise U_{pp}/τ can be multiplied with the factor U_R/U_{pp}. The data of the nomogram must be accounted for periodic pulses. See also "General Technical Data", para 5.2.6.

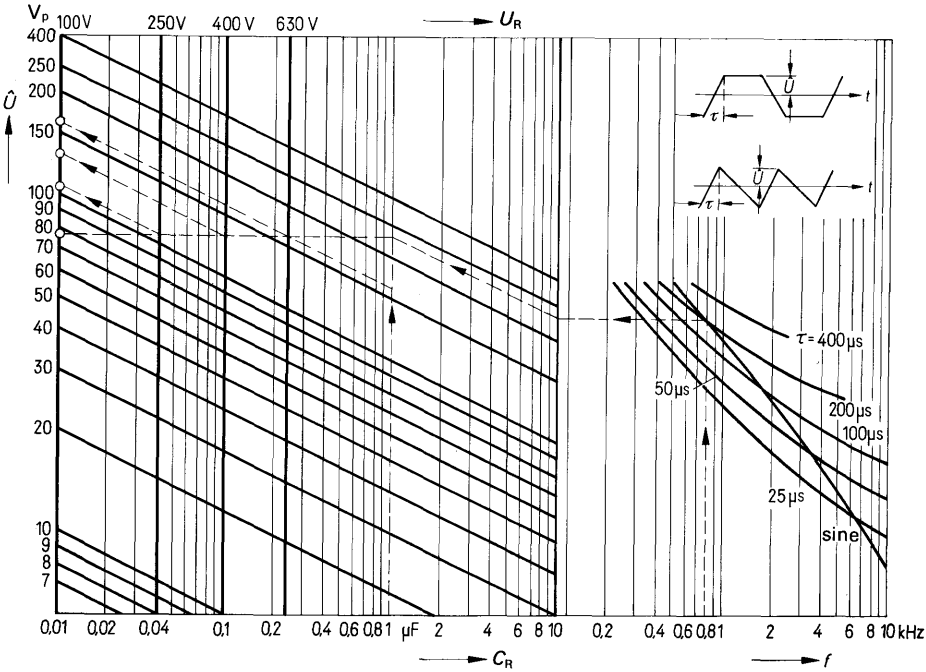
[1] The time constant values shown in the graph are applicable at the time of delivery. During operational life the insulation may decrease for a short period to about 10% of the values at the time of delivery, especially when the max. permissible humidity of 95% is applied for a long period, or when the capacitor is operated close to the maximum limit temperature.

Ac power handling capacity at higher frequencies

The maximum permissible peak voltage $\hat{U}$ for sinusoidal and non-sinusoidal voltage (pulse sawtooth, trapezoidal voltages) can be obtained from the nomogram, where the following limit values $\hat{U}_l$ are not allowed to be exceeded.

Rated voltage U_R	100 V	250 V	400 V	630 V
Limit voltage $\hat{U}_l$	84 V	140 V	224 V	280 V

The nomogram is based on 10 °C (18 °F) inherent temperature rise of the capacitor; this must be taken into account when considering the permissible max. temperature.
With trapezoidal voltage load the second harmonic frequency must be assumed.

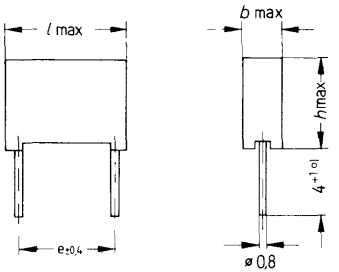


Example given:
f = 800 Hz (repetition frequency)
τ = 200 µs (rise time)
C = 1 µF (capacitance)

According to the dashed line on the graph above this gives:
for the 100 Vdc type a max. peak voltage $\hat{U}$ of about 75 V
for the 250 Vdc type a max. peak voltage $\hat{U}$ of about 105 V
for the 400 Vdc type a max. peak voltage $\hat{U}$ of about 135 V
for the 630 Vdc type a max. peak voltage $\hat{U}$ of about 160 V

Metallized polyester capacitors – High reliability version
(previous designation: MKH capacitors)

Self-healing flat capacitor winding with polyethyleneterephthalate dielectric. Encapsulated in rectangular plastic case, epoxy resin sealed. The case is provided with spacers to improve solderability in the solder bath.
Parallel leads, plug-in. Suitable for use in printed circuits.



Dimensions im mm

l	*e*
13	10
18	15
27	22.5
32	27.5

Rated voltage		100 Vdc	250 Vdc	400 Vdc
Rated capacitance		Dimensions *b* × *h* × *l*		
µF	Tolerance	Ordering code		
0,01	± 10% ≙ K ± 20% ≙ M	–	–	5 × 10,5 × 13 B32235-A6103-*
0,015		–	–	5 × 10,5 × 13 B32235-A6153-*
0,022		–	–	5 × 10,5 × 13 B32235-A6223-*
0,033		–	4 × 9,5 × 13 B32235-B3333-*	6 × 11,5 × 13 B32235-A6333-*
0,047		–	4 × 9,5 × 13 B32235-B3473-*	5,5 × 11 × 18 B32235-A6473-*
0,068		4 × 9,5 × 13 B32235-A1683-*	5 × 10,5 × 13 B32235-B3683-*	7 × 13 × 18 B32235-A6683-*

When ordering, the code letter for the requested tolerance must be substituted for *.
[1] Also available upon request 26 ± 4, ordering code B ••••-••••-•2.

Rated voltage		100 Vdc	250 Vdc	400 Vdc
Rated capacitance		Dimensions $b \times h \times l$		
µF	Tolerance	Ordering code		
0,1		4 × 9,5 × 13 B32235–A1104–•	5,5 × 11 × 18 B32235–B3104–•	7 × 13 × 18 B32235–A6104–•
0,15		5 × 10,5 × 13 B32235–A1154–•	5,5 × 11 × 18 B32235–A3154–•	9 × 14,5 × 18 B32235–A6154–•
0,22		6 × 11 5 × 13 B32235–A1224–•	7 × 13 × 18 B32235–B3224–•	7 × 16,5 × 27 B32235–B6224–•
0,33		5,5 × 11 × 18 B32235–A1334–•	9 × 14,5 × 18 B32235–B3334–•	8,5 × 18,5 × 27 B32235–A6334–•
0,47	± 5% ≙ J[1]	5,5 × 11 × 18 B32235–A1474–•	6,5 × 15 × 27 B32235–B3474–•	10,5 × 19 × 27 B32235–A6474–•
0,68	± 10% ≙ K	7 × 13 × 18 B32235–A1684–•	7 × 16,5 × 27 B32235–B3684–•	–
1,0	± 20% ≙ M	9 × 14,5 × 18 B32235–A1105–•	8,5 × 18,5 × 27 B32235–K3105–•	–
1,5		7 × 16,5 × 27 B32235–A1155–•	11 × 20 × 32 B32235–B3155–•	–
2,2		8,5 × 18,5 × 27 B32235–A1225–•	11 × 20 × 32 B32235–B3225–•	–
3,3		10,5 × 19 × 27 B32235–A1335–•[2]	–	–
4,7		11 × 20 × 32 B32235–A1475–•[2]	–	–
6,8		13 × 22,5 × 32 B32235–A1685–•[2]	–	–

When ordering, the code letter for the requested tolerance must be substituted for •.

[1] Closer capacitance tolerances available upon request.

[2] Not contained in DIN 44 122.

Climatic category in accordance with DIN 40040	**F M F / L R**
Minimum limit temperature	**F** – 55 °C/– 67 °F
Maximum limit temperature	**M**[1] +100 °C/+212 °F
Humidity category	**F**[2] average relative humidity ≦75%; 95% for 30 days per year; continuously 85% for the remaining days; occasionally
Failure quota	**L** 300 failures per 10^9 component hours
Load duration Relative failure rate	**R** 10^5 hours $300 \times 10^{-9} \times 10^5 = 3\%$
Failure criteria Total failure	Short or open circuit
Failure due to variation	Capacitance change $\frac{\Delta C}{C}$ $>\pm 10\%$
	Dissipation factor tan δ $>2 \times$ max. limit value
	Insulation resistance <150 MΩ ($\leqq 0.33$ µF) <50 s (>0.33 µF)
Test category in accordance with DIN 40045 and IEC publ. 68-1	**55/100/21 or 55/100/56**[3], respectively
	Conditions
Damp heat test in accordance with DIN 44122 and DIN 40046, sheet 5 or IEC publ. 68-2-3	Test temperature +40 °C/+104 °F Relative humidity $(93 \pm \frac{2}{3})$ % Test duration 21 days (56 days)
	Test criteria
	Capacitance change $\frac{\Delta C}{C}$ $\leqq \pm 3\%$ ($\pm 5\%$) for $C > 0.1$ µF $\leqq \pm 5\%$ ($\pm 5\%$) for $C \leqq 0.1$ µF
	Dissipation factor change $\Delta \tan \delta$ $\leqq 3 \times 10^{-3}$ at 1 kHz $\leqq 5 \times 10^{-3}$ at 10 kHz
	Insulation resistance ≧50% (20%) of the minimum value at delivery
Resistance to vibration Test F_C: Vibration partial test B 1 in accordance with DIN 40046, sheet 8 and IEC publ. 68-2-6	Duration of endurance conditioning 6 hours Frequency range 10 to 55 Hz Displacement amplitude 0.75 mm (conforming to max. 10 g)

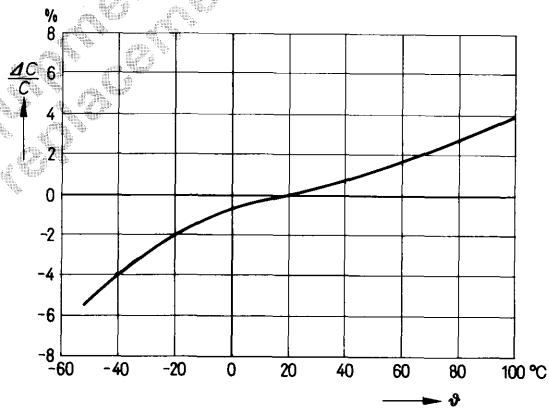
[1] Shelf and service life at temperatures >100 to 125 °C (212 to 257 °F) max. 1,000 hours.
[2] The capacitors also meet the test conditions of humidity category E as to DIN 40040.
[3] For these increased requirements the values in parentheses apply.

Solder conditions	Temperature of the solder bath: max. 260 °C/500 °F Soldering duration: max. 10 s
Capacitance drift i_z	±3%
Dissipation factor tan δ in 10^{-3} measured at 20°C/68 °F	Maximum limit value / Average value

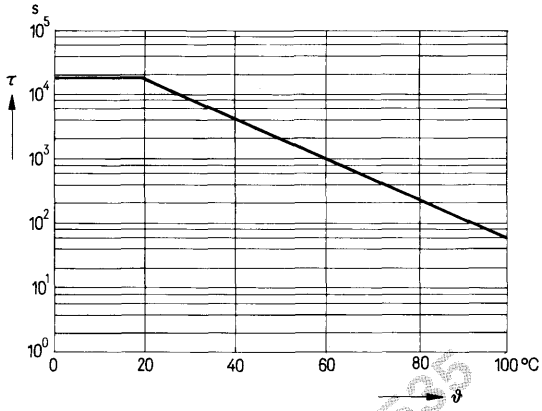
	for $C<0.1$ µF	$C \geqq 0.1$ to $\leqq 1$ µF	$C>1$ to $\leqq 10$ µF
at 1 kHz	8/5	8/5	10/6
at 10 kHz	15/12	15/12	–
at 100 kHz	30/18	–	–

Reversible capacitance change $\frac{\Delta C}{C}$

as a function of temperature at 1 kHz (typical values)

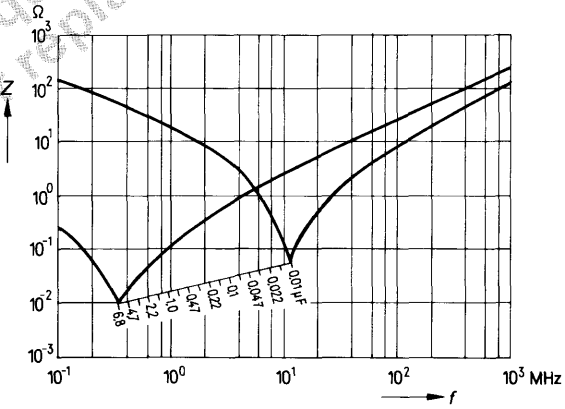


Insulation
(time constant τ)
as a function of
temperature



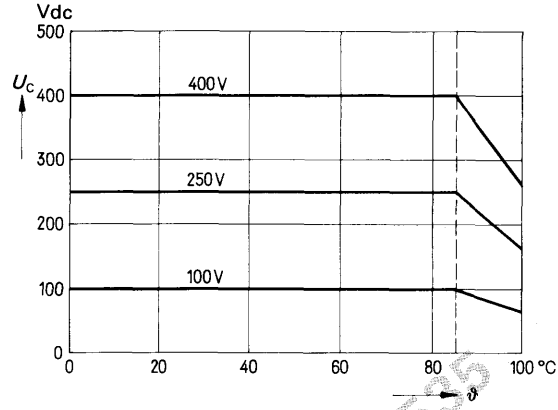
	for U_R = 100 Vdc	for U_R > 100 Vdc
Minimum values[1]		
$C \leqq 0.33$ µF	15 000 MΩ	30 000 MΩ
$C > 0.33$ µF	5 000 s	10 000 s
Average values measured at 20 °C (68 °F)		
$C \leqq 0.33$ µF	>75 000 MΩ	
$C > 0.33$ µF	>25 000 s	

Impedance Z
as a function of frequency f
(typical values)



[1] The indicated values are applicable at the time of delivery. During operational life the insulation may decrease for a short period to about 10% of the values at the time of delivery, especially when the max. permissible humidity of 95% is applied for a long period, or when the capacitor is operated close to the maximum limit temperature.

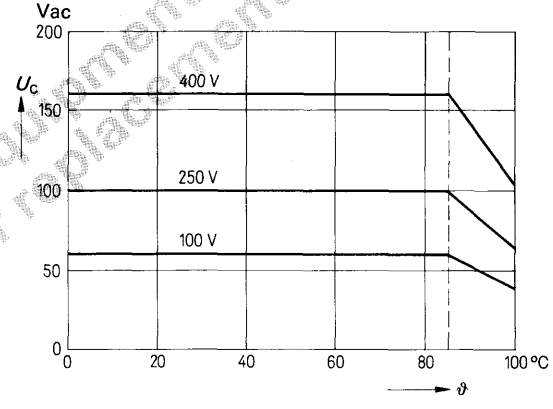
Category voltage U_C
at dc operation
as a function of ambient temperature



2,000 hours at 85 °C/185 °F
for milliseconds
(e. g. switchings)

$1.25 \times U_C$
$1.50 \times U_C$

Category voltage U_C[1]
at ac operation
as a function of ambient temperature



for milliseconds
(e. g. switchings)

$1.50 \times U_C$

For use in pulse discharge circuits (VDE 0560, part 1 and part 2, § 51) MKT capacitors are not suitable. In place of that Siemens MPS and MKV capacitors (B 25***) are recommended.

[1] When an ac voltage is superimposed to a dc voltage, the sum of the dc voltage and the amplitude of the ac voltage shall not exceed the rated voltage.

Pulse handling capability (voltage rate of rise U_{pp}/τ and pulse characteristic k_O). Maximum permissible voltage change per time unit with non-sinusoidal voltage load (pulse, sawtooth).

Rated voltage U_R		Capacitor length 13 mm	18 mm	27 mm	32 mm
100 Vdc	U_{pp}/τ k_O	6 V/µs 1 200 V²/µs	3 V/µs 600 V²/µs	2 V/µs 400 V²/µs	1.5 V/µs 300 V²/µs
250 Vdc	U_{pp}/τ k_O	10 V/µs 5 000 V²/µs	5 V/µs 2 500 V²/µs	3 V/µs 1 500 V²/µs	2.5 V/µs 1 250 V²/µs
400 Vdc	U_{pp}/τ k_O	14 V/µs 11 200 V²/µs	7 V/µs 5 600 V²/µs	4 V/µs 3 200 V²/µs	3 V/µs 2 400 V²/µs

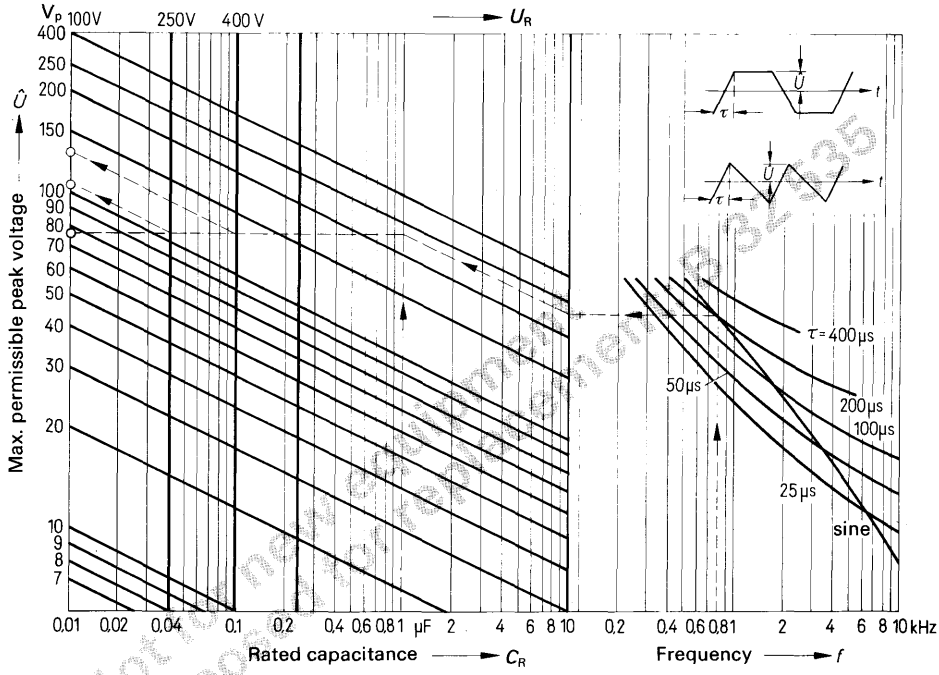
For a voltage swing $U_{pp} < U_R$ the value of the permissible voltage rate of rise U_{pp}/τ can be multiplied with the factor U_R/U_{pp}. The data of the nomogram must be accounted for periodic pulses. See also "General Technical Data", para 5.2.6.

Ac power handling capacity at higher frequencies

The maximum permissible peak voltage $\hat{U}$ for sinusoidal and non-sinusoidal voltage load (pulse, sawtooth, trapezoidal voltages) can be obtained from the nomogram, where the following limit values $\hat{U}_l$ are not allowed to be exceeded.

Rated voltage U_R	100 V	250 V	400 V
Limit voltage $\hat{U}_l$	84 V	140 V	224 V

The nomogram is based on 10 °C (18 °F) inherent temperature rise of the capacitor; this must be taken into account when considering the permissible max. temperature.
With trapezoidal voltage load, the second harmonic frequency must be assumed.



Example given:

f = 800 Hz (repetition frequency)
τ = 200 µs (rise time)
C = 1 µF (capacitance)

According to the dashed line on the graph above this gives:

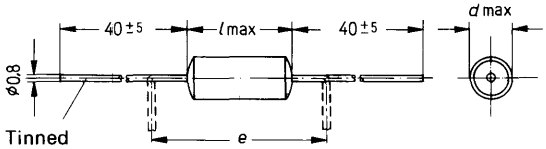
for the 100 Vdc type a max. peak voltage $\hat{U}$ of about 75 V
for the 250 Vdc type a max. peak voltage $\hat{U}$ of about 105 V
for the 400 Vdc type a max. peak voltage $\hat{U}$ of about 135 V

Metallized polyester capacitors – High reliability version
(previous designation: MKH capacitors)

Self healing tubular capacitor winding with polyethyleneterephthalate dielectric. Enclosed in plastic tube, epoxy resin sealed face ends. Central axial leads.

MKT capacitors with quality assessment

Capacitors of the type series B 32 237 are permitted for Space applications (see B 95 050 in the section "Qualified Types"). They comply with the GfW specifications CF 100, CF 105 and have the electronic test symbol.
GfW = Gesellschaft für Weltraumforschung (German Space Agency).



Tinned copper lead

Dimensions in mm

l	e
24	30
33	37.5
45	50
56	60

Ordering code example B32237-A4252-S

Type — Code according to table

Rated voltage		1 kVdc	1.6 kVdc	2.5 kVdc	4 kVdc	6.3 kVdc	8 kVdc	10 kVdc	12.5 kVdc
Rated capacitance	Tolerance	Dimensions $d \times l$ Code							
680 pF		–	–	–	–	–	–	–	9,5×56 -A3681-S
1000 pF		–	–	–	7,5×33 -A4102-S	8,5×33 -B6102-S	8,5×45 -A8102-S	8,5×56 -A9102-S	10,5×56 -A3102-S
2500 pF	+50% ≙ S[1] −20%	–	–	8,5×33 -J2252-S	8,5×33 -J4252-S	11,5×33 -B6252-S	11,5×45 -B8252-S	11,5×56 -A9252-S	12,5×56 -A3252-S
5000 pF		–	7,5×24 -A1502-S	9,5×33 -J2502-S	10,5×33 -J4502-S	10,5×45 -B6502-S	12,5×45 -A8502-S	13,5×56 -A9502-S	–
0,01 µF		–	10,5×24 -A1103-S	10,5×33 -B2103-S	12,5×33 -B4103-S	13,5×45 -B6103-S	16,5×45 -J8103-S	–	–
0,025 µF		11,5×24 -A0253-S	–	16,5×33 -J2253-S	–	–	–	–	–

[1] Capacitance tolerance ± 20% ≙ M upon request.

Climatic category in accordance with DIN 40040 Minimum limit temperature Maximum limit temperature Humidity category Failure quota Load duration Relative failure rate	**G M G / M S** **G** − 40 °C/− 40 °F **M** +100 °C/+212 °F **G** average relative humidity ≦ 65%; 85% for 60 days per year; continuously 75% for the remaining days; occasionally **M** 1000 failures per 10^9 component hours **S** 3×10^4 h $1000 \times 10^{-9} \times 3 \times 10^4 = 3\%$
Failure criteria Total failure Failure due to variation	Short or open circuit Capacitance change $\frac{\Delta C}{C}$ $> \pm 10\%$ Dissipation factor tan δ $> 2 \times$ max. limit value Insulation resistance < 150 MΩ
Test category in accordance with DIN 40045 or IEC publication 68-1 Damp heat test in accordance with DIN 40046, sheet 5 or IEC publication 68-2-3	**40/100/21** **Conditions** Test temperature +40 °C/+104 °F Relative humidity $(93 \pm \frac{2}{3})$ % Test duration 21 days **Test criteria** Capacitance change $\frac{\Delta C}{C}$ ≦ ± 5% Dissipation factor change Δ tan δ ≦ 3×10^{-3} (at 1 kHz) ≦ 5×10^{-3} (at 10 kHz) Insulation resistance ≧ 20% of the minimum value at delivery
Resistance to vibration Test F_C: Vibration partial test B 1 in accordance with DIN 40046, sheet 8 and IEC publication 68-2-6	Duration of endurance conditioning 6 hours Frequency range 10 to 55 Hz Displacement amplitude 0.75 mm (conforming to max. 10 g) For this test the capacitors must be fixed by clamps
Solder conditions	Temperature of the solder bath max. 260 °C (500 °F) Soldering duration max. 10 s Distance to the soldering joint min. 6 mm

Capacitance drift i_Z	±3%

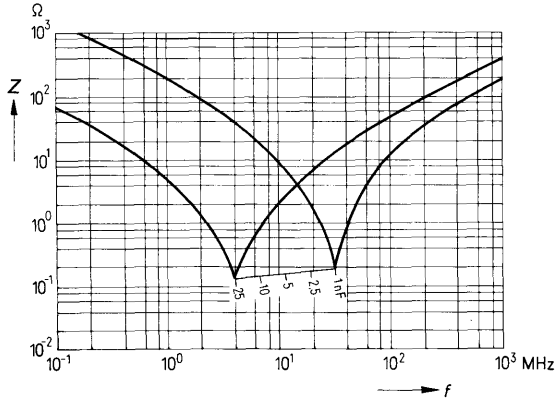
Dissipation factor tan δ measured at 20 °C (68 °F)

	Maximum value	Average value
for 1 kHz	8×10^{-3}	5×10^{-3}
for 10 kHz	15×10^{-3}	13×10^{-3}

Self inductance

approx. 30 to 50 nH
(for 3 mm lead length at both ends)

Impedance Z as a function of frequency f (typical values)



Category voltage U_C at dc operation

$1.05 \times U_R$	up to 40 °C/104 °F	
$1.04 \times U_R$	up to 50 °C/122 °F	
$1.00 \times U_R$	up to 60 °C/140 °F	
$0.93 \times U_R$	up to 70 °C/158 °F	(U_R =
$0.64 \times U_R$	> 70 to 85 °C/158 to 185 °F	rated
$0.55 \times U_R$	> 85 to 100 °C/185 to 212 °F	voltage)

Category voltage U_C[1] at ac operation at 50 Hz

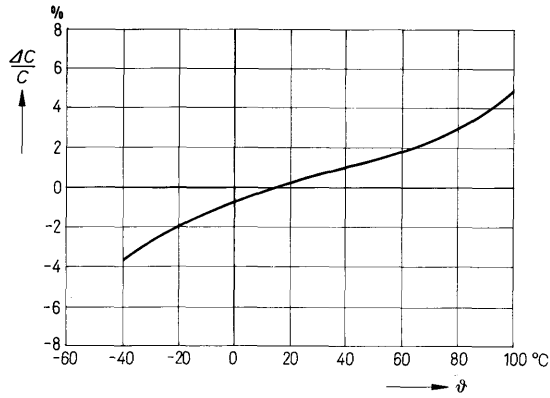
Rated voltage	U_C perm. Vac_{rms}
≦1.6 kVdc	200 Vac to 70 °C/158 °F 150 Vac > 70 to 100 °C/158 to 212 °F
>2.5 kVdc	450 Vac to 70 °C/158 °F 200 Vac > 70 to 100 °C/158 to 212 °F

[1] When an ac voltage is superimposed to a dc voltage, the sum of the dc voltage and the amplitude of the ac voltage shall not exceed the rated voltage.

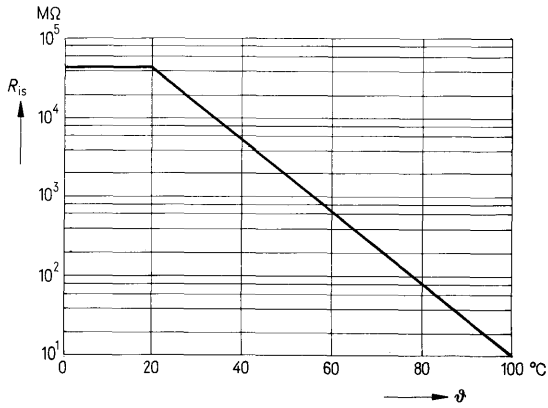
For use in pulse discharge circuits (VDE 0560, part 1 and part 2, § 51) MKT capacitors are not suitable. In place of that Siemens MPS and MKV capacitors (B 25***) are recommended.

Reversible capacitance change $\frac{\Delta C}{C}$

as a function of temperature at 1 kHz (typical values)



Insulation resistance
as a function of temperature



Minimum value[1]	30 000 MΩ
Average value measured at 20 °C (68 °F) 100 Vdc, 1 min.	>75 000 MΩ

[1] The indicated values are applicable at the time of delivery. During operational life the insulation may decrease for a short period to about 10% of the values at the time of delivery, especially when the max. permissible humidity of 85% is applied for a long period, or when the capacitor is operated close to the maximum limit temperature.

Pulse handling capability (voltage rate of rise U_{pp}/τ and pulse characteristic k_O). Maximum permissible voltage change per time unit at non-sinusoidal voltage load (pulse, sawtooth).

Rated voltage U_R	U_{pp}/τ	k_O
1 kVdc	15 V/µs	3×10^4 V²/µs
1.6 kVdc	25 V/µs	9×10^4 V²/µs
2.5 kVdc	25 V/µs	12.5×10^4 V²/µs
4 kVdc	40 V/µs	3.2×10^5 V²/µs
6.3 kVdc	50 V/µs	6.3×10^5 V²/µs
8 kVdc	50 V/µs	8×10^5 V²iµs
10 kVdc	375 V/µs	7.5×10^5 V²/µs
12.5 kVdc	1000 V/µs	25×10^6 V²/µs

For a voltage swing $U_{pp} < U_R$ the value of the permissible voltage rate of rise U_{pp}/τ can be multiplied by the factor U_R/U_{pp}. See also "General Technical Data", para. 5.2.6.

Ac power handling capacity at higher frequencies

Values upon request; a voltage/time diagram is requested.

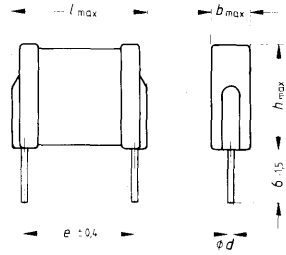
Metallized polyester layer capacitors (previous designation: MKH layer capacitors)

For use in consumer and entertainment electronics, for semiprofessional and professional applications.

Self-healing capacitor comprising polyethyleneterephthalate dielectric.
Mechanical protection: Fully insulated to ensure reliable contacts. The insulation resistance to live parts corresponds to 1.5 times the rated dc voltage of the capacitor.

Connections: Parallel leads, tinned, plug-in in the **lead spacing of 5 mm.**
Particularly suitable for space-saving assembly at high packing density on all kinds of PC boards.

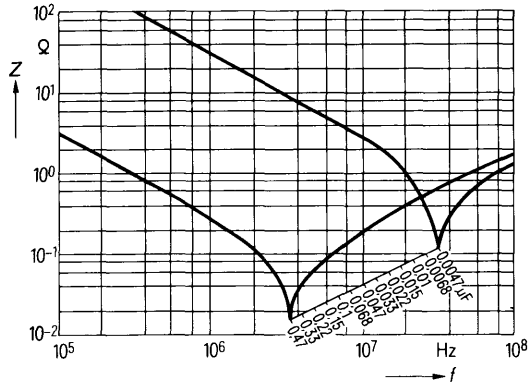
Rated voltage U_R = 63 Vdc		Dimensions $b \times h \times l$ Ordering code
Rated capacitance C_R	Tolerance	
4700 pF	±20% ≙ M[1]	3×6,7×7,2 B32509-A0472-M
6800 pF		3×6,7×7,2 B32509-A0682-M
0,01 µF		3×6,7×7,2 B32509-A0103-M
0,015 µF		3×7,3×7,2 B32509-A0153-M
0,022 µF		3,0×7,3×7,2 B32509-A0223-M
0,033 µF		3,5×7,2×7,2 B32509-A0333-M
0,047 µF		3,5×7,9×7,2 B32509-A0473-M
0,068 µF		3,5×7,2×7,2 B32509-A0683-M
0,1 µF		3,5×8,7×7,2 B32509-A0104-M
0,15 µF		4×9,6×7,2 B32509-A0154-M
0,22 µF		5,0×9,4×7,2 B32509-A0224-M
0,33 µF		5×13,6×7,2 B32509-A0334-M
0,47 µF		6,5×13×7,2 B32509-A0474-M



Dimensions in mm

[1] Closer tolerance ±10 ≙ K upon request.

Climatic category in accordance with DIN 40040	**F M E / L R**
Minimum limit temperature	**F** − 55 °C/− 67 °F
Maximum limit temperature	**M** +100 °C/+212 °F
Humidity category	**E** average relative humidity ≦ 75%; 95% for 30 days per year; continuously 85% for the remaining days; occasionally rare and light dew precipitation permitted
Failure quota	**L** 300 failures per 10^9 component hours
Load duration	**R** 10^5 hours
Relative failure rate	$300 \times 10^{-9} \times 10^5 = 3\%$
Failure criteria	
Total failure	Short or open circuit
Failure due to variation	Capacitance change $\frac{\Delta C}{C}$ $> \pm 10\%$
	Dissipation factor tan δ $> 2 \times$ max. limit value
	Insulation resistance < 150 MΩ (≦0.33 µF) $<$ 50 s (>0.33 µF)
Test category in accordance with DIN 40045 and IEC publ. 68-1	**55/100/21**
	Conditions
Damp heat test in accordance with DIN 40046, sheet 5, or IEC publ. 68-2-3	Test temperature +40 °C/+104 °F Relative humidity $(93 \pm \frac{2}{3})$ % Test duration 21 days
	Test criteria
	Capacitance change $\frac{\Delta C}{C}$ ≦ ± 5%
	Dissipation factor change $\Delta \tan \delta$ ≦ 5×10^{-3} at 1 kHz ≦ 7×10^{-3} at 10 kHz
	Insulation resistance ≧ 50% of the minimum value at delivery
Resistance to vibration Test F_C: Vibration partial test B 1 in accordance with DIN 40046, sheet 8 and IEC publ. 68-2-6	Duration of endurance conditioning 6 hours Frequency range 10 to 55 Hz Displacement amplitude 0.75 mm (conforming to max. 98.1 m/s² or 10 g)
Solder conditions	Temperature of the solder bath max. 260 °C/500 °F Soldering duration max. 10 s
Resistance to washing agents	All usual cleaning agents for assembled PCBs

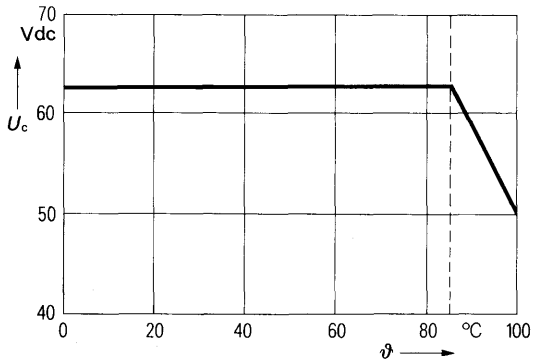
Sealing compound	All sealing compounds common in electrotechnical systems can be used. The max. limit temperature of the capacitor is not allowed to be exceeded during hardening.
Capacitance drift i_Z	±3%
Self inductance	approx. 5 nH
Impedance Z as a function of frequency f (typical values)	

Dissipation factor tan δ measured at 20 °C/68 °F

Maximum limit value / Average value

	$C_R < 0.1$ µF	$C_R \geqq 0.1$ µF
at 1 kHz	$8/5 \times 10^{-3}$	$8/5 \times 10^{-3}$
at 10 kHz	$15/12 \times 10^{-3}$	$15/12 \times 10^{-3}$
at 100 kHz	$30/18 \times 10^{-3}$	–

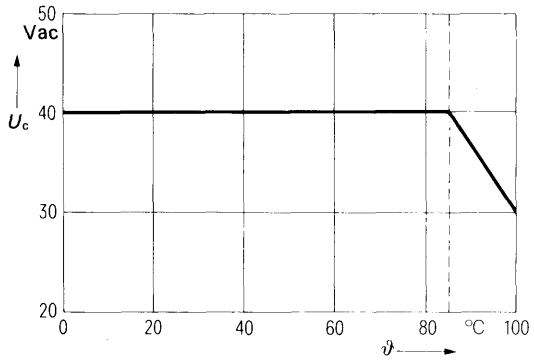
Category voltage U_C
at dc operation
as a function of
temperature ϑ



2 000 hours $1.25 \times U_C$

for milliseconds $1.50 \times U_C$
(e. g. switchings)

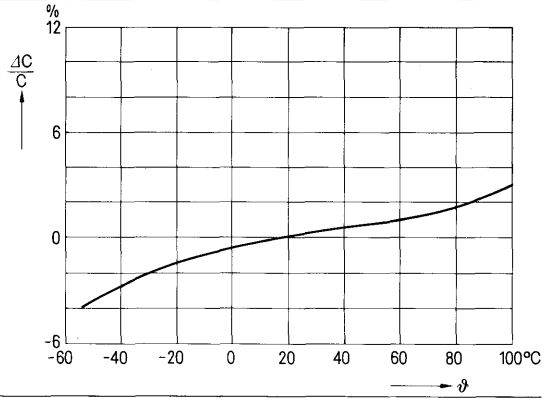
Category voltage U_C[1)]
at ac operation 50 Hz
as a function of
temperature ϑ



max. 2 000 hours $1.25 \times U_C$

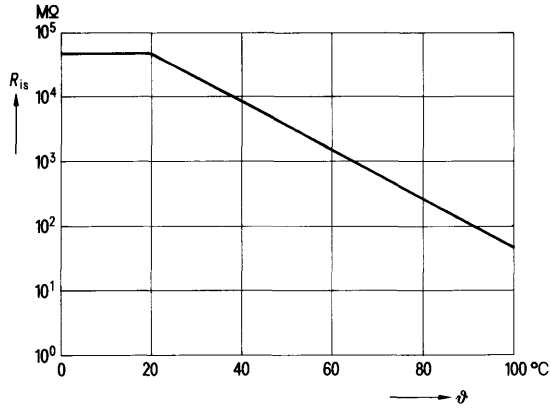
Reversible capacitance change $\frac{\Delta C}{C}$

as a function of temperature at
1 kHz (typical values)



[1)] When an ac voltage is superimposed to a dc voltage, the sum of the dc voltage and the amplitude of the ac voltage shall not exceed the rated voltage.

Insulation resistance
as a function of temperature ϑ



Typical values measured at 20 °C (68 °F) and a relative humidity ≦ 65%

	for $C_R \leqq 0.33$ µF	for $C_R > 0.33$ µF
Minimum value[1]	3 000 MΩ	1 000 s
Average value	>30 000 MΩ	>10 000 s

Pulse handling capability (voltage rate of rise U_{pp}/τ and pulse characteristic k_O).

Maximum permissible voltage change per time unit at non-sinusoidal voltage load (pulse, sawtooth).

Rated voltage U_R	U_{pp}/τ	40 V/µs
63 Vdc	k_O	5 000 V²/µs

For a voltage swing $U_{pp} < U_R$ the value of the permissible voltage rate of rise U_{pp}/τ can be multiplied by the factor U_R/U_{pp}. For periodic pulse load the data of the nomogram is to be taken into account.

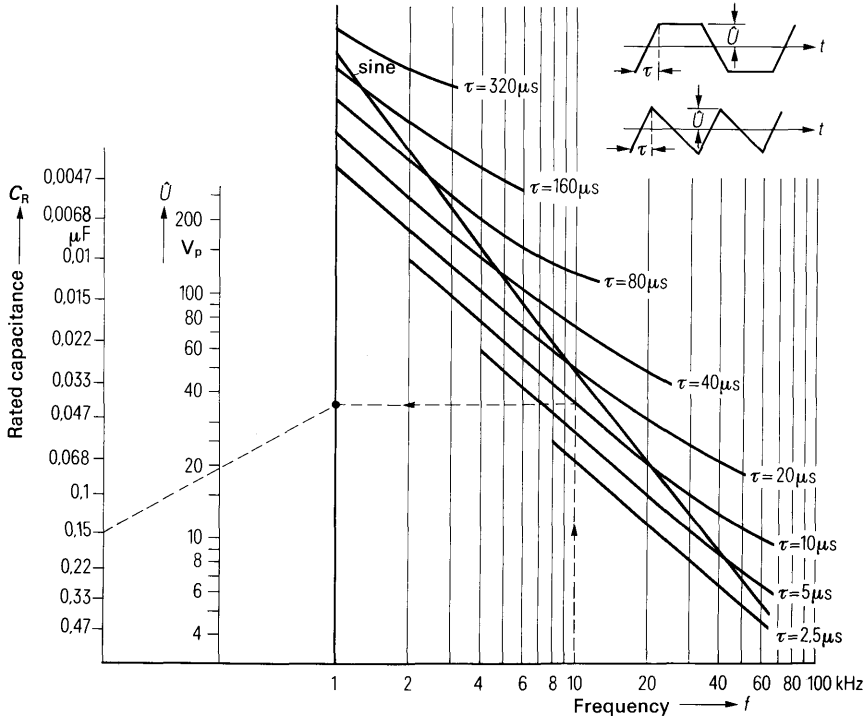
[1] The indicated values are applicable at the time of delivery. During operational life the insulation may decrease for a short period to about 10% of the values at the time of delivery, especially when the max. permissible humidity of 95% is applied for a long period, or when the capacitor is operated close to the maximum limit temperature.

Ac power handling capacity at higher frequencies

The maximum permissible peak voltage $\hat{U}$ for sinusoidal and non-sinusoidal voltage load (pulse, sawtooth, trapezoidal voltages) can be obtained from the nomogram, where the following limit values $\hat{U}_l$ are not allowed to be exceeded.

Rated voltage U_R	63 V
Limit voltage $\hat{U}_l$	55 V

The nomogram is based on 10 °C (18 °F) inherent temperature rise of the capacitor; this must be taken into account when considering the permissible max. temperature.
With trapezoidal voltage load the second harmonic frequency must be assumed.
With sinusoidal voltage load the "sine" characteristic applies.



Example given:

f = 10 kHz (repetition frequency)
τ = 10 µs (rise time)
C = 0.15 µF (capacitance)

According to the dashed line on the graph above this gives a peak voltage $\hat{U}$ of about 19 V.

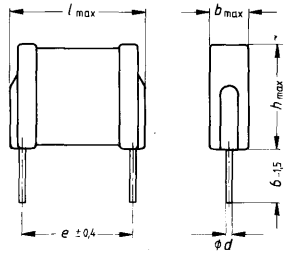
Metallized polyester layer capacitors[1]
(previous designation: MKH layer capacitors)

For use in consumer and entertainment electronics, for semiprofessional and professional applications.

Self-healing capacitor, comprising polyethyleneterephthalate dielectric.
Mechanical protection: Fully insulated to ensure reliable contacts. The insulation resistance to live parts corresponds to 1.5 times the rated dc voltage of the capacitor, it amounts, however, to at least 300 Vdc.
Connections: Parallel leads, tinned, plug-in in the lead spacing of 7.5 to 22.5 mm.

Type	Lead spacing "e"	dia. *d*
B 32510	7.5 mm	0.6
B 32511	10 mm	0.6
B 32512	15 mm	0.6
B 32513	22.5 mm	0.8

Dimensions in mm



Climatic category in accordance with DIN 40 040	**F M E / L R**
Minimum limit temperature	**F** − 55 °C/− 67 °F
Maximum limit temperature	**M** +100 °C/+212 °F
Humidity category	**E** average relative humidity ≦ 75%; rare and light dew precipitation permitted
Failure quota	**L** 300 failures per 10^9 component hours
Load duration	**R** 10^5 h
Relative failure rate	$300 \times 10^{-9} \times 10^5 = 3\%$
Failure criteria	
Total failure	Short or open circuit
Failure due to variation	Capacitance change $\frac{\Delta C}{C}$ $>\pm 10\%$
	Dissipation factor tan δ $>2 \times$ max. limit value
	Insulation resistance <150 MΩ ($\leqq 0.33$ µF)
	$<$ 50 s (>0.33 µF)
Test category in accordance with DIN 40 045 or IEC publication 68-1	**55/100/21**[2]
	Conditions
Damp heat test in accordance with DIN 40 046, sheet 5, or IEC publication 68-2-3	Test temperature +40 °C/104 °F
	Relative humidity $(93 \pm \frac{2}{3})$ %
	Test duration 21 days
	Test criteria
	Capacitance change $\frac{\Delta C}{C}$ $\leqq \pm 5\%$
	Dissipation factor change $\Delta \tan \delta$ $\leqq 3 \times 10^{-3}$ at 1 kHz $\leqq 5 \times 10^{-3}$ at 10 kHz
	Insulation resistance ≧ 50% of the minimum value at delivery

[1] Capacitors with quality assessment according to CECC soon available.
[2] The test criteria are also kept at a humidity load of 56 days.

Rated voltage U_R		100 Vdc				250 Vdc	
Rated capacitance	Tolerance	LS[1] 7.5 mm	LS 10 mm	LS 15 mm	LS 22.5 mm	LS 7.5 mm	LS 10 mm
		Dimensions *b x h x l* Ordering code					
C_R		B32510–	B32511–	B32512–	B32513–	B32510–	B32511–
1000 pF	±10%≙K[2]						
1500 pF							
2200 pF							
3300 pF							
4700 pF							
6800 pF							
0,01 µF						3x8,5x10 –D3103–K	
0,015 µF						3x8,5x10 –D3153–K	
0,022 µF						3x8,5x10 –D3223–K	4,5x8,5x12,5 –D3223–K
0,033 µF		3x8,5x10 –D1333–K				3,5x9x10 –D3333–K	4,5x8,5x12,5 –D3333–K
0,047 µF		3x8,5x10 –D1473–K				4x9x10 –D3473–K	4,5x8x12,5 –D3473–K
0,068 µF		3x8,5x10 –D1683–K				5x10x10 –D3683–K	4,5x8x12,5 –D3683–K
0,1 µF		4x9,5x10 –D1104–K				5x12x10 –D3104–K	4,5x9x12,5 –D3104–K
0,15 µF		4x9,5x10 –D1154–K	4,5x9x12,5 –D1154–K				5,5x10x12,5 –D3154–K
0,22 µF		5,5x10x10 –D1224–K	4,5x9x12,5 –D1224–K				6,0x12x12,5 –D3224–K
0,33 µF		6,5x10,5x10 –D1334–K	5,5x10x12,5 –D1334–K	5x8,5x17,5 –D1334–K			8,5x11x12,5 –D3334–K
0,47 µF		7x14x10 –D1474–K	6,5x10x12,5 –D1474–K	5x8,5x17,5 –D1474–K			9,5x13x12,5 –D3474–K
0,68 µF		9,5x13x10 –D1684–K	7,8x11x12,5 –D1684–K	6x9x17,5 –D1684–K			
1,0 µF			10x11,5x12,5 –D1105–K	6,5x11x17,5 –D1105–K			
1,5 µF				8x12,5x17,5 –D1155–K	6,5x11,5x25 –D1155–K		
2,2 µF				9x15x17,5 –D1225–K	7,5x13x25 –D1225–K		
3,3 µF					9x15x25 –D1335–K		
4,7 µF					11x17,5x25 –D1475–K		
6,8 µF					13x19,5x25 –D1685–K		

[1] Lead spacing [2] Tolerance ±5%≙J upon request. Preferred values.

250 Vdc		400 Vdc				U_R
LS 15 mm	LS 22.5 mm	LS 7.5 mm	LS 10 mm	LS 15 mm	LS 22.5 mm	
Dimensions *b x h x l* Ordering code						
B32512–	B32513–	B32510–	B32511–	B32512–	B32513–	C_R
		3x8,5x10 –D6102–K				1000 pF
		3x8,5x10 –D6152–K				1500 pF
		3x8,5x10 –D6222–K				2200 pF
		3x8,5x10 –D6332–K				3300 pF
		3x8,5x10 –D6472–K				4700 pF
		3x8,5x10 –D6682–K				6800 pF
		3,5x9x10 –D6103–K	4,5x8x12,5 –D6103–K			0,01 µF
		4x9x10 –D6153–K	4,5x8x12,5 –D6153–K			0,015 µF
			4,5x8x12,5 –D6223–K			0,022 µF
			4,5x8x12,5 –D6333–K			0,033 µF
			5x9x12,5 –D6473–K	5,5x8x17,5 –D6473–K		0,047 µF
				5,5x8x17,5 –D6683–K		0,068 µF
				5,5x9x17,5 –D6104–K		0,1 µF
				6x11,5x17,5 –D6154–K		0,15 µF
5x9,5x17,5 –D3224–K				8,5x10,5x17,5 –D6224–K	6x11,5x25 –D6224–K	0,22 µF
6,5x9,5x17,5 –D3334–K				9,5x12,5x17,5 –D6334–K	7x13,5x25 –D6334–K	0,33 µF
7,5x11x17,5 –D3474–K	6x10x25 –D3474–K			11,5x14,5x17,5 –D6474–K	9x14x25 –D6474–K	0,47 µF
8x13x17,5 –D3684–K	7x11x25 –D3684–K				10x17x25 –D6684–K	0,68 µF
11x13x17,5 –D3105–K	8x13,5x25 –D3105–K				12x19,5x25 –D6105–K	1,0 µF
	9x16,5x25 –D3155–K					1,5 µF
	11x19,5x25 –D3225–K					2,2 µF
						3,3 µF
						4,7 µF
						6,8 µF

Resistance to vibration
Test F_C: Vibration
partial test B 1 in accordance with DIN 40 046, sheet 8 and IEC publication 68-2-6

Duration of endurance conditioning	6 hours
Frequency range	10 to 55 Hz
Displacement amplitude	0.75 mm (conforming to max. 98.1 m/s² or to 10 g)

Solder conditions

Temperature of the solder bath	max. 260 °C/500 °F
Soldering duration	max. 10 s

Resistance to washing agents
All usual cleaning agents for assembled PCBs

Sealing compound
All sealing compounds common in electrotechnical systems can be used. The max. limit temperature of the capacitor is not allowed to be exceeded during hardening.

Capacitance drift i_Z
$\pm 3\%$

Self inductance

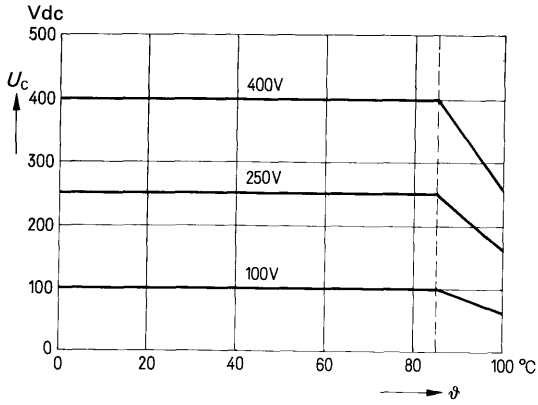
Lead spacing (mm)	7.5	10	15	22.5
Self inductance (approx. nH)	5	6	7	9

Dissipation factor tan δ
measured at 20 °C (68 °F)

Maximum value / Average value

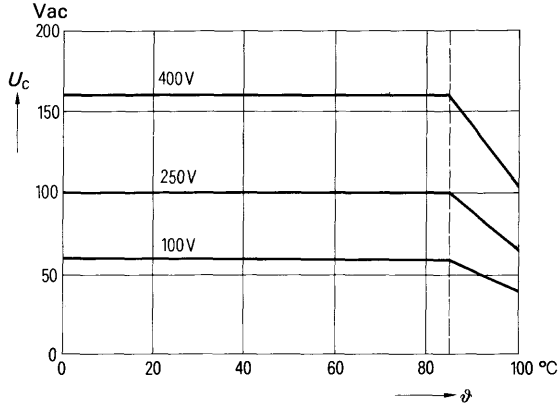
	$C_R < 0.1$ µF	$C_R \geqq 0.1$ µF	$C_R > 1$ µF
at 1 kHz	$8/5 \times 10^{-3}$	$8/5 \times 10^{-3}$	$10/6 \times 10^{-3}$
10 kHz	$15/12 \times 10^{-3}$	$15/12 \times 10^{-3}$	–
100 kHz	$30/18 \times 10^{-3}$	–	–

Category voltage U_C
at dc operation
as a function of temperature ϑ



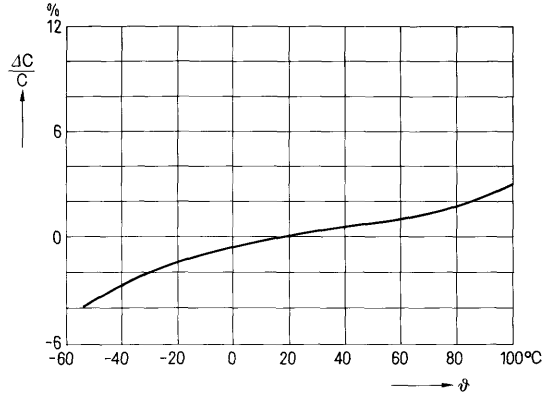
max. 2000 hours $1.25 \times U_C$
for milliseconds $1.50 \times U_C$
(e. g. switchings)

Category voltage U_C[1)]
at ac operation
at 50 Hz
as a function of temperature ϑ



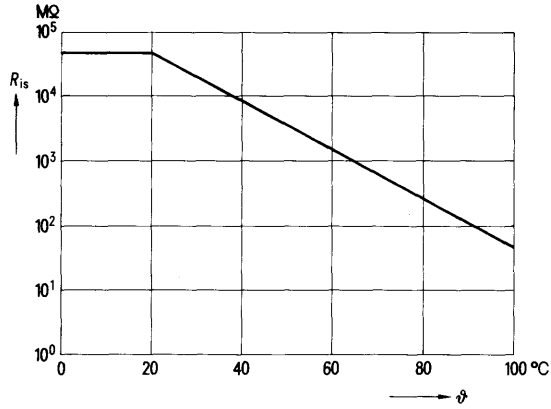
max. 2000 h $\quad 1.25 \times U_C$

Reversible capacitance change $\frac{\Delta C}{C}$
as a function of temperature ϑ
(typical values, measured at 1 kHz)



[1)] When an ac voltage is superimposed to a dc voltage, the sum of the dc voltage and the amplitude of the ac voltage shall not exceed the rated voltage.

Insulation resistance R_{is} as a function of temperature ϑ



Minimum value[1)]

U_R	$C_R \leqq 0.33$ µF	$C_R > 0.33$ µF
100 V	3000 MΩ	1000 s
≧250 V	7500 MΩ	2500 s

Average value

U_R	$C_R \leqq 0.33$ µF	$C_R > 0.33$ µF
100 V	>30 000 MΩ	>10 000 s
≧250 V	>75 000 MΩ	>25 000 s

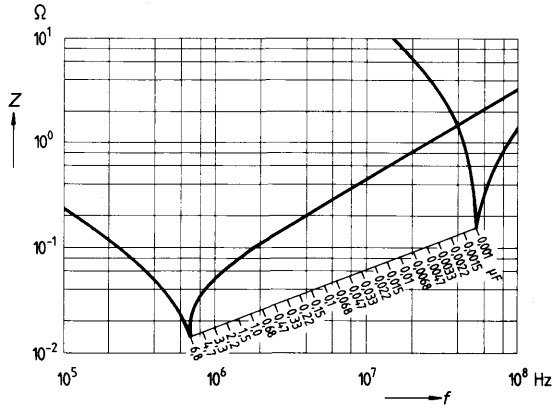
Pulse handling capability (voltage rate of rise U_{pp}/τ and pulse characteristic k_O). Maximum permissible voltage change per time unit with non-sinusoidal voltage load (pulse, sawtooth).

Rated voltage U_R		LS 7.5	LS 10	LS 15	LS 22.5
100 Vdc	U_{pp}/τ in V/µs	50	25	15	50
	k_O in V²/µs	10 000	5 000	3 000	10 000
250 Vdc	U_{pp}/τ in V/µs	100	50	25	100
	k_O in V²/µs	50 000	25 000	12 500	50 000
400 Vdc	U_{pp}/τ in V/µs	125	63	30	125
	k_O in V²/µs	100 000	50 000	25 000	100 000

For a voltage swing $U_{pp} < U_R$ the value of the permissible voltage rate of rise U_{pp}/τ can be multiplied with the factor U_R/U_{pp}. The data of the nomogram must be accounted for periodic pulses. See also "General Technical Data", para. 5.2.6.

[1)] The indicated values are applicable at the time of delivery. During operational life the insulation may decrease for a short period to about 10% of the values at the time of delivery, especially when the max. permissible humidity of 95% is applied for a long period, or when the capacitor is operated close to the maximum limit temperature.

Impedance Z
as a function
of frequency f
(typical values)



Ac power handling capacity at higher frequencies

The maximum permissible peak voltage $\hat{U}$ for sinusoidal and non-sinusoidal voltage (pulse, sawtooth, trapezoidal voltages) can be obtained from the nomogram.
The nomogram is based on 10 °C (18 °F) inherent temperature rise of the capacitor; this must be taken into account when considering the permissible max. temperature.

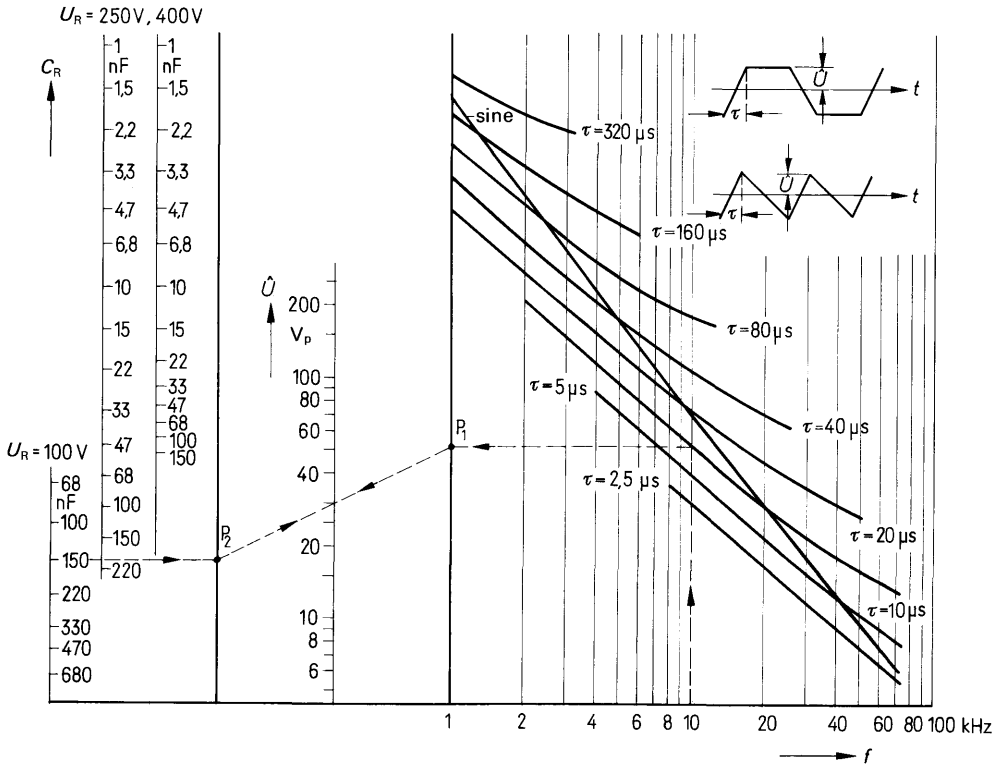
The following limit values $\hat{U}_I$ are not allowed to be exceeded:

Rated voltage U_R	100 V	250 V	400 V
Limit voltage $\hat{U}_I$	85 V	140 V	224 V

B 32510, lead spacing = 7.5 mm

Nomogram for determining the permissible peak voltage $\hat{U}$

Determine points of intersection P_1 and P_2 in accordance with the example plotted. The line of communication P_1, P_2 yields the maximum possible peak voltage.
In case of trapezoidal voltage load with two steep edges, the second harmonic frequency has to be taken into account. With sinusoidal voltage load the "sine" characteristic applies.



Example given:

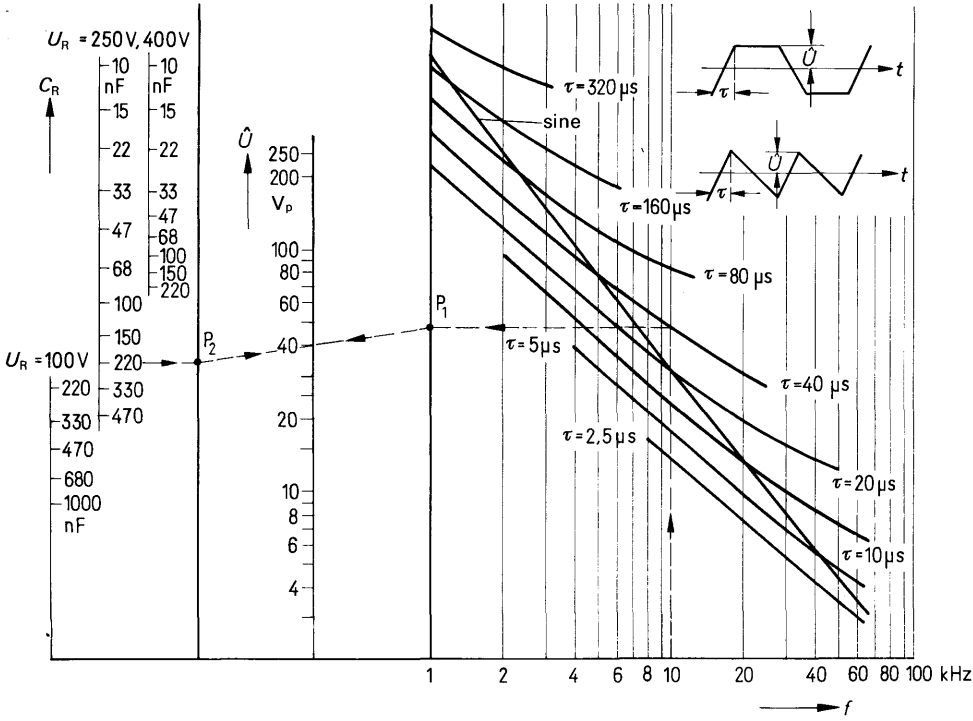
f = 10 kHz	(repetition frequency)	} Point of intersection P_1
τ = 10 µs	(rise time)	
C_R = 150 nF	(capacitance)	} Point of intersection P_2
U_R = 100 V	(rated voltage)	

According to the dashed line on the graph above this gives a max. peak voltage $\hat{U}$ of about 30 V.

B 32511, lead spacing = 10 mm

Nomogram for determining the permissible peak voltage $\hat{U}$

Determine points of intersection P_1 and P_2 in accordance with the example plotted. The line of communication P_1, P_2 yields the maximum possible peak voltage.
In case of trapezoidal voltage load with two steep edges, the second harmonic frequency has to be taken into account. With sinusoidal voltage load the "sine" characteristic applies.



Example given:

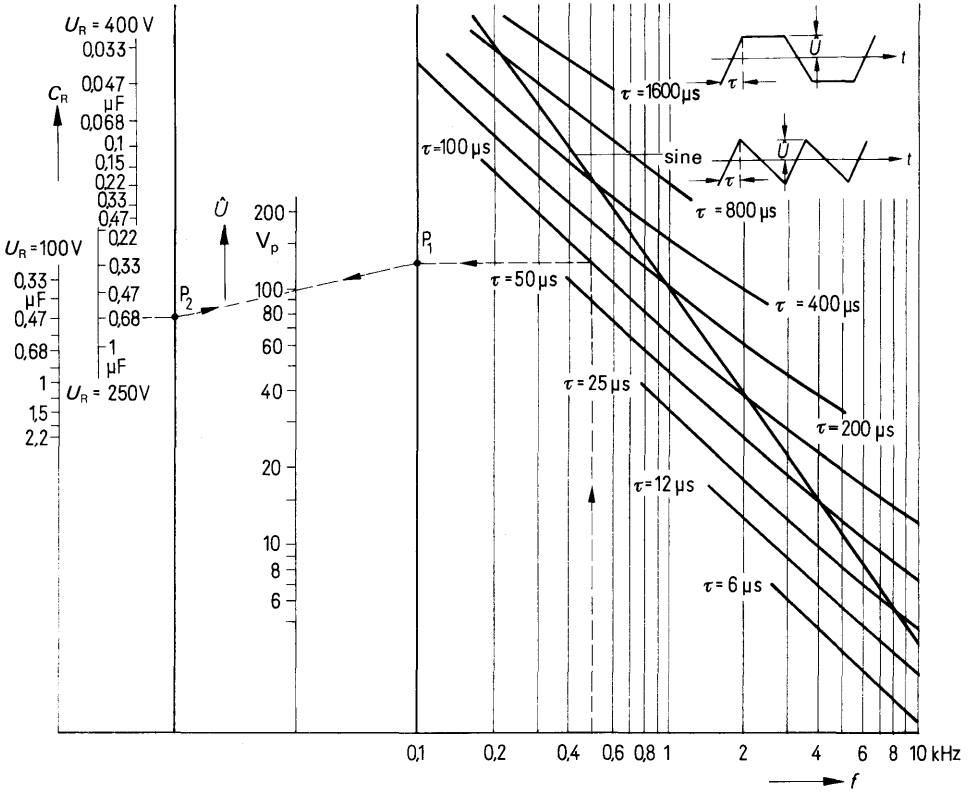
f = 10 kHz	(repetition frequency)	} Point of intersection P_1
τ = 40 µs	(rise time)	
C_R = 220 nF	(capacitance)	} Point of intersection P_2
U_R = 250 V	(rated voltage)	

According to the dashed line on the graph above this gives a max. peak voltage $\hat{U}$ of about 40 V.

B 32512, lead spacing = 15 mm

Nomogram for determining the permissible peak voltage $\hat{U}$

Determine points of intersection P_1 and P_2 in accordance with the example plotted. The line of communication P_1, P_2 yields the maximum possible peak voltage.
In case of trapezoidal voltage load with two steep edges, the second harmonic frequency has to be taken into account. With sinusoidal voltage load the "sine" characteristic applies.



Example given:

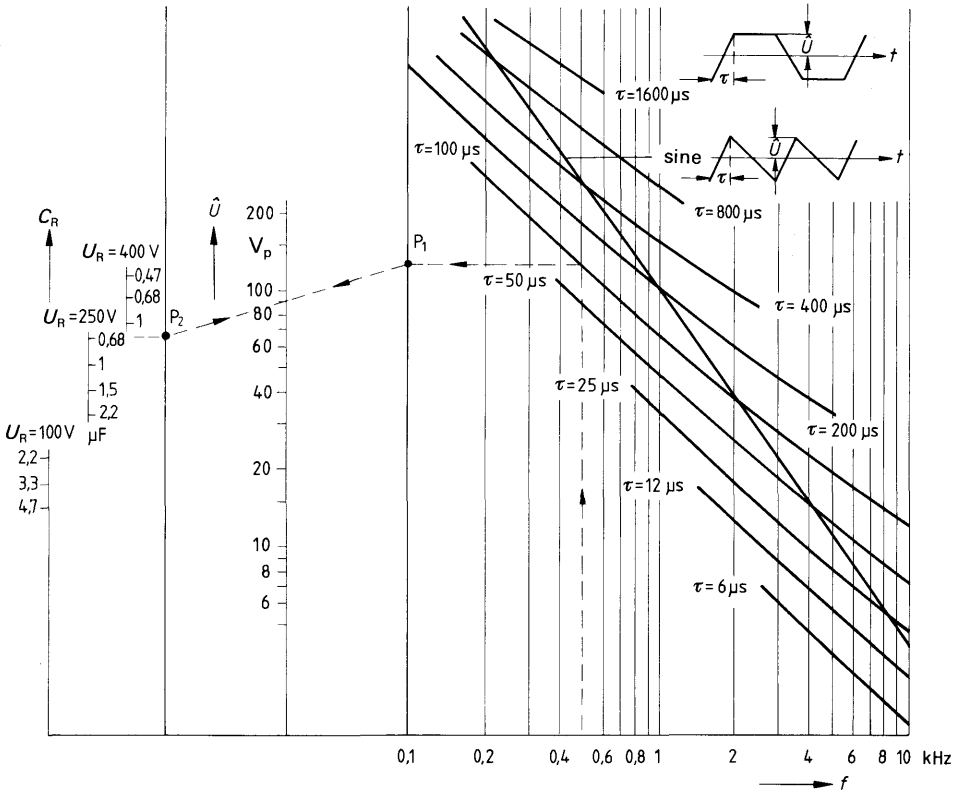
f = 0.5 kHz	(repetition frequency)	} Point of intersection P_1
τ = 100 µs	(rise time)	
C_R = 0.68 µF	(capacitance)	} Point of intersection P_2
U_R = 250 V	(rated voltage)	

According to the dashed line on the graph above this gives a max. peak voltage $\hat{U}$ of about 100 V.

B 32513, lead spacing = 22.5 mm

Nomogram for determining the permissible peak voltage $\hat{U}$

Determine points of intersection P_1 and P_2 in accordance with the example plotted. The line of communication P_1, P_2 yields the maximum possible peak voltage.
In case of trapezoidal voltage load with two steep edges, the second harmonic frequency has to be taken into account. With sinusoidal voltage load the "sine" characteristic applies.



Example given:

f = 0.5 kHz	(repetition frequency)	} Point of intersection P_1
τ = 100 µs	(rise time)	
C_R = 0.68 µF	(capacitance)	} Point of intersection P_2
U_R = 250 V	(rated voltage)	

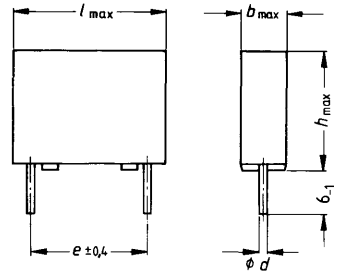
According to the dashed line on the graph above this gives a max. peak voltage $\hat{U}$ of about 90 V.

Metallized polyester layer capacitors – High reliability version
(previous designation: MKH layer capacitors)

For semiprofessional and professional applications.

Self-healing capacitor, face contacts, comprising polyethyleneterephthalate dielectric. Epoxy resin sealed, ensuring resistance to humidity; flame-retardent seal.
In order to improve solderability in the solder bath, the capacitor is provided with spacers.
Connections: Parallel leads, in the lead spacing, tinned, plug-in.

l	Lead spacing "e"	dia. *d*
10	7.5	0.6
13	10	0.8
18	15	0.8
27	22.5	0.8
32	27.5	0.8



Dimensions in mm

Climatic category in accordance with DIN 40 040	**F M D / L R**
Minimum limit temperature	**F** – 55 °C/–67 °F
Maximum limit temperature	**M** +100 °C/212 °F
Humidity category	**D** average relative humidity ≦ 80%
Failure quota	**L** 300 failures per 10^9 component hours
Load duration	**R** 10^5 h
Relative failure rate	$300 \times 10^{-9} \times 10^5 = 3\%$
Failure criteria	
Total failure	Short or open circuit
Failure due to variation	Capacitance change $\frac{\Delta C}{C}$ $>\pm 10\%$
	Dissipation factor tan δ $>2 \times$ max. limit value
	Insulation resistance <150 MΩ ($\leqq 0.33$ μF)
	$<$ 50 s (>0.33 μF)
Test category in accordance with DIN 40 045 or IEC publication 68-1	**55/100/56**
	Conditions
	Test temperature +40 °C/104 °F
	Relative humidity $(93 \pm \frac{2}{3})$ %
	Test duration 56 days
Damp heat test in accordance with DIN 40 046, sheet 5 or IEC publication 68-2-3	**Test criteria**
	Capacitance change $\frac{\Delta C}{C}$ $\leqq \pm 5\%$
	Dissipation factor change Δ tan δ $\leqq 3 \times 10^{-3}$ at 1 kHz
	$\leqq 5 \times 10^{-3}$ at 10 kHz
	Insulation resistance ≧ 50% of the minimum value at delivery

Rated voltage U_R		100 Vdc					250 Vdc	
Rated capacitance C_R	Tolerance	LS[1] 7.5 mm	LS 10 mm	LS 15 mm	LS 22.5 mm	LS 27.5 mm	LS 7.5 mm	LS 10 mm
		Dimensions $b \times h \times l$ Ordering code						
		B32535–	B32535–	B32535–	B32535–	B32535–	B32535–	B32535–
1000 pF	±10%≙K[2]							
1500 pF								
2200 pF								
3300 pF								
4700 pF								
6800 pF								
0,01 µF								
0,015 µF							4x10x10 –C3153–K	
0,022 µF							4x10x10 –C3223–K	
0,033 µF							4x10x10 –C3333–K	4,5x10,5x13 –C3333–K1
0,047 µF		4x10x10 –C1473–K						4,5x10,5x13 –C3473–K
0,068 µF		4x10x10 –C1683–K	4,5x10,5x13 –C1683–K1					4,5x10,5x13 –C3683–K
0,1 µF		4x10x10 –C1104–K	4,5x10,5x13 –C1104–K1					
0,15 µF			4,5x10,5x13 –C1154–K					
0,22 µF			4,5x10,5x13 –C1224–K					
0,33 µF				5,5x11x18 –C1334–K				
0,47 µF				5,5x11x18 –C1474–K				
0,68 µF				7,3x13x18 –C1684–K				
1 µF				7,3x13x18 –C1105–K				
1,5 µF					7,3x16,5x27 –C1155–K			
2,2 µF					8,5x18,5x27 –C1225–K			
3,3 µF					10,5x19x27 –C1335–K			
4,7 µF						11,5x21x32 –C1475–K		
6,8 µF						13,5x23x32 –C1685–K		

[1] Lead spacing. [2] Tolerance ±5%≙J upon request.

250 Vdc			400 Vdc					U_R
LS 15 mm	LS 22.5 mm	LS 27.5 mm	LS 7.5 mm	LS 10 mm	LS 15 mm	LS 22.5 mm	LS 27.5 mm	
Dimensions *b x h x l* Ordering code								
B32535–	B32535–	B32535–	B32535–	B32535–	B32535–	B32535–	B32535–	C_R
			4x10x10 –C6102–K					1000 pF
			4x10x10 –C6152–K					1500 pF
			4x10x10 –C6222–K					2200 pF
			4x10x10 –C6332–K					3300 pF
			4x10x10 –C6472–K					4700 pF
			4x10x10 –C6682–K					6800 pF
			4x10x10 –C6103–K	4,5x10,5x13 –C6103–K1				0,01 µF
				4,5x10,5x13 –C6153–K				0,015µF
				4,5x10,5x13 –C6223–K				0,022µF
				4,5x10,5x13 –C6333–K				0,033µF
					5,5x11x18 –C6473–K			0,047µF
					5,5x11x18 –C6683–K			0,068µF
5,5x11x18 –C3104–K					7,3x13x18 –C6104–K			0,1 µF
5,5x11x18 –C3154–K					7,3x13x18 –C6154–K			0,15 µF
7,3x13x18 –C3224–K						7,3x16,5x27 –C6224–K		0,22 µF
7,3x13x18 –C3334–K						8,5x18,5x27 –C6334–K		0,33 µF
	7,3x16,5x27 –C3474–K					10,5x19x27 –C6474–K		0,47 µF
	8,5x18,5x27 –C3684–K						11,5x21x32 –C6684–K	0,68 µF
	10,5x19x27 –C3105–K						13,5x23x32 –C6105–K	1 µF
		11,5x21x32 –C3155–K						1,5 µF
		13,5x23x32 –C3225–K						2,2 µF
								3,3 µF
								4,7 µF
								6,8 µF

Resistance to vibration
Test F_C: Vibration, partial test B 1 in accordance with DIN 40 046, sheet 8 and IEC publication 68-2-6

Duration of endurance conditioning	6 hours
Frequency range	10 to 55 Hz
Displacement amplitude	0.75 mm (conforming to max. 98.1 m/s² or to 10 g)

Solder conditions

Temperature of the solder bath	max. 260 °C/500 °F
Soldering duration	max. 10 s

Resistance to washing agents
All usual cleaning agents for assembled PCBs

Maximum capacitance drift i_Z
±3%

Self inductance

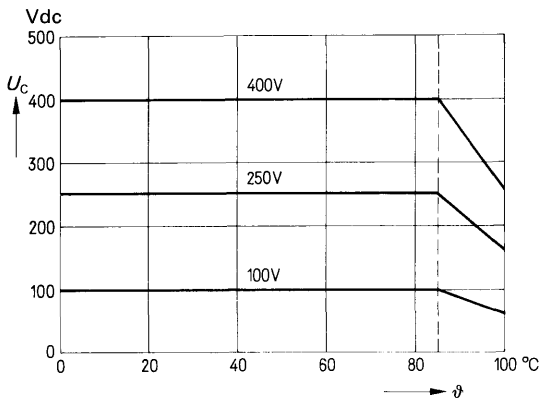
Lead spacing (mm)	7.5	10	15	22.5	27.5
Self inductance (approx. nH)	8	9	10	12	18

Dissipation factor tan δ measured at 20 °C (68 °F)

Maximum value / Average value

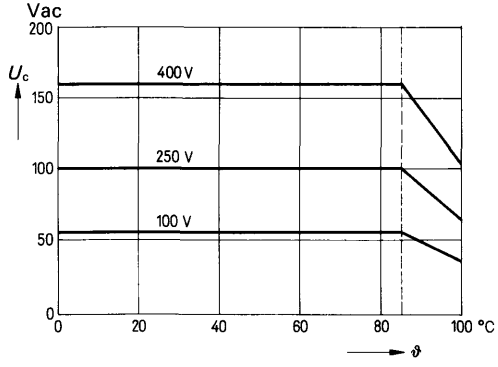
	$C_R < 0.1$ µF	$C_R \geqq 0.1$ µF	$C_R > 1$ µF
at 1 kHz	$8/5 \times 10^{-3}$	$8/5 \times 10^{-3}$	$10/6 \times 10^{-3}$
10 kHz	$15/12 \times 10^{-3}$	$15/12 \times 10^{-3}$	–
100 kHz	$30/18 \times 10^{-3}$	–	–

Category voltage U_C
at dc operation as a function of temperature ϑ



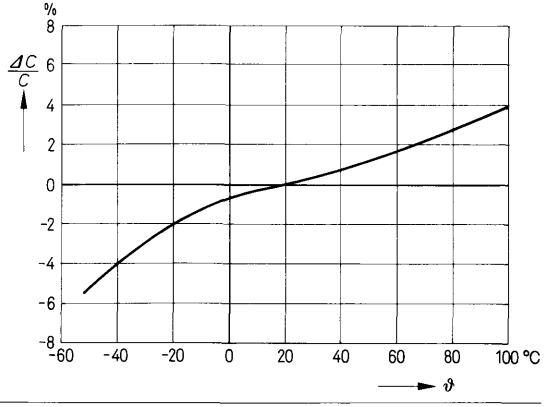
max. 2000 hours $1.25 \times U_C$
for milliseconds $1.50 \times U_C$
(e. g. switchings)

Category voltage U_C[1)]
at ac operation
at 50 Hz
as a function of temperature ϑ

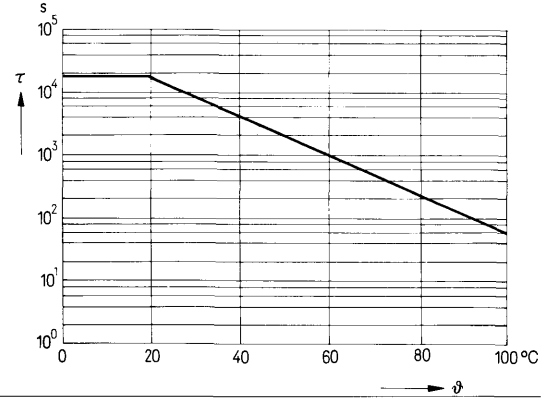


max. 2000 h $1.25 \times U_C$

Reversible capacitance change $\frac{\Delta C}{C}$
as a function of temperature ϑ
(typical values, measured at 1 kHz)



Insulation
(time constant τ)
as a function of temperature ϑ



[1)] The sum of the dc voltage and the peak value of an ac voltage superimposed on the dc voltage shall not exceed the rated voltage.

Insulation resistance R_{is}[1)]

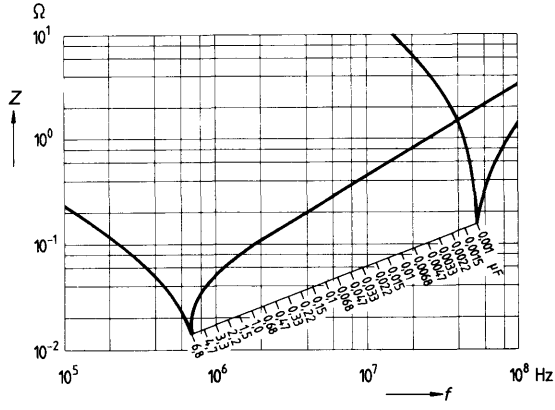
Minimum value

U_R	$C_R \leqq 0.33$ µF	$C_R > 0.33$ µF
100 V	15 000 MΩ	5 000 s
≧250 V	30 000 MΩ	10 000 s

Average value

U_R	$C_R \leqq 0.33$ µF	$C_R > 0.33$ µF
100 V	>30 000 MΩ	>10 000 s
≧250 V	>75 000 MΩ	>25 000 s

Impedance Z as a function of frequency f (typical values)



[1)] The indicated values are applicable at the time of delivery. During operational life the insulation may decrease for a short period to about 10% of the values at the time of delivery, especially when the max. permissible humidity of 95% is applied for a long period, or when the capacitor is operated close to the maximum limit temperature.

Pulse handling capability (voltage rate of rise U_{pp}/τ and pulse characteristic k_O). Maximum permissible voltage change per time unit with non-sinusoidal voltage (pulse, sawtooth).

Rated voltage U_R		LS 7.5	LS 10	LS 15	LS 22.5	LS 27.5
100 Vdc	U_{pp}/τ in V/µs k_O in V²/µs	50 10 000	25 5 000	15 3 000	50 10 000	upon request
250 Vdc	U_{pp}/τ in V/µs k_O in V²/µs	100 50 000	50 25 000	25 12 500	100 50 000	
400 Vdc	U_{pp}/τ in V/µs k_O in V²/µs	125 100 000	63 50 000	30 25 000	125 100 000	

For a voltage swing $U_{pp} < U_R$ the value of the permissible voltage rate of rise U_{pp}/τ can be multiplied with the factor U_R/U_{pp}. The data of the nomogram must be accounted for periodic pulses. See also "General Technical Data", para. 5.2.6.

Ac power handling capacity at higher frequencies

The maximum permissible peak voltage $\hat{U}$ for sinusoidal and non-sinusoidal voltage (pulse, sawtooth, trapezoidal voltages) can be obtained from the nomogram.

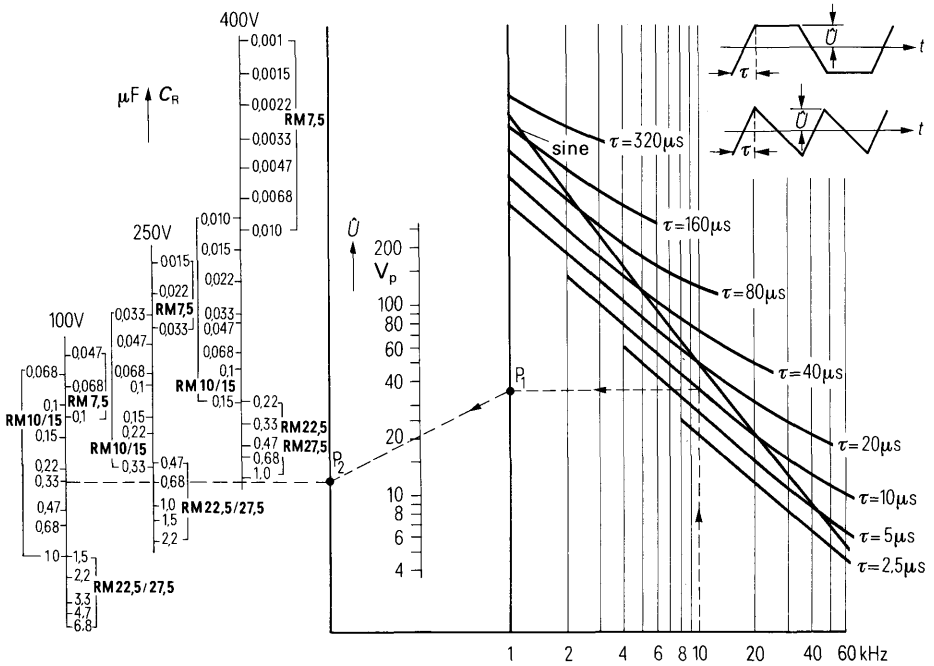
The nomogram is based on 10 °C (18 °F) inherent temperature rise of the capacitor; this must be taken into account when considering the permissible max. temperature.

The following limit values $\hat{U}_l$ are not allowed to be exceeded.

Rated voltage U_R	100 V	250 V	400 V
Limit voltage $\hat{U}_l$	85 V	140 V	224 V

Nomogram for determining the permissible peak voltage $\hat{U}$

Determine points of intersection P_1 and P_2 in accordance with the example plotted. The line of communication P_1, P_2 yields the maximum possible peak voltage.
In case of trapezoidal voltage load with two steep edges the second harmonic frequency has to be taken into account. With sinusoidal voltage load the "sine" characteristic applies.



(**RM** = Lead spacing)

Example given:

f = 10 kHz	(repetition frequency)	} Point of intersection P_1
τ = 10 µs	(rise time)	
C_R = 0.33 µF	(capacitance)	} Point of intersection P_2
U_R = 100 V	(rated voltage)	

According to the dashed line on the graph above this gives a max. peak voltage $\hat{U}$ of about 20.5 V.

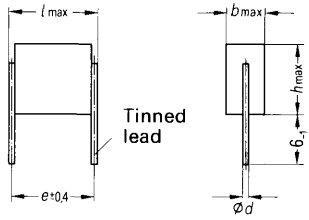
Metallized polyester layer capacitors (previous designation: MKH layer capacitors)
They are delivered as quality assessed version in accordance with CECC 30401-007 (Number of approval: 404.8/10/74).

For use in consumer and entertainment electronics, in semiprofessional and professional systems.

Self-healing capacitor, comprising polyethyleneterephthalate dielectric.
Mechanical protection by small insulating plates. When mounting, attention must be given to the surface leakage paths and air paths to adjacent live parts.
The insulating strength of the sectional areas to live parts corresponds to 1.5 times the rated dc voltage of a capacitor; it amounts, however, to at least 300 Vdc.
Connections: Parallel leads, tinned, plug-in, lead spacing 7.5 to 22.5 mm. Particularly suitable for PCB mounting.

Type	Lead spacing "e"	dia. *d*
B 32560	7.5 mm	0.6
B 32561	10 mm	0.6
B 32562	15 mm	0.6
B 32563	22.5 mm	0.8

Dimensions in mm



Climatic category in accordance with DIN 40040	**F M E / L R**
Minimum limit temperature	**F** − 55 °C/− 67 °F
Maximum limit temperature	**M** +100 °C/212 °F
Humidity category	**E** average relative humidity ≦ 75%; rare and light dew precipitation permitted
Failure quota	**L** 300 failures per 10^9 component hours
Load duration	**R** 10^5 h
Relative failure rate	$300 \times 10^{-9} \times 10^5 = 3\%$
Failure criteria	
Total failure	Short or open circuit
Failure due to variation	Capacitance change $\frac{\Delta C}{C}$ $>\pm 10\%$
	Dissipation factor tan δ $>2 \times$ max. limit value
	Insulation resistance <150 MΩ ($\leqq 0.33$ µF)
	$<$ 50 s (>0.33 µF)
Test category in accordance with DIN 40045 or IEC publication 68-1	**55/100/21**[1]
	Conditions
Damp heat test in accordance with DIN 40046, sheet 5 or IEC publication 68-2-3	Test temperature +40 °C/104 °F
	Relative humidity $(93 \pm \frac{2}{3})$ %
	Test duration 21 days
	Test criteria
	Capacitance change $\frac{\Delta C}{C}$ $\leqq \pm 5\%$
	Dissipation factor change Δ tan δ $\leqq 3 \times 10^{-3}$ at 1 kHz
	$\leqq 5 \times 10^{-3}$ at 10 kHz
	Insulation resistance ≧ 50% of the minimum value at delivery

[1] The test criteria are also kept at a humidity load of 56 days.

Rated voltage U_R		100 Vdc				250 Vdc	
Rated capacitance C_R	Tolerance	LS[1] 7.5 mm	LS 10 mm	LS 15 mm	LS 22.5 mm	LS 7.5 mm	LS 10 mm
		Dimensions $b \times h \times l$ Ordering code					
		B32560–	B32561–	B32562–	B32563–	B32560–	B32561–
1000 pF	± 5%≙J ±10%≙K						
1500 pF							
2200 pF							
3300 pF							
4700 pF							
6800 pF							
0,01 µF							
0,015 µF						2,3x7,3x9 –D3153–*	
0,022 µF						2,3x7,3x9 –D3223–*	3,2x6,6x11,5 –D3223–*
0,033 µF						2,5x7,3x9 –D3333–*	3,3x6,6x11,5 –D3333–*
0,047 µF						2,9x7,4x9 –D3473–*	3,1x6,6x11,5 –D3473–*
0,068 µF		2,4x8,1x9 –D1683–*				3,6x8,1x9 –D3683–*	3,1x6,6x11,5 –D3683–*
0,1 µF		2,7x8,1x9 –D1104–*				4x10,1x9 –D3104–*	3,6x7,4x11,5 –D3104–*
0,15 µF		3,4x8,1x9 –D1154–*					4,3x8,5x11,5 –D3154–
0,22 µF		4,4x8,0x9 –D1224–*	3,4x7,2x11,5 –D1224–*				5,0x10,1x11,5 –D3224–*
0,33 µF		5,5x8,8x9 –D1334–*	4,2x8,1x11,5 –D1334–*				7,1x9x11,5 –D3334–*
0,47 µF		5,5x12,5x9 –D1474–*	5,4x8,1x11,5 –D1474–*	4x6,9x16,5 –D1474–*			8,3x10,8x11,5 –D3474–*
0,68 µF		8x11,4x9 –D1684–*	7,2x8,2x11,5 –D1684–*	5x7,3x16,5 –D1684–*			
1 µF			8,5x9,8x11,5 –D1105–*	5,5x9,2x16,5 –D1105–*			
1,5 µF				7x10,5x16,5 –D1155–*			
2,2 µF				8,5x12,3x16,5 –D1225–*	6,4x11,3x24 –D1225–*		
3,3 µF					7,7x13,4x24 –D1335–*		

[1] Lead spacing. * Here, the requested tolerance ±10%≙K or ±5%≙J must be inserted Preferred values.

250 Vdc		400 Vdc				U_R
LS 15 mm	LS 22.5 mm	LS 7.5 mm	LS 10 mm	LS 15 mm	LS 22.5 mm	
Dimensions *b x h x l* Ordering code						
B32562–	B32563–	B32560–	B32561–	B32562–	B32563–	C_R
		2,4x8,2x9 –D6102–*				1000 pF
		2,3x8,2x9 –D6152–*				1500 pF
		2,3x8,2x9 –D6222–*				2200 pF
		2,3x8,2x9 –D6332–*				3300 pF
		2,3x8,2x9 –D6472–*				4700 pF
		2,4x7,3x9 –D6682–*				6800 pF
		2,4x7,3x9 –D6103–*	3,2x6,6x11,5 –D6103–*			0,01 µF
		2,7x7,3x9 –D6153–*	3,2x6,6x11,5 –D6153–*			0,015 µF
			3,2x6,6x11,5 –D6223–*			0,022 µF
			3,3x6,6x11,5 –D6333–*			0,033 µF
			3,9x7,2x11,5 –D6473–*			0,047 µF
				3,8x6,2x16,5 –D6683–*		0,068 µF
				4,5x7,1x16,5 –D6104–*		0,1 µF
				5,5x8,2x16,5 –D6154–*		0,15 µF
4x7,7x16,5 –D3224–*				7,2x8,6x16,5 –D6224–*		0,22 µF
5,4x7,7x16,5 –D3334–*				8,3x10,9x16,5 –D6334–*		0,33 µF
6,1x9,4x16,5 –D3474–*				10x12,6x16,5 –D6474–*	7,3x12,4x24 –D6474–*	0,47 µF
7x11,4x16,5 –D3684–*	5,9x9,3x24 –D3684–*				8,3x15,4x24 –D6684–*	0,68 µF
9,6x11,5x16,5 –D3105–*	6,5x11,8x24 –D3105–*				10,4x17,5x24 –D6105–*	1 µF
	7,8x14,4x24 –D3155–*					1,5 µF
	9,1x17,5x24 –D3225–*					2,2 µF
						3,3 µF

Resistance to vibration
Test F_C: Vibration
partial test B 1 in accordance with DIN 40 046, sheet 8 and IEC publication 68-2-6

Duration of endurance conditioning	6 hours
Frequency range	10 to 55 Hz
Displacement amplitude	0.75 mm (conforming to max. 98.1 m/s² or to 10 g)

Solder conditions

Temperature of the solder bath	max. 260 °C/500 °F
Soldering duration	max. 10 s

Resistance to washing agents
All usual cleaning agents for assembled PCBs

Sealing compound
All sealing compounds common in electrotechnical systems can be used. The max. limit temperature of the capacitor is not allowed to be exceeded during hardening.

Max. capacitance drift i_z
±3%

Self inductance

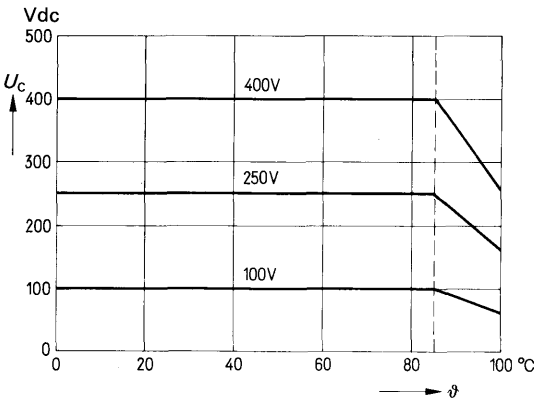
Lead spacing (mm)	7.5	10	15	22.5
Self inductance (approx. nH)	5	6	7	9

Dissipation factor tan δ
measured at 20 °C (68 °F)

Maximum value / Average value

	$C_R < 0.1$ µF	$C_R \geqq 0.1$ µF	$C_R > 1$ µF
at 1 kHz	$8/5 \times 10^{-3}$	$8/5 \times 10^{-3}$	$10/6 \times 10^{-3}$
10 kHz	$15/12 \times 10^{-3}$	$15/12 \times 10^{-3}$	–
100 kHz	$30/18 \times 10^{-3}$	–	–

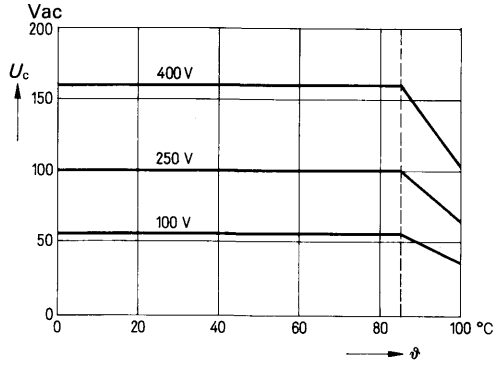
Category voltage U_C
at dc operation
as a function of temperature ϑ



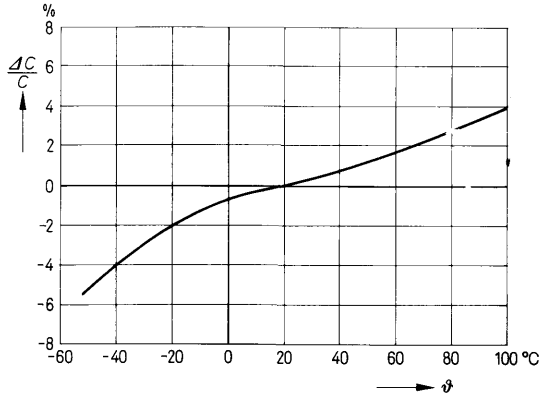
max. 2000 hours 1.25 × U_C
for milliseconds 1.50 × U_C
(e. g. switchings)

Category voltage U_C[1)]
at ac operation
at 50 Hz
as a function of temperature ϑ

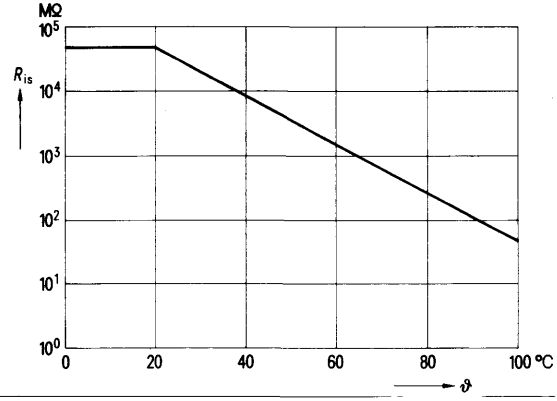
max. 2000 h $1.25 \times U_C$



Reversible capacitance change $\frac{\Delta C}{C}$
as a function of temperature ϑ
at 1 kHz (typical values)



Insulation resistance R_{is}
as a function of temperature ϑ



[1)] When an ac voltage is superimposed to a dc voltage, the sum of the dc voltage and the amplitude of the ac voltage shall not exceed the rated voltage.

Insulation resistance R_{is}[1)]

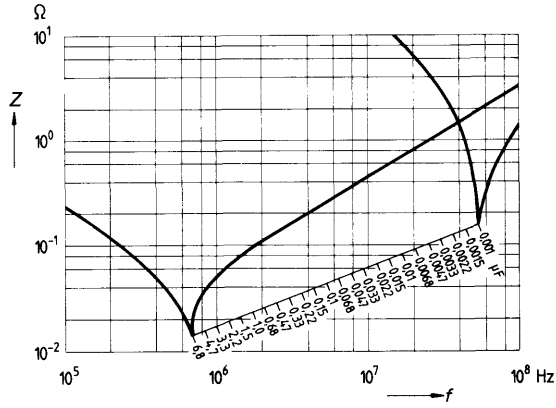
Minimum value

U_R	$C_R \leqq 0.33$ µF	$C_R > 0.33$ µF
100 V	3 000 MΩ	1 000 s
≧250 V	7 500 MΩ	2 500 s

Average value

U_R	$C_R \leqq 0.33$ µF	$C_R > 0.33$ µF
100 V	>30 000 MΩ	>10 000 s
≧250 V	>75 000 MΩ	>25 000 s

Impedance Z as a function of frequency f (typical values)



[1)] The indicated values are applicable at the time of delivery. During operational life the insulation may decrease for a short period to about 10% of the values at the time of delivery, especially when the max. permissible humidity of 95% is applied for a long period, or when the capacitor is operated close to the maximum limit temperature.

Pulse handling capability (voltage rate of rise U_{pp}/τ and pulse characteristic k_O). Maximum permissible voltage change per time unit with non-sinusoidal voltage load (pulse, sawtooth).

Rated voltage U_R		LS 7.5	LS 10	LS 15	LS 22.5	
100 Vdc	U_{pp}/τ in V/µs k_O in V²/µs	50 10 000	25 5 000	15 3 000	50 10 000	
250 Vdc	U_{pp}/τ in V/µs k_O in V²/µs	100 50 000	50 25 000	25 12 500	100 50 000	
400 Vdc	U_{pp}/τ in V/µs k_O in V²/µs	125 100 000	63 50 000	30 25 000	125 100 000	

For a voltage swing $U_{pp} < U_R$ the value of the permissible voltage rate of rise U_{pp}/τ can be multiplied with the factor U_R/U_{pp}. The data of the nomogram must be accounted for periodic pulses. See also "General Technical Data", para. 5.2.6.

Ac power handling capacity at higher frequencies

The maximum permissible peak voltage $\hat{U}$ for sinusoidal and non-sinusoidal voltage load (pulse, sawtooth, trapezoidal voltages) can be obtained from the nomogram.

The nomogram is based on 10 °C (18 °F) inherent temperature rise of the capacitor; this must be taken into account when considering the permissible max. temperature.

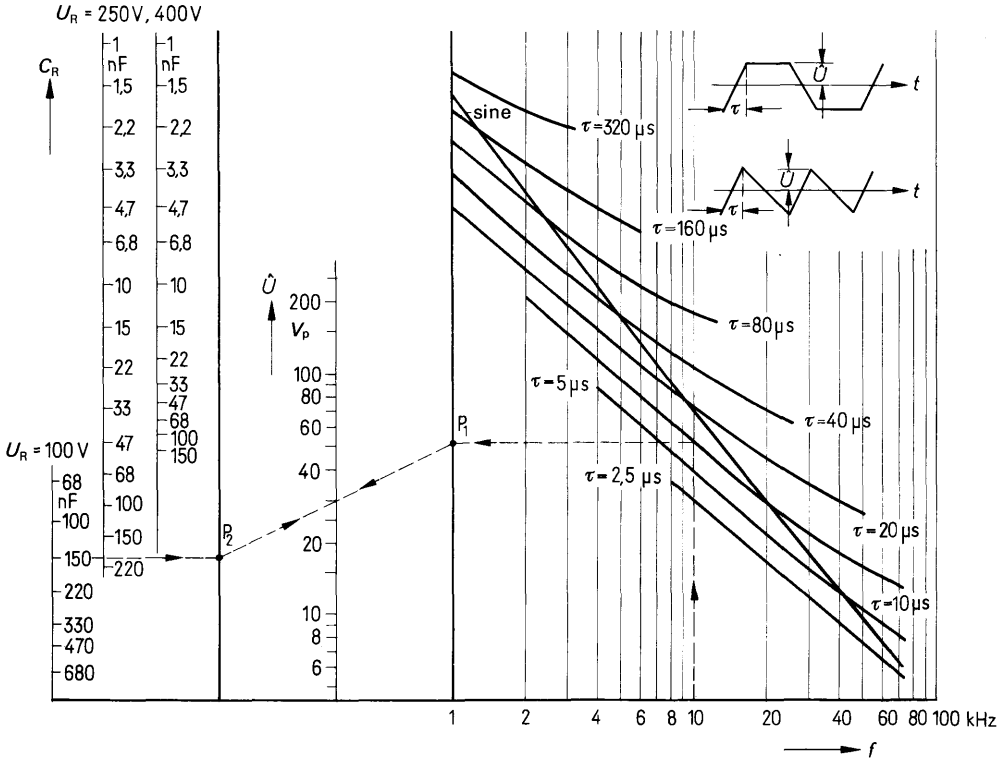
The following limit values $\hat{U}_l$ are not allowed to be exceeded.

Rated voltage U_R	100 V	250 V	400 V
Limit voltage $\hat{U}_l$	85 V	140 V	224 V

B 32 560, lead spacing = 7.5 mm

Nomogram for determining the permissible peak voltage $\hat{U}$

Determine points of intersection P_1 and P_2 in accordance with the example plotted. The line of communication P_1, P_2 yields the maximum possible peak voltage.
In case of trapezoidal voltage load with two steep edges, the second harmonic frequency has to be taken into account. With sinusoidal voltage load the "sine" characteristic applies.



Example given:

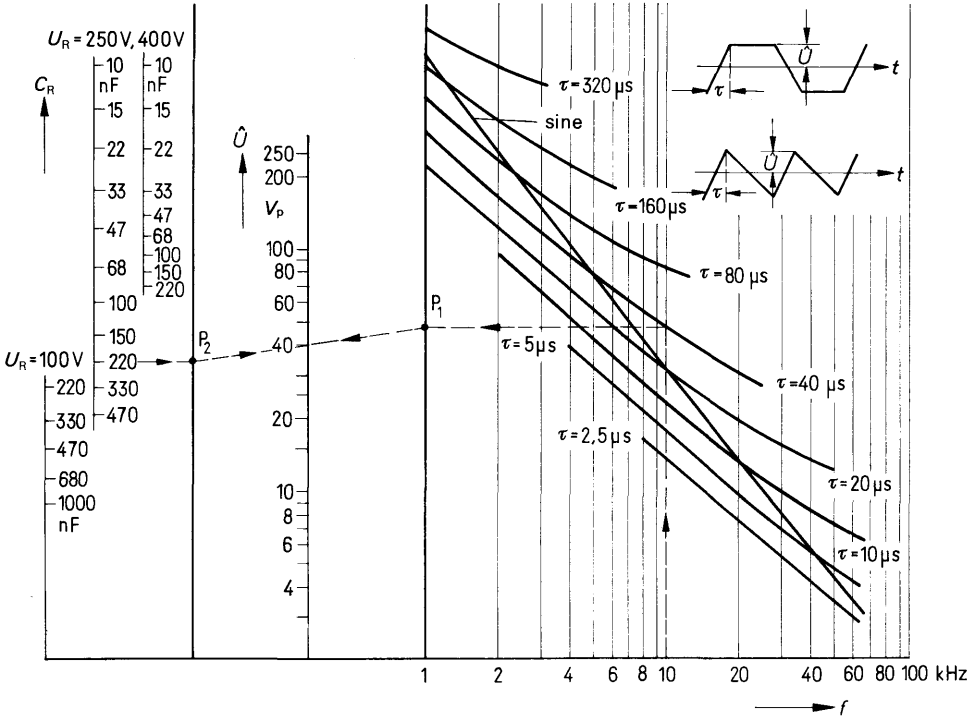
f = 10 kHz	(repetition frequency)	} Point of intersection P_1
τ = 10 µs	(rise time)	
C_R = 150 nF	(capacitance)	} Point of intersection P_2
U_R = 100 V	(rated voltage)	

According to the dashed line on the graph above this gives a max. peak voltage $\hat{U}$ of about 30 V.

B 32561, lead spacing = 10 mm

Nomogram for determining the permissible peak voltage $\hat{U}$

Determine points of intersection P_1 and P_2 in accordance with the example plotted. The line of communication P_1, P_2 yields the maximum possible peak voltage.
In case of trapezoidal voltage load with two steep edges, the second harmonic frequency has to be taken into account. With sinusoidal voltage load the "sine" characteristic applies.



Example given:

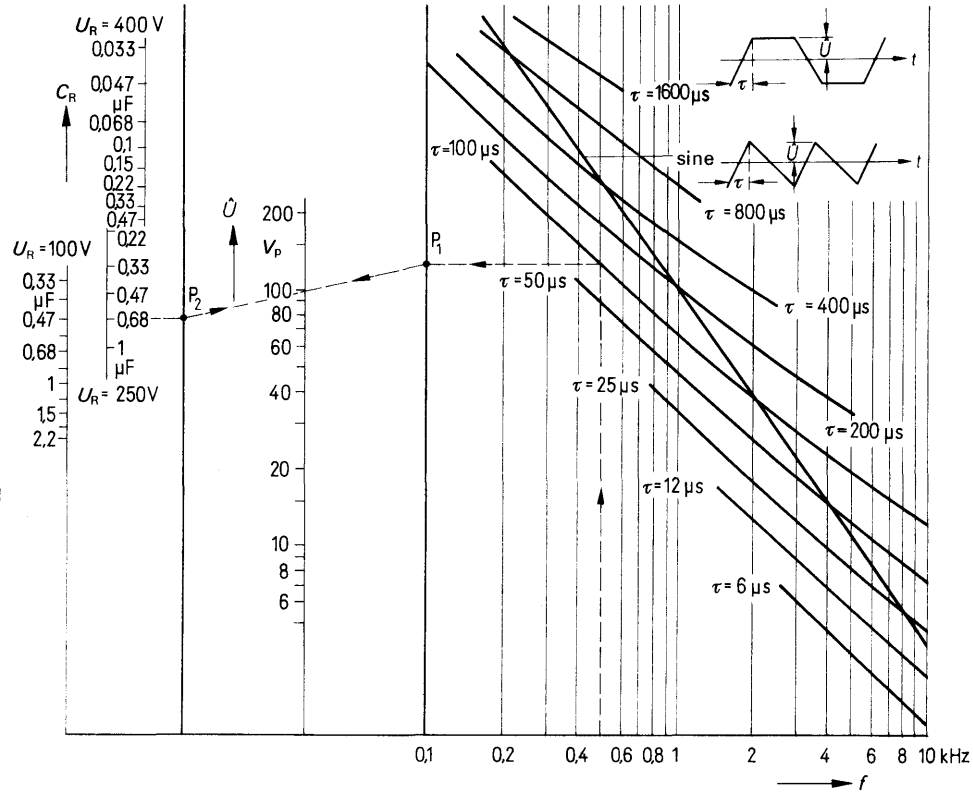
f	= 10 kHz	(repetition frequency)	} Point of intersection P_1
τ	= 40 µs	(rise time)	
C_R	= 220 nF	(capacitance)	} Point of intersection P_2
U_R	= 250 V	(rated voltage)	

According to the dashed line on the graph above this gives a max. peak voltage $\hat{U}$ of about 40 V.

B 32562, lead spacing = 15 mm

Nomogram for determining the permissible peak voltage $\hat{U}$

Determine points of intersection P_1 and P_2 in accordance with the example plotted. The line of communication P_1, P_2 yields the maximum possible peak voltage.
In case of trapezoidal voltage load with two steep edges, the second harmonic frequency has to be taken into account. With sinusoidal voltage load the "sine" characteristic applies.



Example given:

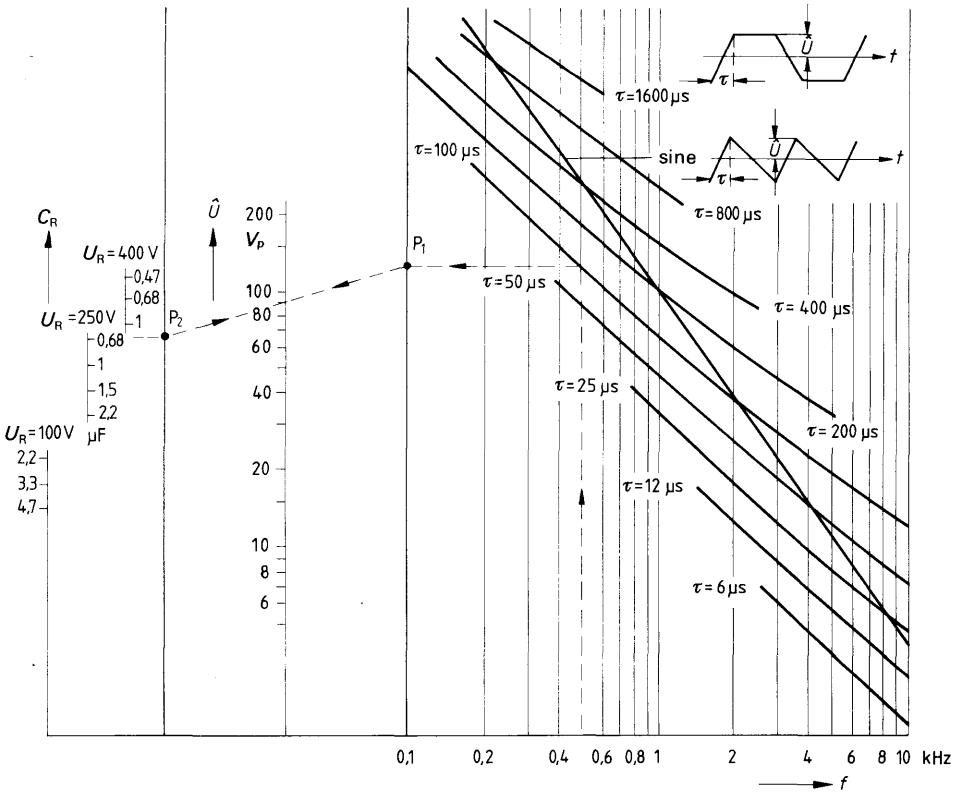
f = 0.5 kHz	(repetition frequency)	} Point of intersection P_1
τ = 100 µs	(rise time)	
C_R = 0.68 µF	(capacitance)	} Point of intersection P_2
U_R = 250 V	(rated voltage)	

According to the dashed line on the graph above this gives a max. peak voltage $\hat{U}$ of about 100 V.

B 32 563, lead spacing = 22.5 mm

Nomogram for determining the permissible peak voltage $\hat{U}$

Determine points of intersection P_1 and P_2 in accordance with the example plotted. The line of communication P_1, P_2 yields the maximum possible peak voltage.
In case of trapezoidal voltage load with two steep edges, the second harmonic frequency has to be taken into account. With sinusoidal voltage load the "sine" characteristic applies.



Example given:

f = 0.5 kHz	(repetition frequency)	} Point of intersection P_1
τ = 100 µs	(rise time)	
C_R = 0.68 µF	(capacitance)	} Point of intersection P_2
U_R = 250 V	(rated voltage)	

According to the dashed line on the graph above this gives a max. peak voltage $\hat{U}$ of about 90 V.

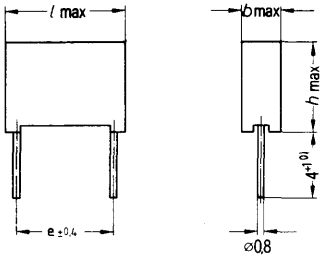
MKC Capacitors
Metallized Polycarbonate Capacitors

Metallized polycarbonate capacitors

High reliability version

(previous designation: MKM capacitors)

Self-healing flat capacitor winding with polycarbonate dielectric. Encapsulated in rectangular plastic case, epoxy resin sealed. The case is provided with spacers to improve solderability in the solder bath. Parallel leads, plug-in. Suitable for use in printed circuits.



Dimensions in mm

l	*e*
13	10
18	15
27	22.5

Rated capacitance µF	Tolerance	Rated voltage	Dimensions *b* × *h* × *l*	Ordering code
0,01	±10%≙K ±20%≙M	160 Vdc	5 ×10,5×13	B32435-A2103-•
0,012			5 ×10,5×13	B32435-A2123-•
0,015			5 ×10,5×13	B32435-A2153-•
0,018			5 ×10,5×13	B32435-A2183-•
0,022			5 ×10,5×13	B32435-A2223-•
0,027			5 ×10,5×13	B32435-A2273-•
0,033			5 ×10,5×13	B32435-A2333-•
0,039			5 ×10,5×13	B32435-A2393-•
0,047			5 ×10,5×13	B32435-A2473-•
0,056			5 ×10,5×13	B32435-A2563-•
0,068			5 ×10,5×13	B32435-B2683-•
0,082			6 ×11,5×13	B32435-A2823-•
0,1	(±5%≙J)[1] ±10%≙K ±20%≙M		6 ×11,5×13	B32435-A2104-•
0,12			5,5×11 ×18	B32435-A2124-•
0,15			5,5×11 ×18	B32435-A2154-•
0,18			7 ×13 ×18	B32435-A2184-•
0,22			7 ×13 ×18	B32435-A2224-•
0,27			7 ×13 ×18	B32435-B2274-•
0,33			9 ×14,5×18	B32435-A2334-•
0,39			9 ×14,5×18	B32435-A2394-•
0,47			6,5×15 ×27	B32435-B2474-•
0,56			7 ×16,5×27	B32435-B2564-•
0,68			8,5×18,5×27	B32435-A2684-•
0,82			8,5×18,5×27	B32435-B2824-•
1			8,5×18,5×27	B32435-B2105-•

*When ordering, the code letter for the requested tolerance must be substituted for •.
[0] available upon request also with 26±4 ordering code: B••••-••••-•2.

[1] Closer capacitance tolerance upon request.

Climatic category in accordance with DIN 40040 Minimum limit temperature Maximum limit temperature Humidity category Failure quota Load duration Relative failure rate	**G P F / L R** **G** −40 °C/− 40 °F **P** +85 °C/+185 °F **F** average relative humidity ≦ 75%; 95% for 30 days per year; continuously 85% for the remaining days; occasionally **L** 300 failures per 10^9 component hours **R** 10^5 h $300 \times 10^{-9} \times 10^5 = 3\%$
Failure criteria Total failure Failure due to variation	Short or open circuit Capacitance change $\frac{\Delta C}{C}$ $> \pm 10\%$ Dissipation factor tan δ 2 × max. limit value Insulation resistance < 150 MΩ (≦ 0.33 µF) Time constant τ < 50 s (> 0.33 µF)
Test category in accordance with DIN 40045 or IEC publication 68-1 Damp heat test in accordance with DIN 40046, sheet 5 or IEC publication 68-2-3	**40/085/21** **Conditions** Test temperature +40 °C/104 °F Relative humidity $(93 \pm \frac{2}{3})$ % Test duration 21 days **Test criteria** Capacitance change $\frac{\Delta C}{C}$ ≦ ± 3% (> 0.1 µF) ≦ ± 5% (≦ 0.1 µF) Dissipation factor change Δ tan δ ≦ 3×10^{-3} at 1 kHz ≦ 5×10^{-3} at 10 kHz Insulation resistance ≧ 50% of the minimum value at delivery
Resistance to vibration Test F_C: Vibration partial test B 1 in accordance with DIN 40046, sheet 8 and IEC publication 68-2-6	Duration of endurance conditioning 6 hours Frequency range 10 to 55 Hz Displacement amplitude 0.75 mm (conforming to max. 10 g)
Solder conditions	Temperature of the solder bath max. 260 °C (500 °F) Soldering duration max. 10 s

[1] The capacitors also meet the test conditions of humidity category E in accordance with DIN 40 040.

Capacitance drift i_Z	±3%

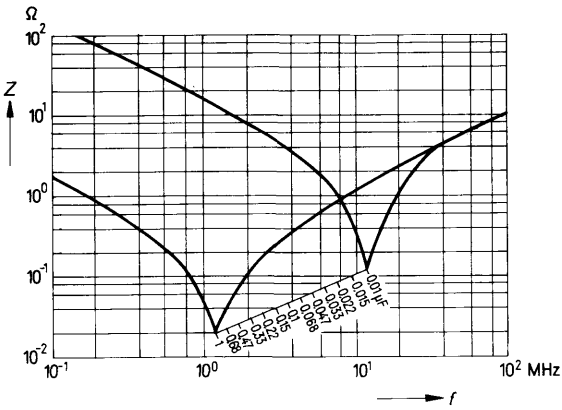
Dissipation factor tan δ
measured at 23 °C/73.4 °F

	Maximum value	Average value
for 1 kHz	3×10^{-3}	3×10^{-3}
for 10 kHz	5×10^{-3}	5×10^{-3}
for 100 kHz	10×10^{-3}	

Self inductance

approx. 20 nH (for 3 mm lead length at both ends)

Impedance Z
as a function of frequency f
(typical values)



Category voltage U_C
at dc operation
2000 hours at 85 °C/185 °F
for milliseconds
(e. g. switchings)

160 Vdc up to 85 °C/185 °F

$1.25 \times U_C$
$1.5 \times U_C$

Category voltage U_C[1)]
at ac operation
for milliseconds
(e. g. switchings)

63 Vac up to 85 °C/185 °F

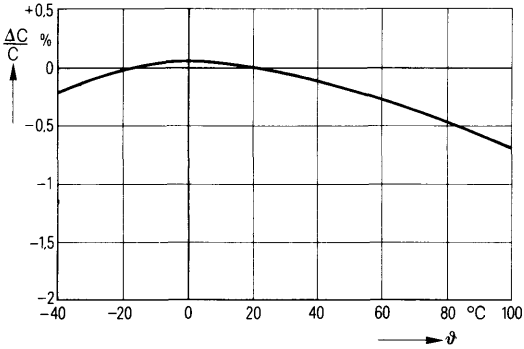
$1.5 \times U_C$

[1)] Applies to frequencies up to 2 kHz and voltage rise times > 25 µs.

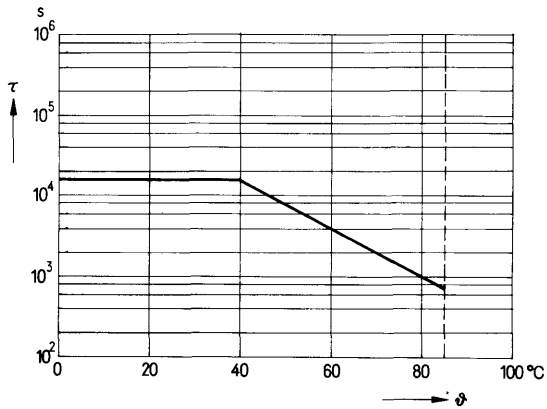
For use in pulse discharge circuits (VDE 0560, part 1 and part 2, § 51) MKC capacitors are not suitable. In place of that Siemens MPS and MKV capacitors (B25***) are recommended.

Reversible capacitance change $\frac{\Delta C}{C}$

as a function of temperature at 1 kHz (typical values)



Insulation
(time constant τ)
as a function of temperature



Minimum value[1]	
for $C \leqq 0.33$ µF	30 000 MΩ
for $C > 0.33$ µF	10 000 s
Average value	
for $C \leqq 0.33$ µF	>75 000 MΩ
for $C > 0.33$ µF	>25 000 s

[1] The indicated values are applicable at the time of delivery. During operational life the insulation may decrease for a short period to about 10% of the values at the time of delivery, especially when the maximum permissible humidity of 95% is applied for a long period, or when the capacitor is operated close to the maximum limit temperature.

Pulse handling capability (voltage rate of rise U_{pp}/τ and pulse characteristic k_O). Maximum permissible voltage change per time unit at non-sinusoidal voltage load (pulse, sawtooth).

Rated voltage U_R		Capacitor length		
		13 mm	18 mm	27 mm
160 Vdc	U_{pp}/τ	10 V/µs	5 V/µs	3 V/µs
	k_O	3 200 V²/µs	1 600 V²/µs	960 V²/µs

For a voltage swing $U_{pp} < U_R$ the value of the permissible voltage rate of rise U_{pp}/τ can be multiplied by the factor U_R/U_{pp}. See also "General Technical Data", para. 5.2.6.

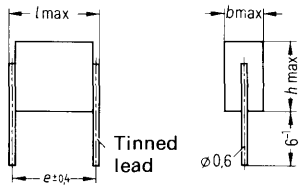
Ac power handling capacity at higher frequencies

Values upon request; a voltage/time diagram is requested.

Metallized polycarbonate layer capacitors – Standard version
(previous designation: MKM layer capacitors)

Self-healing layer capacitor with polycarbonate dielectric.
Mechanical protection by insulating plates. When mounting, attention must be given to the surface leakage paths and air paths to adjacent live parts.

Connections: Parallel leads, tinned, plug-in, lead spacing 7.5 mm and 10 mm.
Suitable for use in single-clad printed circuit boards. Molded types on request.



Dimensions in mm

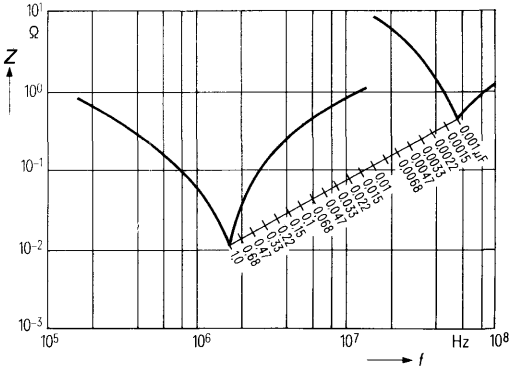
Type	*e*
B 32540	7.5 mm
B 32541	10 mm

Climatic category in accordance with DIN 40040	**F M E**
Minimum limit temperature	**F** – 55 °C/– 67 °F
Maximum limit temperature	**M** +100 °C/+212 °F
Humidity category	**E** average relative humidity ≦ 75%; rare and slight dew precipitation permitted

Rated voltage U_R		100 Vdc		250 Vdc	
Rated capacitance C_R µF	Tolerance	LS[1] 7.5 mm	LS 10 mm	LS 7.5 mm	LS 10 mm
		Dimensions $b \times h \times l$ Ordering code			
0,001	± 10% ≙ K			2,6 × 7,3 × 9 B 32540-C 3102-K	
0,0015				2,6 × 7,3 × 9 B 32540-C 3152-K	
0,0022				2,5 × 7,3 × 9 B 32540-C 3222-K	
0,0033				2,3 × 7,3 × 9 B 32540-C 3332-K	
0,0047				2,3 × 7,3 × 9 B 32540-C 3472-K	
0,0068				2,7 × 7,3 × 9 B 32540-C 3682-K	
0,01	±5% ≙ J ±10% ≙ K			2,3 × 7,3 × 9 B 32540-C 3103-*	3,2 × 6,6 × 11,5 B 32541-C 3103-*
0,015				2,9 × 7,3 × 9 B 32540-C 3153-*	3,2 × 6,6 × 11,5 B 32541-C 3153-*
0,022				2,6 × 7,3 × 9 B 32540-C 3223-*	3,2 × 6,6 × 11,5 B 32541-C 3223-*
0,033				2,6 × 7,3 × 9 B 32540-C 3333-*	3,7 × 6,6 × 11,5 B 32541-C 3333-*
0,047				3,2 × 7,3 × 9 B 32540-C 3473-*	3,2 × 6,6 × 11,5 B 32541-C 3473-*
0,068		2,6 × 8,1 × 9 B 32540-C 1683-*		3,5 × 9,1 × 9 B 32540-C 3683-*	3,2 × 6,6 × 11,5 B 32541-C 3683-*
0,1		3,2 × 8,1 × 9 B 32540-C 1104-*		3,9 × 11,5 × 9 B 32540-C 3104-*	3,5 × 8,3 × 11,5 B 32541-C 3104-*
0,15		3,6 × 10 × 9 B 32540-C 1154-*			4,2 × 9,6 × 11,5 B 32541-C 3154-*
0,22		4,7 × 10 × 9 B 32540-C 1224-*	3,5 × 9,5 × 11,5 B 32541-C 1224-*		4,9 × 11,5 × 11,5 B 32541-C 3224-*
0,33		5,5 × 11,5 × 9 B 32540-C 1334-*	4,1 × 11,5 × 11,5 B 32541-C 1334-*		
0,47		7,2 × 12,5 × 9 B 32540-C 1474-*	5,3 × 11,5 × 11,5 B 32541-C 1474-*		
0,68		8 × 13 × 9 B 32540-C 1684-*	7,1 × 11,5 × 11,5 B 32541-C 1684-*		
1,0			9,8 × 11,5 × 11,5 B 32541-C 1105-*		

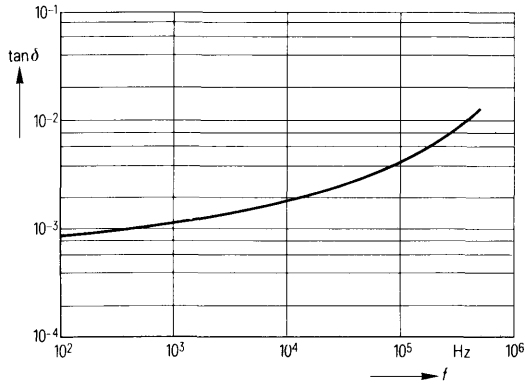
* When ordering, the code letter for the requested tolerance must be substituted for *.

[1] Lead spacing

Test category in accordance with DIN 40045 or IEC publication 68-1 Damp heat test in accordance with DIN 40046, sheet 5 or IEC publication 68-2-3	**55/100/21** **Conditions** Test temperature: +40 °C/+104 °F Relative humidity: $(93 \pm \frac{2}{3})$ % Test duration: 21 days **Test criteria** Capacitance change $\frac{\Delta C}{C}$: $\leqq \pm 5\%$ ($\leqq 0.1$ µF); $\leqq \pm 3\%$ (> 0.1 µF) Dissipation factor change $\Delta \tan \delta$: $\leqq 5 \times 10^{-3}$ at 1 kHz; $\leqq 7 \times 10^{-3}$ at 10 kHz Insulation resistance: $\geqq 10\%$ of the minimum value at delivery
Resistance to vibration Test F_C: Vibration partial test B 1 in accordance with DIN 40046, sheet 8 and IEC publication 68-2-6	Duration of endurance conditioning: 6 hours Frequency range: 10 to 55 Hz Displacement amplitude: 0.75 mm (conforming to max. 98.1 m/s² or 10 g)
Solder conditions	Temperature of the solder bath: max. 255 °C/491 °F Soldering duration: max. 5 s
Capacitance drift i_z	±3%
Self inductance	approx. 6 nH
Impedance Z as a function of frequency f (typical values)	

Dissipation factor tan δ
as a function of frequency f

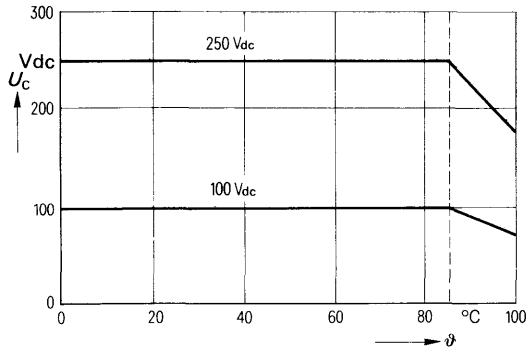
average values
measured at 23 °C (73.4 °F)
and $C \leqq 0.1$ µF



Maximum values

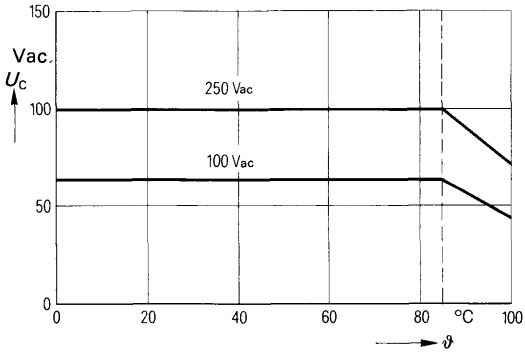
3×10^{-3}	at 1 kHz
10×10^{-3}	at 10 kHz

Category voltage U_C
at dc operation
as a function of ambient
temperature ϑ



max. 2,000 hours	$1.25 \times U_C$
for milliseconds	$1.50 \times U_C$
(e. g. switchings)	

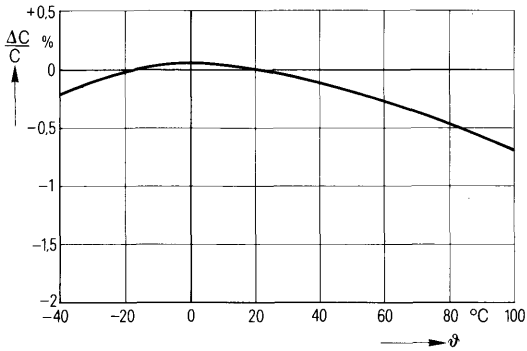
Category voltage U_C[1]
at ac operation
as a function of ambient temperature ϑ



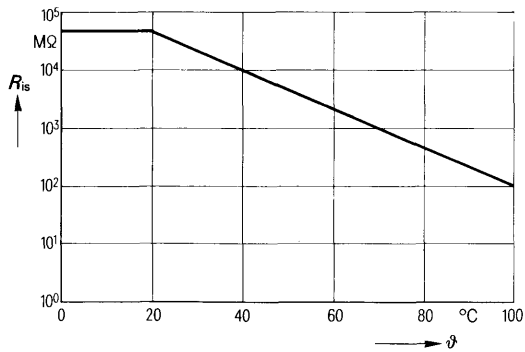
max. 2000 hours $1.25 \times U_C$

Reversible capacitance change $\frac{\Delta C}{C}$

as a function of temperature ϑ
at 1 kHz (typical values)



Insulation resistance R_{is}
as a function of temperature ϑ



[1] When an ac voltage is superimposed to a dc voltage, the sum of the dc voltage and the amplitude of the ac voltage shall not exceed the rated voltage.

Insulation resistance[1]		
Minimum value at delivery for capacitors	for $C \leqq 0.33$ µF	for $C > 0.33$ µF
with U_R = 100 V	3 000 MΩ	1 000 s
with U_R = 250 V	7 500 MΩ	–
Average value at delivery for capacitors		
with U_R = 100 V	>30 000 MΩ	>10 000 s
with U_R = 250 V	>75 000 MΩ	–

Pulse handling capability (voltage rate of rise U_{pp}/τ and pulse characteristic k_0). Maximum permissible voltage change per time unit at non-sinusoidal voltage load (pulse, sawtooth).

Rated voltage U_R		B 32 540 (LS[2] 7.5)	B 32 541 (LS[2] 10)
100 Vdc	U_{pp}/τ	10 V/µs	5 V/µs
	k_0	2 000 V²/µs	1 000 V²/µs
250 Vdc	U_{pp}/τ	20 V/µs	10 V/µs
	k_0	10 000 V²/µs	5 000 V²/µs

For a voltage swing $U_{pp} < U_R$ the value of the permissible voltage rate of rise U_{pp}/τ can be multiplied by the factor U_R/U_{pp}. For periodic pulse load the data of the nomogram has to be taken into account. See also "General Technical Data", para. 5.2.6.

Ac power handling capacity at higher frequencies

The maximum permissible peak voltage $\hat{U}$ for sinusoidal and non-sinusoidal voltage load (pulse sawtooth, trapezoidal voltages) can be obtained from the nomogram.

The following limit values $\hat{U}_l$ are not allowed to be exceeded:

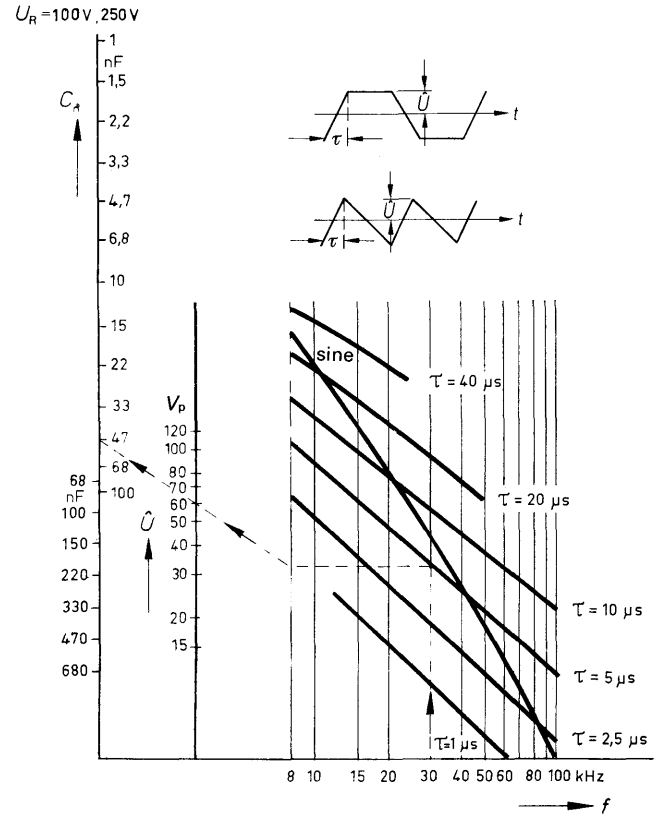
Rated voltage U_R	100 V	250 V
Limit voltage $\hat{U}_l$	85 V	140 V

[1] The indicated values are applicable at the time of delivery. During operational life the insulation may decrease for a short period to about 10% of the values at the time of delivery, especially when the maximum permissible humidity of 95% is applied for a long period, or when the capacitor is operated close to the maximum limit temperature.
[2] Lead spacing.

B 32 540, lead spacing = 7.5 mm

Nomogram for determining the permissible peak Voltage $\hat{U}$

The nomogram is based on 10 °C (18 °F) inherent temperature rise of the capacitor; this must be taken into account when considering the permissible max. temperature.
With trapezoidal voltage load the second harmonic frequency must be assumed.
Capacitance (nF)



Example given:

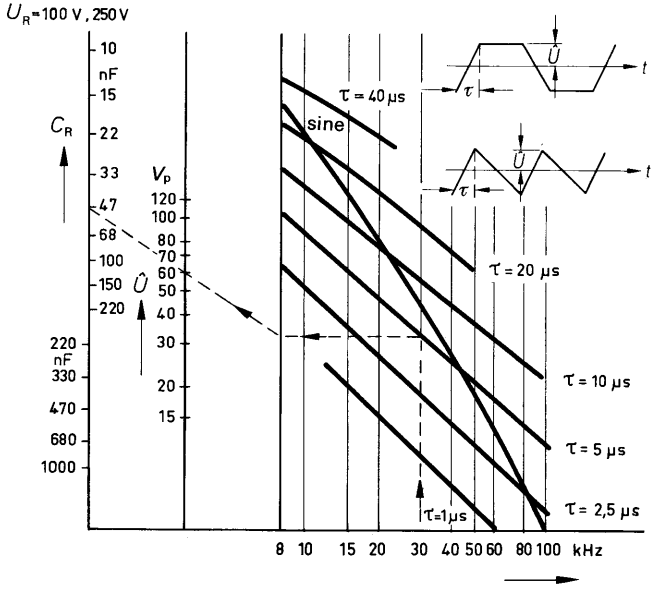
f = 30 kHz (repetition frequency)
τ = 5 µs (rise time)
C_R = 47 nF (capacitance)

According to the dashed line on the graph above this gives a peak voltage $\hat{U}$ of about 60 V.

B 32541, lead spacing = 10 mm

Nomogram for determining the permissible peak Voltage $\hat{U}$

The nomogram is based on 10 °C (18 °F) inherent temperature rise of the capacitor; this must be taken into account when considering the permissible max. temperature.
With trapezoidal voltage load the second harmonic frequency must be assumed.



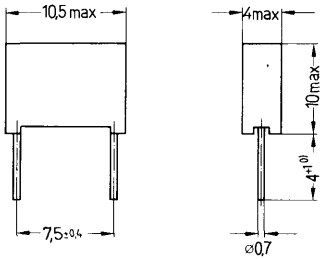
Example given:

f = 30 kHz (repetition frequency)
τ = 5 µs (rise time)
C_R = 47 nF (capacitance)

According to the dashed line on the graph above this gives a peak voltage $\hat{U}$ of about 60 V.

Metallized polycarbonate capacitors
High reliability version
(previous designation: MKM capacitors)

Self-healing capacitor with plastic dielectric. Encapsulated in rectangular plastic case, epoxy resin sealed. Parallel leads, plug-in, lead spacing 7.5 mm. Suitable for use in printed circuit boards. The case is provided with spacers to improve solderability in the solder bath.



Dimensions in mm

Capacitance µF	Rated voltage	Capacitance tolerance	Ordering code
1,0 nF	400 Vdc	±10%≙K ±20%≙M	B32545-B6102-*
1,2 nF			B32545-B6122-*
1,5 nF			B32545-B6152-*
1,8 nF			B32545-B6182-*
2,2 nF			B32545-B6222-*
2,7 nF			B32545-B6272-*
3,3 nF			B32545-B6332-*
3,9 nF			B32545-B6392-*
4,7 nF			B32545-B6472-*
5,6 nF			B32545-B6562-*
6,8 nF			B32545-B6682-*
8,2 nF			B32545-B6822-*
0,010			B32545-B6103-*
0,012	250 Vdc	(±5%≙J)[1] ±10%≙K ±20%≙M	B32545-B3123-*
0,015			B32545-B3153-*
0,018			B32545-B3183-*
0,022			B32545-B3223-*
0,027			B32545-B3273-*
0,033			B32545-B3333-*
0,039	100 Vdc		B32545-B1393-*
0,047			B32545-B1473-*
0,056			B32545-B1563-*
0,068			B32545-B1683-*
0,082			B32545-B1823-*
0,1			B32545-B1104-*

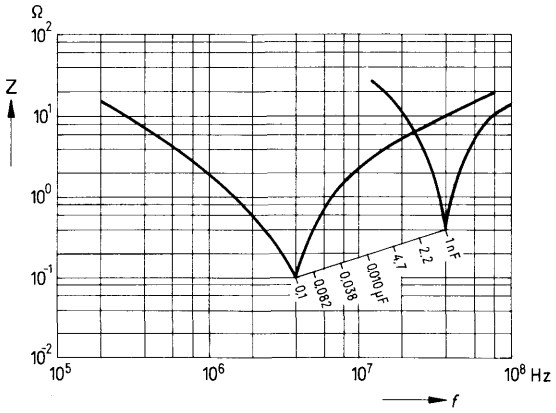
* When ordering, the code letter for the requested tolerance must be substituted for *
[0] available on request also with 15 ± 2; ordering code: B••••-••••-•2.
[1] Closer capacitance tolerances on request.

Climatic category in accordance with DIN 40040 Minimum limit temperature Maximum limit temperature Humidity category Failure quota Load duration Relative failure rate	**F M F / L R** **F** − 55 °C/− 67 °F **M** +100 °C/+212 °F **F**[1] average relative humidity ≦ 75%; 95% for 30 days per year; 85% for the remaining days; occasionally **L** 300 failures per 10^9 component hours **R** 10^5 h $300 \times 10^{-9} \times 10^5 = 3\%$
Failure criteria Total failure Failure due to variation	 Short or open circuit Capacitance change $\frac{\Delta C}{C}$ $> \pm 10\%$ Dissipation factor tan δ $> 2 \times$ max. limit value Insulation resistance < 150 MΩ
Test category in accordance with DIN 40045 and IEC publ. 68-1 Damp heat test in accordance with DIN 40046, sheet 5 or IEC publ. 68-2-3	**55/100/21** **Conditions** Test temperature +40 °C/+104 °F Relative humidity $(93 \pm \frac{2}{3})$ % Test duration 21 days **Test criteria** Capacitance change $\frac{\Delta C}{C}$ ≦ ±5% Dissipation factor change Δ tan δ ≦ 3×10^{-3} at 1 kHz ≦ 5×10^{-3} at 10 kHz Insulation resistance ≧ 50% of the minimum value at delivery
Resistance to vibration Test F_C: Vibration partial test B 1 in accordance with DIN 40046, sheet 8 and IEC publ. 68-2-6	Duration of endurance conditioning 6 hours Frequency range 10 to 55 Hz Displacement amplitude 0.75 mm (conforming to max. 10 g)
Solder conditions	Temperature of the solder bath 260 °C (500 °F) Soldering duration max. 10 s
Capacitance drift i_Z (typical value)	±3%

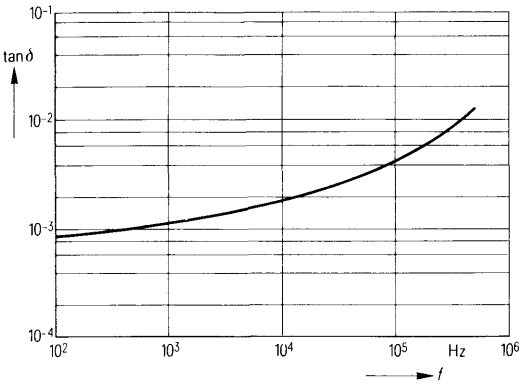
[1] The capacitors also meet the test conditions of humidity category E as to DIN 40040.

Self inductance	approx. 20 nH

Impedance Z
as a function of frequency f
(typical values)



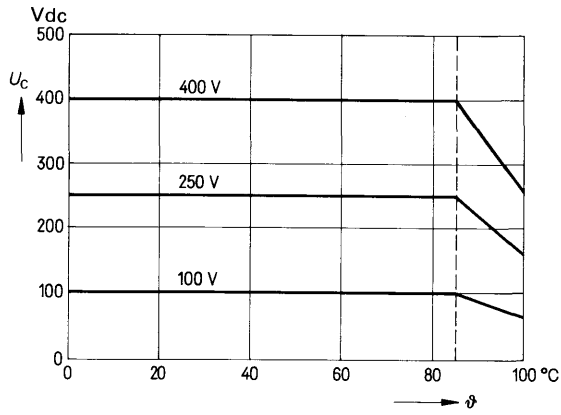
Dissipation factor tan δ
as a function of frequency f



Typical values
measured at 20 °C/68 °F

	Maximum value	Average value
at 1 kHz	3×10^{-3}	1×10^{-3}
at 10 kHz	5×10^{-3}	2×10^{-3}
at 100 kHz	10×10^{-3}	5×10^{-3}

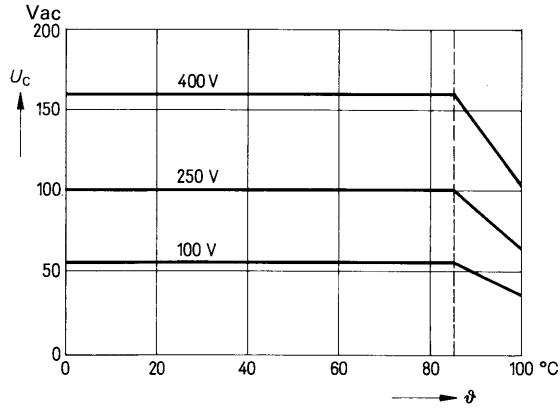
Category voltage U_C
at dc operation
as a function of ambient temperature



max. 2,000 hours
for milliseconds
(e. g. switchings)

$1.25 \times U_C$
$1.50 \times U_C$

Category voltage U_C[1]
at ac operation
as a function of ambient temperature



for milliseconds
(e. g. switchings)

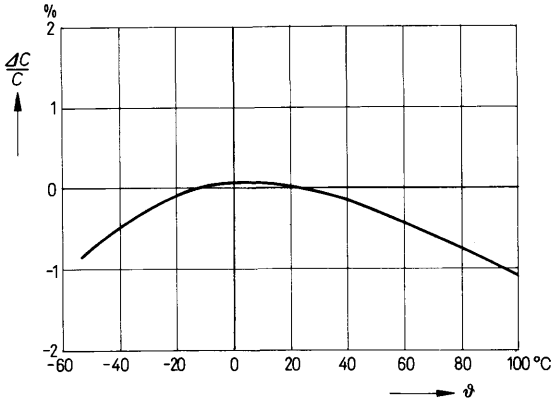
$1.50 \times U_C$

For use in pulse discharge circuits (VDE 0560, part 1 and part 2, § 51) MKC capacitors are not suitable. In place of that Siemens MPS and MKV capacitors (B 25***) are recommended.

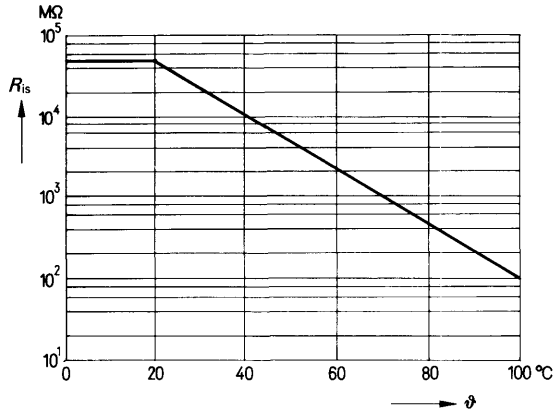
[1] When an ac voltage is superimposed to a dc voltage, the sum of the dc voltage and the amplitude of the ac voltage shall not exceed the rated voltage.

Reversible capacitance change $\frac{\Delta C}{C}$

as a function of temperature at 1 kHz (typical values)



Insulation resistance R_{is} as a function of temperature



Minimum value[1]	
for U_R = 100 V	15 000 MΩ
for U_R > 100 V	30 000 MΩ
Average value	
for U_R = 100 V	>75 000 MΩ
for U_R > 100 V	

[1] The indicated values are applicable at the time of delivery. During operational life the insulation may decrease for a short period to about 10% of the values at the time of delivery, especially when the maximum permissible humidity of 95% is applied for a long period, or when the capacitor is operated close to the maximum limit temperature.

Pulse handling capability (voltage rate of rise U_{pp}/τ and pulse characteristic k_O).

Maximum permissible voltage change per time unit at non-sinusoidal voltage load (pulse, sawtooth).

Rated voltage U_R		Pulse handling capability
100 Vdc	U_{pp}/τ k_O	5 V/µs 1 000 V²/µs
250 Vdc	U_{pp}/τ k_O	10 V/µs 5 000 V²/µs
400 Vdc	U_{pp}/τ k_O	15 V/µs 12 000 V²/µs

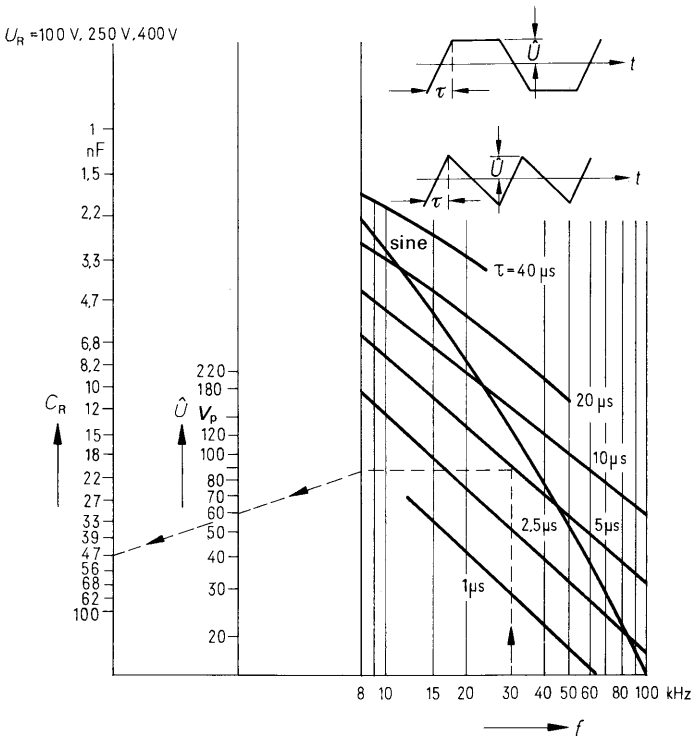
For a voltage swing $U_{pp} < U_R$ the value of the permissible voltage rate of rise U_{pp}/τ can be multiplied by the factor U_R/U_{pp}. For periodic pulse load the data of the nomogram has to be taken into account. See also "General Technical Data", para. 5.2.6.

Ac power handling capacity at higher frequencies

The maximum permissible peak voltage $\hat{U}$ for sinusoidal and non-sinusoidal voltages (pulse, sawtooth, trapezoidal voltages) can be obtained from the nomogram. The following limit values $\hat{U}_l$ are not allowed to be exceeded:

Rated voltage U_R	100 V	250 V	400 V
Limit voltage $\hat{U}_l$	85 V	140 V	220 V

The nomogram is based on 10 °C (18 °F) inherent temperature rise of the capacitor; this must be taken into account when considering the permissible max. temperature.
With trapezoidal voltage load the second harmonic frequency must be assumed. At sinusoidal voltage load, the "sine" characteristic applies.



Example given:

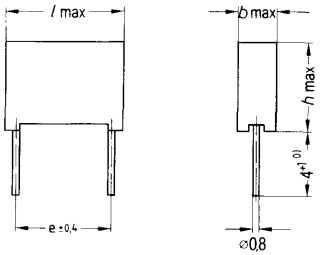
f = 30 kHz (repetition frequency)
τ = 5 µs (rise time)
C = 47 nF (capacitance)

According to the dashed line on the graph above this gives a peak voltage $\hat{U}$ of about 60 V.

Metallized polycarbonate capacitors
High reliability version
(previous designation MKM capacitors)

Self-healing flat winding capacitor with polycarbonate (trade name MAKROFOL®) dielectric and metallized layers. Enclosed in rectangular plastic case, with epoxy resin seal. The case is provided with spacers to improve the solderability in the solder bath.

Connections: Parallel leads, plug-in. Suitable for use in printed circuits. This type is particularly suitable for use at sinusoidal and non-sinusoidal ac voltages.



Dimensions in mm

l	*e*
27	22.5
32	27.5

Rated voltage perm. V_{rms} up to 400 Hz		400 Vdc 220 Vac	630 Vdc 250 Vac
Rated capacitance µF	Tolerance	Dimensions *b x h x l* Ordering code	
0,1	±10%≙K ±20%≙M	–	6,5×15×27 B32892-B6104-*
0,15		–	7×16,5×27 B32892-B6154-*
0,22		6,5×15×27 B32892-B4224-*	10,5×19×27 B32892-B6224-*
0,33		8,5×18,5×27 B32892-B4334-*	11×20×32 B32892-B6334-*
0,47		10,5×19×27 B32892-B4474-*	13×22,5×32 B32892-B6474-*
0,68		11×20×32 B32892-B4684-*	–
1		13×22,5×32 B32892-B4105-*	–

* When ordering, the code letter for the requested tolerance must be substituted for*

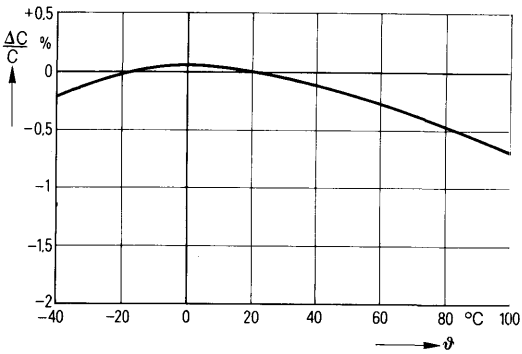
0) Also 26 ± 4 available on request. Ordering code-*002 in the third block of the part number.
® Registered trademark.

Climatic category in accordance with DIN 40040 Min. limit temperature Max. limit temperature Humidity category Failure quota Load duration Relative failure rate	**F M F / M S** **F** − 55 °C/− 67 °F **M** + 100 °C/+ 212 °F **F** average relative humidity ≦ 75 %; 95 % 30 days per year, continuously 85 % for the remaining days, occasionally **M** 1000 failures per 10^9 component hours **S** 3×10^4 hours $1000 \times 10^{-9} \times 3 \times 10^4 = 3$ %
Failure criteria Total failure Failure due to variations	 Short or open circuit Capacitance change $\frac{\Delta C}{C}$ $> \pm 10$ % Dissipation factor tan δ > 2 x max. value Insulation resistance < 50 s (> 0.33 µF) < 150 MΩ ($\leqq 0.33$ µF)
Test category in accordance with DIN 40045 or IEC publication 68-1 Damp heat test in accordance with DIN 40046, sheet 5 and IEC publication 68-2-3	**55/100/21** **Conditions** Test temperature + 40 °C/+ 104 °F Relative humidity $(93 \pm \frac{2}{3})$% Test duration 21 days **Test criteria** Capacitance change $\frac{\Delta C}{C}$ $\leqq \pm 3$ % Dissipation factor change Δ tan δ $\leqq 3 \times 10^{-3}$ (at 1 kHz) $\leqq 5 \times 10^{-3}$ (at 10 kHz) Insulation resistance 50 % of the minimum value at delivery
Resistance to vibration Test F_c: Vibration Partial test B 1 in accordance with DIN 40046, sheet 8 and IEC publication 68-2-6	Duration of endurance conditioning 6 hours Frequency range 10 to 55 Hz Displacement amplitude 0.75 mm (conforming to max. 10 g)
Solder conditions	Temperature of the solder bath max. 260 °C (500 °F) Soldering duration max. 10 s
Capacitance drift i_z	± 5 %

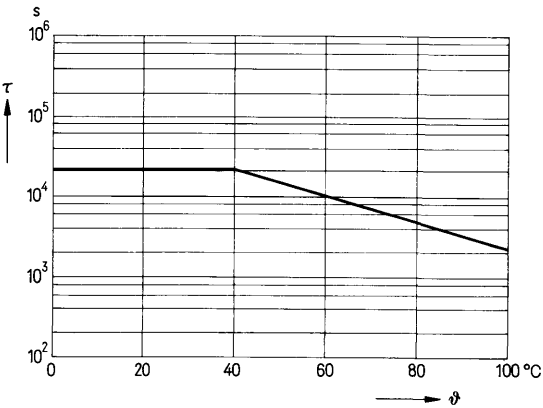
[1] The capacitors also meet the test conditions of humidity category E as to DIN 40040.

Dissipation factor tan δ measured at 20 °C (68 °F)	Maximum value	Average value
at 1 kHz	3×10^{-3}	1×10^{-3}
at 10 kHz	5×10^{-3}	3×10^{-3}

Reversible capacitance change $\frac{\Delta C}{C}$ as a function of temperature at 1 kHz (typical values)



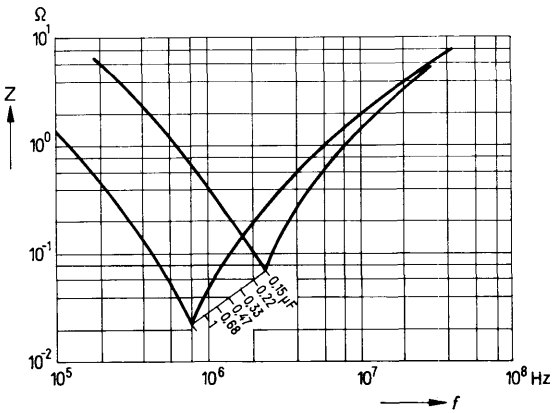
Insulation (time constant τ) as a function of temperature



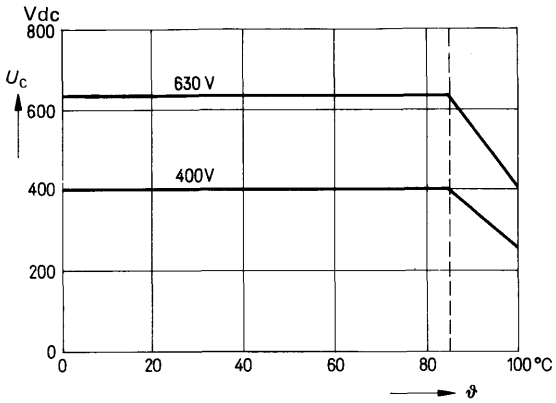
Minimum values at delivery[1]	$C \leqq 0.33$ µF	30 000 MΩ
	$C > 0.33$ µF	10 000 s
Average values at delivery	$C \leqq 0.33$ µF	> 75 000 MΩ
	$C > 0.33$ µF	> 25 000 s

[1] The indicated values are applicable at the time of delivery. During operational life the insulation may decrease for a short period to about 10 % of the values at the time of delivery, especially when the maximum permissible humidity of 95 % is applied for a long period or when the capacitor is operated in the range of the upper temperature limit.

Impedance Z
as a function of frequency f
(typical values)

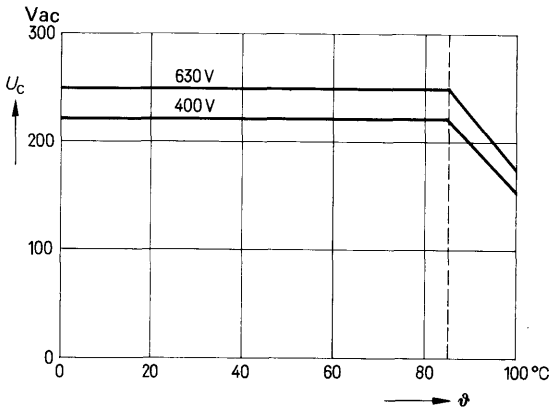


Category voltage U_c
at dc operation
as a function of ambient temperature



2,000 hours at 85 °C (185 °F)	1.25 x U_c
for milliseconds	1.50 x U_c

Category voltage U_C[1)]
Operation at sinusoidal
ac voltage up to 400 Hz
as a function of temperature



Permissible in excess

1.1 x U_c
1.25 x U_C up to 4000 h } at 50 Hz
1.45 x U_C up to 1100 h }

Pulse handling capability (voltage rate of rise U_{PP}/τ and pulse characteristic k_O).
Maximum permissible voltage change per time unit with non-sinusoidal voltage load (pulse, sawtooth).

Rated voltage U_R		Capacitor length 27 mm	Capacitor length 32 mm
400 Vdc	U_{PP}/τ k_O	85 V/µs 68000 V²/µs	65 V/µs 52000 V²/µs
630 Vdc	U_{PP}/τ k_O	135 V/µs 170100 V²/µs	100 V/µs 126000 V²/µs

For a voltage swing $U_{PP} < U_R$ the value of the permissible voltage rate of rise U_{PP}/τ can be multiplied by the factor U_R/U_{PP}.

Ac power handling capacity at higher frequencies

Values upon request; a voltage/time diagram is requested.

1) The sum of the dc voltage and the peak value of an ac voltage superimposed on the dc voltage shall not exceed the rated voltage.

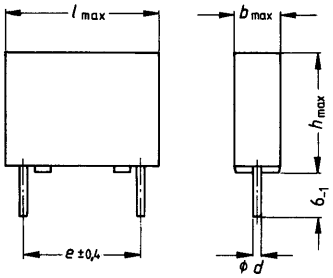
MKP Capacitors

Metallized Polypropylene Capacitors

Metallized polypropylene capacitors – Standard version

Self-healing flat capacitor winding, comprising a polypropylene dielectric. Epoxy resin sealed to ensure resistance to humidity; flame retardant seal. The capacitor is provided with spacers to improve solderability in the solder bath. Parallel leads, plug-in.

These pulse-proof capacitors are particularly suited for use in deflection and high voltage stages of TV sets; e.g. as storage and S-correction capacitor (400 V series), as commutation capacitor in thyristor deflection circuits (1000 V series) and as line flyback capacitor (1500 V series).



l	*e*
18	15
27	22,5
32	27,5

Dimensions in mm

Climatic category in accordance with DIN 40040 Minimum limit temperature Maximum limit temperature Humidity category	**G P F** **G** −40°C/−40°F **P** + 85°C/+185°F **F**[1] average relative humidity ≦ 75% 95% for 30 days per year; continuously 85% for the remaining days; occasionally
Test category in accordance with DIN 40045 and IEC publ. 68-1 Damp heat test in accordance with DIN 40046, sheet 5 or IEC publ. 68-2-3	**40/085/21** **Conditions** Test temperature +40°C/+104°F Relative humidity $(93\pm\frac{2}{3})$ % Test duration 21 days **Test criteria** Capacitance change $\frac{\Delta C}{C}$ ≦±3% Dissipation factor change Δ tan δ ≦ 0.5 x 10^{-3} (at 1 kHz) ≦ 1 x 10^{-3} (at 10 kHz) Insulation resistance ≧ 50% of the minimum value at delivery

[1] The capacitors also meet the test conditions of humidity category E as to DIN 40040.

Rated voltage U_R AC voltage U_C		400 V_{dc} 500 V_{PP} [1]	1000 V_{dc} 700 V_{PP}	1500 V_{dc} 1500 V_{PP}
Rated capacitance C_R [2]	Tolerance	Dimensions *b x h x l* Ordering code		
1,2 nF		–	–	7,3×16,5×27 B32650–J1122–*
1,5 nF		–	–	7,3×16,5×27 B32650–J1152–*
1,8 nF		–	–	7,3×16,5×27 B32650–J1182–*
2,2 nF		–	–	7,3×16,5×27 B32650–J1222–*
3,3 nF		–	–	7,3×16,5×27 B32650–J1332–*
4,7 nF		–	–	7,3×16,5×27 B32650–J1472–*
6,8 nF		–	–	8,5×18,5×27 B32650–J1682–*
0,01 µF		–	–	10,5×19×27 B32650–J1103–*
0,015 µF	± 5% ≙ J ± 10% ≙ K	–	–	12×21×27 B32650–J1153–*
0,022 µF		–	9×15,5×18 B32650–J0223–*	11,5×21×32 B32650–J1223–*
0,033 µF		–	9×15,5×18 B32650–J0333–*	–
0,047 µF		–	7,3×16,5×27 B32650–J0473–*	–
0,068 µF		–	8,5×18,5×27 B32650–J0683–*	–
0,1 µF		7,3×13×18 B32650–J4104–*	10,5×19×27 B32650–J0104–*	–
0,15 µF		9×15,5×18 B32650–J4154–*	12×21×27 B32650–J0154–*	–
0,22 µF		9×15,5×18 B32650–J4224–*	13,5×23×32 B32650–J0224–*	–
0,33 µF		7,3×16,5×27 B32650–J4334–*	–	–
0,47 µF		8,5×18,5×27 B32650–J4474–*	–	–
0,68 µF		10,5×19×27 B32650–J4684–*	–	–
1,0 µF		11,5×21×32 B32650–J4105–*	–	–
1,5 µF		13,5×23×32 B32650–J4155–*	–	–

* When ordering, the code letter for the requested tolerance must be substituted for*

1) With unipolar pulse load U_{ac} = 400 V_P
2) Intermediate values upon request

Resistance to vibration
Test F_c: Vibration
partial test B1 in accordance with DIN 40046, sheet 8 and IEC publ. 68-2-6

Duration of endurance conditioning	6 hours
Frequency range	10 to 55 Hz
Displacement amplitude	0.75 mm (conforming to max. 98.1 m/s² or 10 g)

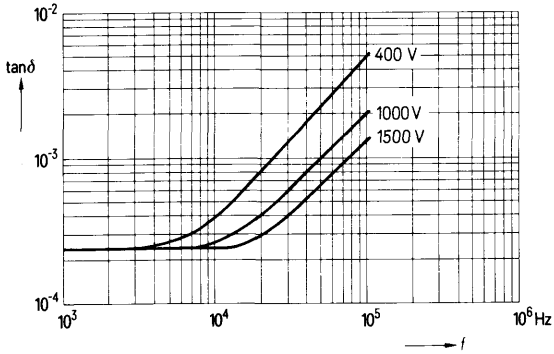
Solder conditions

Temperature of the solder bath	max. 260 °C/500 °F
Soldering duration	max. 10 s.

Capacitance drift i_Z: ± 2%

Dissipation factor tan δ
as a function of frequency f
average values

Parameter: Voltage series
max. lead spacing

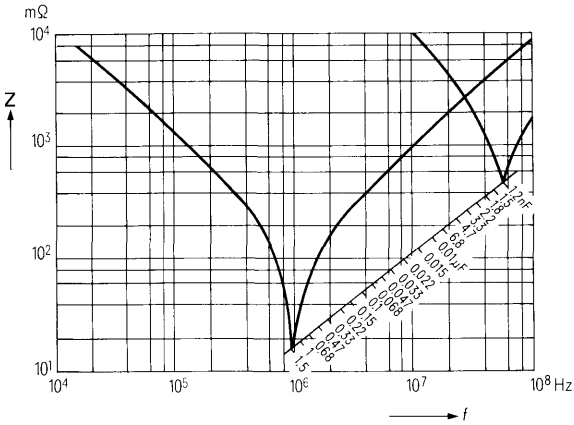


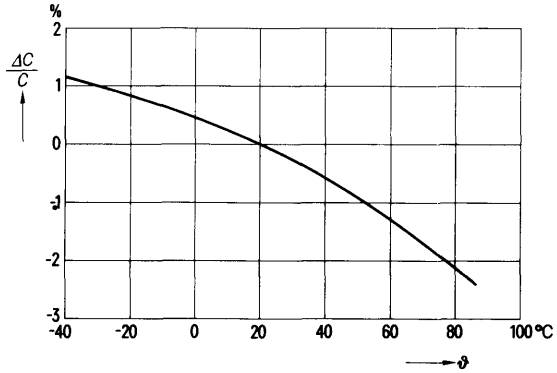
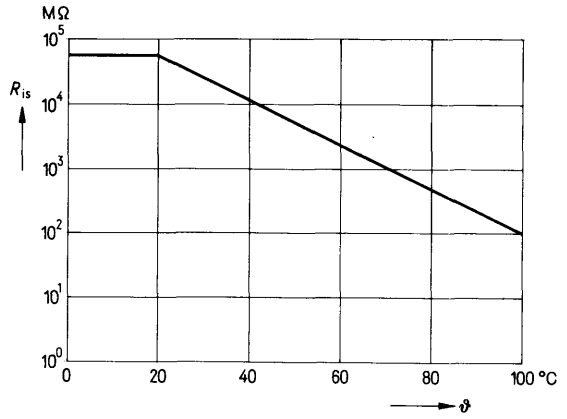
Dissipation factor tan δ
measured at 20 °C/68 °F

	Minimum value		Average value	
	$C \leqq 1\ \mu F$	$C > 1\ \mu F$	$C \leqq 1\ \mu F$	$C > 1\ \mu F$
for 1 kHz	$0.5 \cdot 10^{-3}$	$0.5 \cdot 10^{-3}$	$0.25 \cdot 10^{-3}$	$0.25 \cdot 10^{-3}$
for 10 kHz	$0.8 \cdot 10^{-3}$	$1.2 \cdot 10^{-3}$	$0.4 \cdot 10^{-3}$	$0.6 \cdot 10^{-3}$

Self inductance: approx. 20 nH

Impedance Z
as a function of frequency f
(typical values)



Voltage load	
Test voltage U_t	$1.5 \times U_R$
Category voltage U_c	$1.0 \times U_R$
Reversible capacitance change $\frac{\Delta C}{C}$ as a function of temperature at 1 kHz (typical values)	
Insulation resistance R_{is} as a function of temperature ϑ	
Minimum value[1]	
for $C \leqq 0.33$ µF	30 000 MΩ
for $C > 0.33$ µF	10 000 s
Average value	
for $C \leqq 0.33$ µF	> 75 000 MΩ
for $C > 0.33$ µF	> 25 000 s

[1] The indicated values are applicable at the time of delivery. During operational life the insulation may decrease for a short period to about 10 % of the values at the time of delivery, especially when the max. permissible humidity of 95 % is applied for a long period, or when the capacitor is operated close to the max. operating temperature limit.

Inherent heating	
Power loss at	90 mW (capacitor length 18 mm)
10 °C/18 °F excess temperature	160 mW (capacitor length 27 mm)
of the case (typical values)	260 mW (capacitor length 32 mm)

Pulse handling capability (voltage rate of rise U_{pp}/τ and pulse characteristic k_o)
Maximum permissible voltage change per time unit with non-sinusoidal voltage load (pulse, sawtooth).

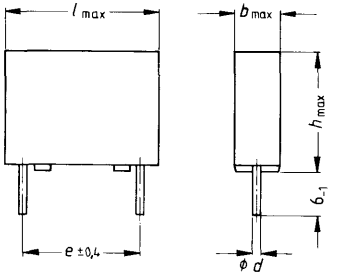
Rated voltage U_R	Perm. ac voltage U_{pp} perm.		Pulse handling capability		
			Capacitor length		
			18 mm	27 mm	32 mm
400 Vdc	500 V_{pp}	U_{pp}/τ	50 V/µs	30 V/µs	20 V/µs
		k_O	0.5×10^5 $V^2/\mu s$	0.3×10^5 $V^2/\mu s$	0.2×10^5 $V^2/\mu s$
1000 Vdc	700 V_{pp}	U_{pp}/τ	215 V/µs	115 V/µs	90 V/µs
		k_O	3×10^5 $V^2/\mu s$	1.6×10^5 $V^2/\mu s$	1.25×10^5 $V^2/\mu s$
1500 Vdc	1500 V_{pp}	U_{pp}/τ	–	430 V/µs	330 V/µs
		k_O	–	13×10^5 $V^2/\mu s$	10×10^5 $V^2/\mu s$

For a voltage swing $U_{pp} < U_{pp\ perm.}$ the value of the permissible voltage rate of rise U_{pp}/τ can be multiplied with the factor $U_{pp\ perm.}/U_{pp}$. The data of the nomogram must be accounted for periodic pulses. See also "General Technical Data", para. 5.2.6.

Metallized polypropylene capacitors – Standard version

Self-healing flat capacitor winding, comprising a polypropylene dielectric. Epoxy resin sealed to ensure resistance to humidity; flame retardant seal. The capacitor is provided with spacers to improve solderability in the solder bath. Parallel leads; plug-in.

The capacitors are particularly suited for use at mains ac voltage load and in pulse circuits.



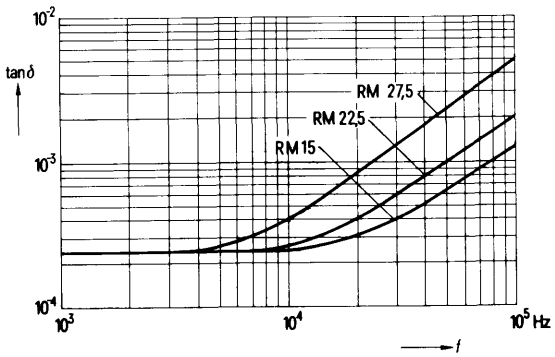
Dimensions in mm

l	*e*
18	15
27	22,5
32	27,5

Rated ac voltage $U_{ac(R)}$ Ac voltage U_R		250 Vac 630 Vdc	
Rated capacitance C_R	Tolerance	Dimensions $b \times h \times l$	Ordering code
0,047 µF	± 5% ≙ J[1] ± 10% ≙ K ± 20% ≙ M	7,3×13×18	B 32655-J6473-*
0,068 µF		7,3×13×18	B32655-J6683-*
0,1 µF		9×15,5×18	B32655-J6104-*
0,15 µF		7,3×16,5×27	B32655-J6154-*
0,22 µF		8,5×18,5×27	B32655-J6224-*
0,33 µF		10,5×19×27	B32655-J6334-*
0,47 µF		12×21×27	B32655-J6474-*
0,68 µF		11,5×21×32	B32655-J6684-*
1,0 µF		13,5×23×32	B32655-J6105-*

* When ordering, the code letter for the requested tolerance must be substituted for*

[1] Upon request

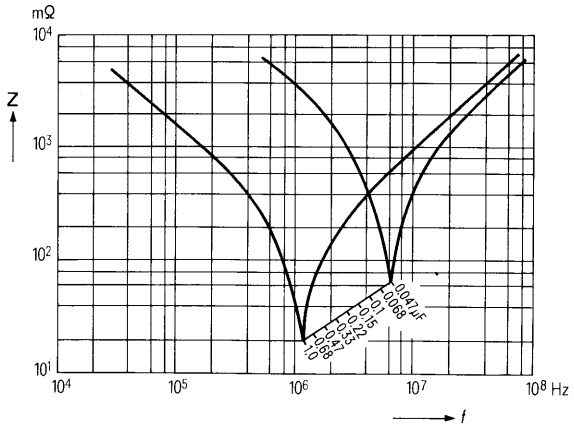
Climatic category in accordance with DIN 40040 Minimum limit temperature Maximum limit temperature Humidity category	**G P F** **G** −40 °C/− 40 °F **P** +85°C/+185 °F **F**[1] average relative humidity ≦ 75%; 95% for 30 days per year; continuously 85% for the remaining days; occasionally
Test category in accordance with DIN 40045 or IEC publication 68-1 Damp heat test in accordance with DIN 40046, sheet 5 or IEC publication 68-2-3	**40/085/21** **Conditions** Test temperature +40 °C/104 °F Relative humidity $(93\pm\frac{2}{3})$ % Test duration 21 days **Test criteria** Capacitance change $\frac{\Delta C}{C}$ ≦ ±3% Dissipation factor change $\Delta \tan\delta$ ≦ 0.5×10^{-3} (at 1 kHz) ≦ 1×10^{-3} (at 10 kHz) Insulation resistance ≧ 50% of the minimum value at delivery.
Resistance to vibration Test F_c: Vibration partial test B 1 in accordance with DIN 40046, sheet 8 and IEC publication 68-2-6	Duration of endurance conditioning 6 hours Frequency range 10 to 55 Hz Displacement amplitude 0.75 mm (conforming to max. 98.1 m/s² or 10 g)
Solder conditions	Temperature of the solder bath max. 260 °C/500 °F Soldering duration max. 10 s
Capacitance drift i_Z	± 2%
Dissipation factor tan δ as a function of frequency f average values Parameter: Lead spacing	

[1] The capacitors also meet the test conditions of humidity category E as to DIN 40040.

Dissipation factor tan δ measured at 20 °C (68 °F)	Maximum value	Average value
for 1 kHz	0.5×10^{-3}	0.25×10^{-3}
for 10 kHz	1×10^{-3}	0.4×10^{-3}

Self inductance — approx. 20 nH

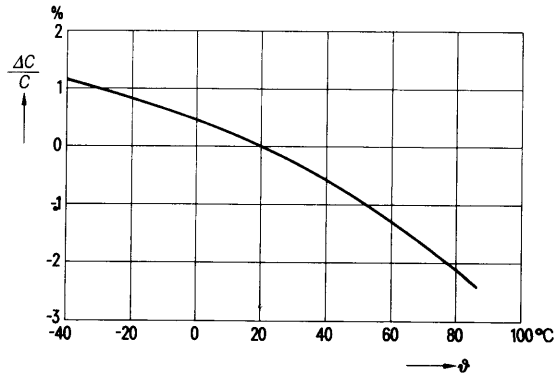
Impedance Z
as a function of frequency f
(typical values)



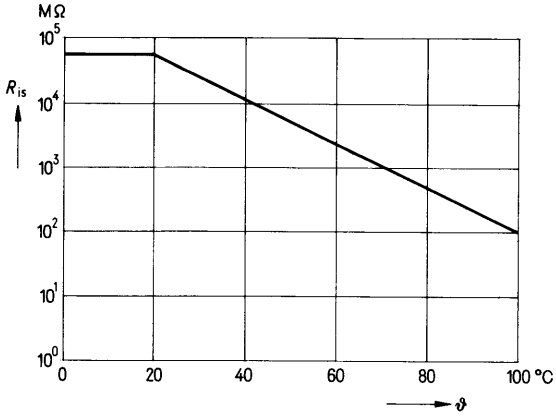
Voltage load

Test voltage	U_t	1200 Vdc, 2 s (layer to layer)
Perm. switching peaks	U_p	≦ 1000 V (occasionally)
Category voltage	U_c	250 Vac, 630 Vdc

Reversible capacitance change $\frac{\Delta C}{C}$
as a function of temperature
at 1 kHz (typical values)



Insulation resistance R_{is} as a function of temperature ϑ



Minimum value[1]	
for $C \leqq 0.33\ \mu F$	30 000 MΩ
for $C > 0.33\ \mu F$	10 000 s
Average value	
for $C \leqq 0.33\ \mu F$	> 75 000 MΩ
for $C > 0.33\ \mu F$	> 25 000 s

Inherent heating	
Power loss at 10 °C/18 °F excess temperature of the case (typical values)	90 mW (capacitor length 18 mm) 160 mW (capacitor length 27 mm) 260 mW (capacitor length 32 mm)

Pulse handling capability (voltage rate of rise U_{pp}/τ and pulse characteristic k_o)
Maximum permissible voltage change per time unit with non-sinusoidal voltage load (pulse, sawtooth).

Rated voltage U_R	Perm. ac voltage U_{pp} perm.		Pulse handling capability		
			Capacitor length		
			18 mm	27 mm	32 mm
250 Vac	700 V_{pp}	U_{pp}/τ k_o	70 V/µs $1\times10^5\ V^2/\mu s$	43 V/µs $0.6\times10^5\ V^2/\mu s$	36 V/µs $0.5\times10^5\ V^2/\mu s$

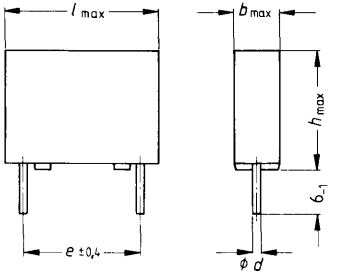
For a voltage swing $U_{pp} > U_{pp\ perm}$ the value of the permissible voltage rate of rise U_{pp}/τ can be multiplied with the factor $U_{pp\ perm}/U_{pp}$. The data of the nomogram must be accounted for periodic pulses. See also "General Technical Data", para 5.2.6.

[1] The indicated values are applicable at the time of delivery. During operational life the insulation may decrease for a short period to about 10 % of the values at the time of delivery, especially when the max. permissible humidity of 95 % is applied for a long period, or when the capacitor is operated close to the max. operating temperature limit.

Metallized polypropylene capacitors – High reliability version

Self-healing flat capacitor winding, comprising a polypropylene dielectric. Epoxy resin sealed to ensure resistance to humidity; flame retardant seal. The capacitor is provided with spacers to improve solderability in the solder bath. Parallel leads; plug-in.

The capacitors are particularly suited for use at mains ac voltage load and in pulse circuits.



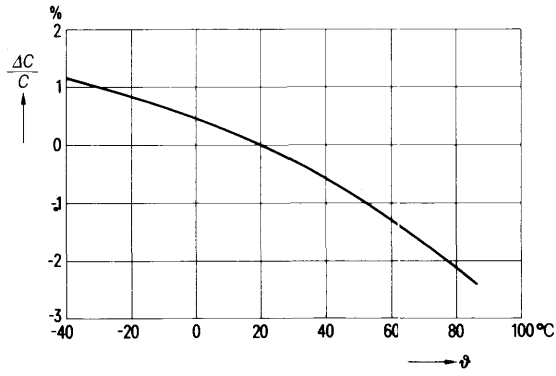
l	e
27	22,5
32	27,5

Dimensions in mm

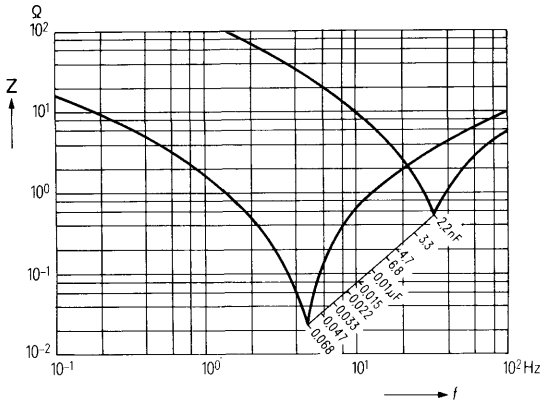
Rated ac voltage $U_{ac(R)}$ Dc voltage U_R		400 V ac 1000 V dc	
Rated capacitance C_R	Tolerance	Dimensions $b \times h \times l$	Ordering code
2,2 nF	± 5%≙J ±10%≙K	7,3×16,5×27	B32656-J8222-*
3,3 nF		7,3×16,5×27	B32656-J8332-*
4,7 nF		7,3×16,5×27	B32656-J8472-*
6,8 nF		7,3×16,5×27	B32656-J8682-*
0,01 µF		7,3×16,5×27	B32656-J8103-*
0,015 µF		8,5×18,5×27	B32656-J8153-*
0,022 µF		10,5×19×27	B32656-J8223-*
0,033 µF		12×21×27	B32656-J8333-*
0,047 µF		11,5×21×32	B32656-J8473-*
0,068 µF		13,5×23×32	B32656-J8683-*

* When ordering, the code letter for the requested tolerance must be substituted for * ±5%≙J; ±10%≙K.

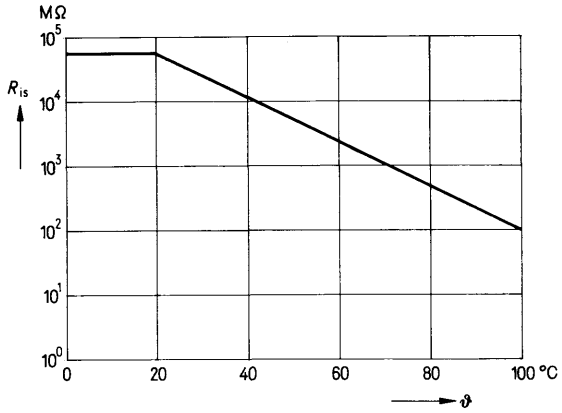
Climatic category in accordance with DIN 40040	**F P D / L S**
Min. limit temperature	**F** −55°C/− 67 °F
Max. limit temperature	**P** +85 °C/+185 °F
Humidity category	**D** average relative humidity ≦ 80%; 100% 30 days per year, continuously; 90% for the remaining days, occasionally
Failure quota	**L** 300 failures per 10^9 component hours
Load duration	**S** 3×10^4 h
Relative failure rate	$300 \times 10^{-9} \times 3 \times 10^4 = 0.9\%$
Reference load	23 °C, ≦ 75% rel. humidity 400 V_{rms}, 10 kHz/for higher load, data upon request
Failure criteria	
Total failure	Short or open circuit
Failure due to variations	Capacitance change $\frac{\Delta C}{C}$ $>\pm 10\%$
	Dissipation factor tan δ $> 4 \times$ max. value
	Insulation resistance ≦ 1500 MΩ
Resistance to vibration	Duration of endurance
Test F_c: Vibration	conditioning 6 hours
Partial test B1 in accordance	Frequency range 10 to 55 Hz
with DIN 40046, sheet 8	Displacement amplitude 0.75 mm (conforming
and IEC publication 68-2-6	to max. 98.1 m/s² or 10 g)
Solder conditions	Temperature of the solder bath max. 260 °C/500 °F
	Soldering duration max. 10 s
Capacitance drift i_Z	± 2%
Reversible capacitance change $\frac{\Delta C}{C}$ as a function of temperature at 1 kHz (typical values)	



Impedance Z
as a function of frequency f
(typical values)

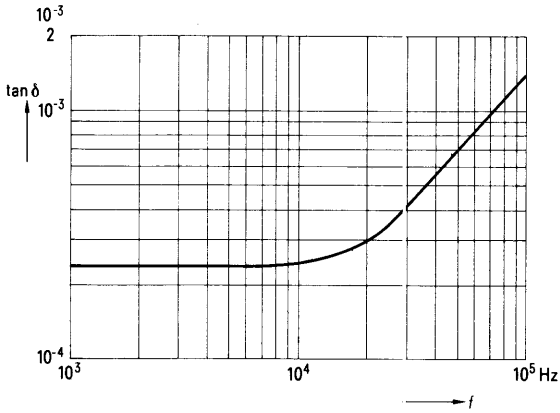


Insulation resistance R_{is}
as a function of
temperature ϑ



Minimum value[1)]	30 000 MΩ
Average value	> 75 000 MΩ

[1)] The values stated apply at the time of delivery. During operational life the insulation may decrease for a short period to about 10 % of the values at the time of delivery, especially when the max. permissible humidity of 100 % is applied for a long period, or when the capacitor is operated close to the maximum operating limit temperature.

Dissipation factor tan δ measured at 20 °C/68 °F	Max. limit value
at 1 kHz	0.5×10^{-3}
at 10 kHz	0.5×10^{-3}
at 100 kHz	2.0×10^{-3}
Dissipation factor tan δ as a function of frequency *f* (typical values)	
Inherent heating Power loss at 10 °C/18 °F excess temperature of the case (typical values)	Lead spacing 22.5: 0.16 W Lead spacing 27.5: 0.26 W
Voltage load Test voltage U_t Category voltage U_c	2500 Vdc 400 Vac 1000 V dc

Pulse handling capability (voltage rate of rise U_{pp}/τ and pulse characteristic k_o)
Maximum permissible voltage change per time unit at non-sinusoidal voltages (pulse, sawtooth).

Rated voltage U_R	Perm. ac voltage U_{pp} perm.		Pulse handlung capability	
			Capacitor length	
			27 mm	32 mm
400 Vac	1130 V_{pp}	U_{pp}/τ k_o	350 V/µs 8×10^5 V^2/µs	175 V/µs 4×10^5 V^2/µs

For a voltage swing $U_{pp} < U_{pp\ perm}$ the value of the permissible voltage rate of rise U_{pp}/τ can be multiplied by the factor $U_{pp\ perm}/U_{pp}$. For periodic pulse load the data of the nomogram has to be taken into account. See also "General Technical Data", para 5.2.6.

MKY Capacitors
Metallized Polystyrene Capacitors

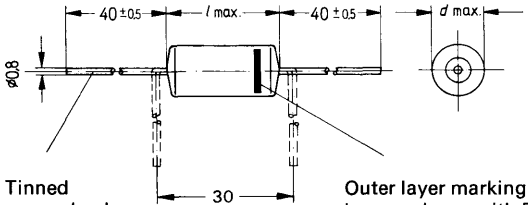
Metallized polystyrene film capacitors

High reliability version

Designation in accordance with DIN 41379: MKS capacitors
Self-healing capacitor winding with polystyrene dielectric.

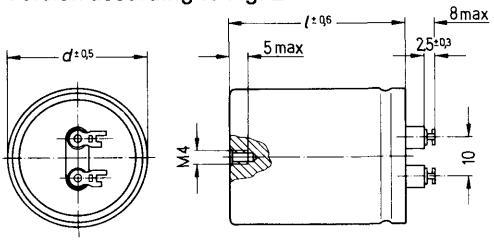
Version according to figure 1: Hermetically sealed in small tubular case (cartridge), shrunk sleeve insulated. Leads insulated at one end in low-loss ceramic lead-through, and centrally soldered in cartridge bottom at the other.
Version according to figure 2: Hermetically sealed in tubular metal case with an inside thread in the case bottom. Closed by a metal cover with low-loss ceramic lead-throughs. Solder tags.

Version according to Fig. 1



Minimum lead bend: 2 mm from face ends.

Version according to Fig. 2



Dimensions in mm

Ordering code example B 32355–J2105–G

Type

Revision status (here only J)

Rated voltage (2 ≙ 250 V dc)

Capacitance tolerance (G ≙ ± 2%)

Rated capacitance (105 ≙ 10 × 10^5 pF = 1 µF)

Rated voltage		250 V dc		Figure
Rated capacitance[1] µF	Tolerance	*d* × *l*	*d* × *l*	
0.10 to 0.15		11.2 × 25.5		
> 0.15 to 0.30		15 × 25.5		1
> 0.30 to 0.50	±5% ≙ J	18.2 × 25.5		
> 0.50 to 1.0	±2% ≙ G		25 × 29	
> 1.0 to 1.9	±1% ≙ F		32 × 29	
> 1.9 to 3.6			32 × 38	2
> 3.6 to 6.0			32 × 50	
> 6.0 to 10			40 × 50	

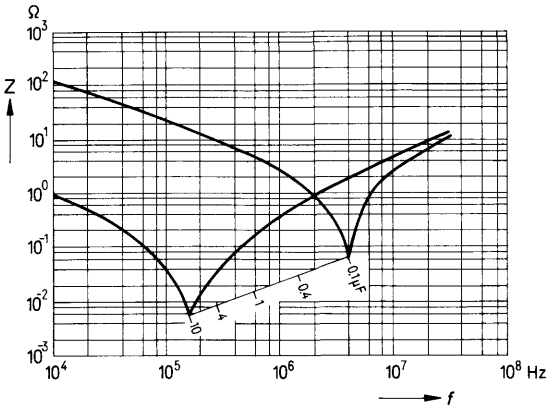
Climatic category in accordance with DIN 40040	**F S C / L R**
Minimum limit temperature	**F** −55 °C/− 67 °F
Maximum limit temperature	**S** +70 °C/+158°F
Humidity category	**C** average relative humidity ≦ 95% Max. value 100%, including dew precipitation
Failure quota	**L** 300 failures per 10^9 component hours
Load duration	**R** 10^5 h
Relative failure rate	300 × 10^{-9} × 10^5 = 3%

[1] Series available are: E24, E48, and E96

Failure criteria Total failure Failure due to variations	Short or open circuit Capacitance change $\frac{\Delta C}{C}$ $>\pm 3\%$ Dissipation factor tan δ $> 2 \times$ max. limit value Insulation resistance < 2500 s
Test category in accordance with DIN 40045 and IEC publ. 68-1 Damp heat test in accordance with DIN 40046, sheet 5, or IEC publ. 68-2-3	**40/070/56** **Conditions** Test temperature +40 °C/+104 °F Relative humidity $(93 \pm \frac{2}{3})$ % Test duration 56 days **Test criteria** Capacitance change $\frac{\Delta C}{C}$ $\leqq \pm 1\%$ Dissipation factor change Δ tan δ $\leqq 3 \times 10^{-3}$ at 1 kHz $\leqq 5 \times 10^{-3}$ at 10 kHz Insulation resistance $\geqq$ 50% of the minimum value at delivery
Resistance to vibration Test F_c: Vibration partial test B 1 in accordance with DIN 40046, sheet 8 and IEC publ. 68-2-6	Duration of endurance conditioning 6 hours Frequency range 10 to 55 Hz Displacement amplitude 0.75 mm (conforming to max. 10 g) Capacitors with a diameter > 15 mm must be fixed by clamps for this test
Capacitance drift i_z	$\pm$ 1%

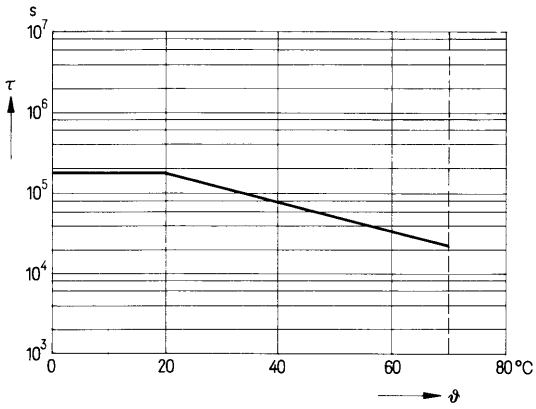
Dissipation factor tan δ[1] measured at 20 °C/68 °F	for $C \leqq 1$ µF	$C \leqq 3.6$ µF	$C > 3.6$ µF
at 1 kHz	0.5×10^{-3}	0.5×10^{-3}	1×10^{-3}
at 10 kHz	1×10^{-3}	–	–

[1] See also graphs on page 198

Solder conditions for cartridge types	Temperature of the solder bath max. 260 °C (500 °F) Soldering duration max. 10 s Distance to the capacitor min. 6 mm
for case types	Temperature of the soldering iron max. 300 °C (572 °F) Soldering duration max. 5 s
Self inductance for cartridge types for case types	approx. 20 nH (for 3 mm lead length approx. 30 to 35 nH at both ends)
Impedance Z as a function of frequency f	
Category voltage U_c at dc operation 2,000 hours for milliseconds[1]	1.00 × U_R 1.25 × U_R up to 70 °C/158 °F 1.50 × U_R
Category voltage U_c at ac operation[2] for milliseconds	100 Vac 50 Hz up to 70 °C/158 °F 1.25 × U_c

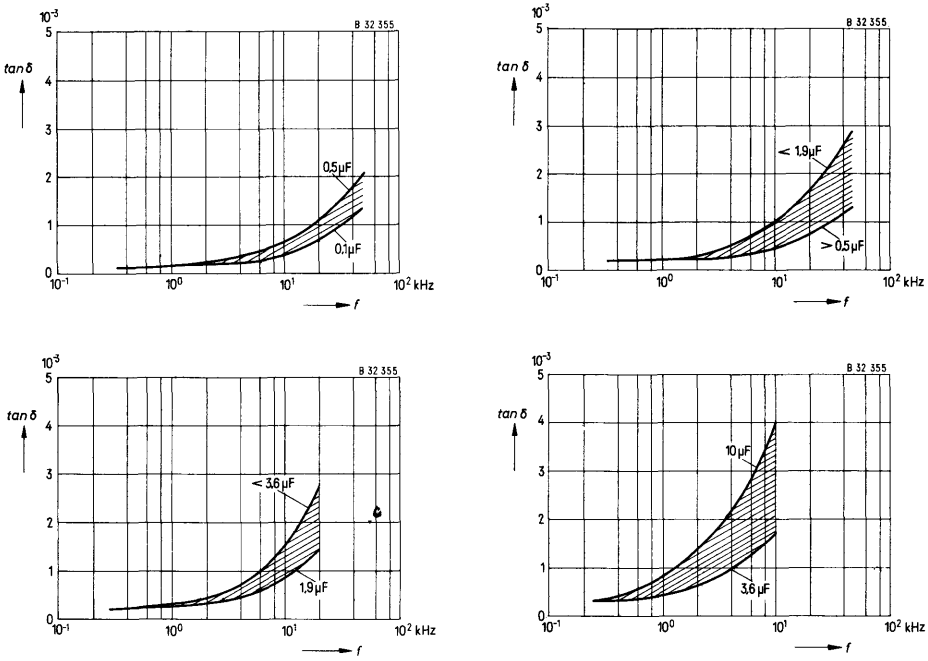
For use in pulse discharge circuits (VDE 0560, part 1 and part 2, § 51) MKY capacitors are not suitable. In place of that Siemens MPS and MKV capacitors (B 25...) are recommended.

[1] Permissible for inevitable exceptions only, not for periodic switchings.
[2] When an ac voltage is superimposed to a dc voltage, the sum of the dc voltage and the amplitude of the ac voltage, shall not exceed the rated voltage.

Temperature coefficient *TC* of the capacitance	$-120 \pm 50 \times 10^{-6}$/K
Insulation (time constant τ) as a function of temperature	
Minimum value[1] for $C \leqq 1$ µF for $C > 1$ µF Average value	 100 000 MΩ 100 000 s > 250 000 s

[1] The indicated values are applicable at the time of delivery. During operational life the insulation may decrease for a short period to about 10 % of the values at the time of delivery, especially when the max. permissible humidity of 100 % is applied for a long period, or when the capacitor is operated close to the maximum operating temperature limit.

Dissipation factor tan δ as a function of frequency *f*
Typical values, measured at 20 °C (68 °F)



Pulse handling capability (voltage rate of rise U_{pp}/τ and pulse characteristic k_o)
Maximum permissible voltage change per time unit at non-sinusoidal voltage load (pulse, sawtooth).

Rated voltage U_R		Capacitor length 29 mm	38 mm	50 mm
250 V dc	U_{pp}/τ	15 V/µs	8 V/µs	5 V/µs
	k_o	7 500 V^2/µs	4 000 V^2/µs	2 500 V^2/µs

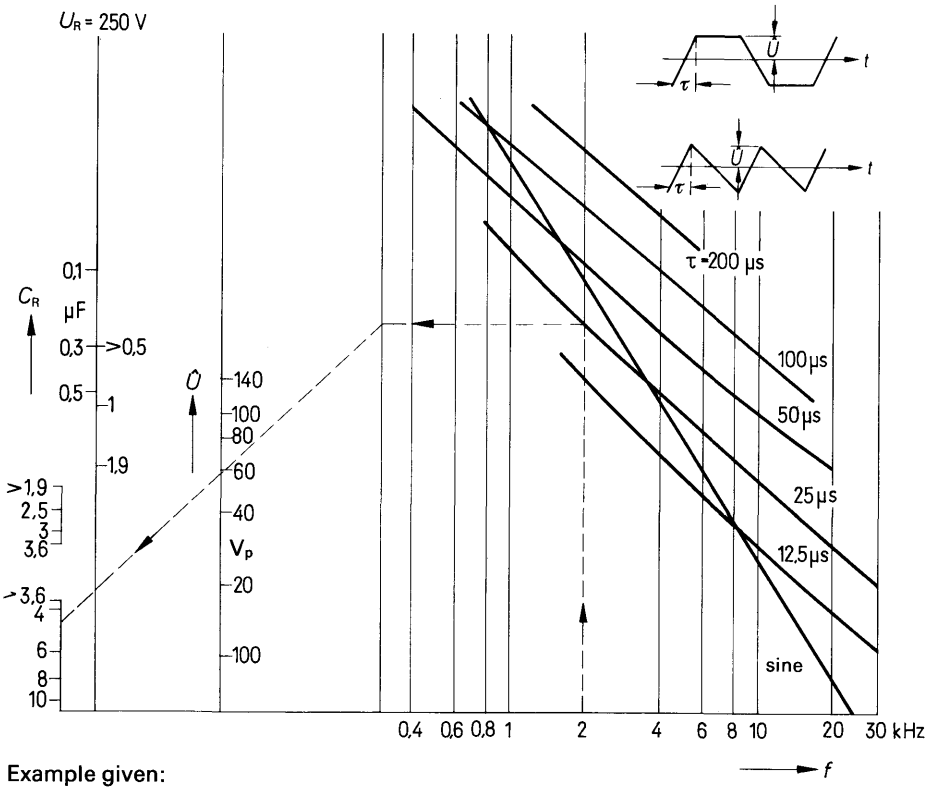
For a voltage swing $U_{pp} < U_R$ the value of the permissible voltage rate of rise U_{pp}/τ can be multiplied by the factor U_R/U_{pp}. For periodic pulse load the data of the nomogram has to be taken into account. See also "General Technical Data", para. 5.2.6.

Ac power handlung capacity at higher frequencies

The maximum permissible peak voltage $\hat{U}$ for sinusoidal and non-sinusoidal voltages (pulse, sawtooth, trapezoidal voltages) can be obtained from the nomogram, where the following limit values $\hat{U}_l$ are not allowed to be exceeded.

Rated voltage U_R	250 V
Limit voltage $\hat{U}_l$	140 V

The nomogram is based on 10 °C (18 °F) inherent temperature rise of the capacitor; this must be taken into account when considering the permissible max. temperature. With trapezoidal voltage load the second harmonic frequency must be assumed. At sinusoidal voltage load, the "sine" characteristic applies.



Example given:

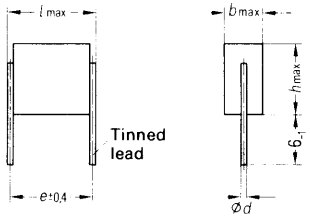
f = 2 kHz (repetition frequency)
τ = 25 µs (rise time)
C = 4.3 µF (capacitance)

According to the dashed line on the graph above this gives a peak voltage $\hat{U}$ of about 60 V.

Qualified Types
in accordance with CECC-, GfW- and VG Specifications

Metallized polyester layer capacitors as quality assessed type in accordance with CECC 30401-007 (Number of approval: 404.8/10/74)
Self-healing capacitor, comprising polyethyleneterephthalate dielectric. Mechanical protection by small insulating plates. When mounting, attention must be given to the surface leakage paths and air paths to adjacent live parts.
The insulating strength of the sectional areas to live parts corresponds to 1.5 times the rated dc voltage of a capacitor; it amounts, however, to at least 300 V dc.
Connections: Parallel leads, tinned, plug-in, lead spacing 7.5 to 22.5 mm. Particularly suitable for PCB mounting.

Type	Lead spacing "e"	dia. *d*
B 32560	7.5 mm	0.6
B 32561	10 mm	0.6
B 32562	15 mm	0.6
B 32563	22.5 mm	0.8



Dimensions in mm

Climatic category in accordance with DIN 40040	**F M E / L R**
Minimum limit temperature	**F** − 55 °C/− 67 °F
Maximum limit temperature	**M** +100 °C/+212 °F
Humidity category	**E** average relative humidity ≦ 75%: rare and slight dew precipitation permitted
Failure quota	**L** 300 failures per 10^9 component hours
Load duration	**R** 10^5 h
Relative failure rate	$300 \times 10^{-9} \times 10^5 = 3\%$
Failure criteria	
Total failure	Short or open circuit
Failure due to variation	Capacitance change $\frac{\Delta C}{C}$ $> \pm 10\%$
	Dissipation factor tan δ $> 2 \times$ max. limit value
	Insulation resistance < 150 MΩ (≦ 0.33 µF)
	$<$ 50 s ($>$ 0.33 µF)
Test category in accordance with DIN 40045 and IEC publ. 68-1	**55/100/21**[1]
	Conditions
Damp heat test in accordance with DIN 40046, sheet 5 or IEC publ. 68-2-3	Test temperature +40 °C/+104 °F
	Relative humidity $(93 \pm \frac{2}{3})$ %
	Test duration 21 days
	Test criteria
	Capacitance change $\frac{\Delta C}{C}$ ≦ ±5%
	Dissipation factor change Δ tan δ ≦ 3×10^{-3} (at 1 kHz) ≦ 5×10^{-3} (at 10 kHz)
	Insulation resistance ≧ 50% of the minimum value at delivery

[1] The test criteria are also kept after a humidity load of 56 days.

MKT Layer Capacitors

Rated voltage U_R		100 V dc				250 V dc	
		LS[1] 7.5 mm	LS 10 mm	LS 15 mm	LS 22,5 mm	LS 7,5 mm	LS 10 mm
Rated capacitance C_R	Tolerance	Dimensions b x h x l Ordering code B32560–	B32561–	B32562–	B32563–	B32560–	B32561–
1000 pF							
1500 pF							
2200 pF							
3300 pF							
4700 pF							
6800 pF							
0,01 µF							
0,015 µF						2,3x7,3x9 -D3153-*	
0,022 µF						2,3x7,3x9 -D3223-*	3,2x6,6x11,5 -D3223-*
0,033 µF						2,5x7,3x9 -D3333-*	3,3x6,6x11,5 -D3333-*
0,047 µF	± 5%≙J					2,9x7,4x9 -D3473-*	3,1x6,6x11,5 -D3473-*
0,068 µF	±10%≙K	2,4x8,1x9 -D1683-*				3,6x8,1x9 -D3683-*	3,1x6,6x11,5 -D3683-*
0,1 µF		2,7x8,1x9 -D1104-*				4x10,1x9 -D3104-*	3,6x7,4x11,5 -D3104-*
0,15 µF		3,4x8,1x9 -D1154-*					4,3x8,5x11,5 -D3154-
0,22 µF		4,4x8,0x9 -D1224-*	3,4x7,2x11,5 -D1224-*				5,0x10,1x11,5 -D3224-*
0,33 µF		5,5x8,8x9 -D1334-*	4,2x8,1x11,5 -D1334-*				7,1x9x11,5 -D3334-*
0,47 µF		5,5x12,5x9 -D1474-*	5,4x8,1x11,5 -D1474-*	4x6,9x16,5 -D1474-*			8,3x10,8x11,5 -D3474-*
0,68 µF		8x11,4x9 -D1684-*	7,2x8,2x11,5 -D1684-*	5x7,3x16,5 -D1684-*			
1 µF			8,5x9,8x11,5 -D1105-*	5,5x9,2x16,5 -D1105-*			
1,5 µF				7x10,5x16,5 -D1155-*			
2,2 µF				8,5x12,3x16,5 -D1225-*	6,4x11,3x24 -D1225-*		
3,3 µF					7,7x13,4x24 -D1335-*		

[1] Lead spacing

* Here, the requested tolerance ± 10% ≙ K or ± 5% ≙ J must be inserted.

Preferred values

250 V dc		400 V dc				U_R
LS 15 mm	LS 22,5 mm	LS 7,5 mm	LS 10 mm	LS 15 mm	LS 22,5 mm	
Dimensions $b \times h \times l$ Ordering code						
B32562–	B32563–	B32560–	B32561–	B32562–	B32563–	C_R
		2,4x8,2x9 –D6102–*				1000 pF
		2,3x8,2x9 –D6152–*				1500 pF
		2,3x8,2x9 –D6222–*				2200 pF
		2,3x8,2x9 –D6332–*				3300 pF
		2,3x8,2x9 –D6472–*				4700 pF
		2,4x7,3x9 –D6682–*				6800 pF
		2,4x7,3x9 –D6103–*	3,2x6,6x11,5 –D6103–*			0,01 µF
		2,7x7,3x9 –D6153–*	3,2x6,6x11,5 –D6153–*			0,015 µF
			3,2x6,6x11,5 –D6223–*			0,022 µF
			3,3x6,6x11,5 –D6333–*			0,033 µF
			3,9x7,2x11,5 –D6473–*			0,047 µF
				3,8x6,2x16,5 –D6683–*		0,068 µF
				4,5x7,1x16,5 –D6104–*		0,1 µF
				5,5x8,2x16,5 –D6154–*		0,15 µF
4x7,7x16,5 –D3224–*				7,2x8,6x16,5 –D6224–*		0,22 µF
5,4x7,7x16,5 –D3334–*				8,3x10,9x16,5 –D6334–*		0,33 µF
6,1x9,4x16,5 –D3474–*				10x12,6x16,5 –D6474–*	7,3x12,4x24 –D6474–*	0,47 µF
7x11,4x16,5 –D3684–*	5,9x9,3x24 –D3684–*				8,3x15,4x24 –D6684–*	0,68 µF
9,6x11,5x16,5 –D3105–*	6,5x11,8x24 –D3105–*				10,4x17,5x24 –D6105–*	1 µF
	7,8x14,4x24 –D3155–*					1,5 µF
	9,1x17,5x24 –D3225–*					2,2 µF
						3,3 µF

For detailed data refer to page 135.

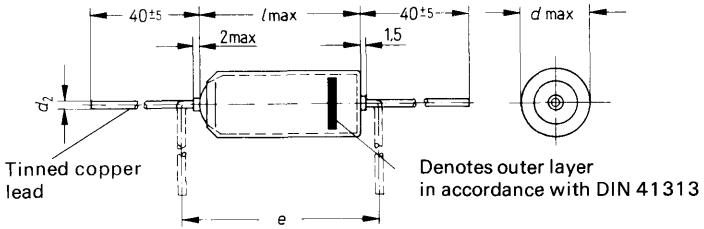
Metallized lacquer capacitors
Type MKU 04 with quality assessment in accordance with VG 95 296, sheet 4

Version: Self-healing capacitor with metallized cellulose acetate film dielectric.

Hermetically enclosed in tubular non-magnetic metal case (cartridge); shrunk sleeve insulated. Leads: Insulated lead-in wire at one end and centrally soldered in cartridge at the other.

MKU capacitors B 95 017 comply with the Siemens MKL types B 32 120, high reliability version.

Qualified in accordance with: VG 95 296, sheet 4 (military type specification for plastic film capacitors, type MKU 04). The capacitors have the electronic test symbol.



Dimensions in mm

l	17.5	21.5	25.5	35.5
e	25	30	35	45

d_1	≦ 8.2	≧ 11.2
dia. d_2	0.6	0.8

Minimum lead bend: 2 mm from face ends.

Type MKU 04 with quality assessment according to VG 95 296, sheet 4

Rated voltage		63 V dc	100 V dc	160 V dc	250 V dc
Rated capacitance µF	Tolerance	Dimensions $d_1 \times l$ Ordering code			
0,1	± 20%		6,2×17,5 B95017-L0202-D	8,2×17,5 B95017-L0302-D	8,2×21,5 B95017-L0402-D
0,15	± 20%	6,2×17,5 B95017-L0104-D	6,9×17,5 B95017-L0204-D	8,2×17,5 B95017-L0304-D	11,2×21,5 B95017-L0404-D
0,22	± 20%	6,2×17,5 B95017-L0106-D	6,9×17,5 B95017-L0206-D	8,2×21,5 B95017-L0306-D	11,2×21,5 B95017-L0406-D
0,33	± 20%	6,9×17,5 B95017-L0108-D	8,2×17,5 B95017-L0208-D	8,2×21,5 B95017-L0308-D	11,2×21,5 B95017-L0408-D
0,47	± 20%	8,2×17,5 B95017-L0110-D	8,2×21,5 B95017-L0210-D	11,2×21,5 B95017-L0310-D	11,2×21,5 B95017-L0410-D
0,68	± 20%	8,2×17,5 B95017-L0112-D	8,2×21,5 B95017-L0212-D	11,2×25,5 B95017-L0312-D	11,2×25,5 B95017-L0412-D
1	± 10%	8,2×21,5 B95017-L0113-D	11,2×21,5 B95017-L0213-D	11,2×25,5 B95017-L0313-D	15×25,5 B95017-L0413-D
1	± 20%	8,2×21,5 B95017-L0114-D	11,2×21,5 B95017-L0214-D	11,2×25,5 B95017-L0314-D	15×25,5 B95017-L0414-D
1,5	± 10%	8,2×21,5 B95017-L0115-D	11,2×25,5 B95017-L0215-D	15×25,5 B95017-L0315-D	15×25,5 B95017-L0415-D
1,5	± 20%	8,2×21,5 B95017-L0116-D	11,2×25,5 B95017-L0216-D	15×25,5 B95017-L0316-D	15×25,5 B95017-L0416-D
2,2	± 10%	11,2×21,5 B95017-L0117-D	11,2×25,5 B95017-L0217-D	11,2×35,5 B95017-L0317-D	15×35,5 B95017-L0417-D
2,2	± 20%	11,2×21,5 B95017-L0118-D	11,2×25,5 B95017-L0218-D	11,2×35,5 B95017-L0318-D	15×35,5 B95017-L0418-D
3,3	± 10%	11,2×25,5 B95017-L0119-D	11,2×35,5 B95017-L0219-D	15×35,5 B95017-L0319-D	16,5×35,5 B95017-L0419-D
3,3	± 20%	11,2×25,5 B95017-L0120-D	11,2×35,5 B95017-L0220-D	15×35,5 B95017-L0320-D	16,5×35,5 B95017-L0420-D
4,7	± 10%	11,2×25,5 B95017-L0121-D	11,2×35,5 B95017-D0221-D	16,5×35,5 B95017-L0321-D	21×35,5 B95017-L0421-D
4,7	± 20%	11,2×25,5 B95017-L0122-D	11,2×35,5 B95017-L0222-D	16,5×35,5 B95017-L0322-D	21×35,5 B95017-L0422-D
6,8	± 10%	11,2×35,5 B95017-L0123-D	15×35,5 B95017-L0223-D	18,2×35,5 B95017-L0323-D	21×35,5 B95017-L0423-D
6,8	± 20%	11,2×35,5 B95017-L0124-D	15×35,5 B95017-L0224-D	18,2×35,5 B95017-L0324-D	21×35,5 B95017-L0424-D
10	± 10%	15×35,5 B95017-L0125-D	16,5×35,5 B95017-L0225-D	21×35,5 B95017-L0325-D	25,8×35,5 B95017-L0425-D
10	± 20%	15×35,5 B95017-L0126-D	16,5×35,5 B95017-L0226-D	21×35,5 B95017-L0326-D	25,8×35,5 B95017-L0426-D

Ordering code example B95017–L0221–D

Type — Counting number[1] (see table)

[1] The counting numbers comply with those of the military specifications (MTV 5910-004 or VG 95 296, sheet 4).

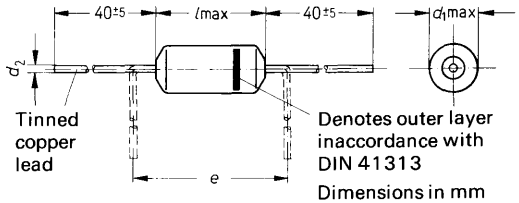
Metallized lacquer capacitors with quality assessment in accordance with GfW specifications CF 100, CF 101 and CF 104.

Version: Self-healing tubular capacitor winding with cellulose acetate dielectric. Enclosed in tubular metal case, shrunk sleeve insulated, epoxy resin sealed face ends. Central axial leads.

MKU capacitors B 95020 comply with the Siemens MKL types B 32110/B 32111 (25 to 250 V dc) or B 32112 (630 V dc) high reliability version.

Qualified in accordance with: GfW specifications CF 100 and CF 101 (25 to 250 V dc)
CF 100 and CF 104 (630 V dc)

The capacitors have the electronic test symbol.



Dimensions in mm

l	18.5	21	25	34	45
e	22.5	25	30	40	52.5

d_1	≦7.4	8.4 to 23.7	25.9
∅ d_2	0.6	0.8	1.0

GfW specification		CF 101					CF 104
Rated voltage		25 Vdc	63 Vdc	100 Vdc	160 Vdc	250 Vdc	630 Vdc
Rated capacitance µF	Tolerance %	Dimensions $d \times l$ Ordering code B95020–	B95020–	B95020–	B95020–	B95020–	B95020–
0,033	±20	–	–	–	–	–	8,4×18,5 -K*608-D300
0,047	±20	–	–	–	–	–	8,4×18,5 -K*610-D300
0,068	±20	–	–	–	–	–	8,4×21 -K*612-D300
0,1	±20	–	–	5,4×18,5 -K*314-D300	6,4×18,5 -K*414-D300	7,4×18,5 -K*514-D300	8,4×21 -K*614-D300
0,15	±20	–	5,4×18,5 -K*216-D300	6,4×18,5 -K*316-D300	7,4×18,5 -K*416-D300	8,4×18,5 -K*516-D300	9,4×25 -K*616-D300
0,22	±20	–	5,4×18,5 -K*218-D300	6,4×18,5 -K*318-D300	7,4×21 -K*418-D300	8,4×21 -K*518-D300	9,4×25 -K*618-D300
0,33	±20	–	6,4×18,5 -K*220-D300	7,4×18,5 -K*320-D300	8,4×21 -K*420-D300	9,4×21 -K*520-D200	11,7×25 -K*620-D300
0,47	±20	5,4×18,5 -K*122-D300	7,4×18,5 -K*222-D300	7,4×21 -K*322-D300	9,4×21 -K*422-D300	10,7×21 -K*522-D300	12,7×25 -K*622-D300
0,68	±20	6,4×18,5 -K*124-D300	7,4×18,5 -K*224-D300	8,4×21 -K*324-D300	9,4×25 -K*424-D300	10,7×25 -K*524-D300	11,7×34 -K*624-D300
1	±10	–	7,4×21 -K*225-D300	9,4×21 -K*325-D300	10,7×25 -K*425-D300	11,7×25 -K*525-D300	–
1	±20	7,4×18,5 -K*126-D300	7,4×21 -K*226-D300	9,4×21 -K*326-D300	10,7×25 -K*426-D300	11,7×25 -K*526-D300	13,7×34 -K*626-D300

GfW specification		CF 101					CF 104
Rated voltage		25 Vdc	63 Vdc	100 Vdc	160 Vdc	250 Vdc	630 Vdc
Rated capacitance µF	Tolerance %	Dimensions $d_1 \times l$ / Ordering code B95020–	B95020–	B95020–	B95020–	B95020	B95020
1,5	±10	–	8,4×21 -K*227-D300	8,4×25 -K*327-D300	12,7×25 -K*427-D300	13,7×25 -K*527-D300	–
1,5	±20	7,4×18,5 -K*128-D300	8,4×21 -K*228-D300	9,4×25 -K*328-D300	12,7×25 -K*428-D300	13,7×25 -K*528-D300	16,7×34 -K*628-D300
2,2	±10	–	10,7×21 -K*229-D300	10,7×25 -K*329-D300	11,7×34 -K*429-D300	12,7×34 -K*529-D300	–
2,2	±20	7,4×21 -K*130-D300	10,7×21 -K*230-D300	10,7×25 -K*330-D300	11,7×34 -K*430-D300	12,7×34 -K*530-D300	18,7×34 -K*630-D300
3,3	±10	–	9,4×25 -K*231-D300	9,4×34 -K*331-D300	13,7×34 -K*431-D300	15,7×34 -K*531-D300	–
3,3	±20	8,4×21 -K*132-D300	9,4×25 -K*232-D300	9,4×34 -K*332-D300	13,7×34 -K*432-D300	15,7×34 -K*532-D300	23,7×34 -K*632-D300
4,7	±10	–	10,7×25 -K*233-D300	11,7×34 -K*333-D300	15,7×34 -K*433-D300	17,5×34 -K*533-D300	–
4,7	±20	9,4×21 -K*134-D300	10,7×25 -K*234-D300	11,7×34 -K*334-D300	15,7×34 -K*434-D300	17,5×34 -K*534-D300	25,9×34 -K*634-D300
6,8	±10	–	10,7×34 -K*235-D300	12,7×34 -K*335-D300	18,7×34 -K*435-D300	20,7×34 -K*535-D300	–
6,8	±20	10,7×25 -K*136-D300	10,7×34 -K*236-D300	12,7×34 -K*336-D300	18,7×34 -K*436-D300	20,7×34 -K*536-D300	–
10	±10	–	12,7×34 -K*237-D300	18,7×34 -K*337-D300	20,7×34 -K*437-D300	25,9×34 -K*537-D300	–
10	±20	11,7×25 -K*138-D300	12,7×34 -K*238-D300	18,7×34 -K*338-D300	20,7×34 -K*438-D300	25,9×34 -K*538-D300	–
22	±10	–	16,7×34 -K*239-D300	–	–	–	–
22	±20	–	16,7×34 -K*240-D300	–	–	–	–
47	±10	–	23,7×34 -K*241-D300	–	–	–	–
47	±20	–	23,7×34 -K*242-D300	–	–	–	–
100	±10	–	25,9×46 -K*243-D300	–	–	–	–
100	±20	–	25,9×46 -K*244-D300	–	–	–	–

Ordering code example B95020–K*338–D300

Type ——— Code number (see table)

* here the test category in accordance with the GfW specification CF 100 and the order must be inserted:

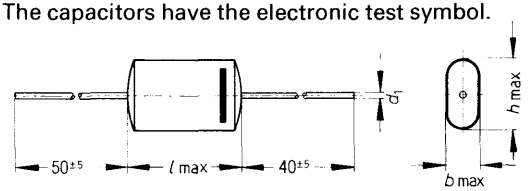
1 for test level A
2 for test level B
3 for test level C
4 for test level D

Metallized polyester capacitors with quality assessment in accordance with GfW specifications CF 100, CF 102

Version: Self healing flat capacitor winding with polyethyleneterephthalate dielectric. Insulating film encapsulated capacitor windings, epoxy resin sealed face ends. Central axial leads.

MKT capacitors B 95 042 comply with the Siemens MKT types B 32 227, high reliability version.

Qualified in accordance with: GfW specifications CF 100 and CF 102.
Standard designation: CF 102-...
The capacitors have the electronic test symbol.



b	≦6	> 6 to 8.5	>8.5
dia. d_1	0.6	0.8	1.0

Dimensions in mm

Rated voltage		1 kVdc	1,6 kVdc	2,5 kVdc	4 kVdc	6,3 kVdc
Rated capacitance		Dimensions $b \times h \times l$ Ordering code				
µF	Tolerance	B95042-	B95042-	B95042-	B95042-	B95042-
0,01	±10%				9,5×22×33 K*401-D300	9×21,5×45 K*501-D300
0,01	±20%				9,5×22×33 K*402-D300	9×21,5×45 K*502-D300
0,025	±10%		6×12,5×33 K*203-D300	8,5×18×33 K*303-D300	10×22,5×45 K*403-D300	13,5×32,5×46 K*503-D300
0,025	±20%		6×12,5×33 K*204-D300	8,5×18×33 K*304-D300	10×22,5×45 K*404-D300	13,5×32,5×46 K*504-D300
0,05	±10%	6,5×13×33 K*105-D300	7×16,5×33 K*205-D300	12,5×25,5×34 K*305-D300	12,5×31×46 K*405-D300	19×44×46 K*505-D300
0,05	±20%	6,5×13×33 K*106-D300	7×16,5×33 K*206-D300	12,5×25,5×34 K*306-D300	12,5×31×46 K*406-D300	19×44×46 K*506-D300
0,1	±10%	7×19,5×33 K*107-D300	9,5×22×33 K*207-D300	10,5×26,5×46 K*307-D300	16,5×42×46 K*407-D300	
0,1	±20%	7×19,5×33 K*108-D300	9,5×22×33 K*208-D300	10,5×26,5×46 K*308-D300	16,5×42×46 K*408-D300	
0,25	±10%	10,5×26,5×33 K*109-D300	15,5×31×34 K*209-D300	15,5×40,5×46 K*309-D300		
0,25	±20%	10,5×26,5×33 K*110-D300	15,5×31×34 K*210-D300	15,5×40,5×46 K*310-D300		

Ordering code example B95042-K*307-D300

Type — Code number (see table)

* here the test category in accordance with the GfW specification CF 100 and the order must be inserted:

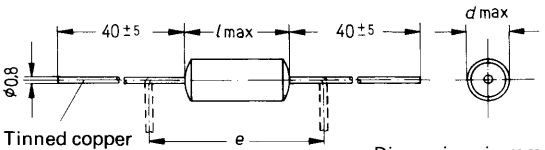
1 for test level A
2 for test level B
3 for test level C
4 for test level D

Metallized polyester capacitors with quality assessment in accordance with GfW specifications CF 100, CF 105

Version: Self healing tubular capacitor winding with polyethyleneterephthalate dielectric. Enclosed in plastic tube, epoxy resin sealed face ends. Central axial leads.

MKT capacitors B 95 050 comply with the Siemens MKT types B 32 237, high reliability version.

Qualified in accordance with: GfW specifications CF 100 and CF 105.
Standard designation: CF 105–...
The capacitors have the electronic test symbol.



Tinned copper lead

Dimensions in mm

l	*e*
24	30
33	37.5
45	50
56	60

Rated voltage		1 kVdc	1,6 kVdc	2,5 kVdc	4 kVdc	6,3 kVdc	8 kVdc	10 kVdc	12,5 kVdc
Rated capacitance	Tolerance	Dimensions *d* x *l* Ordering code B95050–							
680 pF	+50% −20%	–	–	–	–	–	–	–	9,5x56 -K*801-D300
1000 pF		–	–	–	7,5x33 -K*402-D300-	8,5x33 -K*502-D300	8,5x45 -K*602-D300	8,5x56 -K*702-D300	10,5x56 -K*802-D300
2500 pF		–	–	8,5x33 -K*303-D300	8,5x33 -K*403-D300	11,5x33 -K*503-D300	11,5x45 -K*603-D300	11,5x56 -K*703-D300	12,5x56 -K*803-D300
5000 pF		–	7,5x24 -K*204-D300	9,5x33 -K*304-D300	10,5x33 -K*404-D300	10,5x45 -K*504-D300	12,5x45 -K*604-D300	13,5x56 -K*704-D300	–
0,01 µF		–	10,5x24 -K*205-D300	10,5x33 -K*305-D300	12,5x33 -K*405-D300	13,5x45 -K*505-D300	16,5x45 -K*605-D300	–	–
0,025 µF		11,5x24 -K*106-D300	–	16,5x33 -K*306-D300	–	–	–	–	–

Ordering code example B95050–K*303–D300

Type — Code number (see table)

* here the test category in accordance with the GfW specification CF 100 and the order must be inserted:
1 for test level A
2 for test level B
3 for test level C
4 for test level D

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