Metallized polyester film capacitors MKT 470

MKT RADIAL POTTED TYPE **PITCH 5 mm**

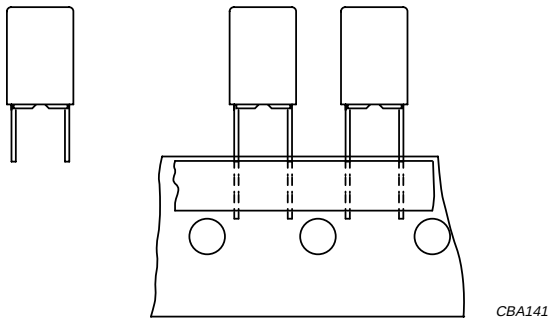


Fig.1 Simplified outlines.

FEATURES

- Low-inductive wound cell of metallized (PETP) film
- Potted with epoxy resin in a flame-retardant case
- Radial leads of solder-coated fecuma wire
- Withstands thermal shocks, oils, solvents and rinsing liquids
- Small stand-off pips to allow removal of solder flux
- Suitable for high density packaging.

APPLICATIONS

- Blocking and coupling of signals
- Bypass and energy reservoir
- Filter networks
- Pulse circuits
- Heavy duty and automotive
- Where high reliability is required.

DETAIL SPECIFICATION

For more detailed data and test requirements see *"Type detail specification HQN-384-02/104"*.

QUICK REFERENCE DATA

DESCRIPTION	VALUE
Capacitance range (E12 series)	0.001 to 1.2 μF
Capacitance tolerance	±10%; ±5%
Rated (DC) voltage	63 V; 100 V; 250 V; 400 V
Climatic category	55/125/56
Maximum application temperature	125 °C
Rated temperature	85 °C
Tangent of loss angle at 100 kHz	150×10^{-4}
Reference specification	IEC 60384-2
Performance grade	grade 1 (long life)

COMPOSITION OF CATALOGUE NUMBER

TYPE AND PITCHES	
470	5.0 mm

MULTIPLIER (nF)	
0.1	2
1	3
10	4
100	5

CAPACITANCE (numerically)

Example:
104 = 10 × 10 = 100 nF

2222	470	XX	XX	X

TYPE	PACKAGING	LEAD CONFIGURATION	C-TOL	63 V	100 V	250 V	400 V
470	ammopack	H = 18.5 mm; P_0 = 12.7 mm	±10%	75	85	35	65
			±5%	76	86	36	66
	loose in box	lead length 4.0 mm	±10%	11	21	41	51
			±5%	12	22	42	52
		lead length 26.0 mm	±10%	15	25	45	55
			±5%	16	26	46	56
	taped on reel	H = 18.5 mm; P_0 = 12.7 mm	±10%	18	28	48	58
			±5%	19	29	49	59

Metallized polyester film capacitors MKT 470

MKT 470 GENERAL DATA **PITCH 5 mm**

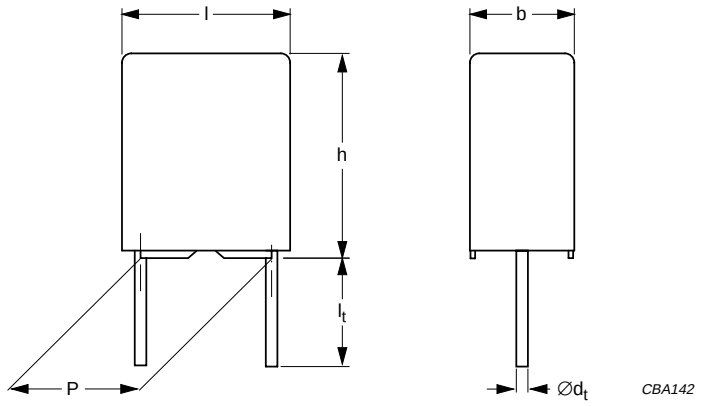


Fig.3 Outline.

Specific reference data for the 63 V DC capacitors

DESCRIPTION	VALUE		
	at 1 kHz	at 10 kHz	at 100 kHz
Tangent of loss angle:			
$C \leq 0.1\ \mu F$	$\leq 60 \times 10^{-4}$	$\leq 120 \times 10^{-4}$	$\leq 200 \times 10^{-4}$
$0.1\ \mu F < C \leq 0.47\ \mu F$	$\leq 60 \times 10^{-4}$	$\leq 120 \times 10^{-4}$	$\leq 225 \times 10^{-4}$
$0.47\ \mu F < C \leq 1.2\ \mu F$	$\leq 60 \times 10^{-4}$	$\leq 120 \times 10^{-4}$	–
Rated voltage pulse slope $(dU/dt)_R$ at 63 V (DC)	100 V/µs		
R between leads, for $C \leq 0.33\ \mu F$ at 10 V; 1 minute	>15000 MΩ		
RC between leads, for $C > 0.33\ \mu F$ at 10 V; 1 minute	>5000 s		
R between interconnected leads and case (foil method)	>30000 MΩ		
Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s	100 V; 1 minute		
Withstanding (DC) voltage between leads and case	200 V; 1 minute		

Available 63 V DC versions

PACKAGING(1)	DIMENSIONS	C-tol	FIRST 9 DIGITS OF CATALOGUE NUMBER	ORDERING
Ammopack	H = 18.5 mm; note 2	±10%	2222 470 75...	preferred
		±5%	2222 470 76...	preferred
Loose in box	l_t = 4.0 +1.0/–0.5 mm	±10%	2222 470 11...	on request
		±5%	2222 470 12...	on request
	l_t = 26.0 ±2.0 mm	±10%	2222 470 15...	on request
		±5%	2222 470 16...	on request
Taped on reel	H = 18.5 mm; note 2	±10%	2222 470 18...	on request
		±5%	2222 470 19...	on request

Notes

1. For SPQ refer to this handbook, chapter *"Packaging information"*.
2. H = in-tape height; for detailed specifications refer to this handbook, chapter *"Packaging information"*.

U_{Rdc} = 63 V; U_{Rac} = 40 V

C (μF)	DIMENSIONS b × h × l (mm)	MASS (g)	CATALOGUE NUMBER	
			AMMOPACK	
			H = 18.5 mm	
			C-tol = ±10%	C-tol = ±5%
			catalogue number(1)	last 5 digits(1)
Pitch = 5.0 ±0.3 mm; d_t = 0.50 ±0.05 mm				
0.068	2.5 × 6.5 × 7.2	0.25	2222 470 75**683**	.. 76**683**
0.082			2222 470 75**823**	.. 76**823**
0.1			2222 470 75**104**	.. 76**104**
0.12	3.5 × 8.0 × 7.2	0.35	2222 470 75**124**	.. 76**124**
0.15			2222 470 75**154**	.. 76**154**
0.18			2222 470 75**184**	.. 76**184**
0.22			2222 470 75**224**	.. 76**224**
0.27			2222 470 75**274**	.. 76**274**
0.33			2222 470 75**334**	.. 76**334**
0.39			2222 470 75**394**	.. 76**394**
0.47	4.5 × 9.0 × 7.2	0.45	2222 470 75**474**	.. 76**474**
0.56			2222 470 75**564**	.. 76**564**
0.68			2222 470 75**684**	.. 76**684**
0.82	6.0 × 11.0 × 7.2	0.60	2222 470 75**824**	.. 76**824**
1			2222 470 75**105**	.. 76**105**
1.2			2222 470 75**125**	.. 76**125**

Note

1. The shading indicates preferred types.

MKT 470 GENERAL DATA **PITCH 5 mm**

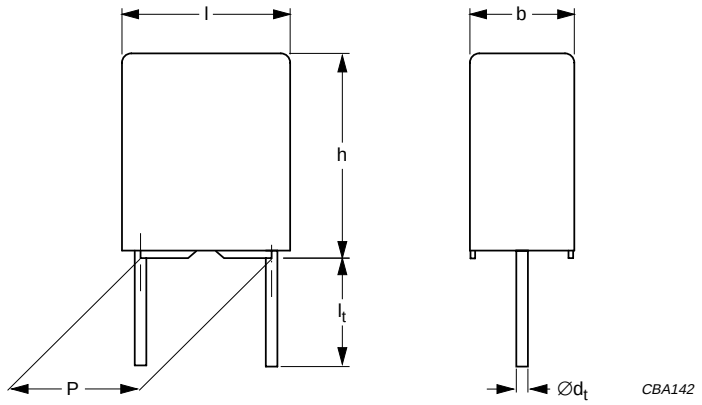


Fig.4 Outline.

Specific reference data for the 100 V DC capacitors

DESCRIPTION	VALUE		
	at 1 kHz	at 10 kHz	at 100 kHz
Tangent of loss angle: $C \leq 0.1\ \mu F$ $0.1\ \mu F < C \leq 0.47\ \mu F$	 $\leq 60 \times 10^{-4}$ $\leq 60 \times 10^{-4}$	 $\leq 120 \times 10^{-4}$ $\leq 120 \times 10^{-4}$	 $\leq 200 \times 10^{-4}$ $\leq 225 \times 10^{-4}$
Rated voltage pulse slope $(dU/dt)_R$ at 100 V (DC)	160 V/μs		
R between leads, for $C \leq 0.33\ \mu F$ at 100 V; 1 minute	>15000 MΩ		
RC between leads, for $C > 0.33\ \mu F$ at 100 V; 1 minute	>5000 s		
R between interconnected leads and case (foil method)	>30000 MΩ		
Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s	160 V; 1 minute		
Withstanding (DC) voltage between leads and case	200 V; 1 minute		

Available 100 V DC versions

PACKAGING(1)	DIMENSIONS	C-tol	FIRST 9 DIGITS OF CATALOGUE NUMBER	ORDERING
Ammopack	H = 18.5 mm; note 2	±10%	2222 470 85...	preferred
		±5%	2222 470 86...	preferred
Loose in box	l_t = 4.0 +1.0/–0.5 mm	±10%	2222 470 21...	on request
		±5%	2222 470 22...	on request
	l_t = 26.0 ±2.0 mm	±10%	2222 470 25...	on request
		±5%	2222 470 26...	on request
Taped on reel	H = 18.5 mm; note 2	±10%	2222 470 28...	on request
		±5%	2222 470 29...	on request

Notes

1. For SPQ refer to this handbook, chapter *"Packaging information"*.
2. H = in-tape height; for detailed specifications refer to this handbook, chapter *"Packaging information"*.

U_{Rdc} = 100 V; U_{Rac} = 63 V

C (μF)	DIMENSIONS b × h × l (mm)	MASS (g)	CATALOGUE NUMBER	
			AMMOPACK	
			H = 18.5 mm	
			C-tol = ±10%	C-tol = ±5%
			catalogue number(1)	last 5 digits(1)
Pitch = 5.0 ±0.3 mm; d_t = 0.50 ±0.05 mm				
0.022	2.5 × 6.5 × 7.2	0.25	2222 470 85**223**	.. 86**223**
0.027			2222 470 85**273**	.. 86**273**
0.033			2222 470 85**333**	.. 86**333**
0.039			2222 470 85**393**	.. 86**393**
0.047			2222 470 85**473**	.. 86**473**
0.056			2222 470 85**563**	.. 86**563**
0.068	3.5 × 8.0 × 7.2	0.35	2222 470 85**683**	.. 86**683**
0.082			2222 470 85**823**	.. 86**823**
0.1			2222 470 85**104**	.. 86**104**
0.12			2222 470 85**124**	.. 86**124**
0.15	4.5 × 9.0 × 7.2	0.45	2222 470 85**154**	.. 86**154**
0.18			2222 470 85**184**	.. 86**184**
0.22			2222 470 85**224**	.. 86**224**
0.27	6.0 × 11.0 × 7.2	0.65	2222 470 85**274**	.. 86**274**
0.33			2222 470 85**334**	.. 86**334**
0.39			2222 470 85**394**	.. 86**394**
0.47			2222 470 85**474**	.. 86**474**

Note

1. The shading indicates preferred types.

Metallized polyester film capacitors MKT 470

MKT 470 GENERAL DATA **PITCH 5 mm**

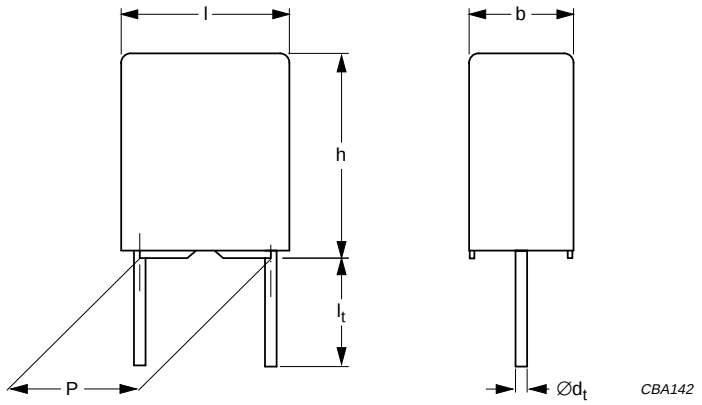


Fig.5 Outline.

Specific reference data for the 250 V DC capacitors

DESCRIPTION	VALUE			
	at 1 kHz	at 10 kHz	at 100 kHz	at 1 MHz
Tangent of loss angle:				
$C \leq 0.01\ \mu F$	$\leq 60 \times 10^{-4}$	$\leq 120 \times 10^{-4}$	$\leq 200 \times 10^{-4}$	$\leq 250 \times 10^{-4}$
$0.01\ \mu F < C \leq 0.1\ \mu F$	$\leq 60 \times 10^{-4}$	$\leq 120 \times 10^{-4}$	$\leq 200 \times 10^{-4}$	–
$0.1\ \mu F < C \leq 0.12\ \mu F$	$\leq 60 \times 10^{-4}$	$\leq 120 \times 10^{-4}$	$\leq 225 \times 10^{-4}$	–
Rated voltage pulse slope $(dU/dt)_R$ at 250 V (DC)	400 V/µs			
R between leads at 100 V; 1 minute	>15000 MΩ			
R between interconnected leads and case (foil method)	>30000 MΩ			
Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s	400 V; 1 minute			
Withstanding (DC) voltage between leads and case	500 V; 1 minute			

Available 250 V DC versions

PACKAGING(1)	DIMENSIONS	C-tol	FIRST 9 DIGITS OF CATALOGUE NUMBER	ORDERING
Ammopack	H = 18.5 mm; note 2	±10%	2222 470 35...	preferred
		±5%	2222 470 36...	preferred
Loose in box	l_t = 4.0 +1.0/–0.5 mm	±10%	2222 470 41...	on request
		±5%	2222 470 42...	on request
	l_t = 26.0 ±2.0 mm	±10%	2222 470 45...	on request
		±5%	2222 470 46...	on request
Taped on reel	H = 18.5 mm; note 2	±10%	2222 470 48...	on request
		±5%	2222 470 49...	on request

Notes

1. For SPQ refer to this handbook, chapter *"Packaging information"*.
2. H = in-tape height; for detailed specifications refer to this handbook, chapter *"Packaging information"*.

U_{Rdc} = 250 V; U_{Rac} = 160 V

C (μF)	DIMENSIONS b × h × l (mm)	MASS (g)	CATALOGUE NUMBER	
			AMMOPACK	
			H = 18.5 mm	
			C-tol = ±10%	C-tol = ±5%
			catalogue number(1)	last 5 digits(1)
Pitch = 5.0 ±0.3 mm; d_t = 0.50 ±0.05 mm				
0.01	2.5 × 6.5 × 7.2	0.25	2222 470 35**103**	.. 36**103**
0.012			2222 470 35**123**	.. 36**123**
0.015			2222 470 35**153**	.. 36**153**
0.018			2222 470 35**183**	.. 36**183**
0.022	3.5 × 8.0 × 7.2	0.35	2222 470 35**223**	.. 36**223**
0.027			2222 470 35**273**	.. 36**273**
0.033			2222 470 35**333**	.. 36**333**
0.039			2222 470 35**393**	.. 36**393**
0.047	4.5 × 9.0 × 7.2	0.45	2222 470 35**473**	.. 36**473**
0.056			2222 470 35**563**	.. 36**563**
0.068			2222 470 35**683**	.. 36**683**
0.082	6.0 × 11.0 × 7.2	0.60	2222 470 35**823**	.. 36**823**
0.1			2222 470 35**104**	.. 36**104**
0.12			2222 470 35**124**	.. 36**124**

Note

1. The shading indicates preferred types.

MKT 470 GENERAL DATA **PITCH 5 mm**

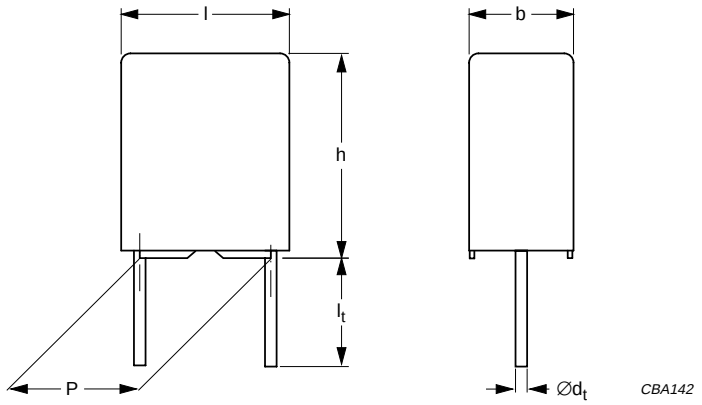


Fig.6 Outline.

Specific reference data for the 400 V DC capacitors

DESCRIPTION	VALUE			
	at 1 kHz	at 10 kHz	at 100 kHz	at 1 MHz
Tangent of loss angle: $C \leq 0.01\ \mu F$ $0.01\ \mu F < C \leq 0.047\ \mu F$	 $\leq 60 \times 10^{-4}$ $\leq 60 \times 10^{-4}$	 $\leq 120 \times 10^{-4}$ $\leq 120 \times 10^{-4}$	 $\leq 200 \times 10^{-4}$ $\leq 200 \times 10^{-4}$	 $\leq 250 \times 10^{-4}$ –
Rated voltage pulse slope $(dU/dt)_R$ at 400 V (DC)	800 V/μs			
R between leads at 100 V; 1 minute	>15000 MΩ			
R between interconnected leads and case (foil method)	>30000 MΩ			
Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s	640 V; 1 minute			
Withstanding (DC) voltage between leads and case	800 V; 1 minute			

Available 400 V DC versions

PACKAGING(1)	DIMENSIONS	C-tol	FIRST 9 DIGITS OF CATALOGUE NUMBER	ORDERING
Ammopack	H = 18.5 mm; note 2	±10%	2222 470 65...	preferred
		±5%	2222 470 66...	preferred
Loose in box	l_t = 4.0 +1.0/–0.5 mm	±10%	2222 470 51...	on request
		±5%	2222 470 52...	on request
	l_t = 26.0 ±2.0 mm	±10%	2222 470 55...	on request
		±5%	2222 470 56...	on request
Taped on reel	H = 18.5 mm; note 2	±10%	2222 470 58...	on request
		±5%	2222 470 59...	on request

Notes

1. For SPQ refer to this handbook, chapter *"Packaging information"*.
2. H = in-tape height; for detailed specifications refer to this handbook, chapter *"Packaging information"*.

U_{Rdc} = 400 V; U_{Rac} = 220 V

C (μF)	DIMENSIONS b × h × l (mm)	MASS (g)	CATALOGUE NUMBER	
			AMMOPACK	
			H = 18.5 mm	
			C-tol = ±10%	C-tol = ±5%
			catalogue number(1)	last 5 digits(1)
Pitch = 5.0 ±0.3 mm; d_t = 0.50 ±0.05 mm				
0.001	2.5 × 6.5 × 7.2	0.25	2222 470 65**102**	.. 66**102**
0.0012			2222 470 65**122**	.. 66**122**
0.0015			2222 470 65**152**	.. 66**152**
0.0018			2222 470 65**182**	.. 66**182**
0.0022			2222 470 65**222**	.. 66**222**
0.0027			2222 470 65**272**	.. 66**272**
0.0033			2222 470 65**332**	.. 66**332**
0.0039			2222 470 65**392**	.. 66**392**
0.0047			2222 470 65**472**	.. 66**472**
0.0056			2222 470 65**562**	.. 66**562**
0.0068			2222 470 65**682**	.. 66**682**
0.0082			2222 470 65**822**	.. 66**822**
0.01	3.5 × 8.0 × 7.2	0.35	2222 470 65**103**	.. 66**103**
0.012			2222 470 65**123**	.. 66**123**
0.015			2222 470 65**153**	.. 66**153**
0.018	4.5 × 9.0 × 7.2	0.45	2222 470 65**183**	.. 66**183**
0.022			2222 470 65**223**	.. 66**223**
0.027			2222 470 65**273**	.. 66**273**
0.033	6.0 × 11.0 × 7.2	0.60	2222 470 65**333**	.. 66**333**
0.039			2222 470 65**393**	.. 66**393**
0.047			2222 470 65**473**	.. 66**473**

Note

1. The shading indicates preferred types.

CONSTRUCTION

Description

- Low-inductive wound cell of metallized polyethylene terephthalate (PETP) film, potted with epoxy resin in a flame-retardant case
- Radial leads, copper clad iron wire
- Small stand-off pips allow removal of solder flux etc. during cleaning of the printed-circuit board.

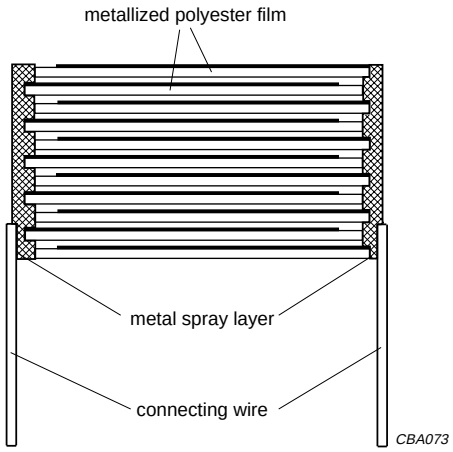


Fig.7 Construction.

Mounting

NORMAL USE

The capacitors are designed for mounting on printed-circuit boards. The capacitors packed in bandoliers are designed for mounting on printed-circuit boards by automatic insertion machines.
For detailed tape specifications refer to this handbook, chapter *"Packaging information"*.

SPECIFIC METHOD OF MOUNTING TO WITHSTAND VIBRATION AND SHOCK TEST

In order to withstand vibration and shock tests, it must be ensured that the stand-off pips are in good contact with the printed-circuit board.

SPACE REQUIREMENTS ON PRINTED-CIRCUIT BOARD

The maximum length and width of film capacitors is shown in Fig.8:

- Eccentricity see Fig.8. The maximum eccentricity is smaller than or equal to the wire diameter of the product concerned.
- Product height with seating plane as given by *"IEC 60717"* as reference: $h_{max} \leq h + 0.3$ mm.

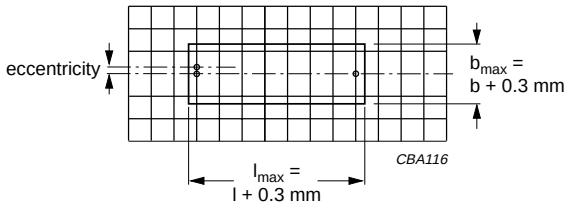


Fig.8 Lay-out..

Storage temperature

- Storage temperature: $T_{stg} = -25$ to $+40$ °C with RH maximum 80% without condensation.

RATINGS AND CHARACTERISTICS REFERENCE CONDITIONS

Unless otherwise specified, all electrical values apply to an ambient free air temperature of 23 ±1 °C, an atmospheric pressure of 86 to 106 kPa and a relative humidity of 50 ±2%.

For reference testing, a conditioning period shall be applied over 96 ±4 hours by heating the products in a circulating air oven at the rated temperature and a relative humidity not exceeding 20%.

CHARACTERISTICS

Capacitance

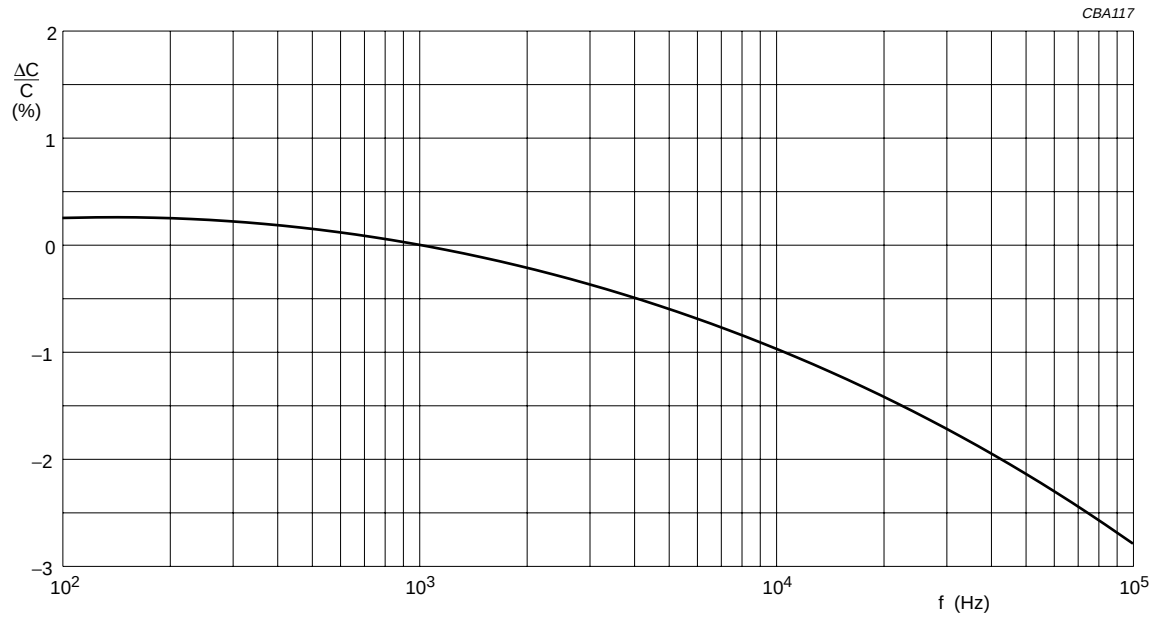


Fig.9 Capacitance change as a function of frequency: typical curve.

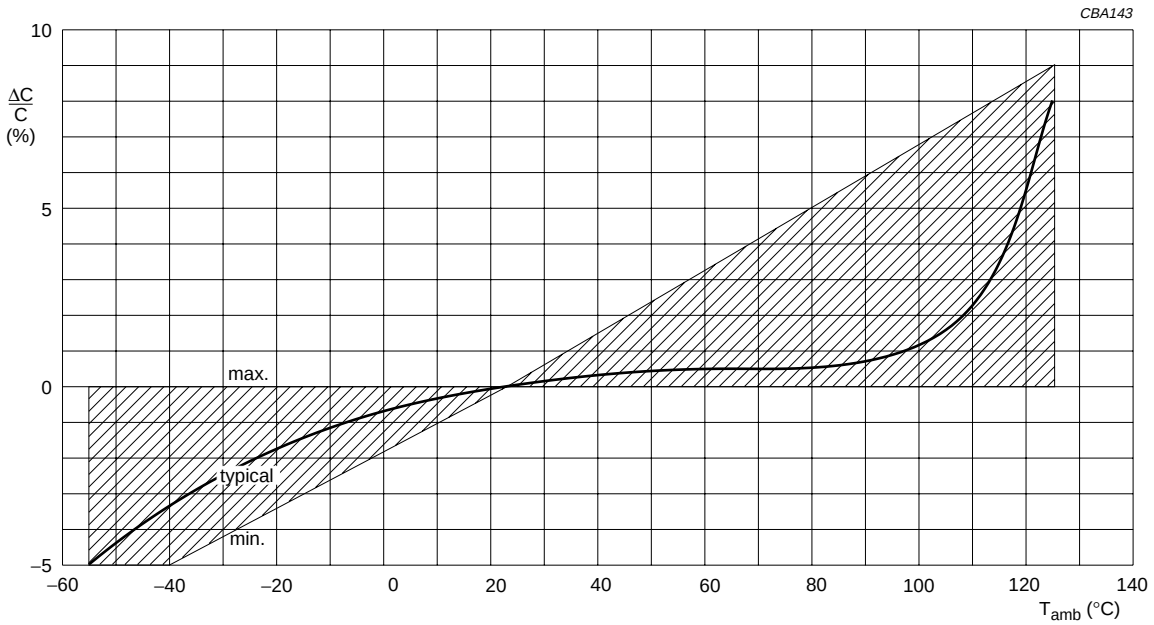


Fig.10 Capacitance change at 1 kHz as a function of temperature: typical curve.

Impedance

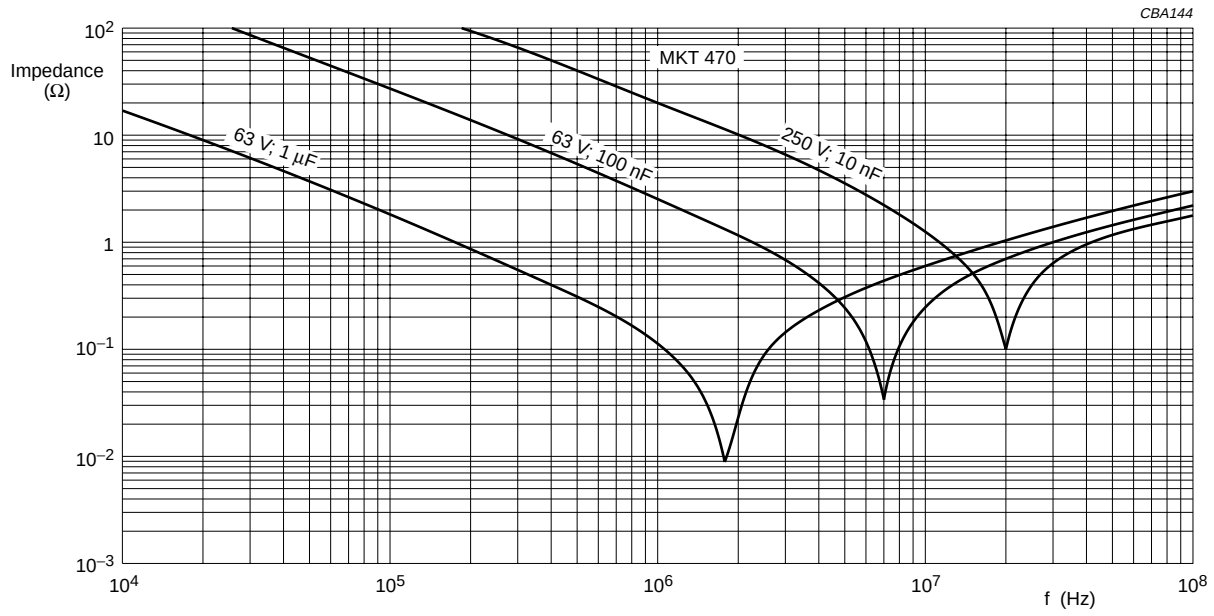


Fig.11 Impedance as a function of frequency: typical curves.

Maximum DC and AC voltage as a function of temperature

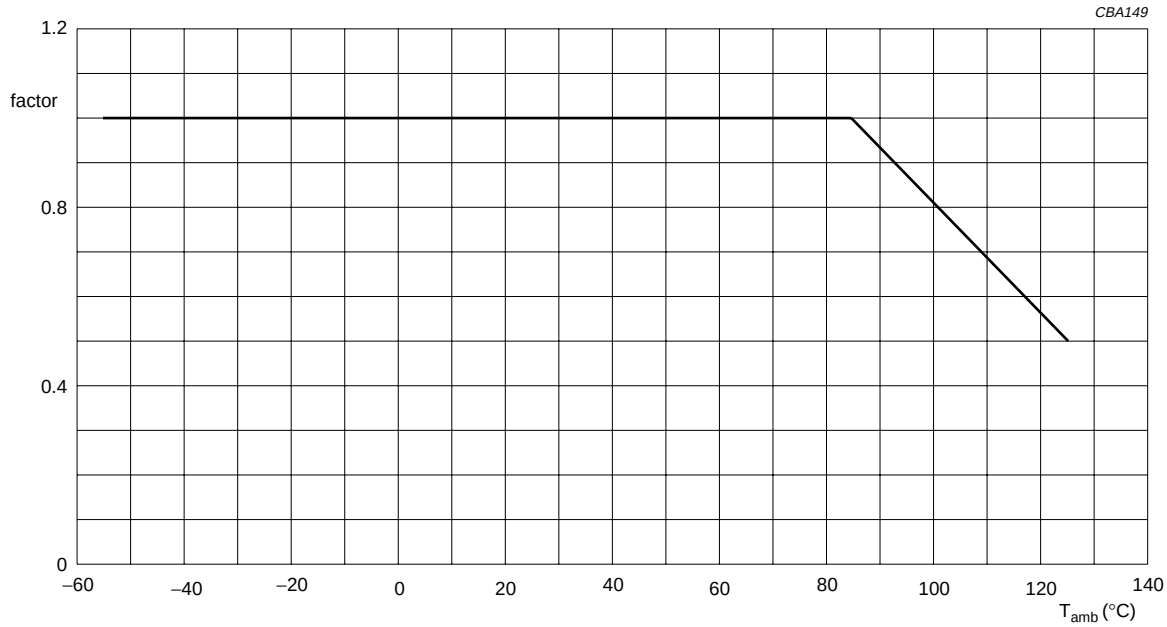


Fig.12 Multiplying factor for DC and AC voltage as a function of temperature.

Maximum RMS voltage (sinewave) as a function of frequency

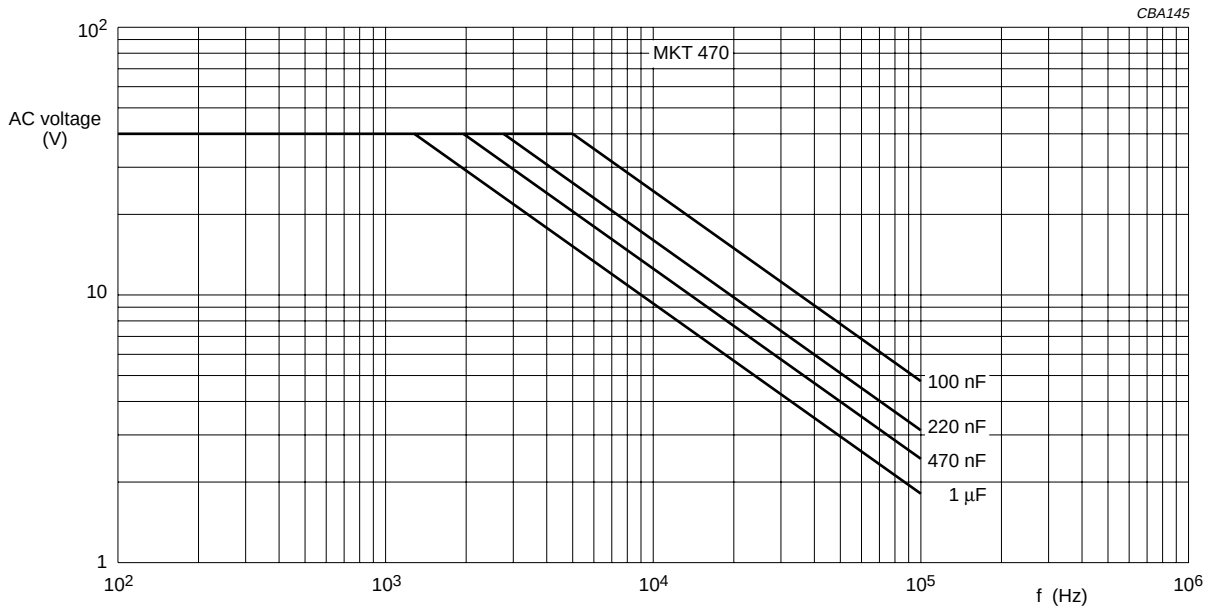


Fig.13 AC voltage (RMS value) as a function of frequency at $T_{amb} \leq 85$ °C for $U_{Rdc} = 63$ V.

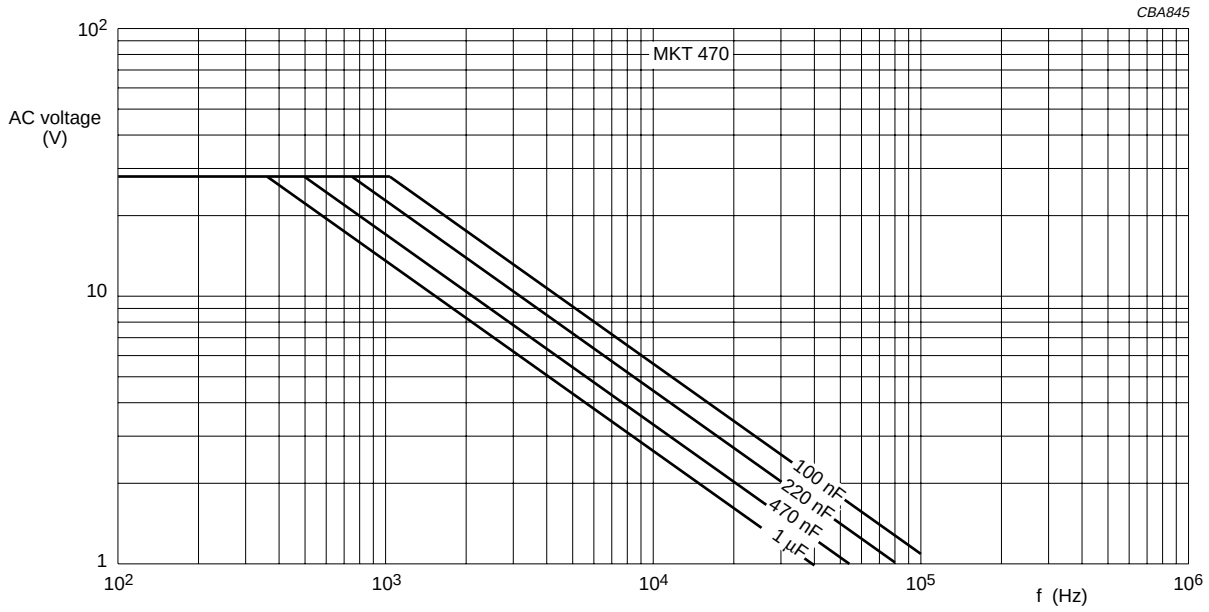


Fig.14 AC voltage (RMS value) as a function of frequency at 85 °C < $T_{amb} \leq 125$ °C for $U_{Rdc} = 63$ V.

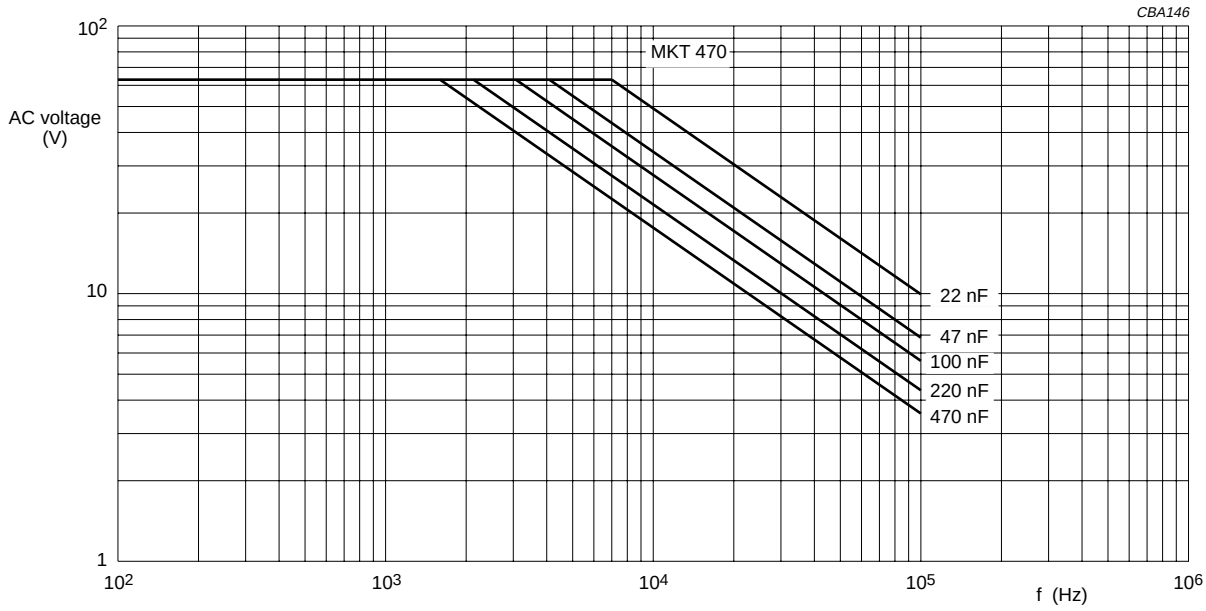


Fig.15 AC voltage (RMS value) as a function of frequency at $T_{amb} \leq 85$ °C for $U_{Rdc} = 100$ V.

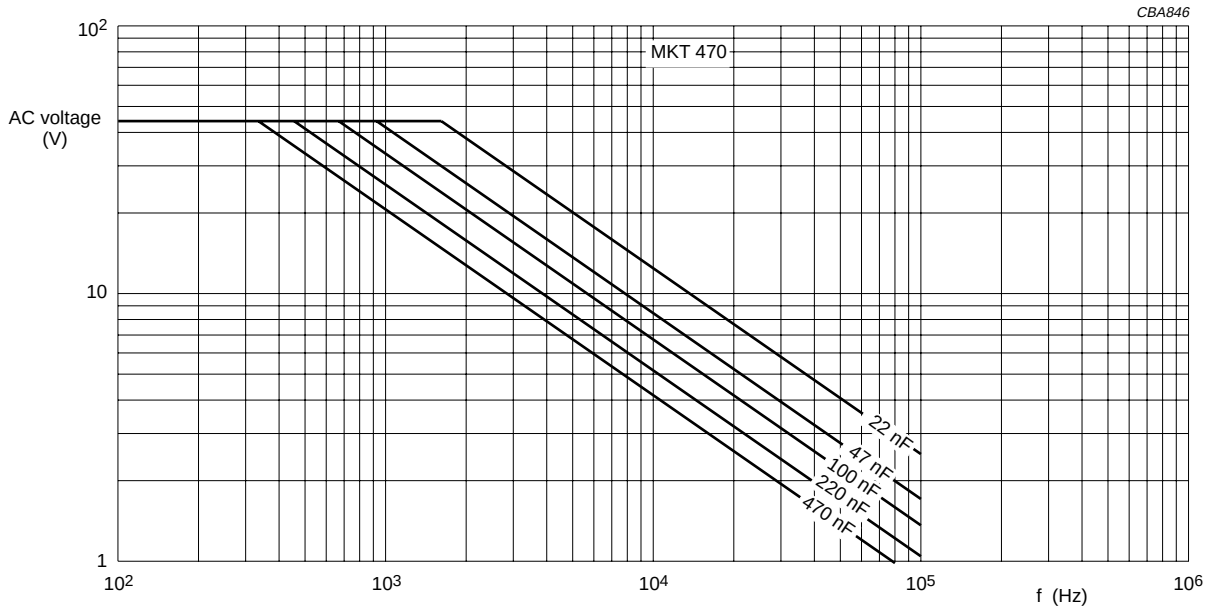


Fig.16 AC voltage (RMS value) as a function of frequency at 85 °C < $T_{amb} \leq 125$ °C for $U_{Rdc} = 100$ V.

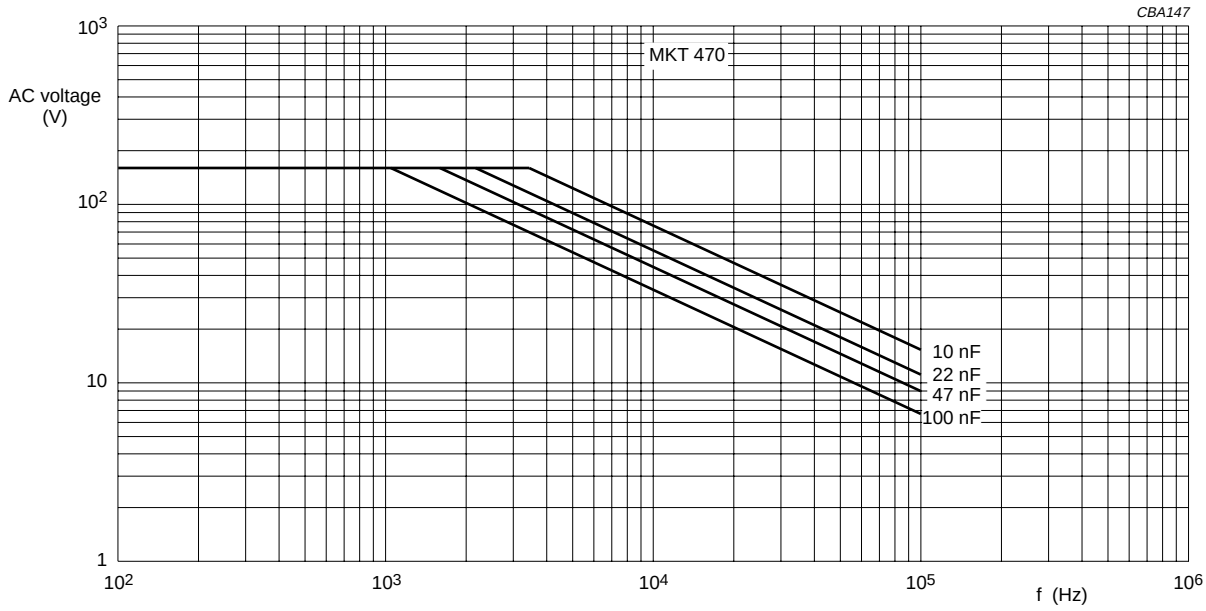


Fig.17 AC voltage (RMS value) as a function of frequency at $T_{amb} \leq 85$ °C for $U_{Rdc} = 250$ V.

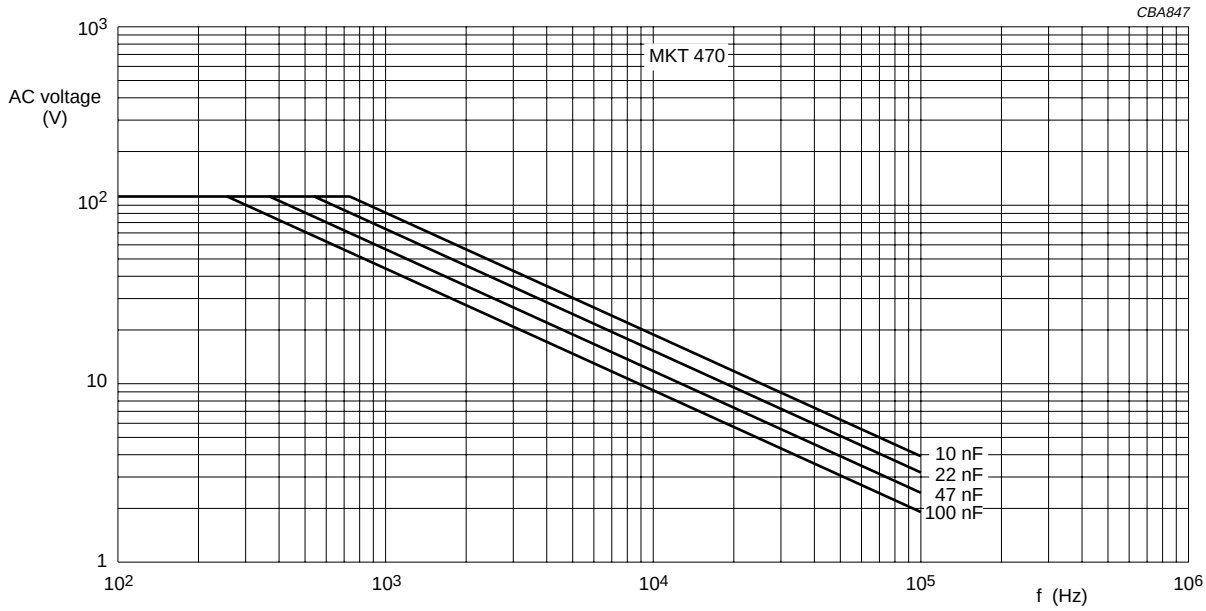


Fig.18 AC voltage (RMS value) as a function of frequency at 85 °C < $T_{amb} \leq 125$ °C for $U_{Rdc} = 250$ V.

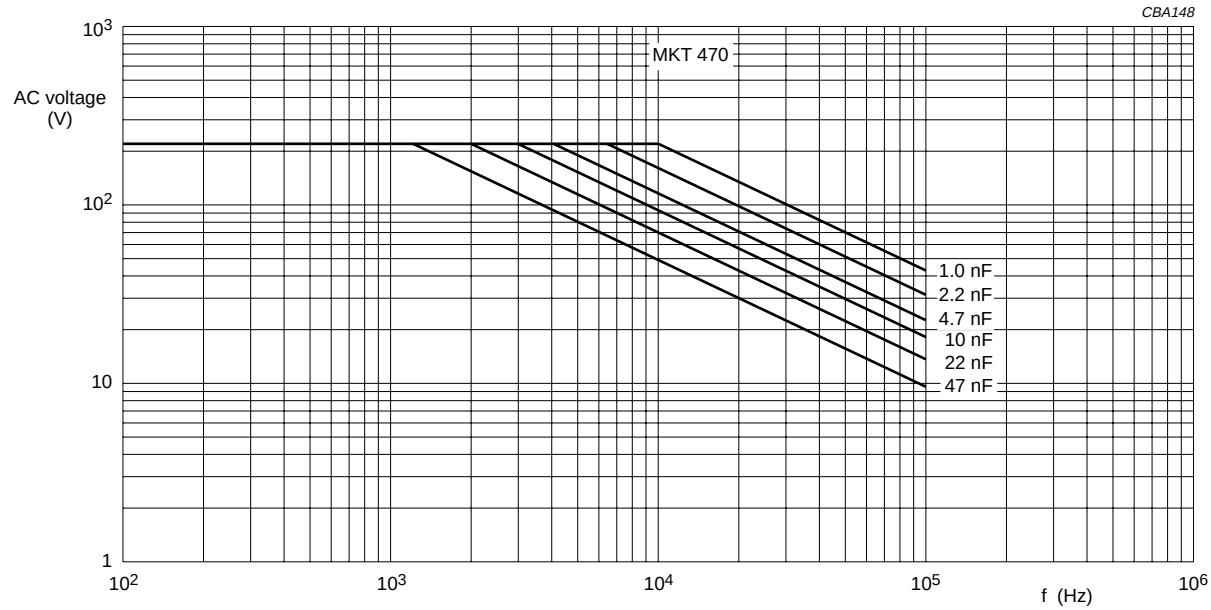


Fig.19 AC voltage (RMS value) as a function of frequency at $T_{amb} \leq 85$ °C for $U_{Rdc} = 400$ V.

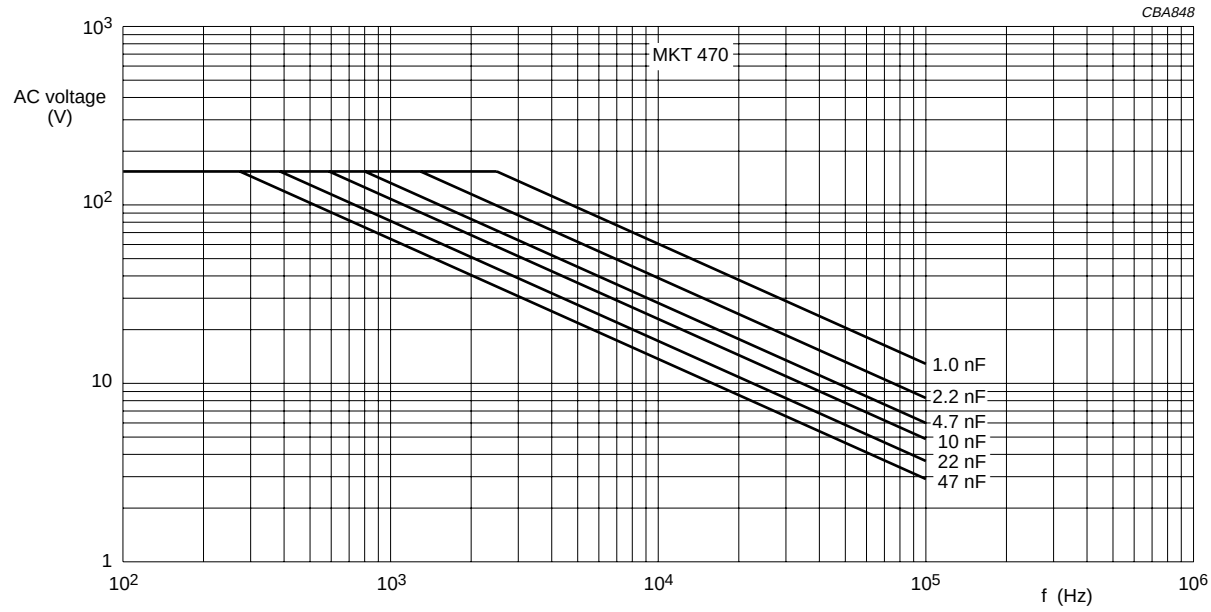


Fig.20 AC voltage (RMS value) as a function of frequency at 85 °C < $T_{amb} \leq 125$ °C for $U_{Rdc} = 400$ V.

Maximum RMS current (sinewave) as a function of frequency

The maximum RMS current is defined by $I_{ac} = \omega \times C \times U_{ac}$.

U_{ac} is the maximum AC voltage depending on the ambient temperature in Figs 13 to 20.

Tangent of loss angle

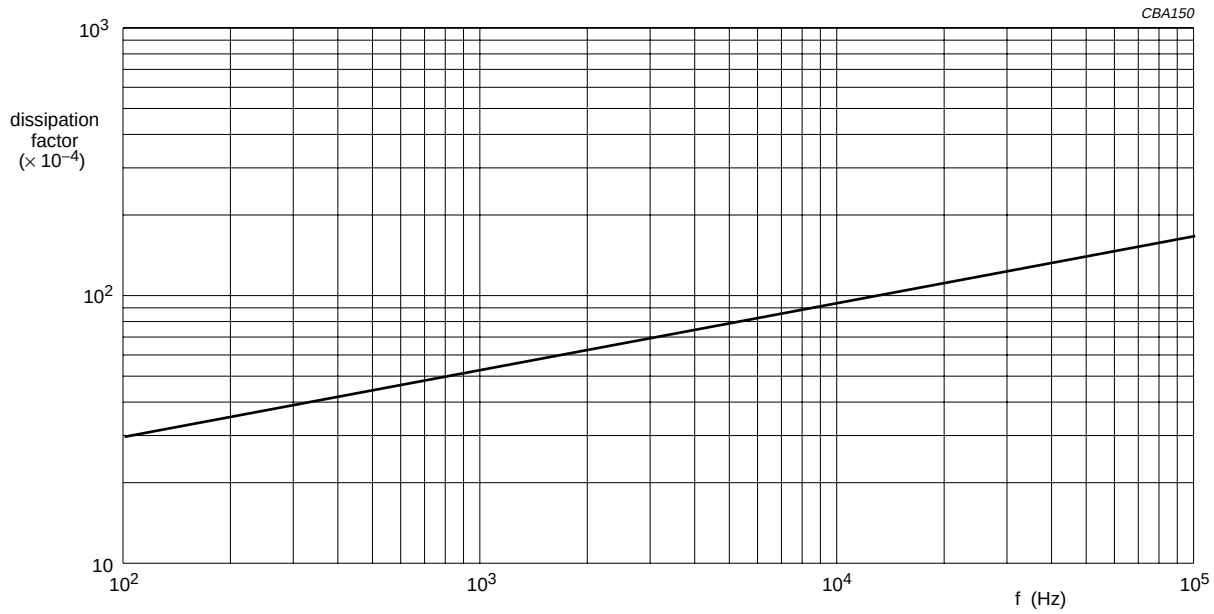


Fig.21 Tangent of loss angle as a function of frequency: typical curve.

Insulation resistance

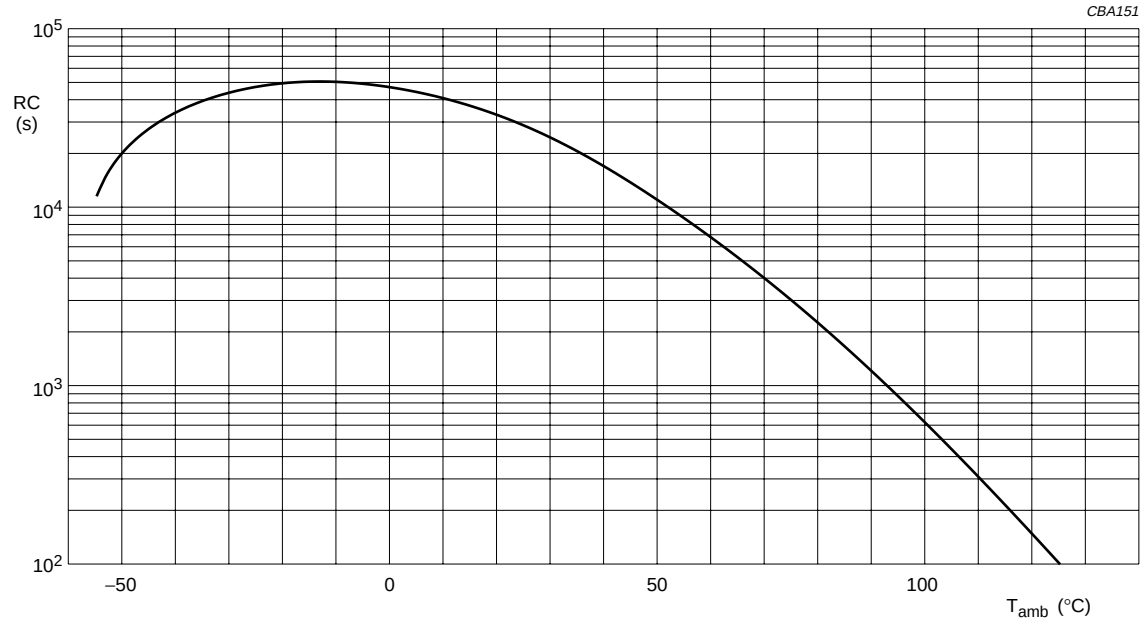


Fig.22 RC product as a function of temperature: typical curve.

Maximum allowed component temperature rise (∆T) as a function of the ambient temperature (T_{amb})

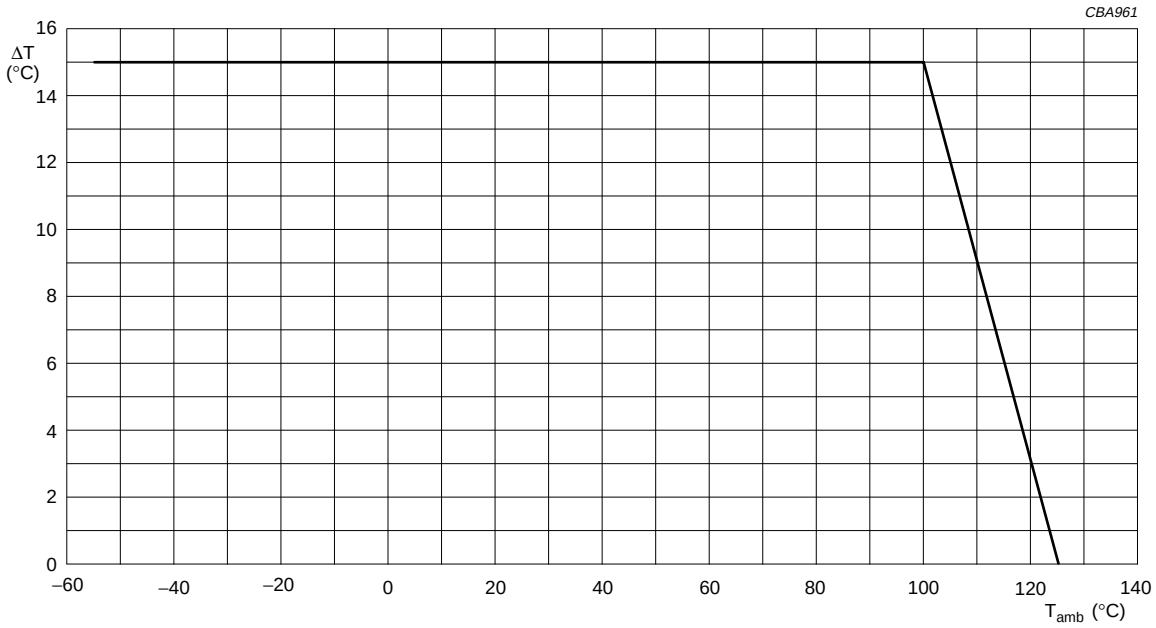


Fig.23 Maximum allowed component temperature rise as a function of the ambient temperature.

Heat conductivity (G) as a function of pitch and capacitor body thickness in mW/°C

Table 1 Heat conductivity

b_{max} (mm)	PITCH (mm)
2.5	2.5
3.5	3.0
4.5	4.0
6.0	5.5

Power dissipation and maximum component temperature rise

The power dissipation must be limited in order not to exceed the maximum allowed component temperature rise as a function of the free air ambient temperature.

Power dissipation can be calculated in accordance with chapter *"Introduction",* section *"Maximum power dissipation"*.

The component temperature rise (∆T) can be measured (see section "Measuring the component temperature" for more details) or calculated by $\Delta T = P/G$:

- ∆T = component temperature rise (°C).
- P = power dissipation of the component (mW).
- G = heat conductivity of the component (mW/°C).

Measuring the component temperature

A thermocouple must be attached to the capacitor body; see Fig.24.

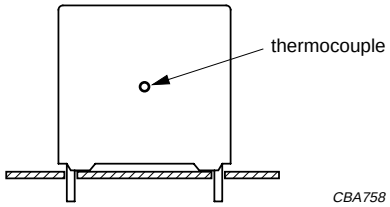


Fig.24 Mounting the thermocouple.

The temperature is measured in unloaded (T_{amb}) and maximum loaded condition (T_c).

The temperature rise is given by: $\Delta T = T_c - T_{amb}$.

To avoid radiation or convection, the capacitor should be tested in a wind-free box.

Application note and limiting conditions

These capacitors are not suitable for mains applications as across-the-line capacitors without additional protection; see below. These mains applications are strictly regulated by safety standards and therefore electromagnetic interference suppression capacitors conforming to the standards must be used.

To select the capacitor for a certain application, the following conditions must be checked:

1. The peak voltage (U_p) shall not be greater than the rated DC voltage (U_{Rdc}).
2. The peak-to-peak voltage (U_{p-p}) shall not be greater than the maximum U_{p-p} to avoid the ionisation inception level.
3. The voltage pulse slope (dU/dt) shall not exceed the rated voltage pulse slope in an RC-circuit at rated voltage and without ringing. If the pulse voltage is lower than the rated DC voltage, the rated voltage pulse slope may be multiplied by U_{Rdc} and divided by the applied voltage.

   For all other pulses following equation must be fulfilled:

   $$2 \times \int_0^T \left(\frac{dU}{dt}\right)^2 \times dt < U_{Rdc} \times \left(\frac{dU}{dt}\right)_{rated}$$

   T is the pulse duration.

   The rated voltage pulse slope is valid for ambient temperatures up to 85 °C. For higher temperatures a derating factor of 3% per K shall be applied.
4. The maximum component surface temperature rise must be lower than the limits in Fig.23.
5. Since in circuits used at voltages over 280 V peak-to-peak the risk for an intrinsically active flammability after a capacitor breakdown (short circuit) increases, it is recommended that the power to the component is limited to 100 times the values mentioned in Table 1 “Heat conductivity”.
6. When using these capacitors as across-the-line capacitor in the input filter for mains applications or as series connected with an impedance to the mains the applicant must guarantee that following conditions are fulfilled in any case (spikes and surge voltages from the mains included).

VOLTAGE CONDITIONS FOR 6 ABOVE

ALLOWED VOLTAGES	$T_{amb} < 85$ °C	$85 < T_{amb} \leq 100$ °C	$100 < T_{amb} \leq 125$ °C
Maximum continuous RMS voltage	$1 \times U_{Rac}$	$0.8 \times U_{Rac}$	$0.5 \times U_{Rac}$
Maximum temporary RMS -overvoltage (<24 hours)	$1.25 \times U_{Rac}$	$1.0 \times U_{Rac}$	$0.625 \times U_{Rac}$
Maximum peak voltage (V_{o-p}) (<2 s)	$1.6 \times U_{Rdc}$	$1.3 \times U_{Rdc}$	$0.8 \times U_{Rdc}$

MARKING

Product marking

The capacitors are marked by YAG laser on the side (see Fig.25) with the following information:

1. Capacitance code in accordance with "*IEC 60062*"
2. Tolerance on rated capacitance: K = ±10%; J = ±5%
3. Rated (DC) voltage (e.g. 63 V)
4. Manufacturer
5. Year and week of manufacture (e.g. 9710)
6. Manufacturers type designation (e.g. 470).

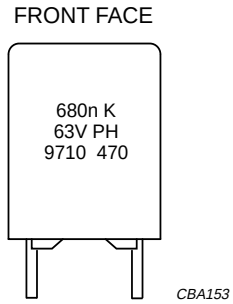
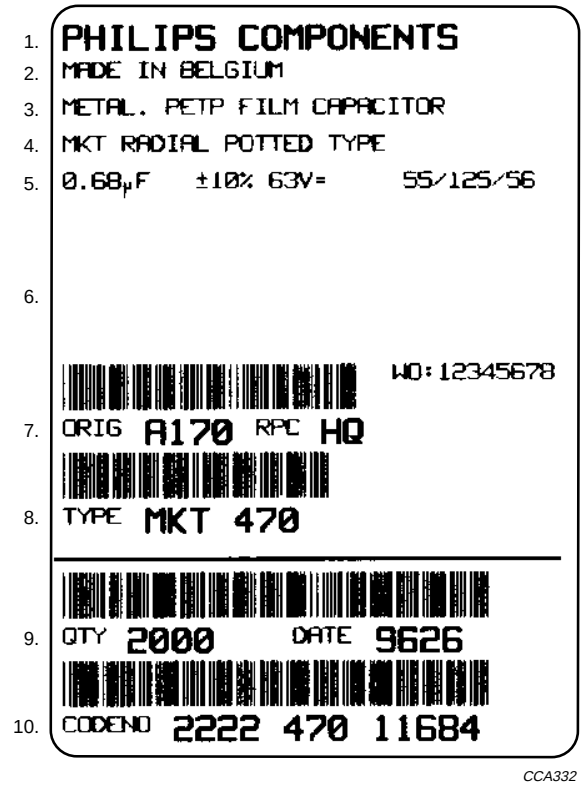


Fig.25 Example of marking.

Package marking

The package containing the capacitors is marked as shown in Fig.26.

Please note:
In due time BC COMPONENTS
will replace PHILIPS COMPONENTS



Barcode label marking

LINE	MARKING EXPLANATION
1	Manufacturer's name
2	Country of origin
3	Sub-family
4	Type description
5	Capacitance value, tolerance and climatic category *("IEC 60068-1")*
6	–
7	Preference origin code: A Country of origin in code: 170 (Belgium) Responsible production centre: HQ Work order: WO Wage number of final inspection
8	Product type description
9	Quantity and production period, year and week code
10	Product code (12NC)

Fig.26 Barcode label.

QUICK REFERENCE TEST REQUIREMENTS (see note 1)

TEST	PROCEDURE (quick reference)	REQUIREMENTS
Robustness of leads		
Tensile strength: *"IEC 60068-2-21"*	load 10 N; 10 s	no visible damage legible marking $\lvert\Delta C/C\rvert \leq 2\%$ $\Delta\tan\delta \leq 50 \times 10^{-4}$ ($C \leq 10$ nF) $\Delta\tan\delta \leq 30 \times 10^{-4}$ (10 nF $< C \leq$ 470 nF) $\Delta\tan\delta \leq 20 \times 10^{-4}$ ($C >$ 470 nF)
Bending: *"IEC 60068-2-21"*	load 5 N; 4 × 90°	
Resistance to soldering heat: *"IEC 60068-2-20"*	solder bath: 260 °C; 10 s	
Component solvent resistance	isopropyl alcohol; 23 °C; 5 minutes	
Robustness of component		
Vibration: *"IEC 60068-2-6"*	10 to 55 Hz; amplitude 0.75 mm or acceleration 98 m/s^2; 6 hours	$\lvert\Delta C/C\rvert \leq 5\%$ for b = 2.5 mm or $\lvert\Delta C/C\rvert \leq 3\%$ for b > 2.5 mm $\Delta\tan\delta \leq 50 \times 10^{-4}$ ($C \leq 10$ nF) $\Delta\tan\delta \leq 30 \times 10^{-4}$ (10 nF $< C \leq$ 470 nF) $\Delta\tan\delta \leq 20 \times 10^{-4}$ ($C >$ 470 nF)
Shock: *"IEC 60068-2-27"*	half sinewave; 490 m/s^2; 11 ms	
Climatic sequence		
Dry heat: *"IEC 60068-2-2"*	16 hours; 125 °C	$\lvert\Delta C/C\rvert \leq 5\%$ $\Delta\tan\delta \leq 80 \times 10^{-4}$ ($C \leq 10$ nF) $\Delta\tan\delta \leq 50 \times 10^{-4}$ (10 nF $< C \leq$ 470 nF) $\Delta\tan\delta \leq 30 \times 10^{-4}$ ($C >$ 470 nF) $R_{ins} \geq 50\%$ of specified value
Damp heat, cyclic, test Db, first cycle: *"IEC 60068-2-30"*		
Cold: *"IEC 60068-2-1"*	2 hours; –55 °C	
Damp heat, cyclic, test Db, remaining cycles: *"IEC 60068-2-30"*		
Other applicable tests		
Damp heat steady state: *"IEC 60068-2-3"*	56 days; 40 °C; 90 to 95% RH	$\lvert\Delta C/C\rvert \leq 5\%$ $\Delta\tan\delta \leq 50 \times 10^{-4}$ ($C \leq 470$ nF) $\Delta\tan\delta \leq 30 \times 10^{-4}$ ($C >$ 470 nF) $R_{ins} \geq 50\%$ of specified value
Endurance (DC): *"IEC 60384-2"*	2000 hours; $1.25 \times U_{Rdc}$; 85 °C $0.625 \times U_{Rdc}$; 125 °C	$\lvert\Delta C/C\rvert \leq 5\%$ $\Delta\tan\delta \leq 50 \times 10^{-4}$ ($C \leq 10$ nF) $\Delta\tan\delta \leq 30 \times 10^{-4}$ (10 nF $< C \leq$ 470 nF) $\Delta\tan\delta \leq 20 \times 10^{-4}$ ($C >$ 470 nF) $R_{ins} \geq 50\%$ of specified value
Heat storage: *"IEC 60384-2"*	2000 hours; 125 °C	$\lvert\Delta C/C\rvert \leq 5\%$ $\Delta\tan\delta \leq 50 \times 10^{-4}$ ($C \leq 10$ nF) $\Delta\tan\delta \leq 30 \times 10^{-4}$ (10 nF $< C \leq$ 470 nF) $\Delta\tan\delta \leq 20 \times 10^{-4}$ ($C >$ 470 nF)

TEST	PROCEDURE (quick reference)	REQUIREMENTS
Resistance to detergents	3 minutes in dishwater at 70 °C	$\lvert\Delta C/C\rvert \leq 1\%$ $\Delta\tan\delta \leq 50 \times 10^{-4}$ ($C \leq 10$ nF) $\Delta\tan\delta \leq 30 \times 10^{-4}$ (10 nF $< C \leq$ 470 nF) $\Delta\tan\delta \leq 20 \times 10^{-4}$ ($C >$ 470 nF) $R_{ins} \geq 50\%$ of specified value
Resistance to soldering heat with preheating: *"IEC 60384-2"*	body temperature: 125 °C; bath temperature: 260 °C; dwell time: 5 s	$\lvert\Delta C/C\rvert \leq 3\%$ for $b = 2.5$ mm or $\lvert\Delta C/C\rvert \leq 5\%$ for $b > 2.5$ mm $\Delta\tan\delta \leq 50 \times 10^{-4}$ ($C \leq 10$ nF) $\Delta\tan\delta \leq 30 \times 10^{-4}$ (10 nF $< C \leq$ 470 nF) $\Delta\tan\delta \leq 20 \times 10^{-4}$ ($C >$ 470 nF)
Passive flammability: *"IEC 60384-1"*	class C	no burning

Note

1. For detailed information: see *"Type detail specification HQN-384-02/104"*.