Polypropylene film foil capacitors KP 460 to 464

KP AXIAL EPOXY LACQUERED TYPE

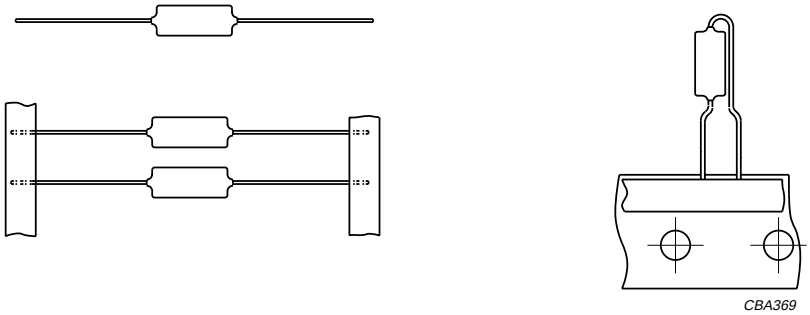


Fig.1 Simplified outlines.

FEATURES

- Supplied loose in box, taped on reel or unidirectional.

APPLICATIONS

- In circuits where close tolerance, reliability and low losses are of prime importance, for example: tuned circuits, filter and timing networks.

DETAIL SPECIFICATION

For more detailed data and test requirements see *"Type detail specification HQN-384-13/101"*.

QUICK REFERENCE DATA

DESCRIPTION	VALUE
Capacitance range (E12 series)	47 to 62000 pF
Capacitance tolerance	±5% (E24 series); ±2% (E24, E48 series); ±1% (E24, E48, E96 series)
Rated (DC) voltage	63 V; 160 V; 250 V; 400 V; 630 V
Climatic category	40/100/56
Rated temperature	85 °C
Maximum application temperature	100 °C
Reference specification	IEC 60384-13
Stability class for: 63; 160; 250 V versions 400; 630 V versions	 class 1 class 2

Polypropylene film foil capacitors KP 460 to 464

COMPOSITION OF CATALOGUE NUMBER

TYPE AND VOLTAGES	
460	63 V
461	160 V
462	250 V
463	400 V
464	630 V

MULTIPLIER (nF)	
0.0001	9
0.001	1
0.01	2
0.1	3

CAPACITANCE (numerically)

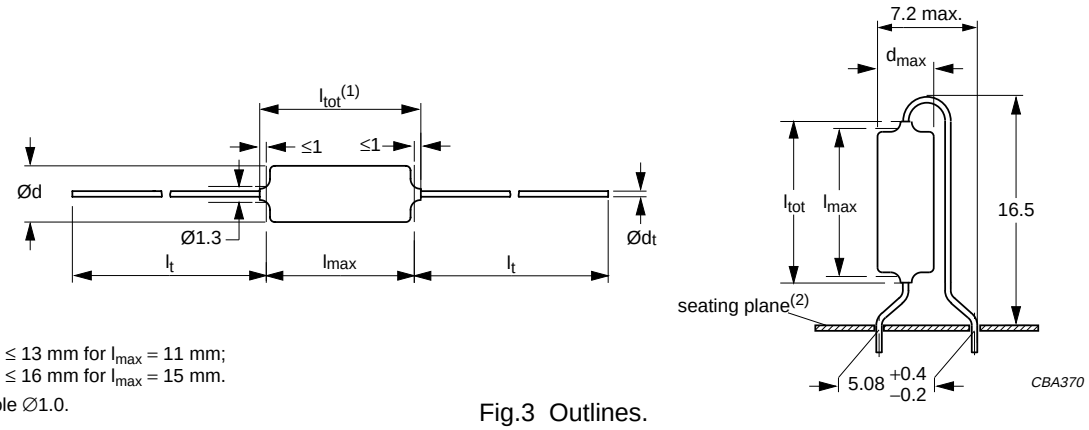
Example:

1003 = 100 × 0.1 = 10 nF

2222	XXX	X	XXX	X

PACKAGING	TAPE DISTANCE	C-TOL	
Taped on reel	tape distance = 63.5 mm	±1%	8
		±2%	7
		±5%	6
Loose in box	lead length 30.0 or 28.0 mm; see tables with catalogue numbers	±1%	4
		±2%	3
		±5%	2
Unidirectional	H = 16.5 mm	±1%	1
		±2%	0

KP 460 GENERAL DATA



(1) $l_{tot} \leq 13$ mm for $l_{max} = 11$ mm;
$l_{tot} \leq 16$ mm for $l_{max} = 15$ mm.

(2) Hole ∅1.0.

Fig.3 Outlines.

Specific reference data for the 63 V DC capacitors

DESCRIPTION	VALUE	
	at 1 kHz	at 100 kHz
Tangent of loss angle:		
5000 pF < C ≤ 20000 pF	$\leq 5 \times 10^{-4}$	$\leq 15 \times 10^{-4}$
20000 pF < C ≤ 47000 pF	$\leq 5 \times 10^{-4}$	$\leq 25 \times 10^{-4}$
C > 47000 pF	$\leq 5 \times 10^{-4}$	$\leq 40 \times 10^{-4}$
Rated voltage pulse slope $(dU/dt)_R$ at 63 V (DC)	10000 V/µs	
R between leads; at 10 V; 1 minute	>100000 MΩ	
R between interconnected leads and case; 10 V; 1 minute	>100000 MΩ	
Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s	126 V; 1 minute	
Withstanding (DC) voltage between leads and case	400 V; 1 minute	

Available 63 V DC versions

PACKAGING	C-tol	FIRST 8 DIGITS OF CATALOGUE NUMBER	ORDERING
Taped on reel; notes 1 and 2	±1%	2222 460 8....	preferred
	±2%	2222 460 7....	preferred
	±5%	2222 460 6....	on request
Loose in box; note 1	±1%	2222 460 4....	on request
	±2%	2222 460 3....	on request
	±5%	2222 460 2....	on request
Unidirectional; notes 1 and 2	±1%	2222 460 1....	on request
	±2%	2222 460 0....	on request

Available on request

PACKAGING	TAPE DISTANCE (mm)
Taped in ammopack	52.5; note 2
	63.5; note 2
Taped on reel	52.5; note 2

Notes

1. For SPQ refer to this handbook, chapter *"Packaging information"*.
2. For detailed specifications refer to this handbook, chapter *"Packaging information"*.

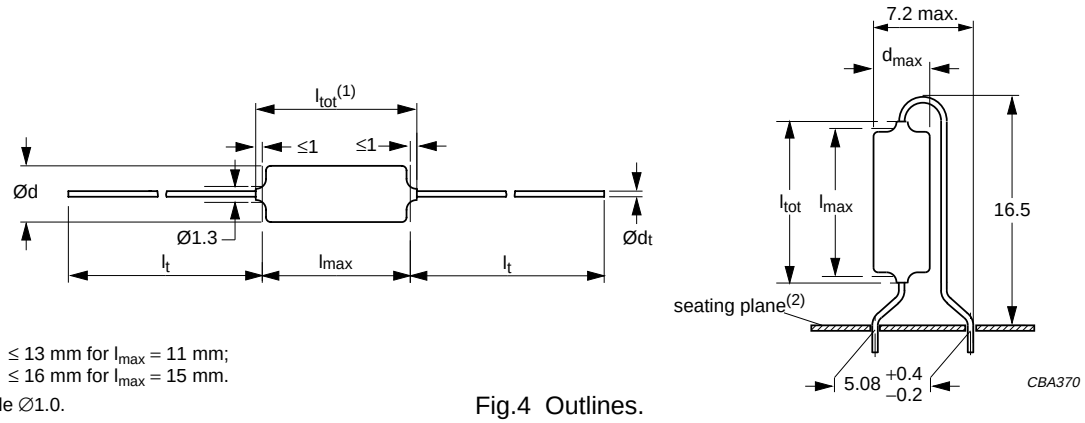
U_{Rdc} = 63 V; U_{Rac} = 40 V

C(1) (E24) (pF)	DIMENSIONS $d_{max} \times l_{max}$ (mm)	MASS (g)	CATALOGUE NUMBER			
			TAPED ON REEL		UNIDIRECTIONAL	
			TAPE DISTANCE 63.5 mm			
			C-tol = ±2%	C-tol = ±1%	C-tol = ±2%	C-tol = ±1%
			catalogue number(2)	last 5 digits(2)	last 5 digits	last 5 digits
l_t = 30.0 mm; d_t = 0.60 ±0.06 mm						
6800	5.0 × 11.0	0.5	2222 460 7**6802**	.. 8**6802**	.. 0**6802**	.. 1**6802**
7500		0.5	2222 460 7**7502**	.. 8**7502**	.. 0**7502**	.. 1**7502**
8200		0.6	2222 460 7**8202**	.. 8**8202**	.. 0**8202**	.. 1**8202**
9100		0.6	2222 460 7**9102**	.. 8**9102**	.. 0**9102**	.. 1**9102**
l_t = 28.0 mm; d_t = 0.60 ±0.06 mm						
10000	6.0 × 15.0	0.6	2222 460 7**1003**	.. 8**1003**	–	–
11000		0.6	2222 460 7**1103**	.. 8**1103**		
12000		0.7	2222 460 7**1203**	.. 8**1203**		
13000		0.8	2222 460 7**1303**	.. 8**1303**		
15000		0.7	2222 460 7**1503**	.. 8**1503**		
16000		0.7	2222 460 7**1603**	.. 8**1603**		
18000		0.8	2222 460 7**1803**	.. 8**1803**		
20000		0.8	2222 460 7**2003**	.. 8**2003**		
22000		0.9	2222 460 7**2203**	.. 8**2203**		
24000	6.5 × 15.0	0.9	2222 460 7**2403**	.. 8**2403**	–	–
27000		1.0	2222 460 7**2703**	.. 8**2703**		
30000	7.0 × 15.0	1.1	2222 460 7**3003**	.. 8**3003**	–	–
33000		1.2	2222 460 7**3303**	.. 8**3303**		
36000		1.2	2222 460 7**3603**	.. 8**3603**		
39000	7.5 × 15.0	1.3	2222 460 7**3903**	.. 8**3903**	–	–
43000		1.4	2222 460 7**4303**	.. 8**4303**		
47000	8.0 × 15.0	1.5	2222 460 7**4703**	.. 8**4703**	–	–
51000		1.6	2222 460 7**5103**	.. 8**5103**		
56000	8.5 × 15.0	1.7	2222 460 7**5603**	.. 8**5603**	–	–
62000		1.8	2222 460 7**6203**	.. 8**6203**		

Notes

1. In addition to the values of the E24 series as quoted, intermediate values are available of the E48 series (with a tolerance of ±2% or ±1%) and the E96 series (with a tolerance of ±1%). The specifications of these intermediate values are equal to the specifications of the next higher value of the E24 series.
2. The shading indicates preferred types.

KP 461 GENERAL DATA



(1) $l_{tot} \leq 13$ mm for $l_{max} = 11$ mm;
$l_{tot} \leq 16$ mm for $l_{max} = 15$ mm.

(2) Hole ∅1.0.

Fig.4 Outlines.

Specific reference data for the 160 V DC capacitors

DESCRIPTION	VALUE	
	at 1 kHz	at 100 kHz
Tangent of loss angle:		
1000 pF < C ≤ 5000 pF	$\leq 5 \times 10^{-4}$	$\leq 10 \times 10^{-4}$
5000 pF < C ≤ 20000 pF	$\leq 5 \times 10^{-4}$	$\leq 15 \times 10^{-4}$
20000 pF < C ≤ 39000 pF	$\leq 5 \times 10^{-4}$	$\leq 25 \times 10^{-4}$
Rated voltage pulse slope $(dU/dt)_R$ at 160 V (DC)	10000 V/µs	
R between leads; at 100 V; 1 minute	>100000 MΩ	
R between interconnected leads and case; 100 V; 1 minute	>100000 MΩ	
Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s	320 V; 1 minute	
Withstanding (DC) voltage between leads and case	400 V; 1 minute	

Available 160 V DC versions

PACKAGING	C-tol	FIRST 8 DIGITS OF CATALOGUE NUMBER	ORDERING
Taped on reel; notes 1 and 2	±1%	2222 461 8....	preferred
	±2%	2222 461 7....	preferred
	±5%	2222 461 6....	on request
Loose in box; note 1	±1%	2222 461 4....	on request
	±2%	2222 461 3....	on request
	±5%	2222 461 2....	on request
Unidirectional; notes 1 and 2	±1%	2222 461 1....	on request
	±2%	2222 461 0....	on request

Available on request

PACKAGING	TAPE DISTANCE (mm)
Taped in ammopack	52.5; note 2
	63.5; note 2
Taped on reel	52.5; note 2

Notes

1. For SPQ refer to this handbook, chapter *"Packaging information"*.
2. For detailed specifications refer to this handbook, chapter *"Packaging information"*.

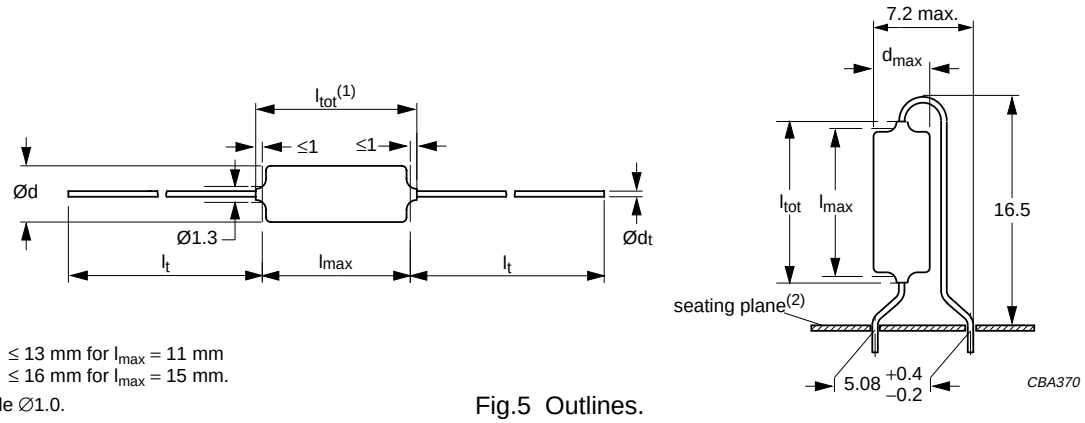
U_{Rdc} = 160 V; U_{Rac} = 63 V

C(1) (E24) (pF)	DIMENSIONS $d_{max} \times l_{max}$ (mm)	MASS (g)	CATALOGUE NUMBER			
			TAPED ON REEL		UNIDIRECTIONAL	
			TAPE DISTANCE 63.5 mm			
			C-tol = ±2%	C-tol = ±1%	C-tol = ±2%	C-tol = ±1%
			catalogue number(2)	last 5 digits(2)	last 5 digits	last 5 digits
l_t = 30.0 mm; d_t = 0.60 ±0.06 mm						
3600	5.0 × 11.0	0.5	2222 461 7**3602**	.. 8**3602**	.. 0**3602**	.. 1**3602**
3900		0.5	2222 461 7**3902**	.. 8**3902**	.. 0**3902**	.. 1**3902**
4300		0.5	2222 461 7**4302**	.. 8**4302**	.. 0**4302**	.. 1**4302**
4700		0.5	2222 461 7**4702**	.. 8**4702**	.. 0**4702**	.. 1**4702**
5100		0.5	2222 461 7**5102**	.. 8**5102**	.. 0**5102**	.. 1**5102**
5600		0.5	2222 461 7**5602**	.. 8**5602**	.. 0**5602**	.. 1**5602**
6200		0.6	2222 461 7**6202**	.. 8**6202**	.. 0**6202**	.. 1**6202**
l_t = 28.0 mm; d_t = 0.60 ±0.06 mm						
6800	6.0 × 15.0	0.4	2222 461 7**6802**	.. 8**6802**	–	–
7500		0.7	2222 461 7**7502**	.. 8**7502**		
8200		0.6	2222 461 7**8202**	.. 8**8202**		
9100		0.6	2222 461 7**9102**	.. 8**9102**		
10000		0.7	2222 461 7**1003**	.. 8**1003**		
11000		0.7	2222 461 7**1103**	.. 8**1103**		
12000		0.7	2222 461 7**1203**	.. 8**1203**		
13000		0.8	2222 461 7**1303**	.. 8**1303**		
15000		0.8	2222 461 7**1503**	.. 8**1503**		
16000	6.5 × 15.0	0.9	2222 461 7**1603**	.. 8**1603**	–	–
18000		0.9	2222 461 7**1803**	.. 8**1803**		
20000		1.0	2222 461 7**2003**	.. 8**2003**		
22000	7.0 × 15.0	1.1	2222 461 7**2203**	.. 8**2203**	–	–
24000		1.1	2222 461 7**2403**	.. 8**2403**		
27000	7.5 × 15.0	1.2	2222 461 7**2703**	.. 8**2703**	–	–
30000	8.0 × 15.0	1.3	2222 461 7**3003**	.. 8**3003**	–	–
33000		1.4	2222 461 7**3303**	.. 8**3303**		
36000	8.5 × 15.0	1.5	2222 461 7**3603**	.. 8**3603**	–	–
39000		1.6	2222 461 7**3903**	.. 8**3903**		

Notes

1. In addition to the values of the E24 series as quoted, intermediate values are available of the E48 series (with a tolerance of ±2% or ±1%) and the E96 series (with a tolerance of ±1%). The specifications of these intermediate values are equal to the specifications of the next higher value of the E24 series.
2. The shading indicates preferred types.

KP 462 GENERAL DATA



(1) l_{tot} ≤ 13 mm for l_{max} = 11 mm
l_{tot} ≤ 16 mm for l_{max} = 15 mm.

(2) Hole ∅1.0.

Fig.5 Outlines.

Specific reference data for the 250 V DC capacitors

DESCRIPTION	VALUE	
	at 1 kHz	at 100 kHz
Tangent of loss angle:		
1 000 pF < C ≤ 5000 pF	$\leq 5 \times 10^{-4}$	$\leq 10 \times 10^{-4}$
5 000 pF < C ≤ 20000 pF	$\leq 5 \times 10^{-4}$	$\leq 15 \times 10^{-4}$
20 000 pF < C ≤ 22000 pF	$\leq 5 \times 10^{-4}$	$\leq 25 \times 10^{-4}$
Rated voltage pulse slope $(dU/dt)_R$ at 250 V (DC)	10000 V/µs	
R between leads; at 100 V; 1 minute	>100000 MΩ	
R between interconnected leads and case; 100 V; 1 minute	>100000 MΩ	
Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s	500 V; 1 minute	
Withstanding (DC) voltage between leads and case	500 V; 1 minute	

Available 250 V DC versions

PACKAGING	C-tol	FIRST 8 DIGITS OF CATALOGUE NUMBER	ORDERING
Taped on reel; notes 1 and 2	±1%	2222 462 8....	preferred
	±2%	2222 462 7....	preferred
	±5%	2222 462 6....	on request
Loose in box; note 1	±1%	2222 462 4....	on request
	±2%	2222 462 3....	on request
	±5%	2222 462 2....	on request
Unidirectional; notes 1 and 2	±1%	2222 462 1....	on request
	±2%	2222 462 0....	on request

Available on request

PACKAGING	TAPE DISTANCE (mm)
Taped in ammopack	52.5; note 2
	63.5; note 2
Taped on reel	52.5; note 2

Notes

1. For SPQ refer to this handbook, chapter *"Packaging information"*.
2. For detailed specifications refer to this handbook, chapter *"Packaging information"*.

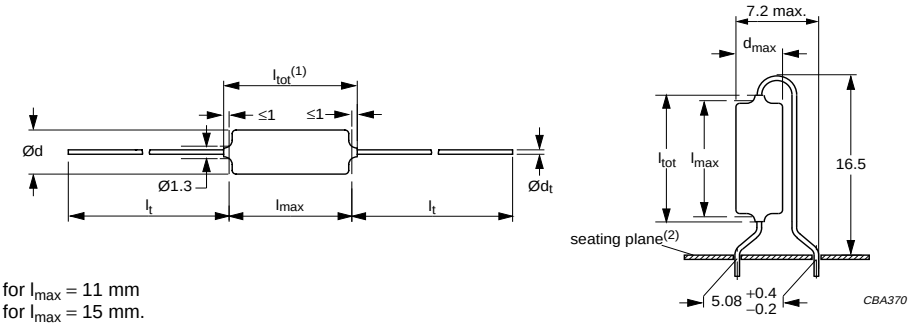
U_{Rdc} = 250 V; U_{Rac} = 125 V

C[1] (E24) (pF)	DIMENSIONS $d_{max} \times l_{max}$ (mm)	MASS (g)	CATALOGUE NUMBER			
			TAPED ON REEL		UNIDIRECTIONAL	
			TAPE DISTANCE 63.5 mm			
			C-tol = ±2%	C-tol = ±1%	C-tol = ±2%	C-tol = ±1%
			catalogue number[2]	last 5 digits[2]	last 5 digits	last 5 digits
l_t = 30.0 mm; d_t = 0.60 ±0.06 mm						
1200	5.0 × 11.0	0.5	2222 462 71202	.. 81202	.. 01202	.. 11202
1300		0.5	2222 462 71302	.. 81302	.. 01302	.. 11302
1500		0.4	2222 462 71502	.. 81502	.. 01502	.. 11502
1600		0.5	2222 462 71602	.. 81602	.. 01602	.. 11602
1800		0.6	2222 462 71802	.. 81802	.. 01802	.. 11802
2000		0.6	2222 462 72002	.. 82002	.. 02002	.. 12002
2200		0.5	2222 462 72202	.. 82202	.. 02202	.. 12202
2400		0.5	2222 462 72402	.. 82402	.. 02402	.. 12402
2700		0.5	2222 462 72702	.. 82702	.. 02702	.. 12702
3000		0.5	2222 462 73002	.. 83002	.. 03002	.. 13002
3300		0.5	2222 462 73302	.. 83302	.. 03302	.. 13302
l_t = 28.0 mm; d_t = 0.60 ±0.06 mm						
3600	6.0 × 15.0	0.5	2222 462 73602	.. 83602	–	–
3900		0.5	2222 462 73902	.. 83902		
4300		0.6	2222 462 74302	.. 84302		
4700		0.6	2222 462 74702	.. 84702		
5100		0.6	2222 462 75102	.. 85102		
5600		0.6	2222 462 75602	.. 85602		
6200		0.7	2222 462 76202	.. 86202		
6800		0.7	2222 462 76802	.. 86802		
7500		0.7	2222 462 77502	.. 87502		
8200	6.5 × 15.0	0.8	2222 462 78202	.. 88202	–	–
9100		0.8	2222 462 79102	.. 89102		
10000		0.9	2222 462 71003	.. 81003		
11000	7.0 × 15.0	0.9	2222 462 71103	.. 81103	–	–
12000		1.0	2222 462 71203	.. 81203		
13000		1.0	2222 462 71303	.. 81303		
15000	7.5 × 15.0	1.1	2222 462 71503	.. 81503	–	–
16000		1.2	2222 462 71603	.. 81603		
18000	8.0 × 15.0	1.3	2222 462 71803	.. 81803	–	–
20000	8.5 × 15.0	1.4	2222 462 72003	.. 82003	–	–
22000		1.5	2222 462 72203	.. 82203		

Notes

1. In addition to the values of the E24 series as quoted, intermediate values are available of the E48 series (with a tolerance of ±2% or ±1%) and the E96 series (with a tolerance of ±1%). The specifications of these intermediate values are equal to the specifications of the next higher value of the E24 series.
2. The shading indicates preferred types.

KP 463 GENERAL DATA



(1) l_{tot} ≤ 13 mm for l_{max} = 11 mm
l_{tot} ≤ 16 mm for l_{max} = 15 mm.

(2) Hole ∅1.0.

Fig.6 Outlines.

Specific reference data for the 400 V DC capacitors

DESCRIPTION	VALUE		
	at 1 kHz	at 100 kHz	at 1 MHz(1)
Tangent of loss angle: C ≤ 1000 pF 1000 pF < C ≤ 5000 pF	 $\leq 5 \times 10^{-4}$ $\leq 5 \times 10^{-4}$	 – $\leq 10 \times 10^{-4}$	 $\leq 10 \times 10^{-4}$ –
Rated voltage pulse slope $(dU/dt)_R$ at 400 V (DC)	10000 V/µs		
R between leads; at 100 V; 1 minute	>100000 MΩ		
R between interconnected leads and case; 100 V; 1 minute	>100000 MΩ		
Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s	800 V; 1 minute		
Withstanding (DC) voltage between leads and case	800 V; 1 minute		

Note

1. For unidirectional capacitors $\leq 13 \times 10^{-4}$.

Available 400 V DC versions

PACKAGING	C-tol	FIRST 8 DIGITS OF CATALOGUE NUMBER	ORDERING
Taped on reel; notes 1 and 2	±1%	2222 463 8....	preferred
	±2%	2222 463 7....	preferred
	±5%	2222 463 6....	on request
Loose in box; note 1	±1%	2222 463 4....	on request
	±2%	2222 463 3....	on request
	±5%	2222 463 2....	on request
Unidirectional; notes 1 and 2	±1%	2222 463 1....	on request
	±2%	2222 463 0....	on request

Available on request

PACKAGING	TAPE DISTANCE (mm)
Taped in ammopack	52.5; note 2
	63.5; note 2
Taped on reel	52.5; note 2

Notes

1. For SPQ refer to this handbook, chapter *"Packaging information"*.
2. For detailed specifications refer to this handbook, chapter *"Packaging information"*.

U_{Rdc} = 400 V; U_{Rac} = 160 V

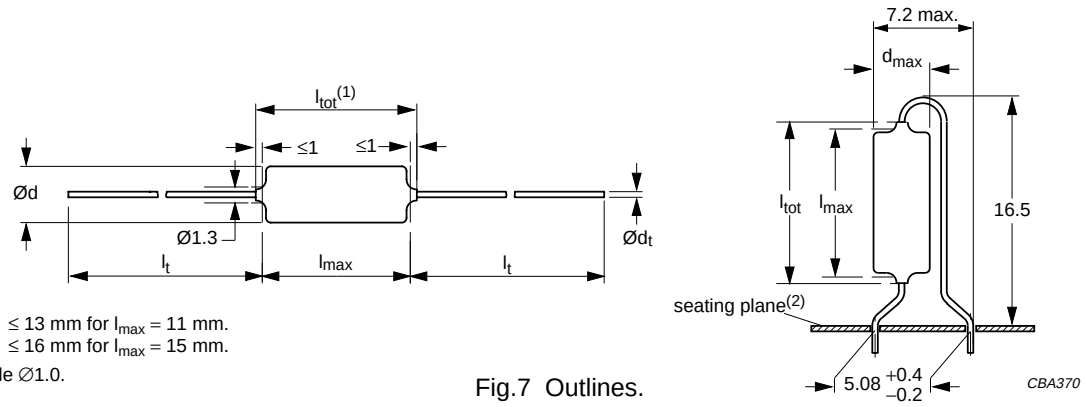
C[1] (E 24) (pF)	DIMENSIONS $d_{max} \times l_{max}$ (mm)	MASS (g)	CATALOGUE NUMBER			
			TAPED ON REEL		UNIDIRECTIONAL	
			TAPE DISTANCE 63.5 mm			
			C-tol = ±2%	C-tol = ±1%	C-tol = ±2%	C-tol = 1%
			catalogue number[2]	last 5 digits[2]	last 5 digits	last 5 digits
l_t = 30.0 mm; d_t = 0.60 ±0.06 mm						
620	5.0 × 11.0	0.5	2222 463 7**6201**	.. 8**6201**	.. 0**6201**	.. 1**6201**
680		0.5	2222 463 7**6801**	.. 8**6801**	.. 0**6801**	.. 1**6801**
750		0.5	2222 463 7**7501**	.. 8**7501**	.. 0**7501**	.. 1**7501**
820		0.5	2222 463 7**8201**	.. 8**8201**	.. 0**8201**	.. 1**8201**
910		0.5	2222 463 7**9101**	.. 8**9101**	.. 0**9101**	.. 1**9101**
1000		0.5	2222 463 7**1002**	.. 8**1002**	.. 0**1002**	.. 1**1002**
1100		0.5	2222 463 7**1102**	.. 8**1102**	.. 0**1102**	.. 1**1102**
l_t = 28.0 mm; d_t = 0.60 ±0.06 mm						
1200	6.0 × 15.0	0.5	2222 463 7**1202**	.. 8**1202**	–	–
1300		0.5	2222 463 7**1302**	.. 8**1302**		
1500		0.5	2222 463 7**1502**	.. 8**1502**		
1600		0.5	2222 463 7**1602**	.. 8**1602**		
1800		0.5	2222 463 7**1802**	.. 8**1802**		
2000		0.5	2222 463 7**2002**	.. 8**2002**		
2200	6.5 × 15.0	0.5	2222 463 7**2202**	.. 8**2202**	–	–
2400		0.5	2222 463 7**2402**	.. 8**2402**		
2700		0.6	2222 463 7**2702**	.. 8**2702**		
3000		0.7	2222 463 7**3002**	.. 8**3002**		
3300	7.0 × 15.0	0.7	2222 463 7**3302**	.. 8**3302**	–	–
3600		0.7	2222 463 7**3602**	.. 8**3602**		
3900		0.8	2222 463 7**3902**	.. 8**3902**		
4300	7.5 × 15.0	0.8	2222 463 7**4302**	.. 8**4302**	–	–
4700		0.9	2222 463 7**4702**	.. 8**4702**		
5100		0.9	2222 463 7**5102**	.. 8**5102**		
5600	8.0 × 15.0	1.0	2222 463 7**5602**	.. 8**5602**	–	–
6200		1.0	2222 463 7**6202**	.. 8**6202**		
6800	8.5 × 15.0	1.1	2222 463 7**6802**	.. 8**6802**	–	–
7500		1.2	2222 463 7**7502**	.. 8**7502**		
8200		1.3	2222 463 7**8202**	.. 8**8202**		

Notes

1. In addition to the values of the E24 series as quoted, intermediate values are available of the E48 series (with a tolerance of ±2% or ±1%) and the E96 series (with a tolerance of ±1%). The specifications of these intermediate values are equal to the specifications of the next higher value of the E24 series.
2. The shading indicates preferred types.

Polypropylene film foil capacitors KP 464

KP 464 GENERAL DATA



(1) l_{tot} ≤ 13 mm for l_{max} = 11 mm.
l_{tot} ≤ 16 mm for l_{max} = 15 mm.

(2) Hole ∅1.0.

Fig.7 Outlines.

Specific reference data for the 630 V DC capacitors

DESCRIPTION	VALUE	
	at 1 kHz	at 1 MHz(1)
Tangent of loss angle: C ≤ 560 pF	$\leq 5 \times 10^{-4}$	$\leq 10 \times 10^{-4}$
Rated voltage pulse slope $(dU/dt)_R$ at 630 V (DC)	10000 V/µs	
R between leads; at 500 V; 1 minute	>100000 MΩ	
R between interconnected leads and case; 500 V; 1 minute	>100000 MΩ	
Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s	1260 V; 1 minute	
Withstanding (DC) voltage between leads and case	1260 V; 1 minute	

Note

1. For unidirectional capacitors $\leq 13 \times 10^{-4}$.

Available 630 V DC versions

PACKAGING	C-tol	FIRST 8 DIGITS OF CATALOGUE NUMBER	ORDERING
Taped on reel; notes 1 and 2	±1%	2222 464 8....	preferred
	±2%	2222 464 7....	preferred
	±5%	2222 464 6....	on request
Loose in box; note 1	±1%	2222 464 4....	on request
	±2%	2222 464 3....	on request
	±5%	2222 464 2....	on request
Unidirectional; notes 1 and 2	±1%	2222 464 1....	on request
	±2%	2222 464 0....	on request

Available on request

PACKAGING	TAPE DISTANCE (mm)
Taped in ammopack	52.5; note 2
	63.5; note 2
Taped on reel	52.5; note 2

Notes

1. For SPQ refer to this handbook, chapter *"Packaging information"*.
2. For detailed specifications refer to this handbook, chapter *"Packaging information"*.

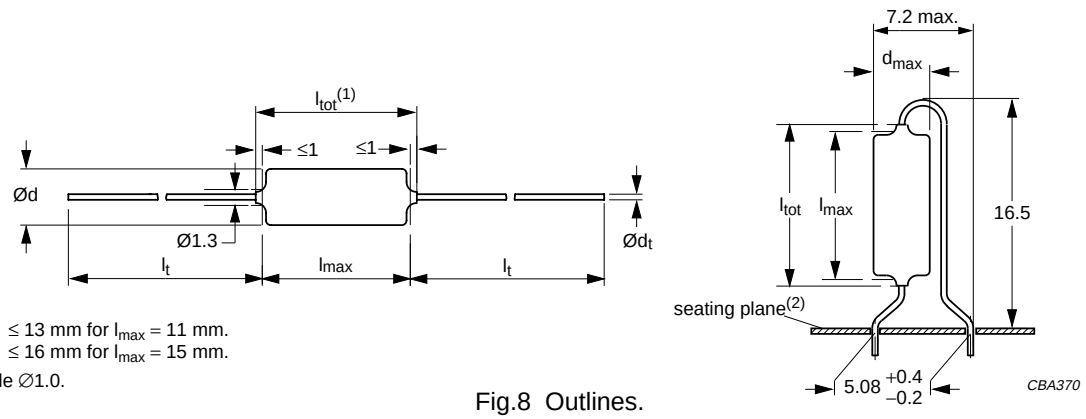
U_{Rdc} = 630 V; U_{Rac} = 200 V

C(1) (E24) (pF)	DIMENSIONS $d_{max} \times l_{max}$ (mm)	MASS (g)	CATALOGUE NUMBER			
			TAPED ON REEL		UNIDIRECTIONAL	
			TAPE DISTANCE 63.5 mm			
			C-tol = ±2%	C-tol = ±1%	C-tol = ±2%	C-tol = ±1%
			catalogue number(2)	last 5 digits(2)	last 5 digits	last 5 digits
l_t = 30.0 mm; d_t = 0.60 ±0.06 mm						
47		0.4	2222 464 7**4709**	.. 8**4709**	.. 0**4709**	.. 1**4709**
51		0.4	2222 464 7**5109**	.. 8**5109**	.. 0**5109**	.. 1**5109**
56		0.4	2222 464 7**5609**	.. 8**5609**	.. 0**5609**	.. 1**5609**
62		0.4	2222 464 7**6209**	.. 8**6209**	.. 0**6209**	.. 1**6209**
68		0.4	2222 464 7**6809**	.. 8**6809**	.. 0**6809**	.. 1**6809**
75		0.4	2222 464 7**7509**	.. 8**7509**	.. 0**7509**	.. 1**7509**
82		0.4	2222 464 7**8209**	.. 8**8209**	.. 0**8209**	.. 1**8209**
91		0.4	2222 464 7**9109**	.. 8**9109**	.. 0**9109**	.. 1**9109**
100		0.4	2222 464 7**1001**	.. 8**1001**	.. 0**1001**	.. 1**1001**
110		0.4	2222 464 7**1101**	.. 8**1101**	.. 0**1101**	.. 1**1101**
120		0.4	2222 464 7**1201**	.. 8**1201**	.. 0**1201**	.. 1**1201**
130		0.5	2222 464 7**1301**	.. 8**1301**	.. 0**1301**	.. 1**1301**
150		0.4	2222 464 7**1501**	.. 8**1501**	.. 0**1501**	.. 1**1501**
160	5.0 × 11.0	0.4	2222 464 7**1601**	.. 8**1601**	.. 0**1601**	.. 1**1601**
180		0.5	2222 464 7**1801**	.. 8**1801**	.. 0**1801**	.. 1**1801**
200		0.5	2222 464 7**2001**	.. 8**2001**	.. 0**2001**	.. 1**2001**
220		0.6	2222 464 7**2201**	.. 8**2201**	.. 0**2201**	.. 1**2201**
240		0.6	2222 464 7**2401**	.. 8**2401**	.. 0**2401**	.. 1**2401**
270		0.6	2222 464 7**2701**	.. 8**2701**	.. 0**2701**	.. 1**2701**
300		0.7	2222 464 7**3001**	.. 8**3001**	.. 0**3001**	.. 1**3001**
330		0.4	2222 464 7**3301**	.. 8**3301**	.. 0**3301**	.. 1**3301**
360		0.4	2222 464 7**3601**	.. 8**3601**	.. 0**3601**	.. 1**3601**
390		0.5	2222 464 7**3901**	.. 8**3901**	.. 0**3901**	.. 1**3901**
430		0.5	2222 464 7**4301**	.. 8**4301**	.. 0**4301**	.. 1**4301**
470		0.5	2222 464 7**4701**	.. 8**4701**	.. 0**4701**	.. 1**4701**
510		0.5	2222 464 7**5101**	.. 8**5101**	.. 0**5101**	.. 1**5101**
560		0.5	2222 464 7**5601**	.. 8**5601**	.. 0**5601**	.. 1**5601**

Notes

1. In addition to the values of the E24 series as quoted, intermediate values are available of the E48 series (with a tolerance of ±2% or ±1%) and the E96 series (with a tolerance of ±1%). The specifications of these intermediate values are equal to the specifications of the next higher value of the E24 series.
2. The shading indicates preferred types.

KP 464 GENERAL DATA



(1) $l_{tot} \leq 13$ mm for $l_{max} = 11$ mm.
$l_{tot} \leq 16$ mm for $l_{max} = 15$ mm.

(2) Hole ∅1.0.

Fig.8 Outlines.

Specific reference data for the 630 V DC capacitors

DESCRIPTION	VALUE		
	at 1 kHz	at 100 kHz	at 1 MHz
Tangent of loss angle: C ≤ 1000 pF 1000 pF < C ≤ 4700 pF	 $\leq 5 \times 10^{-4}$ $\leq 5 \times 10^{-4}$	 – $\leq 15 \times 10^{-4}$	 $\leq 10 \times 10^{-4}$ –
Rated voltage pulse slope (dU/dt)R at 630 V (DC)	10000 V/µs		
R between leads; at 500 V; 1 minute	>100000 MΩ		
R between interconnected leads and case; 500 V; 1 minute	>100000 MΩ		
Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s	1260 V; 1 minute		
Withstanding (DC) voltage between leads and case	1260 V; 1 minute		

Available 630 V DC versions

PACKAGING	C-tol	FIRST 8 DIGITS OF CATALOGUE NUMBER	ORDERING
Taped on reel; notes 1 and 2	±1%	2222 464 8....	preferred
	±2%	2222 464 7....	preferred
	±5%	2222 464 6....	on request
Loose in box; note 1	±1%	2222 464 4....	on request
	±2%	2222 464 3....	on request
	±5%	2222 464 2....	on request
Unidirectional; notes 1 and 2	±1%	2222 464 1....	on request
	±2%	2222 464 0....	on request

Available on request

PACKAGING	TAPE DISTANCE (mm)
Taped in ammopack	52.5; note 2
	63.5; note 2
Taped on reel	52.5; note 2

Notes

1. For SPQ refer to this handbook, chapter *"Packaging information"*.
2. For detailed specifications refer to this handbook, chapter *"Packaging information"*.

U_{Rdc} = 630 V; U_{Rac} = 200 V

C(1) (E 24) (pF)	DIMENSIONS $d_{max} \times l_{max}$ (mm)	MASS (g)	CATALOGUE NUMBER	
			TAPED ON REEL	
			TAPE DISTANCE 63.5 mm	
			C-tol = ±2%	C-tol = ±1%
			catalogue number(2)	last 5 digits(2)
l_t = 28.0 mm; d_t = 0.60 ±0.06 mm				
620	6.0 × 15.0	0.5	2222 464 7**6201**	.. 8**6201**
680		0.5	2222 464 7**6801**	.. 8**6801**
750		0.5	2222 464 7**7501**	.. 8**7501**
820		0.5	2222 464 7**8201**	.. 8**8201**
910		0.5	2222 464 7**9101**	.. 8**9101**
1000		0.5	2222 464 7**1002**	.. 8**1002**
1100		0.5	2222 464 7**1102**	.. 8**1102**
1200		0.5	2222 464 7**1202**	.. 8**1202**
1300	6.5 × 15.0	0.6	2222 464 7**1302**	.. 8**1302**
1500		0.6	2222 464 7**1502**	.. 8**1502**
1600		0.7	2222 464 7**1602**	.. 8**1602**
1800		0.7	2222 464 7**1802**	.. 8**1802**
2000	7.0 × 15.0	0.8	2222 464 7**2002**	.. 8**2002**
2200		0.9	2222 464 7**2202**	.. 8**2202**
2400		0.9	2222 464 7**2402**	.. 8**2402**
2700	7.5 × 15.0	0.9	2222 464 7**2702**	.. 8**2702**
3000		1.0	2222 464 7**3002**	.. 8**3002**
3300	8.0 × 15.0	1.1	2222 464 7**3302**	.. 8**3302**
3600		1.2	2222 464 7**3602**	.. 8**3602**
3900		1.3	2222 464 7**3902**	.. 8**3902**
4300	8.5 × 15.0	1.4	2222 464 7**4302**	.. 8**4302**
4700		1.5	2222 464 7**4702**	.. 8**4702**

Notes

1. In addition to the values of the E24 series as quoted, intermediate values are available of the E48 series (with a tolerance of ±2% or ±1%) and the E96 series (with a tolerance of ±1%). The specifications of these intermediate values are equal to the specifications of the next higher value of the E24 series.
2. The shading indicates preferred types.

Polypropylene film foil capacitors KP 460 to 464

CONSTRUCTION

Description

- Low-inductive wound cell of metal foil and a polypropylene film
- Protected by a hard, water-repellent solvent-resistant blue epoxy lacquer
- Axial iron leads, solder-coated.

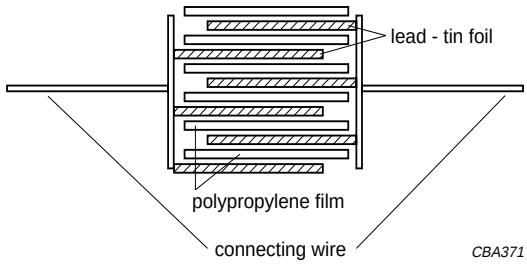


Fig.9 Construction.

Mounting

NORMAL USE

The capacitors are suitable for vertical or horizontal mounting on printed-circuit boards. The capacitors packed on bandoliers are designed for mounting on printed-circuit boards by means of automatic insertion machines.

SPECIFIC METHOD OF MOUNTING TO WITHSTAND VIBRATION AND SHOCK

The capacitors shall be mechanically fixed by the leads.

SOLDERING CONDITIONS

The capacitance stability is dependent on the maximum temperature the capacitor reaches during soldering. Figure 10 shows the typical effect of $\Delta C/C$ as a function of soldering time under the worst possible mounting conditions (horizontal on the PCB, minimum possible pitch) and with 80 °C preheating.

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%.

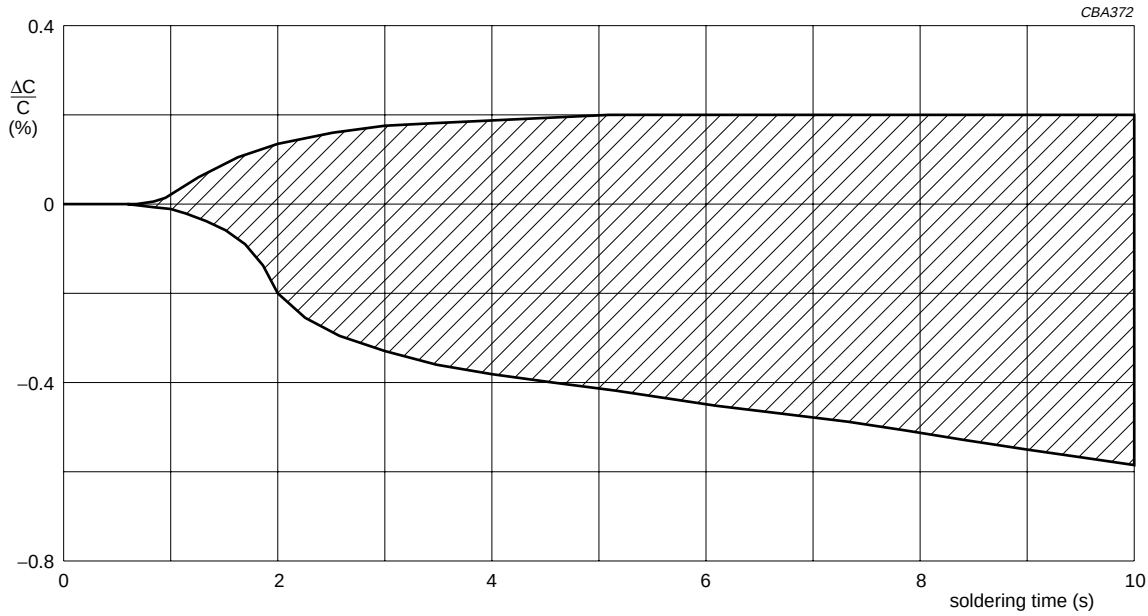


Fig.10 $\Delta C/C$ as a function of soldering time.

CHARACTERISTICS

Capacitance

- Temperature coefficient:
  - between –40 and +20 °C for C ≤ 1000 pF: $-(125 \pm 125) \times 10^{-6}$/K
  - between –40 and +20 °C for C > 1000 pF: $-(125 \pm 60) \times 10^{-6}$/K
  - between +20 and +100 °C: $-(250 \pm 120) \times 10^{-6}$/K.

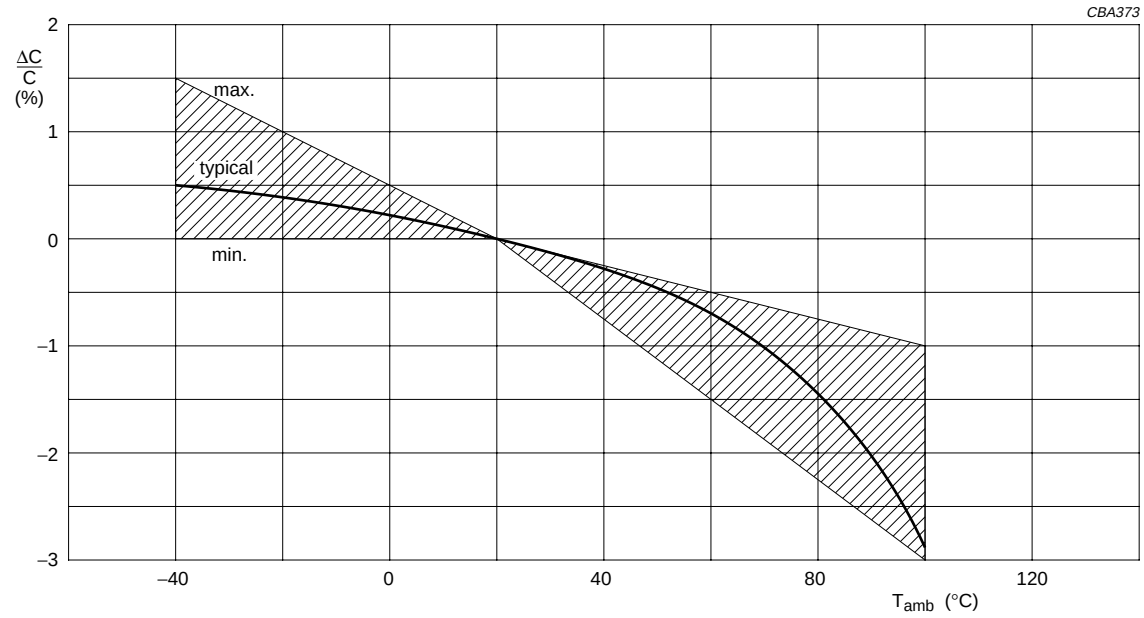


Fig.11 Capacitance change at 1 kHz as a function of ambient temperature.

Maximum DC voltage as a function of temperature

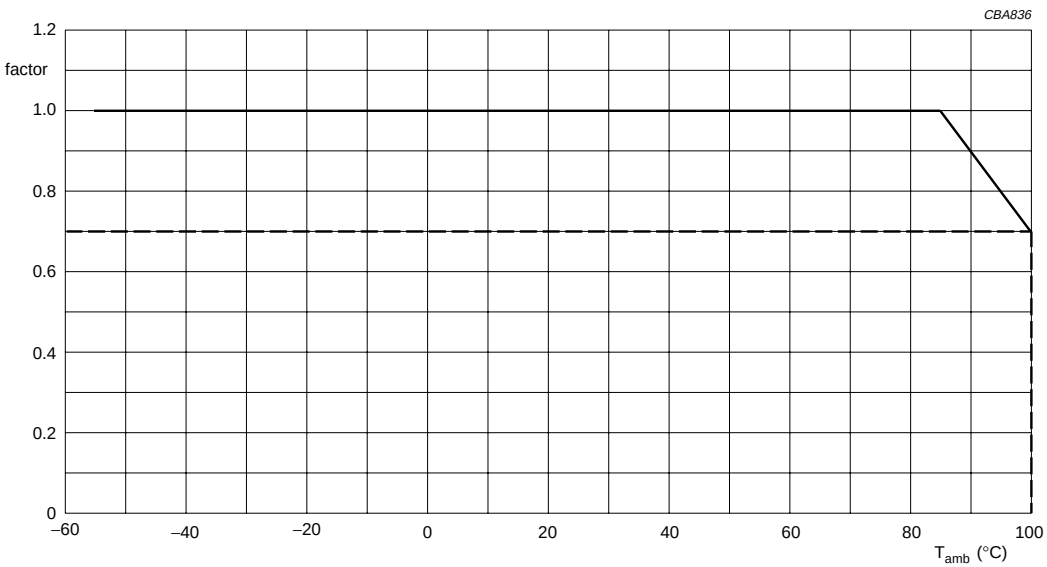


Fig.12 Multiplying factor for DC voltage as a function of temperature.

Maximum RMS voltage (sinewave) as a function of frequency

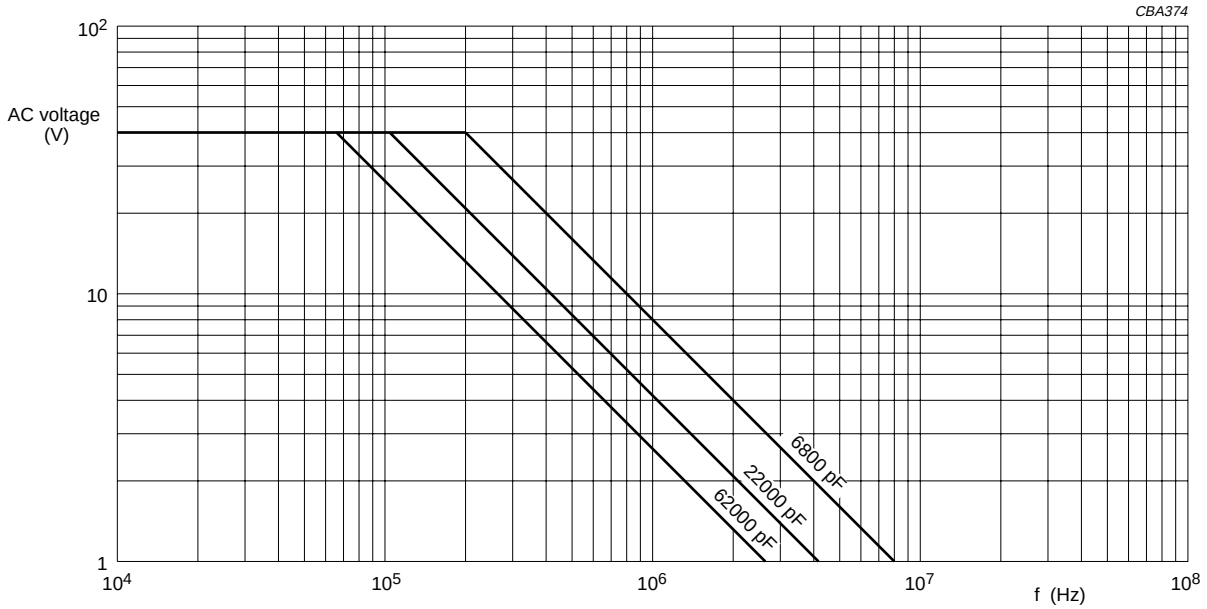


Fig.13 AC voltage (RMS value) as a function of frequency at $T_{amb} \leq 70$ °C for $U_{Rdc} = 63$ V.

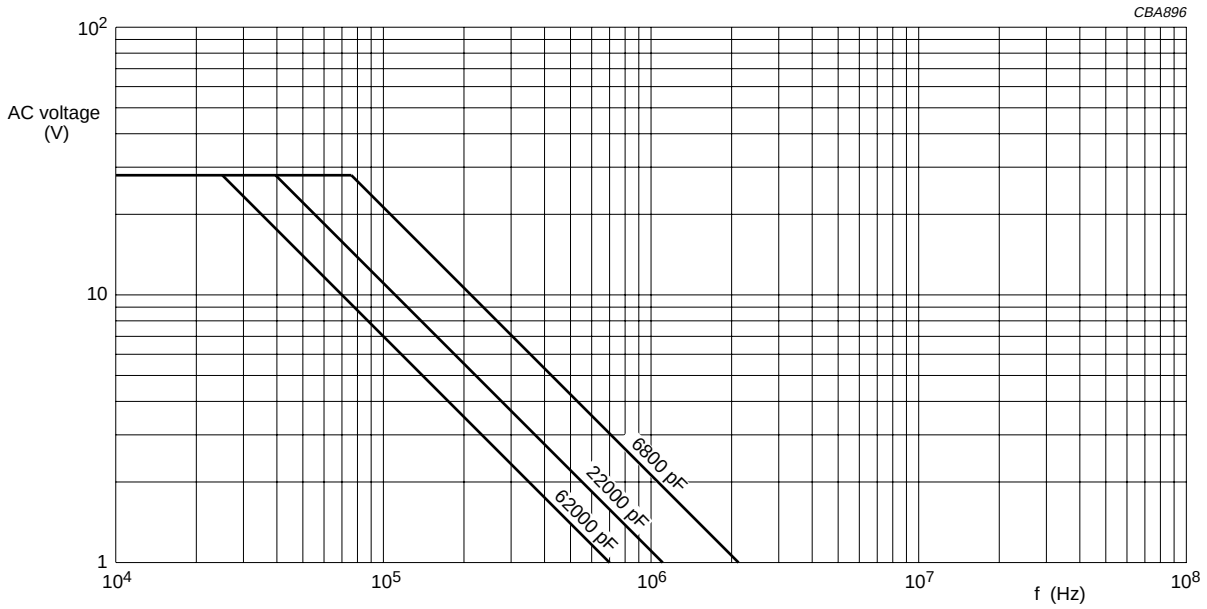


Fig.14 AC voltage (RMS value) as a function of frequency at 70 °C < $T_{amb} \leq 100$ °C for $U_{Rdc} = 63$ V.

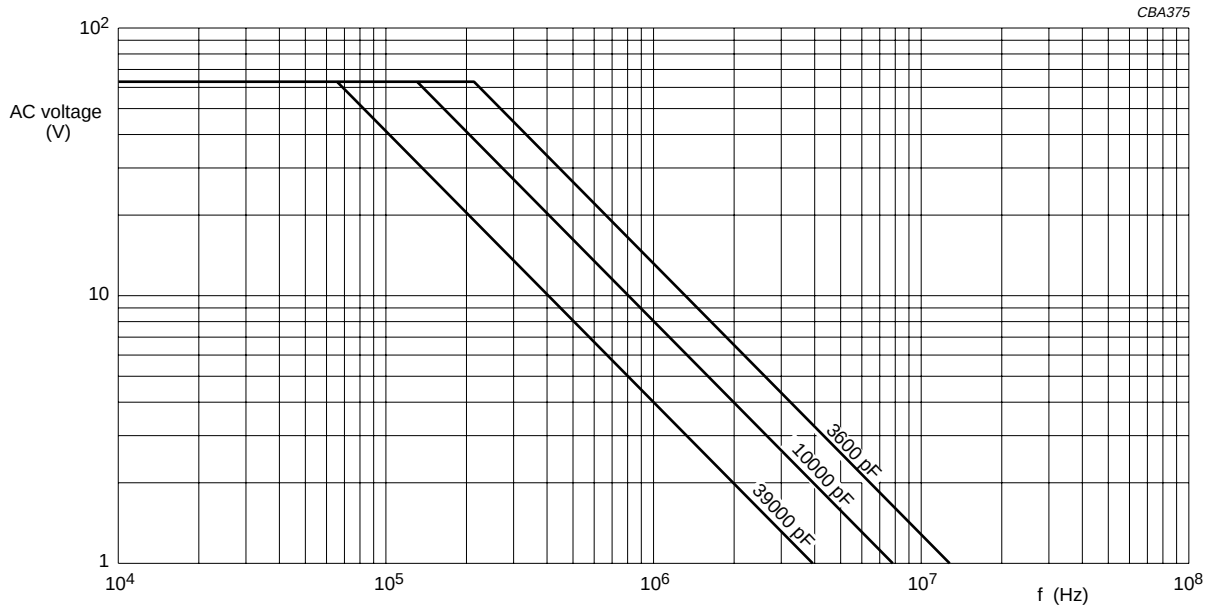


Fig.15 AC voltage (RMS value) as a function of frequency at $T_{amb} \leq 70$ °C for $U_{Rdc} = 160$ V.

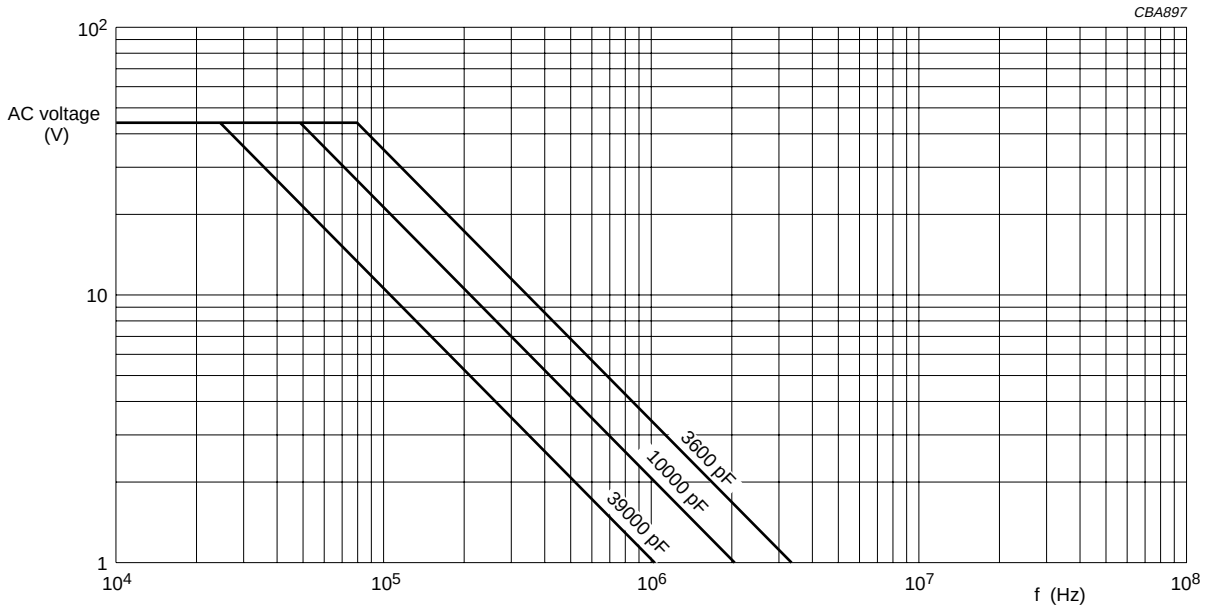


Fig.16 AC voltage (RMS value) as a function of frequency at 70 °C < $T_{amb} \leq 100$ °C for $U_{Rdc} = 160$ V.

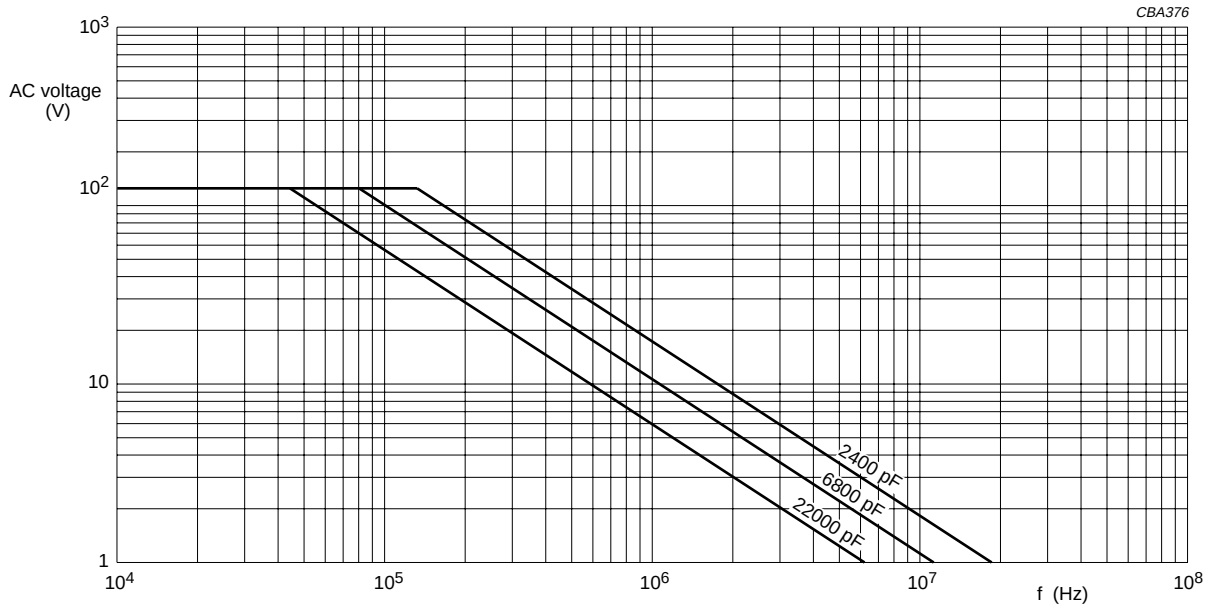


Fig.17 AC voltage (RMS value) as a function of frequency at $T_{amb} \leq 70$ °C for $U_{Rdc} = 250$ V.

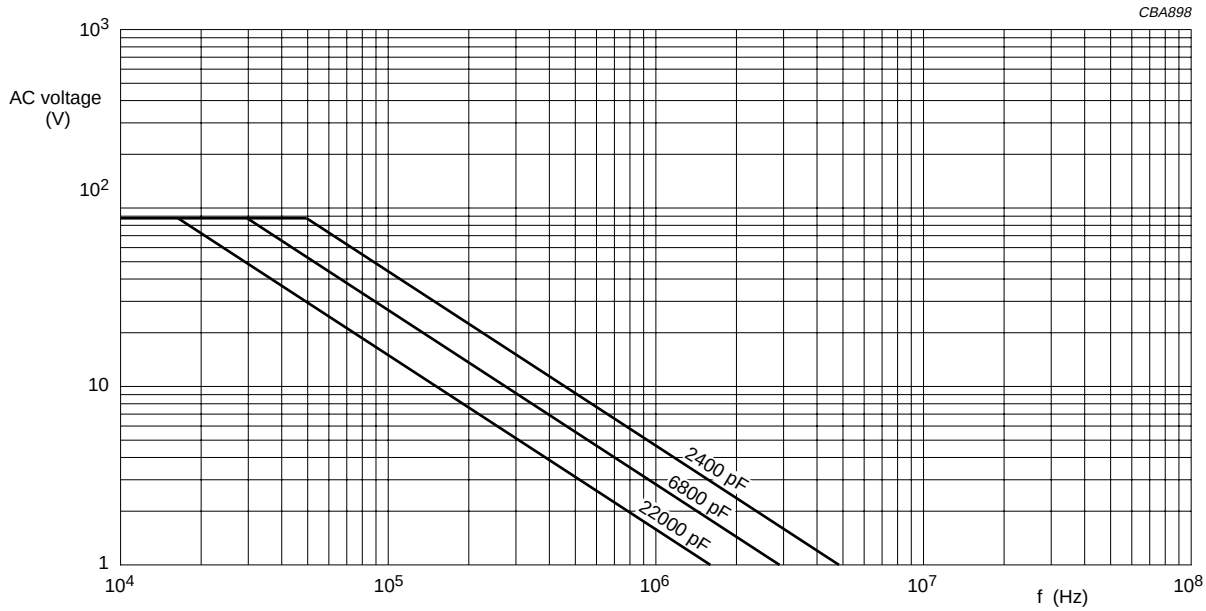


Fig.18 AC voltage (RMS value) as a function of frequency at 70 °C < $T_{amb} \leq 100$ °C for $U_{Rdc} = 250$ V.

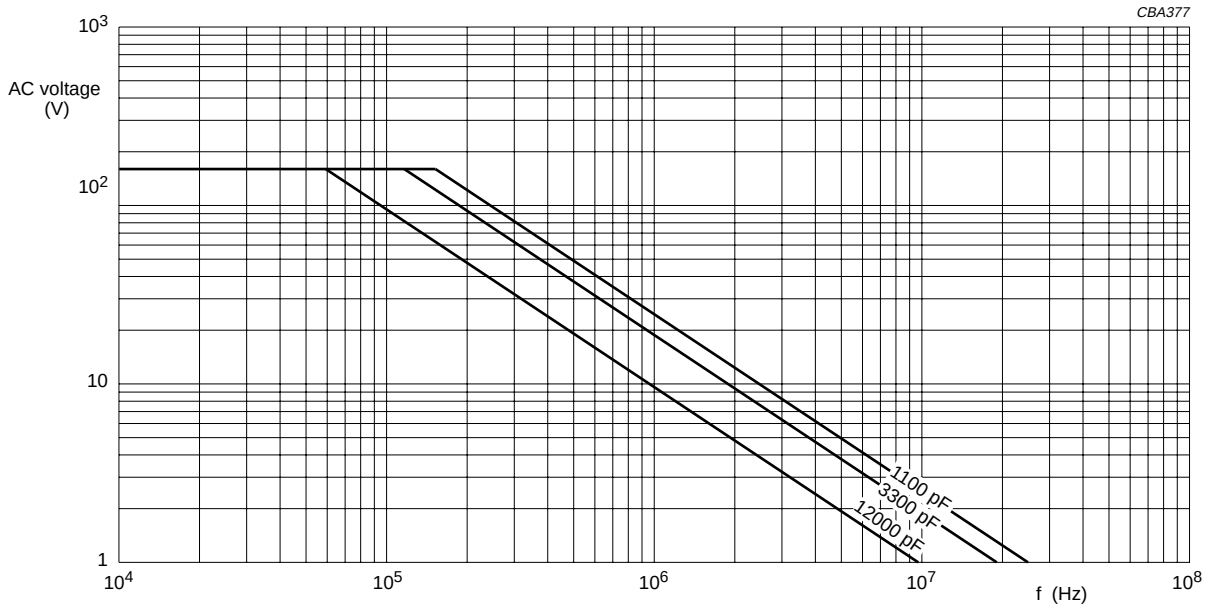


Fig.19 AC voltage (RMS value) as a function of frequency at $T_{amb} \leq 70$ °C for $U_{Rdc} = 400$ V.

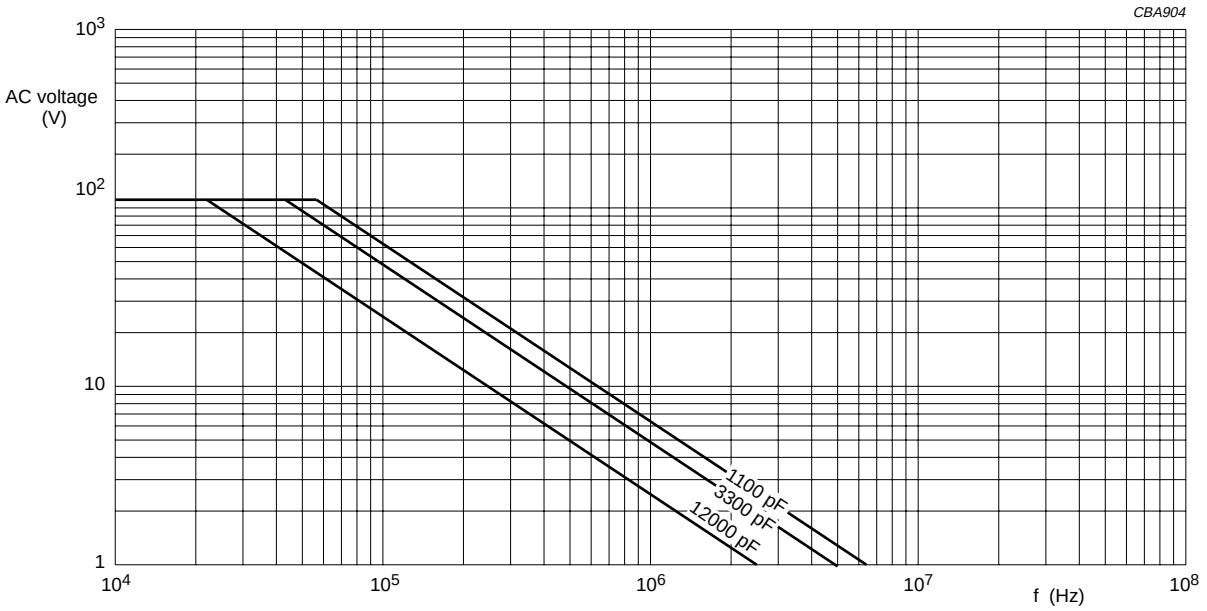


Fig.20 AC voltage (RMS value) as a function of frequency at 70 °C < $T_{amb} \leq 100$ °C for $U_{Rdc} = 400$ V.

Maximum RMS current (sinewave) as a function of frequency

The maximum RMS current is defined by .

U_{ac} is the maximum AC voltage depending on the ambient temperature in Figs 13 to 22.

Tangent of loss angle

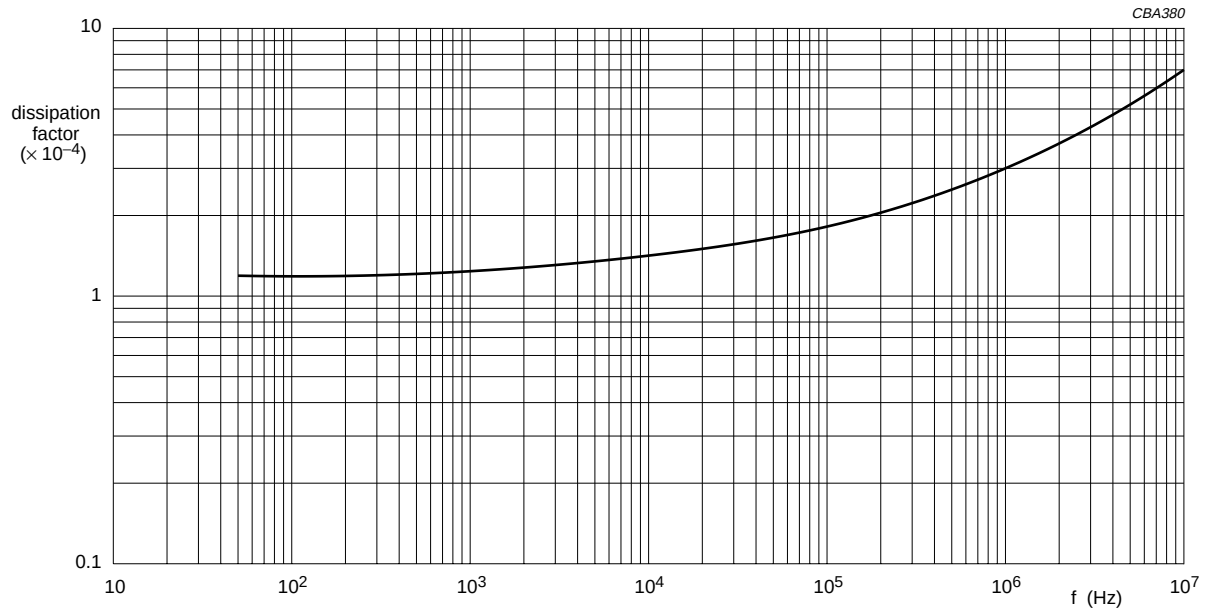


Fig.23 Tangent of loss angle as a function of frequency: typical curve.

Insulation resistance

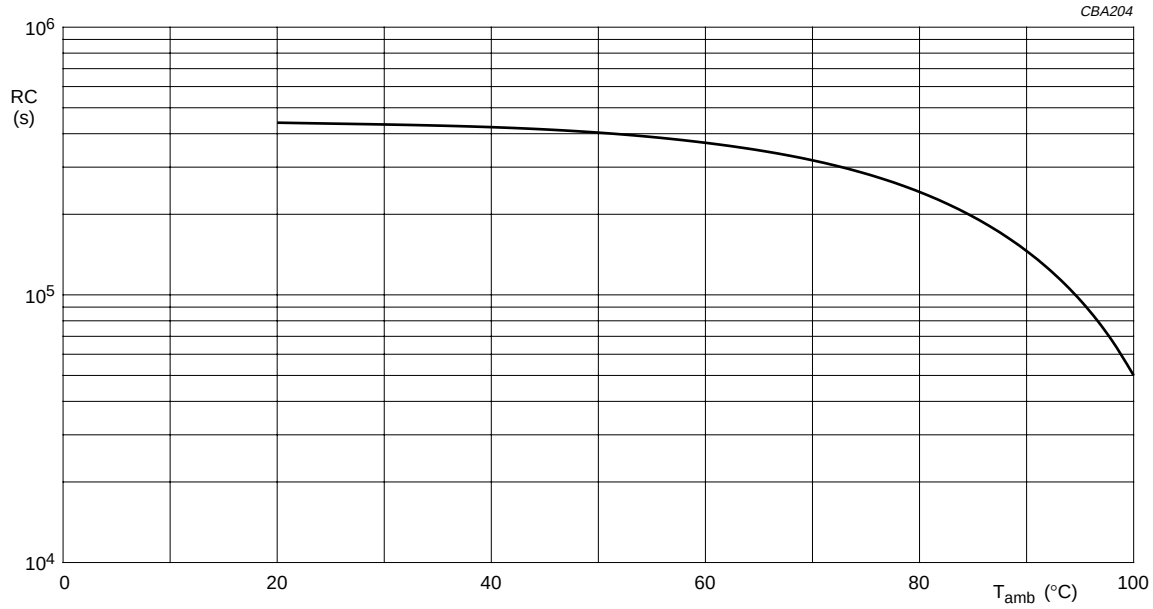


Fig.24 RC product as a function of ambient free air temperature: typical curve.

Inductance

- L dependent on lead and capacitor length: ≤10 nH/cm.

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

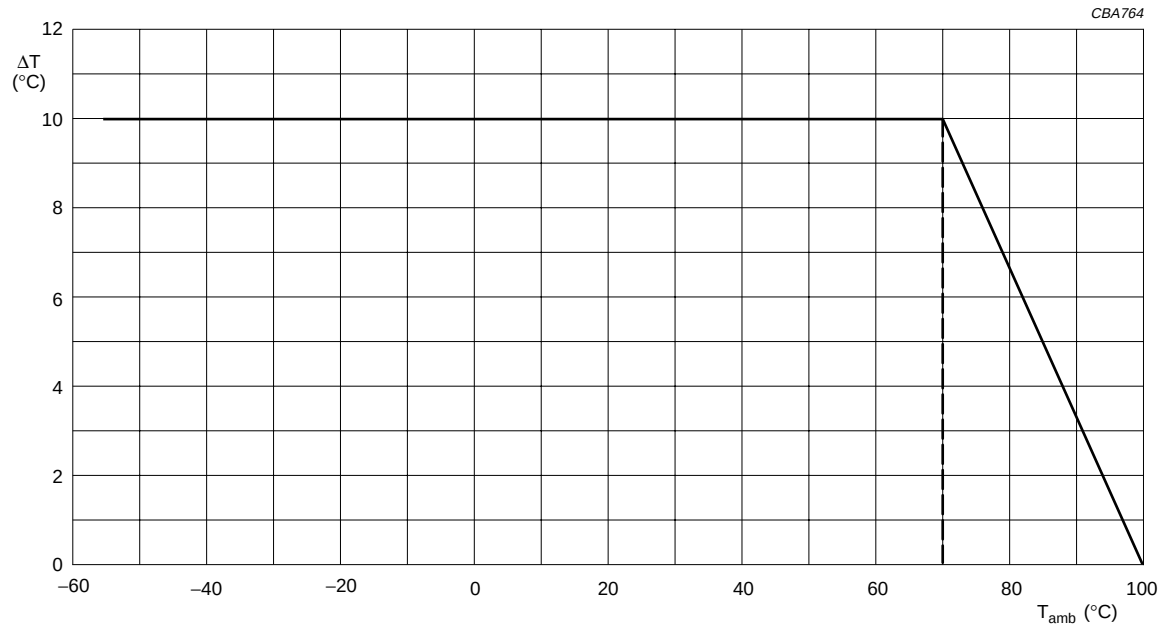


Fig.25 Maximum allowed component temperature rise as a function of the ambient temperature.

Heat conductivity (G) as a function of body dimensions in mW/°C

Table 1 Heat conductivity

$d_{max} \times l_{max}$ (mm)	G (mW/°C)
5.0 × 11.0	2.7
5.5 × 15.0	4.3
6.0 × 15.0	4.7
7.0 × 15.0	5.3
7.5 × 15.0	5.7
8.0 × 15.0	6.3
8.5 × 15.0	6.7

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

- ΔT = 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 as in Fig.26.

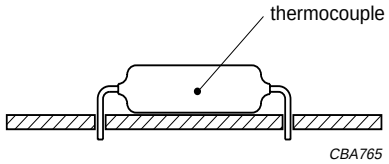


Fig.26 Mounting the thermocouple.

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

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 ($U_{p\text{-}p}$) shall not be greater than the maximum $U_{p\text{-}p}$ 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.
4. The maximum component surface temperature rise must be lower than the limits in Fig.25.
5. The maximum component surface temperature must be lower than 100 °C.
6. The capacitance drift is influenced by the soldering conditions (see section “Soldering conditions” for more details).

MARKING

Product marking

The capacitors are marked in black ink with the following information:

1. Rated capacitance code in accordance with *"IEC 60062"*
2. Tolerance on rated capacitance: F = ±1%; G ±2%; J = ±5%
3. Rated (DC) voltage (e.g. 63 V)
4. Code for dielectric material (KP)
5. Production date code in accordance with *"IEC 60062; clause 5"*
6. Manufacturer.

MARKING EXAMPLE

8n2
G 63
KPK2 (see Table 2)
PHILIPS

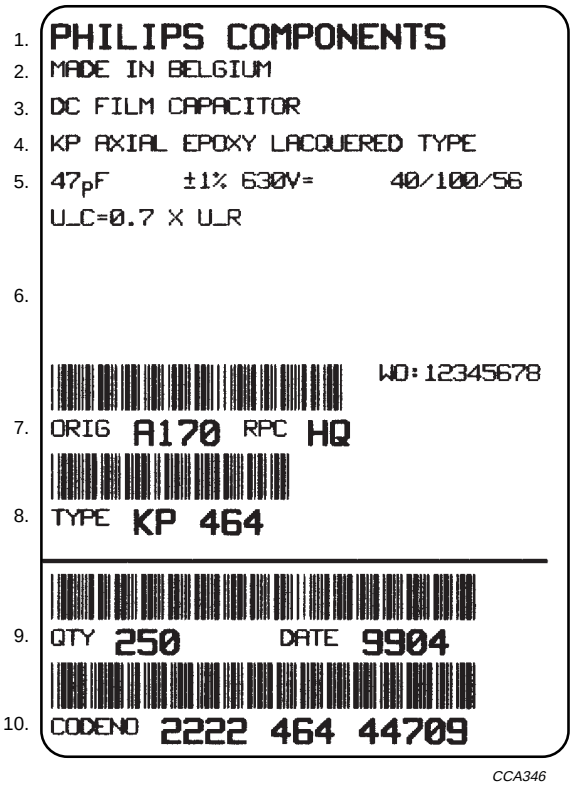
Table 2 Letter codes for year and numbers for month of production

YEAR	LETTER CODE	MONTH	CODE
1998	K	January	1
1999	L	February	2
2000	M	March	3
2001	N	April	4
2002	P	May	5
2003	R	June	6
2004	S	July	7
2005	T	August	8
2006	U	September	9
2007	V	October	O
2008	W	November	N
2009	X	December	D

Package marking

The package containing the capacitors is marked as shown in Fig.27.

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, voltage 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
8	Product type description
9	Quantity and production period, year and week code
10	Product code (12NC)

Fig.27 Barcode label.

QUICK REFERENCE TEST REQUIREMENTS (see note 1)

TEST	PROCEDURE (quick reference)	REQUIREMENTS
Robustness of leads		
Tensile: *"IEC 60068-2-21"*	load 10 N; 10 s	no visible damage legible marking $\lvert\Delta C/C\rvert \leq 2\%$ +1 pF ($C \leq 1100$ pF) $\lvert\Delta C/C\rvert \leq 1\%$ ($C > 1100$ pF)
Bending: *"IEC 60068-2-21"*	load 5 N; 4 × 90°	
Torsion:	2 × 180 °	
Resistance to soldering heat: *"IEC 60068-2-20"*	solder bath: 260 °C; 5 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	$\lvert\Delta C/C\rvert \leq 2\%$ +1 pF ($C \leq 1100$ pF) $\lvert\Delta C/C\rvert \leq 1\%$ ($C > 1100$ pF) $R_{ins} \geq 50\%$ of specified value
Shock: *"IEC 60068-2-27"*	half sinewave; 490 m/s^2; 11 ms	
Climatic sequence		
Dry heat: *"IEC 60068-2-2"*	16 hours; 100 °C	$\lvert\Delta C/C\rvert \leq 1\%$ +1 pF ($C \leq 1100$ pF) $\lvert\Delta C/C\rvert \leq 1\%$ ($C > 1100$ pF) $R_{ins} \geq 50\%$ of specified value
Damp heat, cyclic, test Db, first cycle: *"IEC 60068-2-30"*		
Cold: *"IEC 60068-2-1"*	2 hours; –40 °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	$\lvert\Delta C/C\rvert \leq 1\%$ +1 pF ($C \leq 1100$ pF) $\lvert\Delta C/C\rvert \leq 1\%$ ($C > 1100$ pF) $R_{ins} \geq 50\%$ of specified value
Endurance (DC): *"IEC 60384-13"*	1000 hours; 1.5 × U_{Rdc}; 85 °C 1.05 × U_{Rdc}; 100 °C	$\lvert\Delta C/C\rvert \leq 2\%$ +1 pF ($C \leq 1100$ pF) $\lvert\Delta C/C\rvert \leq 1\%$ ($C > 1100$ pF) $R_{ins} \geq 100\%$ of specified value
Variation of capacitance with temperature: *"IEC 60384-13"*	static method; one cycle	$\lvert\Delta C/C\rvert \leq 2\%$ +1 pF ($C \leq 1100$ pF) $\lvert\Delta C/C\rvert \leq 1\%$ ($C > 1100$ pF) $R_{ins} \geq 10000$ MΩ
Heat storage: *"IEC 60384-13"*	1000 hours; 100 °C	$\lvert\Delta C/C\rvert \leq 2\%$ +1 pF ($C \leq 1100$ pF) $\lvert\Delta C/C\rvert \leq 1\%$ ($C > 1100$ pF)
Resistance to soldering heat with preheating: *"IEC 60384-13"*	body temperature: 100 °C; bath temperature: 260 °C; dwell time: 5 s	$\lvert\Delta C/C\rvert \leq 2\%$ +1 pF ($C \leq 1100$ pF) $\lvert\Delta C/C\rvert \leq 1\%$ ($C > 1100$ pF)

Note

1. For detailed information: see *"Type detail specification HQN-384-13/101"*.