

DATA SHEET

KP 460 to 464 **Polypropylene film foil capacitors**

Product specification
Supersedes data of 2001 Sep 13
File under BCcomponents, BC05

2002 Oct 09

Polypropylene film foil capacitors

KP 460 to 464

KP AXIAL EPOXY LACQUERED TYPE

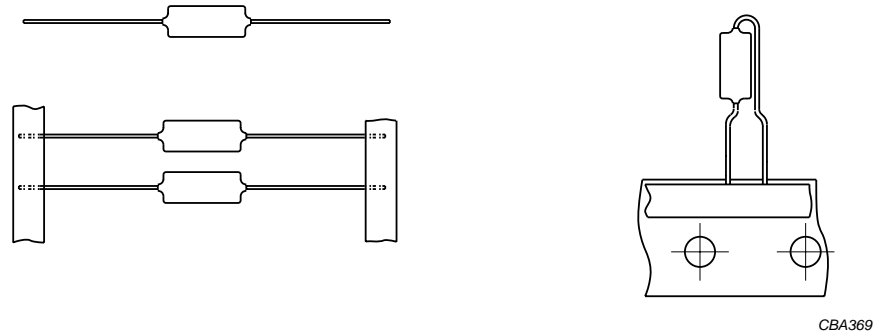


Fig.1 Simplified outlines.

FEATURES

- Supplied loose in box, taped on reel or unidirectional.
- Intermediate values are available of the E96 series.

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 62 000 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
Rated (AC) voltage	40 V; 63 V; 125 V; 160 V; 200 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	class 1
400; 630 V versions	class 2

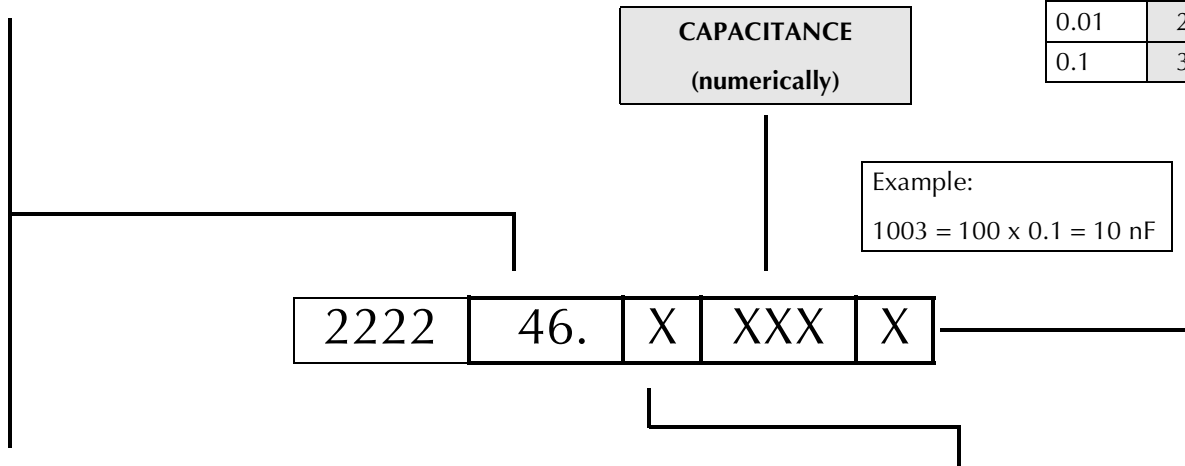
Polypropylene film foil capacitors

KP 460 to 464

COMPOSITION OF CATALOGUE NUMBER

TYPE AND VOLTAGES	
460	63 V
461	160 V

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



TYPE	PACKAGING	LEAD CONFIGURATION AND TAPE DISTANCE	PREFERRED TYPES		
			C-TOL	63 V	160 V
460	Taped on reel	tape distance 63.5 mm	±1%	8	
			±2%	7	
461	Taped on reel	tape distance 63.5 mm	±1%		8
			±2%		7
			ON REQUEST		
460	Taped on reel	tape distance 63.5 mm	±5%	6	
			±1%	4	
	Loose in box	lead length 30.0 or 28.0 mm	±2%	3	
			±5%	2	
	Unidirectional		±1%	1	
			±2%	0	
461	Taped on reel	tape distance 63.5 mm	±5%		6
			±1%		4
	Loose in box	lead length 30.0 or 28.0 mm	±2%		3
			±5%		2
	Unidirectional		±1%		1
			±2%		0

Polypropylene film foil capacitors

KP 460 to 464

TYPE AND VOLTAGES	
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 x 0.1 = 10 nF

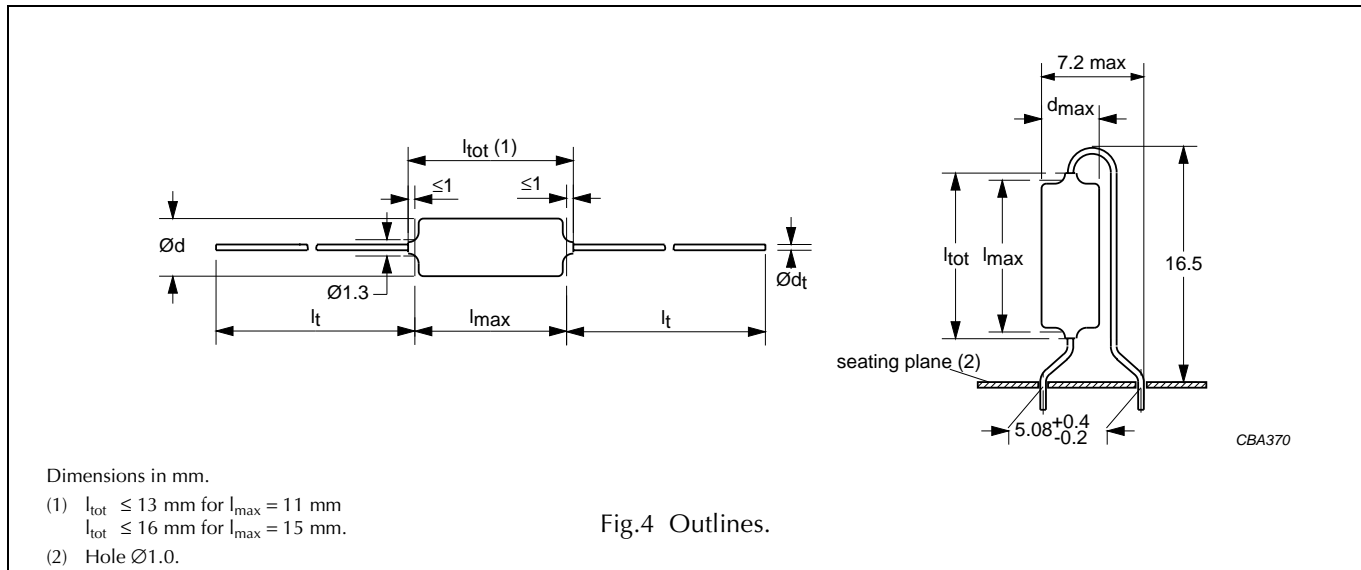
2222 46. X XXX X

TYPE	PACKAGING	LEAD CONFIGURATION AND TAPE DISTANCE	PREFERRED TYPES			
			C-TOL	250 V	400 V	630 V
462	Taped on reel	tape distance 63.5 mm	±1%	8		
			±2%	7		
463	Taped on reel	tape distance 63.5 mm	±1%		8	
			±2%		7	
464	Taped on reel	tape distance 63.5 mm	±1%			8
			±2%			7
			ON REQUEST			
462	Taped on reel	tape distance 63.5 mm	±5%	6		
	Loose in box	lead length 30.0 or 28.0 mm	±1%	4		
			±2%	3		
			±5%	2		
			±1%	1		
	Unidirectional		±2%	0		
463	Taped on reel	tape distance 63.5 mm	±5%		6	
	Loose in box	lead length 30.0 or 28.0 mm	±1%		4	
			±2%		3	
			±5%		2	
			±1%		1	
	Unidirectional		±2%		0	
464	Taped on reel	tape distance 63.5 mm	±5%			6
	Loose in box	lead length 30.0 or 28.0 mm	±1%			4
			±2%			3
			±5%			2
			±1%			1
	Unidirectional		±2%			0

Polypropylene film foil capacitors

KP 460

KP 460 GENERAL DATA



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 20000 pF < C ≤ 47000 pF C > 47000 pF	≤ 5 × 10 ⁻⁴ ≤ 5 × 10 ⁻⁴ ≤ 5 × 10 ⁻⁴	≤ 15 × 10 ⁻⁴ ≤ 25 × 10 ⁻⁴ ≤ 40 × 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	±1%	2222 460 8....	preferred
	±2%	2222 460 7....	preferred
	±5%	2222 460 6....	on request
Loose in box	±1%	2222 460 4....	on request
	±2%	2222 460 3....	on request
	±5%	2222 460 2....	on request
Unidirectional; notes	±1%	2222 460 1....	on request
	±2%	2222 460 0....	on request

Available on request

PACKAGING	TAPE DISTANCE (mm)
Taped in ammpack	52.5
	63.5
Taped on reel	52.5

Polypropylene film foil capacitors

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 $U_{Rdc} = 63 \text{ V}$; $U_{Rac} = 40 \text{ V}$

C (E 24) (pF)	DIMENSIONS $d_{max} \times l_{max}$ (mm)	MASS (g)	CATALOGUE NUMBER 2222 460 AND PACKAGING						
			TAPED ON REEL			LOOSE IN BOX	UNIDIRECTIONAL		
			TAPE DISTANCE 63.5 mm				C-tol = $\pm 2\%$	C-tol = $\pm 1\%$	SPQ
			C-tol = $\pm 2\%$	C-tol = $\pm 1\%$	SPQ	C-tol = $\pm 2\%$			
last 5 digits of catalogue number			SPQ	SPQ	last 5 digits of catalogue number		SPQ		
$l_t = 30.0 \text{ mm}$; $d_t = 0.60 \pm 0.06 \text{ mm}$									
6800	5.0 × 11.0	0.5	76802	86802	2500	250	06802	16802	1000
7500		0.5	77502	87502			07502	17502	
8200		0.6	78202	88202			08202	18202	
9100		0.6	79102	89102			09102	19102	
$l_t = 28.0 \text{ mm}$; $d_t = 0.60 \pm 0.06 \text{ mm}$									
10000	6.0 × 15.0	0.6	71003	81003	1500	250			
11000		0.6	71103	81103					
12000		0.7	71203	81203					
13000		0.8	71303	81303					
15000		0.7	71503	81503					
16000		0.7	71603	81603					
18000		0.8	71803	81803					
20000		0.8	72003	82003					
22000	0.9	72203	82203						
24000	6.5 × 15.0	0.9	72403	82403	1500	250			
27000		1.0	72703	82703					
30000	7.0 × 15.0	1.1	73003	83003	1000	200			
33000		1.2	73303	83303					
36000		1.2	73603	83603					
39000	7.5 × 15.0	1.3	73903	83903	1000	150			
43000		1.4	74303	84303					
47000	8.0 × 15.0	1.5	74703	84703	1000	150			
51000		1.6	75103	85103					
56000	8.5 × 15.0	1.7	75603	85603	1000	125			
62000		1.8	76203	86203					

Polypropylene film foil capacitors

KP 461

KP 461 GENERAL DATA

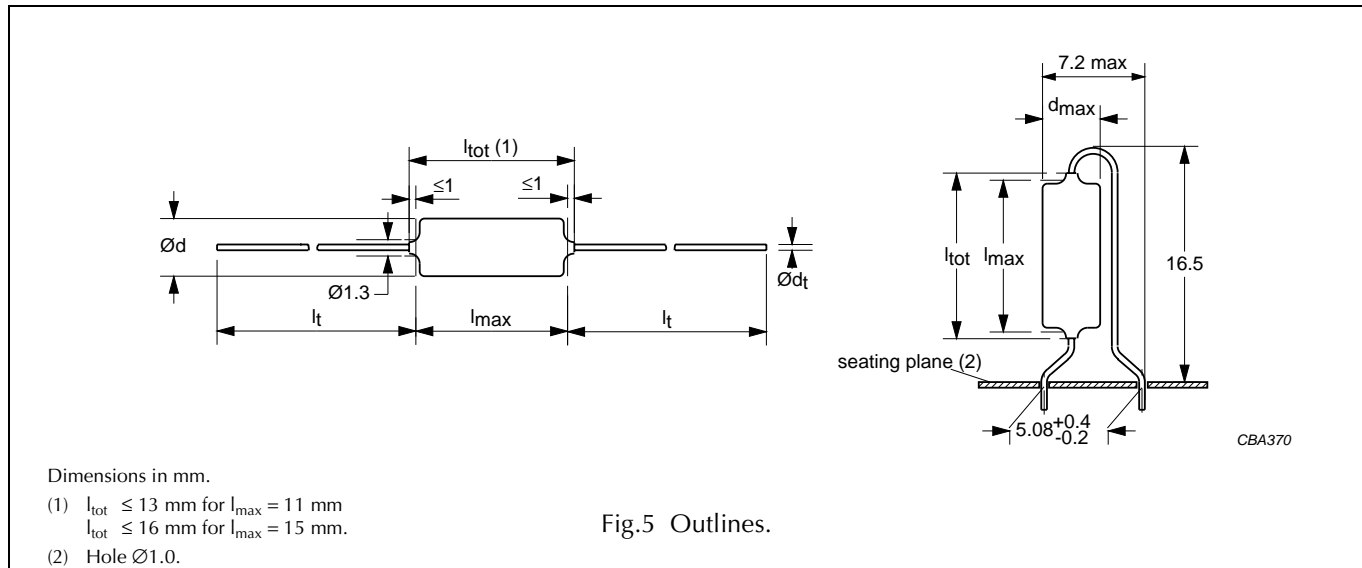


Fig.5 Outlines.

Specific reference data for the 160 V DC capacitors

DESCRIPTION	VALUE	
	at 1 kHz	at 100 kHz
Tangent of loss angle:		
1 000 pF < C ≤ 5 000 pF	$\leq 5 \times 10^{-4}$	$\leq 10 \times 10^{-4}$
5 000 pF < C ≤ 20 000 pF	$\leq 5 \times 10^{-4}$	$\leq 15 \times 10^{-4}$
20 000 pF < C ≤ 39 000 pF	$\leq 5 \times 10^{-4}$	$\leq 25 \times 10^{-4}$
Rated voltage pulse slope (dU/dt) _R at 160 V (DC)	10 000 V/μs	
R between leads; at 100 V; 1 minute	>100 000 MΩ	
R between interconnected leads and case; 100 V; 1 minute	>100 000 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	±1%	2222 461 8....	preferred
	±2%	2222 461 7....	preferred
	±5%	2222 461 6....	on request
Loose in box	±1%	2222 461 4....	on request
	±2%	2222 461 3....	on request
	±5%	2222 461 2....	on request
Unidirectional	±1%	2222 461 1....	on request
	±2%	2222 461 0....	on request

Available on request

PACKAGING	TAPE DISTANCE (mm)
Taped in ammpack	52.5
	63.5
Taped on reel	52.5

Polypropylene film foil capacitors

KP 461

 $U_{Rdc} = 160 \text{ V}$; $U_{Rac} = 63 \text{ V}$

C (E 24) (pF)	DIMENSIONS $d_{max} \times l_{max}$ (mm)	MASS (g)	CATALOGUE NUMBER 2222 461 AND PACKAGING						
			TAPED ON REEL			LOOSE IN BOX	UNIDIRECTIONAL		
			TAPE DISTANCE 63.5 mm				C-tol = $\pm 2\%$	C-tol = $\pm 1\%$	SPQ
			C-tol = $\pm 2\%$	C-tol = $\pm 1\%$	SPQ	C-tol = $\pm 2\%$			
last 5 digits of catalogue number			SPQ	SPQ	last 5 digits of catalogue number		SPQ		
$l_t = 30.0 \text{ mm}$; $d_t = 0.60 \pm 0.06 \text{ mm}$									
3600	5.0 × 11.0	0.5	73602	83602	2500	250	03602	13602	1000
3900		0.5	73902	83902			03902	13902	
4300		0.5	74302	84302			04302	14302	
4700		0.5	74702	84702			04702	14702	
5100		0.5	75102	85102			05102	15102	
5600		0.5	75602	85602			05602	15602	
6200		0.6	76202	86202			06202	16202	
$l_t = 28.0 \text{ mm}$; $d_t = 0.60 \pm 0.06 \text{ mm}$									
6800	6.0 × 15.0	0.4	76802	86802	1500	250			
7500		0.7	77502	87502					
8200		0.6	78202	88202					
9100		0.6	79102	89102					
10000		0.7	71003	81003					
11000		0.7	71103	81103					
12000		0.7	71203	81203					
13000		0.8	71303	81303					
15000	0.8	71503	81503						
16000	6.5 × 15.0	0.9	71603	81603	1500	250			
18000		0.9	71803	81803					
20000		1.0	72003	82003					
22000	7.0 × 15.0	1.1	72203	82203	1000	200			
24000		1.1	72403	82403					
27000	7.5 × 15.0	1.2	72703	82703	1000	150			
30000	8.0 × 15.0	1.3	73003	83003	1000	150			
33000		1.4	73303	83303					
36000	8.5 × 15.0	1.5	73603	83603	1000	125			
39000		1.6	73903	83903					

Polypropylene film foil capacitors

KP 462

KP 462 GENERAL DATA

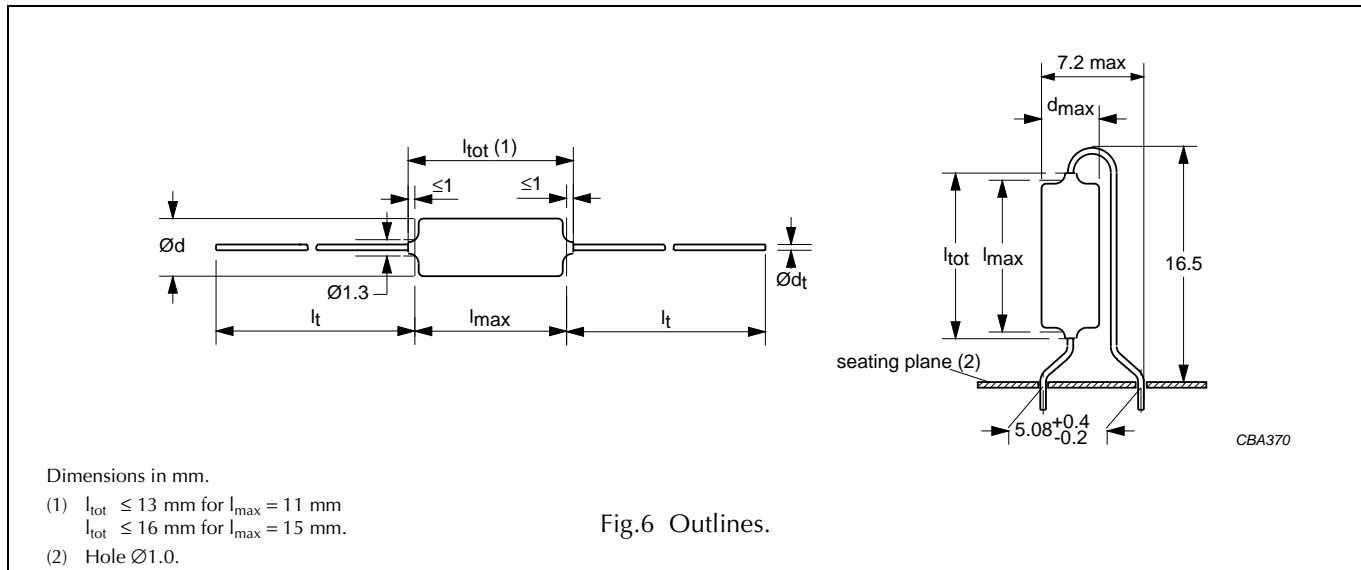


Fig.6 Outlines.

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 ≤ 5 000 pF	$\leq 5 \times 10^{-4}$	$\leq 10 \times 10^{-4}$
5 000 pF < C ≤ 20 000 pF	$\leq 5 \times 10^{-4}$	$\leq 15 \times 10^{-4}$
20 000 pF < C ≤ 22 000 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	±1%	2222 462 8....	preferred
	±2%	2222 462 7....	preferred
	±5%	2222 462 6....	on request
Loose in box	±1%	2222 462 4....	on request
	±2%	2222 462 3....	on request
	±5%	2222 462 2....	on request
Unidirectional	±1%	2222 462 1....	on request
	±2%	2222 462 0....	on request

Available on request

PACKAGING	TAPE DISTANCE (mm)
Taped in ammpack	52.5
	63.5
Taped on reel	52.5

Polypropylene film foil capacitors

KP 462

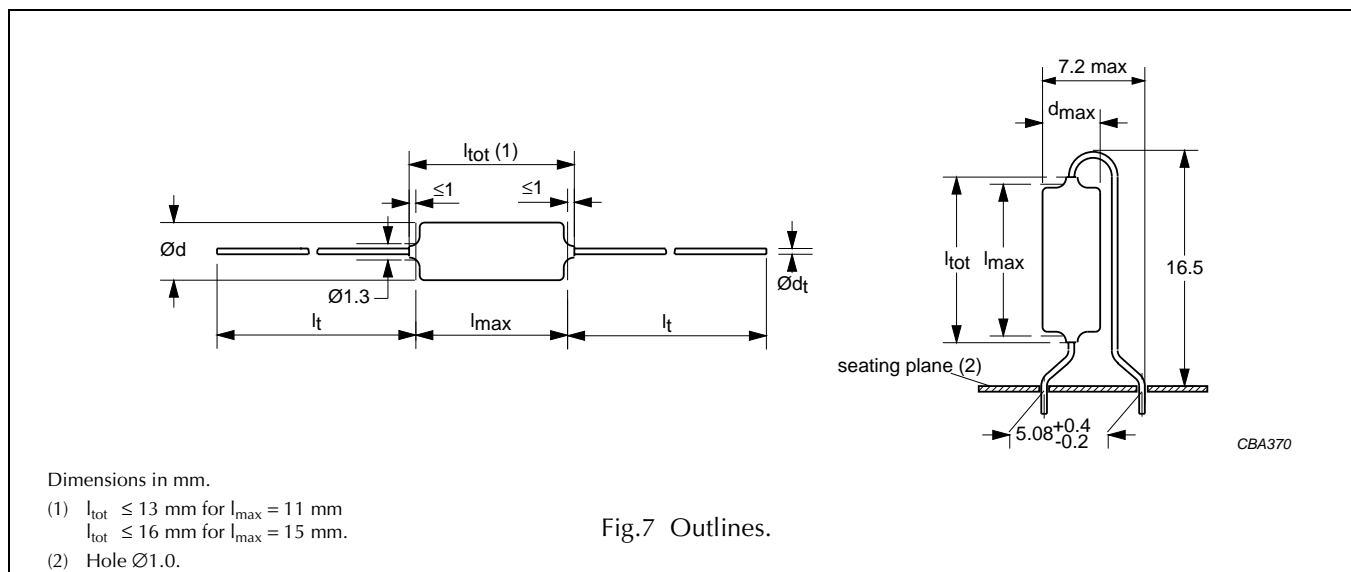
 $U_{Rdc} = 250 \text{ V}$; $U_{Rac} = 125 \text{ V}$

C (E 24) (pF)	DIMENSIONS $d_{max} \times l_{max}$ (mm)	MASS (g)	CATALOGUE NUMBER 2222 462 AND PACKAGING						
			TAPED ON REEL			LOOSE IN BOX	UNIDIRECTIONAL		
			TAPE DISTANCE 63.5 mm				C-tol = $\pm 2\%$	C-tol = $\pm 1\%$	SPQ
			C-tol = $\pm 2\%$	C-tol = $\pm 1\%$	SPQ	C-tol = $\pm 2\%$			
last 5 digits of catalogue number		SPQ	SPQ	last 5 digits of catalogue number		SPQ			
$l_t = 30.0 \text{ mm}$; $d_t = 0.60 \pm 0.06 \text{ mm}$									
1200	5.0 × 11.0	0.5	71202	81202	2500	250	01202	11202	1000
1300		0.5	71302	81302			01302	11302	
1500		0.4	71502	81502			01502	11502	
1600		0.5	71602	81602			01602	11602	
1800		0.6	71802	81802			01802	11802	
2000		0.6	72002	82002			02002	12002	
2200		0.5	72202	82202			02202	12202	
2400		0.5	72402	82402			02402	12402	
2700		0.5	72702	82702			02702	12702	
3000		0.5	73002	83002			03002	13002	
3300		0.5	73302	83302			03302	13302	
$l_t = 28.0 \text{ mm}$; $d_t = 0.60 \pm 0.06 \text{ mm}$									
3600	6.0 × 15.0	0.5	73602	83602	1500	250			
3900		0.5	73902	83902					
4300		0.6	74302	84302					
4700		0.6	74702	84702					
5100		0.6	75102	85102					
5600		0.6	75602	85602					
6200		0.7	76202	86202					
6800		0.7	76802	86802					
7500	0.7	77502	87502						
8200	6.5 × 15.0	0.8	78202	88202	1500	250			
9100		0.8	79102	89102					
10000		0.9	71003	81003					
11000	7.0 × 15.0	0.9	71103	81103	1000	200			
12000		1.0	71203	81203					
13000		1.0	71303	81303					
15000	7.5 × 15.0	1.1	71503	81503	1000	150			
16000		1.2	71603	81603					
18000	8.0 × 15.0	1.3	71803	81803	1000	150			
20000	8.5 × 15.0	1.4	72003	82003	1000	125			
22000		1.5	72203	82203					

Polypropylene film foil capacitors

KP 463

KP 463 GENERAL DATA



Specific reference data for the 400 V DC capacitors

DESCRIPTION	VALUE		
	at 1 kHz	at 100 kHz	at 1MHz ⁽¹⁾
Tangent of loss angle: C ≤ 1000 pF	$\leq 5 \times 10^{-4}$	–	$\leq 10 \times 10^{-4}$
1 000 pF < C ≤ 5 000 pF	$\leq 5 \times 10^{-4}$	$\leq 10 \times 10^{-4}$	–
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%	2222 463 8....	preferred
	±2%	2222 463 7....	preferred
	±5%	2222 463 6....	on request
Loose in box	±1%	2222 463 4....	on request
	±2%	2222 463 3....	on request
	±5%	2222 463 2....	on request
Unidirectional	±1%	2222 463 1....	on request
	±2%	2222 463 0....	on request

Available on request

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

Polypropylene film foil capacitors

KP 463

 $U_{Rdc} = 400 \text{ V}$; $U_{Rac} = 160 \text{ V}$

C (E 24) (pF)	DIMENSIONS $d_{max} \times l_{max}$ (mm)	MASS (g)	CATALOGUE NUMBER 2222 463 AND PACKAGING						
			TAPED ON REEL			LOOSE IN BOX	UNIDIRECTIONAL		
			TAPE DISTANCE 63.5 mm				C-tol = $\pm 2\%$	C-tol = $\pm 1\%$	SPQ
			C-tol = $\pm 2\%$	C-tol = $\pm 1\%$	SPQ	C-tol = $\pm 2\%$			
last 5 digits of catalogue number			SPQ	SPQ	last 5 digits of catalogue number		SPQ		
$l_t = 30.0 \text{ mm}$; $d_t = 0.60 \pm 0.06 \text{ mm}$									
620	5.0 × 11.0	0.5	76201	86201	2500	250	06201	16201	1000
680		0.5	76801	86801			06801	16801	
750		0.5	77501	87501			07501	17501	
820		0.5	78201	88201			08201	18201	
910		0.5	79101	89101			09101	19101	
1000		0.5	71002	81002			01002	11002	
1100		0.5	71102	81102			01102	11102	
$l_t = 28.0 \text{ mm}$; $d_t = 0.60 \pm 0.06 \text{ mm}$									
1200	6.0 × 15.0	0.5	71202	81202	1500	250			
1300		0.5	71302	81302					
1500		0.5	71502	81502					
1600		0.5	71602	81602					
1800		0.5	71802	81802					
2000		0.5	72002	82002					
2200	6.5 × 15.0	0.5	72202	82202	1500	250			
2400		0.5	72402	82402					
2700		0.6	72702	82702					
3000		0.7	73002	83002					
3300	7.0 × 15.0	0.7	73302	83302	1000	200			
3600		0.7	73602	83602					
3900		0.8	73902	83902					
4300	7.5 × 15.0	0.8	74302	84302	1000	150			
4700		0.9	74702	84702					
5100		0.9	75102	85102					
5600	8.0 × 15.0	1.0	75602	85602	1000	150			
6200		1.0	76202	86202					
6800	8.5 × 15.0	1.1	76802	86802	1000	125			
7500		1.2	77502	87502					
8200		1.3	78202	88202					

Polypropylene film foil capacitors

KP 464

KP 464 GENERAL DATA

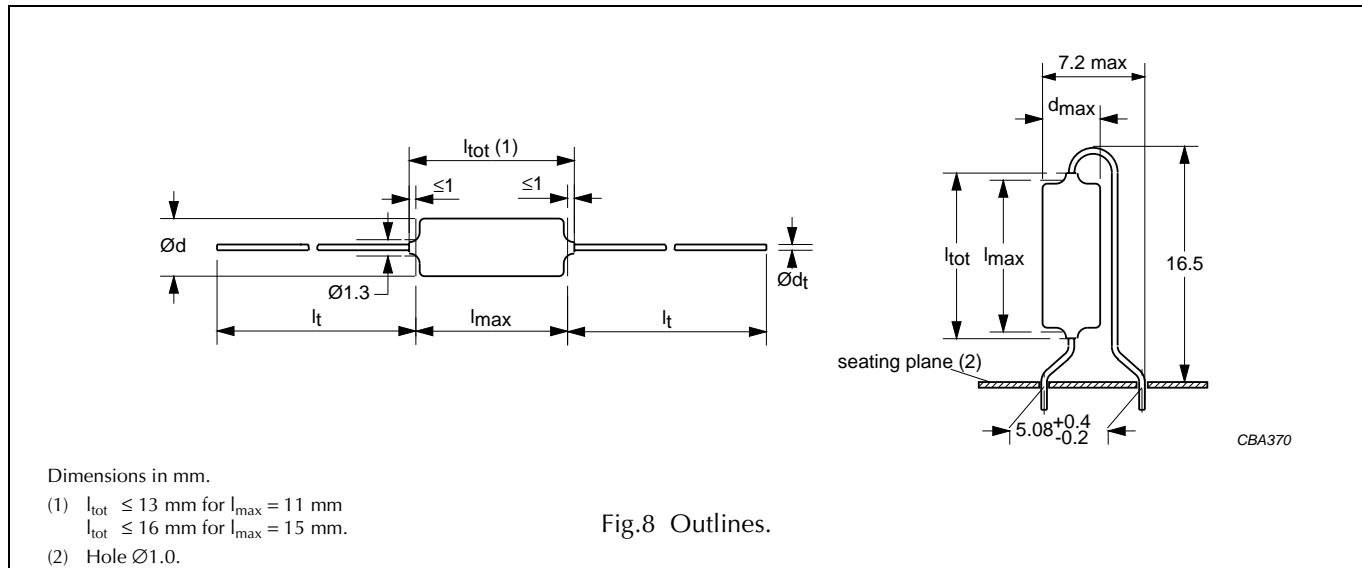


Fig.8 Outlines.

Specific reference data for the 630 V DC capacitors

DESCRIPTION	VALUE	
	at 1 kHz	at 1 MHz ⁽¹⁾
Tangent of loss angle: $C \leq 560$ pF	$\leq 5 \times 10^{-4}$	$\leq 10 \times 10^{-4}$
Rated voltage pulse slope (dU/dt) _R at 630 V (DC)	10000 V/ μ s	
R between leads; at 500 V; 1 minute	>100000 M Ω	
R between interconnected leads and case; 500 V; 1 minute	>100000 M Ω	
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

- 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	$\pm 1\%$	2222 464 8....	preferred
	$\pm 2\%$	2222 464 7....	preferred
	$\pm 5\%$	2222 464 6....	on request
Loose in box	$\pm 1\%$	2222 464 4....	on request
	$\pm 2\%$	2222 464 3....	on request
	$\pm 5\%$	2222 464 2....	on request
Unidirectional	$\pm 1\%$	2222 464 1....	on request
	$\pm 2\%$	2222 464 0....	on request

Available on request

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

Polypropylene film foil capacitors

KP 464

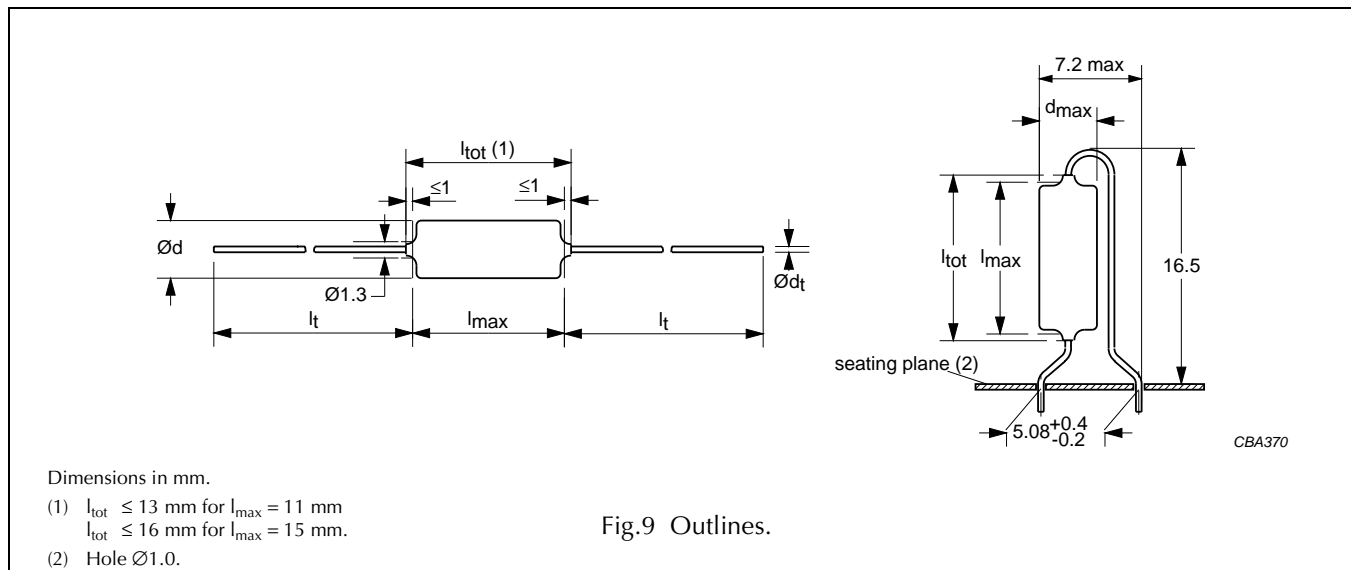
 $U_{Rdc} = 630 \text{ V}$; $U_{Rac} = 200 \text{ V}$

C (E 24) (pF)	DIMENSIONS $d_{max} \times l_{max}$ (mm)	MASS (g)	CATALOGUE NUMBER 2222 464 AND PACKAGING						
			TAPED ON REEL			LOOSE IN BOX	UNIDIRECTIONAL		
			TAPE DISTANCE 63.5 mm				C-tol = $\pm 2\%$	C-tol = $\pm 1\%$	SPQ
			C-tol = $\pm 2\%$	C-tol = $\pm 1\%$	SPQ	C-tol = $\pm 2\%$			
last 5 digits of catalogue number		SPQ	SPQ	last 5 digits of catalogue number		SPQ			
$l_t = 30.0 \text{ mm}$; $d_t = 0.60 \pm 0.06 \text{ mm}$									
47	5.0 × 11.0	0.4	74709	84709	2500	250	04709	14709	1000
51		0.4	75109	85109			05109	15109	
56		0.4	75609	85609			05609	15609	
62		0.4	76209	86209			06209	16209	
68		0.4	76809	86809			06809	16809	
75		0.4	77509	87509			07509	17509	
82		0.4	78209	88209			08209	18209	
91		0.4	79109	89109			09109	19109	
100		0.4	71001	81001			01001	11001	
110		0.4	71101	81101			01101	11101	
120		0.4	71201	81201			01201	11201	
130		0.5	71301	81301			01301	11301	
150		0.4	71501	81501			01501	11501	
160		0.4	71601	81601			01601	11601	
180		0.5	71801	81801			01801	11801	
200		0.5	72001	82001			02001	12001	
220		0.6	72201	82201			02201	12201	
240		0.6	72401	82401			02401	12401	
270		0.6	72701	82701			02701	12701	
300		0.7	73001	83001			03001	13001	
330		0.4	73301	83301			03301	13301	
360		0.4	73601	83601			03601	13601	
390		0.5	73901	83901			03901	13901	
430		0.5	74301	84301			04301	14301	
470		0.5	74701	84701			04701	14701	
510		0.5	75101	85101			05101	15101	
560		0.5	75601	85601			05601	15601	

Polypropylene film foil capacitors

KP 464

KP 464 GENERAL DATA



Specific reference data for the 630 V DC capacitors

DESCRIPTION	VALUE		
	at 1 kHz	at 100 kHz	at 1 MHz
Tangent of loss angle: $C \leq 1000$ pF 1000 pF < $C \leq 4700$ 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		

Available 630 V DC versions

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

Available on request

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

Polypropylene film foil capacitors

KP 460 to 464

 $U_{Rdc} = 630 \text{ V}$; $U_{Rac} = 200 \text{ V}$

C (E 24) (pF)	DIMENSIONS $d_{max} \times l_{max}$ (mm)	MASS (g)	CATALOGUE NUMBER 2222 464 AND PACKAGING			
			TAPED ON REEL			LOOSE IN BOX
			TAPE DISTANCE 63.5 mm			
			C-tol = $\pm 2\%$	C-tol = $\pm 1\%$	SPQ	SPQ
last 5 digits of catalogue number						
$l_t = 28.0 \text{ mm}$; $d_t = 0.60 \pm 0.06 \text{ mm}$						
620	6.0 × 15.0	0.5	76201	86201	1 500	250
680		0.5	76801	86801		
750		0.5	77501	87501		
820		0.5	78201	88201		
910		0.5	79101	89101		
1 000		0.5	71002	81002		
1 100		0.5	71102	81102		
1 200		0.5	71202	81202		
1 300	6.5 × 15.0	0.6	71302	81302	1 500	250
1 500		0.6	71502	81502		
1 600		0.7	71602	81602		
1 800		0.7	71802	81802		
2 000	7.0 × 15.0	0.8	72002	82002	1 000	200
2 200		0.9	72202	82202		
2 400		0.9	72402	82402		
2 700	7.5 × 15.0	0.9	72702	82702	1 000	150
3 000		1.0	73002	83002		
3 300	8.0 × 15.0	1.1	73302	83302	1 000	150
3 600		1.2	73602	83602		
3 900		1.3	73902	83902		
4 300	8.5 × 15.0	1.4	74302	84302	1 000	125
4 700		1.5	74702	84702		

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.

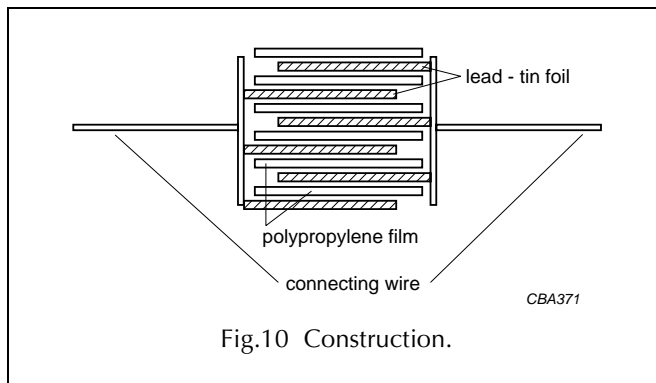


Fig.10 Construction.

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 11 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 $50 \pm 2\%$.

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%.

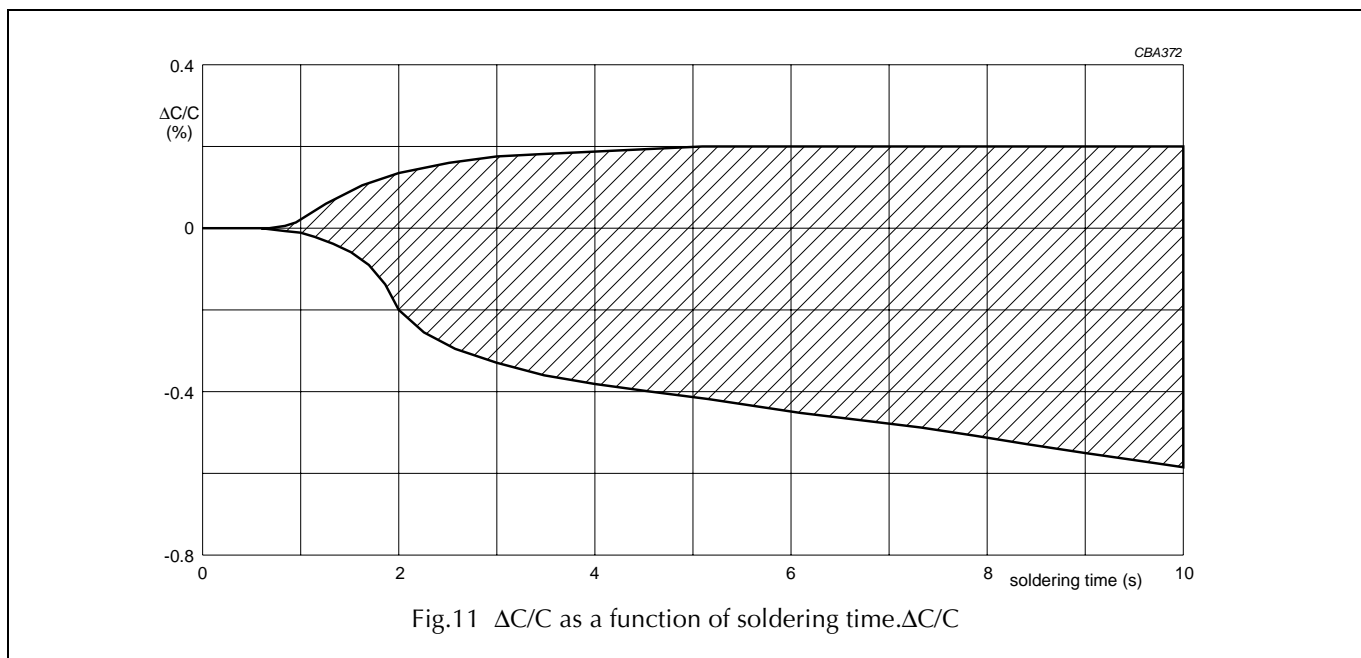


Fig.11 $\Delta C/C$ as a function of soldering time. $\Delta C/C$

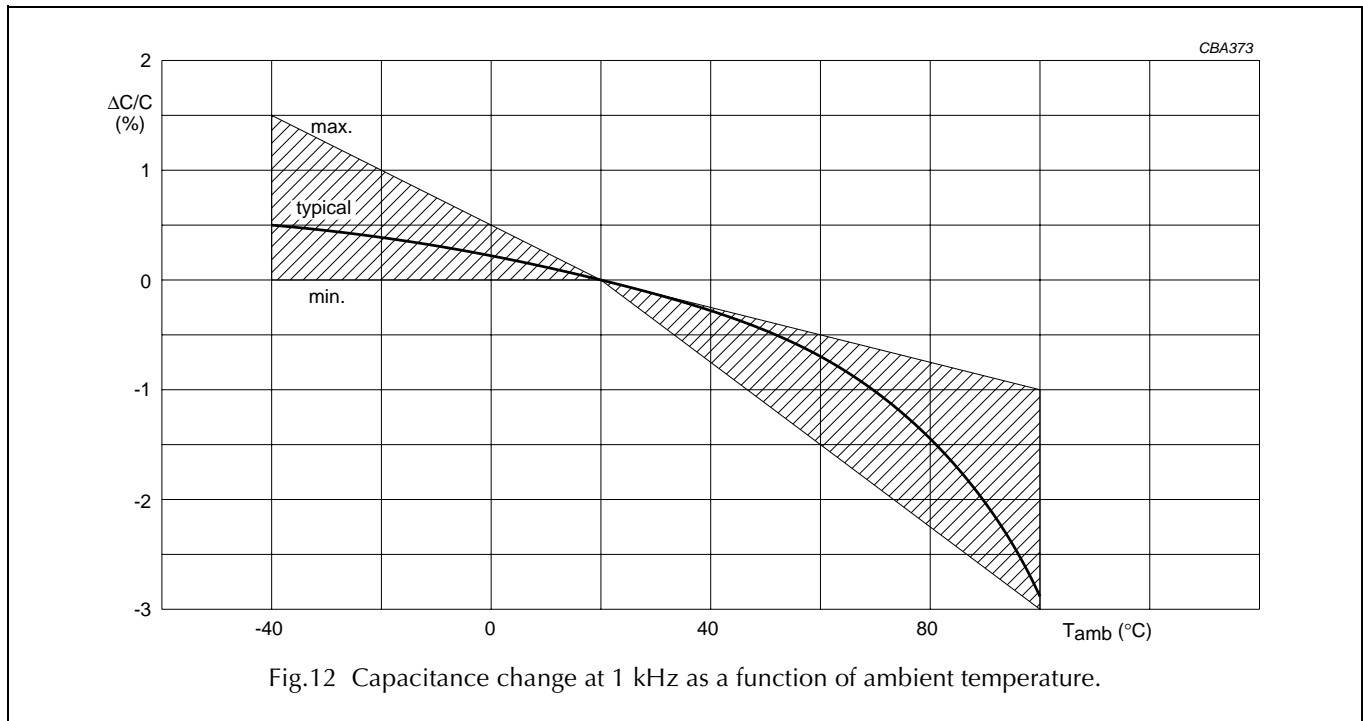
Polypropylene film foil capacitors

KP 460 to 464

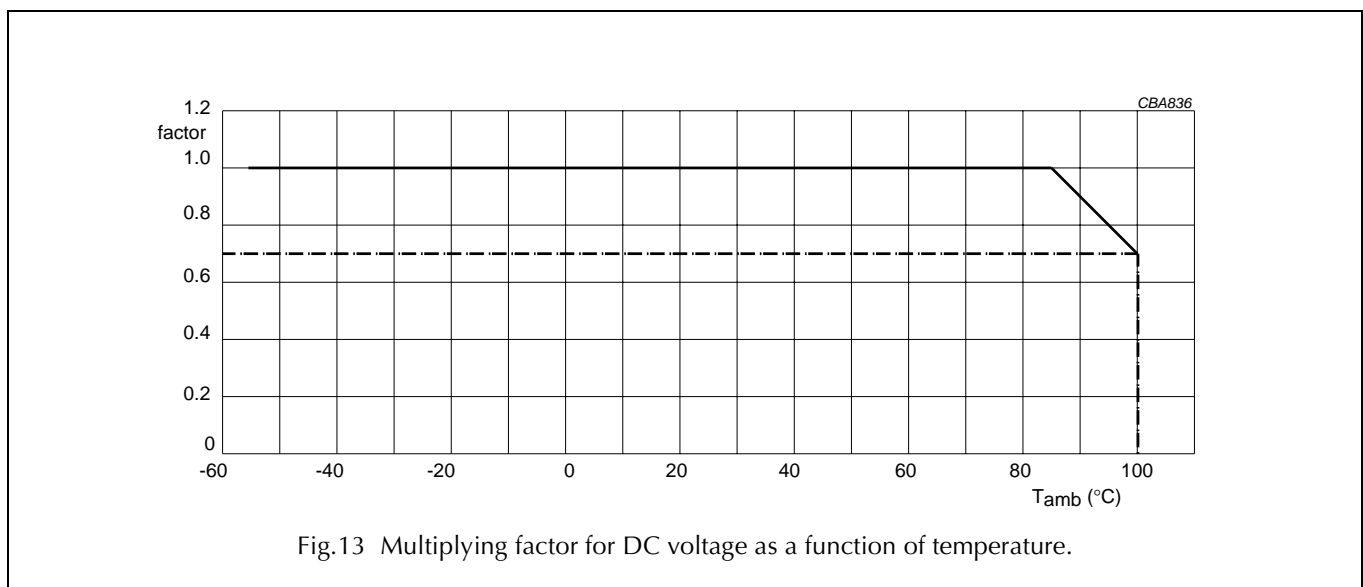
CHARACTERISTICS

Capacitance

- Temperature coefficient:
 - between -40 and $+20$ °C for $C \leq 1000$ 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: $-(250 \pm 120) \times 10^{-6}/K$.



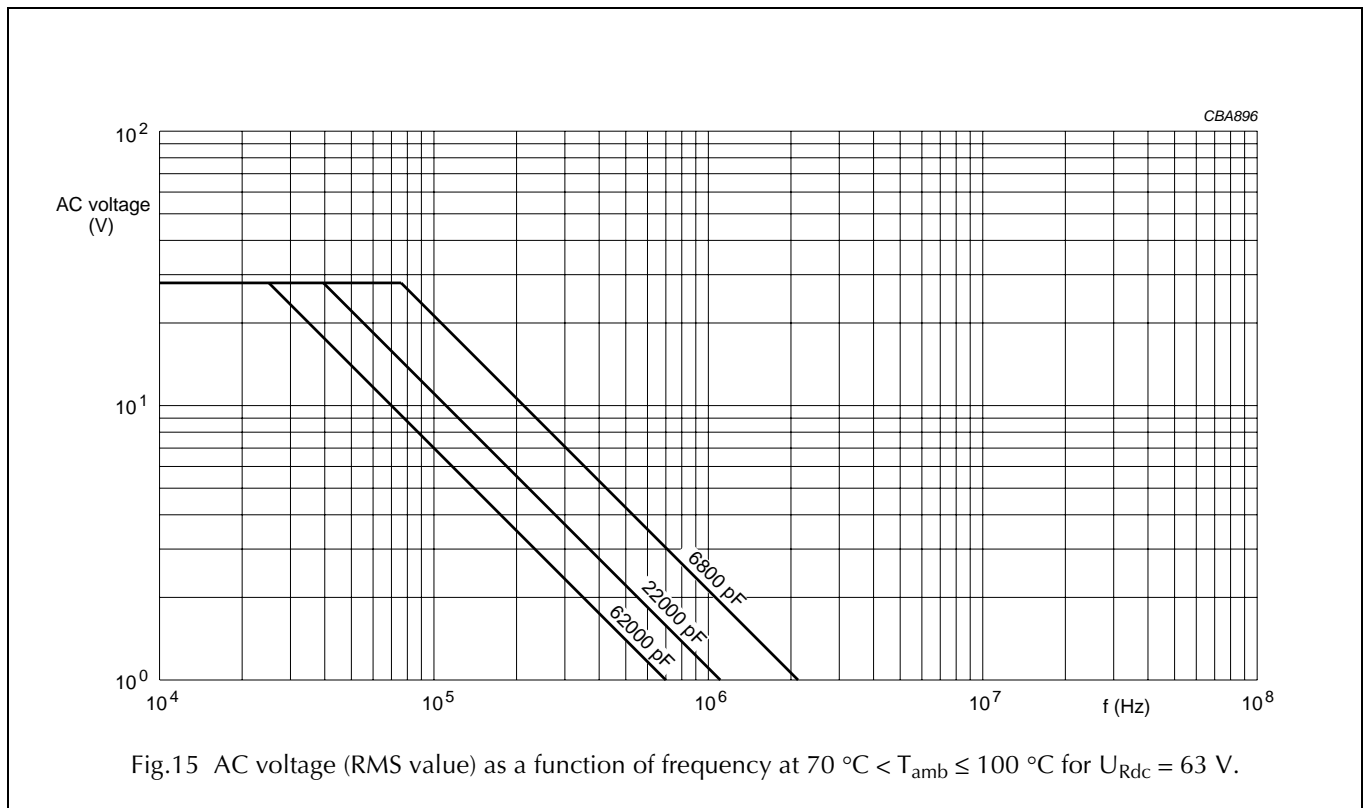
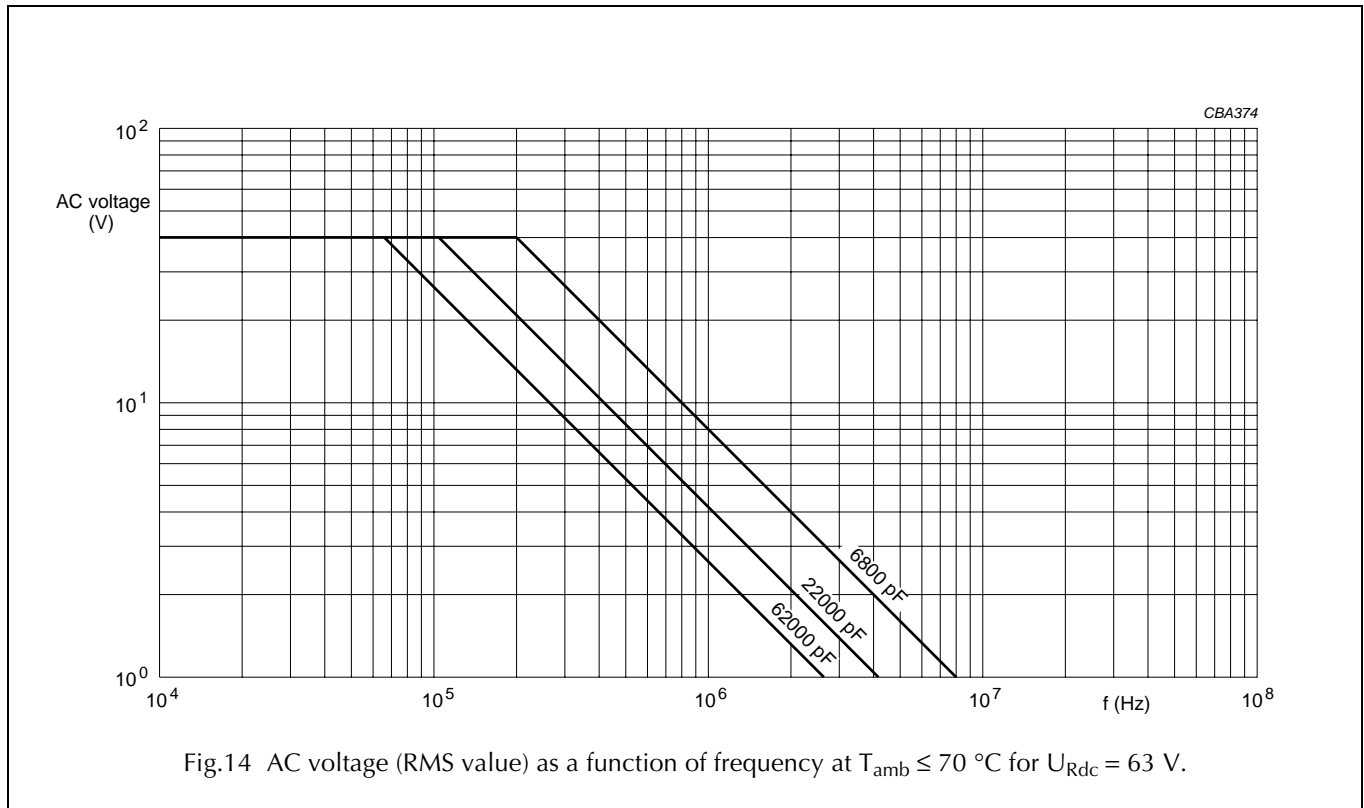
Maximum DC voltage as a function of temperature



Polypropylene film foil capacitors

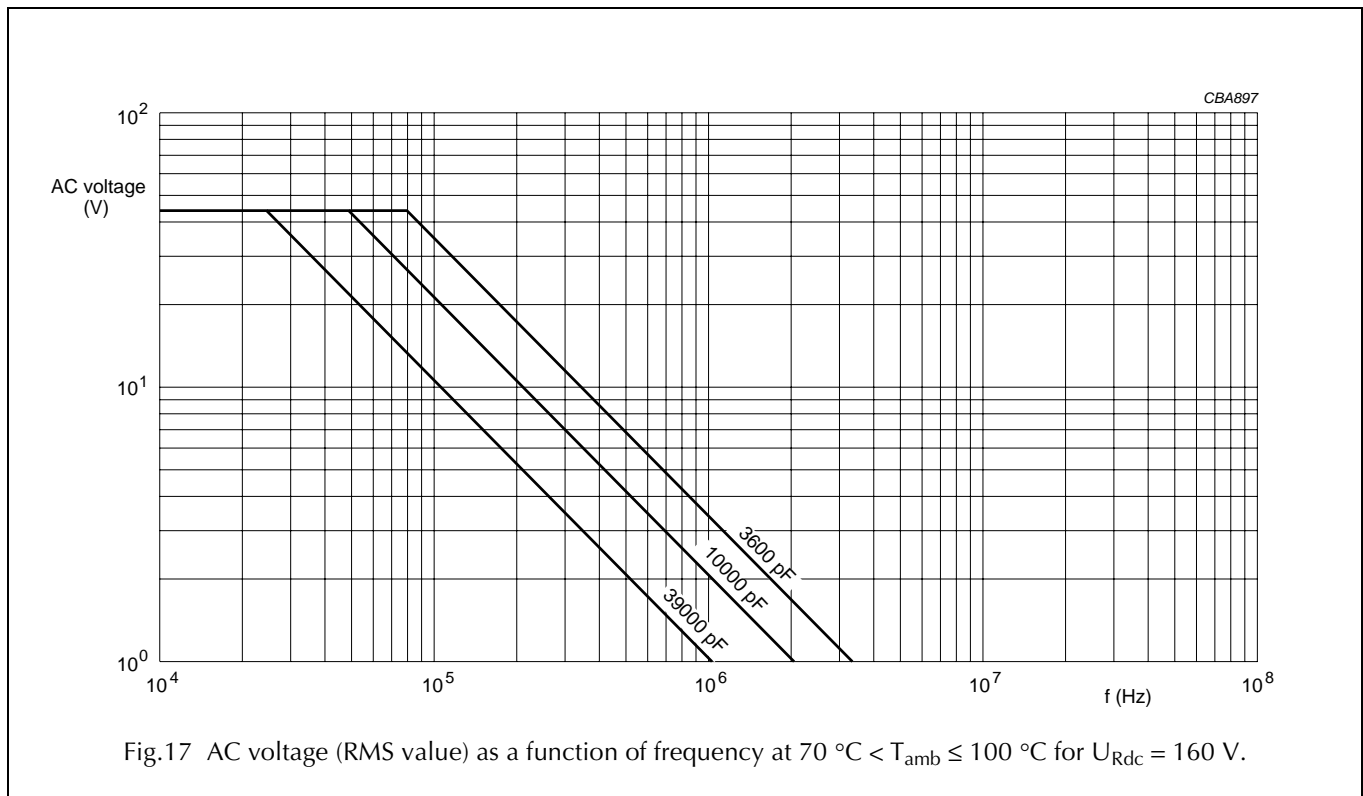
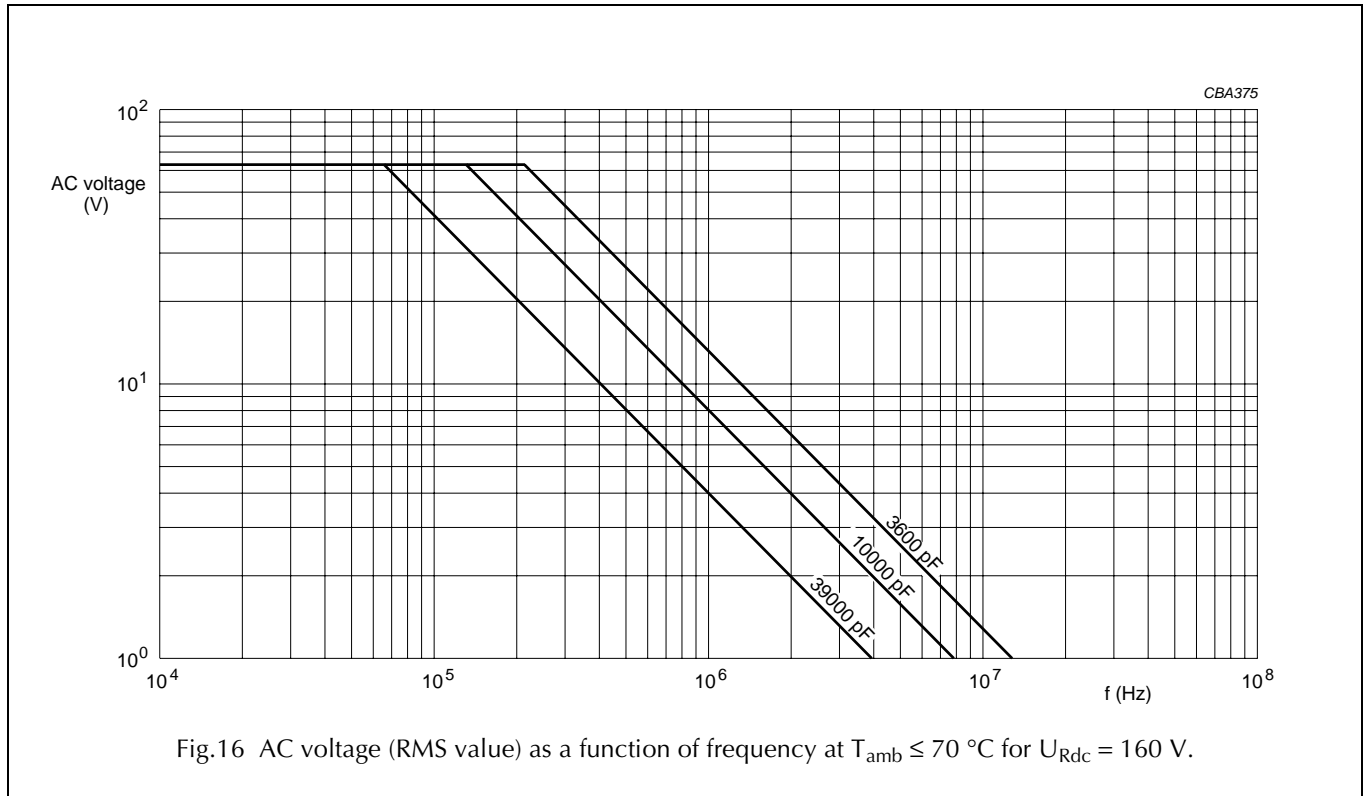
KP 460 to 464

Maximum RMS voltage (sinewave) as a function of frequency



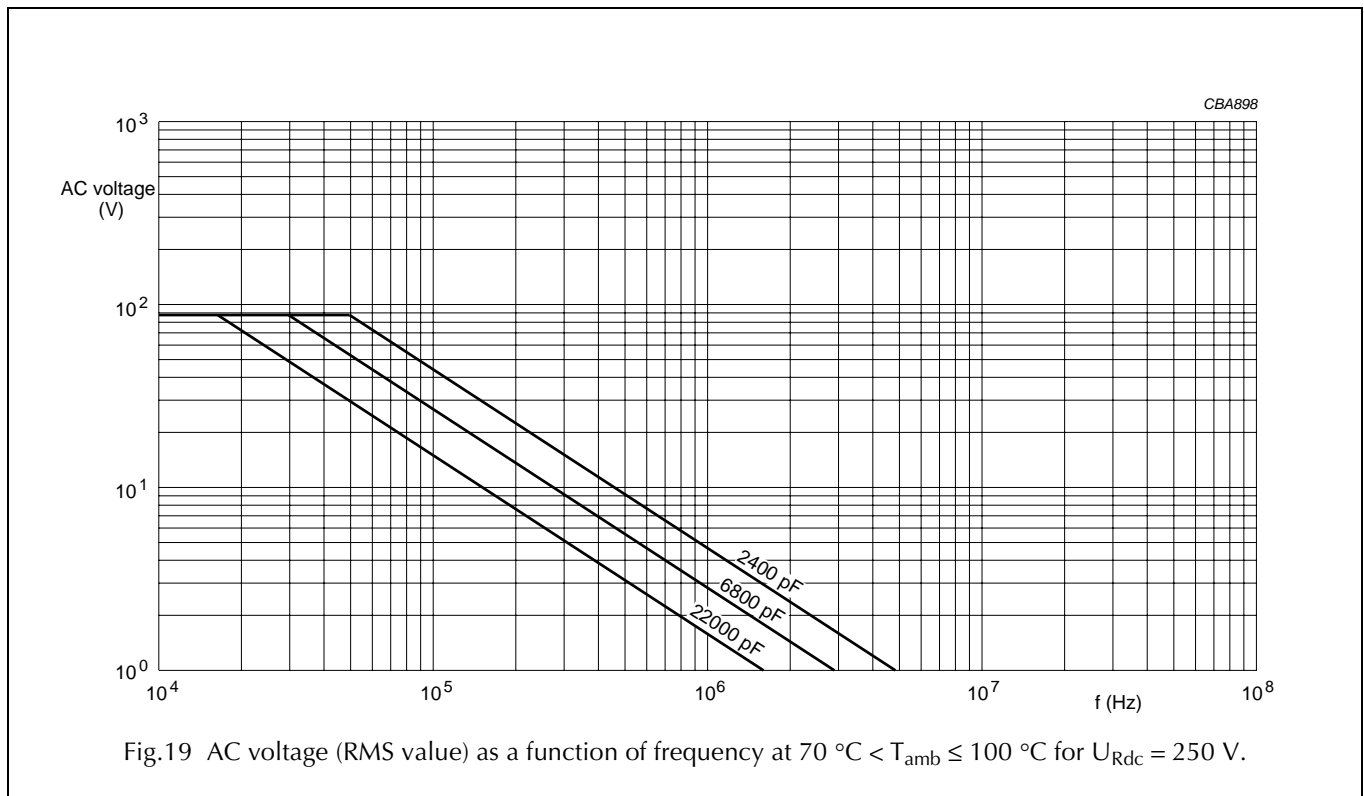
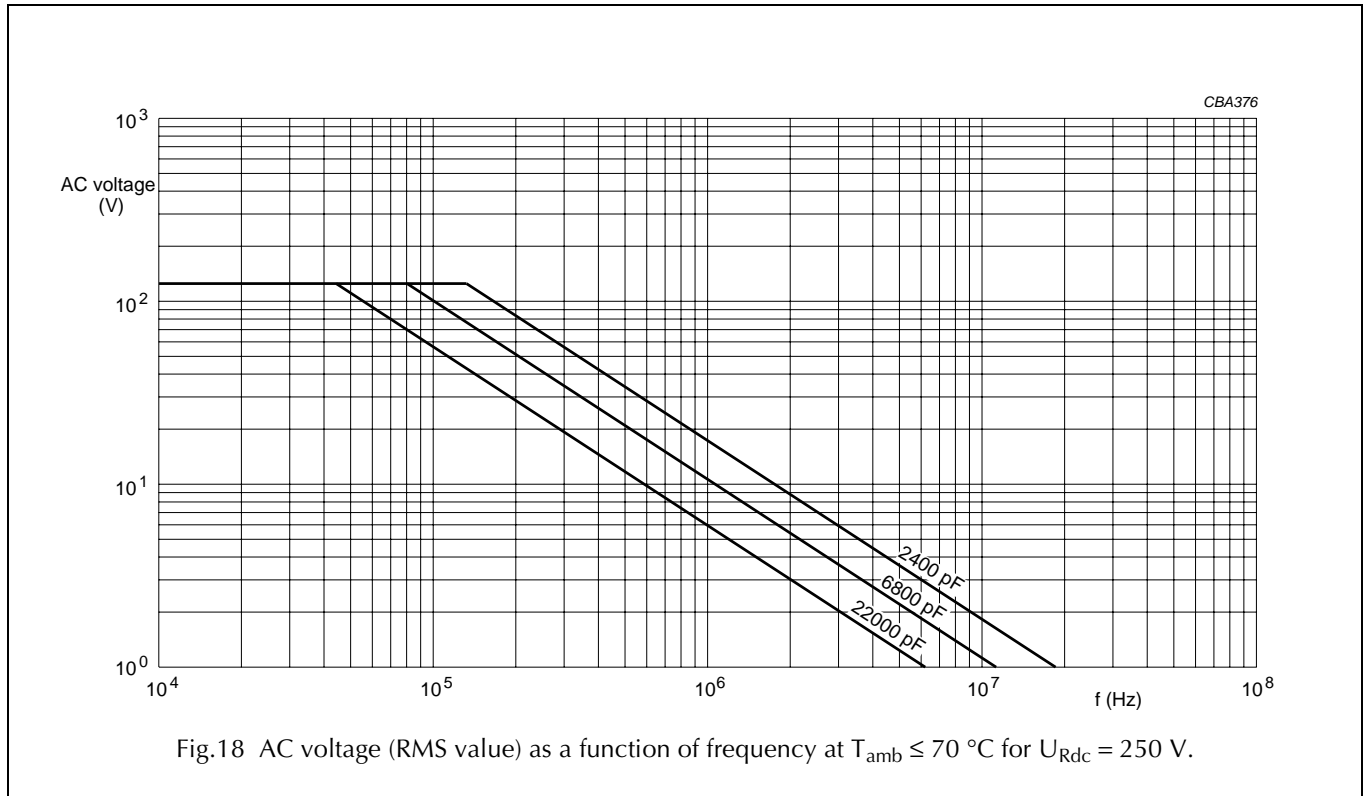
Polypropylene film foil capacitors

KP 460 to 464



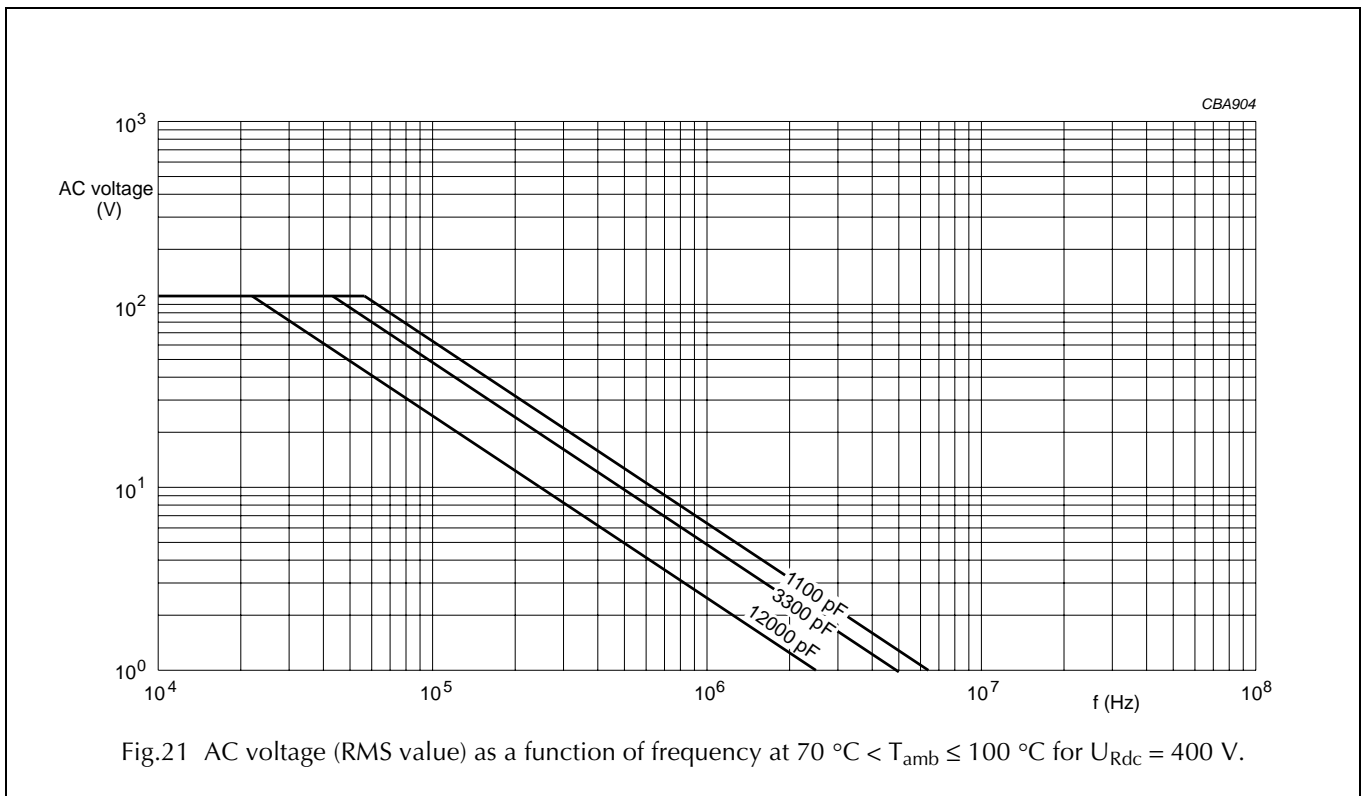
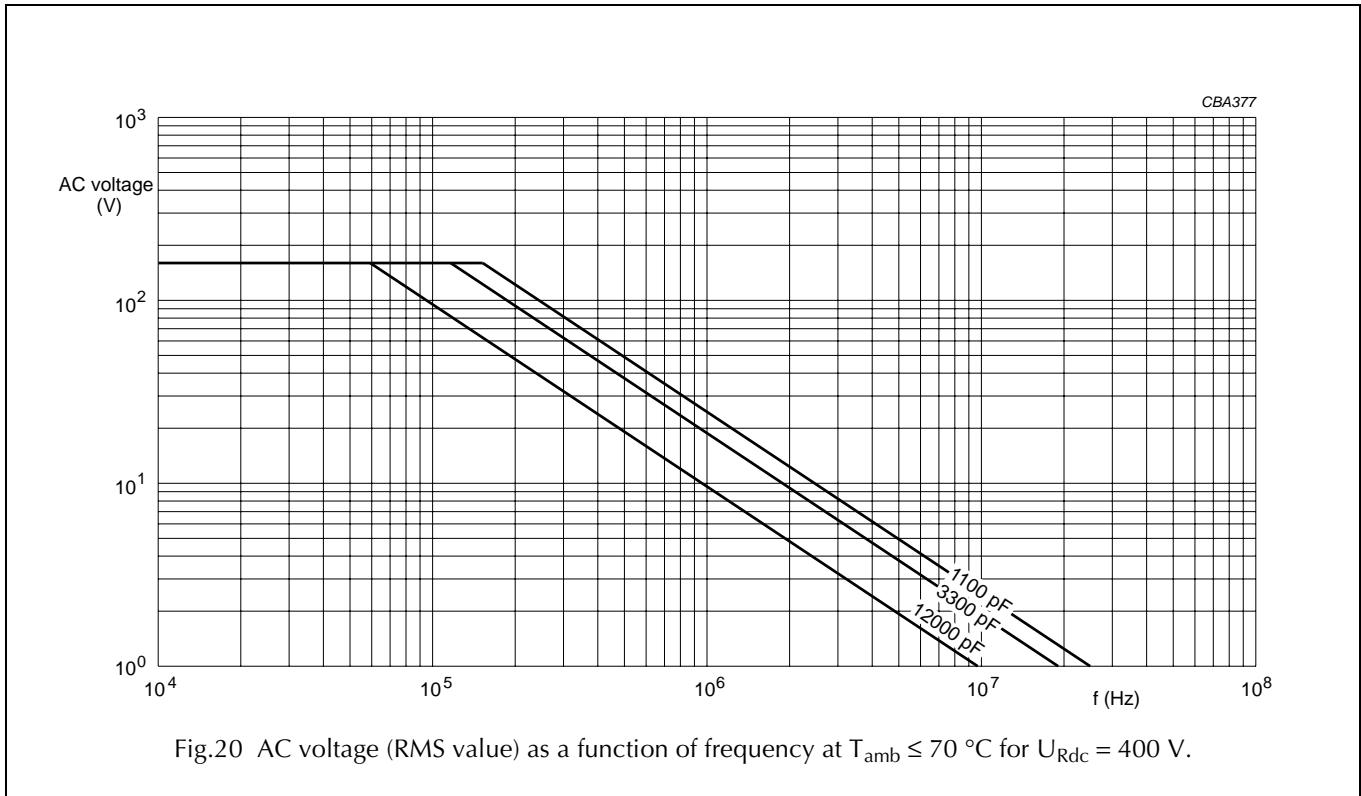
Polypropylene film foil capacitors

KP 460 to 464



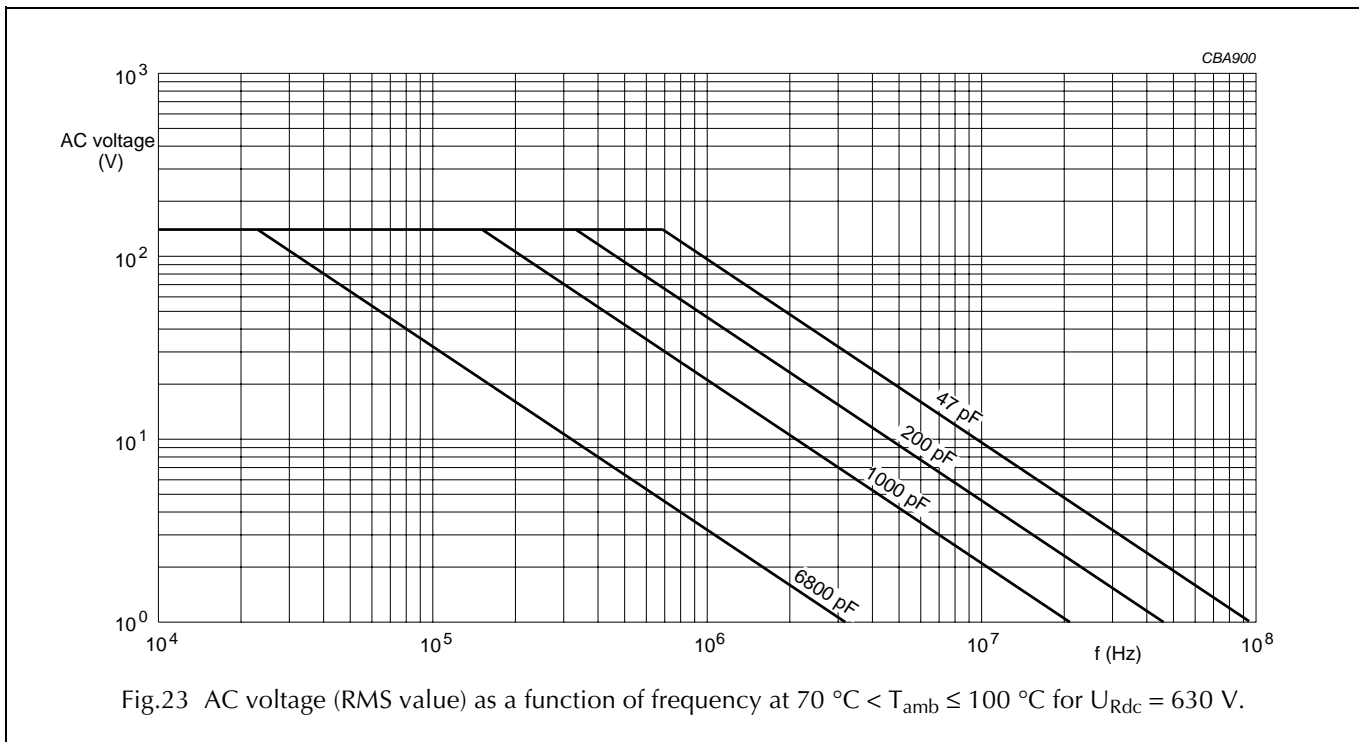
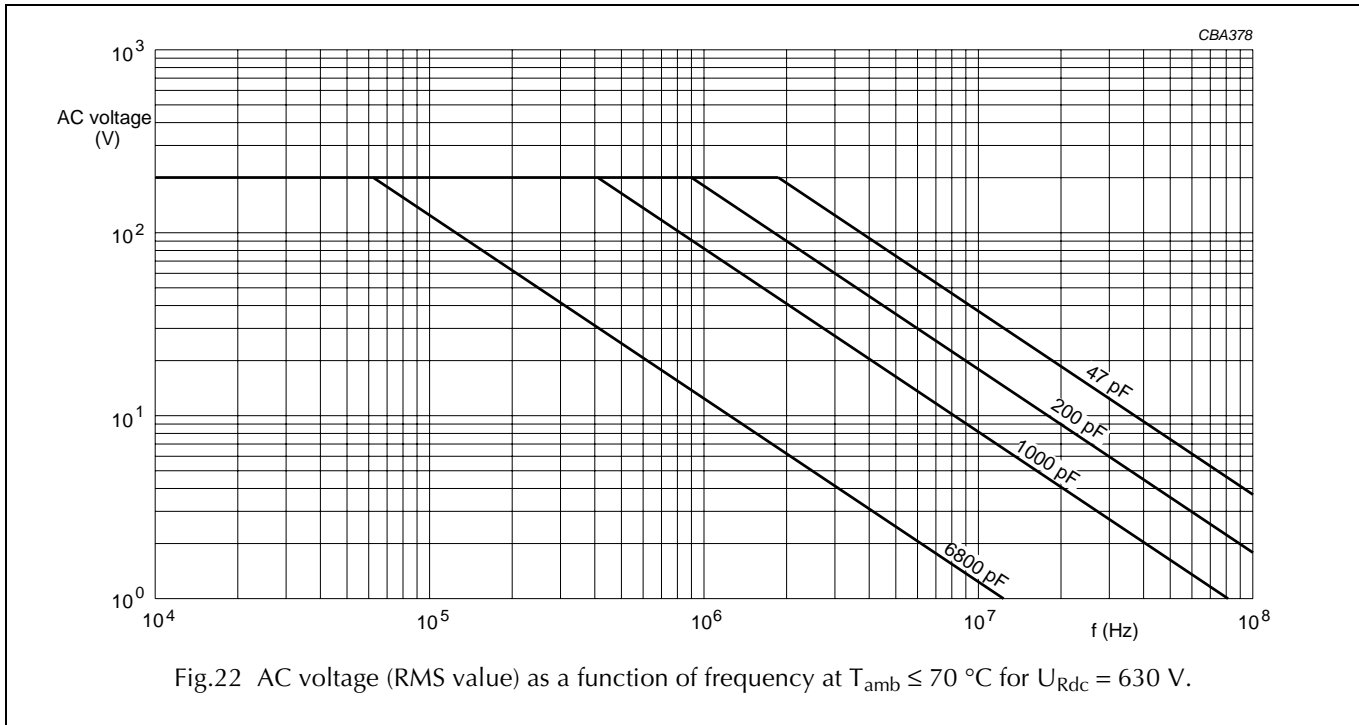
Polypropylene film foil capacitors

KP 460 to 464



Polypropylene film foil capacitors

KP 460 to 464



Maximum RMS current (sinewave) as a function of frequency

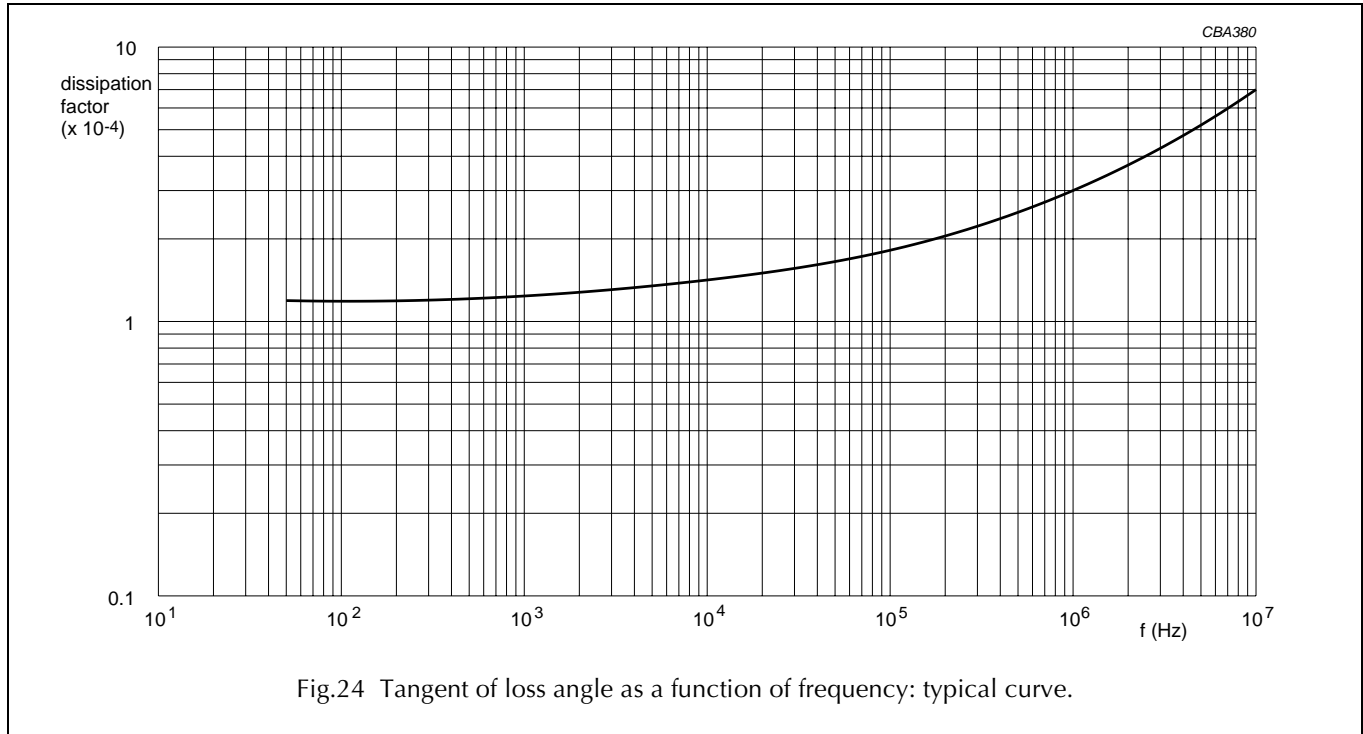
The maximum RMS current is defined by $I_{ac} = \omega \times C \times U_{ac}$.

U_{ac} is the maximum AC voltage depending on the ambient temperature in Figs 14 to 23.

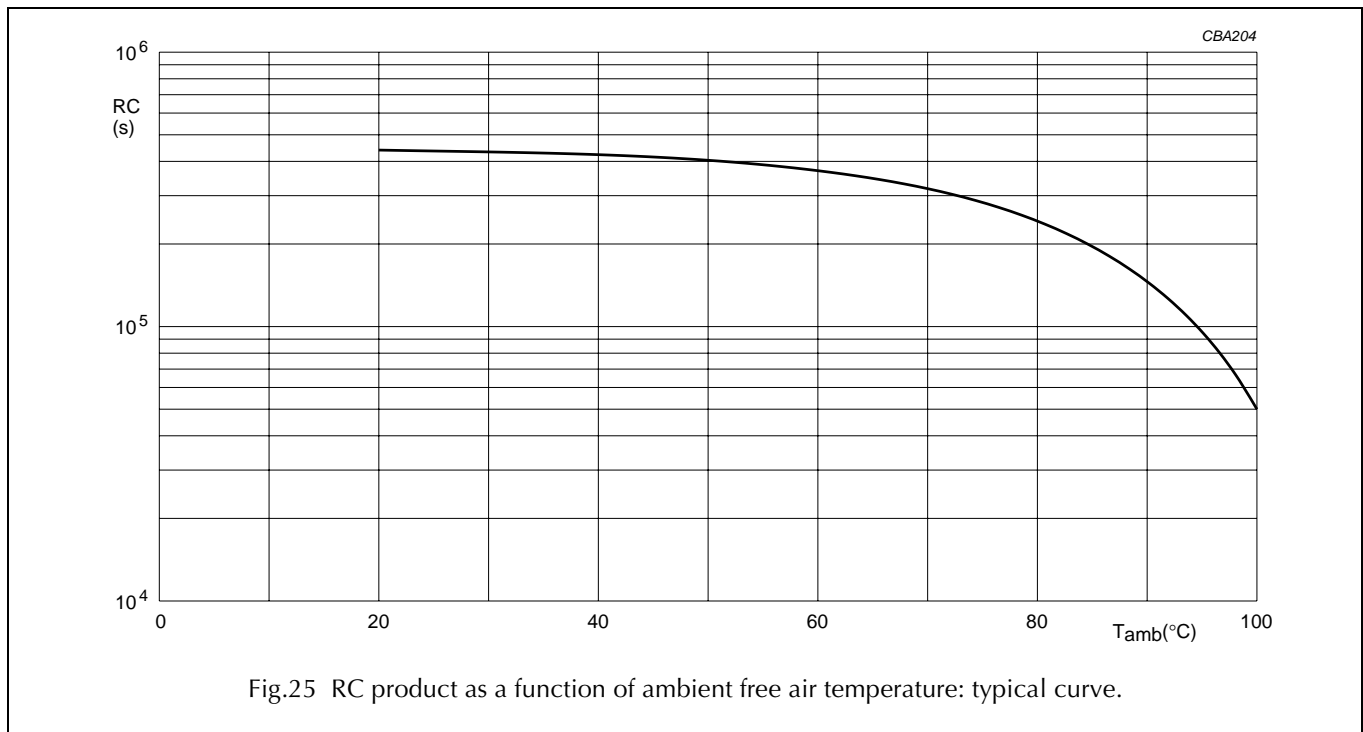
Polypropylene film foil capacitors

KP 460 to 464

Tangent of loss angle



Insulation resistance



Inductance

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

Polypropylene film foil capacitors

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

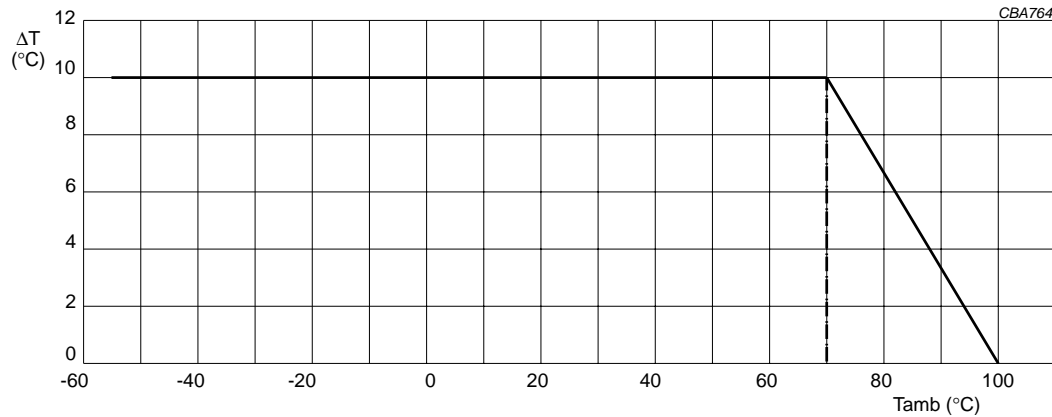


Fig.26 Maximum allowed component temperature rise as a function of the ambient temperature.

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.

The power dissipation can be calculated according 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).

Polypropylene film foil capacitors

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Measuring the component temperature

A thermocouple must be attached to the capacitor body as in Fig.27.

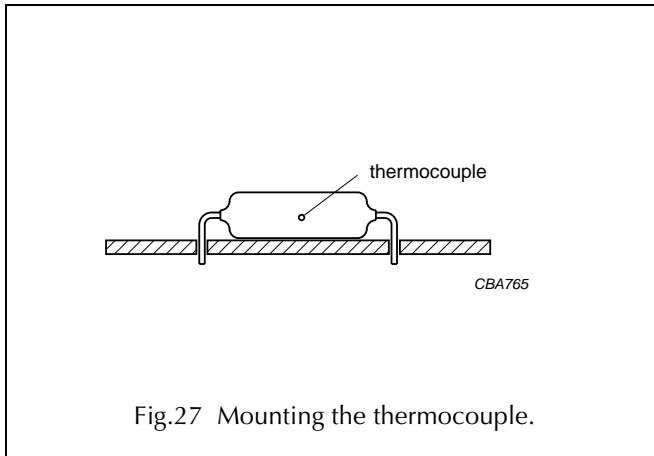


Fig.27 Mounting the thermocouple.

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-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.

4. The maximum component surface temperature rise must be lower than the limits in Fig.26.
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).

Polypropylene film foil capacitors

KP 460 to 464

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 = $\pm 1\%$; G $\pm 2\%$; J = $\pm 5\%$
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)
 BC.

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

Polypropylene film foil capacitors

KP 460 to 464

Package marking

The package containing the capacitors is marked as shown in Fig.28.

Barcode label marking	Barcode label marking																						
<p>BCcomponents MADE IN BELGIUM DC FILM CAPACITOR KP AXIAL EPOXY LACQUERED TYPE 47μF \pm1% 630V= 40/100/56 ULC=0.7 X ULR</p> <p>WO: 12345678</p> <p>ORIG A170 RPC HQ</p> <p>TYPE KP 464</p> <hr/> <p>QTY 250 DATE 0003</p> <p>CODENO 2222 464 44709</p>	<table border="1"> <thead> <tr> <th>LINE</th> <th>MARKING EXPLANATION</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Manufacturer's name</td> </tr> <tr> <td>2</td> <td>Country of origin</td> </tr> <tr> <td>3</td> <td>Sub-family</td> </tr> <tr> <td>4</td> <td>Type description</td> </tr> <tr> <td>5</td> <td>Capacitance value, tolerance, voltage and climatic category ("IEC 60068-1")</td> </tr> <tr> <td>6</td> <td>–</td> </tr> <tr> <td>7</td> <td>Preference origin code: A Country of origin in code: 170 (Belgium) Responsible production centre: HQ Work order: WO</td> </tr> <tr> <td>8</td> <td>Product type description</td> </tr> <tr> <td>9</td> <td>Quantity and production period, year and week code</td> </tr> <tr> <td>10</td> <td>Product code (12NC)</td> </tr> </tbody> </table>	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)
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9	Quantity and production period, year and week code																						
10	Product code (12NC)																						

Fig.28 Barcode label.

Polypropylene film foil capacitors

KP 460 to 464

QUICK REFERENCE TEST REQUIREMENTS

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