

## Polypropylene film foil capacitors

## KP 460 to 464

## KP AXIAL EPOXY LACQUERED TYPE

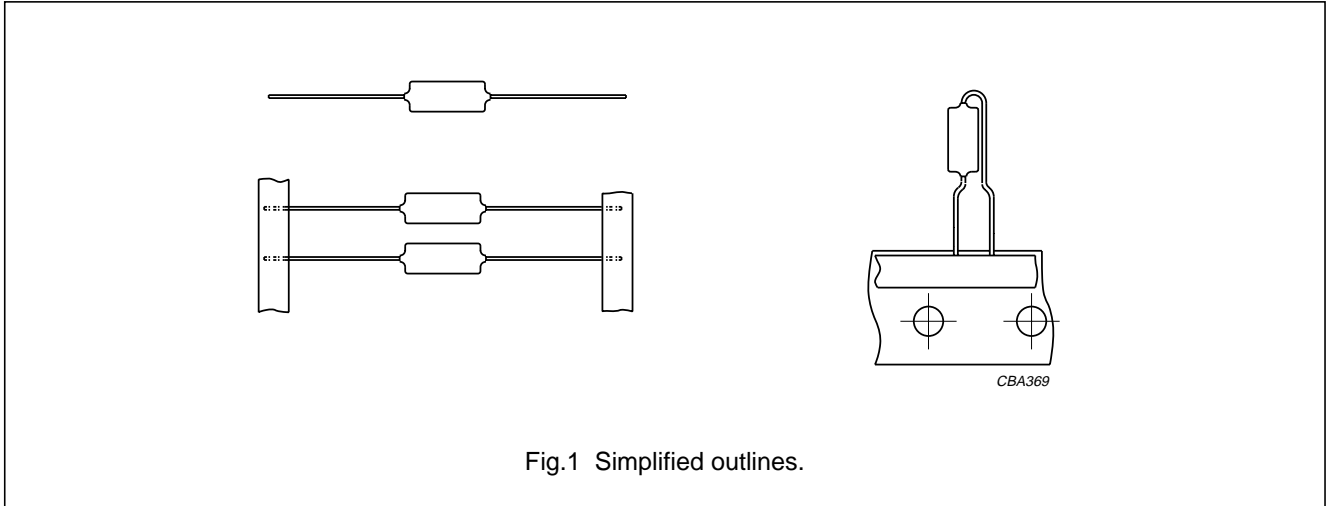


Fig.1 Simplified outlines.

## 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	class 1
400; 630 V versions	class 2

Polypropylene film foil capacitors

KP 460 to 464

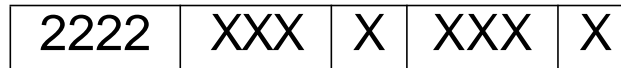
COMPOSITION OF CATALOGUE NUMBER

TYPE AND VOLTAGES	
460	63 V
461	160 V
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

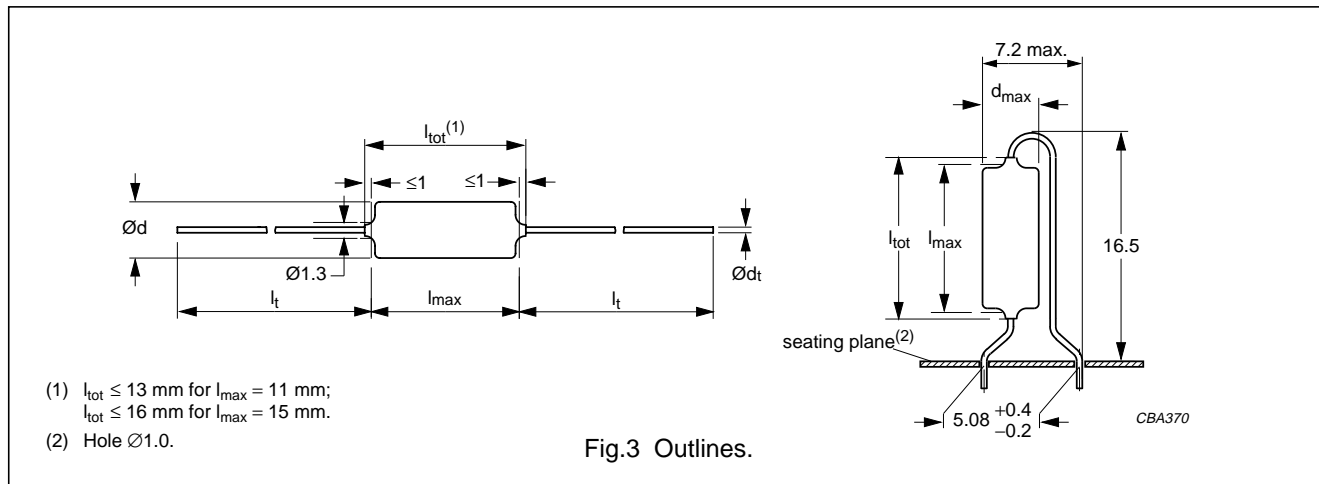


PACKAGING	TAPE DISTANCE	C-TOL	
Taped on reel	tape distance = 63.5 mm	±1%	8
		±2%	7
		±5%	6
Loose in box	lead length 30.0 or 28.0 mm; see tables with catalogue numbers	±1%	4
		±2%	3
		±5%	2
Unidirectional	H = 16.5 mm	±1%	1
		±2%	0

# 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 <sup>-4</sup> ≤ 5 × 10 <sup>-4</sup> ≤ 5 × 10 <sup>-4</sup>	≤ 15 × 10 <sup>-4</sup> ≤ 25 × 10 <sup>-4</sup> ≤ 40 × 10 <sup>-4</sup>
Rated voltage pulse slope (dU/dt) <sub>R</sub> 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

- For SPQ refer to this handbook, chapter "Packaging information".
- For detailed specifications refer to this handbook, chapter "Packaging information".

## Polypropylene film foil capacitors

KP 460

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

C <sup>(1)</sup> (E24) (pF)	DIMENSIONS $d_{max} \times l_{max}$ (mm)	MASS (g)	CATALOGUE NUMBER			
			TAPED ON REEL		UNIDIRECTIONAL	
			TAPE DISTANCE 63.5 mm			
			C-tol = $\pm 2\%$	C-tol = $\pm 1\%$	C-tol = $\pm 2\%$	C-tol = $\pm 1\%$
			catalogue number <sup>(2)</sup>	last 5 digits <sup>(2)</sup>	last 5 digits	last 5 digits
<b><math>l_t = 30.0 \text{ mm}</math>; <math>d_t = 0.60 \pm 0.06 \text{ mm}</math></b>						
6800	5.0 × 11.0	0.5	2222 460 76802	.. 86802	.. 06802	.. 16802
7500		0.5	2222 460 77502	.. 87502	.. 07502	.. 17502
8200		0.6	2222 460 78202	.. 88202	.. 08202	.. 18202
9100		0.6	2222 460 79102	.. 89102	.. 09102	.. 19102
<b><math>l_t = 28.0 \text{ mm}</math>; <math>d_t = 0.60 \pm 0.06 \text{ mm}</math></b>						
10000	6.0 × 15.0	0.6	2222 460 71003	.. 81003		
11000		0.6	2222 460 71103	.. 81103		
12000		0.7	2222 460 71203	.. 81203		
13000		0.8	2222 460 71303	.. 81303		
15000		0.7	2222 460 71503	.. 81503	–	–
16000		0.7	2222 460 71603	.. 81603		
18000		0.8	2222 460 71803	.. 81803		
20000		0.8	2222 460 72003	.. 82003		
22000		0.9	2222 460 72203	.. 82203		
24000		6.5 × 15.0	0.9	2222 460 72403	.. 82403	–
27000	1.0		2222 460 72703	.. 82703		
30000	7.0 × 15.0	1.1	2222 460 73003	.. 83003		
33000		1.2	2222 460 73303	.. 83303	–	–
36000		1.2	2222 460 73603	.. 83603		
39000	7.5 × 15.0	1.3	2222 460 73903	.. 83903	–	–
43000		1.4	2222 460 74303	.. 84303		
47000	8.0 × 15.0	1.5	2222 460 74703	.. 84703	–	–
51000		1.6	2222 460 75103	.. 85103		
56000	8.5 × 15.0	1.7	2222 460 75603	.. 85603	–	–
62000		1.8	2222 460 76203	.. 86203		

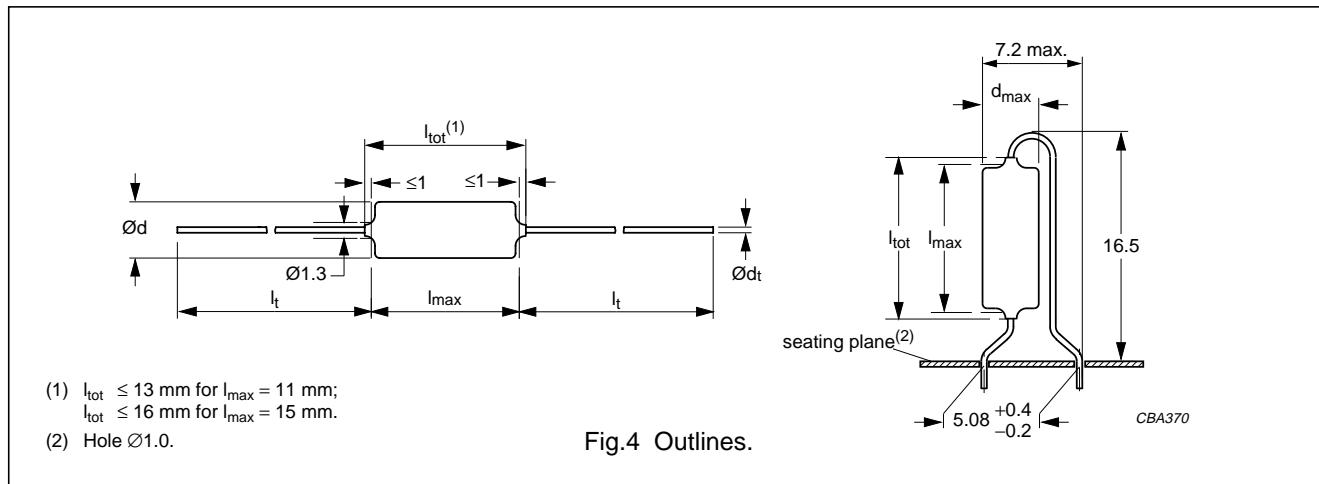
## Notes

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

# Polypropylene film foil capacitors

KP 461

## KP 461 GENERAL DATA



### 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 5000 pF < C ≤ 20000 pF 20000 pF < C ≤ 39000 pF	≤ 5 × 10 <sup>-4</sup> ≤ 5 × 10 <sup>-4</sup> ≤ 5 × 10 <sup>-4</sup>	≤ 10 × 10 <sup>-4</sup> ≤ 15 × 10 <sup>-4</sup> ≤ 25 × 10 <sup>-4</sup>
Rated voltage pulse slope (dU/dt) <sub>R</sub> 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 ammpack	52.5; note 2
	63.5; note 2
Taped on reel	52.5; note 2

### Notes

- For SPQ refer to this handbook, chapter "Packaging information".
- For detailed specifications refer to this handbook, chapter "Packaging information".

## Polypropylene film foil capacitors

KP 461

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

C <sup>(1)</sup> (E24) (pF)	DIMENSIONS $d_{max} \times l_{max}$ (mm)	MASS (g)	CATALOGUE NUMBER			
			TAPED ON REEL		UNIDIRECTIONAL	
			TAPE DISTANCE 63.5 mm			
			C-tol = $\pm 2\%$	C-tol = $\pm 1\%$	C-tol = $\pm 2\%$	C-tol = $\pm 1\%$
			catalogue number <sup>(2)</sup>	last 5 digits <sup>(2)</sup>	last 5 digits	last 5 digits
<b><math>l_t = 30.0 \text{ mm}</math>; <math>d_t = 0.60 \pm 0.06 \text{ mm}</math></b>						
3600	5.0 × 11.0	0.5	2222 461 73602	.. 83602	.. 03602	.. 13602
3900		0.5	2222 461 73902	.. 83902	.. 03902	.. 13902
4300		0.5	2222 461 74302	.. 84302	.. 04302	.. 14302
4700		0.5	2222 461 74702	.. 84702	.. 04702	.. 14702
5100		0.5	2222 461 75102	.. 85102	.. 05102	.. 15102
5600		0.5	2222 461 75602	.. 85602	.. 05602	.. 15602
6200		0.6	2222 461 76202	.. 86202	.. 06202	.. 16202
<b><math>l_t = 28.0 \text{ mm}</math>; <math>d_t = 0.60 \pm 0.06 \text{ mm}</math></b>						
6800	6.0 × 15.0	0.4	2222 461 76802	.. 86802		
7500		0.7	2222 461 77502	.. 87502		
8200		0.6	2222 461 78202	.. 88202		
9100		0.6	2222 461 79102	.. 89102		
10000		0.7	2222 461 71003	.. 81003	–	–
11000		0.7	2222 461 71103	.. 81103		
12000		0.7	2222 461 71203	.. 81203		
13000		0.8	2222 461 71303	.. 81303		
15000	0.8	2222 461 71503	.. 81503			
16000	6.5 × 15.0	0.9	2222 461 71603	.. 81603		
18000		0.9	2222 461 71803	.. 81803	–	–
20000		1.0	2222 461 72003	.. 82003		
22000	7.0 × 15.0	1.1	2222 461 72203	.. 82203	–	–
24000		1.1	2222 461 72403	.. 82403		
27000	7.5 × 15.0	1.2	2222 461 72703	.. 82703	–	–
30000	8.0 × 15.0	1.3	2222 461 73003	.. 83003	–	–
33000		1.4	2222 461 73303	.. 83303		
36000	8.5 × 15.0	1.5	2222 461 73603	.. 83603	–	–
39000		1.6	2222 461 73903	.. 83903		

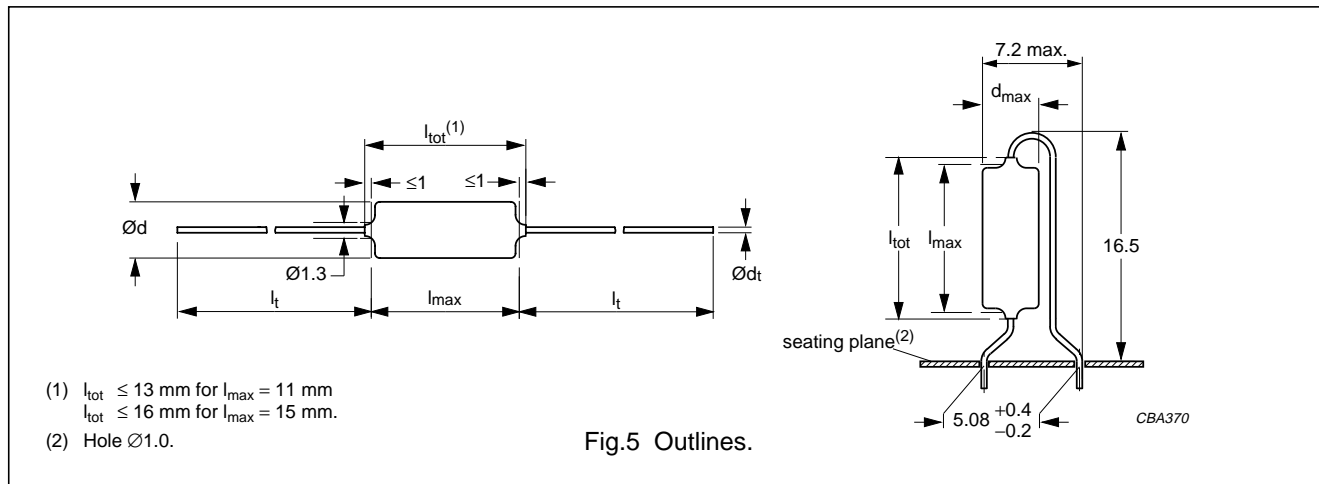
## Notes

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

# Polypropylene film foil capacitors

KP 462

## KP 462 GENERAL DATA



### 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 5 000 pF < C ≤ 20000 pF 20 000 pF < C ≤ 22000 pF	≤ 5 × 10 <sup>-4</sup> ≤ 5 × 10 <sup>-4</sup> ≤ 5 × 10 <sup>-4</sup>	≤ 10 × 10 <sup>-4</sup> ≤ 15 × 10 <sup>-4</sup> ≤ 25 × 10 <sup>-4</sup>
Rated voltage pulse slope (dU/dt) <sub>R</sub> 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

- For SPQ refer to this handbook, chapter "Packaging information".
- For detailed specifications refer to this handbook, chapter "Packaging information".

## Polypropylene film foil capacitors

KP 462

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

C <sup>(1)</sup> (E24) (pF)	DIMENSIONS $d_{max} \times l_{max}$ (mm)	MASS (g)	CATALOGUE NUMBER				
			TAPED ON REEL		UNIDIRECTIONAL		
			TAPE DISTANCE 63.5 mm				
			C-tol = $\pm 2\%$	C-tol = $\pm 1\%$	C-tol = $\pm 2\%$	C-tol = $\pm 1\%$	
			catalogue number <sup>(2)</sup>	last 5 digits <sup>(2)</sup>	last 5 digits	last 5 digits	
<b><math>l_t = 30.0 \text{ mm}</math>; <math>d_t = 0.60 \pm 0.06 \text{ mm}</math></b>							
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	
<b><math>l_t = 28.0 \text{ mm}</math>; <math>d_t = 0.60 \pm 0.06 \text{ mm}</math></b>							
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

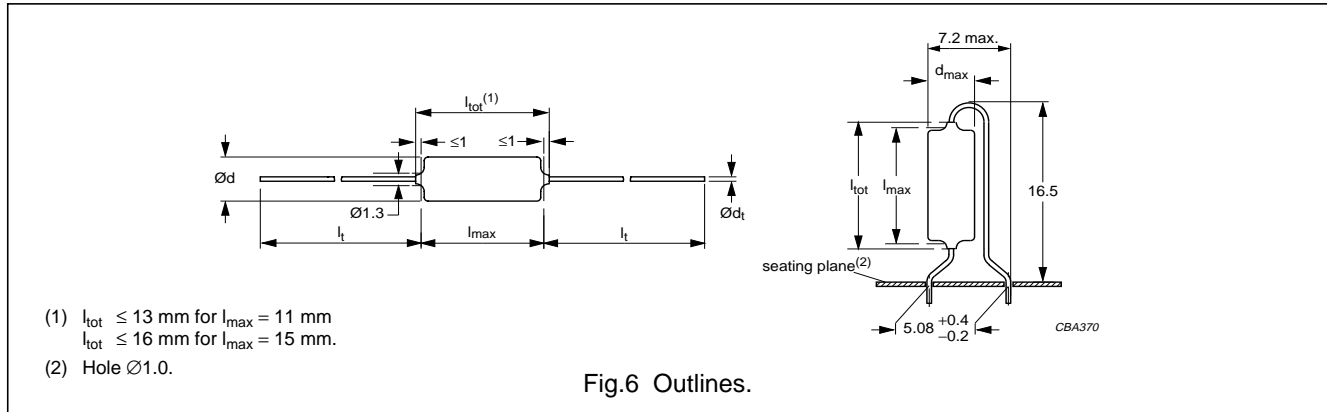
- In addition to the values of the E24 series as quoted, intermediate values are available of the E48 series (with a tolerance of  $\pm 2\%$  or  $\pm 1\%$ ) and the E96 series (with a tolerance of  $\pm 1\%$ ). The specifications of these intermediate values are equal to the specifications of the next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



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 1 MHz <sup>(1)</sup>
Tangent of loss angle: $C \leq 1000 \text{ pF}$ $1000 \text{ pF} < C \leq 5000 \text{ pF}$	$\leq 5 \times 10^{-4}$ $\leq 5 \times 10^{-4}$	– $\leq 10 \times 10^{-4}$	$\leq 10 \times 10^{-4}$ –
Rated voltage pulse slope $(dU/dt)_R$ at 400 V (DC)	10000 V/ $\mu$ s		
R between leads; at 100 V; 1 minute	$>100000 \text{ M}\Omega$		
R between interconnected leads and case; 100 V; 1 minute	$>100000 \text{ M}\Omega$		
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	$\pm 1\%$	2222 463 8....	preferred
	$\pm 2\%$	2222 463 7....	preferred
	$\pm 5\%$	2222 463 6....	on request
Loose in box; note 1	$\pm 1\%$	2222 463 4....	on request
	$\pm 2\%$	2222 463 3....	on request
	$\pm 5\%$	2222 463 2....	on request
Unidirectional; notes 1 and 2	$\pm 1\%$	2222 463 1....	on request
	$\pm 2\%$	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

- For SPQ refer to this handbook, chapter "Packaging information".
- For detailed specifications refer to this handbook, chapter "Packaging information".

## Polypropylene film foil capacitors

KP 463

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

C <sup>(1)</sup> (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 <sup>(2)</sup>	last 5 digits <sup>(2)</sup>	last 5 digits	last 5 digits
<b><math>l_t = 30.0 \text{ mm}</math>; <math>d_t = 0.60 \pm 0.06 \text{ mm}</math></b>						
620	5.0 × 11.0	0.5	2222 463 76201	.. 86201	.. 06201	.. 16201
680		0.5	2222 463 76801	.. 86801	.. 06801	.. 16801
750		0.5	2222 463 77501	.. 87501	.. 07501	.. 17501
820		0.5	2222 463 78201	.. 88201	.. 08201	.. 18201
910		0.5	2222 463 79101	.. 89101	.. 09101	.. 19101
1000		0.5	2222 463 71002	.. 81002	.. 01002	.. 11002
1100		0.5	2222 463 71102	.. 81102	.. 01102	.. 11102
<b><math>l_t = 28.0 \text{ mm}</math>; <math>d_t = 0.60 \pm 0.06 \text{ mm}</math></b>						
1200	6.0 × 15.0	0.5	2222 463 71202	.. 81202		
1300		0.5	2222 463 71302	.. 81302		
1500		0.5	2222 463 71502	.. 81502		
1600		0.5	2222 463 71602	.. 81602	–	–
1800		0.5	2222 463 71802	.. 81802		
2000		0.5	2222 463 72002	.. 82002		
2200	6.5 × 15.0	0.5	2222 463 72202	.. 82202		
2400		0.5	2222 463 72402	.. 82402		
2700		0.6	2222 463 72702	.. 82702	–	–
3000		0.7	2222 463 73002	.. 83002		
3300	7.0 × 15.0	0.7	2222 463 73302	.. 83302		
3600		0.7	2222 463 73602	.. 83602	–	–
3900		0.8	2222 463 73902	.. 83902		
4300	7.5 × 15.0	0.8	2222 463 74302	.. 84302		
4700		0.9	2222 463 74702	.. 84702	–	–
5100		0.9	2222 463 75102	.. 85102		
5600	8.0 × 15.0	1.0	2222 463 75602	.. 85602	–	–
6200		1.0	2222 463 76202	.. 86202		
6800	8.5 × 15.0	1.1	2222 463 76802	.. 86802		
7500		1.2	2222 463 77502	.. 87502	–	–
8200		1.3	2222 463 78202	.. 88202		

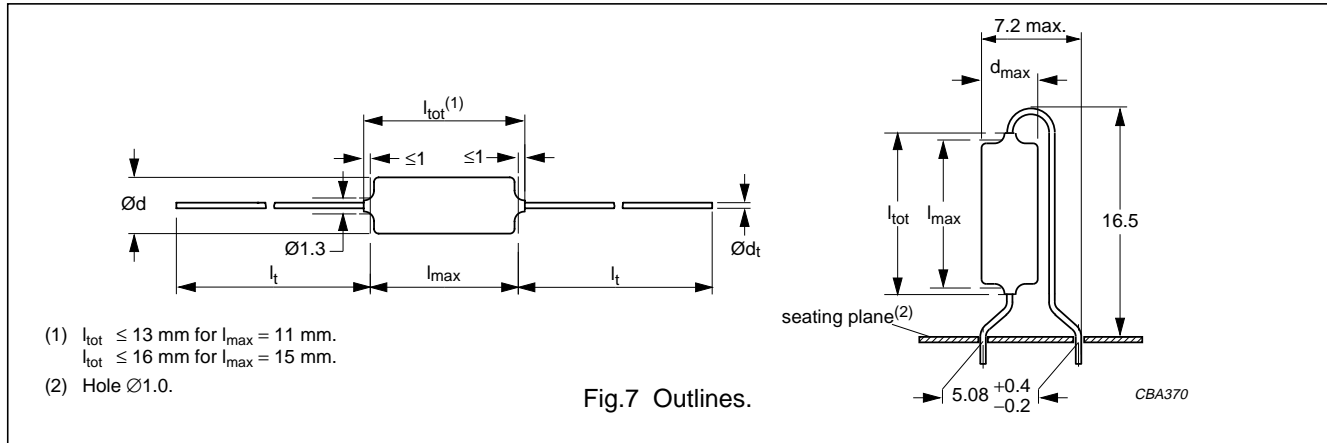
## Notes

- 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.
- The shading indicates preferred types.

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 1 MHz <sup>(1)</sup>
Tangent of loss angle: $C \leq 560 \text{ pF}$	$\leq 5 \times 10^{-4}$	$\leq 10 \times 10^{-4}$
Rated voltage pulse slope $(dU/dt)_R$ at 630 V (DC)	10000 V/ $\mu\text{s}$	
R between leads; at 500 V; 1 minute	$>100000 \text{ M}\Omega$	
R between interconnected leads and case; 500 V; 1 minute	$>100000 \text{ M}\Omega$	
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; notes 1 and 2	$\pm 1\%$	2222 464 8....	preferred
	$\pm 2\%$	2222 464 7....	preferred
	$\pm 5\%$	2222 464 6....	on request
Loose in box; note 1	$\pm 1\%$	2222 464 4....	on request
	$\pm 2\%$	2222 464 3....	on request
	$\pm 5\%$	2222 464 2....	on request
Unidirectional; notes 1 and 2	$\pm 1\%$	2222 464 1....	on request
	$\pm 2\%$	2222 464 0....	on request

Available on request

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

Notes

- For SPQ refer to this handbook, chapter "Packaging information".
- For detailed specifications refer to this handbook, chapter "Packaging information".

## Polypropylene film foil capacitors

KP 464

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

C <sup>(1)</sup> (E24) (pF)	DIMENSIONS $d_{max} \times l_{max}$ (mm)	MASS (g)	CATALOGUE NUMBER			
			TAPED ON REEL		UNIDIRECTIONAL	
			TAPE DISTANCE 63.5 mm			
			C-tol = $\pm 2\%$	C-tol = $\pm 1\%$	C-tol = $\pm 2\%$	C-tol = $\pm 1\%$
			catalogue number <sup>(2)</sup>	last 5 digits <sup>(2)</sup>	last 5 digits	last 5 digits
$l_t = 30.0 \text{ mm}$ ; $d_t = 0.60 \pm 0.06 \text{ mm}$						
47	5.0 × 11.0	0.4	2222 464 74709	.. 84709	.. 04709	.. 14709
51		0.4	2222 464 75109	.. 85109	.. 05109	.. 15109
56		0.4	2222 464 75609	.. 85609	.. 05609	.. 15609
62		0.4	2222 464 76209	.. 86209	.. 06209	.. 16209
68		0.4	2222 464 76809	.. 86809	.. 06809	.. 16809
75		0.4	2222 464 77509	.. 87509	.. 07509	.. 17509
82		0.4	2222 464 78209	.. 88209	.. 08209	.. 18209
91		0.4	2222 464 79109	.. 89109	.. 09109	.. 19109
100		0.4	2222 464 71001	.. 81001	.. 01001	.. 11001
110		0.4	2222 464 71101	.. 81101	.. 01101	.. 11101
120		0.4	2222 464 71201	.. 81201	.. 01201	.. 11201
130		0.5	2222 464 71301	.. 81301	.. 01301	.. 11301
150		0.4	2222 464 71501	.. 81501	.. 01501	.. 11501
160		0.4	2222 464 71601	.. 81601	.. 01601	.. 11601
180		0.5	2222 464 71801	.. 81801	.. 01801	.. 11801
200		0.5	2222 464 72001	.. 82001	.. 02001	.. 12001
220		0.6	2222 464 72201	.. 82201	.. 02201	.. 12201
240		0.6	2222 464 72401	.. 82401	.. 02401	.. 12401
270		0.6	2222 464 72701	.. 82701	.. 02701	.. 12701
300		0.7	2222 464 73001	.. 83001	.. 03001	.. 13001
330		0.4	2222 464 73301	.. 83301	.. 03301	.. 13301
360		0.4	2222 464 73601	.. 83601	.. 03601	.. 13601
390		0.5	2222 464 73901	.. 83901	.. 03901	.. 13901
430		0.5	2222 464 74301	.. 84301	.. 04301	.. 14301
470		0.5	2222 464 74701	.. 84701	.. 04701	.. 14701
510		0.5	2222 464 75101	.. 85101	.. 05101	.. 15101
560		0.5	2222 464 75601	.. 85601	.. 05601	.. 15601

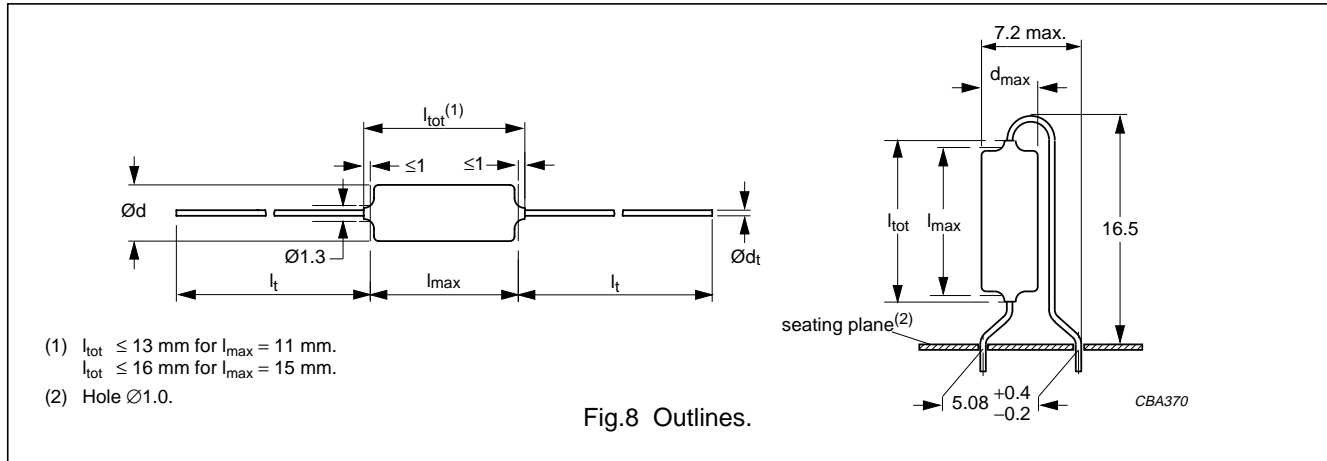
## Notes

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

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: $C \leq 1000 \text{ pF}$ $1000 \text{ pF} < C \leq 4700 \text{ pF}$	$\leq 5 \times 10^{-4}$ $\leq 5 \times 10^{-4}$	– $\leq 15 \times 10^{-4}$	$\leq 10 \times 10^{-4}$ –
Rated voltage pulse slope (dU/dt)R at 630 V (DC)	10000 V/ $\mu$ s		
R between leads; at 500 V; 1 minute	$>100000 \text{ M}\Omega$		
R between interconnected leads and case; 500 V; 1 minute	$>100000 \text{ M}\Omega$		
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	$\pm 1\%$	2222 464 8....	preferred
	$\pm 2\%$	2222 464 7....	preferred
	$\pm 5\%$	2222 464 6....	on request
Loose in box; note 1	$\pm 1\%$	2222 464 4....	on request
	$\pm 2\%$	2222 464 3....	on request
	$\pm 5\%$	2222 464 2....	on request
Unidirectional; notes 1 and 2	$\pm 1\%$	2222 464 1....	on request
	$\pm 2\%$	2222 464 0....	on request

Available on request

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

Notes

- For SPQ refer to this handbook, chapter "Packaging information".
- For detailed specifications refer to this handbook, chapter "Packaging information".

## Polypropylene film foil capacitors

KP464

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

C <sup>(1)</sup> (E 24) (pF)	DIMENSIONS $d_{max} \times l_{max}$ (mm)	MASS (g)	CATALOGUE NUMBER	
			TAPED ON REEL	
			TAPE DISTANCE 63.5 mm	
			C-tol = $\pm 2\%$	C-tol = $\pm 1\%$
			catalogue number <sup>(2)</sup>	last 5 digits <sup>(2)</sup>
<b><math>l_t = 28.0 \text{ mm}</math>; <math>d_t = 0.60 \pm 0.06 \text{ mm}</math></b>				
620	6.0 × 15.0	0.5	2222 464 <b>76201</b>	.. 86201
680		0.5	2222 464 <b>76801</b>	.. 86801
750		0.5	2222 464 <b>77501</b>	.. 87501
820		0.5	2222 464 <b>78201</b>	.. 88201
910		0.5	2222 464 <b>79101</b>	.. 89101
1000		0.5	2222 464 <b>71002</b>	.. 81002
1100		0.5	2222 464 <b>71102</b>	.. 81102
1200		0.5	2222 464 <b>71202</b>	.. 81202
1300	6.5 × 15.0	0.6	2222 464 <b>71302</b>	.. 81302
1500		0.6	2222 464 <b>71502</b>	.. 81502
1600		0.7	2222 464 <b>71602</b>	.. 81602
1800		0.7	2222 464 <b>71802</b>	.. 81802
2000	7.0 × 15.0	0.8	2222 464 <b>72002</b>	.. 82002
2200		0.9	2222 464 <b>72202</b>	.. 82202
2400		0.9	2222 464 <b>72402</b>	.. 82402
2700	7.5 × 15.0	0.9	2222 464 <b>72702</b>	.. 82702
3000		1.0	2222 464 <b>73002</b>	.. 83002
3300	8.0 × 15.0	1.1	2222 464 <b>73302</b>	.. 83302
3600		1.2	2222 464 <b>73602</b>	.. 83602
3900		1.3	2222 464 <b>73902</b>	.. 83902
4300	8.5 × 15.0	1.4	2222 464 <b>74302</b>	.. 84302
4700		1.5	2222 464 <b>74702</b>	.. 84702

## Notes

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

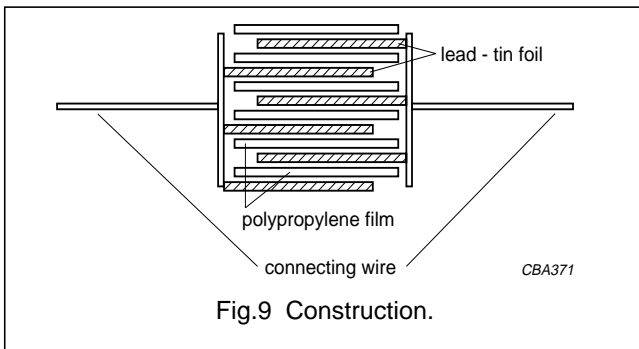
# Polypropylene film foil capacitors

# 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.



### 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.

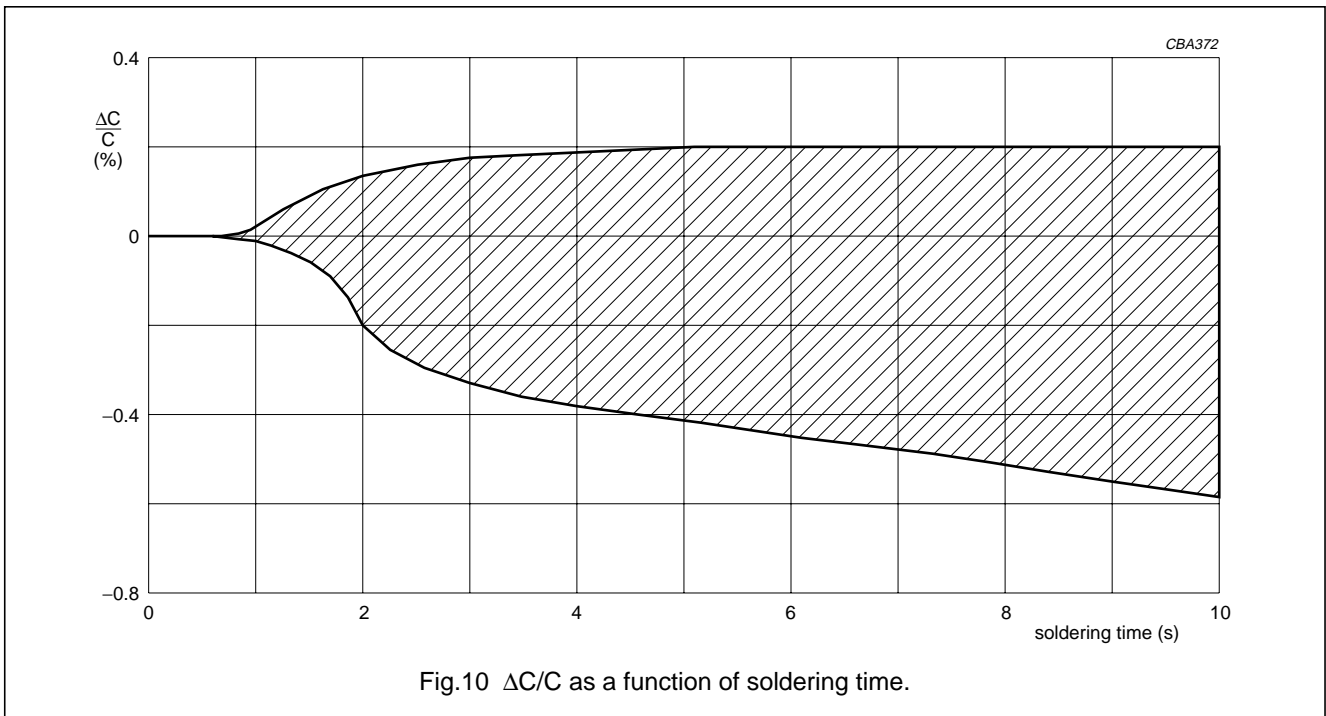
### Storage temperature

- 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  $23 \pm 1$  °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  $96 \pm 4$  hours by heating the products in a circulating air oven at the rated temperature and a relative humidity not exceeding 20%.



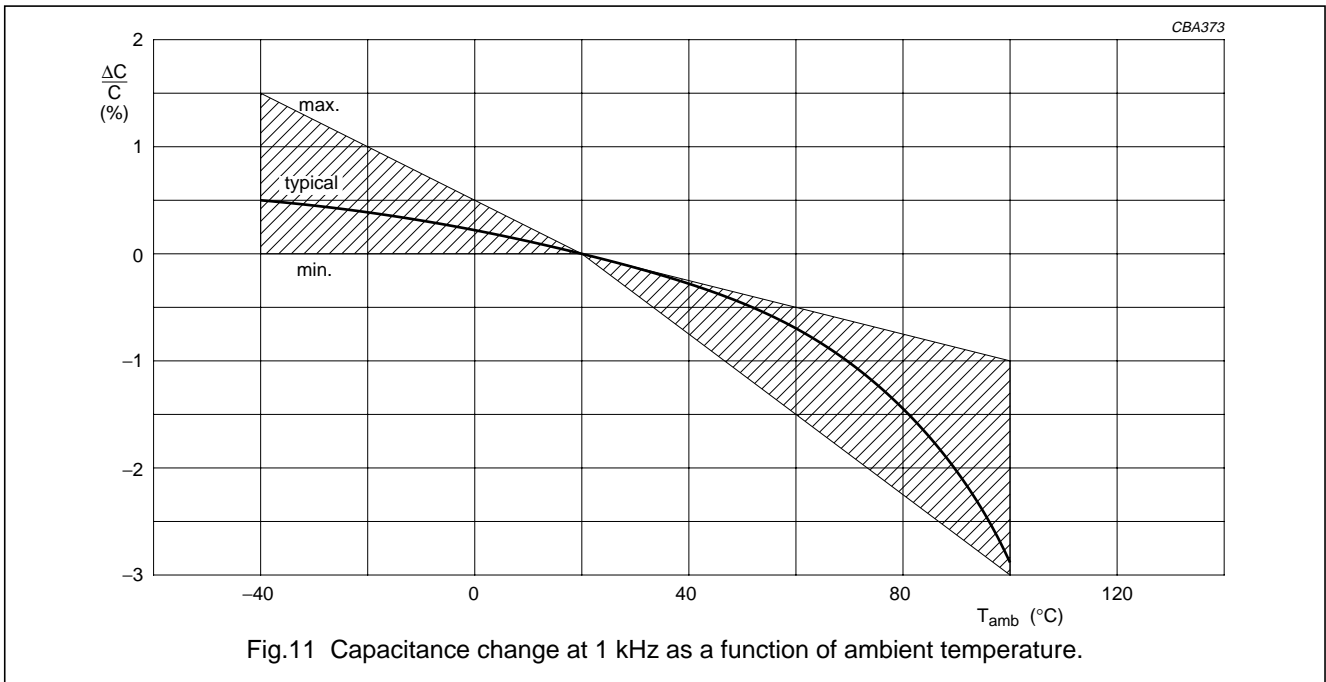
Polypropylene film foil capacitors

KP 460 to 464

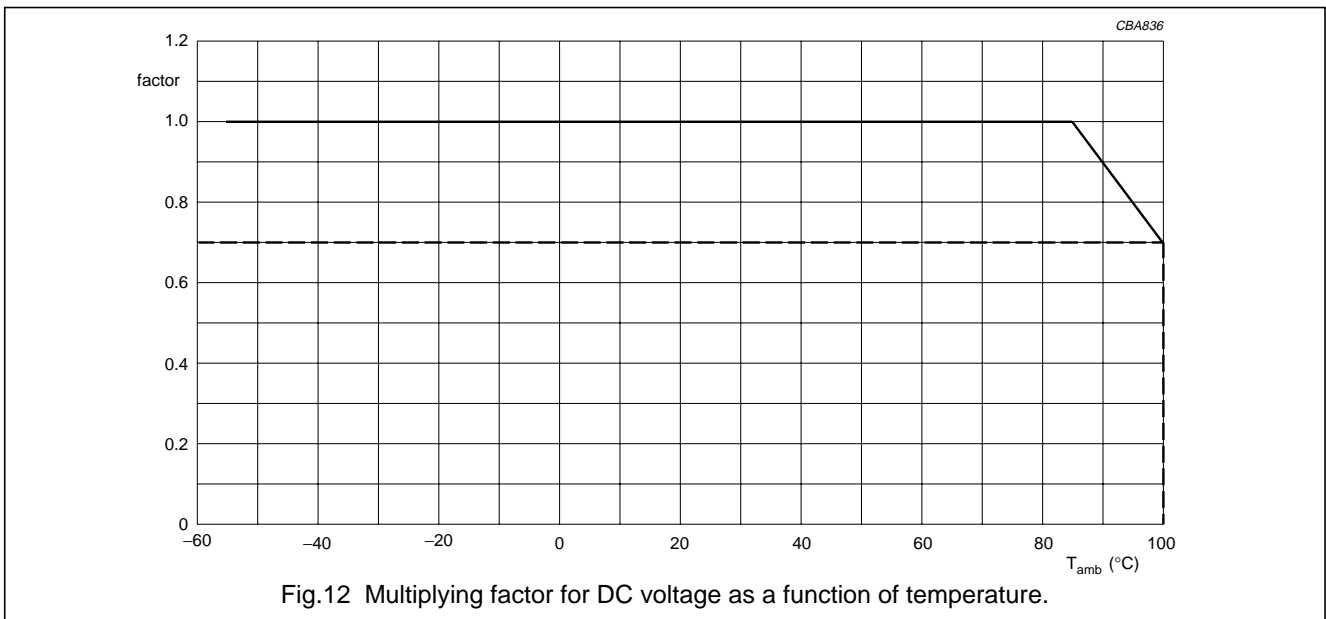
**CHARACTERISTICS**

**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**

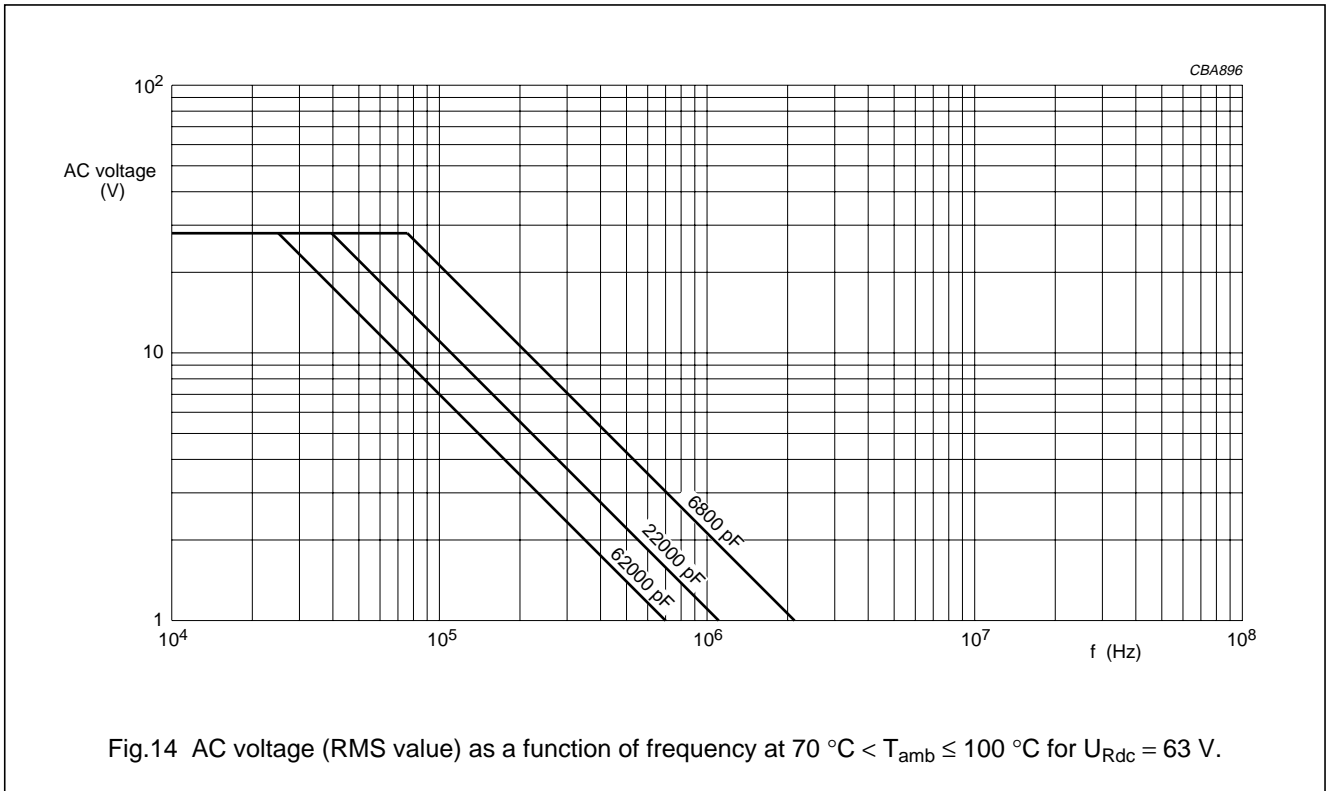
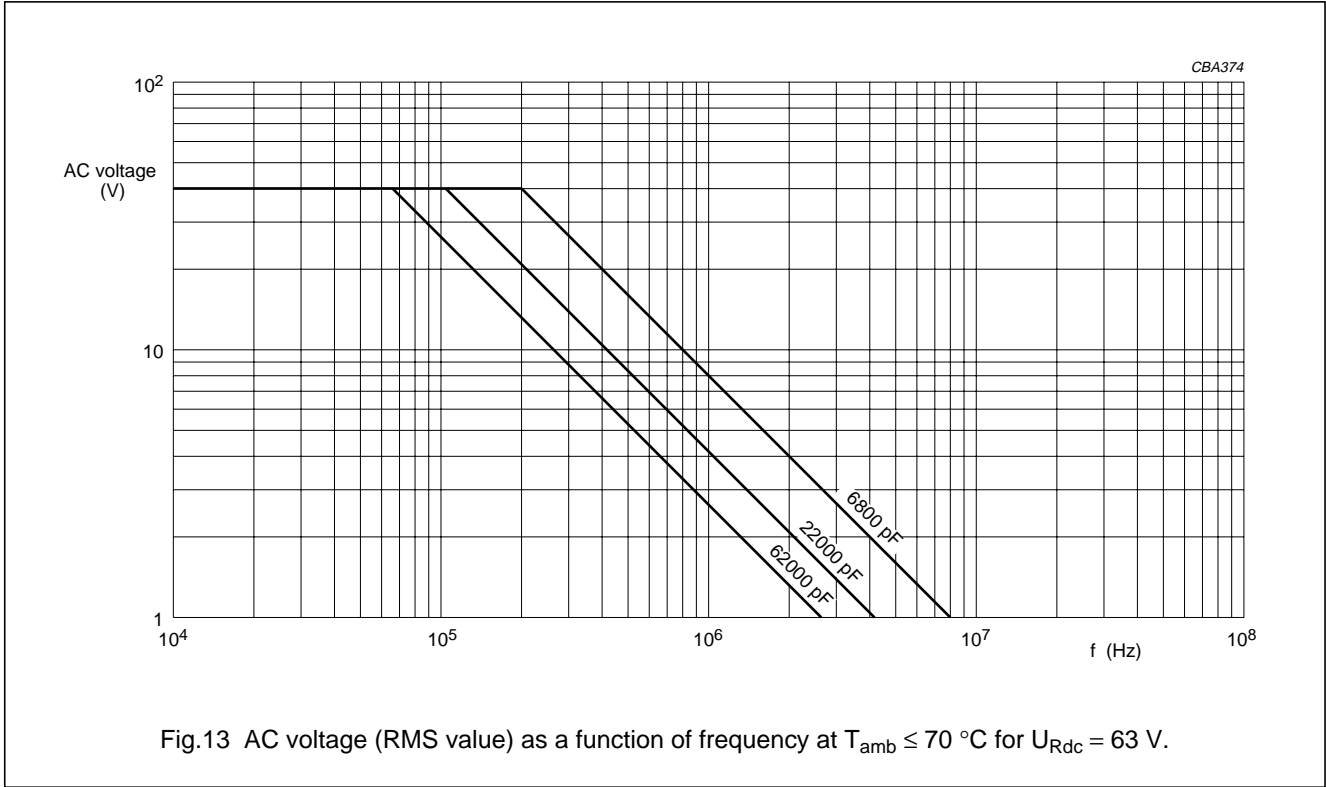




# Polypropylene film foil capacitors

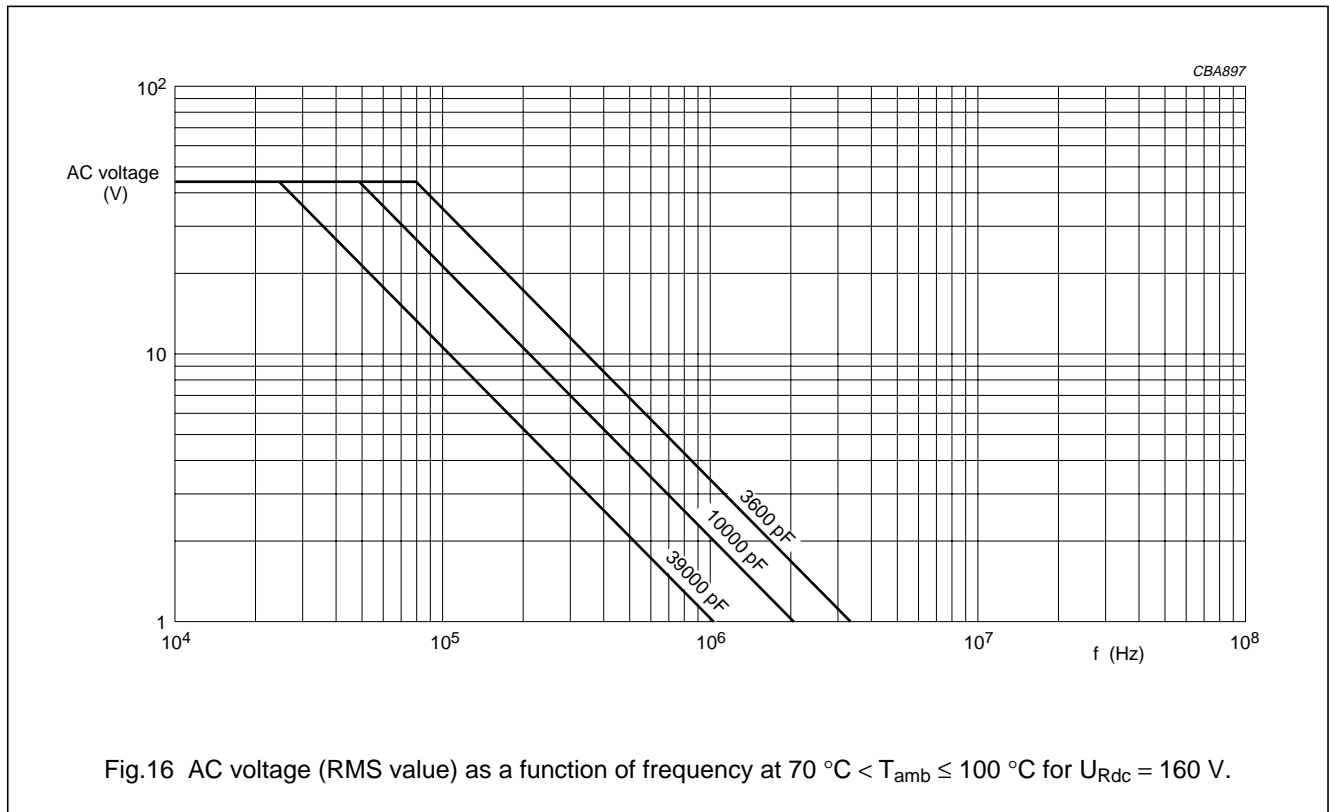
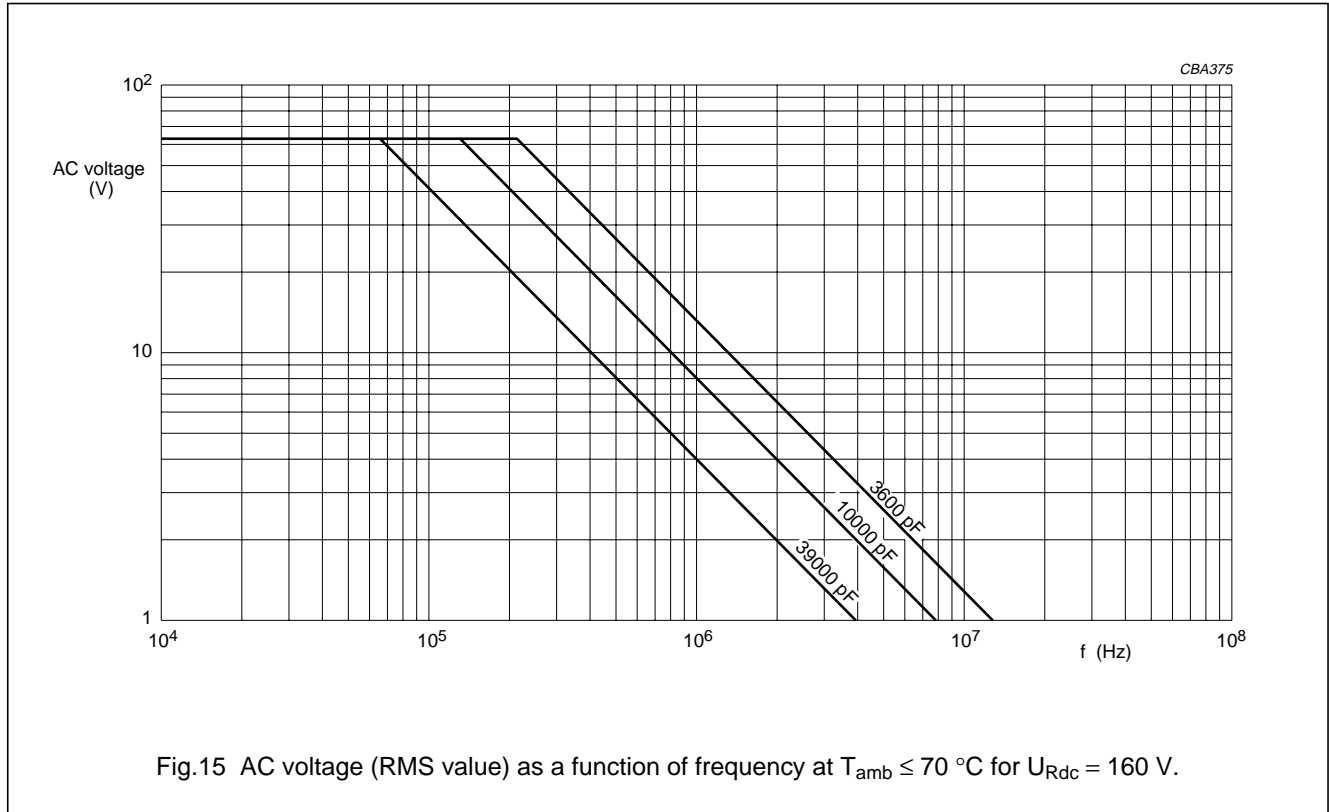
# KP 460 to 464

## Maximum RMS voltage (sinewave) as a function of frequency



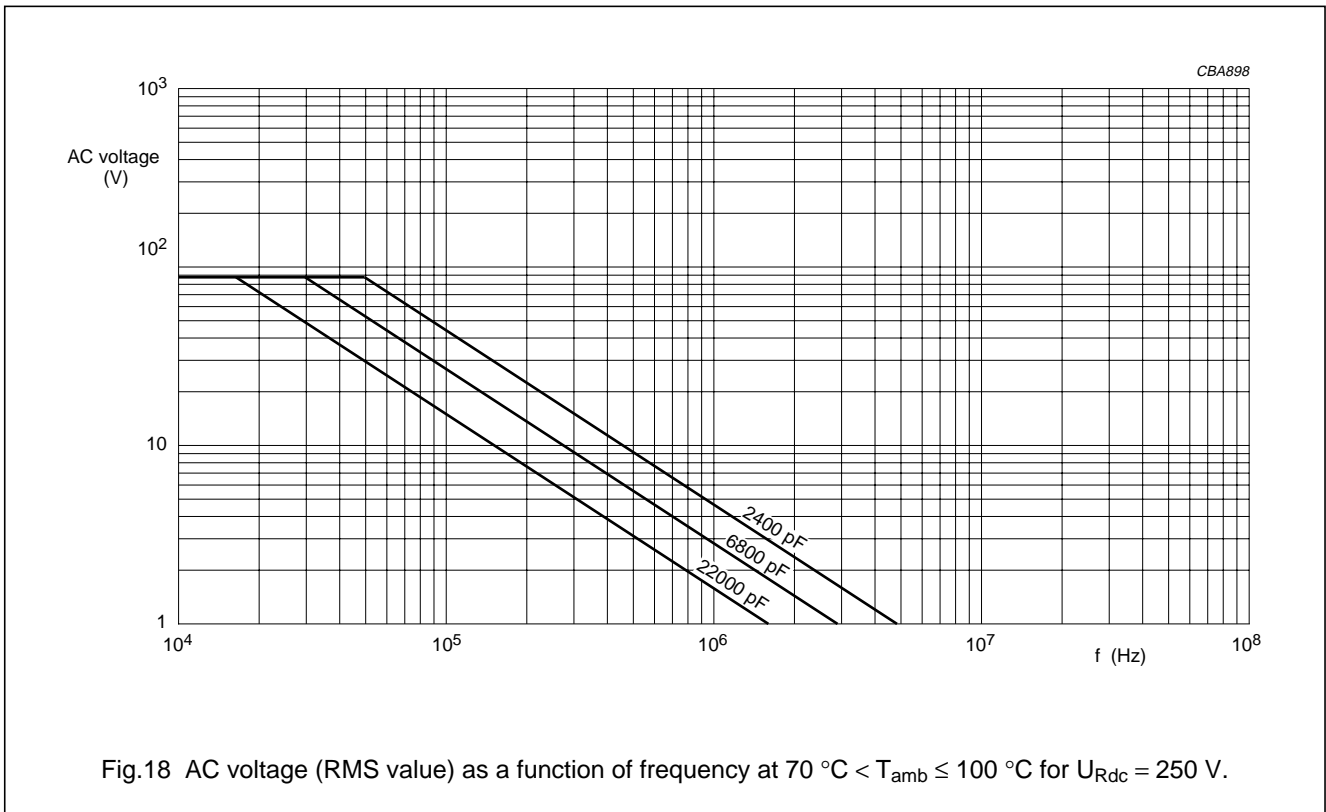
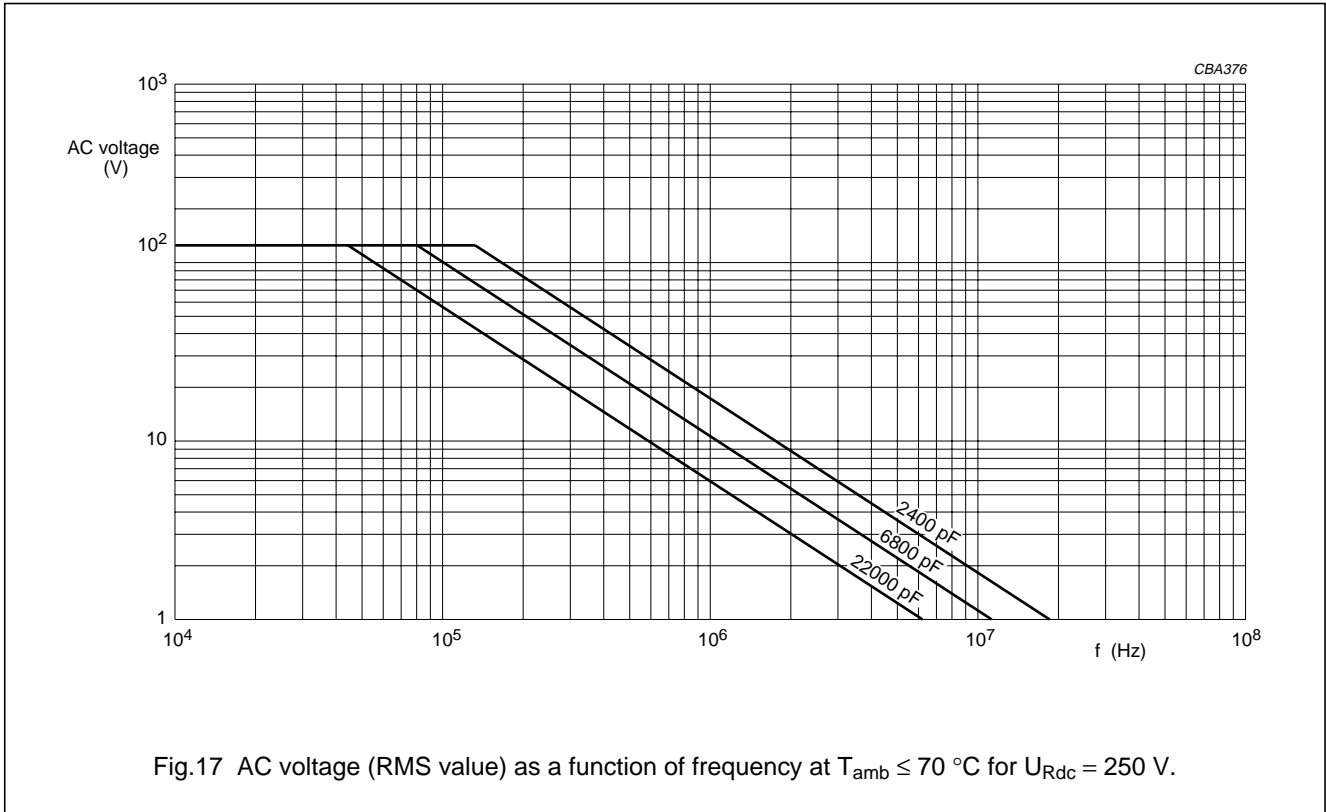
Polypropylene film foil capacitors

KP 460 to 464



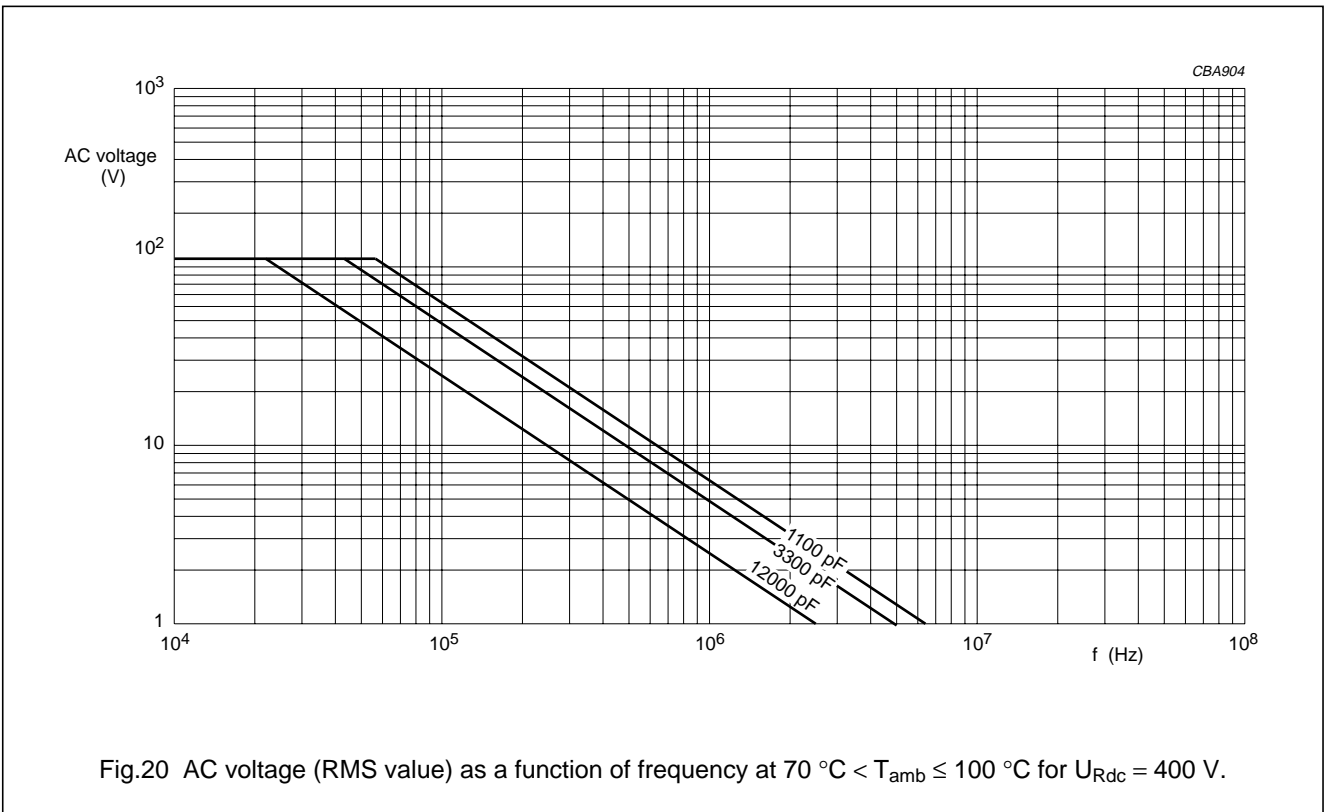
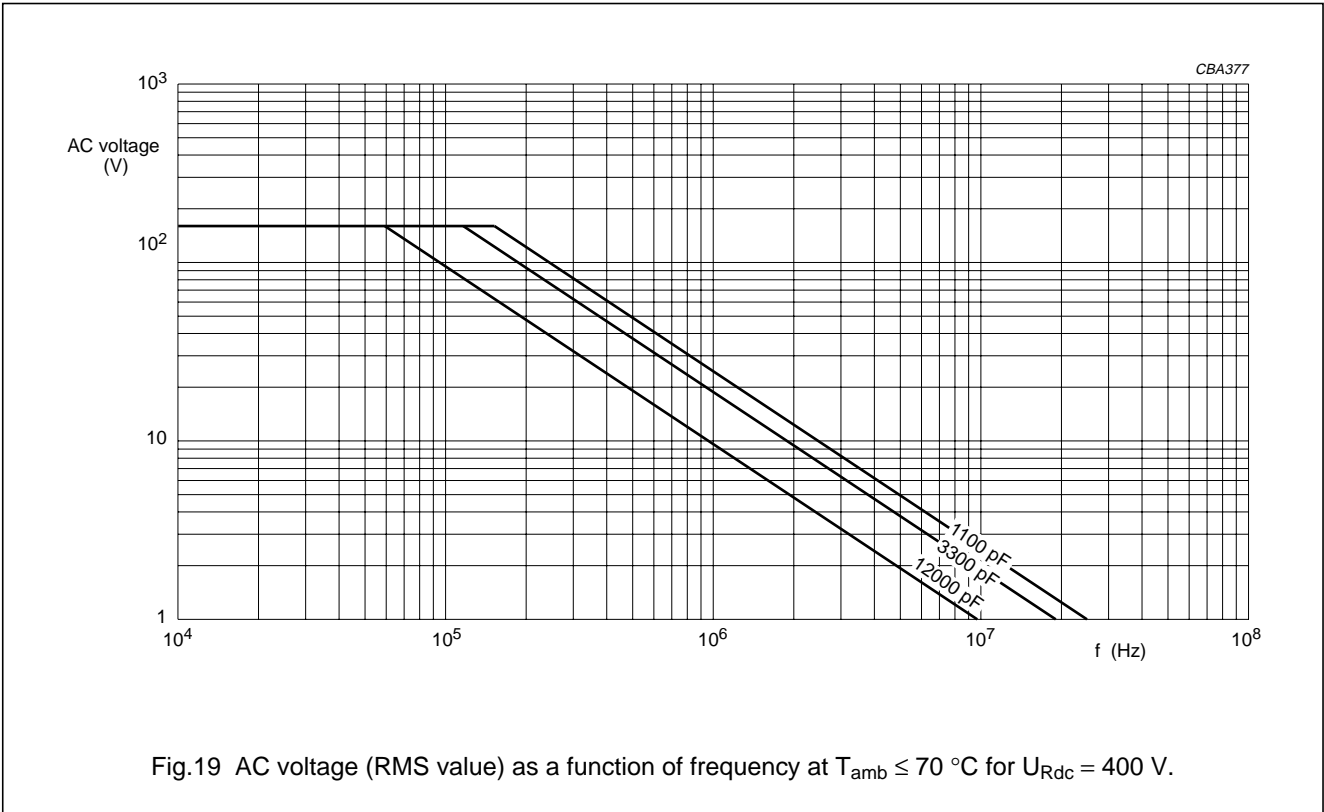
Polypropylene film foil capacitors

KP 460 to 464



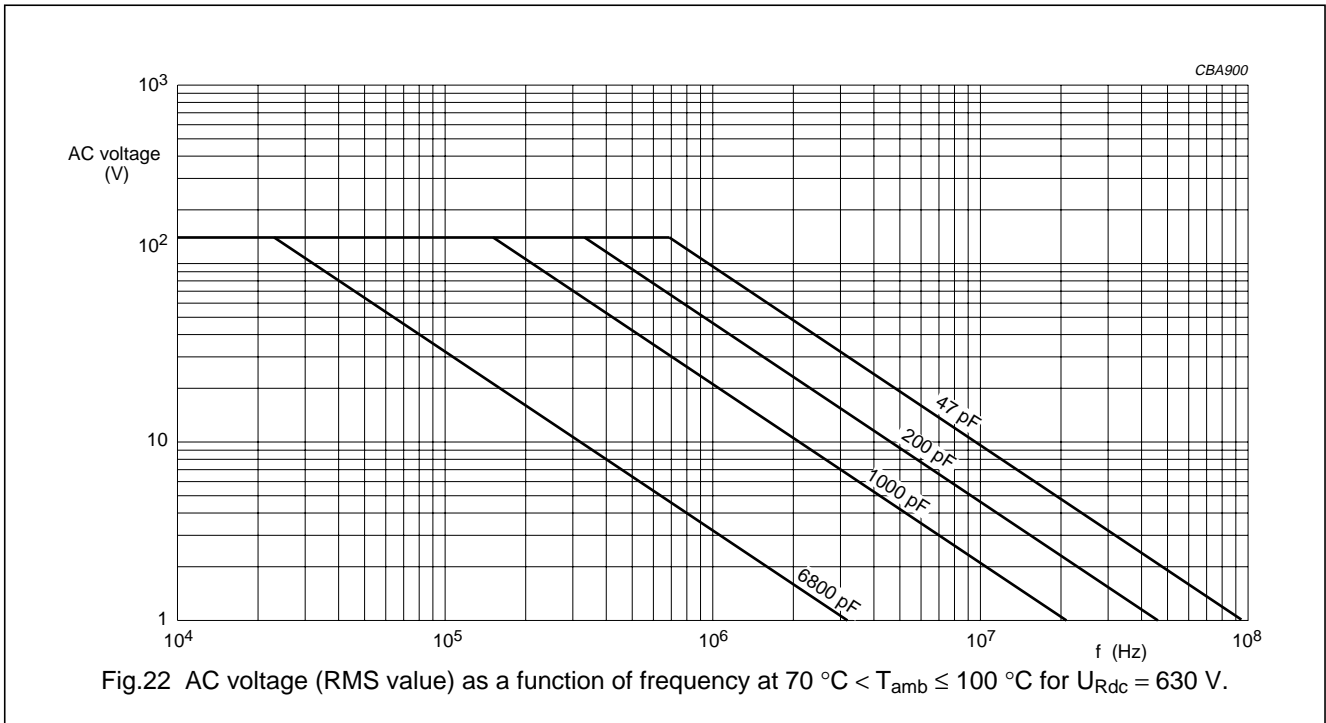
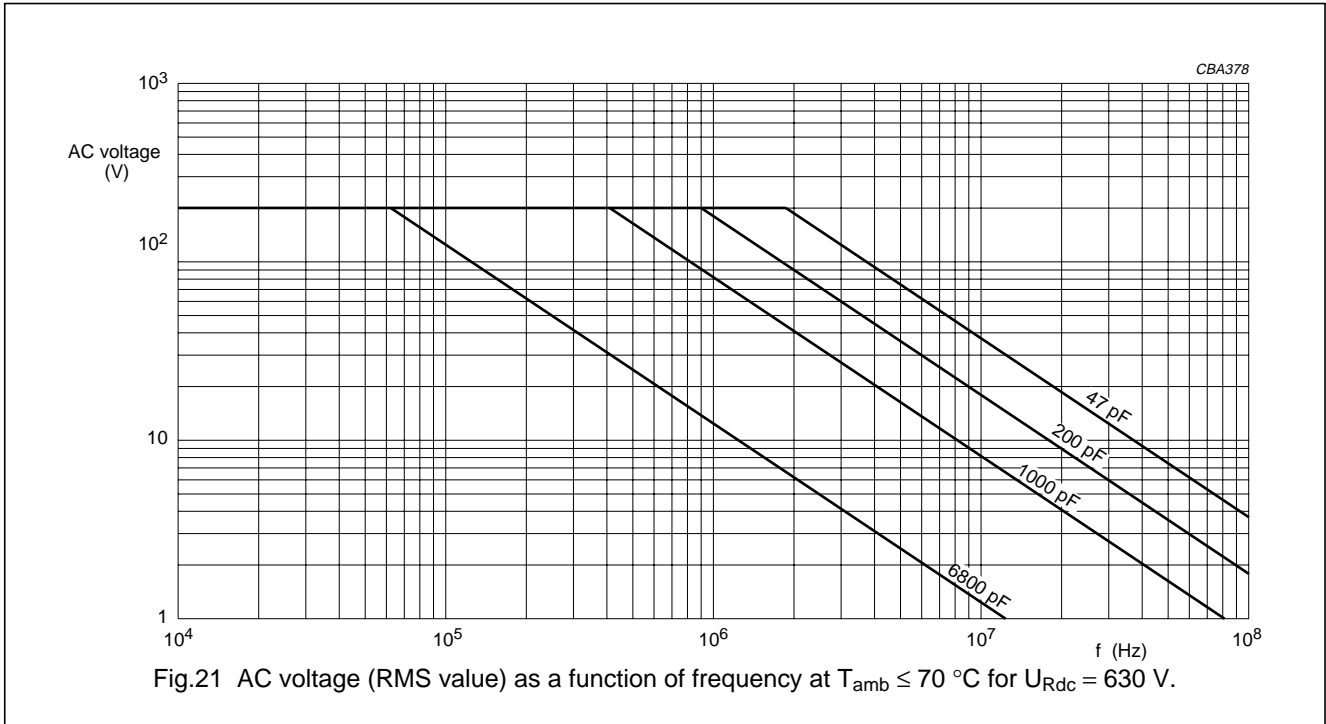
Polypropylene film foil capacitors

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 13 to 22.

Polypropylene film foil capacitors

KP 460 to 464

**Tangent of loss angle**

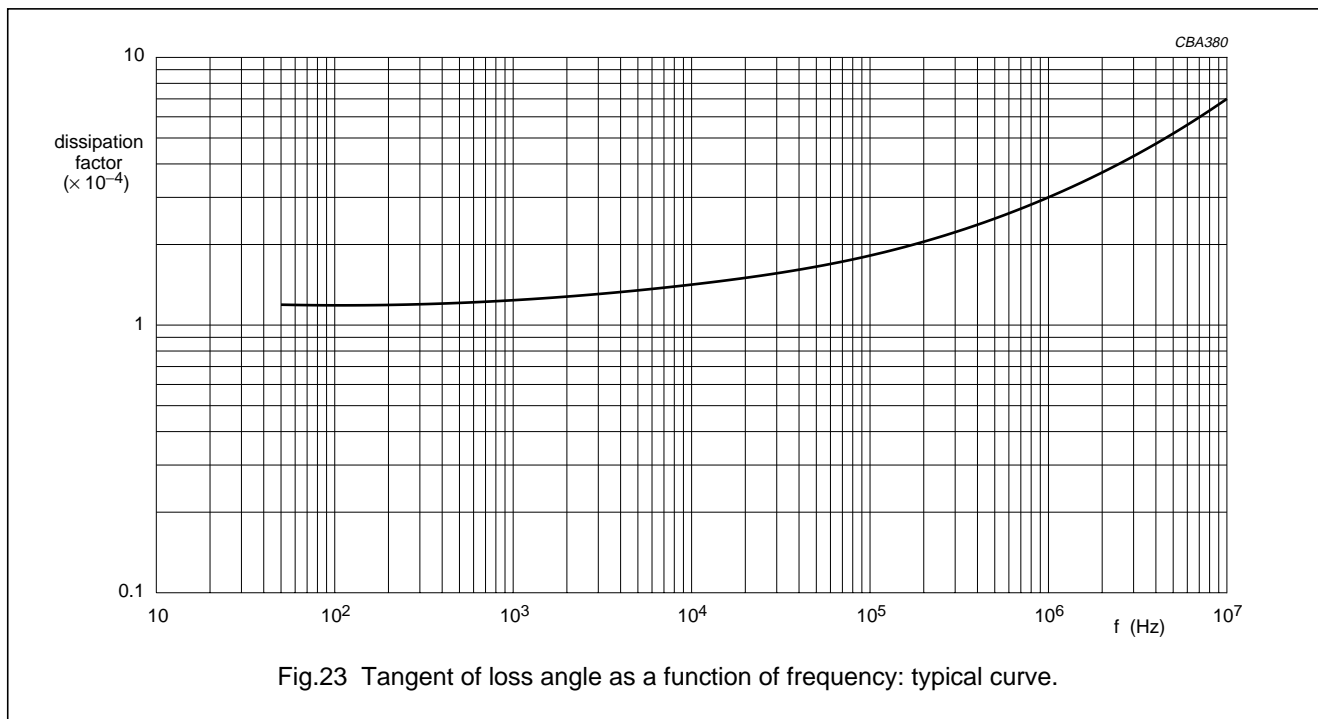


Fig.23 Tangent of loss angle as a function of frequency: typical curve.

**Insulation resistance**

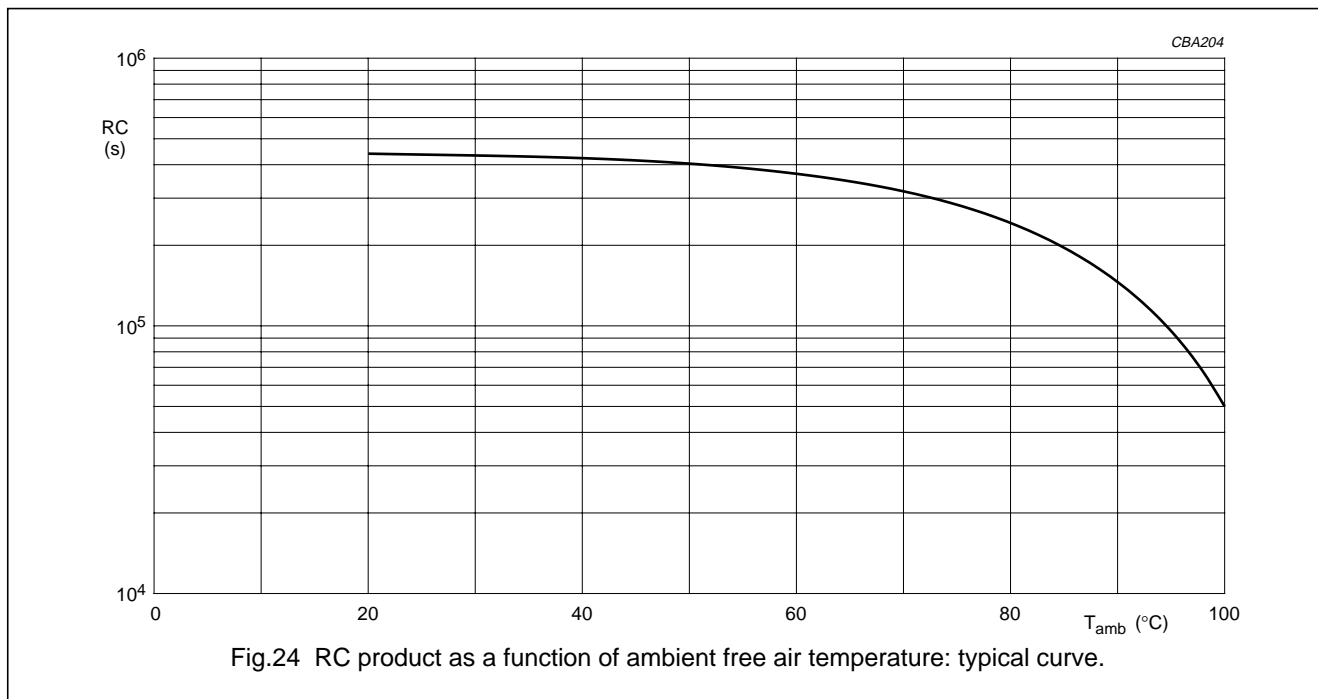


Fig.24 RC product as a function of ambient free air temperature: typical curve.

**Inductance**

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

Polypropylene film foil capacitors

KP 460 to 464

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

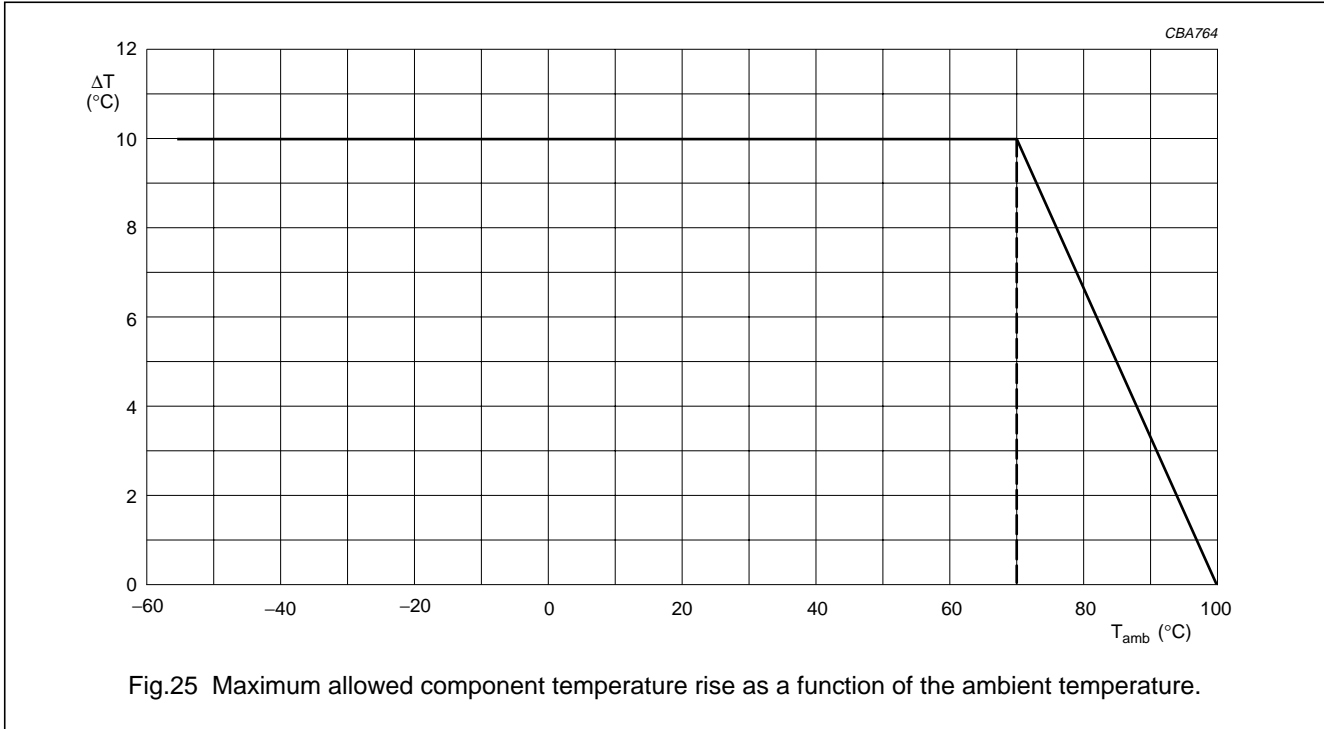


Fig.25 Maximum allowed component temperature rise as a function of the ambient temperature.

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

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

## Polypropylene film foil capacitors

## KP 460 to 464

**Measuring the component temperature**

A thermocouple must be attached to the capacitor body as in Fig.26.

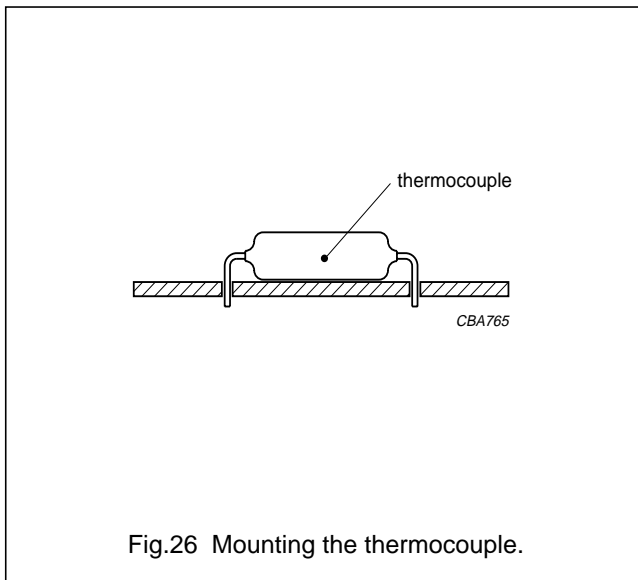


Fig.26 Mounting the thermocouple.

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 ( $U_{p-p}$ ) 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.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).



## 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)  
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





Polypropylene film foil capacitors

KP 460 to 464

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

<ol style="list-style-type: none"> <li>1. PHILIPS COMPONENTS</li> <li>2. MADE IN BELGIUM</li> <li>3. DC FILM CAPACITOR</li> <li>4. KP AXIAL EPOXY LACQUERED TYPE</li> <li>5. 47pF ±1% 630V= 40/100/56 ULC=0.7 X ULR</li> <li>6.</li> <li>7.  WO: 12345678 ORIG A170 RPC HQ</li> <li>8.  TYPE KP 464</li> <li>9.  QTY 250 DATE 9904</li> <li>10.  CODENO 2222 464 44709</li> </ol>	<p><b>Barcode label marking</b></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)																						

CCA346

Fig.27 Barcode label.

## Polypropylene film foil capacitors

KP 460 to 464

## QUICK REFERENCE TEST REQUIREMENTS (see note 1)

TEST	PROCEDURE (quick reference)	REQUIREMENTS
<b>Robustness of leads</b>		
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: $260^\circ\text{C}$ ; 5 s	
Component solvent resistance	isopropyl alcohol; $23^\circ\text{C}$ ; 5 minutes	
<b>Robustness of component</b>		
Vibration: "IEC 60068-2-6"	10 to 55 Hz; amplitude 0.75 mm or acceleration $98 \text{ m/s}^2$ ; 6 hours	$ \Delta C/C  \leq 2\% + 1 \text{ pF}$ ( $C \leq 1100 \text{ pF}$ ) $ \Delta C/C  \leq 1\%$ ( $C > 1100 \text{ pF}$ ) $R_{\text{ins}} \geq 50\%$ of specified value
Shock: "IEC 60068-2-27"	half sinewave; $490 \text{ m/s}^2$ ; 11 ms	
<b>Climatic sequence</b>		
Dry heat: "IEC 60068-2-2"	16 hours; $100^\circ\text{C}$	$ \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; $-40^\circ\text{C}$	
Damp heat, cyclic, test Db, remaining cycles: "IEC 60068-2-30"		
<b>Other applicable tests</b>		
Damp heat, steady state: "IEC 60068-2-3"	56 days; $40^\circ\text{C}$ ; 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; $1.5 \times U_{\text{Rdc}}$ ; $85^\circ\text{C}$ $1.05 \times U_{\text{Rdc}}$ ; $100^\circ\text{C}$	$ \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; $100^\circ\text{C}$	$ \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: $100^\circ\text{C}$ ; bath temperature: $260^\circ\text{C}$ ; dwell time: 5 s	$ \Delta C/C  \leq 2\% + 1 \text{ pF}$ ( $C \leq 1100 \text{ pF}$ ) $ \Delta C/C  \leq 1\%$ ( $C > 1100 \text{ pF}$ )

**Note**

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