

# DATA SHEET

## **MKP 416 to 420** Metallized polypropylene filter capacitors

Product specification  
Supersedes data of 9th October 2002  
File under BCcomponents, BC05

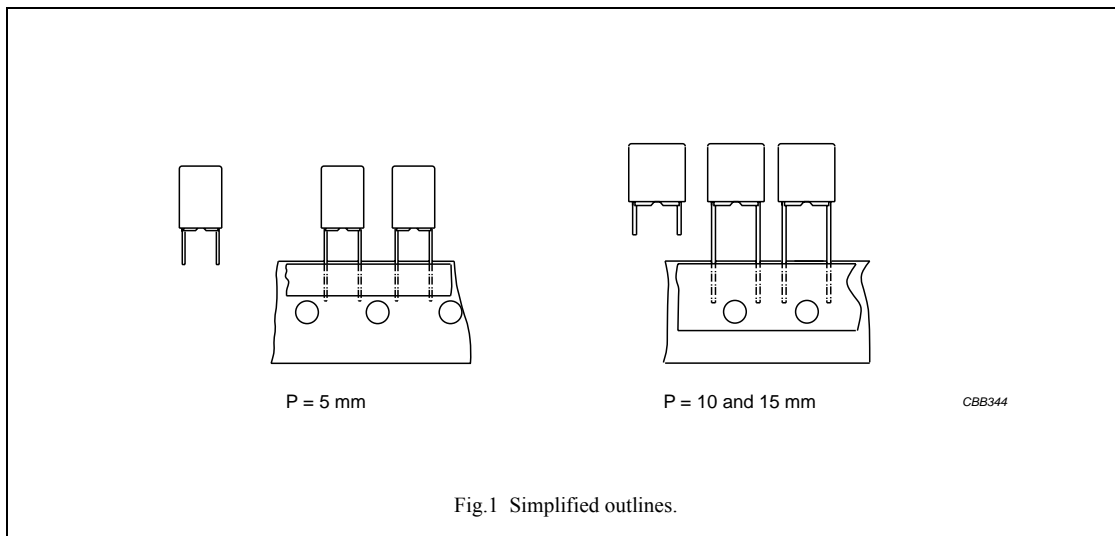
2002 Dec 11

## Metallized polypropylene filter capacitors

MKP 416 to 420

MKP RADIAL POTTED TYPE

PITCH 5/10/15 mm



## FEATURES

- 5, 10 and 15 mm lead pitch
- Supplied loose in box, in ammpack and taped on reel
- Intermediate values are available of the E96 series.

## APPLICATIONS

- Low losses due to low contact resistance and low loss dielectric result in applications where high frequency occur or high stability is preferred
- Their small dimensions make them suitable for circuits with high packaging density.

## DETAIL SPECIFICATION

For more detailed data and test requirements see “*Type detail specification HQN-384-16/101*”.

## QUICK REFERENCE DATA

DESCRIPTION	VALUE
Capacitance range (E24 series)	0.001 to 1.2 $\mu$ F
Capacitance tolerance	$\pm 5\%$ ; $\pm 2\%$
Rated (DC) voltage	63 V; 160 V; 250 V; 400 V; 630 V
Rated (AC) voltage	25 V; 63 V; 100 V; 125 V; 160 V
Rated peak-to-peak voltage	70 V; 180 V; 280 V; 350 V; 450 V
Climatic category	55/085/56
Rated temperature (DC)	85 °C
Rated temperature (AC)	85 °C
Maximum application temperature	85 °C
Reference specification	IEC 60384-16
Performance grade	grade 1 (long life)
Stability grade	grade 1
Materials	qualified in accordance with UL94 V-0

Metallized polypropylene filter capacitors

MKP 416 to 420

COMPOSITION OF CATALOGUE NUMBER

TYPE AND PITCHES	
416	5.0/10.0/15.0 mm
417	5.0/10.0/15.0 mm

MULTIPLIER R (nF)	
0.01	2
0.1	3
1	4

**CAPACITANCE**  
(numerically)

Example:  
1004 = 100 x 1 = 100 nF

2222 4.. X XXX X

TYPE	PACKAGING	LEAD CONFIGURATION	PREFERRED TYPES		
			C-TOL	63 V	160 V
416	Taped		±2%	1	
	Loose in box	lead length 3.5 mm	±2%	7	
417	Taped		±2%		1
	Loose in box	lead length 3.5 mm	±2%		7
			<b>ON REQUEST</b>		
416	Taped		±5%	0	
			±5%	3	
	Loose in box	lead length 4.0 mm	±2%	4	
		lead length 3.5 mm	±5%	6	
417	Taped		±5%		0
			±5%		3
	Loose in box	lead length 4.0 mm	±2%		4
		lead length 3.5 mm	±5%		6

# Metallized polypropylene filter capacitors

TYPE AND PITCHES	
418	5.0/10.0/15.0 mm
419	5.0/10.0/15.0 mm
420	5.0/10.0/15.0 mm

MULTIPLIER R (nF)	
0.01	2
0.1	3
1	4

**CAPACITANCE**  
(numerically)

Example:  
1004 = 100 x 1 = 100 nF

2222 4.. X XXX X

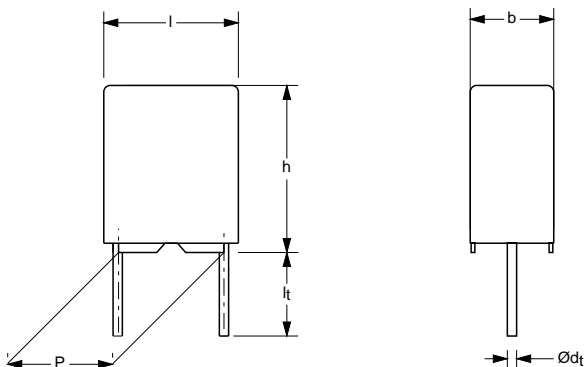
TYPE	PACKAGING	LEAD CONFIGURATION	PREFERRED TYPES			
			C-TOL	250 V	400 V	630 V
418	Taped		±2%	1		
	Loose in box	lead length 3.5 mm	±2%	7		
419	Taped		±2%		1	
	Loose in box	lead length 3.5 mm	±2%		7	
420	Taped		±2%			1
	Loose in box	lead length 3.5 mm	±2%			7
			<b>ON REQUEST</b>			
418	Taped		±5%	0		
	Loose in box	lead length 4.0 mm	±5%	3		
		lead length 3.5 mm	±2%	4		
419	Taped		±5%		0	
	Loose in box	lead length 4.0 mm	±5%		3	
		lead length 3.5 mm	±2%		4	
420	Taped		±5%			0
	Loose in box	lead length 4.0 mm	±5%			3
		lead length 3.5 mm	±2%			4
			±5%			6

## Metallized polypropylene filter capacitors

MKP 416

## MKP 416 GENERAL DATA

PITCH 5/10 mm



CBA112

Fig.4 Outline.

## Specific reference data for the 63 V DC capacitors

DESCRIPTION	VALUE	
	at 10 kHz	at 100 kHz
Tangent of loss angle:		
$C \leq 0.11 \mu\text{F}$	$\leq 5 \times 10^{-4}$	$\leq 25 \times 10^{-4}$
$0.11 \mu\text{F} < C \leq 0.18 \mu\text{F}$	$\leq 10 \times 10^{-4}$	$\leq 30 \times 10^{-4}$
$0.18 \mu\text{F} < C \leq 0.27 \mu\text{F}$	$\leq 10 \times 10^{-4}$	$\leq 35 \times 10^{-4}$
Rated voltage pulse slope $(dU/dt)_R$ at 63 V (DC):		
P = 5 mm	50 V/ $\mu\text{s}$	
P = 10 mm	20 V/ $\mu\text{s}$	
R between leads at 50 V; 1 minute	>100 000 M $\Omega$	
R between interconnected leads and case at 50 V; 1 minute	>100 000 M $\Omega$	
Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s	100 V; 1 minute	
Withstanding (DC) voltage between leads and case	2840 V; 1 minute	

## Available 63 V DC versions

PACKAGING	DIMENSIONS	C-tol	FIRST 9 DIGITS OF CATALOGUE NUMBER	ORDERING
Ammopack	H = 18.5 mm; P <sub>0</sub> = 12.7 mm	±5%	2222 416 0....	on request
		±2%	2222 416 1....	preferred
Loose in box	l <sub>t</sub> = 4.0 +1.0/-0.5 mm	±5%	2222 416 3....	on request
		±2%	2222 416 4....	on request

## Metallized polypropylene filter capacitors

MKP 416

 $U_{Rdc} = 63 \text{ V}$ ;  $U_{Rac} = 25 \text{ V}$ ;  $U_{p-p} = 70 \text{ V}$ 

C (E 24) ( $\mu\text{F}$ )	DIMENSIONS $b \times h \times l$ (mm)	MASS (g)	CATALOGUE NUMBER 2222 416 ..... AND PACKAGING		
			AMMOPACK		LOOSE IN BOX
			H = 18.5 mm; P <sub>0</sub> = 12.7 mm		$l_t = 4.0 +1.0/-0.5 \text{ mm}$
			C-tol = $\pm 2\%$	SPQ	SPQ
			last 5 digits of catalogue number		
<b>Pitch = 5.0 <math>\pm</math>0.3 mm; <math>d_t = 0.50 \pm 0.05 \text{ mm}</math></b>					
0.036	4.5 $\times$ 9.0 $\times$ 7.2	0.45	13603	1000	2000
0.039			13903		
0.043			14303		
0.047			14703		
0.051	6.0 $\times$ 11.0 $\times$ 7.2	0.60	15103	750	1500
0.056			15603		
0.062			16203		
0.068			16803		
0.075			17503		
0.082			18203		
0.091			19103		
0.1			11004		
0.11			11104		
0.12	11204				
<b>Pitch = 10.0 <math>\pm</math>0.4 mm; <math>d_t = 0.60 \pm 0.06 \text{ mm}</math></b>					
0.13	5.0 $\times$ 11.0 $\times$ 12.5	0.85	11304	600	1000
0.15			11504		
0.16	6.0 $\times$ 12.0 $\times$ 12.5	1.10	11604	500	750
0.18			11804		
0.20			12004		
0.22			12204		
0.24			12404		
0.27			12704		

## Metallized polypropylene filter capacitors

MKP 416

## MKP 416 GENERAL DATA

PITCH 15 mm

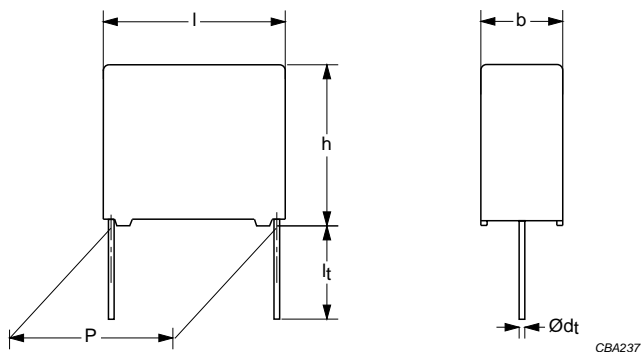


Fig.5 Outline.

## Specific reference data for the 63 V DC capacitors

DESCRIPTION	VALUE	
	at 10 kHz	at 100 kHz
Tangent of loss angle:		
0.3 $\mu\text{F} < C \leq 0.39 \mu\text{F}$	$\leq 10 \times 10^{-4}$	$\leq 40 \times 10^{-4}$
0.39 $\mu\text{F} < C \leq 0.56 \mu\text{F}$	$\leq 10 \times 10^{-4}$	$\leq 45 \times 10^{-4}$
0.56 $\mu\text{F} < C \leq 0.75 \mu\text{F}$	$\leq 10 \times 10^{-4}$	$\leq 50 \times 10^{-4}$
0.75 $\mu\text{F} < C \leq 1.1 \mu\text{F}$	$\leq 10 \times 10^{-4}$	$\leq 60 \times 10^{-4}$
Rated voltage pulse slope $(dU/dt)_R$ at 63 V (DC)	50 V/ $\mu\text{s}$	
R between leads, for $C \leq 0.33 \mu\text{F}$ at 50 V; 1 minute	$>100\,000 \text{ M}\Omega$	
RC between leads, for $C > 0.33 \mu\text{F}$ at 50 V; 1 minute	$>30\,000 \text{ s}$	
R between interconnected leads and case at 50 V; 1 minute	$>100\,000 \text{ M}\Omega$	
Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s	100 V; 1 minute	
Withstanding (DC) voltage between leads and case	2840 V; 1 minute	

## Available 63 V DC versions

PACKAGING	DIMENSIONS	C-tol	FIRST 9 DIGITS OF CATALOGUE NUMBER	ORDERING
Taped on reel	H = 18.5 mm; P <sub>0</sub> = 12.7 mm; reel diameter 356 mm	$\pm 5\%$	2222 416 0...	on request
		$\pm 2\%$	2222 416 1...	preferred
Loose in box	l <sub>t</sub> = 3.5 $\pm$ 0.3 mm	$\pm 5\%$	2222 416 6...	on request
		$\pm 2\%$	2222 416 7....	preferred

## Metallized polypropylene filter capacitors

MKP 416

 $U_{Rdc} = 63 \text{ V}$ ;  $U_{Rac} = 25 \text{ V}$ ;  $U_{p-p} = 70 \text{ V}$ 

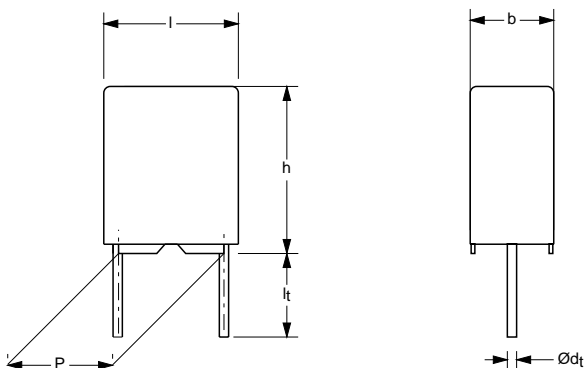
C (E 24) ( $\mu\text{F}$ )	DIMENSIONS $b \times h \times l$ (mm)	MASS (g)	CATALOGUE NUMBER 2222 416 ..... AND PACKAGING			
			REEL		LOOSE IN BOX	
			H = 18.5 mm; P <sub>0</sub> = 12.7 mm		l <sub>t</sub> = 3.5 ± 0.3 mm	
			C-tol = ±2%	SPQ	C-tol = ±2%	SPQ
			last 5 digits of catalogue number		last 5 digits of catalogue number	
<b>Pitch = 15.0 ± 0.4 mm; d<sub>t</sub> = 0.80 ± 0.08 mm</b>						
0.3	6.0 × 12.0 × 17.5	1.4	13004	900	73004	1000
0.33			13304		73304	
0.36			13604		73604	
0.39			13904		73904	
0.43	7.0 × 13.5 × 17.5	1.9	14304	800	74304	750
0.47			14704		74704	
0.51			15104		75104	
0.56			15604		75604	
0.62	8.5 × 15.0 × 17.5	2.6	16204	650	76204	750
0.68			16804		76804	
0.75			17504		77504	
0.82			18204		78204	
0.91	10.0 × 16.5 × 17.5	3.1	19104	600	79104	500
1.0			11005		71005	
1.1			11105		71105	

## Metallized polypropylene filter capacitors

MKP 417

## MKP 417 GENERAL DATA

PITCH 5/10 mm



CBA112

Fig.6 Outline.

## Specific reference data for the 160 V DC capacitors

DESCRIPTION	VALUE	
	at 10 kHz	at 100 kHz
Tangent of loss angle:		
$C \leq 0.027 \mu\text{F}$	$\leq 5 \times 10^{-4}$	$\leq 15 \times 10^{-4}$
$0.027 \mu\text{F} < C \leq 0.075 \mu\text{F}$	$\leq 5 \times 10^{-4}$	$\leq 20 \times 10^{-4}$
$0.075 \mu\text{F} < C \leq 0.11 \mu\text{F}$	$\leq 5 \times 10^{-4}$	$\leq 25 \times 10^{-4}$
$0.11 \mu\text{F} < C \leq 0.18 \mu\text{F}$	$\leq 10 \times 10^{-4}$	$\leq 30 \times 10^{-4}$
$0.18 \mu\text{F} < C \leq 0.24 \mu\text{F}$	$\leq 10 \times 10^{-4}$	$\leq 35 \times 10^{-4}$
Rated voltage pulse slope $(dU/dt)_R$ at 160 V (DC):		
P = 5 mm	50 V/ $\mu\text{s}$	
P = 10 mm	20 V/ $\mu\text{s}$	
R between leads at 100 V; 1 minute	>100 000 M $\Omega$	
R between interconnected leads and case at 100 V; 1 minute	>100 000 M $\Omega$	
Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s	260 V; 1 minute	
Withstanding (DC) voltage between leads and case	2 840 V; 1 minute	

## Available 160 V DC versions

PACKAGING	DIMENSIONS	C-tol	FIRST 9 DIGITS OF CATALOGUE NUMBER	ORDERING
Ammopack	H = 18.5 mm; P <sub>0</sub> = 12.7 mm	±5%	2222 417 0...	on request
		±2%	2222 417 1....	preferred
Loose in box	l <sub>t</sub> = 4.0 +1.0/-0.5 mm	±5%	2222 417 3....	on request
		±2%	2222 417 4....	on request

## Metallized polypropylene filter capacitors

MKP 417

 $U_{Rdc} = 160 \text{ V}$ ;  $U_{Rac} = 63 \text{ V}$ ;  $U_{p-p} = 180 \text{ V}$ 

C (E 24) ( $\mu\text{F}$ )	DIMENSIONS $b \times h \times l$ (mm)	MASS (g)	CATALOGUE NUMBER 2222 417 ..... AND PACKAGING		
			REEL		LOOSE IN BOX
			H = 18.5 mm; P <sub>0</sub> = 12.7 mm		$l_t = 4.0 +1.0/-0.5 \text{ mm}$
			C-tol = $\pm 2\%$	SPQ	SPQ
			last 5 digits of catalogue number		
<b>Pitch = <math>5.0 \pm 0.3 \text{ mm}</math>; <math>d_t = 0.50 \pm 0.05 \text{ mm}</math></b>					
0.024	4.5 × 9.0 × 7.2	0.45	12403	1000	2000
0.027			12703		
0.03			13003		
0.033			13303		
0.036	6.0 × 11.0 × 7.2	0.60	13603	750	1500
0.039			13903		
0.043			14303		
0.047			14703		
0.051			15103		
0.056			15603		
0.062			16203		
0.068			16803		
<b>Pitch = <math>10.0 \pm 0.4 \text{ mm}</math>; <math>d_t = 0.60 \pm 0.06 \text{ mm}</math></b>					
0.075	4.0 × 10.0 × 12.5	0.60	17503	750	1000
0.082			18203		
0.091			19103		
0.1			11004		
0.11	5.0 × 11.0 × 12.5	0.85	11104	600	1000
0.12			11204		
0.13			11304		
0.15			11504		
0.16	6.0 × 12.0 × 12.5	1.10	11604	500	750
0.18			11804		
0.20			12004		
0.22			12204		
0.24			12404		

## Metallized polypropylene filter capacitors

MKP 417

## MKP 417 GENERAL DATA

PITCH 15 mm

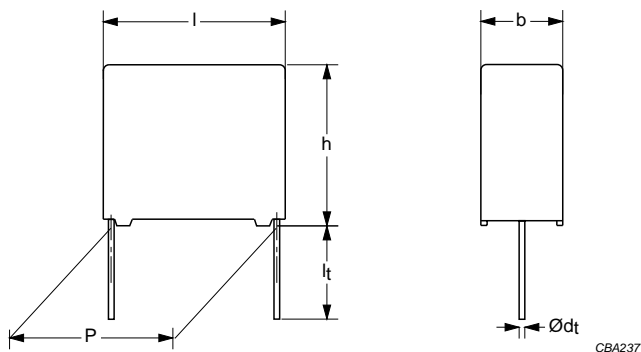


Fig.7 Outline.

## Specific reference data for the 160 V DC capacitors

DESCRIPTION	VALUE	
	at 10 kHz	at 100 kHz
Tangent of loss angle:		
0.27 $\mu\text{F}$ < C $\leq$ 0.39 $\mu\text{F}$	$\leq 10 \times 10^{-4}$	$\leq 40 \times 10^{-4}$
0.39 $\mu\text{F}$ < C $\leq$ 0.56 $\mu\text{F}$	$\leq 10 \times 10^{-4}$	$\leq 45 \times 10^{-4}$
0.56 $\mu\text{F}$ < C $\leq$ 0.75 $\mu\text{F}$	$\leq 10 \times 10^{-4}$	$\leq 50 \times 10^{-4}$
0.75 $\mu\text{F}$ < C $\leq$ 1.1 $\mu\text{F}$	$\leq 10 \times 10^{-4}$	$\leq 60 \times 10^{-4}$
Rated voltage pulse slope $(dU/dt)_R$ at 160 V (DC)	50 V/ $\mu\text{s}$	
R between leads, for C $\leq$ 0.33 $\mu\text{F}$ at 100 V; 1 minute	$> 100\,000 \text{ M}\Omega$	
RC between leads, for C > 0.33 $\mu\text{F}$ at 100 V; 1 minute	$> 30\,000 \text{ s}$	
R between interconnected leads and case at 100 V; 1 minute	$> 100\,000 \text{ M}\Omega$	
Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s	260 V; 1 minute	
Withstanding (DC) voltage between leads and case	2840 V; 1 minute	

## Available 160 V DC versions

PACKAGING	DIMENSIONS	C-tol	FIRST 9 DIGITS OF CATALOGUE NUMBER	ORDERING
Taped on reel	H = 18.5 mm; P <sub>0</sub> = 12.7 mm; reel diameter 356 mm	$\pm 5\%$	2222 417 0....	on request
		$\pm 2\%$	2222 417 1....	preferred
Loose in box	l <sub>t</sub> = 3.5 $\pm$ 0.3 mm	$\pm 5\%$	2222 417 6....	on request
		$\pm 2\%$	2222 417 7....	preferred

## Metallized polypropylene filter capacitors

MKP 417

 $U_{Rdc} = 160 \text{ V}$ ;  $U_{Rac} = 63 \text{ V}$ ;  $U_{p-p} = 180 \text{ V}$ 

C (E 24) ( $\mu\text{F}$ )	DIMENSIONS $b \times h \times l$ (mm)	MASS (g)	CATALOGUE NUMBER 2222 417 ..... AND PACKAGING			
			REEL		LOOSE IN BOX	
			H = 18.5 mm; P <sub>0</sub> = 12.7 mm		l <sub>t</sub> = 3.5 ± 0.3 mm	
			C-tol = ±2%	SPQ	C-tol = ±2%	SPQ
			last 5 digits of catalogue number		last 5 digits of catalogue number	
<b>Pitch = 15.0 ± 0.4 mm; d<sub>t</sub> = 0.80 ± 0.08 mm</b>						
0.27	5.0 × 11.0 × 17.5	1.2	12704	1100	72704	1250
0.3	6.0 × 12.0 × 17.5	1.4	13004	900	73004	1000
0.33			13304		73304	
0.36			13604		73604	
0.39			13904		73904	
0.43			7.0 × 13.5 × 17.5		1.9	
0.47	14704	74704				
0.51	15104	75104				
0.56	15604	75604				
0.62	8.5 × 15.0 × 17.5	2.6	16204	650	76204	750
0.68			16804		76804	
0.75			17504		77504	
0.82			18204		78204	
0.91	10.0 × 16.5 × 17.5	3.1	19104	600	79104	500
1.0			11005		71005	
1.1			11105		71105	

## Metallized polypropylene filter capacitors

MKP 418

## MKP 418 GENERAL DATA

PITCH 5/10 mm

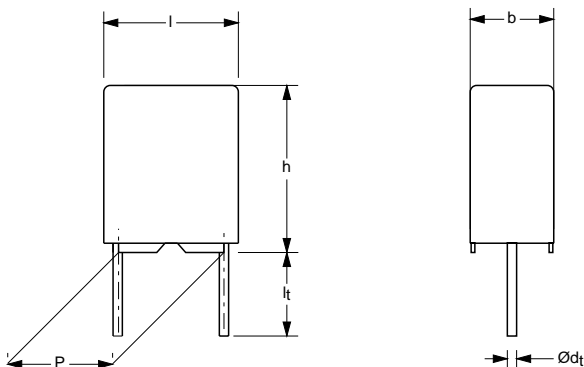


Fig.8 Outline.

## Specific reference data for the 250 V DC capacitors

DESCRIPTION	VALUE	
	at 10 kHz	at 100 kHz
Tangent of loss angle:		
$C \leq 0.027 \mu\text{F}$	$\leq 5 \times 10^{-4}$	$\leq 15 \times 10^{-4}$
$0.027 \mu\text{F} < C \leq 0.075 \mu\text{F}$	$\leq 5 \times 10^{-4}$	$\leq 20 \times 10^{-4}$
$0.075 \mu\text{F} < C \leq 0.11 \mu\text{F}$	$\leq 5 \times 10^{-4}$	$\leq 25 \times 10^{-4}$
$0.11 \mu\text{F} < C \leq 0.13 \mu\text{F}$	$\leq 10 \times 10^{-4}$	$\leq 30 \times 10^{-4}$
Rated voltage pulse slope $(dU/dt)_R$ at 250 V (DC):		
$P = 5 \text{ mm}$	50 V/ $\mu\text{s}$	
$P = 10 \text{ mm}$	20 V/ $\mu\text{s}$	
R between leads at 100 V; 1 minute	>100 000 M $\Omega$	
R between interconnected leads and case at 100 V; 1 minute	>100 000 M $\Omega$	
Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s	400 V; 1 minute	
Withstanding (DC) voltage between leads and case	2 840 V; 1 minute	

## Available 250 V DC versions

PACKAGING	DIMENSIONS	C-tol	FIRST 9 DIGITS OF CATALOGUE NUMBER	ORDERING
Ammopack	$H = 18.5 \text{ mm}; P_0 = 12.7 \text{ mm}$	$\pm 5\%$	2222 418 0.....	on request
		$\pm 2\%$	2222 418 1.....	preferred
Loose in box	$l_t = 4.0 +1.0/-0.5 \text{ mm}$	$\pm 5\%$	2222 418 3.....	on request
		$\pm 2\%$	2222 418 4.....	on request

## Metallized polypropylene filter capacitors

MKP 418

 $U_{Rdc} = 250 \text{ V}$ ;  $U_{Rac} = 100 \text{ V}$ ;  $U_{p-p} = 280 \text{ V}$ 

C (E 24) ( $\mu\text{F}$ )	DIMENSIONS $b \times h \times l$ (mm)	MASS (g)	CATALOGUE NUMBER 2222 418 ..... AND PACKAGING		
			REEL		LOOSE IN BOX
			H = 18.5 mm; $P_0 = 12.7 \text{ mm}$		$l_t = 4.0 +1.0/-0.5 \text{ mm}$
			C-tol = $\pm 2\%$	SPQ	SPQ
			last 5 digits of catalogue number		
<b>Pitch = <math>5.0 \pm 0.3 \text{ mm}</math>; <math>d_t = 0.50 \pm 0.05 \text{ mm}</math></b>					
0.01	3.5 × 8.0 × 7.2	0.35	11003	1500	3000
0.011			11103		
0.012			11203		
0.013			11303		
0.015			11503		
0.016	4.5 × 9.0 × 7.2	0.45	11603	1000	2000
0.018			11803		
0.02			12003		
0.022			12203		
0.024			12403		
0.027	6.0 × 11.0 × 7.2	0.60	12703	750	1500
0.03			13003		
0.033			13303		
0.036			13603		
0.039			13903		
0.043			14303		
<b>Pitch = <math>10.0 \pm 0.4 \text{ mm}</math>; <math>d_t = 0.60 \pm 0.06 \text{ mm}</math></b>					
0.047	4.0 × 10.0 × 12.5	0.60	14703	750	1000
0.051			15103		
0.056			15603		
0.062			16203		
0.068			16803		
0.075	5.0 × 11.0 × 12.5	0.85	17503	600	1000
0.082			18203		
0.091			19103		
0.1	6.0 × 12.0 × 12.5	1.10	11004	500	750
0.11			11104		
0.12			11204		
0.13			11304		

## Metallized polypropylene filter capacitors

MKP 418

## MKP 418 GENERAL DATA

PITCH 15 mm

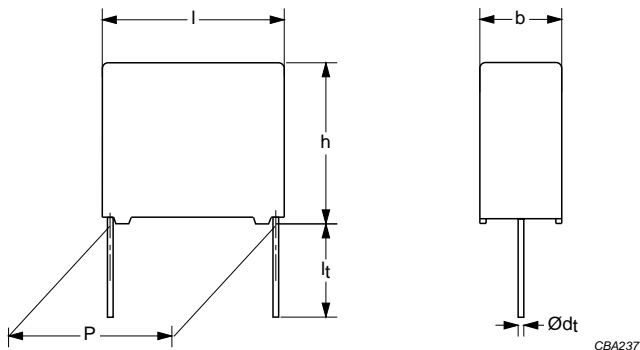


Fig.9 Outline.

## Specific reference data for the 250 V DC capacitors

DESCRIPTION	VALUE	
	at 10 kHz	at 100 kHz
Tangent of loss angle:		
$0.15 \mu\text{F} < C \leq 0.3 \mu\text{F}$	$\leq 10 \times 10^{-4}$	$\leq 35 \times 10^{-4}$
$0.3 \mu\text{F} < C \leq 0.39 \mu\text{F}$	$\leq 10 \times 10^{-4}$	$\leq 40 \times 10^{-4}$
$0.39 \mu\text{F} < C \leq 0.56 \mu\text{F}$	$\leq 10 \times 10^{-4}$	$\leq 45 \times 10^{-4}$
$0.56 \mu\text{F} < C \leq 0.68 \mu\text{F}$	$\leq 10 \times 10^{-4}$	$\leq 50 \times 10^{-4}$
Rated voltage pulse slope $(dU/dt)_R$ at 250 V (DC)	50 V/ $\mu\text{s}$	
R between leads, for $C \leq 0.33 \mu\text{F}$ at 100 V; 1 minute	$>100\,000 \text{ M}\Omega$	
RC between leads, for $C > 0.33 \mu\text{F}$ at 100 V; 1 minute	$>30\,000 \text{ s}$	
R between interconnected leads and case at 100 V; 1 minute	$>100\,000 \text{ M}\Omega$	
Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s	400 V; 1 minute	
Withstanding (DC) voltage between leads and case	2840 V; 1 minute	

## Available 250 V DC versions

PACKAGING	DIMENSIONS	C-tol	FIRST 9 DIGITS OF CATALOGUE NUMBER	ORDERING
Taped on reel	H = 18.5 mm; P <sub>0</sub> = 12.7 mm; reel diameter 356 mm	$\pm 5\%$	2222 418 0.....	on request
		$\pm 2\%$	2222 418 1.....	preferred
Loose in box	$l_t = 3.5 \pm 0.3 \text{ mm}$	$\pm 5\%$	2222 418 6.....	on request
		$\pm 2\%$	2222 418 7.....	preferred

## Metallized polypropylene filter capacitors

MKP 418

 $U_{Rdc} = 250 \text{ V}$ ;  $U_{Rac} = 100 \text{ V}$ ;  $U_{p-p} = 280 \text{ V}$ 

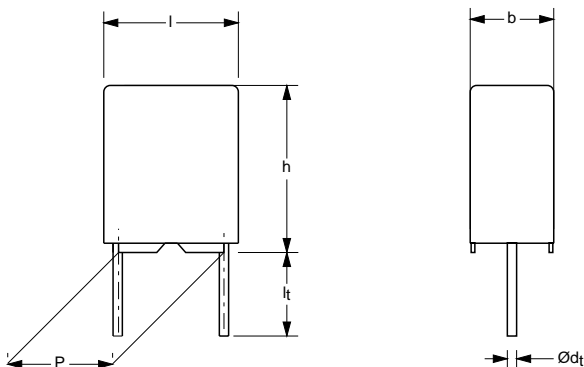
C (E 24) ( $\mu\text{F}$ )	DIMENSIONS $b \times h \times l$ (mm)	MASS (g)	CATALOGUE NUMBER 2222 418 ..... AND PACKAGING			
			REEL		LOOSE IN BOX	
			H = 18.5 mm; P <sub>0</sub> = 12.7 mm		l <sub>t</sub> = 3.5 ± 0.3 mm	
			C-tol = ±2%	SPQ	C-tol = ±2%	SPQ
			last 5 digits of catalogue number		last 5 digits of catalogue number	
<b>Pitch = 15.0 ± 0.4 mm; d<sub>t</sub> = 0.80 ± 0.08 mm</b>						
0.15	5.0 × 11.0 × 17.5	1.2	11504	1100	71504	1250
0.16			11604		71604	
0.18	6.0 × 12.0 × 17.5	1.4	11804	900	71804	1000
0.2			12004		72004	
0.22			12204		72204	
0.24			12404		72404	
0.27			12704		72704	
0.3	7.0 × 13.5 × 17.5	1.9	13004	800	73004	750
0.33			13304		73304	
0.36			13604		73604	
0.39			13904		73904	
0.43	8.5 × 15.0 × 17.5	2.6	14304	650	74304	750
0.47			14704		74704	
0.51			15104		75104	
0.56			15604		75604	
0.62	10.0 × 16.5 × 17.5	3.1	16204	600	76204	500
0.68			16804		76804	

## Metallized polypropylene filter capacitors

MKP 419

## MKP 419 GENERAL DATA

PITCH 5 mm



CBA112

Fig.10 Outline.

## Specific reference data for the 400 V DC capacitors

DESCRIPTION	VALUE	
	at 10 kHz	at 100 kHz
Tangent of loss angle: $C \leq 0.0091 \mu\text{F}$ $0.0091 \mu\text{F} < C \leq 0.02 \mu\text{F}$	$\leq 5 \times 10^{-4}$	$\leq 10 \times 10^{-4}$
Rated voltage pulse slope $(dU/dt)_R$ at 400 V (DC)	50 V/ $\mu\text{s}$	
R between leads at 100 V; 1 minute	>100 000 M $\Omega$	
R between interconnected leads and case at 100 V; 1 minute	>100 000 M $\Omega$	
Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s	640 V; 1 minute	
Withstanding (DC) voltage between leads and case	2 840 V; 1 minute	

## Available 400 V DC versions

PACKAGING	DIMENSIONS	C-tol	FIRST 9 DIGITS OF CATALOGUE NUMBER	ORDERING
Ammopack	H = 18.5 mm; P <sub>0</sub> = 12.7 mm	±5%	2222 419 0.....	on request
		±2%	2222 419 1.....	preferred
Loose in box	l <sub>t</sub> = 4.0 +1.0/-0.5 mm	±5%	2222 419 3.....	on request
		±2%	2222 419 4.....	on request

## Metallized polypropylene filter capacitors

MKP 419

 $U_{Rdc} = 400 \text{ V}$ ;  $U_{Rac} = 125 \text{ V}$ ;  $U_{p-p} = 350 \text{ V}$ 

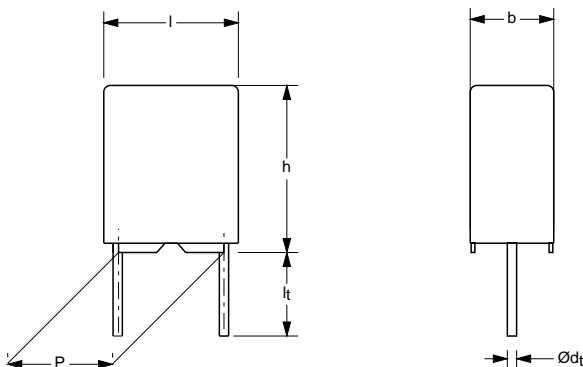
C (E 24) ( $\mu\text{F}$ )	DIMENSIONS $b \times h \times l$ (mm)	MASS (g)	CATALOGUE NUMBER 2222 419 ..... AND PACKAGING		
			REEL		LOOSE IN BOX
			H = 18.5 mm; $P_0 = 12.7 \text{ mm}$		$l_t = 4.0 +1.0/-0.5 \text{ mm}$
			C-tol = $\pm 2\%$	SPQ	SPQ
			last 5 digits of catalogue number		
<b>Pitch = <math>5.0 \pm 0.3 \text{ mm}</math>; <math>d_t = 0.50 \pm 0.05 \text{ mm}</math></b>					
0.001	$3.5 \times 8.0 \times 7.2$	0.35	11002	1500	3000
0.0011			11102		
0.0012			11202		
0.0013			11302		
0.0015			11502		
0.0016			11602		
0.0018			11802		
0.002			12002		
0.0022			12202		
0.0024			12402		
0.0027			12702		
0.003			13002		
0.0033			13302		
0.0036			13602		
0.0039	13902				
0.0043	$4.5 \times 9.0 \times 7.2$	0.45	14302	1000	2000
0.0047			14702		
0.0051			15102		
0.0056			15602		
0.0062			16202		
0.0068			16802		
0.0075			17502		
0.0082			18202		
0.0091			19102		
0.01			11003		
0.011			11103		
0.012			11203		
0.013	$6.0 \times 11.0 \times 7.2$	0.60	11303	750	1500
0.015			11503		
0.016			11603		
0.018			11803		
0.02			12003		

## Metallized polypropylene filter capacitors

MKP 419

## MKP 419 GENERAL DATA

PITCH 10 mm



CBA112

Fig.11 Outline.

## Specific reference data for the 400 V DC capacitors

DESCRIPTION	VALUE	
	at 10 kHz	at 100 kHz
Tangent of loss angle:		
$C \leq 0.027 \mu\text{F}$	$\leq 5 \times 10^{-4}$	$\leq 15 \times 10^{-4}$
$0.027 \mu\text{F} < C \leq 0.068 \mu\text{F}$	$\leq 5 \times 10^{-4}$	$\leq 20 \times 10^{-4}$
Rated voltage pulse slope $(dU/dt)_R$ at 400 V (DC)	20 V/ $\mu\text{s}$	
R between leads at 100 V; 1 minute	>100 000 M $\Omega$	
R between interconnected leads and case at 100 V; 1 minute	>100 000 M $\Omega$	
Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s	640 V; 1 minute	
Withstanding (DC) voltage between leads and case	2 840 V; 1 minute	

## Available 400 V DC versions

PACKAGING	DIMENSIONS	C-tol	FIRST 9 DIGITS OF CATALOGUE NUMBER	ORDERING
Ammopack	H = 18.5 mm; P <sub>0</sub> = 12.7 mm	±5%	2222 419 0.....	on request
		±2%	2222 419 1.....	preferred
Loose in box	l <sub>t</sub> = 4.0 +1.0/-0.5 mm	±5%	2222 419 3.....	on request
		±2%	2222 419 4.....	on request

## Metallized polypropylene filter capacitors

MKP 419

 $U_{Rdc} = 400 \text{ V}$ ;  $U_{Rac} = 125 \text{ V}$ ;  $U_{p-p} = 350 \text{ V}$ 

C (E 24) ( $\mu\text{F}$ )	DIMENSIONS $b \times h \times l$ (mm)	MASS (g)	CATALOGUE NUMBER 2222 419 ..... AND PACKAGING		
			REEL		LOOSE IN BOX
			H = 18.5 mm; P <sub>0</sub> = 12.7 mm		$l_t = 4.0 +1.0/-0.5 \text{ mm}$
			C-tol = $\pm 2\%$	SPQ	SPQ
last 5 digits of catalogue number					
<b>Pitch = <math>10.0 \pm 0.4 \text{ mm}</math>; <math>d_t = 0.60 \pm 0.06 \text{ mm}</math></b>					
0.022	4.0 × 10.0 × 12.5	0.60	12203	750	1000
0.024			12403		
0.027			12703		
0.03			13003		
0.033			13303		
0.036	5.0 × 11.0 × 12.5	0.85	13603	600	1000
0.039			13903		
0.043			14303		
0.047	6.0 × 12.0 × 12.5	1.10	14703	500	750
0.051			15103		
0.056			15603		
0.062			16203		
0.068			16803		

## Metallized polypropylene filter capacitors

MKP 419

## MKP 419 GENERAL DATA

PITCH 15 mm

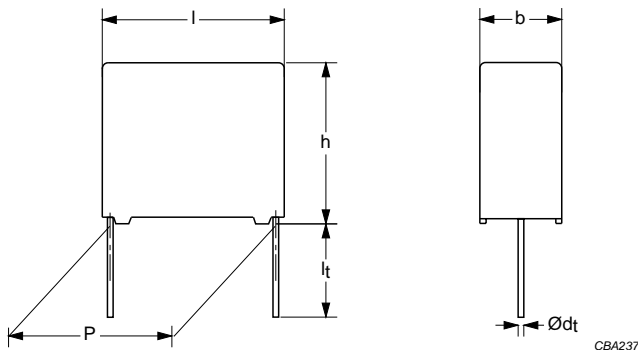


Fig.12 Outline.

## Specific reference data for the 400 V DC capacitors

DESCRIPTION	VALUE	
	at 10 kHz	at 100 kHz
Tangent of loss angle:		
0.075 $\mu\text{F} < C \leq 0.11 \mu\text{F}$	$\leq 5 \times 10^{-4}$	$\leq 25 \times 10^{-4}$
0.11 $\mu\text{F} < C \leq 0.22 \mu\text{F}$	$\leq 10 \times 10^{-4}$	$\leq 30 \times 10^{-4}$
0.22 $\mu\text{F} < C \leq 0.36 \mu\text{F}$	$\leq 10 \times 10^{-4}$	$\leq 35 \times 10^{-4}$
Rated voltage pulse slope $(dU/dt)_R$ at 400 V (DC)	50 V/ $\mu\text{s}$	
R between leads, for $C \leq 0.33 \mu\text{F}$ at 100 V; 1 minute	$>100\,000 \text{ M}\Omega$	
RC between leads, for $C > 0.33 \mu\text{F}$ at 100 V; 1 minute	$>30\,000 \text{ s}$	
R between interconnected leads and case at 100 V; 1 minute	$>100\,000 \text{ M}\Omega$	
Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s	640 V; 1 minute	
Withstanding (DC) voltage between leads and case	2840 V; 1 minute	

## Available 400 V DC versions

PACKAGING	DIMENSIONS	C-tol	FIRST 9 DIGITS OF CATALOGUE NUMBER	ORDERING
Taped on reel	H = 18.5 mm; P <sub>0</sub> = 12.7 mm; reel diameter 356 mm	$\pm 5\%$	2222 419 0.....	on request
		$\pm 2\%$	2222 419 1.....	preferred
Loose in box	l <sub>t</sub> = 3.5 $\pm$ 0.3 mm	$\pm 5\%$	2222 419 6.....	on request
		$\pm 2\%$	2222 419 7.....	preferred

## Metallized polypropylene filter capacitors

MKP 419

 $U_{Rdc} = 400 \text{ V}$ ;  $U_{Rac} = 125 \text{ V}$ ;  $U_{p-p} = 350 \text{ V}$ 

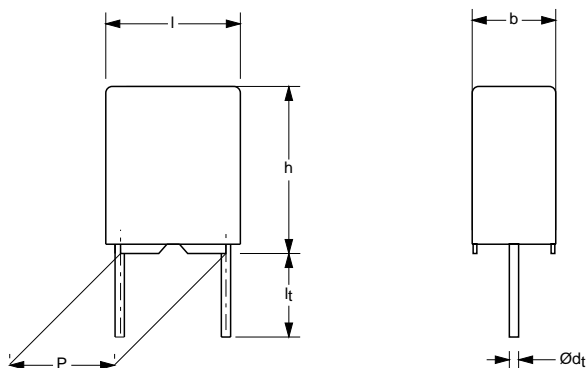
C (E 24) ( $\mu\text{F}$ )	DIMENSIONS $b \times h \times l$ (mm)	MASS (g)	CATALOGUE NUMBER 2222 419 ..... AND PACKAGING			
			REEL		LOOSE IN BOX	
			H = 18.5 mm; P <sub>0</sub> = 12.7 mm		l <sub>t</sub> = 3.5 ± 0.3 mm	
			C-tol = ±2%	SPQ	C-tol = ±2%	SPQ
			last 5 digits of catalogue number		last 5 digits of catalogue number	
<b>Pitch = 15.0 ± 0.4 mm; d<sub>t</sub> = 0.80 ± 0.08 mm</b>						
0.075	5.0 × 11.0 × 17.5	1.2	17503	1100	77503	1250
0.082			18203		78203	
0.091	6.0 × 12.0 × 17.5	1.4	19103	900	79103	1000
0.1			11004		71004	
0.11			11104		71104	
0.12			11204		71204	
0.13			11304		71304	
0.15	7.0 × 13.5 × 17.5	1.9	11504	800	71504	750
0.16			11604		71604	
0.18			11804		71804	
0.2	8.5 × 15.0 × 17.5	2.6	12004	650	72004	750
0.22			12204		72204	
0.24			12404		72404	
0.27			12704		72704	
0.3	10.0 × 16.5 × 17.5	3.1	13004	600	73004	500
0.33			13304		73304	
0.36			13604		73604	

## Metallized polypropylene filter capacitors

MKP 420

## MKP 420 GENERAL DATA

PITCH 5 mm



CBA112

Fig.13 Outline.

## Specific reference data for the 630 V DC capacitors

DESCRIPTION	VALUE	
	at 10 kHz	at 100 kHz
Tangent of loss angle: $C \leq 0.0068 \mu\text{F}$	$\leq 5 \times 10^{-4}$	$\leq 10 \times 10^{-4}$
Rated voltage pulse slope $(dU/dt)_R$ at 630 V (DC)	50 V/ $\mu\text{s}$	
R between leads at 500 V; 1 minute	$>100\,000 \text{ M}\Omega$	
R between interconnected leads and case at 500 V; 1 minute	$>100\,000 \text{ M}\Omega$	
Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s	1 000 V; 1 minute	
Withstanding (DC) voltage between leads and case	1 260 V; 1 minute	

## Available 630 V DC versions

PACKAGING	DIMENSIONS	C-tol	FIRST 9 DIGITS OF CATALOGUE NUMBER	ORDERING
Ammopack	$H = 18.5 \text{ mm}; P_0 = 12.7 \text{ mm}$	$\pm 5\%$	2222 420 0.....	on request
		$\pm 2\%$	2222 420 1.....	preferred
Loose in box	$l_t = 4.0 +1.0/-0.5 \text{ mm}$	$\pm 5\%$	2222 420 3.....	on request
		$\pm 2\%$	2222 420 4.....	on request

## Metallized polypropylene filter capacitors

MKP 420

 $U_{Rdc} = 630 \text{ V}$ ;  $U_{Rac} = 160 \text{ V}$ ;  $U_{p-p} = 450 \text{ V}$ 

C (E 24) ( $\mu\text{F}$ )	DIMENSIONS $b \times h \times l$ (mm)	MASS (g)	CATALOGUE NUMBER 2222 420 ..... AND PACKAGING		
			REEL		LOOSE IN BOX
			H = 18.5 mm; P <sub>0</sub> = 12.7 mm		$l_t = 4.0 +1.0/-0.5 \text{ mm}$
			C-tol = $\pm 2\%$	SPQ	SPQ
			last 5 digits of catalogue number		
<b>Pitch = <math>5.0 \pm 0.3 \text{ mm}</math>; <math>d_t = 0.50 \pm 0.05 \text{ mm}</math></b>					
0.0015	$3.5 \times 8.0 \times 7.2$	0.35	11502	1500	3000
0.0016			11602		
0.0018			11802		
0.002			12002		
0.0022			12202		
0.0024			12402		
0.0027			12702		
0.003	$4.5 \times 9.0 \times 7.2$	0.45	13002	1000	2000
0.0033			13302		
0.0036			13602		
0.0039			13902		
0.0043	$6.0 \times 11.0 \times 7.2$	0.60	14302	750	1500
0.0047			14702		
0.0051			15102		
0.0056			15602		
0.0062			16202		
0.0068			16802		

## Metallized polypropylene filter capacitors

MKP 420

## MKP 420 GENERAL DATA

PITCH 10 mm

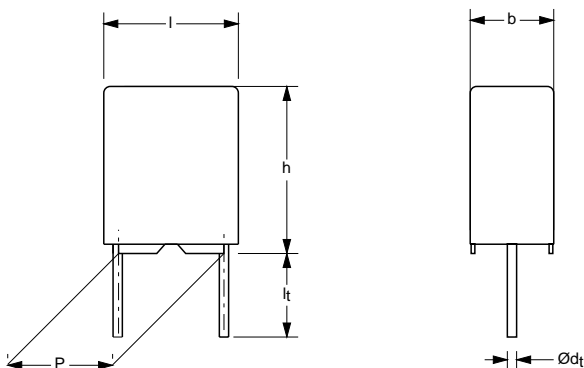


Fig.14 Outline.

## Specific reference data for the 630 V DC capacitors

DESCRIPTION	VALUE	
	at 10 kHz	at 100 kHz
Tangent of loss angle:		
$C \leq 0.027 \mu\text{F}$	$\leq 5 \times 10^{-4}$	$\leq 15 \times 10^{-4}$
$0.027 \mu\text{F} < C \leq 0.047 \mu\text{F}$	$\leq 5 \times 10^{-4}$	$\leq 20 \times 10^{-4}$
Rated voltage pulse slope $(dU/dt)_R$ at 630 V (DC)	50 V/ $\mu\text{s}$	
R between leads at 500 V; 1 minute	$>100\,000 \text{ M}\Omega$	
R between interconnected leads and case at 500 V; 1 minute	$>100\,000 \text{ M}\Omega$	
Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s	1 000 V; 1 minute	
Withstanding (DC) voltage between leads and case	2 840 V; 1 minute	

## Available 630 V DC versions

PACKAGING	DIMENSIONS	C-tol	FIRST 9 DIGITS OF CATALOGUE NUMBER	ORDERING
Ammopack	$H = 18.5 \text{ mm}; P_0 = 12.7 \text{ mm}$	$\pm 5\%$	2222 420 0.....	on request
		$\pm 2\%$	2222 420 1.....	preferred
Loose in box	$l_t = 4.0 +1.0/-0.5 \text{ mm}$	$\pm 5\%$	2222 420 3.....	on request
		$\pm 2\%$	2222 420 4.....	on request

## Metallized polypropylene filter capacitors

MKP 420

 $U_{Rdc} = 630 \text{ V}$ ;  $U_{Rac} = 160 \text{ V}$ ;  $U_{p-p} = 450 \text{ V}$ 

C (E 24) ( $\mu\text{F}$ )	DIMENSIONS $b \times h \times l$ (mm)	MASS (g)	CATALOGUE NUMBER 2222 420 ..... AND PACKAGING		
			REEL		LOOSE IN BOX
			H = 18.5 mm; P <sub>0</sub> = 12.7 mm		$l_t = 4.0 +1.0/-0.5 \text{ mm}$
			C-tol = $\pm 2\%$	SPQ	SPQ
			last 5 digits of catalogue number		
<b>Pitch = <math>10.0 \pm 0.4 \text{ mm}</math>; <math>d_t = 0.60 \pm 0.06 \text{ mm}</math></b>					
0.01	4.0 × 10.0 × 12.5	0.60	2222 420 11003	750	1000
0.011			2222 420 11103		
0.012			2222 420 11203		
0.013			2222 420 11303		
0.015			2222 420 11503		
0.016			2222 420 11603		
0.018	5.0 × 11.0 × 12.5	0.85	2222 420 11803	600	1000
0.02			2222 420 12003		
0.022			2222 420 12203		
0.024			2222 420 12403		
0.027	6.0 × 12.0 × 12.5	1.10	2222 420 12703	500	750
0.03			2222 420 13003		
0.033			2222 420 13303		
0.036			2222 420 13603		
0.039			2222 420 13903		
0.043			2222 420 14303		
0.047			2222 420 14703		

## Metallized polypropylene filter capacitors

MKP 420

## MKP 420 GENERAL DATA

PITCH 15 mm

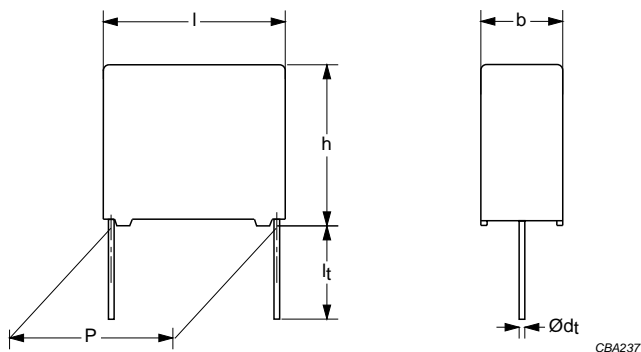


Fig.15 Outline.

## Specific reference data for the 630 V DC capacitors

DESCRIPTION	VALUE	
Tangent of loss angle: 0.051 $\mu\text{F} < C \leq 0.11 \mu\text{F}$ 0.11 $\mu\text{F} < C \leq 0.16 \mu\text{F}$	at 10 kHz	at 100 kHz
	$\leq 5 \times 10^{-4}$	$\leq 25 \times 10^{-4}$
	$\leq 10 \times 10^{-4}$	$\leq 35 \times 10^{-4}$
Rated voltage pulse slope $(dU/dt)_R$ at 630 V (DC)	50 V/ $\mu\text{s}$	
R between leads at 500 V; 1 minute	$>100\,000 \text{ M}\Omega$	
R between interconnected leads and case at 500 V; 1 minute	$>100\,000 \text{ M}\Omega$	
Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s	1 000 V; 1 minute	
Withstanding (DC) voltage between leads and case	1 260 V; 1 minute	

## Available 630 V DC versions

PACKAGING	DIMENSIONS	C-tol	FIRST 9 DIGITS OF CATALOGUE NUMBER	ORDERING
Taped on reel	H = 18.5 mm; P <sub>0</sub> = 12.7 mm; reel diameter 356 mm	$\pm 5\%$	2222 420 0.....	on request
		$\pm 2\%$	2222 420 1.....	preferred
Loose in box	$l_t = 3.5 \pm 0.3 \text{ mm}$	$\pm 5\%$	2222 420 6.....	on request
		$\pm 2\%$	2222 420 7.....	preferred

## Metallized polypropylene filter capacitors

MKP 416 to 420

 $U_{Rdc} = 630 \text{ V}$ ;  $U_{Rac} = 160 \text{ V}$ ;  $U_{p-p} = 450 \text{ V}$ 

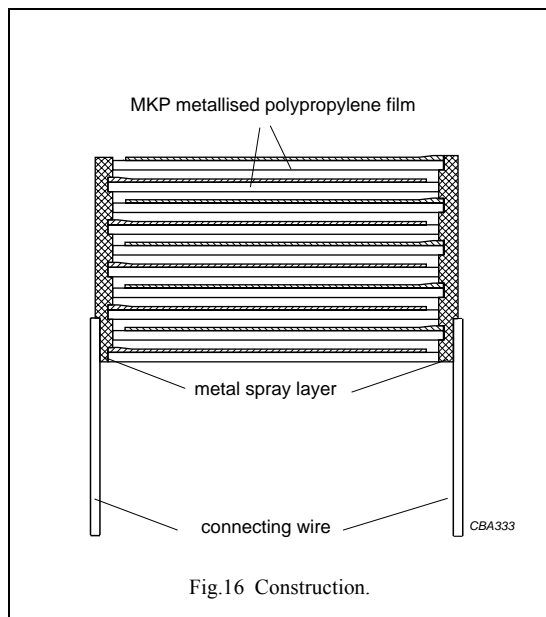
C (E 24) ( $\mu\text{F}$ )	DIMENSIONS $b \times h \times l$ (mm)	MASS (g)	CATALOGUE NUMBER 2222 420 ..... AND PACKAGING			
			REEL		LOOSE IN BOX	
			H = 18.5 mm; P <sub>0</sub> = 12.7 mm		l <sub>t</sub> = 3.5 ± 0.3 mm	
			C-tol = ±2%	SPQ	C-tol = ±2%	SPQ
			last 5 digits of catalogue number		last 5 digits of catalogue number	
<b>Pitch = 15.0 ± 0.4 mm; d<sub>t</sub> = 0.80 ± 0.08 mm</b>						
0.051	6.0 × 12.0 × 17.5	1.4	15103	900	75103	1000
0.056			15603		75603	
0.062	7.0 × 13.5 × 17.5	1.9	16203	800	76203	750
0.068			16803		76803	
0.075			17503		77503	
0.082			18203		78203	
0.091	8.5 × 15.0 × 17.5	2.6	19103	650	79103	750
0.1			11004		71004	
0.11			11104		71104	
0.12			11204		71204	
0.13	10.0 × 16.5 × 17.5	3.1	11304	600	71304	500
0.15			11504		71504	
0.16			11604		71604	

## Metallized polypropylene filter capacitors

MKP 416 to 420

**CONSTRUCTION****Description**

- Low-inductive wound cell of metallized polypropylene (PP) film, potted with epoxy resin in a flame-retardant case
- Radial leads, solder-coated
  - Copper clad steel wire for pitch = 2e, 4e and 6e (case size 1750 and 1760)
  - Copper wire pitch = 6e (case size 1770, 1785 and 1710)
- Solder-plated copper-clad steel wire to ensure good resistance to soldering heat
- Small stand-off pips allow removal of solder flux etc. during cleaning of the printed-circuit board.

**Mounting****NORMAL USE**

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

**SPECIFIC METHOD OF MOUNTING TO WITHSTAND VIBRATION AND SHOCK**

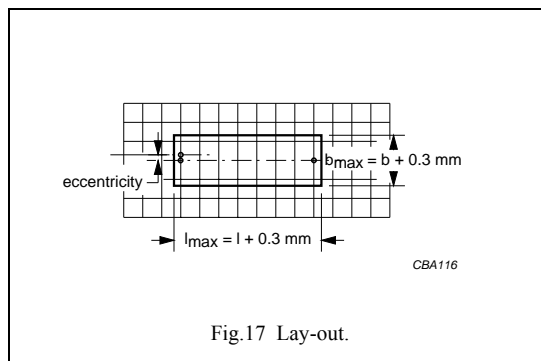
In order to withstand vibration and shock tests, it must be ensured that the stand-off pips are in good contact with the printed-circuit board.

The capacitors shall be mechanically fixed by the leads.

**SPACE REQUIREMENTS ON PRINTED-CIRCUIT BOARD**

The maximum length and width of film capacitors is shown in Fig.17:

- Eccentricity as in Fig.17. The maximum eccentricity is smaller than or equal to the lead diameter of the product concerned.
- Product height with seating plane as given by "IEC 60717" as reference:  $h_{\max} \leq h + 0.3 \text{ mm}$ .

**Storage temperature**

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

**RATINGS AND CHARACTERISTICS REFERENCE CONDITIONS**

Unless otherwise specified, all electrical values apply at an ambient free air temperature of  $23 \pm 1 \text{ }^\circ\text{C}$ , 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%.

# Metallized polypropylene filter capacitors

# MKP 416 to 420

## CHARACTERISTICS

### Capacitance

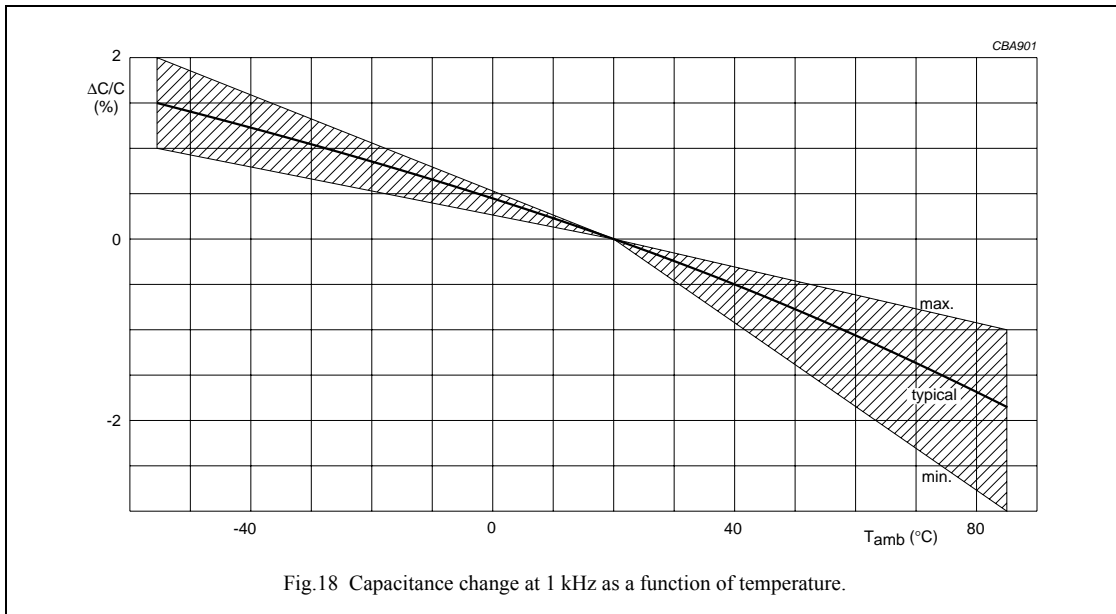


Fig.18 Capacitance change at 1 kHz as a function of temperature.

### Impedance

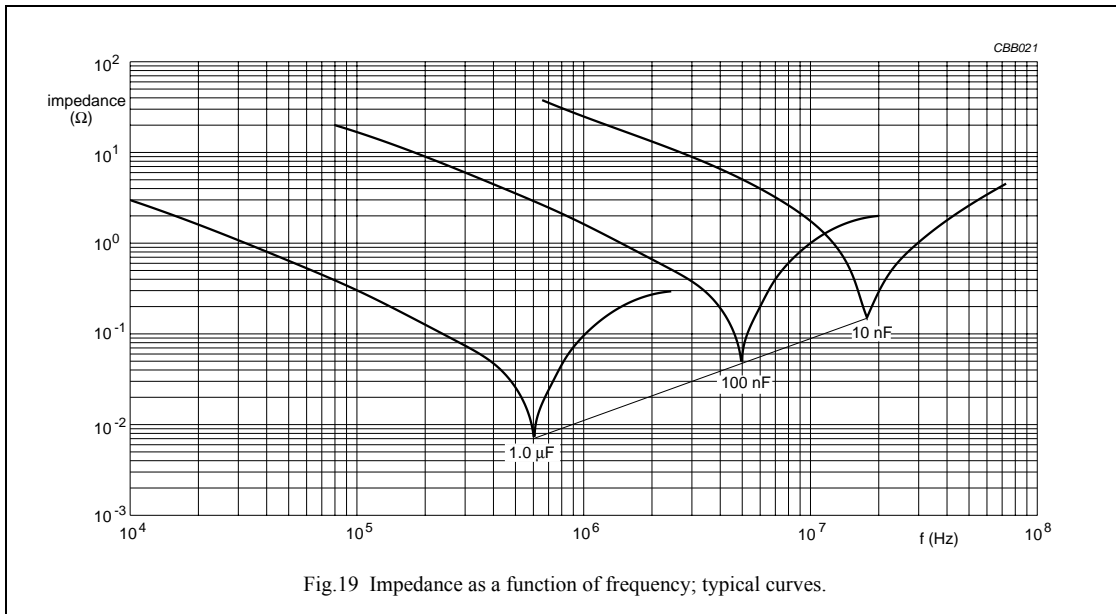
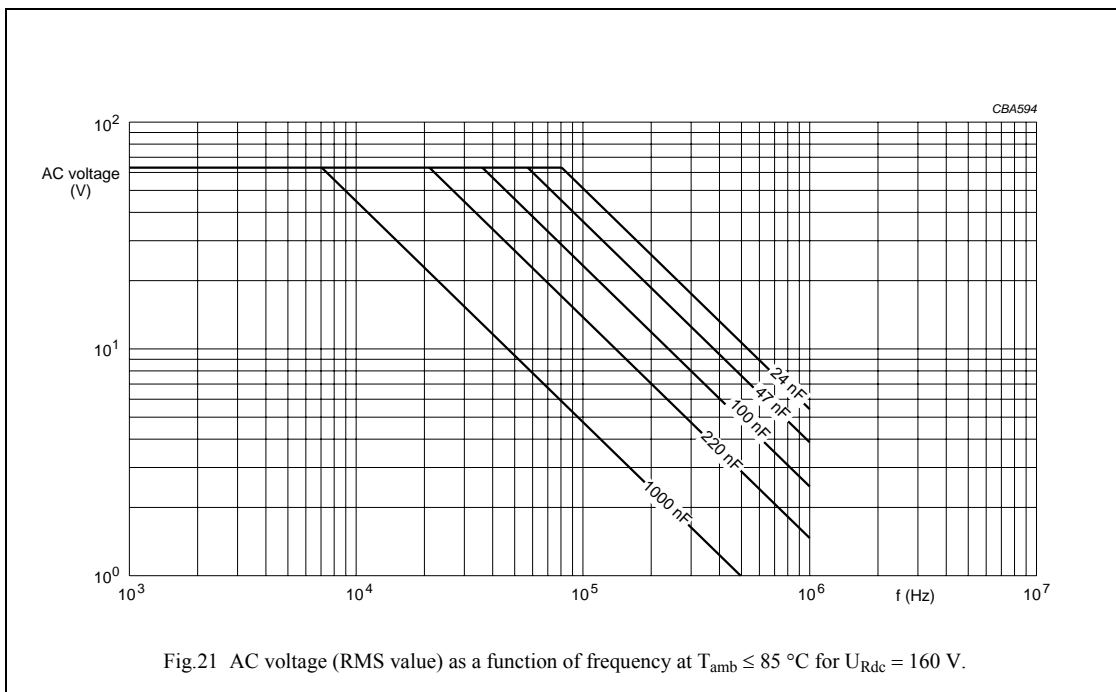
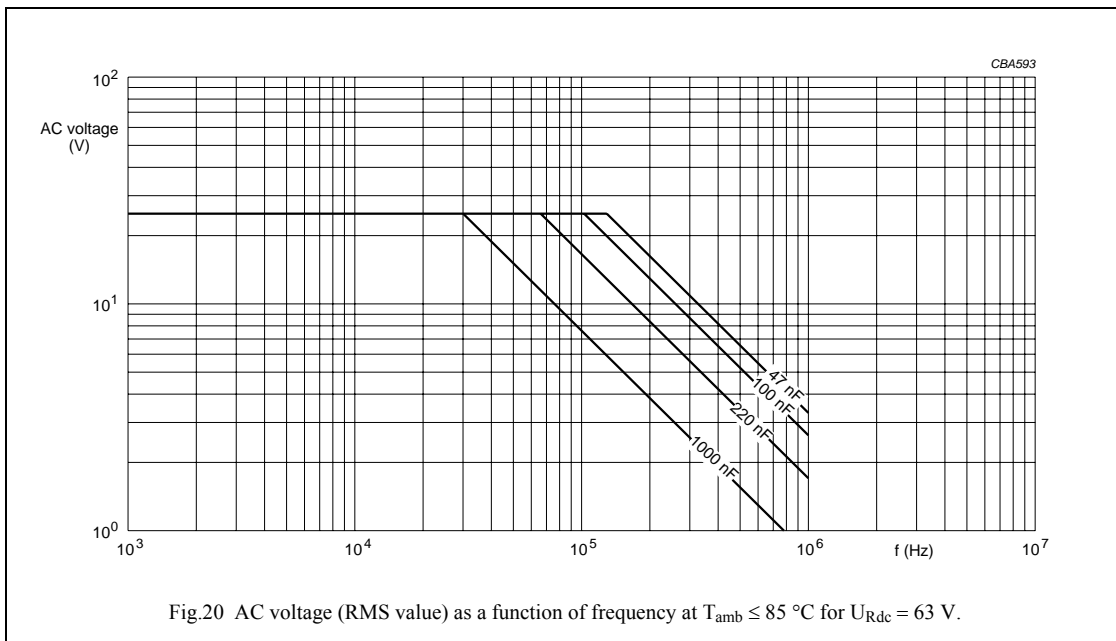


Fig.19 Impedance as a function of frequency; typical curves.

Metallized polypropylene filter capacitors

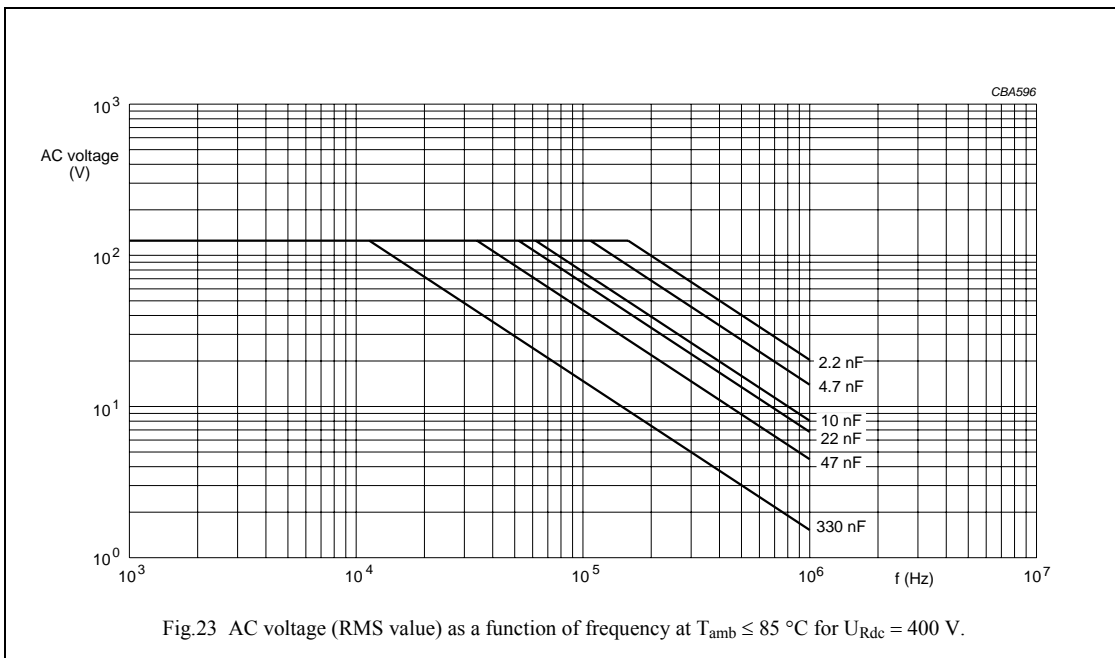
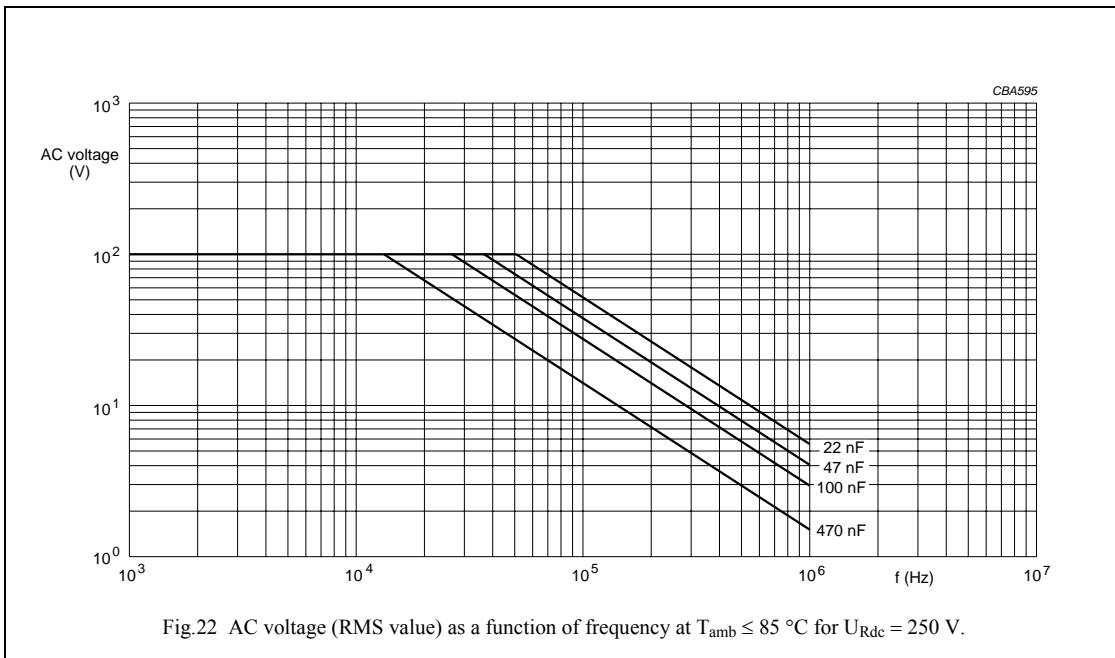
MKP 416 to 420

Maximum RMS voltage (sinewave) as a function of frequency



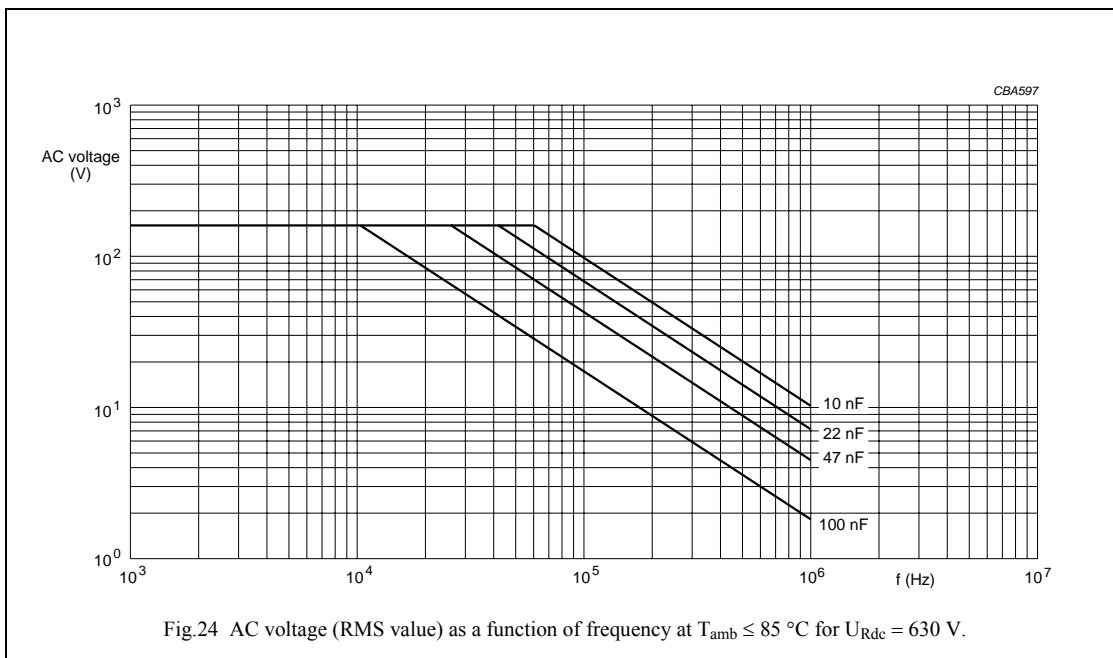
Metallized polypropylene filter capacitors

MKP 416 to 420



## Metallized polypropylene filter capacitors

## MKP 416 to 420

**Maximum RMS current (sinewave) as a function of frequency**

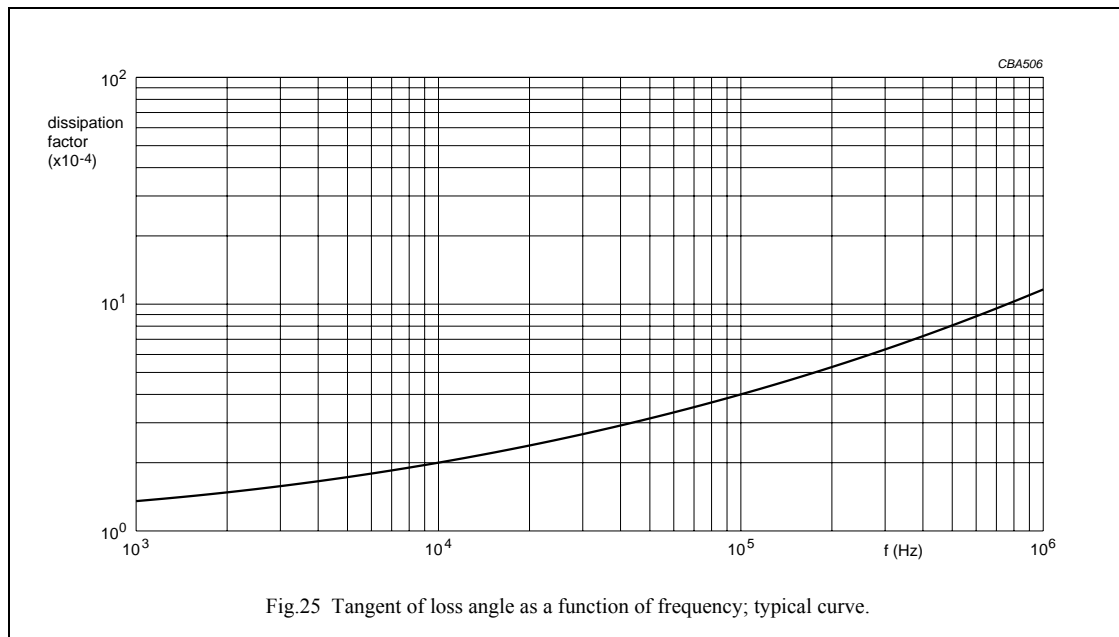
The maximum RMS current is defined by  $I_{\text{ac}} = \omega \times C \times U_{\text{ac}}$ .

$U_{\text{ac}}$  is the maximum AC voltage depending on the ambient temperature in Figs 20 to 24.

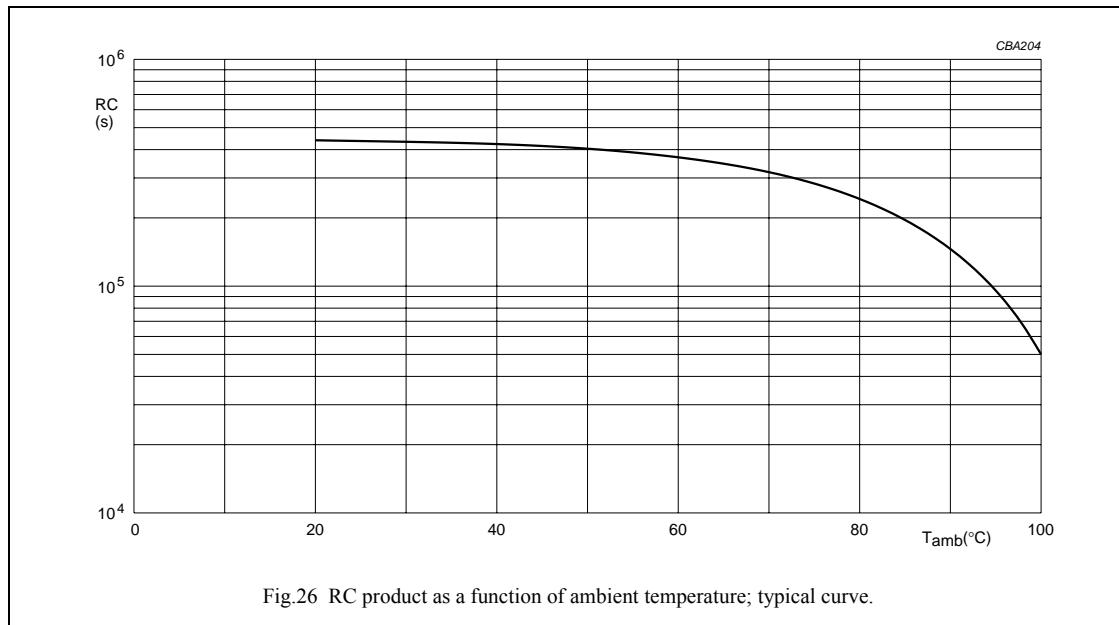
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**Tangent of loss angle**



**Insulation resistance**



## Metallized polypropylene filter capacitors

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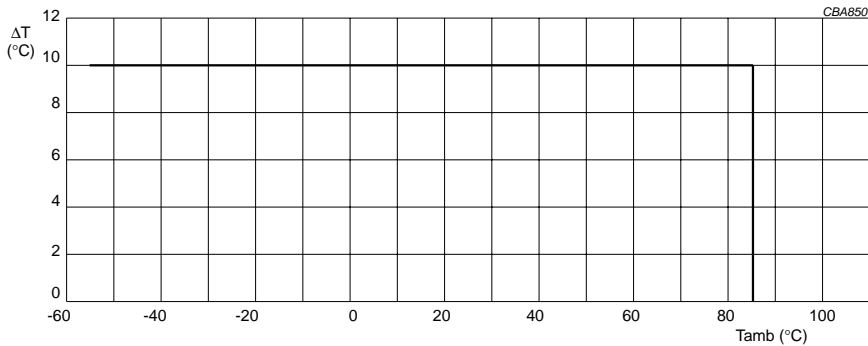
**Maximum allowed component temperature rise (DT) as a function of the ambient temperature ( $T_{amb}$ )**

Fig.27 Maximum allowed component temperature rise as a function of the ambient temperature.

**Heat conductivity (G) as a function of pitch and capacitor body thickness in mW/×C****Table 1** Heat conductivity

$b_{max}$ (mm)	PITCH (mm)		
	5	10	15
3.5	3.0	–	–
4.0	–	6.5	–
4.5	4.0	–	–
5.0	–	7.5	10
6.0	5.5	9.0	11
7.0	–	–	12
8.5	–	–	16
10.0	–	–	18

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

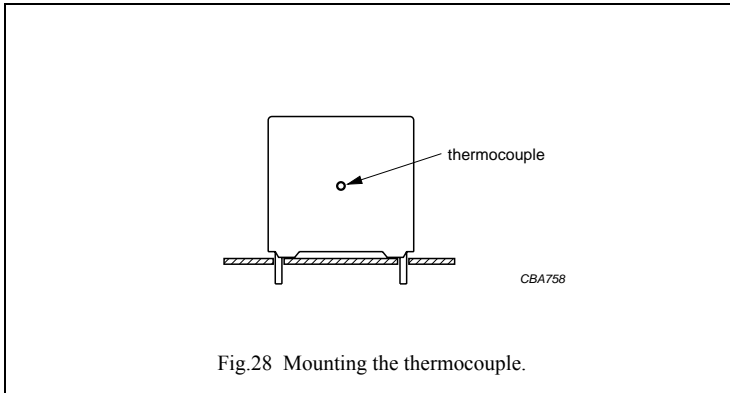
- $\Delta T$  = component temperature rise (°C).
- P = power dissipation of the component (mW).
- G = heat conductivity of the component (mW/°C).

# Metallized polypropylene filter capacitors

MKP 416 to 420

## Measuring the component temperature

A thermocouple must be attached to the capacitor body; see Fig.28.



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.

## Metallized polypropylene filter capacitors

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**Application note and limiting conditions**

These capacitors are not suitable for mains applications as across-the-line capacitors without additional protection, as described hereunder. These mains applications are strictly regulated in safety standards and therefore electromagnetic interference suppression capacitors conforming the standards must be used.

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

1. The peak voltage ( $U_p$ ) shall not be greater than the rated DC voltage ( $U_{Rdc}$ ).
2. The peak-to-peak voltage ( $U_{p-p}$ ) shall not be greater than the maximum  $U_{p-p}$ .
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.27.
5. Since in circuits used at voltages over 280 V peak-to-peak the risk for an intrinsically active flammability after a capacitor breakdown (short circuit) increases, it is recommended that the power to the component is limited to 100 times the values mentioned in Table 1 "Heat conductivity".
6. When using these capacitors in the input filters or as series connected with an impedance to the mains the applicant must guarantee that following conditions are fulfilled in any case (spikes and surge voltages from the mains or line card supply included).

## VOLTAGE CONDITIONS FOR 6 ABOVE

ALLOWED VOLTAGES	$T_{amb} \leq 85 \text{ }^\circ\text{C}$
Maximum continuous RMS voltage	$U_{Rac}$
Maximum temporary RMS -overvoltage (<24 hours)	$1.25 \times U_{Rac}$
Maximum peak voltage ( $V_{o-p}$ ) (<2 s)	$1.6 \times U_{Rdc}$

**Example**

$C = 0.1 \text{ } \mu\text{F}$  - 250 V used for the sine voltage signal of  $2 V_{RMS}$  at 1 MHz superimposed on 160 V (DC).

The ambient temperature is  $50 \text{ }^\circ\text{C}$ . The circuit is high ohmic during a capacitor breakdown.

Checking the conditions:

1. The peak voltage  $U_p = 162.8 \text{ V}$  is lower than 250 V (DC).
2. The peak-to-peak voltage  $5.6 \text{ V}$  is lower than  $2 \times \sqrt{2} \times 100 \text{ V(AC)} = 280 U_{p-p}$ .
3. The signal is not pulsed.
4. This is a sinewave, according the curves in, the capacitor can be applied.
5. Not applicable.
6. Not applicable.

## Metallized polypropylene filter capacitors

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**MARKING****Product marking**

## CAPACITORS WITH PITCH = 5 mm

The capacitors are marked on the side (see Fig.29) with the following information:

1. Capacitance code in accordance with "IEC 60062": n = nF
2. Tolerance on rated capacitance: G =  $\pm 2\%$ ; J =  $\pm 5\%$
3. Rated (DC) voltage (e.g. 250 V)
4. Code for manufacturer
5. Year and week of manufacture (e.g. 0001)
6. Manufacturers type designation.

## CAPACITORS WITH PITCH = 10 mm

The capacitors are marked on the front face (see Fig.30) with the following information:

1. Year and week of manufacture (e.g. 0001)
2. Capacitance code in accordance with "IEC 60062"
3. Tolerance on rated capacitance: G =  $\pm 2\%$ ; J =  $\pm 5\%$
4. Rated (DC) voltage (e.g. 160 V)
5. Code for dielectric material (MKP)
6. Manufacturer's type designation (e.g. 417)
7. Code for manufacturer
8. Code for factory of origin (HQ).

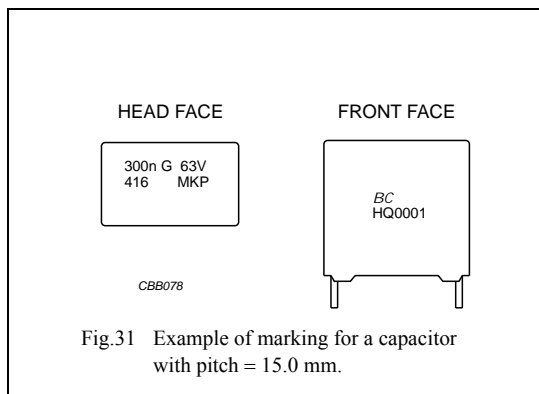
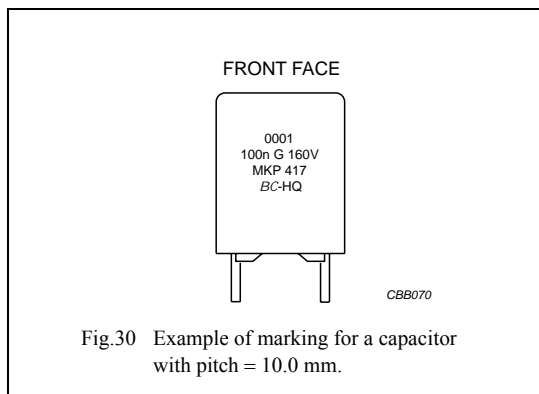
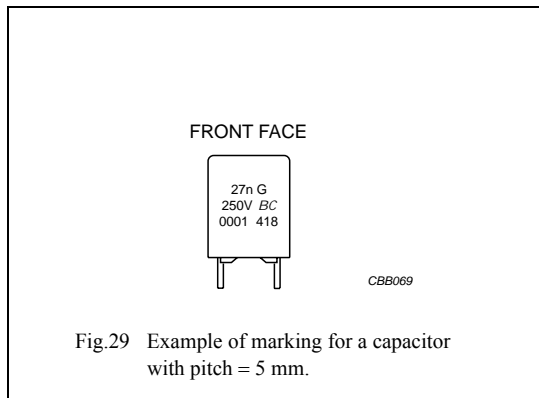
## CAPACITORS WITH PITCH = 15 mm

The capacitors are marked on the top (see Fig.31) with the following information:

1. Rated capacitance code in accordance with "IEC 60062"
2. Tolerance on rated capacitance: G =  $\pm 2\%$ ; J =  $\pm 5\%$
3. Rated voltage (DC) (e.g. 63 V)
4. Manufacturer's type designation (416)
5. Code for dielectric material (MKP);

and on the side with the following information:

1. Manufacturer
2. Code for factory of origin (HQ)
3. Year and week of manufacture (e.g. 0001).



## Metallized polypropylene filter capacitors

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## Package marking

The package containing the capacitors is marked as shown in Fig.32.

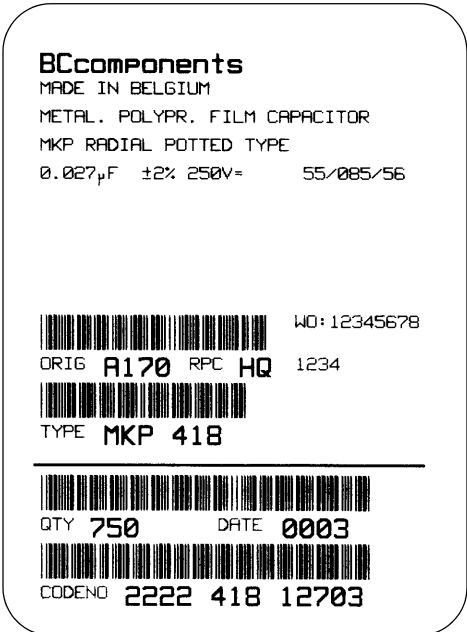
Barcode label marking	LINE	MARKING EXPLANATION
 <p><b>BCcomponents</b> MADE IN BELGIUM METAL. POLYPR. FILM CAPACITOR MKP RADIAL POTTED TYPE 0.027µF ±2% 250V= 55/085/56</p> <p>WD: 12345678</p> <p>ORIG <b>A170</b> RPC HQ 1234</p> <p>TYPE <b>MKP 418</b></p> <hr/> <p>QTY <b>750</b> DATE <b>0003</b></p> <p>CODENO <b>2222 418 12703</b></p>	1	Manufacturer's name
	2	Country of origin
	3	Sub-family
	4	Type description
	5	Capacitance value in µF, 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 Wage number of final inspection
	8	Product type description
	9	Quantity and production period, year and week code
	10	Product code (12NC)

Fig.32 Barcode label.

## Metallized polypropylene filter capacitors

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## QUICK REFERENCE TEST REQUIREMENTS

TEST	PROCEDURE (quick reference)	REQUIREMENTS
<b>Robustness of leads</b>		
Tensile strength: "IEC 60068-2-21"	load 10 N; 10 s	no visible damage legible marking $ \Delta C/C  \leq 1\% + 5 \text{ pF}$ $\Delta \tan \delta \leq 5 \times 10^{-4}$
Bending: "IEC 60068-2-21"	load 5 N; $4 \times 90^\circ$	
Resistance to soldering heat "IEC 60068-2-20"	solder bath: 260 °C; 5 s	
Component solvent resistance	isopropyl alcohol; 23 °C; 5 minutes	
<b>Robustness of component</b>		
Vibration: "IEC 60068-2-6"	10 to 55 Hz; amplitude 0.75 mm or acceleration 98 m/s <sup>2</sup> ; 6 hours	$ \Delta C/C  \leq 1\% + 5 \text{ pF}$ $\Delta \tan \delta \leq 5 \times 10^{-4}$
Shock: "IEC 60068-2-27"	half sinewave; 490 m/s <sup>2</sup> ; 11 ms	
<b>Climatic sequence</b>		
Dry heat: "IEC 60068-2-2"	16 hours; 85 °C	$ \Delta C/C  \leq 1\% + 5 \text{ pF}$ $\Delta \tan \delta \leq 5 \times 10^{-4}$ $R_{\text{ins}} \geq 50\%$ of specified value
Damp heat, cyclic, test Db, first cycle: "IEC 60068-2-30"		
Cold: "IEC 60068-2-1"	2 hours; -55 °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 °C; 90 to 95% RH	$ \Delta C/C  \leq 1\% + 5 \text{ pF}$ $\Delta \tan \delta \leq 5 \times 10^{-4}$ $R_{\text{ins}} \geq 50\%$ of specified value
Endurance (DC): "IEC 60384-16"	2000 hours: $1.25 \times U_{\text{Rdc}}$ ; 85 °C	
Heat storage: "IEC 60384-16"	2000 hours; 85 °C	$ \Delta C/C  \leq 1\% + 5 \text{ pF}$ $\Delta \tan \delta \leq 5 \times 10^{-4}$
Resistance to soldering heat with preheating: "IEC 60384-16"	body temperature: 85 °C; bath temperature: 260 °C; dwell time: 10 s	
Passive flammability: "IEC 60384-1"	class C	no burning
Endurance (AC): "IEC 60384-16"	1000 hours: 85 °C $1.25 \times U_{\text{Rac}}$ (RMS); 50 Hz	$ \Delta C/C  \leq 2\% + 5 \text{ pF}$ $\Delta \tan \delta \leq 5 \times 10^{-4}$ $R_{\text{ins}} \geq 50\%$ of specified value