DATA SHEET

MKP 416 to 420
Metallized polypropylene filter capacitors

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

2002 Oct 09

BC COMPONENTS

Metallized polypropylene filter capacitors

MKP 416 to 420

MKP RADIAL POTTED TYPE **PITCH 5/10/15 mm**

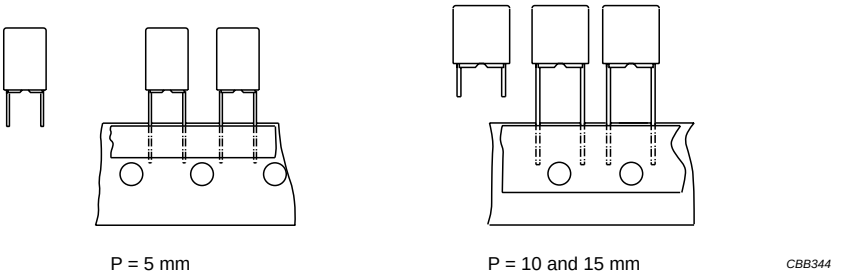


Fig.1 Simplified outlines.

FEATURES

- 5, 10 and 15 mm lead pitch
- Supplied loose in box, in ammopack 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 µF
Capacitance tolerance	±5%; ±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 (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
				ON REQUEST	
416	Taped		±5%	0	
	Loose in box	lead length 4.0 mm	±5%	3	
			±2%	4	
		lead length 3.5 mm	±5%	6	
417	Taped		±5%		0
	Loose in box	lead length 4.0 mm	±5%		3
			±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 (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
				ON REQUEST		
418	Taped		±5%	0		
	Loose in box	lead length 4.0 mm	±5%	3		
			±2%	4		
		lead length 3.5 mm	±5%	6		
419	Taped		±5%		0	
	Loose in box	lead length 4.0 mm	±5%		3	
			±2%		4	
		lead length 3.5 mm	±5%		6	
420	Taped		±5%			0
	Loose in box	lead length 4.0 mm	±5%			3
			±2%			4
		lead length 3.5 mm	±5%			6

Metallized polypropylene filter capacitors MKP 416

MKP 416 GENERAL DATA **PITCH 5/10 mm**

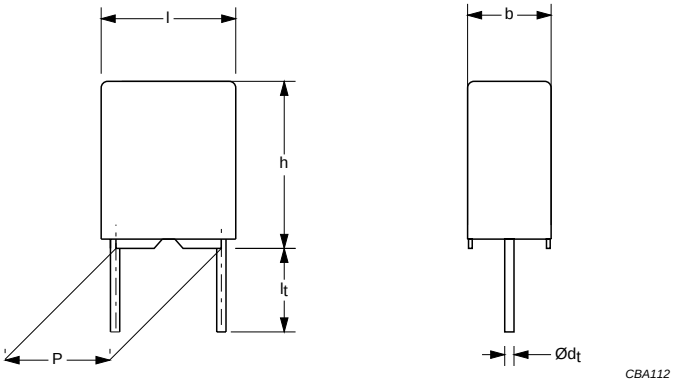


Fig.4 Outline.

Specific reference data for the 63 V DC capacitors

DESCRIPTION	VALUE	
Tangent of loss angle:	at 10 kHz	at 100 kHz
C ≤ 0.11 µF	$\leq 5 \times 10^{-4}$	$\leq 25 \times 10^{-4}$
0.11 µF < C ≤ 0.18 µF	$\leq 10 \times 10^{-4}$	$\leq 30 \times 10^{-4}$
0.18 µF < C ≤ 0.27 µF	$\leq 10 \times 10^{-4}$	$\leq 35 \times 10^{-4}$
Rated voltage pulse slope $(dU/dt)_R$ at 63 V (DC):		
P = 5 mm	50 V/µs	
P = 10 mm	20 V/µs	
R between leads at 50 V; 1 minute	>100000 MΩ	
R between interconnected leads and case at 50 V; 1 minute	>100000 MΩ	
Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s	100 V; 1 minute	
Withstanding (DC) voltage between leads and case	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_0 = 12.7 mm	±5%	2222 416 0....	on request
		±2%	2222 416 1....	preferred
Loose in box	l_t = 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 V; U_{Rac} = 25 V; U_{p-p} = 70 V

C (E 24) (µF)	DIMENSIONS b × h × l (mm)	MASS (g)	CATALOGUE NUMBER 2222 416 ..... AND PACKAGING		
			AMMOPACK		LOOSE IN BOX
			H = 18.5 mm; P_0 = 12.7 mm		l_t = 4.0 +1.0/–0.5 mm
			C-tol = ±2%		
			last 5 digits of catalogue number	SPQ	SPQ
Pitch = 5.0 ±0.3 mm; d_t = 0.50 ±0.05 mm					
0.036	4.5 × 9.0 × 7.2	0.45	1**3603**	1000	2000
0.039			1**3903**		
0.043			1**4303**		
0.047			1**4703**		
0.051	6.0 × 11.0 × 7.2	0.60	1**5103**	750	1500
0.056			1**5603**		
0.062			1**6203**		
0.068			1**6803**		
0.075			1**7503**		
0.082			1**8203**		
0.091			1**9103**		
0.1			1**1004**		
0.11			1**1104**		
0.12			1**1204**		
Pitch = 10.0 ±0.4 mm; d_t = 0.60 ±0.06 mm					
0.13	5.0 × 11.0 × 12.5	0.85	1**1304**	600	1000
0.15			1**1504**		
0.16	6.0 × 12.0 × 12.5	1.10	1**1604**	500	750
0.18			1**1804**		
0.20			1**2004**		
0.22			1**2204**		
0.24			1**2404**		
0.27			1**2704**		

Metallized polypropylene filter capacitors MKP 416

MKP 416 GENERAL DATA **PITCH 15 mm**

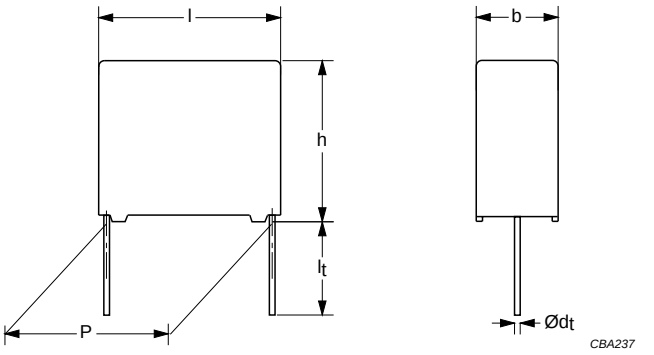


Fig.5 Outline.

Specific reference data for the 63 V DC capacitors

DESCRIPTION	VALUE	
Tangent of loss angle:	at 10 kHz	at 100 kHz
0.3 µF < C ≤ 0.39 µF	$\leq 10 \times 10^{-4}$	$\leq 40 \times 10^{-4}$
0.39 µF < C ≤ 0.56 µF	$\leq 10 \times 10^{-4}$	$\leq 45 \times 10^{-4}$
0.56 µF < C ≤ 0.75 µF	$\leq 10 \times 10^{-4}$	$\leq 50 \times 10^{-4}$
0.75 µF < C ≤ 1.1 µF	$\leq 10 \times 10^{-4}$	$\leq 60 \times 10^{-4}$
Rated voltage pulse slope $(dU/dt)_R$ at 63 V (DC)	50 V/µs	
R between leads, for C ≤ 0.33 µF at 50 V; 1 minute	>100000 MΩ	
RC between leads, for C > 0.33 µF at 50 V; 1 minute	>30000 s	
R between interconnected leads and case at 50 V; 1 minute	>100000 MΩ	
Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s	100 V; 1 minute	
Withstanding (DC) voltage between leads and case	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_0 = 12.7 mm; reel diameter 356 mm	±5%	2222 416 0....	on request
		±2%	2222 416 1....	preferred
Loose in box	l_t = 3.5 ±0.3 mm	±5%	2222 416 6....	on request
		±2%	2222 416 7....	preferred

Metallized polypropylene filter capacitors MKP 416

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

C (E 24) (µF)	DIMENSIONS b × h × l (mm)	MASS (g)	CATALOGUE NUMBER 2222 416 ..... AND PACKAGING			
			REEL		LOOSE IN BOX	
			H = 18.5 mm; P_0 = 12.7 mm		l_t = 3.5 ±0.3 mm	
			C-tol = ±2%		C-tol = ±2%	
			last 5 digits of catalogue number	SPQ	last 5 digits of catalogue number	SPQ
Pitch = 15.0 ±0.4 mm; d_t = 0.80 ±0.08 mm						
0.3	6.0 × 12.0 × 17.5	1.4	1**3004**	900	7**3004**	1000
0.33			1**3304**		7**3304**	
0.36			1**3604**		7**3604**	
0.39			1**3904**		7**3904**	
0.43	7.0 × 13.5 × 17.5	1.9	1**4304**	800	7**4304**	750
0.47			1**4704**		7**4704**	
0.51			1**5104**		7**5104**	
0.56			1**5604**		7**5604**	
0.62	8.5 × 15.0 × 17.5	2.6	1**6204**	650	7**6204**	750
0.68			1**6804**		7**6804**	
0.75			1**7504**		7**7504**	
0.82			1**8204**		7**8204**	
0.91	10.0 × 16.5 × 17.5	3.1	1**9104**	600	7**9104**	500
1.0			1**1005**		7**1005**	
1.1			1**1105**		7**1105**	

Metallized polypropylene filter capacitors MKP 417

MKP 417 GENERAL DATA **PITCH 5/10 mm**

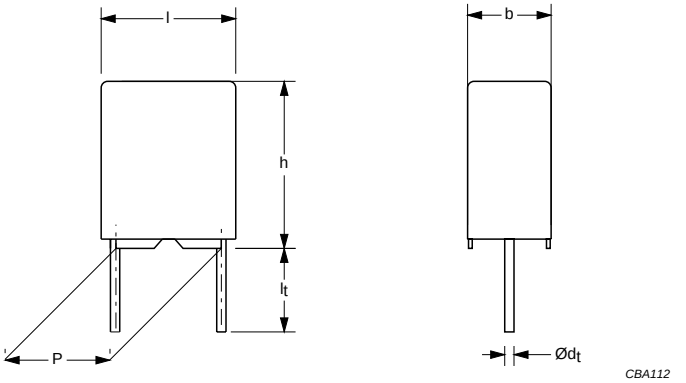


Fig.6 Outline.

Specific reference data for the 160 V DC capacitors

DESCRIPTION	VALUE	
Tangent of loss angle:	at 10 kHz	at 100 kHz
C ≤ 0.027 µF	$\leq 5 \times 10^{-4}$	$\leq 15 \times 10^{-4}$
0.027 µF < C ≤ 0.075 µF	$\leq 5 \times 10^{-4}$	$\leq 20 \times 10^{-4}$
0.075 µF < C ≤ 0.11 µF	$\leq 5 \times 10^{-4}$	$\leq 25 \times 10^{-4}$
0.11 µF < C ≤ 0.18 µF	$\leq 10 \times 10^{-4}$	$\leq 30 \times 10^{-4}$
0.18 µF < C ≤ 0.24 µF	$\leq 10 \times 10^{-4}$	$\leq 35 \times 10^{-4}$
Rated voltage pulse slope $(dU/dt)_R$ at 160 V (DC):		
P = 5 mm	50 V/µs	
P = 10 mm	20 V/µs	
R between leads at 100 V; 1 minute	>100000 MΩ	
R between interconnected leads and case at 100 V; 1 minute	>100000 MΩ	
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
Ammopack	H = 18.5 mm; P_0 = 12.7 mm	±5%	2222 417 0....	on request
		±2%	2222 417 1....	preferred
Loose in box	l_t = 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 V; U_{Rac} = 63 V; U_{p-p} = 180 V

C (E 24) (µF)	DIMENSIONS b × h × l (mm)	MASS (g)	CATALOGUE NUMBER 2222 417 ..... AND PACKAGING		
			REEL		LOOSE IN BOX
			H = 18.5 mm; P_0 = 12.7 mm		l_t = 4.0 +1.0/–0.5 mm
			C-tol = ±2%		
			last 5 digits of catalogue number	SPQ	SPQ
Pitch = 5.0 ±0.3 mm; d_t = 0.50 ±0.05 mm					
0.024	4.5 × 9.0 × 7.2	0.45	1**2403**	1000	2000
0.027			1**2703**		
0.03			1**3003**		
0.033			1**3303**		
0.036	6.0 × 11.0 × 7.2	0.60	1**3603**	750	1500
0.039			1**3903**		
0.043			1**4303**		
0.047			1**4703**		
0.051			1**5103**		
0.056			1**5603**		
0.062			1**6203**		
0.068			1**6803**		
Pitch = 10.0 ±0.4 mm; d_t = 0.60 ±0.06 mm					
0.075	4.0 × 10.0 × 12.5	0.60	1**7503**	750	1000
0.082			1**8203**		
0.091			1**9103**		
0.1			1**1004**		
0.11	5.0 × 11.0 × 12.5	0.85	1**1104**	600	1000
0.12			1**1204**		
0.13			1**1304**		
0.15			1**1504**		
0.16	6.0 × 12.0 × 12.5	1.10	1**1604**	500	750
0.18			1**1804**		
0.20			1**2004**		
0.22			1**2204**		
0.24			1**2404**		

Metallized polypropylene filter capacitors MKP 417

MKP 417 GENERAL DATA **PITCH 15 mm**

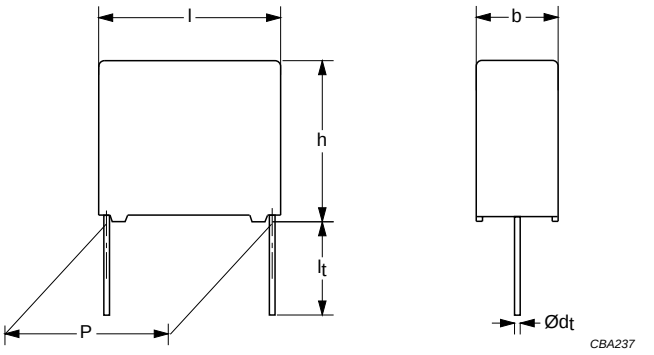


Fig.7 Outline.

Specific reference data for the 160 V DC capacitors

DESCRIPTION	VALUE	
Tangent of loss angle:	at 10 kHz	at 100 kHz
0.27 µF < C ≤ 0.39 µF	$\leq 10 \times 10^{-4}$	$\leq 40 \times 10^{-4}$
0.39 µF < C ≤ 0.56 µF	$\leq 10 \times 10^{-4}$	$\leq 45 \times 10^{-4}$
0.56 µF < C ≤ 0.75 µF	$\leq 10 \times 10^{-4}$	$\leq 50 \times 10^{-4}$
0.75 µF < C ≤ 1.1 µF	$\leq 10 \times 10^{-4}$	$\leq 60 \times 10^{-4}$
Rated voltage pulse slope $(dU/dt)_R$ at 160 V (DC)	50 V/µs	
R between leads, for C ≤ 0.33 µF at 100 V; 1 minute	>100000 MΩ	
RC between leads, for C > 0.33 µF at 100 V; 1 minute	>30000 s	
R between interconnected leads and case at 100 V; 1 minute	>100000 MΩ	
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_0 = 12.7 mm; reel diameter 356 mm	±5%	2222 417 0....	on request
		±2%	2222 417 1....	preferred
Loose in box	l_t = 3.5 ±0.3 mm	±5%	2222 417 6....	on request
		±2%	2222 417 7....	preferred

Metallized polypropylene filter capacitors MKP 417

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

C (E 24) (µF)	DIMENSIONS b × h × l (mm)	MASS (g)	CATALOGUE NUMBER 2222 417 ..... AND PACKAGING			
			REEL		LOOSE IN BOX	
			H = 18.5 mm; P_0 = 12.7 mm		l_t = 3.5 ±0.3 mm	
			C-tol = ±2%		C-tol = ±2%	
			last 5 digits of catalogue number	SPQ	last 5 digits of catalogue number	SPQ
Pitch = 15.0 ±0.4 mm; d_t = 0.80 ±0.08 mm						
0.27	5.0 × 11.0 × 17.5	1.2	1**2704**	1100	7**2704**	1250
0.3	6.0 × 12.0 × 17.5	1.4	1**3004**	900	7**3004**	1000
0.33			1**3304**		7**3304**	
0.36			1**3604**		7**3604**	
0.39			1**3904**		7**3904**	
0.43	7.0 × 13.5 × 17.5	1.9	1**4304**	800	7**4304**	750
0.47			1**4704**		7**4704**	
0.51			1**5104**		7**5104**	
0.56			1**5604**		7**5604**	
0.62	8.5 × 15.0 × 17.5	2.6	1**6204**	650	7**6204**	750
0.68			1**6804**		7**6804**	
0.75			1**7504**		7**7504**	
0.82			1**8204**		7**8204**	
0.91	10.0 × 16.5 × 17.5	3.1	1**9105**	600	7**9105**	500
1.0			1**1005**		7**1005**	
1.1			1**1105**		7**1105**	

Metallized polypropylene filter capacitors MKP 418

MKP 418 GENERAL DATA **PITCH 5/10 mm**

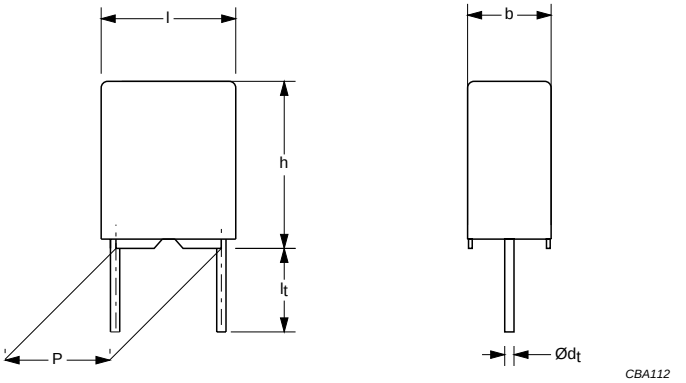


Fig.8 Outline.

Specific reference data for the 250 V DC capacitors

DESCRIPTION	VALUE	
Tangent of loss angle:	at 10 kHz	at 100 kHz
C ≤ 0.027 µF	$\leq 5 \times 10^{-4}$	$\leq 15 \times 10^{-4}$
0.027 µF < C ≤ 0.075 µF	$\leq 5 \times 10^{-4}$	$\leq 20 \times 10^{-4}$
0.075 µF < C ≤ 0.11 µF	$\leq 5 \times 10^{-4}$	$\leq 25 \times 10^{-4}$
0.11 µF < C ≤ 0.13 µF	$\leq 10 \times 10^{-4}$	$\leq 30 \times 10^{-4}$
Rated voltage pulse slope $(dU/dt)_R$ at 250 V (DC):		
P = 5 mm	50 V/µs	
P = 10 mm	20 V/µs	
R between leads at 100 V; 1 minute	>100000 MΩ	
R between interconnected leads and case at 100 V; 1 minute	>100000 MΩ	
Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s	400 V; 1 minute	
Withstanding (DC) voltage between leads and case	2840 V; 1 minute	

Available 250 V DC versions

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

Metallized polypropylene filter capacitors MKP 418

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

C (E 24) (µF)	DIMENSIONS b × h × l (mm)	MASS (g)	CATALOGUE NUMBER 2222 418 ..... AND PACKAGING		
			REEL		LOOSE IN BOX
			H = 18.5 mm; P_0 = 12.7 mm		l_t = 4.0 +1.0/–0.5 mm
			C-tol = ±2%		
			last 5 digits of catalogue number	SPQ	SPQ
Pitch = 5.0 ±0.3 mm; d_t = 0.50 ±0.05 mm					
0.01	3.5 × 8.0 × 7.2	0.35	1**1003**	1500	3000
0.011			1**1103**		
0.012			1**1203**		
0.013			1**1303**		
0.015			1**1503**		
0.016	4.5 × 9.0 × 7.2	0.45	1**1603**	1000	2000
0.018			1**1803**		
0.02			1**2003**		
0.022			1**2203**		
0.024			1**2403**		
0.027	6.0 × 11.0 × 7.2	0.60	1**2703**	750	1500
0.03			1**3003**		
0.033			1**3303**		
0.036			1**3603**		
0.039			1**3903**		
0.043			1**4303**		
Pitch = 10.0 ±0.4 mm; d_t = 0.60 ±0.06 mm					
0.047	4.0 × 10.0 × 12.5	0.60	1**4703**	750	1000
0.051			1**5103**		
0.056			1**5603**		
0.062			1**6203**		
0.068			1**6803**		
0.075	5.0 × 11.0 × 12.5	0.85	1**7503**	600	1000
0.082			1**8203**		
0.091			1**9103**		
0.1	6.0 × 12.0 × 12.5	1.10	1**1004**	500	750
0.11			1**1104**		
0.12			1**1204**		
0.13			1**1304**		

Metallized polypropylene filter capacitors MKP 418

MKP 418 GENERAL DATA **PITCH 15 mm**

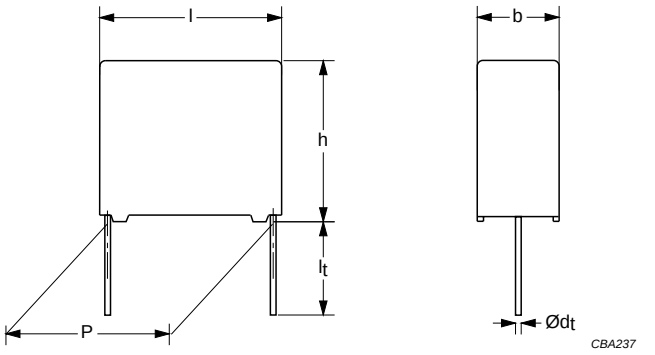


Fig.9 Outline.

Specific reference data for the 250 V DC capacitors

DESCRIPTION	VALUE	
Tangent of loss angle:	at 10 kHz	at 100 kHz
0.15 µF < C ≤ 0.3 µF	$\leq 10 \times 10^{-4}$	$\leq 35 \times 10^{-4}$
0.3 µF < C ≤ 0.39 µF	$\leq 10 \times 10^{-4}$	$\leq 40 \times 10^{-4}$
0.39 µF < C ≤ 0.56 µF	$\leq 10 \times 10^{-4}$	$\leq 45 \times 10^{-4}$
0.56 µF < C ≤ 0.68 µF	$\leq 10 \times 10^{-4}$	$\leq 50 \times 10^{-4}$
Rated voltage pulse slope $(dU/dt)_R$ at 250 V (DC)	50 V/µs	
R between leads, for C ≤ 0.33 µF at 100 V; 1 minute	>100000 MΩ	
RC between leads, for C > 0.33 µF at 100 V; 1 minute	>30000 s	
R between interconnected leads and case at 100 V; 1 minute	>100000 MΩ	
Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s	400 V; 1 minute	
Withstanding (DC) voltage between leads and case	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_0 = 12.7 mm; reel diameter 356 mm	±5%	2222 418 0.....	on request
		±2%	2222 418 1.....	preferred
Loose in box	l_t = 3.5 ±0.3 mm	±5%	2222 418 6.....	on request
		±2%	2222 418 7.....	preferred

Metallized polypropylene filter capacitors MKP 418

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

C (E 24) (µF)	DIMENSIONS b × h × l (mm)	MASS (g)	CATALOGUE NUMBER 2222 418 ..... AND PACKAGING			
			REEL		LOOSE IN BOX	
			H = 18.5 mm; P_0 = 12.7 mm		l_t = 3.5 ±0.3 mm	
			C-tol = ±2%		C-tol = ±2%	
			last 5 digits of catalogue number	SPQ	last 5 digits of catalogue number	SPQ
Pitch = 15.0 ±0.4 mm; d_t = 0.80 ±0.08 mm						
0.15	5.0 × 11.0 × 17.5	1.2	1**1504**	1100	7**1504**	1250
0.16			1**1604**		7**1604**	
0.18	6.0 × 12.0 × 17.5	1.4	1**1804**	900	7**1804**	1000
0.2			1**2004**		7**2004**	
0.22			1**2204**		7**2204**	
0.24			1**2404**		7**2404**	
0.27	7.0 × 13.5 × 17.5	1.9	1**2704**	800	7**2704**	750
0.3			1**3004**		7**3004**	
0.33			1**3304**		7**3304**	
0.36			1**3604**		7**3604**	
0.39	8.5 × 15.0 × 17.5	2.6	1**3904**	650	7**3904**	750
0.43			1**4304**		7**4304**	
0.47			1**4704**		7**4704**	
0.51			1**5104**		7**5104**	
0.56	10.0 × 16.5 × 17.5	3.1	1**5604**	600	7**5604**	500
0.62			1**6204**		7**6204**	
0.68			1**6804**		7**6804**	

Metallized polypropylene filter capacitors MKP 419

MKP 419 GENERAL DATA **PITCH 5 mm**

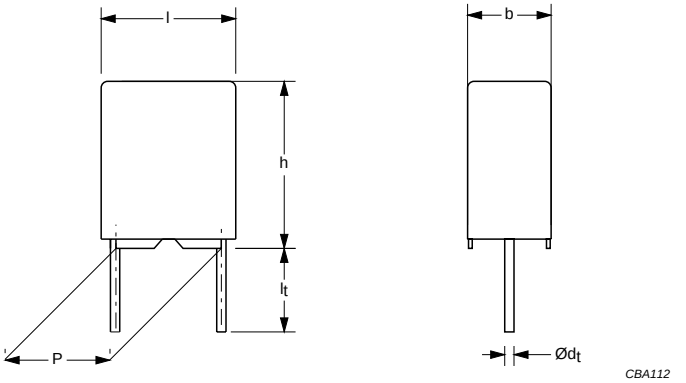


Fig.10 Outline.

Specific reference data for the 400 V DC capacitors

DESCRIPTION	VALUE	
Tangent of loss angle:	at 10 kHz	at 100 kHz
C ≤ 0.0091 µF	$\leq 5 \times 10^{-4}$	$\leq 10 \times 10^{-4}$
0.0091 µF < C ≤ 0.02 µF	$\leq 5 \times 10^{-4}$	$\leq 15 \times 10^{-4}$
Rated voltage pulse slope $(dU/dt)_R$ at 400 V (DC)	50 V/µs	
R between leads at 100 V; 1 minute	>100000 MΩ	
R between interconnected leads and case at 100 V; 1 minute	>100000 MΩ	
Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s	640 V; 1 minute	
Withstanding (DC) voltage between leads and case	2840 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_0 = 12.7 mm	±5%	2222 419 0.....	on request
		±2%	2222 419 1.....	preferred
Loose in box	l_t = 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 V; U_{Rac} = 125 V; U_{p-p} = 350 V

C (E 24) (µF)	DIMENSIONS b × h × l (mm)	MASS (g)	CATALOGUE NUMBER 2222 419 ..... AND PACKAGING		
			REEL		LOOSE IN BOX
			H = 18.5 mm; P_0 = 12.7 mm		l_t = 4.0 +1.0/–0.5 mm
			C-tol = ±2%		
			last 5 digits of catalogue number	SPQ	SPQ
Pitch = 5.0 ±0.3 mm; d_t = 0.50 ±0.05 mm					
0.001	3.5 × 8.0 × 7.2	0.35	1**1002**	1500	3000
0.0011			1**1102**		
0.0012			1**1202**		
0.0013			1**1302**		
0.0015			1**1502**		
0.0016			1**1602**		
0.0018			1**1802**		
0.002			1**2002**		
0.0022			1**2202**		
0.0024			1**2402**		
0.0027			1**2702**		
0.003			1**3002**		
0.0033			1**3302**		
0.0036			1**3602**		
0.0039			1**3902**		
0.0043	4.5 × 9.0 × 7.2	0.45	1**4302**	1000	2000
0.0047			1**4702**		
0.0051			1**5102**		
0.0056			1**5602**		
0.0062			1**6202**		
0.0068			1**6802**		
0.0075			1**7502**		
0.0082			1**8202**		
0.0091			1**9102**		
0.01			1**1003**		
0.011			1**1103**		
0.012			1**1203**		
0.013	6.0 × 11.0 × 7.2	0.60	1**1303**	750	1500
0.015			1**1503**		
0.016			1**1603**		
0.018			1**1803**		
0.02			1**2003**		

Metallized polypropylene filter capacitors MKP 419

MKP 419 GENERAL DATA **PITCH 10 mm**

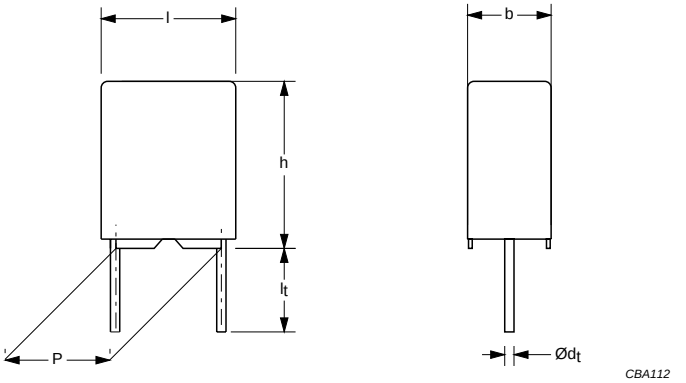


Fig.11 Outline.

Specific reference data for the 400 V DC capacitors

DESCRIPTION	VALUE	
Tangent of loss angle:	at 10 kHz	at 100 kHz
C ≤ 0.027 µF	$\leq 5 \times 10^{-4}$	$\leq 15 \times 10^{-4}$
0.027 µF < C ≤ 0.068 µF	$\leq 5 \times 10^{-4}$	$\leq 20 \times 10^{-4}$
Rated voltage pulse slope $(dU/dt)_R$ at 400 V (DC)	20 V/µs	
R between leads at 100 V; 1 minute	>100000 MΩ	
R between interconnected leads and case at 100 V; 1 minute	>100000 MΩ	
Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s	640 V; 1 minute	
Withstanding (DC) voltage between leads and case	2840 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_0 = 12.7 mm	±5%	2222 419 0.....	on request
		±2%	2222 419 1.....	preferred
Loose in box	l_t = 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 V; U_{Rac} = 125 V; U_{p-p} = 350 V

C (E 24) (µF)	DIMENSIONS b × h × l (mm)	MASS (g)	CATALOGUE NUMBER 2222 419 ..... AND PACKAGING		
			REEL		LOOSE IN BOX
			H = 18.5 mm; P_0 = 12.7 mm		l_t = 4.0 +1.0/–0.5 mm
			C-tol = ±2%		
			last 5 digits of catalogue number	SPQ	SPQ
Pitch = 10.0 ±0.4 mm; d_t = 0.60 ±0.06 mm					
0.022	4.0 × 10.0 × 12.5	0.60	1**2203**	750	1000
0.024			1**2403**		
0.027			1**2703**		
0.03			1**3003**		
0.033			1**3303**		
0.036	5.0 × 11.0 × 12.5	0.85	1**3603**	600	1000
0.039			1**3903**		
0.043			1**4303**		
0.047	6.0 × 12.0 × 12.5	1.10	1**4703**	500	750
0.051			1**5103**		
0.056			1**5603**		
0.062			1**6203**		
0.068			1**6803**		

Metallized polypropylene filter capacitors MKP 419

MKP 419 GENERAL DATA **PITCH 15 mm**

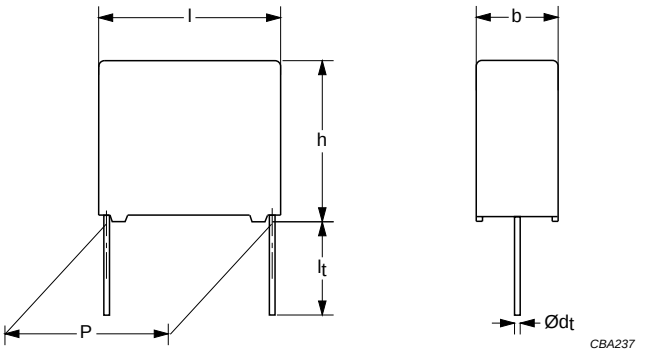


Fig.12 Outline.

Specific reference data for the 400 V DC capacitors

DESCRIPTION	VALUE	
Tangent of loss angle:	at 10 kHz	at 100 kHz
0.075 µF < C ≤ 0.11 µF	$\leq 5 \times 10^{-4}$	$\leq 25 \times 10^{-4}$
0.11 µF < C ≤ 0.22 µF	$\leq 10 \times 10^{-4}$	$\leq 30 \times 10^{-4}$
0.22 µF < C ≤ 0.36 µF	$\leq 10 \times 10^{-4}$	$\leq 35 \times 10^{-4}$
Rated voltage pulse slope $(dU/dt)_R$ at 400 V (DC)	50 V/µs	
R between leads, for C ≤ 0.33 µF at 100 V; 1 minute	>100000 MΩ	
RC between leads, for C > 0.33 µF at 100 V; 1 minute	>30000 s	
R between interconnected leads and case at 100 V; 1 minute	>100000 MΩ	
Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s	640 V; 1 minute	
Withstanding (DC) voltage between leads and case	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_0 = 12.7 mm; reel diameter 356 mm	±5%	2222 419 0.....	on request
		±2%	2222 419 1.....	preferred
Loose in box	l_t = 3.5 ±0.3 mm	±5%	2222 419 6.....	on request
		±2%	2222 419 7.....	preferred

Metallized polypropylene filter capacitors MKP 419

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

C (E 24) (µF)	DIMENSIONS b × h × l (mm)	MASS (g)	CATALOGUE NUMBER 2222 419 ..... AND PACKAGING			
			REEL		LOOSE IN BOX	
			H = 18.5 mm; P_0 = 12.7 mm		l_t = 3.5 ±0.3 mm	
			C-tol = ±2%		C-tol = ±2%	
			last 5 digits of catalogue number	SPQ	last 5 digits of catalogue number	SPQ
Pitch = 15.0 ±0.4 mm; d_t = 0.80 ±0.08 mm						
0.075	5.0 × 11.0 × 17.5	1.2	1**7503**	1100	7**7503**	1250
0.082			1**8203**		7**8203**	
0.091	6.0 × 12.0 × 17.5	1.4	1**9103**	900	7**9103**	1000
0.1			1**1004**		7**1004**	
0.11			1**1104**		7**1104**	
0.12			1**1204**		7**1204**	
0.13			1**1304**		7**1304**	
0.15	7.0 × 13.5 × 17.5	1.9	1**1504**	800	7**1504**	750
0.16			1**1604**		7**1604**	
0.18			1**1804**		7**1804**	
0.2	8.5 × 15.0 × 17.5	2.6	1**2004**	650	7**2004**	750
0.22			1**2204**		7**2204**	
0.24			1**2404**		7**2404**	
0.27			1**2704**		7**2704**	
0.3	10.0 × 16.5 × 17.5	3.1	1**3004**	600	7**3004**	500
0.33			1**3304**		7**3304**	
0.36			1**3604**		7**3604**	

Metallized polypropylene filter capacitors MKP 420

MKP 420 GENERAL DATA **PITCH 5 mm**

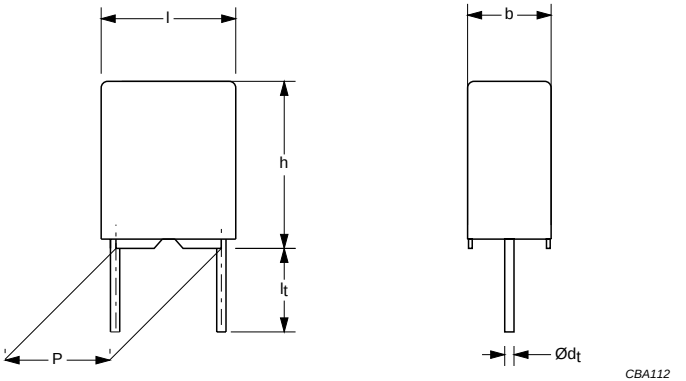


Fig.13 Outline.

Specific reference data for the 630 V DC capacitors

DESCRIPTION	VALUE	
Tangent of loss angle:	at 10 kHz	at 100 kHz
$C \leq 0.0068\ \mu F$	$\leq 5 \times 10^{-4}$	$\leq 10 \times 10^{-4}$
Rated voltage pulse slope $(dU/dt)_R$ at 630 V (DC)	50 V/μs	
R between leads at 500 V; 1 minute	>100000 MΩ	
R between interconnected leads and case at 500 V; 1 minute	>100000 MΩ	
Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s	1000 V; 1 minute	
Withstanding (DC) voltage between leads and case	1260 V; 1 minute	

Available 630 V DC versions

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

Metallized polypropylene filter capacitors MKP 420

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

C (E 24) (µF)	DIMENSIONS b × h × l (mm)	MASS (g)	CATALOGUE NUMBER 2222 420 ..... AND PACKAGING		
			REEL		LOOSE IN BOX
			H = 18.5 mm; P_0 = 12.7 mm		l_t = 4.0 +1.0/–0.5 mm
			C-tol = ±2%		
			last 5 digits of catalogue number	SPQ	SPQ
Pitch = 5.0 ±0.3 mm; d_t = 0.50 ±0.05 mm					
0.0015	3.5 × 8.0 × 7.2	0.35	1**1502**	1500	3000
0.0016			1**1602**		
0.0018			1**1802**		
0.002			1**2002**		
0.0022			1**2202**		
0.0024			1**2402**		
0.0027			1**2702**		
0.003	4.5 × 9.0 × 7.2	0.45	1**3002**	1000	2000
0.0033			1**3302**		
0.0036			1**3602**		
0.0039			1**3902**		
0.0043	6.0 × 11.0 × 7.2	0.60	1**4302**	750	1500
0.0047			1**4702**		
0.0051			1**5102**		
0.0056			1**5602**		
0.0062			1**6202**		
0.0068			1**6802**		

MKP 420 GENERAL DATA **PITCH 10 mm**

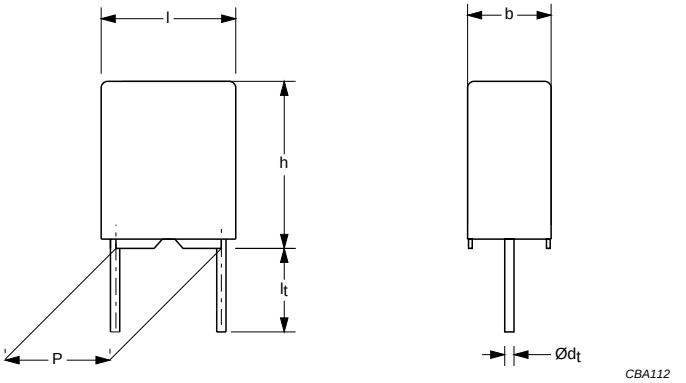


Fig.14 Outline.

Specific reference data for the 630 V DC capacitors

DESCRIPTION	VALUE	
Tangent of loss angle:	at 10 kHz	at 100 kHz
$C \leq 0.027\ \mu F$	$\leq 5 \times 10^{-4}$	$\leq 15 \times 10^{-4}$
$0.027\ \mu F < C \leq 0.047\ \mu F$	$\leq 5 \times 10^{-4}$	$\leq 20 \times 10^{-4}$
Rated voltage pulse slope $(dU/dt)_R$ at 630 V (DC)	50 V/μs	
R between leads at 500 V; 1 minute	>100000 MΩ	
R between interconnected leads and case at 500 V; 1 minute	>100000 MΩ	
Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s	1000 V; 1 minute	
Withstanding (DC) voltage between leads and case	2840 V; 1 minute	

Available 630 V DC versions

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

Metallized polypropylene filter capacitors MKP 420

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

C (E 24) (µF)	DIMENSIONS b × h × l (mm)	MASS (g)	CATALOGUE NUMBER 2222 420 ..... AND PACKAGING		
			REEL		LOOSE IN BOX
			H = 18.5 mm; P_0 = 12.7 mm		l_t = 4.0 +1.0/–0.5 mm
			C-tol = ±2%		
			last 5 digits of catalogue number	SPQ	SPQ
Pitch = 10.0 ±0.4 mm; d_t = 0.60 ±0.06 mm					
0.01	4.0 × 10.0 × 12.5	0.60	2222 420 1**1003**	750	1000
0.011			2222 420 1**1103**		
0.012			2222 420 1**1203**		
0.013			2222 420 1**1303**		
0.015			2222 420 1**1503**		
0.016			2222 420 1**1603**		
0.018	5.0 × 11.0 × 12.5	0.85	2222 420 1**1803**	600	1000
0.02			2222 420 1**2003**		
0.022			2222 420 1**2203**		
0.024			2222 420 1**2403**		
0.027	6.0 × 12.0 × 12.5	1.10	2222 420 1**2703**	500	750
0.03			2222 420 1**3003**		
0.033			2222 420 1**3303**		
0.036			2222 420 1**3603**		
0.039			2222 420 1**3903**		
0.043			2222 420 1**4303**		
0.047			2222 420 1**4703**		

Metallized polypropylene filter capacitors MKP 420

MKP 420 GENERAL DATA **PITCH 15 mm**

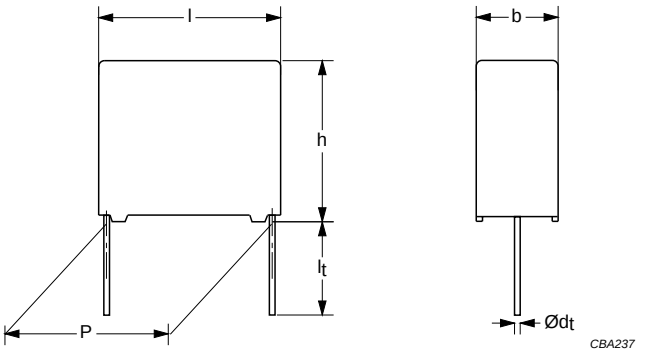


Fig.15 Outline.

Specific reference data for the 630 V DC capacitors

DESCRIPTION	VALUE	
Tangent of loss angle:	at 10 kHz	at 100 kHz
0.051 µF < C ≤ 0.11 µF	$\leq 5 \times 10^{-4}$	$\leq 25 \times 10^{-4}$
0.11 µF < C ≤ 0.16 µF	$\leq 10 \times 10^{-4}$	$\leq 35 \times 10^{-4}$
Rated voltage pulse slope $(dU/dt)_R$ at 630 V (DC)	50 V/µs	
R between leads at 500 V; 1 minute	>100000 MΩ	
R between interconnected leads and case at 500 V; 1 minute	>100000 MΩ	
Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s	1000 V; 1 minute	
Withstanding (DC) voltage between leads and case	1260 V; 1 minute	

Available 630 V DC versions

PACKAGING	DIMENSIONS	C-tol	FIRST 9 DIGITS OF CATALOGUE NUMBER	ORDERING
Tapedon reel	H = 18.5 mm; P_0 = 12.7 mm; reel diameter 356 mm	±5%	2222 420 0.....	on request
		±2%	2222 420 1.....	preferred
Loose in box	l_t = 3.5 ±0.3 mm	±5%	2222 420 6.....	on request
		±2%	2222 420 7.....	preferred

Metallized polypropylene filter capacitors MKP 416 to 420

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

C (E 24) (µF)	DIMENSIONS b × h × l (mm)	MASS (g)	CATALOGUE NUMBER 2222 420 ..... AND PACKAGING			
			REEL		LOOSE IN BOX	
			H = 18.5 mm; P_0 = 12.7 mm		l_t = 3.5 ±0.3 mm	
			C-tol = ±2%		C-tol = ±2%	
			last 5 digits of catalogue number	SPQ	last 5 digits of catalogue number	SPQ
Pitch = 15.0 ±0.4 mm; d_t = 0.80 ±0.08 mm						
0.051	6.0 × 12.0 × 17.5	1.4	1**5103**	900	7**5103**	1000
0.056			1**5603**		7**5603**	
0.062	7.0 × 13.5 × 17.5	1.9	1**6203**	800	7**6203**	750
0.068			1**6803**		7**6803**	
0.075			1**7503**		7**7503**	
0.082			1**8203**		7**8203**	
0.091	8.5 × 15.0 × 17.5	2.6	1**9103**	650	7**9103**	750
0.1			1**1004**		7**1004**	
0.11			1**1104**		7**1104**	
0.12			1**1204**		7**1204**	
0.13	10.0 × 16.5 × 17.5	3.1	1**1304**	600	7**1304**	500
0.15			1**1504**		7**1504**	
0.16			1**1604**		7**1604**	

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.

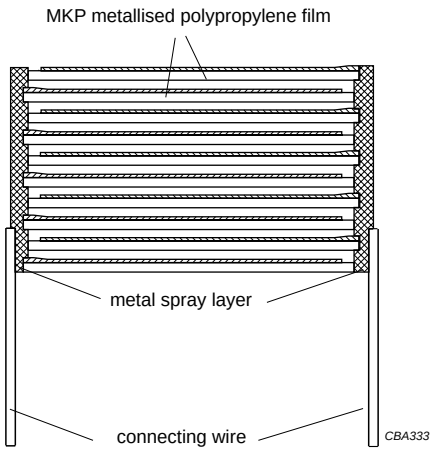


Fig.16 Construction.

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: $h_{max} \leq h + 0.3$ mm.

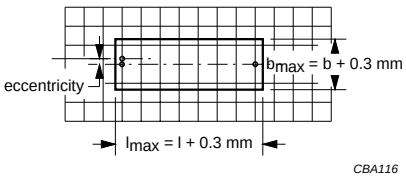


Fig.17 Lay-out.

Storage temperature

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

RATINGS AND CHARACTERISTICS REFERENCE CONDITIONS

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

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

CHARACTERISTICS

Capacitance

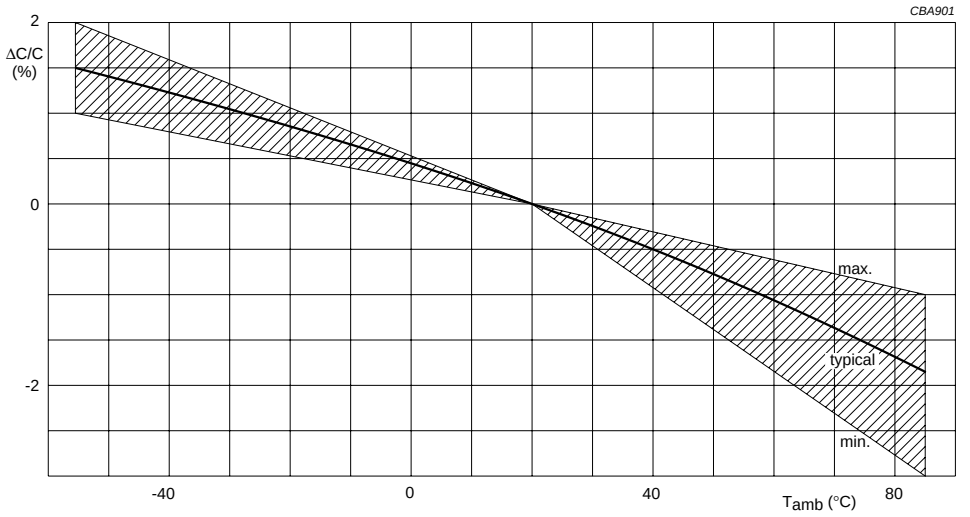


Fig.18 Capacitance change at 1 kHz as a function of temperature.

Impedance

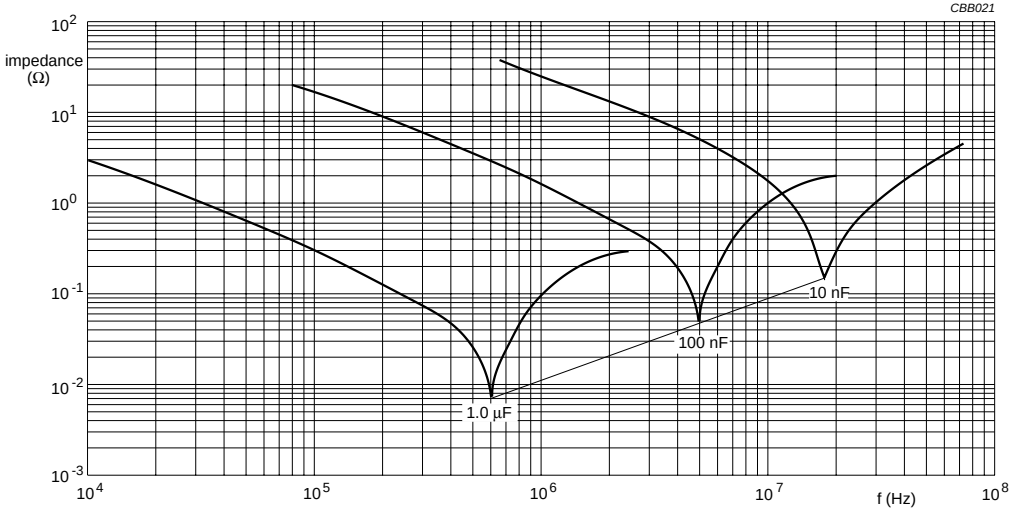


Fig.19 Impedance as a function of frequency; typical curves.

Maximum RMS voltage (sinewave) as a function of frequency

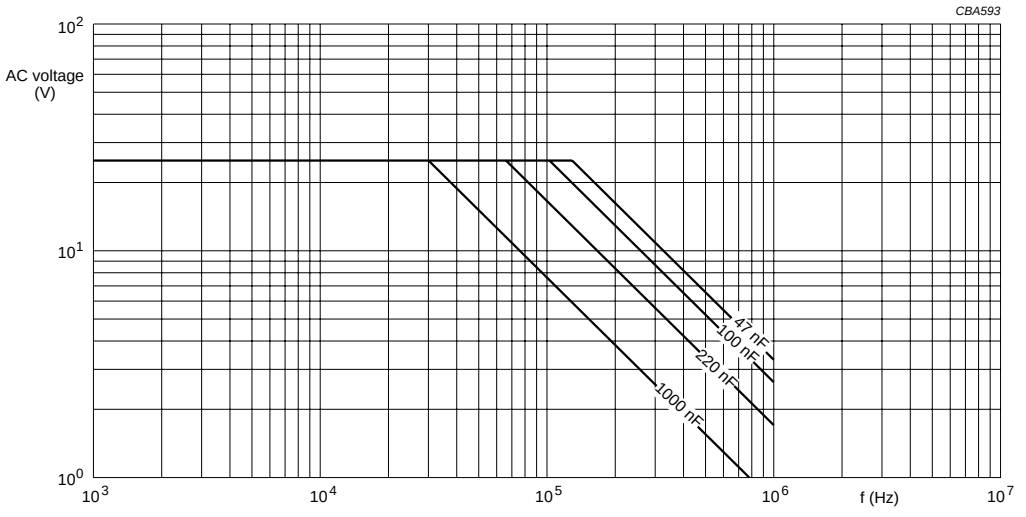


Fig.20 AC voltage (RMS value) as a function of frequency at $T_{amb} \leq 85$ °C for $U_{Rdc} = 63$ V.

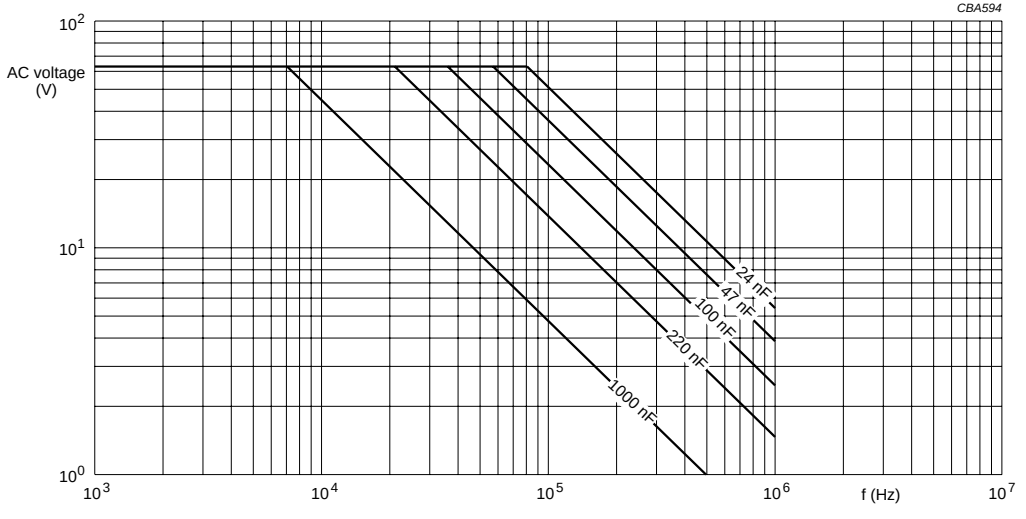


Fig.21 AC voltage (RMS value) as a function of frequency at $T_{amb} \leq 85$ °C for $U_{Rdc} = 160$ V.

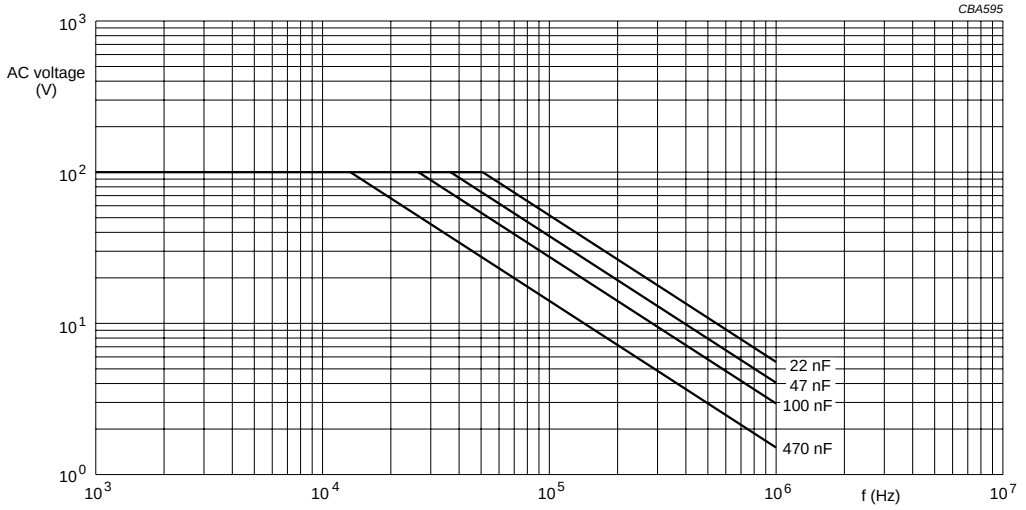


Fig.22 AC voltage (RMS value) as a function of frequency at $T_{amb} \leq 85$ °C for $U_{Rdc} = 250$ V.

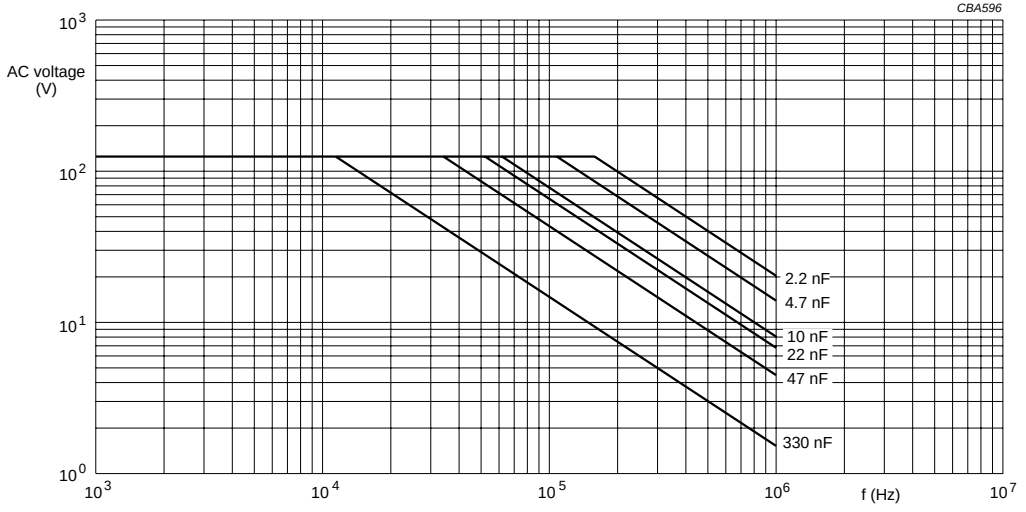


Fig.23 AC voltage (RMS value) as a function of frequency at $T_{amb} \leq 85$ °C for $U_{Rdc} = 400$ V.

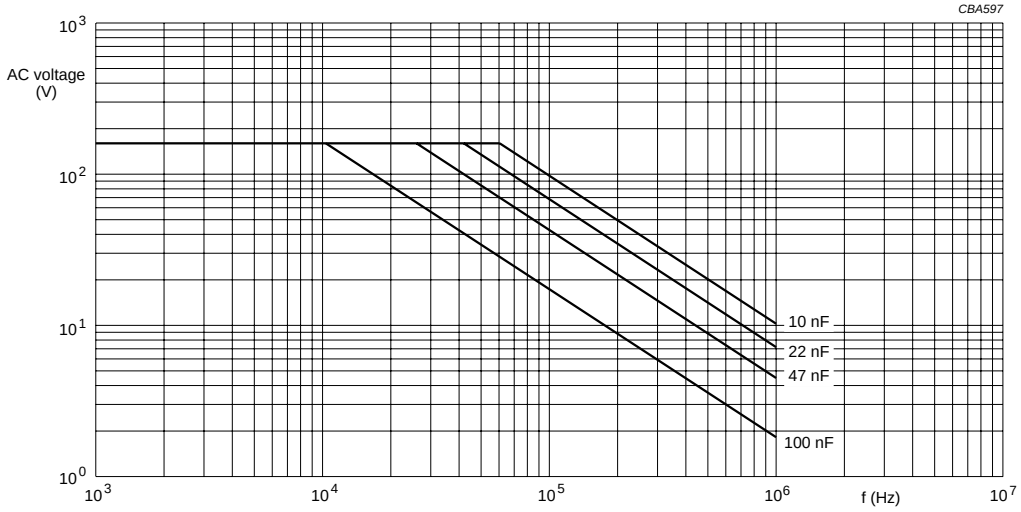


Fig.24 AC voltage (RMS value) as a function of frequency at $T_{amb} \leq 85$ °C for $U_{Rdc} = 630$ V.

Maximum RMS current (sinewave) as a function of frequency

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

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

Tangent of loss angle

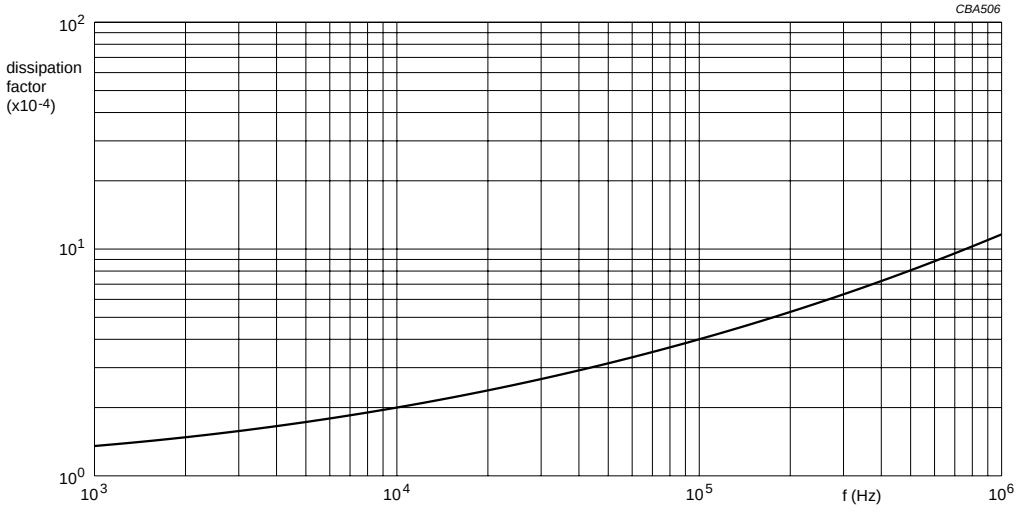


Fig.25 Tangent of loss angle as a function of frequency; typical curve.

Insulation resistance

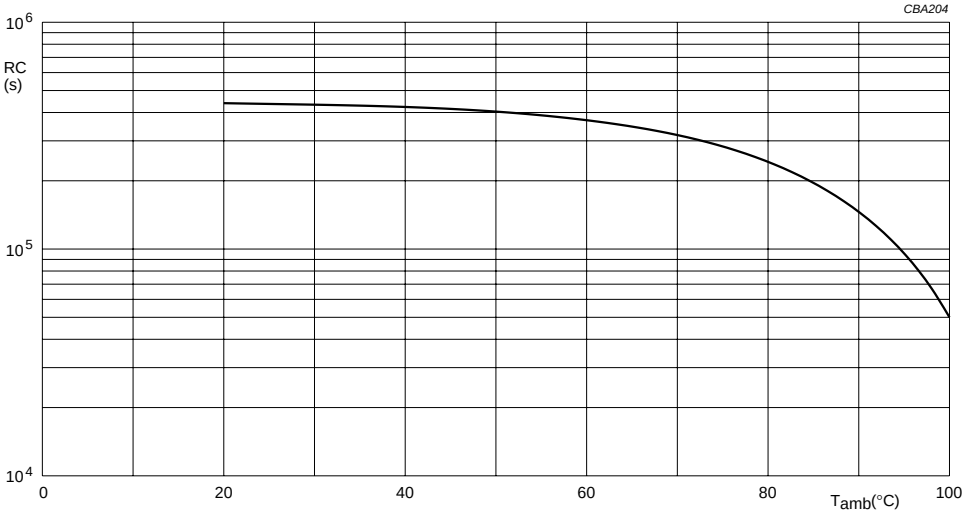


Fig.26 RC product as a function of ambient temperature; typical curve.

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

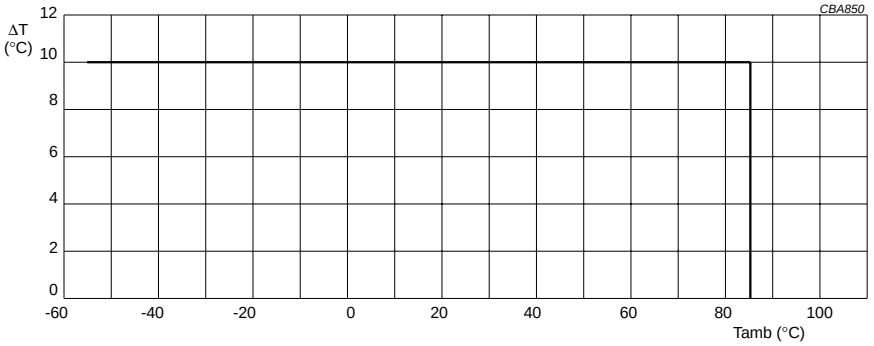


Fig.27 Maximum allowed component temperature rise as a function of the ambient temperature.

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 $\Delta T = P/G$:

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

Measuring the component temperature

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

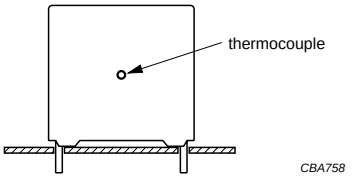


Fig.28 Mounting the thermocouple.

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

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

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

Application note and limiting conditions

These capacitors are not suitable for mains applications as across-the-line capacitors without additional protection, 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	$T_{amb} \leq 85$ °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 µF - 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 °C. The circuit is high ohmic during a capacitor breakdown.

Checking the conditions:

1. The peak voltage U_p = 162.8 V is lower than 250 V (DC).
2. The peak-to-peak voltage 5.6 V is lower than $2 \times \sqrt{2} \times 100$ 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.

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 = ±2%; J = ±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.

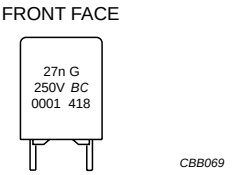


Fig.29 Example of marking for a capacitor with pitch = 5 mm.

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 = ±2%; J = ±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).

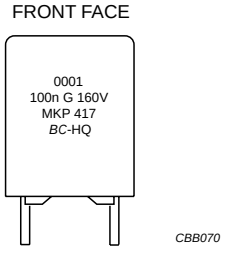


Fig.30 Example of marking for a capacitor with pitch = 10.0 mm.

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 = ±2%; J = ±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).

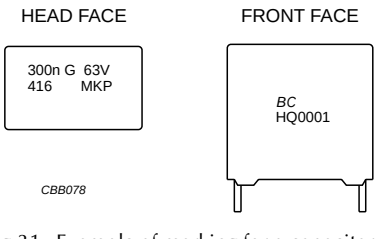
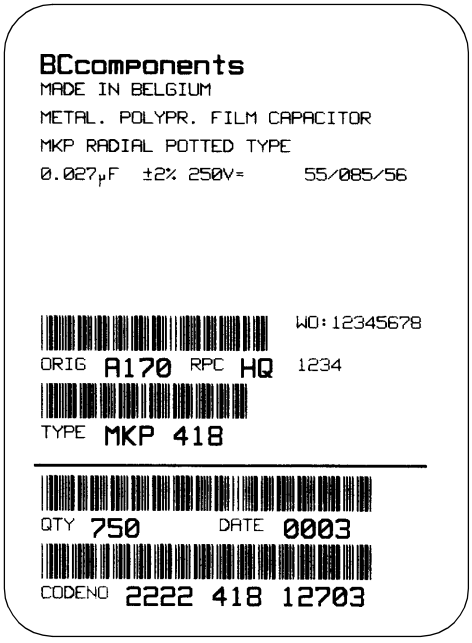


Fig.31 Example of marking for a capacitor with pitch = 15.0 mm.

Package marking

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



Barcode label marking

LINE	MARKING EXPLANATION
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.

QUICK REFERENCE TEST REQUIREMENTS

TEST	PROCEDURE (quick reference)	REQUIREMENTS
Robustness of leads		
Tensile strength: *"IEC 60068-2-21"*	load 10 N; 10 s	no visible damage legible marking $\|\Delta C/C\| \leq 1\% + 5$ pF $\Delta\tan\delta \leq 5 \times 10^{-4}$
Bending: *"IEC 60068-2-21"*	load 5 N; 4 × 90 °	
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	$\|\Delta C/C\| \leq 1\% + 5$ pF $\Delta\tan\delta \leq 5 \times 10^{-4}$
Shock: *"IEC 60068-2-27"*	half sinewave; 490 m/s^2; 11 ms	
Climatic sequence		
Dry heat: *"IEC 60068-2-2"*	16 hours; 85 °C	$\|\Delta C/C\| \leq 1\% + 5$ pF $\Delta\tan\delta \leq 5 \times 10^{-4}$ $R_{ins} \geq 50\%$ of specified value
Damp heat, cyclic, test Db, first cycle: *"IEC 60068-2-30"*		
Cold: *"IEC 60068-2-1"*	2 hours; –55 °C	
Damp heat, cyclic, test Db, remaining cycles: *"IEC 60068-2-30"*		
Other applicable tests		
Damp heat, steady state: *"IEC 60068-2-3"*	56 days; 40 °C; 90 to 95% RH	$\|\Delta C/C\| \leq 1\% + 5$ pF $\Delta\tan\delta \leq 5 \times 10^{-4}$ $R_{ins} \geq 50\%$ of specified value
Endurance (DC): *"IEC 60384-16"*	2000 hours: 1.25 × U_{Rdc}; 85 °C	$\|\Delta C/C\| \leq 1\% + 5$ pF $\Delta\tan\delta \leq 5 \times 10^{-4}$ $R_{ins} \geq 50\%$ of specified value
Heat storage: *"IEC 60384-16"*	2000 hours; 85 °C	$\|\Delta C/C\| \leq 1\% + 5$ 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	$\|\Delta C/C\| \leq 1\% + 5$ pF $\Delta\tan\delta \leq 5 \times 10^{-4}$
Passive flammability: *"IEC 60384-1"*	class C	no burning
Endurance (AC): *"IEC 60384-16"*	1000 hours: 85 °C 1.25 × U_{Rac} (RMS); 50 Hz	$\|\Delta C/C\| \leq 2\% + 5$ pF $\Delta\tan\delta \leq 5 \times 10^{-4}$ $R_{ins} \geq 50\%$ of specified value