# DATA SHEET

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

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

2002 Oct 09

BC COMPONENTS

# Polypropylene film foil capacitors KP 460 to 464

## KP AXIAL EPOXY LACQUERED TYPE

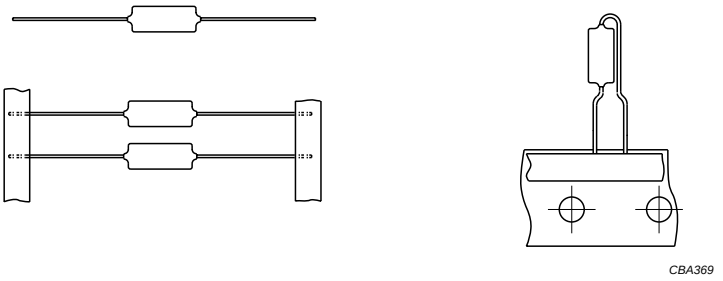



Fig.1 Simplified outlines.

## FEATURES

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

## APPLICATIONS

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

## DETAIL SPECIFICATION

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

## QUICK REFERENCE DATA

| DESCRIPTION | VALUE |
|---|---|
| Capacitance range (E12 series) | 47 to 62000 pF |
| Capacitance tolerance | ±5% (E24 series);<br>±2% (E24, E48 series);<br>±1% (E24, E48, E96 series) |
| Rated (DC) voltage | 63 V; 160 V; 250 V; 400 V; 630 V |
| Rated (AC) voltage | 40 V; 63 V; 125 V; 160 V; 200 V |
| Climatic category | 40/100/56 |
| Rated temperature | 85 °C |
| Maximum application temperature | 100 °C |
| Reference specification | IEC 60384-13 |
| Stability class for: | |
| 63; 160; 250 V versions | class 1 |
| 400; 630 V versions | class 2 |

# Polypropylene film foil capacitors KP 460 to 464

## COMPOSITION OF CATALOGUE NUMBER

| TYPE AND VOLTAGES | |
|---|---|
| 460 | 63 V |
| 461 | 160 V |

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

CAPACITANCE (numerically)

Example:
1003 = 100 x 0.1 = 10 nF

| 2222 | 46. | X | XXX | X |
|---|---|---|---|---|

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

# Polypropylene film foil capacitors KP 460 to 464

| TYPE AND VOLTAGES | |
|---|---|
| 462 | 250 V |
| 463 | 400 V |
| 464 | 630 V |

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

**CAPACITANCE (numerically)**

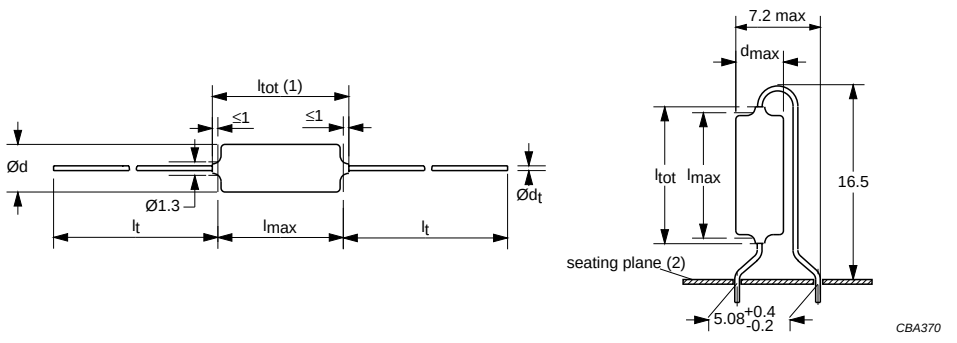
Example:
1003 = 100 x 0.1 = 10 nF

| 2222 | 46. | X | XXX | X |
|---|---|---|---|---|

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

# Polypropylene film foil capacitors KP 460

## KP 460 GENERAL DATA




Dimensions in mm.

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

(2) Hole Ø1.0.

Fig.4 Outlines.

**Specific reference data for the 63 V DC capacitors**

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

**Available 63 V DC versions**

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

**Available on request**

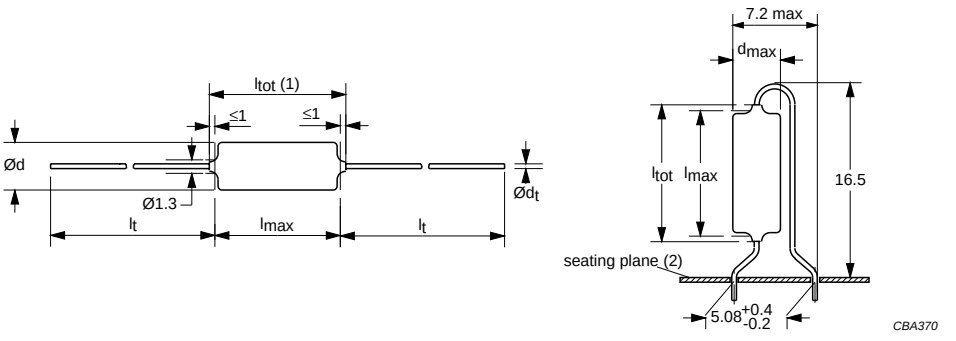
| PACKAGING | TAPE DISTANCE (mm) |
|---|---|
| Taped in ammopack | 52.5 |
| | 63.5 |
| Taped on reel | 52.5 |

# Polypropylene film foil capacitors KP 460

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

| C (E 24) (pF) | DIMENSIONS $d_{max} \times l_{max}$ (mm) | MASS (g) | CATALOGUE NUMBER 2222 460 ..... AND PACKAGING | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | TAPED ON REEL | | | LOOSE IN BOX | UNIDIRECTIONAL | | |
| | | | TAPE DISTANCE 63.5 mm | | | | | | |
| | | | C-tol = ±2% | C-tol = ±1% | | | C-tol = ±2% | C-tol = ±1% | |
| | | | last 5 digits of catalogue number | | SPQ | SPQ | last 5 digits of catalogue number | | SPQ |
| **$l_t$ = 30.0 mm; $d_t$ = 0.60 ±0.06 mm** | | | | | | | | | |
| 6800 | 5.0 × 11.0 | 0.5 | 7**6802** | 8**6802** | 2500 | 250 | 0**6802** | 1**6802** | 1000 |
| 7500 | | 0.5 | 7**7502** | 8**7502** | | | 0**7502** | 1**7502** | |
| 8200 | | 0.6 | 7**8202** | 8**8202** | | | 0**8202** | 1**8202** | |
| 9100 | | 0.6 | 7**9102** | 8**9102** | | | 0**9102** | 1**9102** | |
| **$l_t$ = 28.0 mm; $d_t$ = 0.60 ±0.06 mm** | | | | | | | | | |
| 10000 | 6.0 × 15.0 | 0.6 | 7**1003** | 8**1003** | 1500 | 250 | | | |
| 11000 | | 0.6 | 7**1103** | 8**1103** | | | | | |
| 12000 | | 0.7 | 7**1203** | 8**1203** | | | | | |
| 13000 | | 0.8 | 7**1303** | 8**1303** | | | | | |
| 15000 | | 0.7 | 7**1503** | 8**1503** | | | | | |
| 16000 | | 0.7 | 7**1603** | 8**1603** | | | | | |
| 18000 | | 0.8 | 7**1803** | 8**1803** | | | | | |
| 20000 | | 0.8 | 7**2003** | 8**2003** | | | | | |
| 22000 | | 0.9 | 7**2203** | 8**2203** | | | | | |
| 24000 | 6.5 × 15.0 | 0.9 | 7**2403** | 8**2403** | 1500 | 250 | | | |
| 27000 | | 1.0 | 7**2703** | 8**2703** | | | | | |
| 30000 | 7.0 × 15.0 | 1.1 | 7**3003** | 8**3003** | 1000 | 200 | | | |
| 33000 | | 1.2 | 7**3303** | 8**3303** | | | | | |
| 36000 | | 1.2 | 7**3603** | 8**3603** | | | | | |
| 39000 | 7.5 × 15.0 | 1.3 | 7**3903** | 8**3903** | 1000 | 150 | | | |
| 43000 | | 1.4 | 7**4303** | 8**4303** | | | | | |
| 47000 | 8.0 × 15.0 | 1.5 | 7**4703** | 8**4703** | 1000 | 150 | | | |
| 51000 | | 1.6 | 7**5103** | 8**5103** | | | | | |
| 56000 | 8.5 × 15.0 | 1.7 | 7**5603** | 8**5603** | 1000 | 125 | | | |
| 62000 | | 1.8 | 7**6203** | 8**6203** | | | | | |

**KP 461 GENERAL DATA**




Dimensions in mm.

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

(2) Hole Ø1.0.

Fig.5 Outlines.

**Specific reference data for the 160 V DC capacitors**

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

**Available 160 V DC versions**

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

**Available on request**

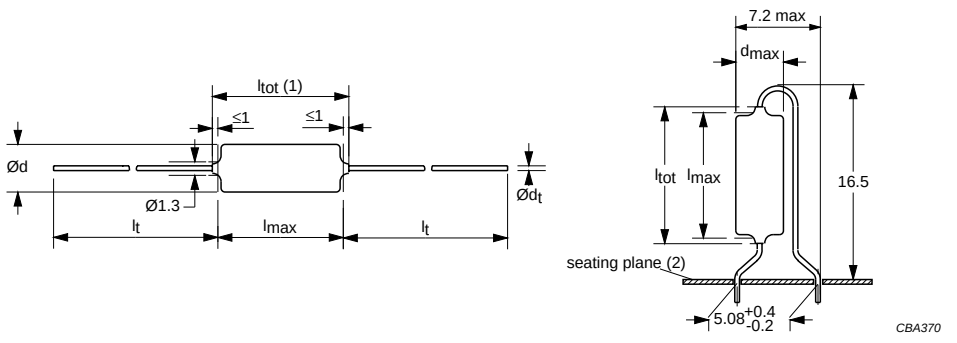
| PACKAGING | TAPE DISTANCE (mm) |
|---|---|
| Taped in ammopack | 52.5 |
| | 63.5 |
| Taped on reel | 52.5 |

# Polypropylene film foil capacitors KP 461

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

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

**KP 462 GENERAL DATA**




Dimensions in mm.

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

(2) Hole Ø1.0.

Fig.6 Outlines.

**Specific reference data for the 250 V DC capacitors**

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

**Available 250 V DC versions**

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

**Available on request**

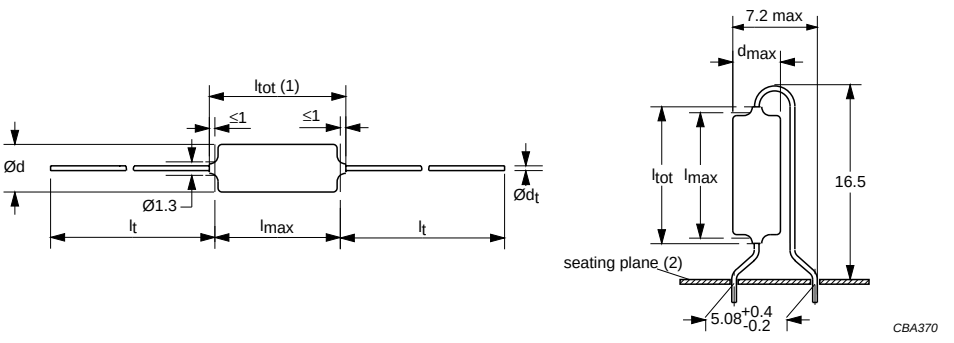
| PACKAGING | TAPE DISTANCE (mm) |
|---|---|
| Taped in ammopack | 52.5 |
| | 63.5 |
| Taped on reel | 52.5 |

# Polypropylene film foil capacitors KP 462

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

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

**KP 463 GENERAL DATA**




Dimensions in mm.

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

(2) Hole Ø1.0.

Fig.7 Outlines.

**Specific reference data for the 400 V DC capacitors**

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

**Note**

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

**Available 400 V DC versions**

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

**Available on request**

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

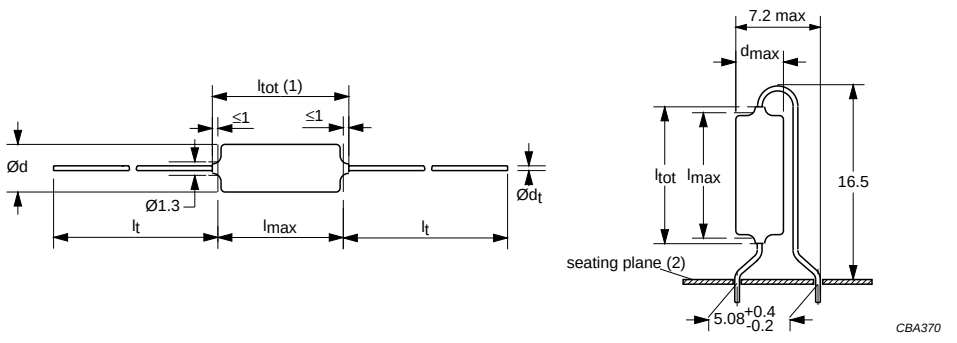
# Polypropylene film foil capacitors KP 463

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

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

# Polypropylene film foil capacitors KP 464

## KP 464 GENERAL DATA




Dimensions in mm.

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

(2) Hole Ø1.0.

Fig.8 Outlines.

**Specific reference data for the 630 V DC capacitors**

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

**Note**

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

**Available 630 V DC versions**

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

**Available on request**

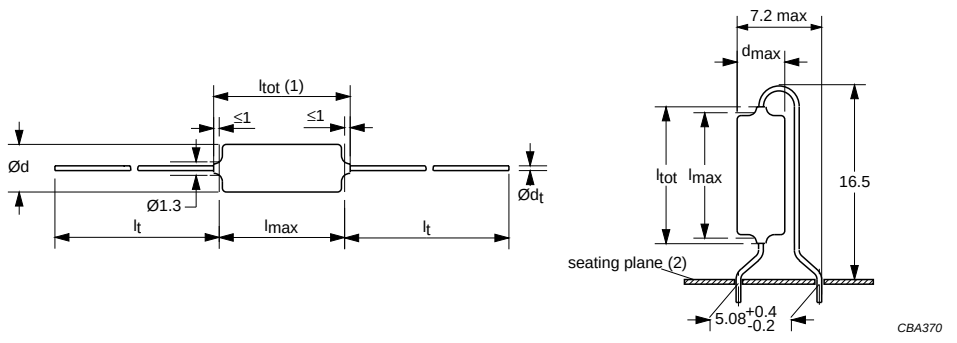
| PACKAGING | TAPE DISTANCE (mm) |
|---|---|
| Taped in ammopack | 52.5 |
| | 63.5 |
| Taped on reel | 52.5 |

# Polypropylene film foil capacitors KP 464

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

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

**KP 464 GENERAL DATA**




Dimensions in mm.

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

(2) Hole Ø1.0.

Fig.9 Outlines.

**Specific reference data for the 630 V DC capacitors**

| DESCRIPTION | VALUE | | |
|---|---|---|---|
| Tangent of loss angle: | at 1 kHz | at 100 kHz | at 1 MHz |
| $C \leq 1000$ pF | $\leq 5 \times 10^{-4}$ | – | $\leq 10 \times 10^{-4}$ |
| 1 000 pF < C ≤ 4700 pF | $\leq 5 \times 10^{-4}$ | $\leq 15 \times 10^{-4}$ | – |
| Rated voltage pulse slope (dU/dt)R at 630 V (DC) | 10000 V/µs | | |
| R between leads; at 500 V; 1 minute | >100000 MΩ | | |
| R between interconnected leads and case; 500 V; 1 minute | >100000 MΩ | | |
| Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s | 1260 V; 1 minute | | |
| Withstanding (DC) voltage between leads and case | 1260 V; 1 minute | | |

**Available 630 V DC versions**

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

**Available on request**

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

# Polypropylene film foil capacitors KP 460 to 464

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

| C (E 24) (pF) | DIMENSIONS $d_{max} \times l_{max}$ (mm) | MASS (g) | CATALOGUE NUMBER 2222 464 ..... AND PACKAGING | | | |
|---|---|---|---|---|---|---|
| | | | TAPED ON REEL | | | LOOSE IN BOX |
| | | | TAPE DISTANCE 63.5 mm | | | |
| | | | C-tol = ±2% | C-tol = ±1% | SPQ | SPQ |
| | | | last 5 digits of catalogue number | | | |
| **$l_t$ = 28.0 mm; $d_t$ = 0.60 ±0.06 mm** | | | | | | |
| 620 | 6.0 × 15.0 | 0.5 | 7**6201** | 8**6201** | 1500 | 250 |
| 680 | | 0.5 | 7**6801** | 8**6801** | | |
| 750 | | 0.5 | 7**7501** | 8**7501** | | |
| 820 | | 0.5 | 7**8201** | 8**8201** | | |
| 910 | | 0.5 | 7**9101** | 8**9101** | | |
| 1000 | | 0.5 | 7**1002** | 8**1002** | | |
| 1100 | | 0.5 | 7**1102** | 8**1102** | | |
| 1200 | | 0.5 | 7**1202** | 8**1202** | | |
| 1300 | 6.5 × 15.0 | 0.6 | 7**1302** | 8**1302** | 1500 | 250 |
| 1500 | | 0.6 | 7**1502** | 8**1502** | | |
| 1600 | | 0.7 | 7**1602** | 8**1602** | | |
| 1800 | | 0.7 | 7**1802** | 8**1802** | | |
| 2000 | 7.0 × 15.0 | 0.8 | 7**2002** | 8**2002** | 1000 | 200 |
| 2200 | | 0.9 | 7**2202** | 8**2202** | | |
| 2400 | | 0.9 | 7**2402** | 8**2402** | | |
| 2700 | 7.5 × 15.0 | 0.9 | 7**2702** | 8**2702** | 1000 | 150 |
| 3000 | | 1.0 | 7**3002** | 8**3002** | | |
| 3300 | 8.0 × 15.0 | 1.1 | 7**3302** | 8**3302** | 1000 | 150 |
| 3600 | | 1.2 | 7**3602** | 8**3602** | | |
| 3900 | | 1.3 | 7**3902** | 8**3902** | | |
| 4300 | 8.5 × 15.0 | 1.4 | 7**4302** | 8**4302** | 1000 | 125 |
| 4700 | | 1.5 | 7**4702** | 8**4702** | | |

## CONSTRUCTION

### Description

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

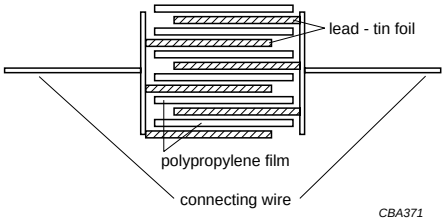



Fig.10 Construction.

### Mounting

NORMAL USE

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

SPECIFIC METHOD OF MOUNTING TO WITHSTAND VIBRATION AND SHOCK

The capacitors shall be mechanically fixed by the leads.

SOLDERING CONDITIONS

The capacitance stability is dependent on the maximum temperature the capacitor reaches during soldering. Figure 11 shows the typical effect of ΔC/C as a function of soldering time under the worst possible mounting conditions (horizontal on the PCB, minimum possible pitch) and with 80 °C preheating.

### Storage temperature

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

## RATINGS AND CHARACTERISTICS REFERENCE CONDITIONS

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

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

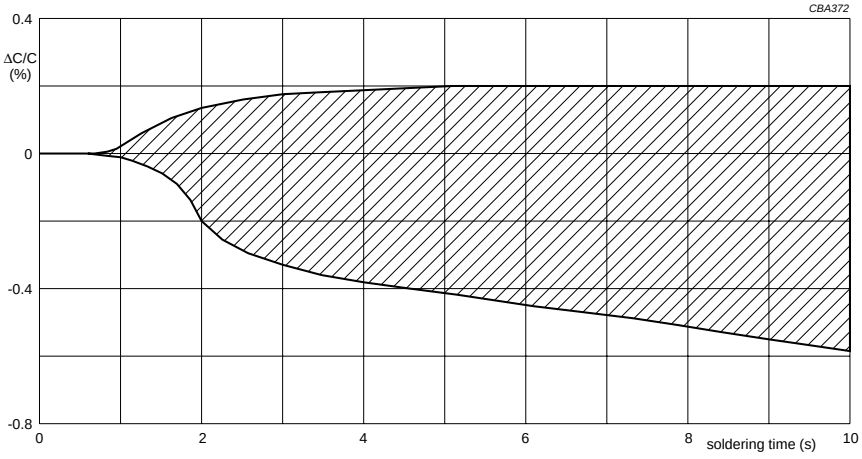



Fig.11 ΔC/C as a function of soldering time.ΔC/C

## CHARACTERISTICS

### Capacitance

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

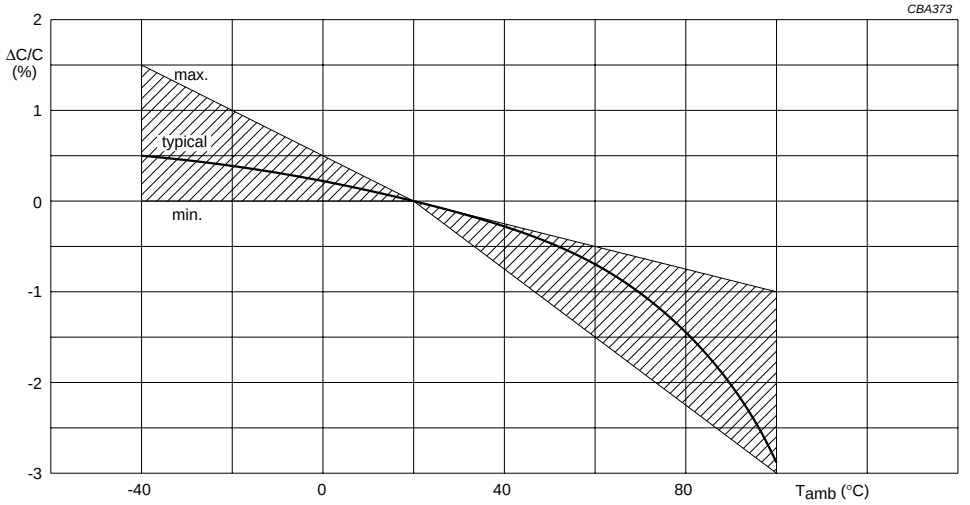



Fig.12 Capacitance change at 1 kHz as a function of ambient temperature.

### Maximum DC voltage as a function of temperature

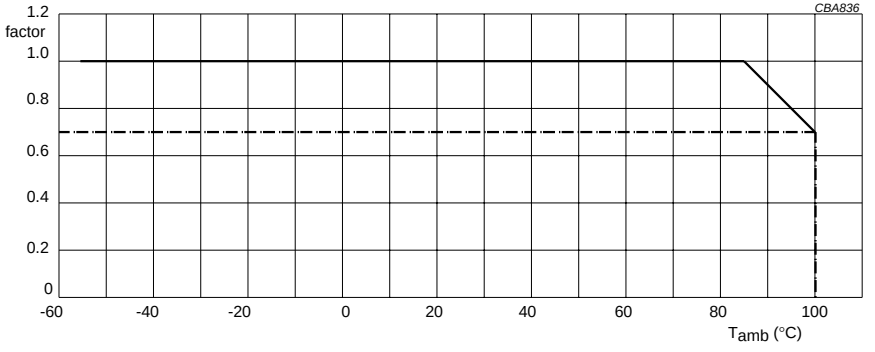



Fig.13 Multiplying factor for DC voltage as a function of temperature.

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

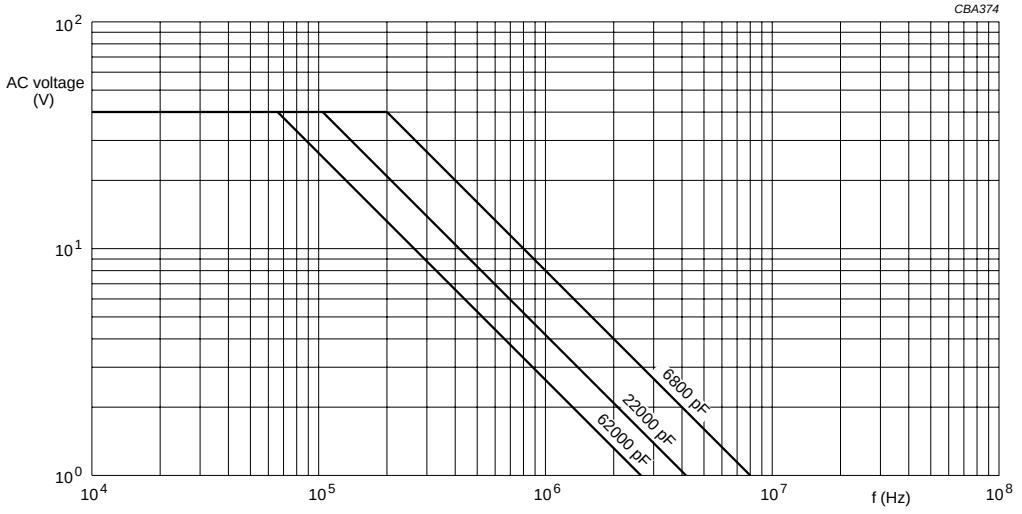



Fig.14 AC voltage (RMS value) as a function of frequency at $T_{amb} \leq 70$ °C for $U_{Rdc} = 63$ V.

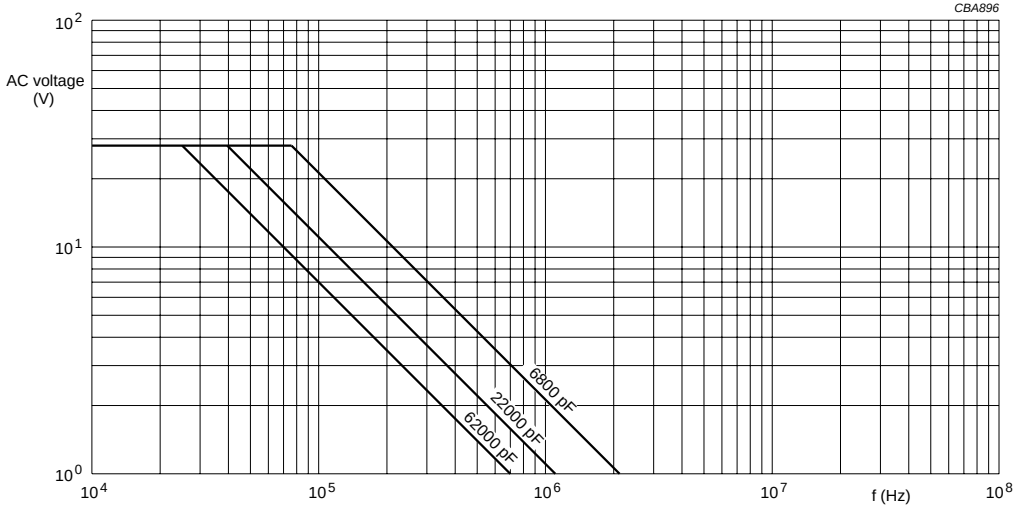



Fig.15 AC voltage (RMS value) as a function of frequency at 70 °C < $T_{amb} \leq 100$ °C for $U_{Rdc} = 63$ V.

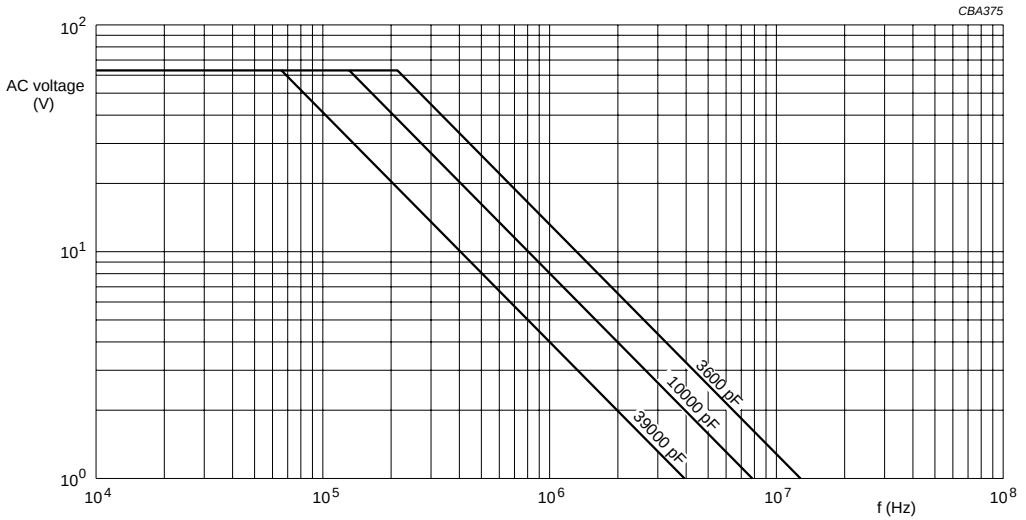



Fig.16 AC voltage (RMS value) as a function of frequency at $T_{amb} \leq 70$ °C for $U_{Rdc} = 160$ V.

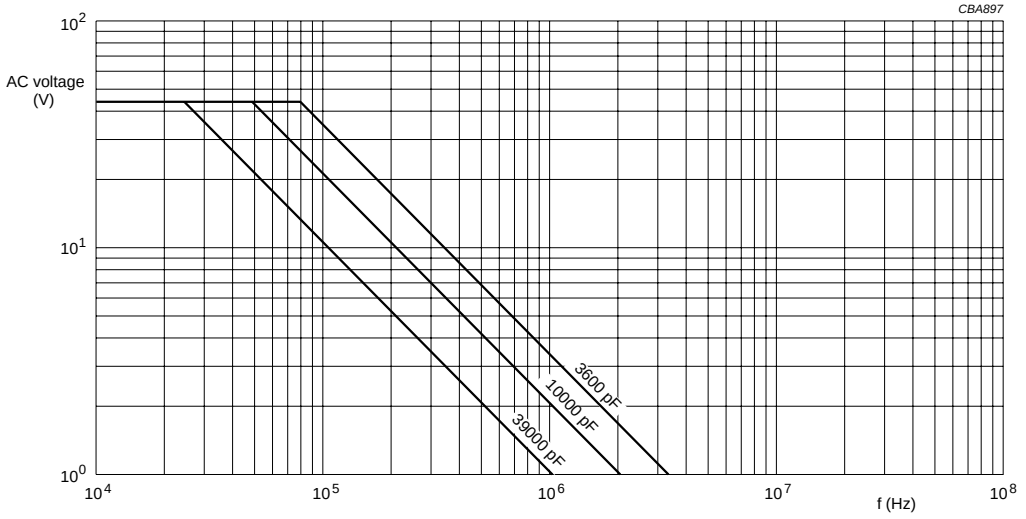



Fig.17 AC voltage (RMS value) as a function of frequency at 70 °C < $T_{amb} \leq 100$ °C for $U_{Rdc} = 160$ V.

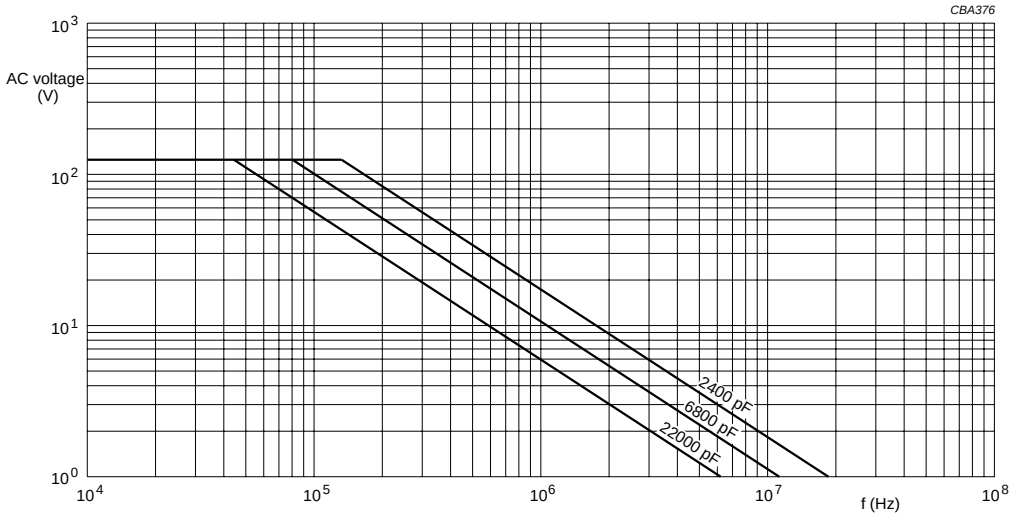



Fig.18 AC voltage (RMS value) as a function of frequency at $T_{amb} \leq 70$ °C for $U_{Rdc} = 250$ V.

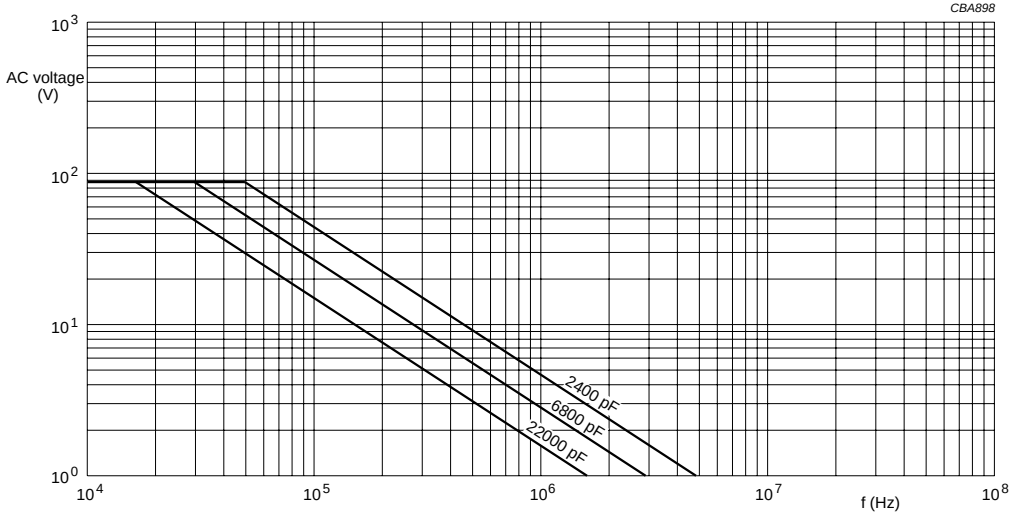



Fig.19 AC voltage (RMS value) as a function of frequency at 70 °C < $T_{amb} \leq 100$ °C for $U_{Rdc} = 250$ V.

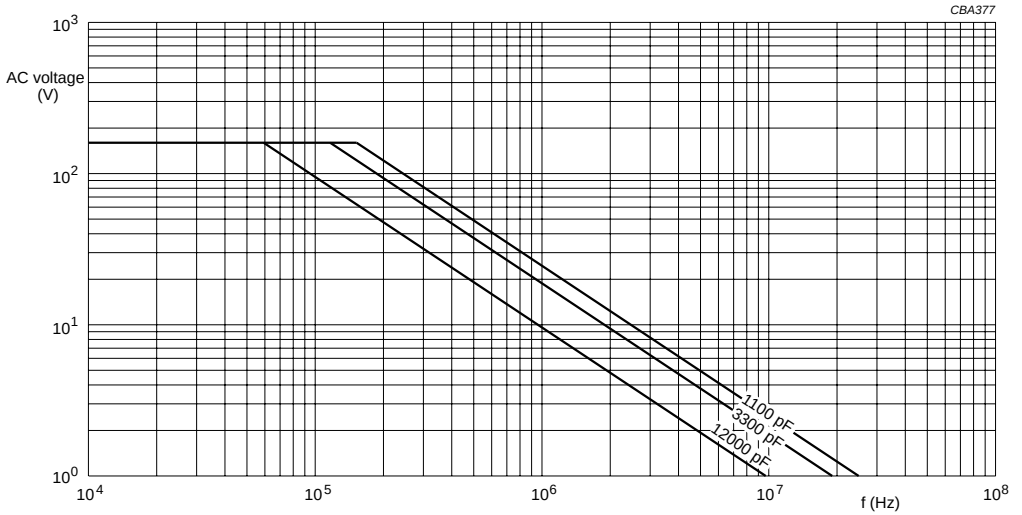



Fig.20 AC voltage (RMS value) as a function of frequency at $T_{amb} \leq 70$ °C for $U_{Rdc} = 400$ V.

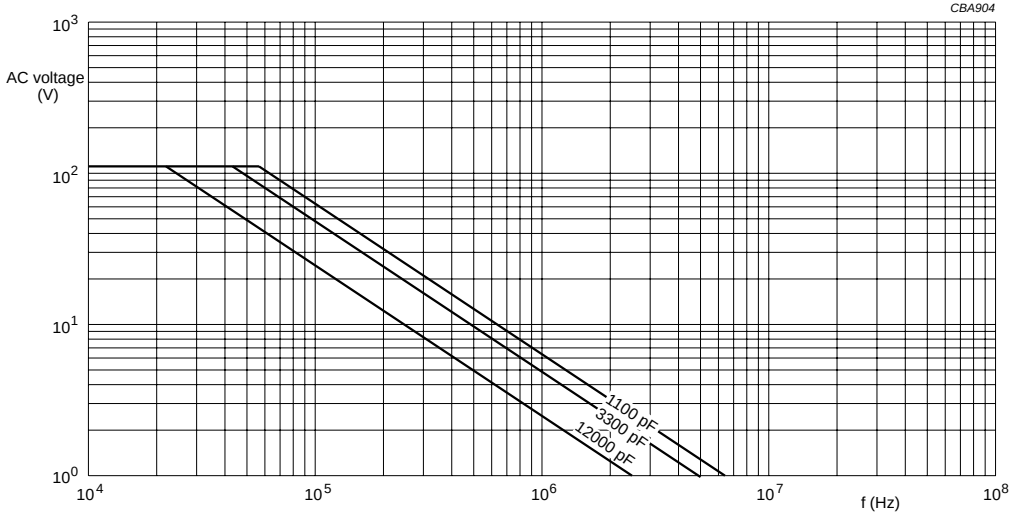



Fig.21 AC voltage (RMS value) as a function of frequency at 70 °C < $T_{amb} \leq 100$ °C for $U_{Rdc} = 400$ V.

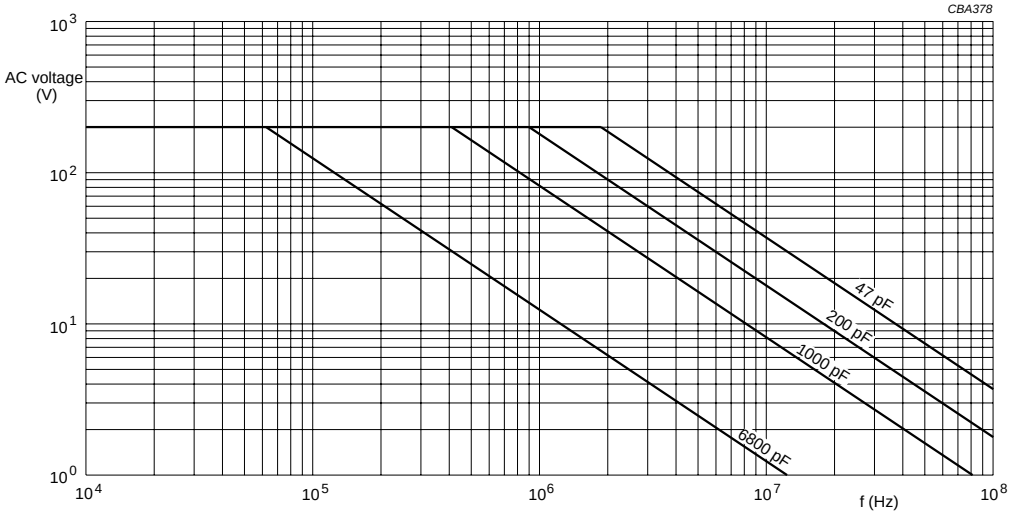



Fig.22 AC voltage (RMS value) as a function of frequency at $T_{amb} \leq 70$ °C for $U_{Rdc} = 630$ V.

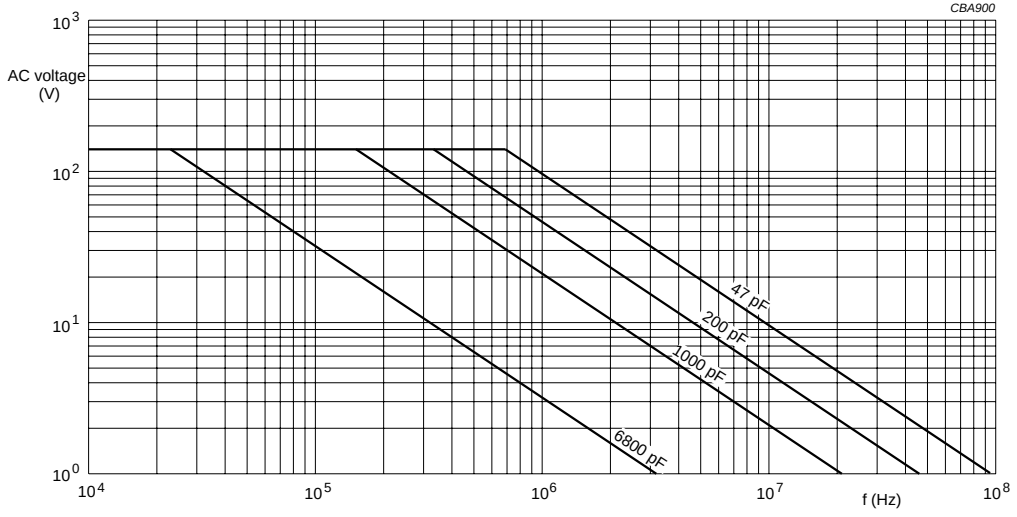



Fig.23 AC voltage (RMS value) as a function of frequency at 70 °C < $T_{amb} \leq 100$ °C for $U_{Rdc} = 630$ V.

**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 14 to 23.

**Tangent of loss angle**

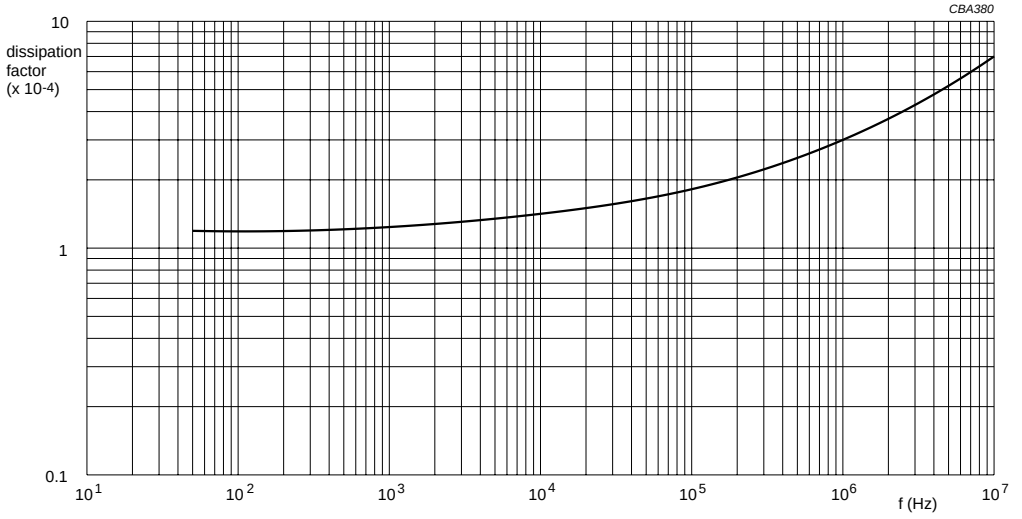



Fig.24 Tangent of loss angle as a function of frequency: typical curve.

**Insulation resistance**

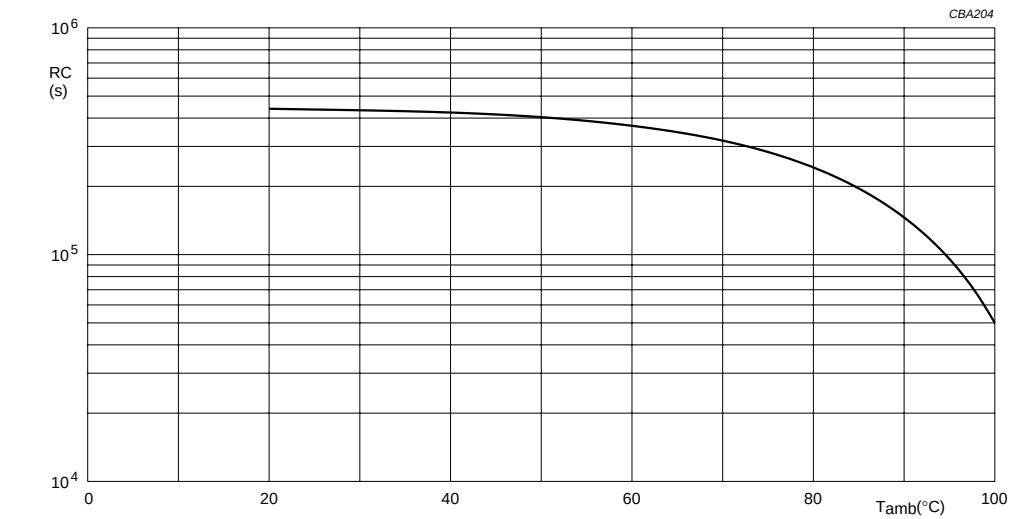



Fig.25 RC product as a function of ambient free air temperature: typical curve.

**Inductance**

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

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

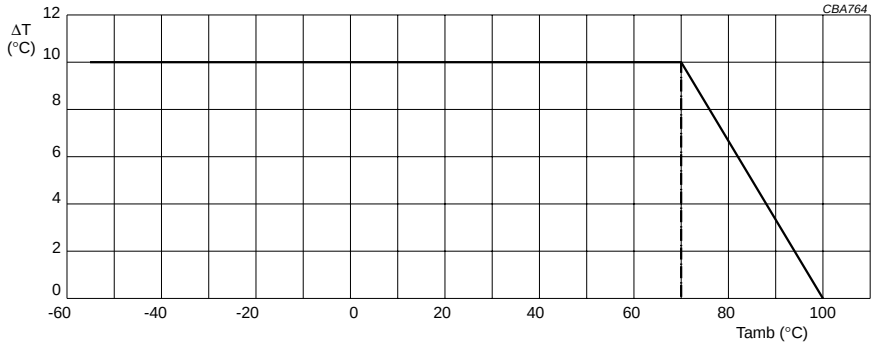



Fig.26 Maximum allowed component temperature rise as a function of the ambient temperature.

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

*Table 1* Heat conductivity

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

**Power dissipation and maximum component temperature rise**

The power dissipation must be limited in order not to exceed the maximum allowed component temperature rise as a function of the free air ambient temperature.

The power dissipation can be calculated according chapter *"Introduction"*, section *"Maximum power dissipation"*.

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

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

**Measuring the component temperature**

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

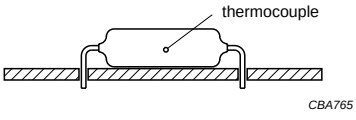



Fig.27 Mounting the thermocouple.

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

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

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

**Application note and limiting conditions**

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

1. The peak voltage ($U_p$) shall not be greater than the rated DC voltage ($U_{Rdc}$).
2. The peak-to-peak voltage ($U_{p-p}$) shall not be greater than the maximum $U_{p-p}$ to avoid the ionisation inception level.
3. The voltage pulse slope (dU/dt) shall not exceed the rated voltage pulse slope in an RC-circuit at rated voltage and without ringing. If the pulse voltage is lower than the rated DC voltage, the rated voltage pulse slope may be multiplied by $U_{Rdc}$ and divided by the applied voltage.

   For all other pulses following equation must be fulfilled:

   $$2 \times \int_0^T \left(\frac{dU}{dt}\right)^2 \times dt < U_{Rdc} \times \left(\frac{dU}{dt}\right)_{rated}$$

   T is the pulse duration.
4. The maximum component surface temperature rise must be lower than the limits in Fig.26.
5. The maximum component surface temperature must be lower than 100 °C.
6. The capacitance drift is influenced by the soldering conditions (see section “Soldering conditions” for more details).

## MARKING

### Product marking

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

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

MARKING EXAMPLE

8n2

G 63

KPK2 (see Table 2)

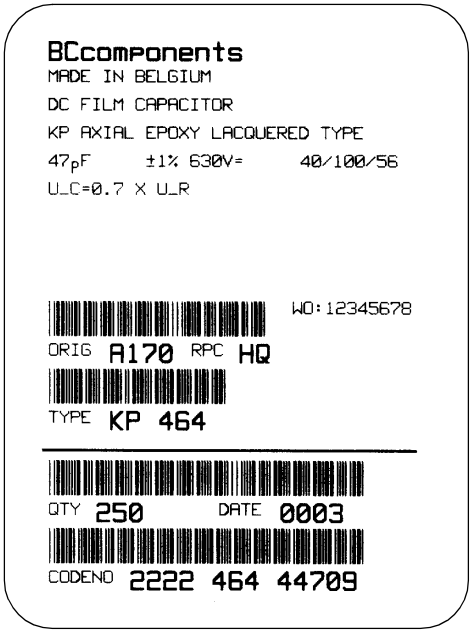
BC.

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

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

**Package marking**

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




**Barcode label marking**

| LINE | MARKING EXPLANATION |
|---|---|
| 1 | Manufacturer's name |
| 2 | Country of origin |
| 3 | Sub-family |
| 4 | Type description |
| 5 | Capacitance value, tolerance, voltage and climatic category (*"IEC 60068-1"*) |
| 6 | – |
| 7 | Preference origin code: A<br>Country of origin in code: 170 (Belgium)<br>Responsible production centre: HQ<br>Work order: WO |
| 8 | Product type description |
| 9 | Quantity and production period, year and week code |
| 10 | Product code (12NC) |

Fig.28 Barcode label.

**QUICK REFERENCE TEST REQUIREMENTS**

| TEST | PROCEDURE (quick reference) | REQUIREMENTS |
|---|---|---|
| **Robustness of leads** | | |
| Tensile: *"IEC 60068-2-21"* | load 10 N; 10 s | no visible damage<br>legible marking<br>$\|\Delta C/C\| \leq 2\%$ +1 pF ($C \leq 1100$ pF)<br>$\|\Delta C/C\| \leq 1\%$ ($C > 1100$ pF) |
| Bending: *"IEC 60068-2-21"* | load 5 N; 4 × 90 ° | |
| Torsion: | 2 × 180 ° | |
| Resistance to soldering heat: *"IEC 60068-2-20"* | solder bath: 260 °C; 5 s | |
| Component solvent resistance | isopropyl alcohol; 23 °C; 5 minutes | |
| **Robustness of component** | | |
| Vibration: *"IEC 60068-2-6"* | 10 to 55 Hz; amplitude 0.75 mm or acceleration 98 m/s$^2$; 6 hours | $\|\Delta C/C\| \leq 2\%$ +1 pF ($C \leq 1100$ pF)<br>$\|\Delta C/C\| \leq 1\%$ ($C > 1100$ pF)<br>$R_{ins} \geq 50\%$ of specified value |
| Shock: *"IEC 60068-2-27"* | half sinewave; 490 m/s$^2$; 11 ms | |
| **Climatic sequence** | | |
| Dry heat: *"IEC 60068-2-2"* | 16 hours; 100 °C | $\|\Delta C/C\| \leq 1\%$ +1 pF ($C \leq 1100$ pF)<br>$\|\Delta C/C\| \leq 1\%$ ($C > 1100$ pF)<br>$R_{ins} \geq 50\%$ of specified value |
| Damp heat, cyclic, test Db, first cycle: *"IEC 60068-2-30"* | | |
| Cold: *"IEC 60068-2-1"* | 2 hours; –40 °C | |
| Damp heat, cyclic, test Db, remaining cycles: *"IEC 60068-2-30"* | | |
| **Other applicable tests** | | |
| Damp heat, steady state: *"IEC 60068-2-3"* | 56 days; 40 °C; 90 to 95% RH | $\|\Delta C/C\| \leq 1\%$ +1 pF ($C \leq 1100$ pF)<br>$\|\Delta C/C\| \leq 1\%$ ($C > 1100$ pF)<br>$R_{ins} \geq 50\%$ of specified value |
| Endurance (DC): *"IEC 60384-13"* | 1000 hours;<br>$1.5 \times U_{Rdc}$; 85 °C<br>$1.05 \times U_{Rdc}$; 100 °C | $\|\Delta C/C\| \leq 2\%$ +1 pF ($C \leq 1100$ pF)<br>$\|\Delta C/C\| \leq 1\%$ ($C > 1100$ pF)<br>$R_{ins} \geq 100\%$ of specified value |
| Variation of capacitance with temperature: *"IEC 60384-13"* | static method; one cycle | $\|\Delta C/C\| \leq 2\%$ +1 pF ($C \leq 1100$ pF)<br>$\|\Delta C/C\| \leq 1\%$ ($C > 1100$ pF)<br>$R_{ins} \geq 10000$ MΩ |
| Heat storage: *"IEC 60384-13"* | 1000 hours; 100 °C | $\|\Delta C/C\| \leq 2\%$ +1 pF ($C \leq 1100$ pF)<br>$\|\Delta C/C\| \leq 1\%$ ($C > 1100$ pF) |
| Resistance to soldering heat with preheating: *"IEC 60384-13"* | body temperature: 100 °C;<br>bath temperature: 260 °C;<br>dwell time: 5 s | $\|\Delta C/C\| \leq 2\%$ +1 pF ($C \leq 1100$ pF)<br>$\|\Delta C/C\| \leq 1\%$ ($C > 1100$ pF) |