

# DATA SHEET

**MKT 470**

**Metallized polyester film capacitors**

Product specification  
Supersedes data of April 1999  
File under BCcomponents, BC05

2000 Feb 01

# Metallized polyester film capacitors

# MKT 470

MKT RADIAL POTTED TYPE

PITCH 5 mm

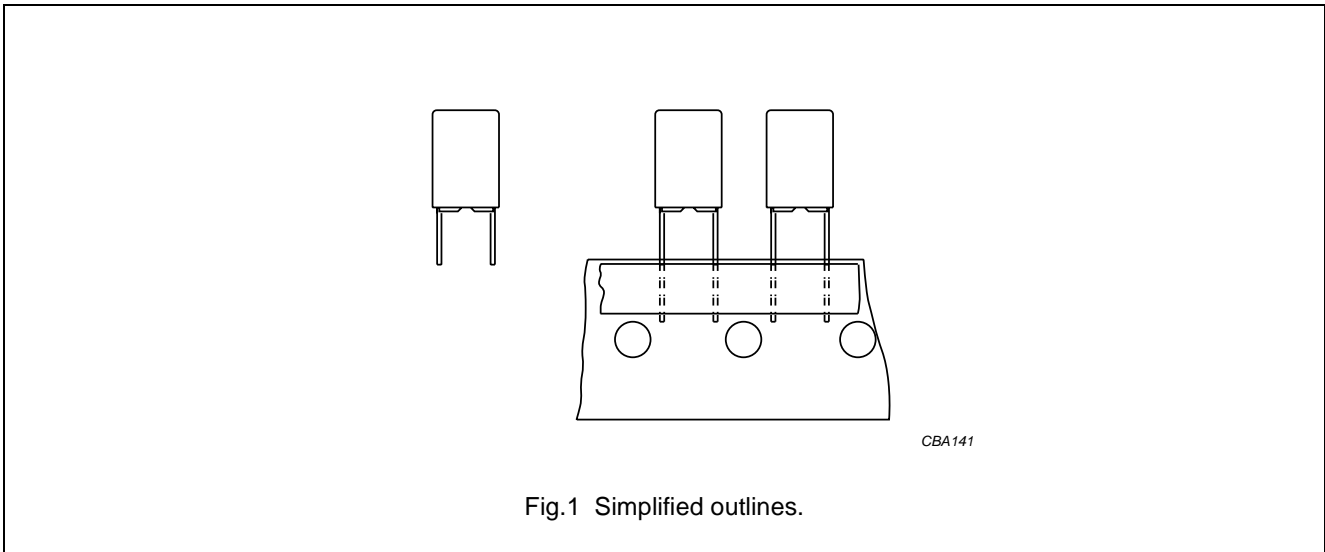


Fig.1 Simplified outlines.

## FEATURES

- Low-inductive wound cell of metallized (PETP) film
- Potted with epoxy resin in a flame-retardant case
- Radial leads of solder-coated fecuma wire
- Withstands thermal shocks, oils, solvents and rinsing liquids
- Small stand-off pips to allow removal of solder flux
- Suitable for high density packaging.

## QUICK REFERENCE DATA

| DESCRIPTION                      | VALUE                     |
|----------------------------------|---------------------------|
| Capacitance range (E12 series)   | 0.001 to 1.2 $\mu$ F      |
| Capacitance tolerance            | $\pm$ 10%; $\pm$ 5%       |
| Rated (DC) voltage               | 63 V; 100 V; 250 V; 400 V |
| Climatic category                | 55/125/56                 |
| Maximum application temperature  | 125 °C                    |
| Rated temperature                | 85 °C                     |
| Tangent of loss angle at 100 kHz | $150 \times 10^{-4}$      |
| Reference specification          | IEC 60384-2               |
| Performance grade                | grade 1 (long life)       |

## APPLICATIONS

- Blocking and coupling of signals
- Bypass and energy reservoir
- Filter networks
- Pulse circuits
- Heavy duty and automotive
- Where high reliability is required.

## DETAIL SPECIFICATION

For more detailed data and test requirements see "Type detail specification HQN-384-02/104".

Metallized polyester film capacitors

MKT 470

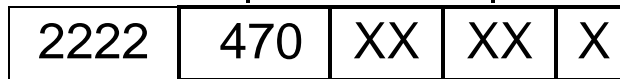
COMPOSITION OF CATALOGUE NUMBER

| TYPE AND PITCHES |        |
|------------------|--------|
| 470              | 5.0 mm |

| MULTIPLIER<br>(nF) |   |
|--------------------|---|
| 0.1                | 2 |
| 1                  | 3 |
| 10                 | 4 |
| 100                | 5 |

CAPACITANCE  
(numerically)

Example:  
104 = 10 x 10 = 100 nF



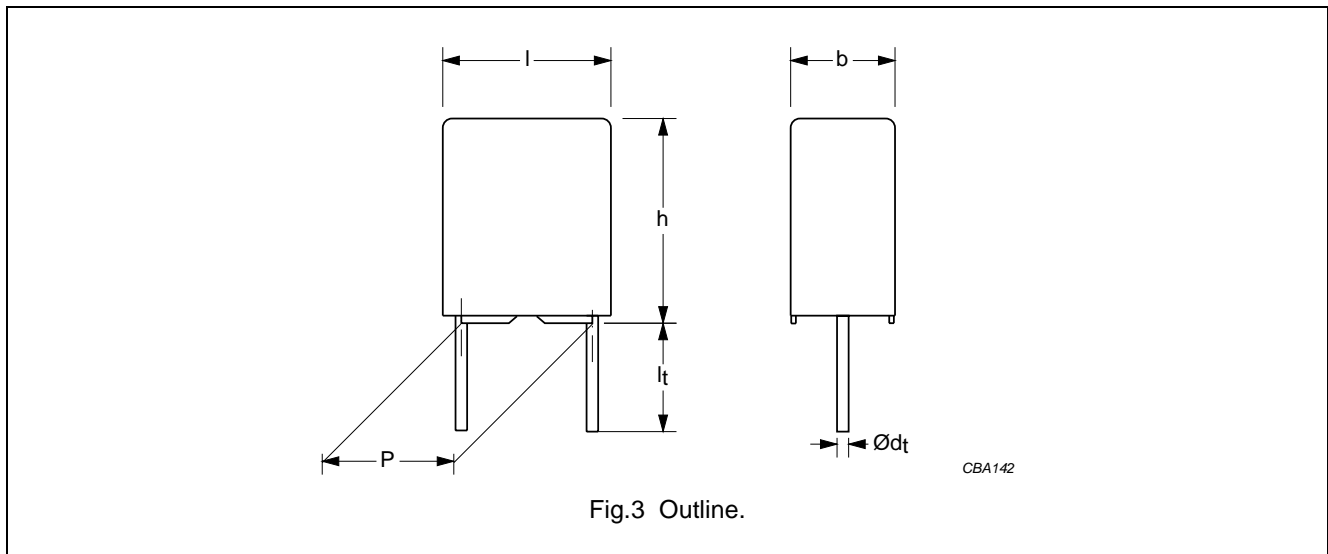
| TYPE | PACKAGING     | LEAD CONFIGURATION                    | C-TOL | 63 V | 100 V | 250 V | 400 V |
|------|---------------|---------------------------------------|-------|------|-------|-------|-------|
| 470  | ammopack      | H = 18.5 mm; P <sub>0</sub> = 12.7 mm | ±10%  | 75   | 85    | 35    | 65    |
|      |               |                                       | ±5%   | 76   | 86    | 36    | 66    |
|      | loose in box  | lead length 4.0 mm                    | ±10%  | 11   | 21    | 41    | 51    |
|      |               |                                       | ±5%   | 12   | 22    | 42    | 52    |
|      |               | lead length 26.0 mm                   | ±10%  | 15   | 25    | 45    | 55    |
|      |               |                                       | ±5%   | 16   | 26    | 46    | 56    |
|      | taped on reel | H = 18.5 mm; P <sub>0</sub> = 12.7 mm | ±10%  | 18   | 28    | 48    | 58    |
|      |               |                                       | ±5%   | 19   | 29    | 49    | 59    |

Metallized polyester film capacitors

MKT 470

MKT 470 GENERAL DATA

PITCH 5 mm



Specific reference data for the 63 V DC capacitors

| DESCRIPTION  | VALUE  |   |   |
|--|--|---|---|
|  | at 1 kHz   | at 10 kHz   | at 100 kHz  |
| Tangent of loss angle:<br>C ≤ 0.1 µF<br>0.1 µF < C ≤ 0.47 µF<br>0.47 µF < C ≤ 1.2 µF | ≤60 × 10 <sup>-4</sup><br>≤60 × 10 <sup>-4</sup><br>≤60 × 10 <sup>-4</sup> | ≤120 × 10 <sup>-4</sup><br>≤120 × 10 <sup>-4</sup><br>≤120 × 10 <sup>-4</sup> | ≤200 × 10 <sup>-4</sup><br>≤225 × 10 <sup>-4</sup><br>- |
| Rated voltage pulse slope (dU/dt) <sub>R</sub> at 63 V (DC)                          | 100 V/µs   |   |   |
| R between leads, for C ≤ 0.33 µF at 10 V; 1 minute                                   | >15000 MΩ  |   |   |
| RC between leads, for C > 0.33 µF at 10 V; 1 minute                                  | >5000 s  |   |   |
| R between interconnected leads and case (foil method)                                | >30000 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                                     | 200 V; 1 minute  |   |   |

Available 63 V DC versions

| PACKAGING <sup>(1)</sup> | DIMENSIONS                        | C-tol | FIRST 9 DIGITS OF CATALOGUE NUMBER | ORDERING   |
|--------------------------|-----------------------------------|-------|------------------------------------|------------|
| Ammopack                 | H = 18.5 mm; note 2               | ±10%  | 2222 470 75...                     | preferred  |
|                          |                                   | ±5%   | 2222 470 76...                     | preferred  |
| Loose in box             | l <sub>t</sub> = 4.0 +1.0/-0.5 mm | ±10%  | 2222 470 11...                     | on request |
|                          |                                   | ±5%   | 2222 470 12...                     | on request |
|                          | l <sub>t</sub> = 26.0 ±2.0 mm     | ±10%  | 2222 470 15...                     | on request |
|                          |                                   | ±5%   | 2222 470 16...                     | on request |
| Taped on reel            | H = 18.5 mm; note 2               | ±10%  | 2222 470 18...                     | on request |
|                          |                                   | ±5%   | 2222 470 19...                     | on request |

Notes

1. For SPQ refer to this handbook, chapter "Packaging information".
2. H = in-tape height; for detailed specifications refer to this handbook, chapter "Packaging information".

## Metallized polyester film capacitors

MKT 470

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

| C<br>( $\mu\text{F}$ )  | DIMENSIONS<br>$b \times h \times l$<br>(mm) | MASS<br>(g) | CATALOGUE NUMBER                |                              |
|---|---|-------------|---------------------------------|------------------------------|
|   |   |             | AMMOPACK                        |                              |
|   |   |             | H = 18.5 mm                     |                              |
|   |   |             | C-tol = $\pm 10\%$              | C-tol = $\pm 5\%$            |
|   |   |             | catalogue number <sup>(1)</sup> | last 5 digits <sup>(1)</sup> |
| <b>Pitch = <math>5.0 \pm 0.3 \text{ mm}</math>; <math>d_t = 0.50 \pm 0.05 \text{ mm}</math></b> |   |             |                                 |                              |
| 0.068   | 2.5 × 6.5 × 7.2                             | 0.25        | 2222 470 75683                  | .. 76683                     |
| 0.082   |   |             | 2222 470 75823                  | .. 76823                     |
| 0.1   |   |             | 2222 470 75104                  | .. 76104                     |
| 0.12  | 3.5 × 8.0 × 7.2                             | 0.35        | 2222 470 75124                  | .. 76124                     |
| 0.15  |   |             | 2222 470 75154                  | .. 76154                     |
| 0.18  |   |             | 2222 470 75184                  | .. 76184                     |
| 0.22  |   |             | 2222 470 75224                  | .. 76224                     |
| 0.27  |   |             | 2222 470 75274                  | .. 76274                     |
| 0.33  |   |             | 2222 470 75334                  | .. 76334                     |
| 0.39  |   |             | 2222 470 75394                  | .. 76394                     |
| 0.47  | 4.5 × 9.0 × 7.2                             | 0.45        | 2222 470 75474                  | .. 76474                     |
| 0.56  |   |             | 2222 470 75564                  | .. 76564                     |
| 0.68  |   |             | 2222 470 75684                  | .. 76684                     |
| 0.82  | 6.0 × 11.0 × 7.2                            | 0.60        | 2222 470 75824                  | .. 76824                     |
| 1   |   |             | 2222 470 75105                  | .. 76105                     |
| 1.2   |   |             | 2222 470 75125                  | .. 76125                     |

**Note**

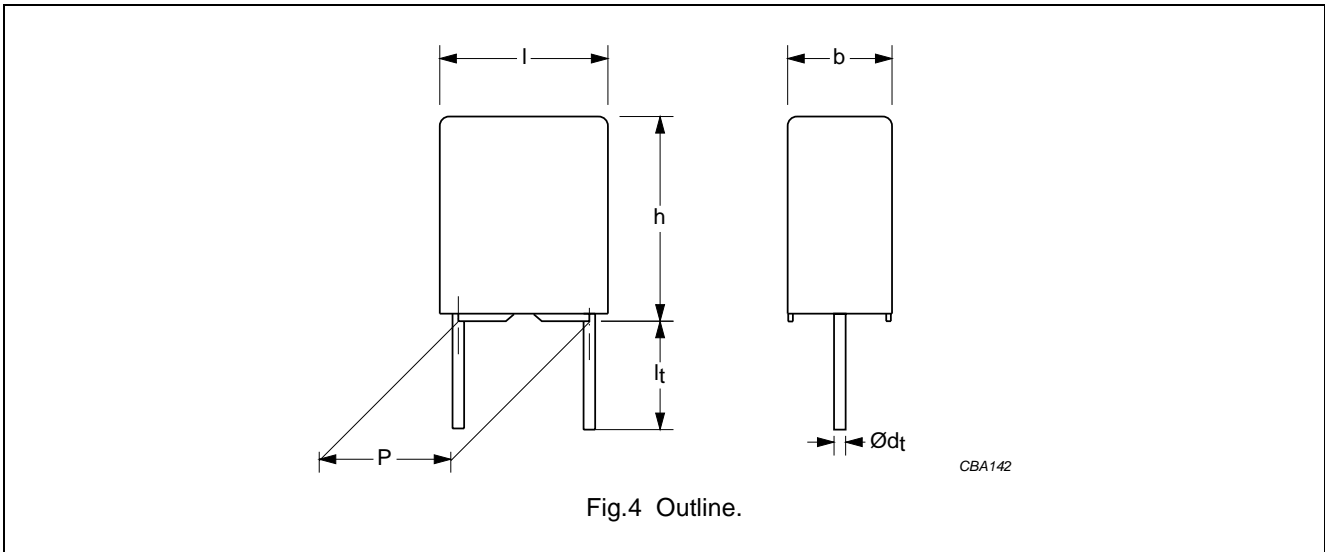
1. The shading indicates preferred types.

# Metalized polyester film capacitors

MKT 470

**MKT 470 GENERAL DATA**

**PITCH 5 mm**



**Specific reference data for the 100 V DC capacitors**

| DESCRIPTION  | VALUE  |  |  |
|--|--|--|--|
|  | at 1 kHz   | at 10 kHz  | at 100 kHz   |
| Tangent of loss angle:<br>C ≤ 0.1 μF<br>0.1 μF < C ≤ 0.47 μF         | ≤60 × 10 <sup>-4</sup><br>≤60 × 10 <sup>-4</sup> | ≤120 × 10 <sup>-4</sup><br>≤120 × 10 <sup>-4</sup> | ≤200 × 10 <sup>-4</sup><br>≤225 × 10 <sup>-4</sup> |
| Rated voltage pulse slope (dU/dt) <sub>R</sub> at 100 V (DC)         | 160 V/μs   |  |  |
| R between leads, for C ≤ 0.33 μF at 100 V; 1 minute                  | >15000 MΩ  |  |  |
| RC between leads, for C > 0.33 μF at 100 V; 1 minute                 | >5000 s  |  |  |
| R between interconnected leads and case (foil method)                | >30000 MΩ  |  |  |
| Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s | 160 V; 1 minute                                  |  |  |
| Withstanding (DC) voltage between leads and case                     | 200 V; 1 minute                                  |  |  |

**Available 100 V DC versions**

| PACKAGING <sup>(1)</sup> | DIMENSIONS                        | C-tol | FIRST 9 DIGITS OF CATALOGUE NUMBER | ORDERING   |
|--------------------------|-----------------------------------|-------|------------------------------------|------------|
| Ammopack                 | H = 18.5 mm; note 2               | ±10%  | 2222 470 85...                     | preferred  |
|                          |                                   | ±5%   | 2222 470 86...                     | preferred  |
| Loose in box             | l <sub>t</sub> = 4.0 +1.0/-0.5 mm | ±10%  | 2222 470 21...                     | on request |
|                          |                                   | ±5%   | 2222 470 22...                     | on request |
|                          | l <sub>t</sub> = 26.0 ±2.0 mm     | ±10%  | 2222 470 25...                     | on request |
|                          |                                   | ±5%   | 2222 470 26...                     | on request |
| Taped on reel            | H = 18.5 mm; note 2               | ±10%  | 2222 470 28...                     | on request |
|                          |                                   | ±5%   | 2222 470 29...                     | on request |

**Notes**

1. For SPQ refer to this handbook, chapter "Packaging information".
2. H = in-tape height; for detailed specifications refer to this handbook, chapter "Packaging information".

## Metallized polyester film capacitors

MKT 470

 $U_{Rdc} = 100 \text{ V}$ ;  $U_{Rac} = 63 \text{ V}$ 

| C<br>( $\mu\text{F}$ )  | DIMENSIONS<br>$b \times h \times l$<br>(mm) | MASS<br>(g) | CATALOGUE NUMBER                |                              |
|---|---|-------------|---------------------------------|------------------------------|
|   |   |             | AMMOPACK                        |                              |
|   |   |             | H = 18.5 mm                     |                              |
|   |   |             | C-tol = $\pm 10\%$              | C-tol = $\pm 5\%$            |
|   |   |             | catalogue number <sup>(1)</sup> | last 5 digits <sup>(1)</sup> |
| <b>Pitch = <math>5.0 \pm 0.3 \text{ mm}</math>; <math>d_t = 0.50 \pm 0.05 \text{ mm}</math></b> |   |             |                                 |                              |
| 0.022   | 2.5 × 6.5 × 7.2                             | 0.25        | 2222 470 85223                  | .. 86223                     |
| 0.027   |   |             | 2222 470 85273                  | .. 86273                     |
| 0.033   |   |             | 2222 470 85333                  | .. 86333                     |
| 0.039   |   |             | 2222 470 85393                  | .. 86393                     |
| 0.047   |   |             | 2222 470 85473                  | .. 86473                     |
| 0.056   |   |             | 2222 470 85563                  | .. 86563                     |
| 0.068   | 3.5 × 8.0 × 7.2                             | 0.35        | 2222 470 85683                  | .. 86683                     |
| 0.082   |   |             | 2222 470 85823                  | .. 86823                     |
| 0.1   |   |             | 2222 470 85104                  | .. 86104                     |
| 0.12  |   |             | 2222 470 85124                  | .. 86124                     |
| 0.15  | 4.5 × 9.0 × 7.2                             | 0.45        | 2222 470 85154                  | .. 86154                     |
| 0.18  |   |             | 2222 470 85184                  | .. 86184                     |
| 0.22  |   |             | 2222 470 85224                  | .. 86224                     |
| 0.27  | 6.0 × 11.0 × 7.2                            | 0.65        | 2222 470 85274                  | .. 86274                     |
| 0.33  |   |             | 2222 470 85334                  | .. 86334                     |
| 0.39  |   |             | 2222 470 85394                  | .. 86394                     |
| 0.47  |   |             | 2222 470 85474                  | .. 86474                     |

**Note**

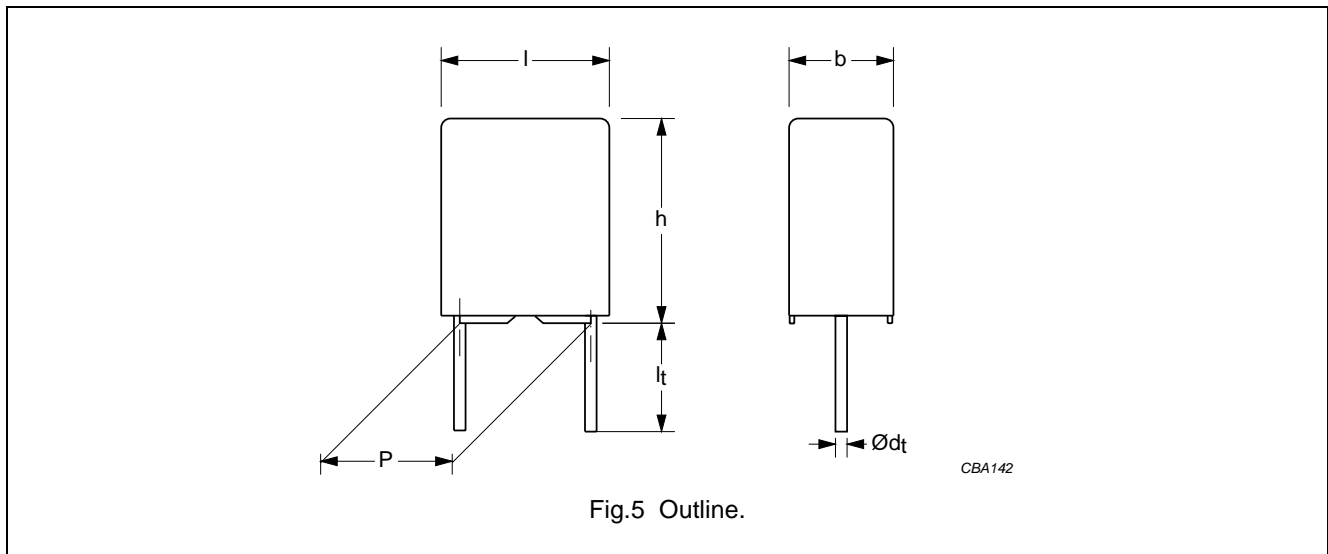
1. The shading indicates preferred types.

Metallized polyester film capacitors

MKT 470

MKT 470 GENERAL DATA

PITCH 5 mm



Specific reference data for the 250 V DC capacitors

| DESCRIPTION   | VALUE                    |                           |                           |                           |
|---|--------------------------|---------------------------|---------------------------|---------------------------|
|   | at 1 kHz                 | at 10 kHz                 | at 100 kHz                | at 1 MHz                  |
| Tangent of loss angle:<br>$C \leq 0.01 \mu\text{F}$<br>$0.01 \mu\text{F} < C \leq 0.1 \mu\text{F}$<br>$0.1 \mu\text{F} < C \leq 0.12 \mu\text{F}$ | $\leq 60 \times 10^{-4}$ | $\leq 120 \times 10^{-4}$ | $\leq 200 \times 10^{-4}$ | $\leq 250 \times 10^{-4}$ |
| Rated voltage pulse slope $(dU/dt)_R$ at 250 V (DC)   | 400 V/ $\mu\text{s}$     |                           |                           |                           |
| R between leads at 100 V; 1 minute  | $>15000 \text{ M}\Omega$ |                           |                           |                           |
| R between interconnected leads and case (foil method)   | $>30000 \text{ M}\Omega$ |                           |                           |                           |
| Withstanding (DC) voltage (cut off current 10 mA);<br>rise time 100 V/s   | 400 V; 1 minute          |                           |                           |                           |
| Withstanding (DC) voltage between leads and case  | 500 V; 1 minute          |                           |                           |                           |

Available 250 V DC versions

| PACKAGING <sup>(1)</sup> | DIMENSIONS                       | C-tol      | FIRST 9 DIGITS OF CATALOGUE NUMBER | ORDERING   |
|--------------------------|----------------------------------|------------|------------------------------------|------------|
| Ammopack                 | H = 18.5 mm; note 2              | $\pm 10\%$ | 2222 470 35...                     | preferred  |
|                          |                                  | $\pm 5\%$  | 2222 470 36...                     | preferred  |
| Loose in box             | $l_t = 4.0 +1.0/-0.5 \text{ mm}$ | $\pm 10\%$ | 2222 470 41...                     | on request |
|                          |                                  | $\pm 5\%$  | 2222 470 42...                     | on request |
|                          | $l_t = 26.0 \pm 2.0 \text{ mm}$  | $\pm 10\%$ | 2222 470 45...                     | on request |
|                          |                                  | $\pm 5\%$  | 2222 470 46...                     | on request |
| Taped on reel            | H = 18.5 mm; note 2              | $\pm 10\%$ | 2222 470 48...                     | on request |
|                          |                                  | $\pm 5\%$  | 2222 470 49...                     | on request |

Notes

- For SPQ refer to this handbook, chapter "Packaging information".
- H = in-tape height; for detailed specifications refer to this handbook, chapter "Packaging information".



## Metallized polyester film capacitors

MKT 470

 $U_{Rdc} = 250 \text{ V}$ ;  $U_{Rac} = 160 \text{ V}$ 

| C<br>( $\mu\text{F}$ )  | DIMENSIONS<br>$b \times h \times l$<br>(mm) | MASS<br>(g) | CATALOGUE NUMBER                |                              |
|---|---|-------------|---------------------------------|------------------------------|
|   |   |             | AMMOPACK                        |                              |
|   |   |             | H = 18.5 mm                     |                              |
|   |   |             | C-tol = $\pm 10\%$              | C-tol = $\pm 5\%$            |
|   |   |             | catalogue number <sup>(1)</sup> | last 5 digits <sup>(1)</sup> |
| <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  | 2.5 × 6.5 × 7.2                             | 0.25        | 2222 470 35103                  | .. 36103                     |
| 0.012   |   |             | 2222 470 35123                  | .. 36123                     |
| 0.015   |   |             | 2222 470 35153                  | .. 36153                     |
| 0.018   |   |             | 2222 470 35183                  | .. 36183                     |
| 0.022   | 3.5 × 8.0 × 7.2                             | 0.35        | 2222 470 35223                  | .. 36223                     |
| 0.027   |   |             | 2222 470 35273                  | .. 36273                     |
| 0.033   |   |             | 2222 470 35333                  | .. 36333                     |
| 0.039   |   |             | 2222 470 35393                  | .. 36393                     |
| 0.047   | 4.5 × 9.0 × 7.2                             | 0.45        | 2222 470 35473                  | .. 36473                     |
| 0.056   |   |             | 2222 470 35563                  | .. 36563                     |
| 0.068   |   |             | 2222 470 35683                  | .. 36683                     |
| 0.082   | 6.0 × 11.0 × 7.2                            | 0.60        | 2222 470 35823                  | .. 36823                     |
| 0.1   |   |             | 2222 470 35104                  | .. 36104                     |
| 0.12  |   |             | 2222 470 35124                  | .. 36124                     |

**Note**

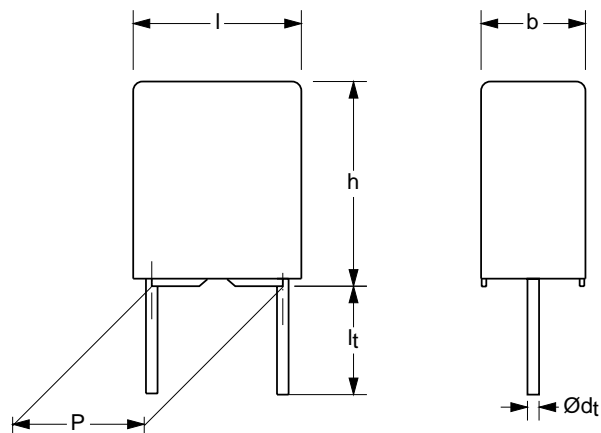
1. The shading indicates preferred types.

## Metallized polyester film capacitors

MKT 470

## MKT 470 GENERAL DATA

PITCH 5 mm



CBA142

Fig.6 Outline.

## Specific reference data for the 400 V DC capacitors

| DESCRIPTION   | VALUE  |  |  |                              |
|---|--|--|--|------------------------------|
|   | at 1 kHz   | at 10 kHz  | at 100 kHz   | at 1 MHz                     |
| Tangent of loss angle:<br>C ≤ 0.01 μF<br>0.01 μF < C ≤ 0.047 μF         | ≤60 × 10 <sup>-4</sup><br>≤60 × 10 <sup>-4</sup> | ≤120 × 10 <sup>-4</sup><br>≤120 × 10 <sup>-4</sup> | ≤200 × 10 <sup>-4</sup><br>≤200 × 10 <sup>-4</sup> | ≤250 × 10 <sup>-4</sup><br>– |
| Rated voltage pulse slope (dU/dt) <sub>R</sub> at 400 V (DC)            | 800 V/μs   |  |  |                              |
| R between leads at 100 V; 1 minute                                      | >15000 MΩ  |  |  |                              |
| R between interconnected leads and case (foil method)                   | >30000 MΩ  |  |  |                              |
| Withstanding (DC) voltage (cut off current 10 mA);<br>rise time 100 V/s | 640 V; 1 minute                                  |  |  |                              |
| Withstanding (DC) voltage between leads and case                        | 800 V; 1 minute                                  |  |  |                              |

## Available 400 V DC versions

| PACKAGING <sup>(1)</sup> | DIMENSIONS                        | C-tol | FIRST 9 DIGITS OF CATALOGUE NUMBER | ORDERING   |
|--------------------------|-----------------------------------|-------|------------------------------------|------------|
| Ammopack                 | H = 18.5 mm; note 2               | ±10%  | 2222 470 65...                     | preferred  |
|                          |                                   | ±5%   | 2222 470 66...                     | preferred  |
| Loose in box             | l <sub>t</sub> = 4.0 +1.0/-0.5 mm | ±10%  | 2222 470 51...                     | on request |
|                          |                                   | ±5%   | 2222 470 52...                     | on request |
|                          | l <sub>t</sub> = 26.0 ±2.0 mm     | ±10%  | 2222 470 55...                     | on request |
|                          |                                   | ±5%   | 2222 470 56...                     | on request |
| Taped on reel            | H = 18.5 mm; note 2               | ±10%  | 2222 470 58...                     | on request |
|                          |                                   | ±5%   | 2222 470 59...                     | on request |

## Notes

- For SPQ refer to this handbook, chapter "Packaging information".
- H = in-tape height; for detailed specifications refer to this handbook, chapter "Packaging information".

## Metallized polyester film capacitors

MKT 470

 $U_{Rdc} = 400 \text{ V}$ ;  $U_{Rac} = 220 \text{ V}$ 

| C<br>( $\mu\text{F}$ )  | DIMENSIONS<br>$b \times h \times l$<br>(mm) | MASS<br>(g) | CATALOGUE NUMBER                |                              |
|---|---|-------------|---------------------------------|------------------------------|
|   |   |             | AMMOPACK                        |                              |
|   |   |             | H = 18.5 mm                     |                              |
|   |   |             | C-tol = $\pm 10\%$              | C-tol = $\pm 5\%$            |
|   |   |             | catalogue number <sup>(1)</sup> | last 5 digits <sup>(1)</sup> |
| <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   | 2.5 × 6.5 × 7.2                             | 0.25        | 2222 470 65 <b>102</b>          | .. 66 <b>102</b>             |
| 0.0012  |   |             | 2222 470 65 <b>122</b>          | .. 66 <b>122</b>             |
| 0.0015  |   |             | 2222 470 65 <b>152</b>          | .. 66 <b>152</b>             |
| 0.0018  |   |             | 2222 470 65 <b>182</b>          | .. 66 <b>182</b>             |
| 0.0022  |   |             | 2222 470 65 <b>222</b>          | .. 66 <b>222</b>             |
| 0.0027  |   |             | 2222 470 65 <b>272</b>          | .. 66 <b>272</b>             |
| 0.0033  |   |             | 2222 470 65 <b>332</b>          | .. 66 <b>332</b>             |
| 0.0039  |   |             | 2222 470 65 <b>392</b>          | .. 66 <b>392</b>             |
| 0.0047  |   |             | 2222 470 65 <b>472</b>          | .. 66 <b>472</b>             |
| 0.0056  |   |             | 2222 470 65 <b>562</b>          | .. 66 <b>562</b>             |
| 0.0068  |   |             | 2222 470 65 <b>682</b>          | .. 66 <b>682</b>             |
| 0.0082  |   |             | 2222 470 65 <b>822</b>          | .. 66 <b>822</b>             |
| 0.01  | 3.5 × 8.0 × 7.2                             | 0.35        | 2222 470 65 <b>103</b>          | .. 66 <b>103</b>             |
| 0.012   |   |             | 2222 470 65 <b>123</b>          | .. 66 <b>123</b>             |
| 0.015   |   |             | 2222 470 65 <b>153</b>          | .. 66 <b>153</b>             |
| 0.018   | 4.5 × 9.0 × 7.2                             | 0.45        | 2222 470 65 <b>183</b>          | .. 66 <b>183</b>             |
| 0.022   |   |             | 2222 470 65 <b>223</b>          | .. 66 <b>223</b>             |
| 0.027   |   |             | 2222 470 65 <b>273</b>          | .. 66 <b>273</b>             |
| 0.033   | 6.0 × 11.0 × 7.2                            | 0.60        | 2222 470 65 <b>333</b>          | .. 66 <b>333</b>             |
| 0.039   |   |             | 2222 470 65 <b>393</b>          | .. 66 <b>393</b>             |
| 0.047   |   |             | 2222 470 65 <b>473</b>          | .. 66 <b>473</b>             |

**Note**

1. The shading indicates preferred types.

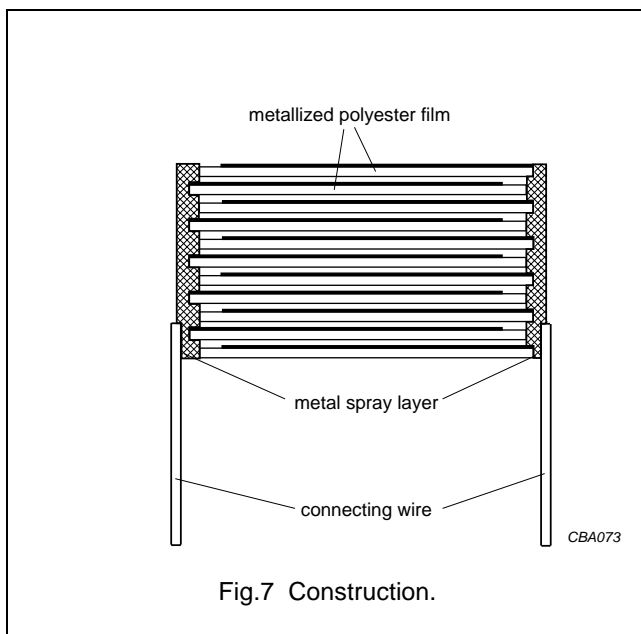
# Metallized polyester film capacitors

## MKT 470

### CONSTRUCTION

#### Description

- Low-inductive wound cell of metallized polyethylene terephthalate (PETP) film, potted with epoxy resin in a flame-retardant case
- Radial leads, copper clad iron wire
- 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 mounting on printed-circuit boards. The capacitors packed in bandoliers are designed for mounting on printed-circuit boards by automatic insertion machines.

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

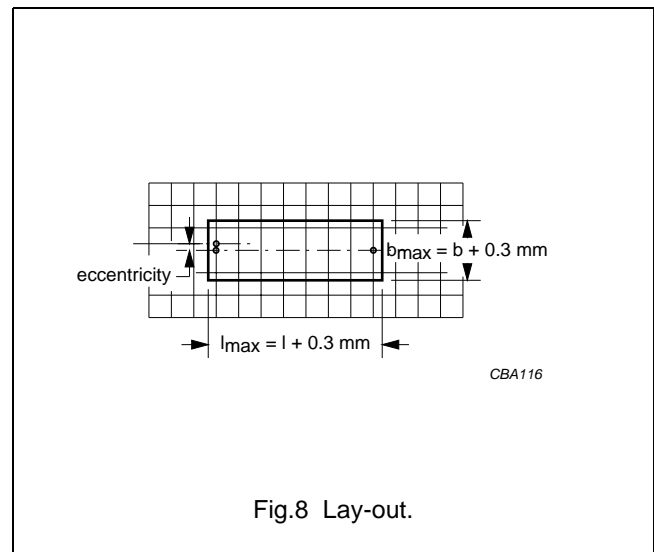
##### SPECIFIC METHOD OF MOUNTING TO WITHSTAND VIBRATION AND SHOCK TEST

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.

#### SPACE REQUIREMENTS ON PRINTED-CIRCUIT BOARD

The maximum length and width of film capacitors is shown in Fig.8:

- Eccentricity see Fig.8. The maximum eccentricity is smaller than or equal to the wire 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 to 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  $50 \pm 2\%$ .

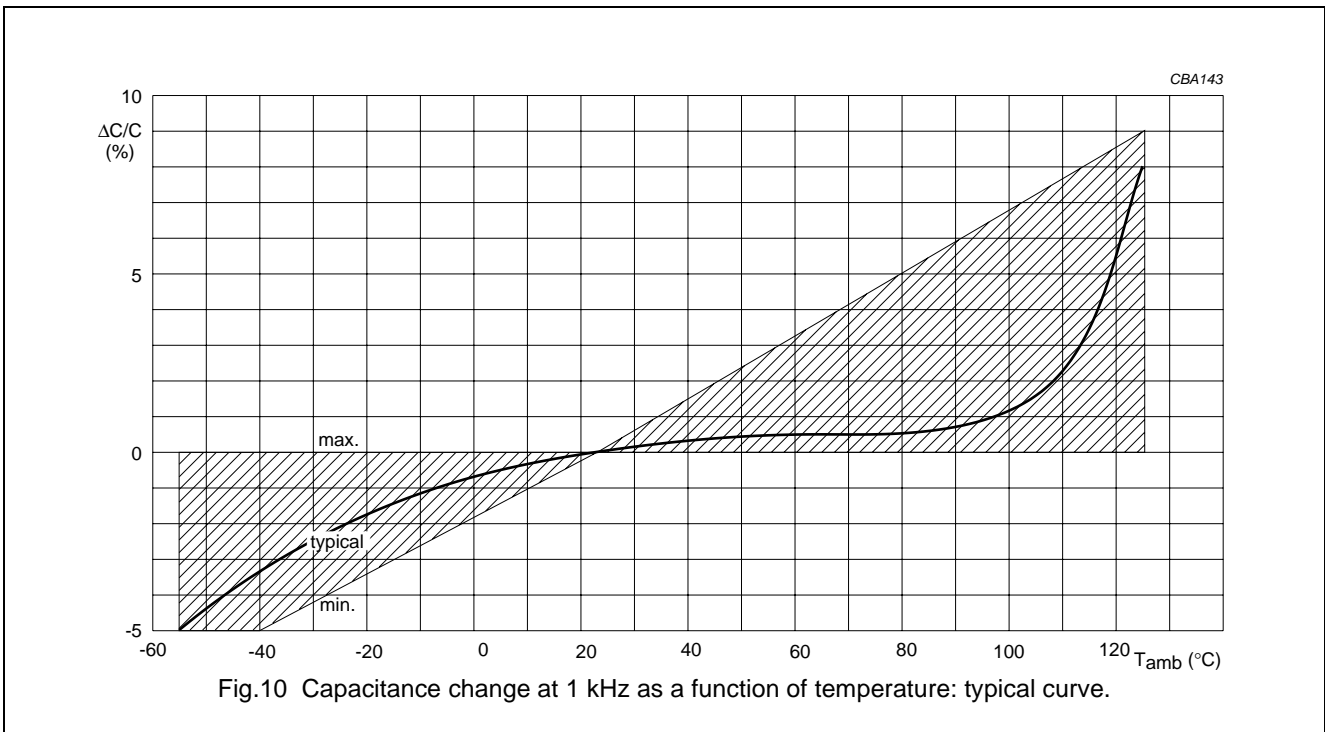
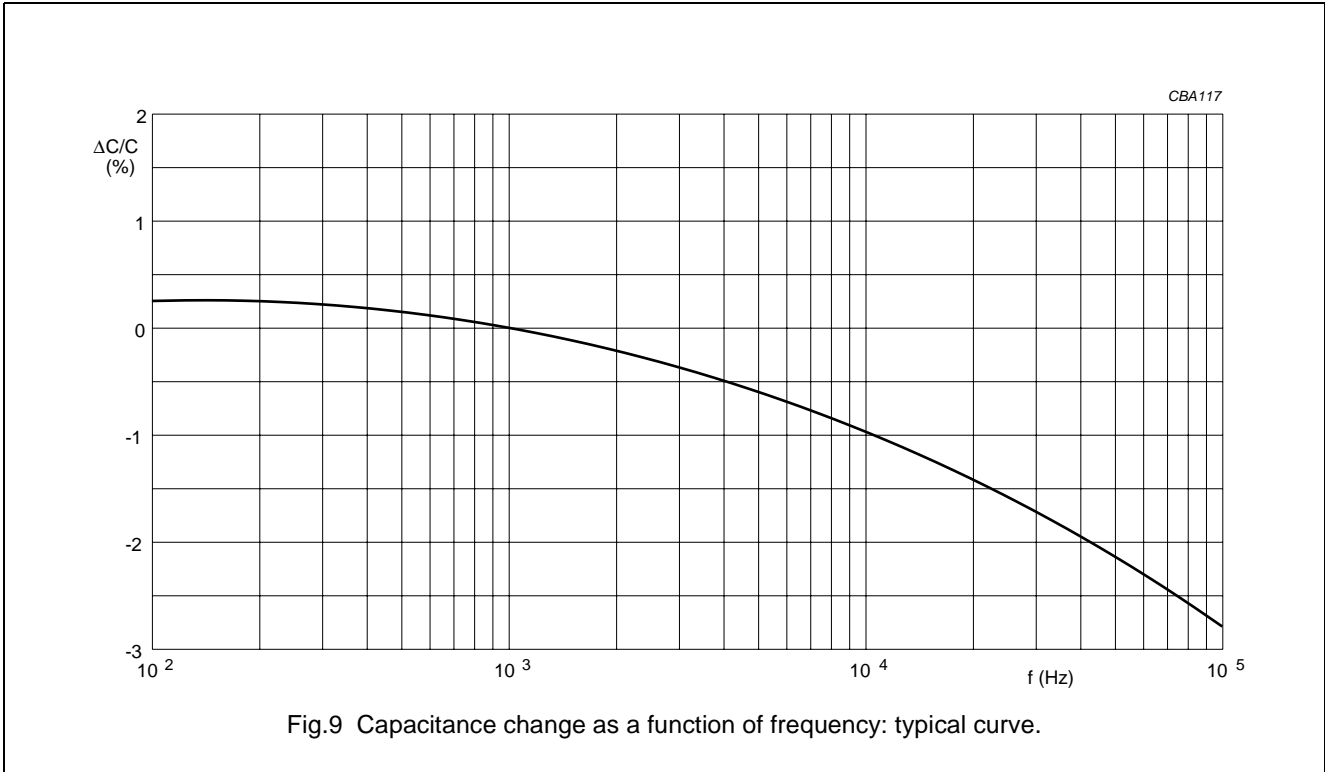
For reference testing, a conditioning period shall be applied over  $96 \pm 4$  hours by heating the products in a circulating air oven at the rated temperature and a relative humidity not exceeding 20%.

Metallized polyester film capacitors

MKT 470

CHARACTERISTICS

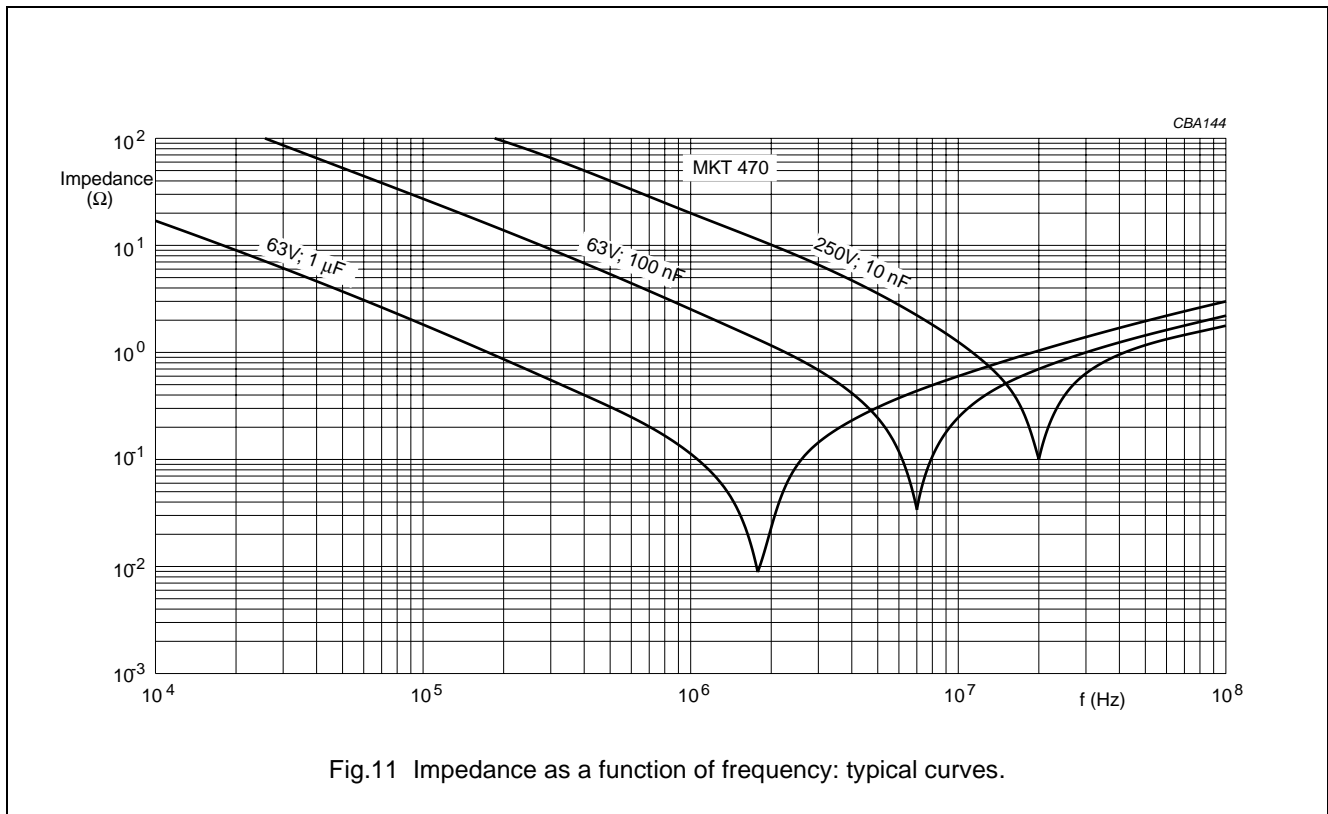
Capacitance



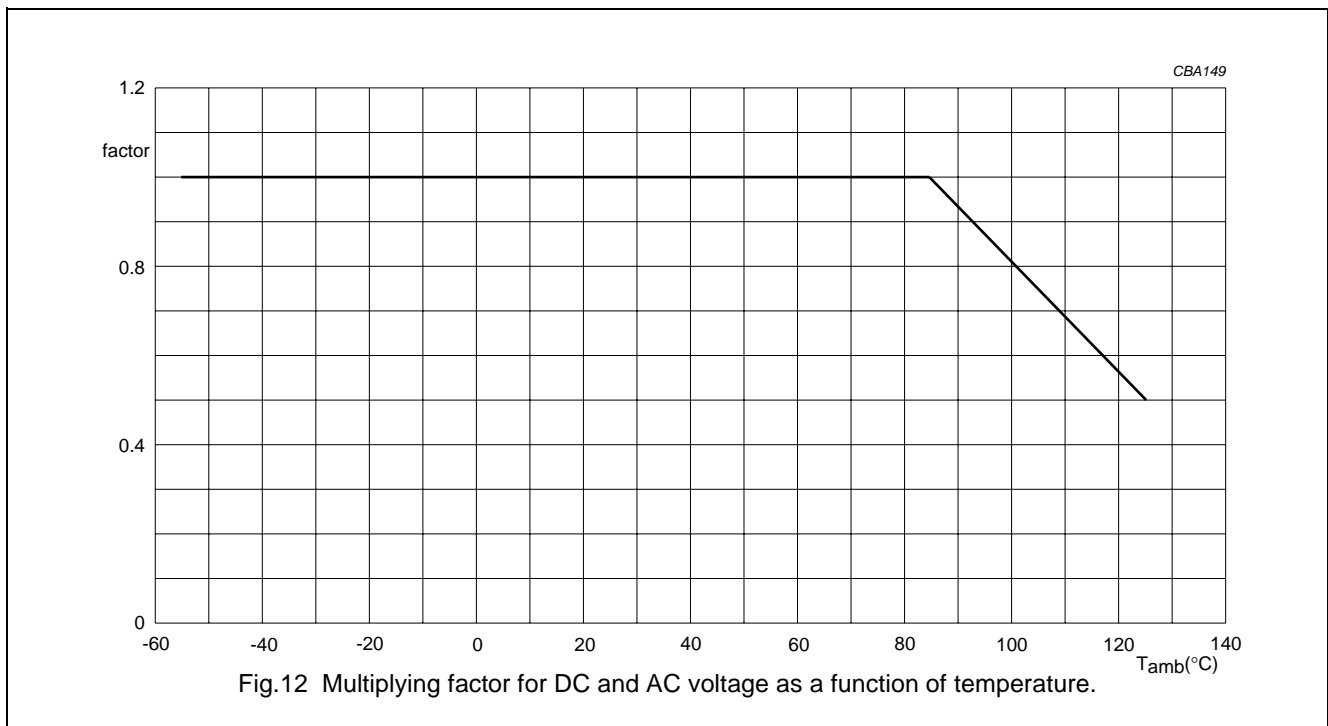
Metallized polyester film capacitors

MKT 470

Impedance



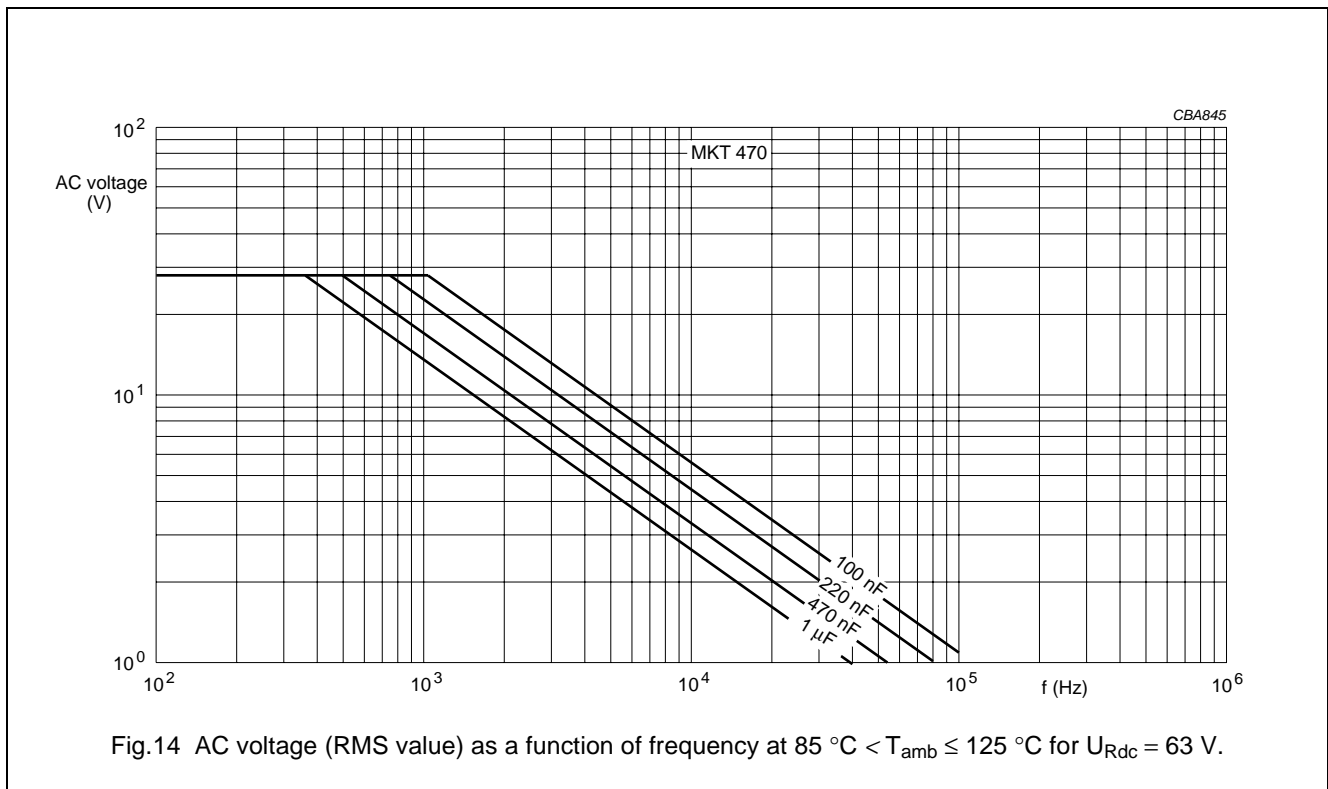
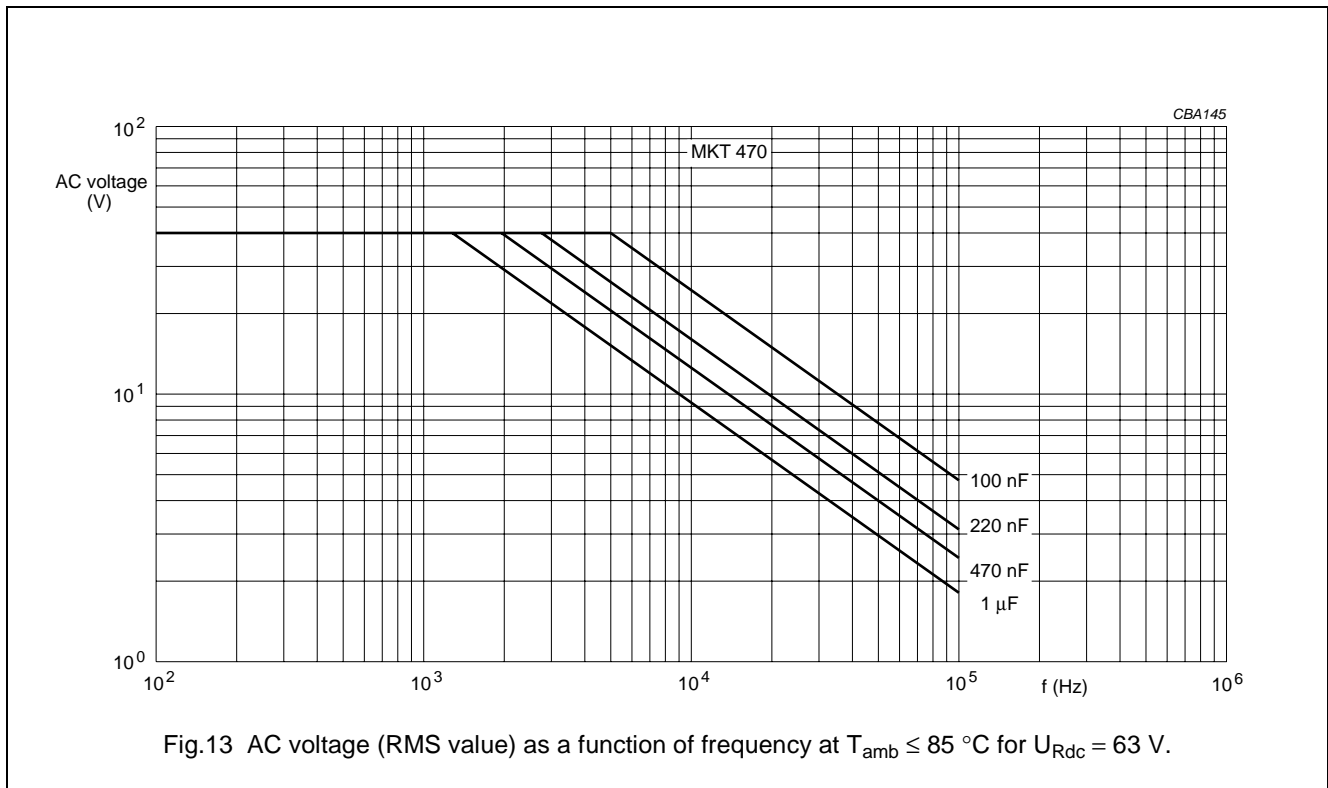
Maximum DC and AC voltage as a function of temperature



Metallized polyester film capacitors

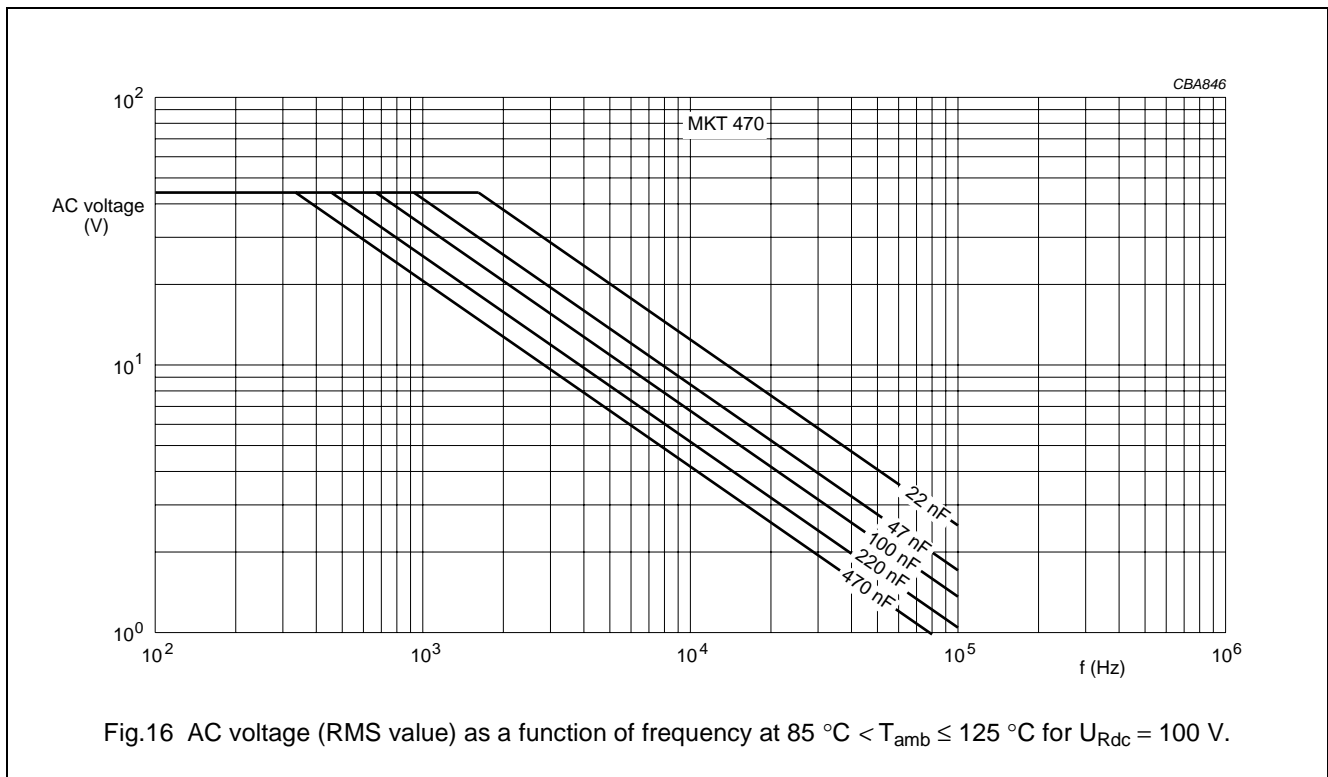
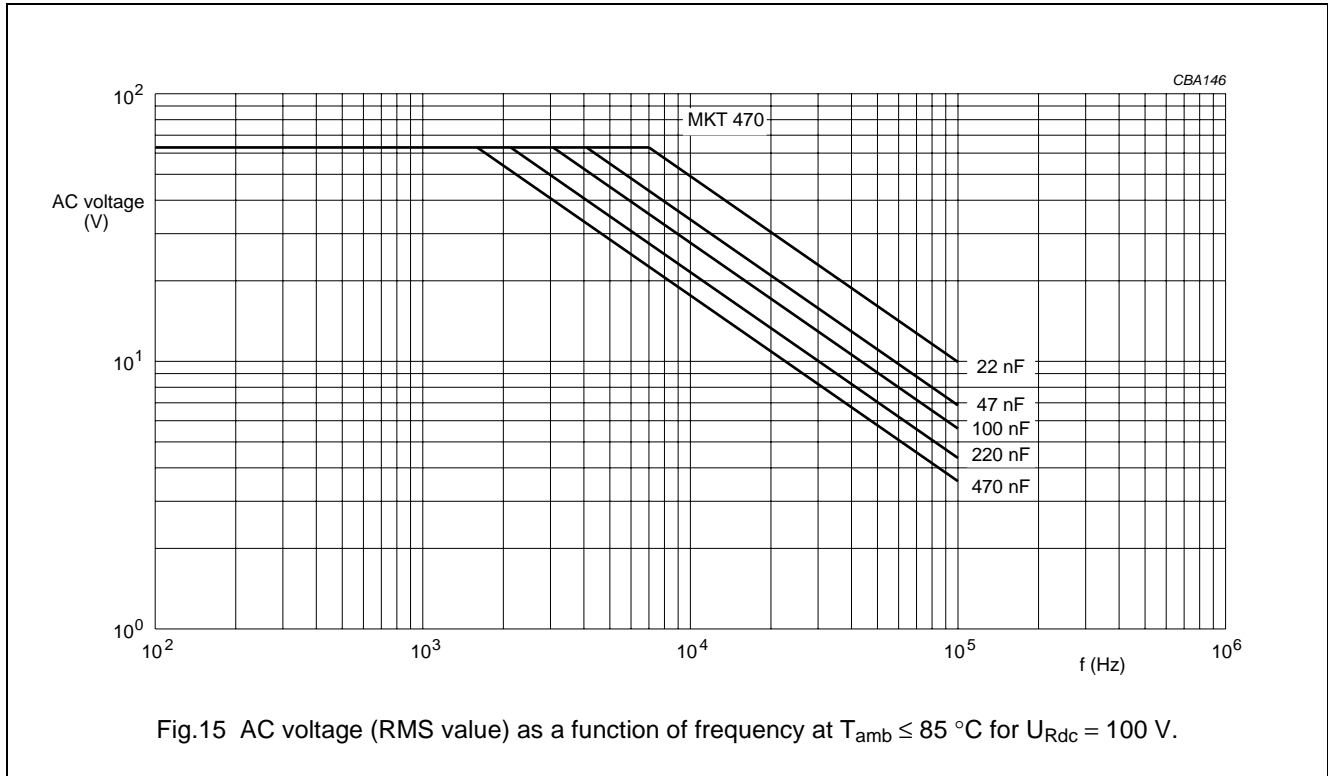
MKT 470

Maximum RMS voltage (sinewave) as a function of frequency



Metallized polyester film capacitors

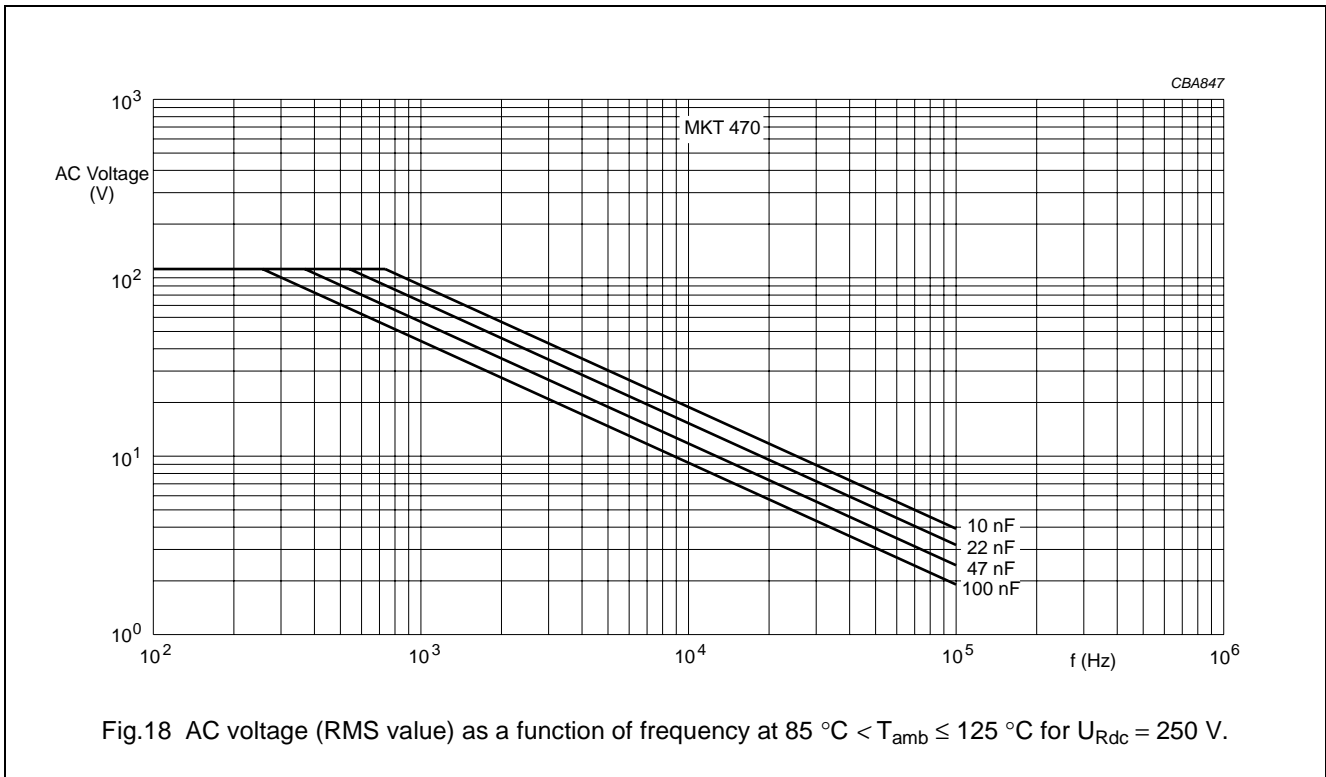
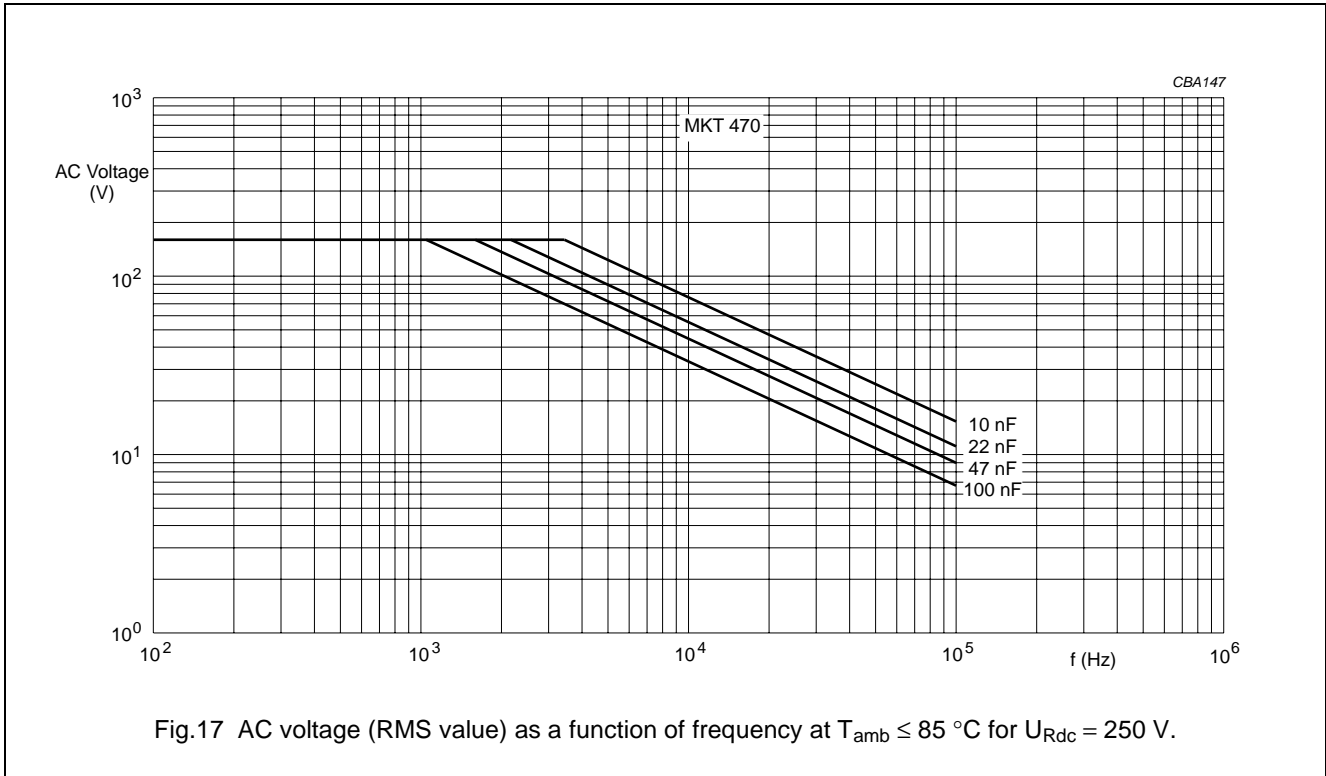
MKT 470





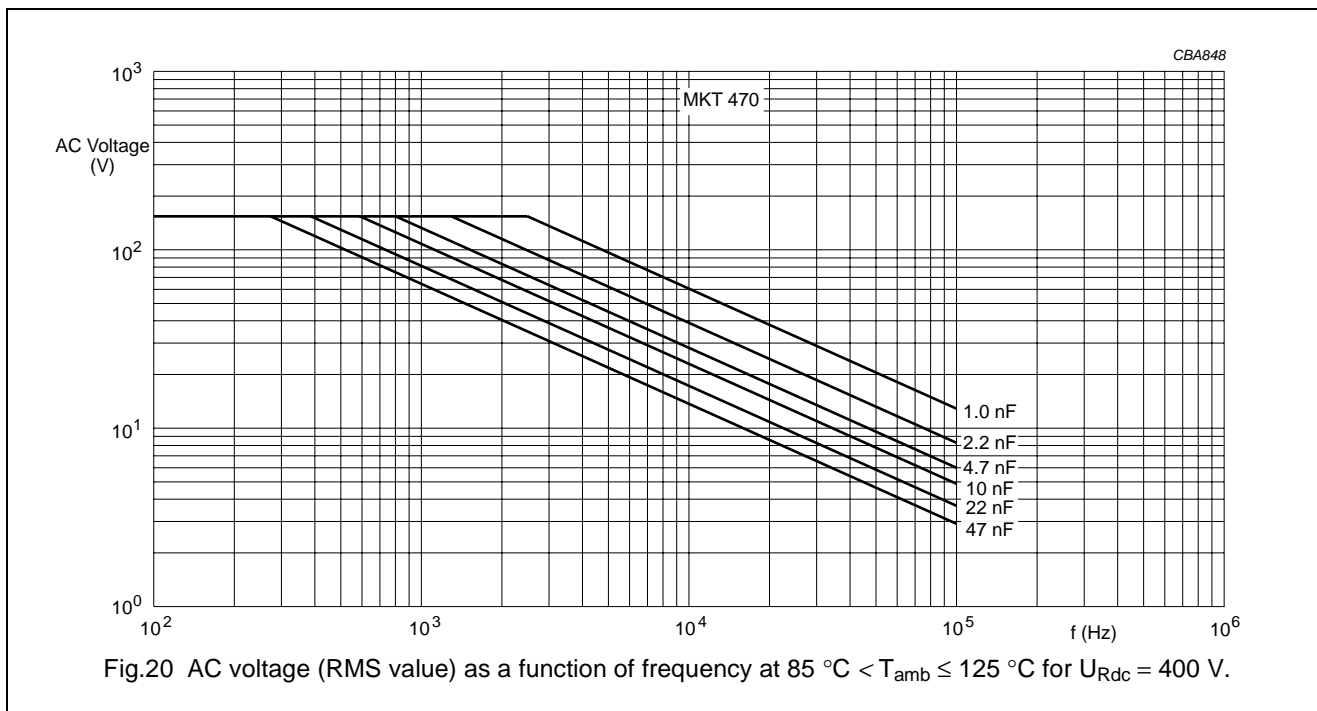
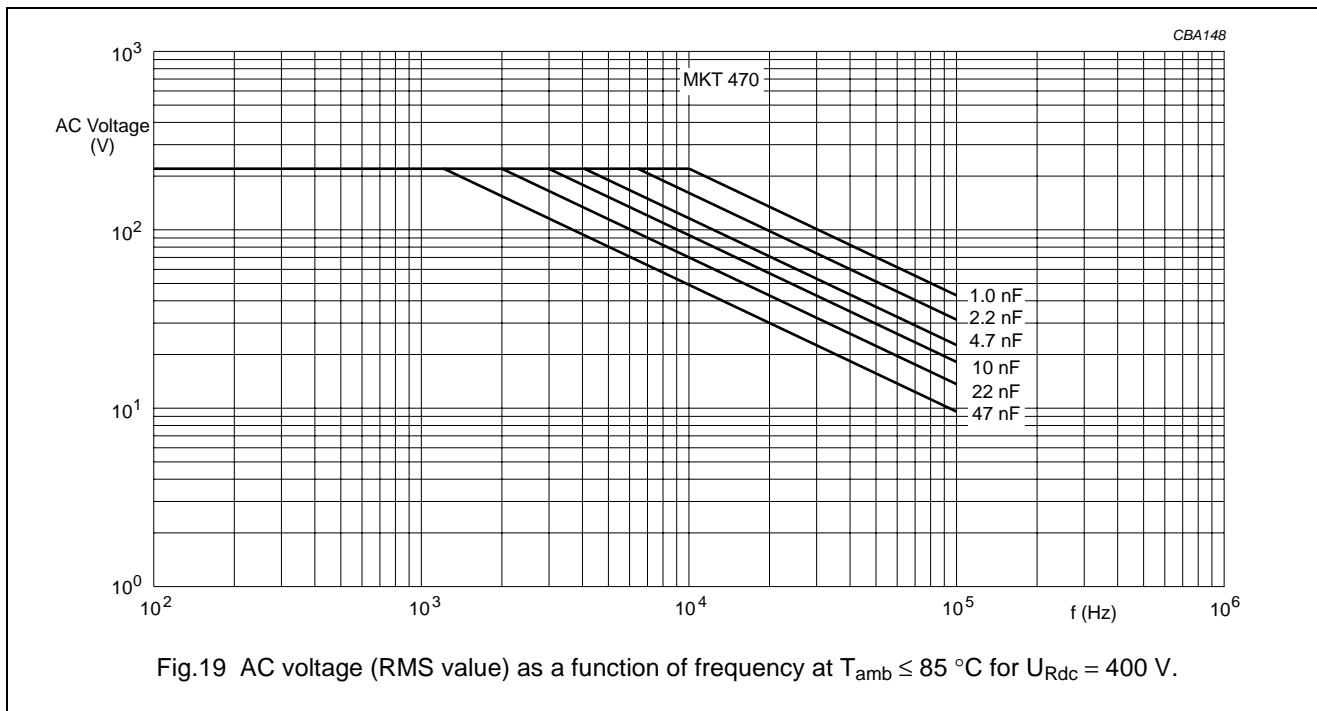
Metallized polyester film capacitors

MKT 470



Metallized polyester film capacitors

MKT 470



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

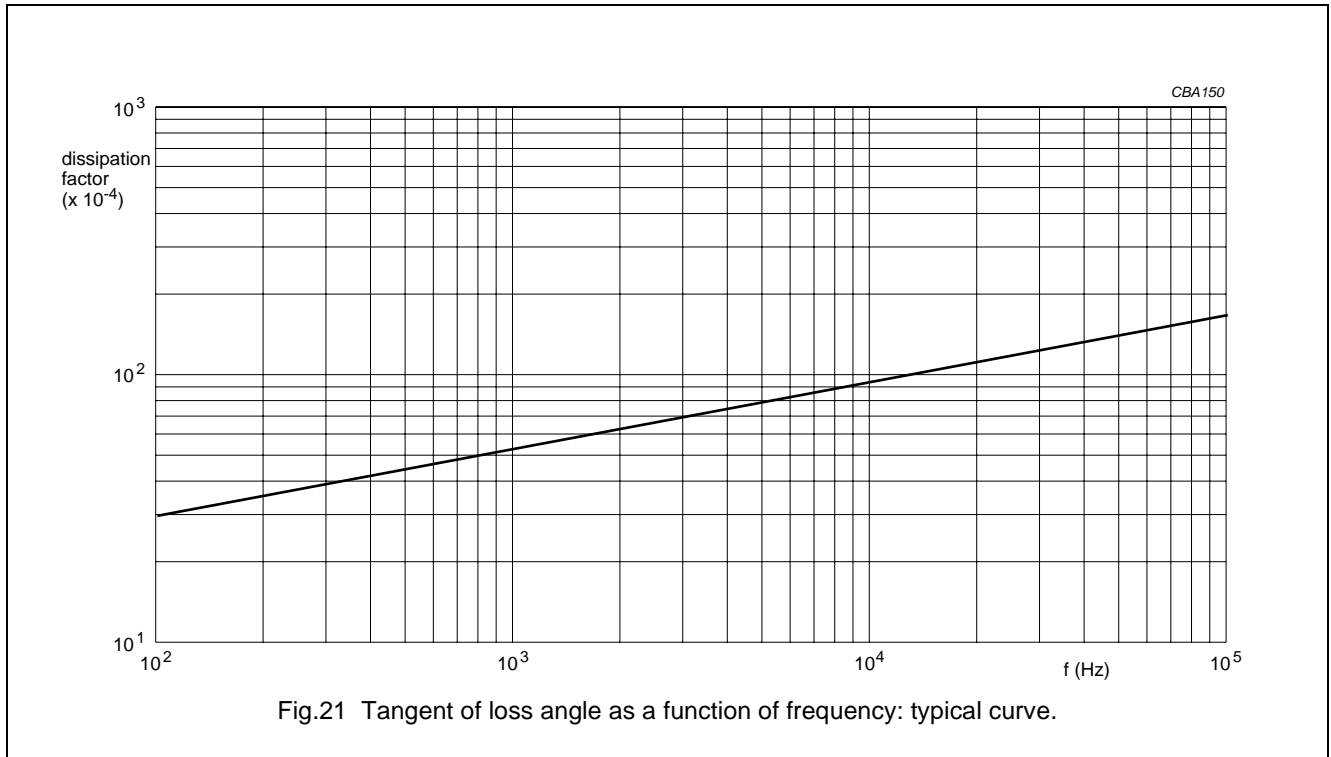
The maximum RMS current is defined by  $I_{ac} = \omega \times C \times U_{ac}$ .

$U_{ac}$  is the maximum AC voltage depending on the ambient temperature in Figs 13 to 20.

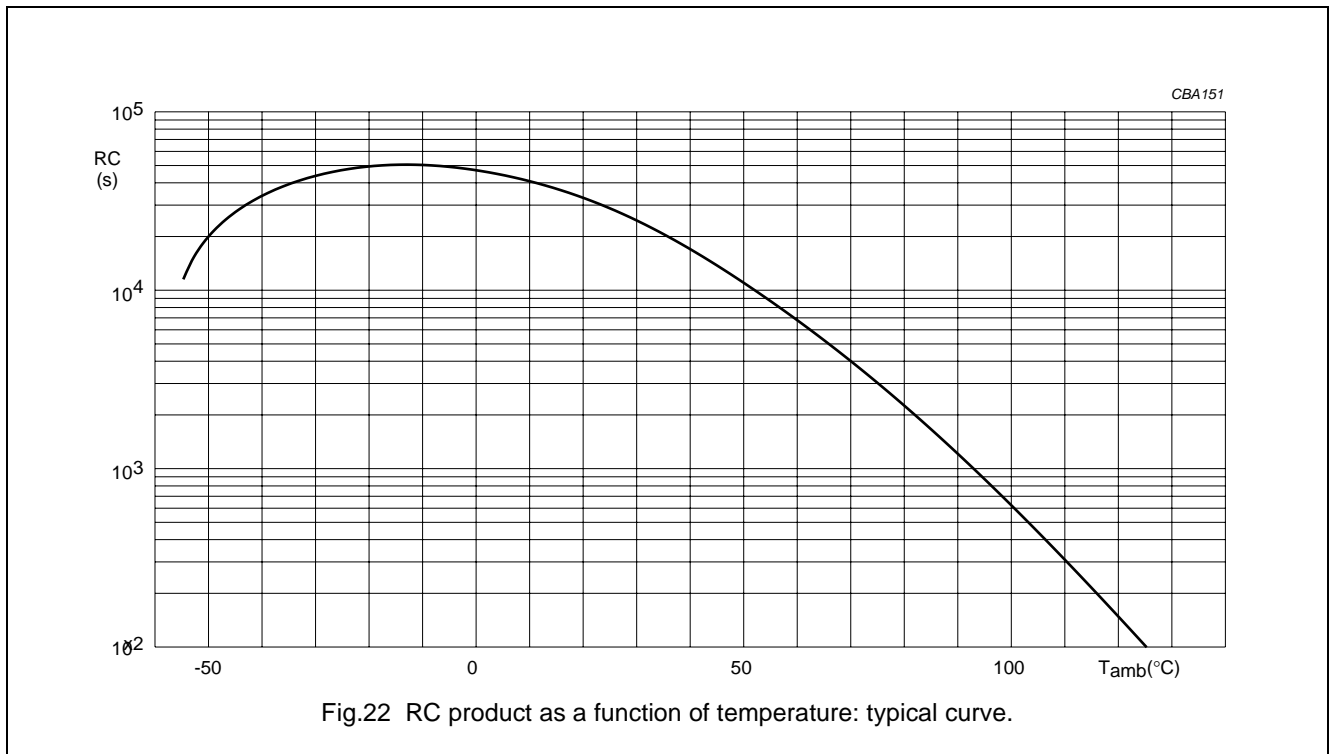
# Metallized polyester film capacitors

MKT 470

## Tangent of loss angle



## Insulation resistance



## Metallized polyester film capacitors

MKT 470

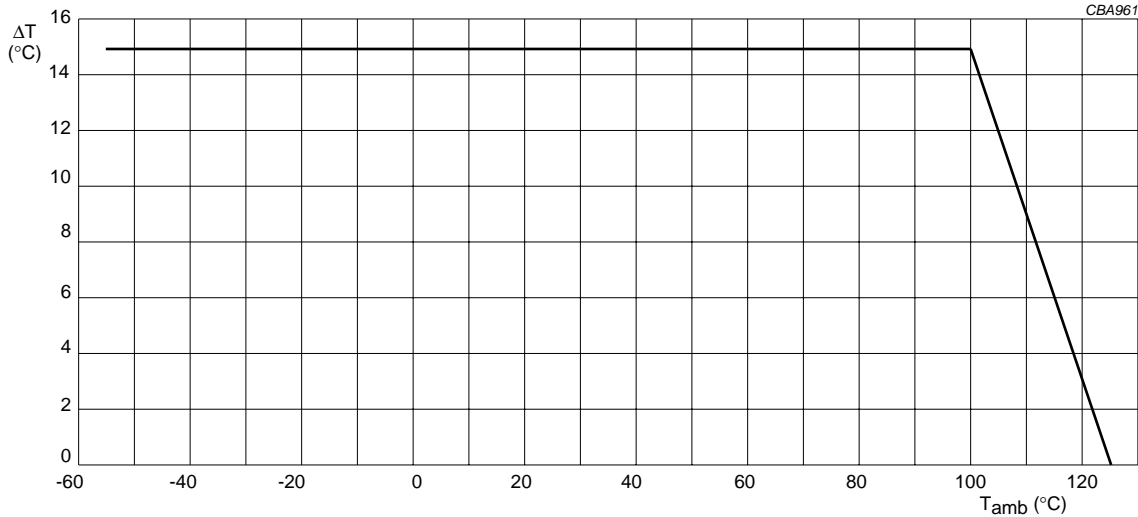
**Maximum allowed component temperature rise ( $\Delta T$ ) as a function of the ambient temperature ( $T_{amb}$ )**

Fig.23 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

| $b_{max}$<br>(mm) | PITCH<br>(mm) |
|-------------------|---------------|
| 2.5               | 2.5           |
| 3.5               | 3.0           |
| 4.5               | 4.0           |
| 6.0               | 5.5           |

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

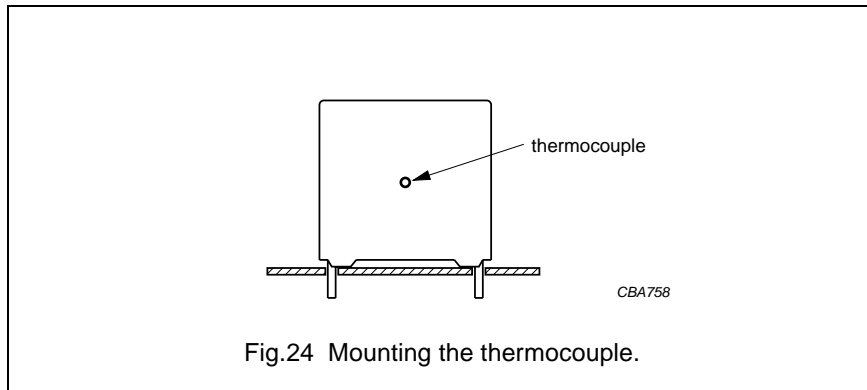
- $\Delta T$  = component temperature rise (°C).
- P = power dissipation of the component (mW).
- G = heat conductivity of the component (mW/°C).

## Metallized polyester film capacitors

MKT 470

### Measuring the component temperature

A thermocouple must be attached to the capacitor body; see Fig.24.



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 polyester film capacitors

MKT 470

## 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  $U_{p-p}$  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.

The rated voltage pulse slope is valid for ambient temperatures up to 85 °C. For higher temperatures a derating factor of 3% per K shall be applied.

4. The maximum component surface temperature rise must be lower than the limits in Fig.23.
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 as across-the-line capacitor in the input filter for mains applications 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 included).

### VOLTAGE CONDITIONS FOR 6 ABOVE

| ALLOWED VOLTAGES                               | $T_{amb} < 85 \text{ °C}$ | $85 < T_{amb} \leq 100 \text{ °C}$ | $100 < T_{amb} \leq 125 \text{ °C}$ |
|--|---------------------------|------------------------------------|-------------------------------------|
| Maximum continuous RMS voltage                 | $1 \times U_{Rac}$        | $0.8 \times U_{Rac}$               | $0.5 \times U_{Rac}$                |
| Maximum temporary RMS -overvoltage (<24 hours) | $1.25 \times U_{Rac}$     | $1.0 \times U_{Rac}$               | $0.625 \times U_{Rac}$              |
| Maximum peak voltage ( $V_{o-p}$ ) (<2 s)      | $1.6 \times U_{Rdc}$      | $1.3 \times U_{Rdc}$               | $0.8 \times U_{Rdc}$                |

# Metallized polyester film capacitors

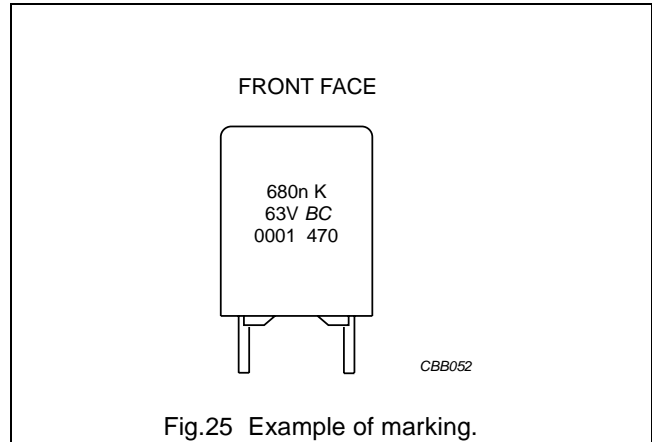
MKT 470

## MARKING

### Product marking

The capacitors are marked by YAG laser on the side (see Fig.25) with the following information:

1. Capacitance code in accordance with "IEC 60062"
2. Tolerance on rated capacitance: K = ±10%; J = ±5%
3. Rated (DC) voltage (e.g. 63 V)
4. Manufacturer
5. Year and week of manufacture (e.g. 0001)
6. Manufacturers type designation (e.g. 470).



### Package marking

The package containing the capacitors is marked as shown in Fig.26.

**BCcomponents**  
MADE IN BELGIUM  
DC FILM CAPACITOR  
MKT RADIAL POTTED TYPE  
0.68 $\mu$ F ±10% 63V= 55/125/56

WO: 12345678

ORIG **A170** RPC **HQ**

TYPE **MKT 470**

---

QTY **2000** DATE **0003**

CODENO **2222 470 11684**

### Barcode label marking

| LINE | MARKING EXPLANATION   |
|------|---|
| 1    | Manufacturer's name   |
| 2    | Country of origin   |
| 3    | Sub-family  |
| 4    | Type description  |
| 5    | Capacitance value, tolerance 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>WO: work order<br>Wage number of final inspection |
| 8    | Product type description  |
| 9    | Quantity and production period, year and week code  |
| 10   | Product code (12NC)   |

Fig.26 Barcode label.

## Metallized polyester film capacitors

MKT 470

## QUICK REFERENCE TEST REQUIREMENTS (see note 1)

| TEST  | PROCEDURE<br>(quick reference)  | REQUIREMENTS  |
|---|---|---|
| <b>Robustness of leads</b>  |   |   |
| Tensile strength:<br>"IEC 60068-2-21"                             | load 10 N; 10 s   | no visible damage<br>legible marking<br>$ \Delta C/C  \leq 2\%$<br>$\Delta \tan \delta \leq 50 \times 10^{-4}$ ( $C \leq 10$ nF)<br>$\Delta \tan \delta \leq 30 \times 10^{-4}$ ( $10$ nF < $C \leq 470$ nF)<br>$\Delta \tan \delta \leq 20 \times 10^{-4}$ ( $C > 470$ nF)                         |
| Bending:<br>"IEC 60068-2-21"                                      | load 5 N; $4 \times 90^\circ$   |   |
| Resistance to soldering heat:<br>"IEC 60068-2-20"                 | solder bath: 260 °C; 10 s   |   |
| Component solvent resistance                                      | isopropyl alcohol; 23 °C; 5 minutes   |   |
| <b>Robustness of component</b>                                    |   |   |
| Vibration:<br>"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 5\%$ for $b = 2.5$ mm or<br>$ \Delta C/C  \leq 3\%$ for $b > 2.5$ mm<br>$\Delta \tan \delta \leq 50 \times 10^{-4}$ ( $C \leq 10$ nF)<br>$\Delta \tan \delta \leq 30 \times 10^{-4}$ ( $10$ nF < $C \leq 470$ nF)<br>$\Delta \tan \delta \leq 20 \times 10^{-4}$ ( $C > 470$ nF) |
| Shock:<br>"IEC 60068-2-27"  | half sinewave; 490 m/s <sup>2</sup> ; 11 ms                                     |   |
| <b>Climatic sequence</b>  |   |   |
| Dry heat:<br>"IEC 60068-2-2"                                      | 16 hours; 125 °C  | $ \Delta C/C  \leq 5\%$<br>$\Delta \tan \delta \leq 80 \times 10^{-4}$ ( $C \leq 10$ nF)<br>$\Delta \tan \delta \leq 50 \times 10^{-4}$ ( $10$ nF < $C \leq 470$ nF)<br>$\Delta \tan \delta \leq 30 \times 10^{-4}$ ( $C > 470$ nF)<br>$R_{ins} \geq 50\%$ of specified value                       |
| Damp heat, cyclic, test Db, first cycle:<br>"IEC 60068-2-30"      |   |   |
| Cold:<br>"IEC 60068-2-1"  | 2 hours; -55 °C   |   |
| Damp heat, cyclic, test Db, remaining cycles:<br>"IEC 60068-2-30" |   |   |
| <b>Other applicable tests</b>                                     |   |   |
| Damp heat steady state:<br>"IEC 60068-2-3"                        | 56 days; 40 °C; 90 to 95% RH  | $ \Delta C/C  \leq 5\%$<br>$\Delta \tan \delta \leq 50 \times 10^{-4}$ ( $C \leq 470$ nF)<br>$\Delta \tan \delta \leq 30 \times 10^{-4}$ ( $C > 470$ nF)<br>$R_{ins} \geq 50\%$ of specified value  |
| Endurance (DC):<br>"IEC 60384-2"                                  | 2000 hours;<br>$1.25 \times U_{Rdc}$ ; 85 °C<br>$0.625 \times U_{Rdc}$ ; 125 °C |   |
| Heat storage:<br>"IEC 60384-2"                                    | 2000 hours; 125 °C  | $ \Delta C/C  \leq 5\%$<br>$\Delta \tan \delta \leq 50 \times 10^{-4}$ ( $C \leq 10$ nF)<br>$\Delta \tan \delta \leq 30 \times 10^{-4}$ ( $10$ nF < $C \leq 470$ nF)<br>$\Delta \tan \delta \leq 20 \times 10^{-4}$ ( $C > 470$ nF)   |



## Metallized polyester film capacitors

MKT 470

| TEST   | PROCEDURE<br>(quick reference)  | REQUIREMENTS  |
|--|---|---|
| Resistance to detergents                                       | 3 minutes in dishwasher at 70 °C  | $ \Delta C/C  \leq 1\%$<br>$\Delta \tan \delta \leq 50 \times 10^{-4}$ ( $C \leq 10$ nF)<br>$\Delta \tan \delta \leq 30 \times 10^{-4}$ ( $10$ nF $< C \leq 470$ nF)<br>$\Delta \tan \delta \leq 20 \times 10^{-4}$ ( $C > 470$ nF)<br>$R_{ins} \geq 50\%$ of specified value                       |
| Resistance to soldering heat with preheating:<br>"IEC 60384-2" | body temperature: 125 °C;<br>bath temperature: 260 °C;<br>dwell time: 5 s | $ \Delta C/C  \leq 3\%$ for $b = 2.5$ mm or<br>$ \Delta C/C  \leq 5\%$ for $b > 2.5$ mm<br>$\Delta \tan \delta \leq 50 \times 10^{-4}$ ( $C \leq 10$ nF)<br>$\Delta \tan \delta \leq 30 \times 10^{-4}$ ( $10$ nF $< C \leq 470$ nF)<br>$\Delta \tan \delta \leq 20 \times 10^{-4}$ ( $C > 470$ nF) |
| Passive flammability:<br>"IEC 60384-1"                         | class C   | No burning  |

**Note**

1. For detailed information: see "Type detail specification HQN-384-02/104".