

## Overview

KEMET's MS/MD Series of aluminum electrolytic capacitors are designed for intermittent duty only and capable of withstanding the AC voltage applied to the motor during starting. The capacitor construction is comprised of either double anode or O-style (double anode and floating cathode) windings, which are housed in a molded plastic case. KEMET's MD Series is VDE approved to IEC 60252-2 for the defined ratings.

## Applications

KEMET's MS/MD Series is a range of aluminium electrolytic capacitors specifically designed for AC operation which helps to start the motor by providing a leading current to the auxiliary winding. The capacitor is not permanently connected to the winding of the motor and is usually switched off automatically after starting.

## Benefits

- Intermittent AC motor starting
- 6.3 mm double amp tags (quick connect types)
- VDE approved to IEC 60252-2



## Part Number System

| 080                                     | MS                                                                   | 12                               | AA                     | M                   | A                        | 1                     | STD            |
|-----------------------------------------|----------------------------------------------------------------------|----------------------------------|------------------------|---------------------|--------------------------|-----------------------|----------------|
| Capacitance Code (µF)                   | Rating                                                               | Rated Voltage (VAC)              | Size Code              | Manufacturing Style | Capacitance Tolerance    | Terminal Code         | Version        |
| Example:<br>080 = 80 µF<br>120 = 120 µF | MS = Motor start<br>single rating<br>MD = Motor<br>start dual rating | 12 = 120<br>22 = 220<br>26 = 260 | See Dimension<br>Table | M = Molded<br>case  | A = -0% +25%<br>K = ±10% | 1 = Double amp<br>tag | STD = Standard |

## Performance Characteristics

| Item                  | Performance Characteristics                                       |                                                      |
|-----------------------|-------------------------------------------------------------------|------------------------------------------------------|
| Series                | MD (Dual voltage rating)                                          | MS (Single voltage rating)                           |
| Capacitance Range     | 25 – 750 $\mu$ F                                                  | 25 – 750 $\mu$ F                                     |
| Rated Voltage         | 120 – 360 VAC 50 Hz                                               | 120 – 260 VAC 50 Hz                                  |
| Operating Temperature | -20°C to +70°C                                                    | -20°C to +60°C                                       |
| Capacitance Tolerance | $\pm 10\%$ , -0% +25%                                             | $\pm 10\%$ , -0% +25%                                |
| Operational Lifetime  | 500 hours at +70°C, 1.1 $V_R$ (specified duty cycle)              | 500 hours at +60°C, 1.1 $V_R$ (specified duty cycle) |
| Shelf Life            | 2 years                                                           | 2 years                                              |
| Standards             | IEC 60252-2: AC Motor Capacitors - Part 2: Motor Start Capacitors |                                                      |

## VDE Approvals to IEC 60252-2

| Rated Voltage          | 220 V    | 260 V    |
|------------------------|----------|----------|
| Capacitor Type         | MD       | MD       |
| Capacitance ( $\mu$ F) | (Note 1) | (Note 2) |
| 30                     | AA       |          |
| 40                     | AA AB    | AB       |
| 50                     | AA AB    | AB       |
| 60                     | AA AB    | AB       |
| 70                     | AB       | AB       |
| 80                     | AB AC    | AB       |
| 90                     | AC       | AC       |
| 100                    | AC       | AC       |
| 120                    | AC       | AC       |
| 125                    | AC       | AC       |

### Note 1: Duty cycles approved

220 V at SD = 3 & ED = 1.7%

300 V at SD = 1 & ED = 0.1%

### Note 2: Duty cycles approved

260 V at SD = 3 and ED = 1.7% (40 – 125  $\mu$ F)

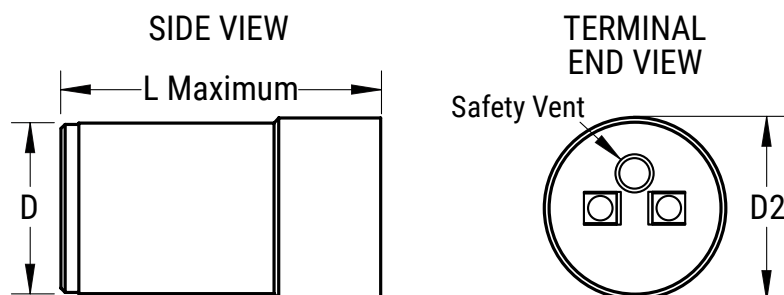
330 v at SD = 1 and ED = 0.55% (40 – 125  $\mu$ F)

360 v at SD = 1 and ED = 0.33% (90 – 125  $\mu$ F)

### General approval notes:

- Valid for both  $\pm 10\%$  and -0+25% tolerance.
- Valid for intermediate capacitance. Values in increments of 1  $\mu$ F between 30  $\mu$ F and 100  $\mu$ F, and in increments of 5  $\mu$ F between 100  $\mu$ F and 125  $\mu$ F.
- Approved duty cycles relate to 50 Hz, as per section 3.1.12.2 of IEC60252-2 operation at 60 Hz is also approved if the relative operation time is reduced by 20%. For example a 50 Hz duty cycle with ED = 1.7% is also approved for 60 Hz with ED = 1.36%.

## Dimensions – Millimeters



| Size Code | Dimensions in mm |      |         |
|-----------|------------------|------|---------|
|           | D                | D2   | L       |
|           | ±0.5             | ±0.5 | Maximum |
| AA        | 38               | 39   | 75      |
| AB        | 38               | 39   | 90      |
| AC        | 38               | 39   | 116     |

### Power Factor

The tangent of the loss angle for motor start capacitors shall not exceed 0.1 and shall be calculated as follows:

$$\tan \delta = \frac{W}{V \times I} = \frac{\text{true watts}}{\text{apparent watts}}$$

### Duty Cycle

The standard rating is 1.67% or 1/60th full time and corresponds to a maximum duty of 20 starts, each of three seconds duration per hour. It is expressed as 3/1.67 (a 3 minute cycle with 1.67% duration during which the capacitor may be energized). If the same capacitor is to be used for a duty cycle of 60 starts per hour the cycle duration will be 1 minute. The operation time per cycle will then have to be reduced to 1.67% of 1 minute (i.e. 1 second). Alternative duty cycles are available on request.

### Presence of Run Capacitor

When the motor is fitted with both starting and run capacitors, consideration should be given to fitting of the appropriate discharge resistor to the starting capacitor. This is to protect the run capacitor from damage through discharge of the starting capacitor.

### Container Form

Cylindrical mouldings, meeting creepage and clearance distances, according to IEC 60335–1 and flammability ratings according to UL94–V1.

## Discharge Resistors

A discharge resistor may be fitted to a motor start capacitor to prevent electrical overstress of the capacitor and/or for safety reasons. In accordance with IEC 60252, the resistor value should be such that it reduces the voltage on the capacitor, from the line voltage to less than 50 V within 60 seconds. The resistor value may be approximated as follows:  $R(\text{k}\Omega) = T / \text{Rated Capacitance } (\mu\text{F})$

| AC Voltage | T      |
|------------|--------|
| 120        | 50,000 |
| 220        | 32,000 |
| 260        | 30,000 |
| 280        | 28,000 |
| 330        | 26,000 |

| Resistor Value (kΩ) | Wattage |
|---------------------|---------|
| 5.6                 | 2W      |
| 15                  | 2W      |
| 33                  | 0.5W    |
| 56                  | 1W      |
| 82                  | 2W      |
| 100                 | 1W      |

## Environmental Compliance

As an environmentally conscious company, KEMET is working continuously with improvements concerning the environmental effects of both our capacitors and their production. In Europe (RoHS Directive) and in some other geographical areas like China, legislation has been put in place to prevent the use of some hazardous materials, such as lead (Pb), in electronic equipment. All products in this catalog are produced to help our customers' obligations to guarantee their products and fulfill these legislative requirements. The only material of concern in our products has been lead (Pb), which has been removed from all designs to fulfill the requirement of containing less than 0.1% of lead in any homogeneous material. KEMET will closely follow any changes in legislation world wide and makes any necessary changes in its products, whenever needed.

Some customer segments such as medical, military and automotive electronics may still require the use of lead in electrode coatings. To clarify the situation and distinguish products from each other, a special symbol is used on the packaging labels for RoHS compatible capacitors.

Because of customer requirements, there may appear additional markings such as LF = Lead Free or LFW = Lead Free Wires on the label.

**Table 1A – Ratings & Part Number Reference**

| VAC        | Rated Capacitance        |              | Capacitance Tolerance        | Case Size<br>D x L (mm) | Duty Cycle           |                      | Part Number        | Approval   |            |
|------------|--------------------------|--------------|------------------------------|-------------------------|----------------------|----------------------|--------------------|------------|------------|
|            | Minimum (µF)             | Maximum (µF) |                              |                         | 120 V <sub>RMS</sub> | 150 V <sub>RMS</sub> |                    | VDE        | CQC        |
| 120        | 25                       | 325          | -0/+25%                      | 38 x 75                 | 1.67%                |                      | (1)MS12AAMA1STD    | -          | -          |
| 120        | 25                       | 360          | ±10%                         | 38 x 75                 | 1.67%                |                      | (1)MS12AAMK1STD    | -          | -          |
| 120        | 85                       | 460          | -0/+25%                      | 38 x 90                 | 1.67%                |                      | (1)MS12ABMA1STD    | -          | -          |
| 120        | 90                       | 510          | ±10%                         | 38 x 90                 | 1.67%                |                      | (1)MS12ABMK1STD    | -          | -          |
| 120        | 120                      | 670          | -0/+25%                      | 38 x 116                | 1.67%                |                      | (1)MS12ACMA1STD    | -          | -          |
| 120        | 130                      | 750          | ±10%                         | 38 x 116                | 1.67%                |                      | (1)MS12ACMK1STD    | -          | -          |
| 120        | 25                       | 325          | -0/+25%                      | 38 x 75                 | 1.67%                | 0.55%                | (1)MD12AAMA1STD    | -          | x          |
| 120        | 25                       | 360          | ±10%                         | 38 x 75                 | 1.67%                | 0.55%                | (1)MD12AAMK1STD    | -          | x          |
| 120        | 85                       | 460          | -0/+25%                      | 38 x 90                 | 1.67%                | 0.55%                | (1)MD12ABMA1STD    | -          | x          |
| 120        | 90                       | 510          | ±10%                         | 38 x 90                 | 1.67%                | 0.55%                | (1)MD12ABMK1STD    | -          | x          |
| 120        | 120                      | 670          | -0/+25%                      | 38 x 116                | 1.67%                | 0.55%                | (1)MD12ACMA1STD    | -          | x          |
| 120        | 130                      | 750          | ±10%                         | 38 x 116                | 1.67%                | 0.55%                | (1)MD12ACMK1STD    | -          | x          |
| <b>VAC</b> | <b>Rated Capacitance</b> |              | <b>Capacitance Tolerance</b> | <b>Case Size</b>        | <b>Duty Cycle</b>    |                      | <b>Part Number</b> | <b>VDE</b> | <b>CQC</b> |

(1) Insert capacitance code. Valid in increments of 1 µF between 30 µF and 100 µF, and in increments of 5 µF between 100 µF and 125 µF

**Table 1B – Ratings & Part Number Reference**

| VAC        | Rated Capacitance        |              | Capacitance Tolerance        | Case Size<br>D x L (mm) | Duty Cycle           |                      | Part Number        | Approval   |            |
|------------|--------------------------|--------------|------------------------------|-------------------------|----------------------|----------------------|--------------------|------------|------------|
|            | Minimum (µF)             | Maximum (µF) |                              |                         | 220 V <sub>RMS</sub> | 300 V <sub>RMS</sub> |                    | VDE        | CQC        |
| 220        | 30                       | 65           | -0/+25%                      | 38 x 75                 | 1.67%                |                      | (1)MS22AAMA1STD    | -          | -          |
| 220        | 30                       | 70           | ±10%                         | 38 x 75                 | 1.67%                |                      | (1)MS22AAMK1STD    | -          | -          |
| 220        | 40                       | 90           | -0/+25%                      | 38 x 90                 | 1.67%                |                      | (1)MS22ABMA1STD    | -          | -          |
| 220        | 40                       | 100          | ±10%                         | 38 x 90                 | 1.67%                |                      | (1)MS22ABMK1STD    | -          | -          |
| 220        | 55                       | 140          | -0/+25%                      | 38 x 116                | 1.67%                |                      | (1)MS22ACMA1STD    | -          | -          |
| 220        | 65                       | 150          | ±10%                         | 38 x 116                | 1.67%                |                      | (1)MS22ACMK1STD    | -          | -          |
| 220        | 30                       | 60           | -0/+25%                      | 38 x 75                 | 1.67%                | 0.10%                | (1)MD22AAMA1STD    | x          | x          |
| 220        | 30                       | 60           | ±10%                         | 38 x 75                 | 1.67%                | 0.10%                | (1)MD22AAMK1STD    | x          | x          |
| 220        | 40                       | 80           | -0/+25%                      | 38 x 90                 | 1.67%                | 0.10%                | (1)MD22ABMA1STD    | x          | x          |
| 220        | 40                       | 80           | ±10%                         | 38 x 90                 | 1.67%                | 0.10%                | (1)MD22ABMK1STD    | x          | x          |
| 220        | 80                       | 125          | -0/+25%                      | 38 x 116                | 1.67%                | 0.10%                | (1)MD22ACMA1STD    | x          | x          |
| 220        | 80                       | 125          | ±10%                         | 38 x 116                | 1.67%                | 0.10%                | (1)MD22ACMK1STD    | x          | x          |
| <b>VAC</b> | <b>Rated Capacitance</b> |              | <b>Capacitance Tolerance</b> | <b>Case Size</b>        | <b>Duty Cycle</b>    |                      | <b>Part Number</b> | <b>VDE</b> | <b>CQC</b> |

(1) Insert capacitance code. Valid in increments of 1 µF between 30 µF and 100 µF, and in increments of 5 µF between 100 µF and 125 µF

**Table 1C – Ratings & Part Number Reference**

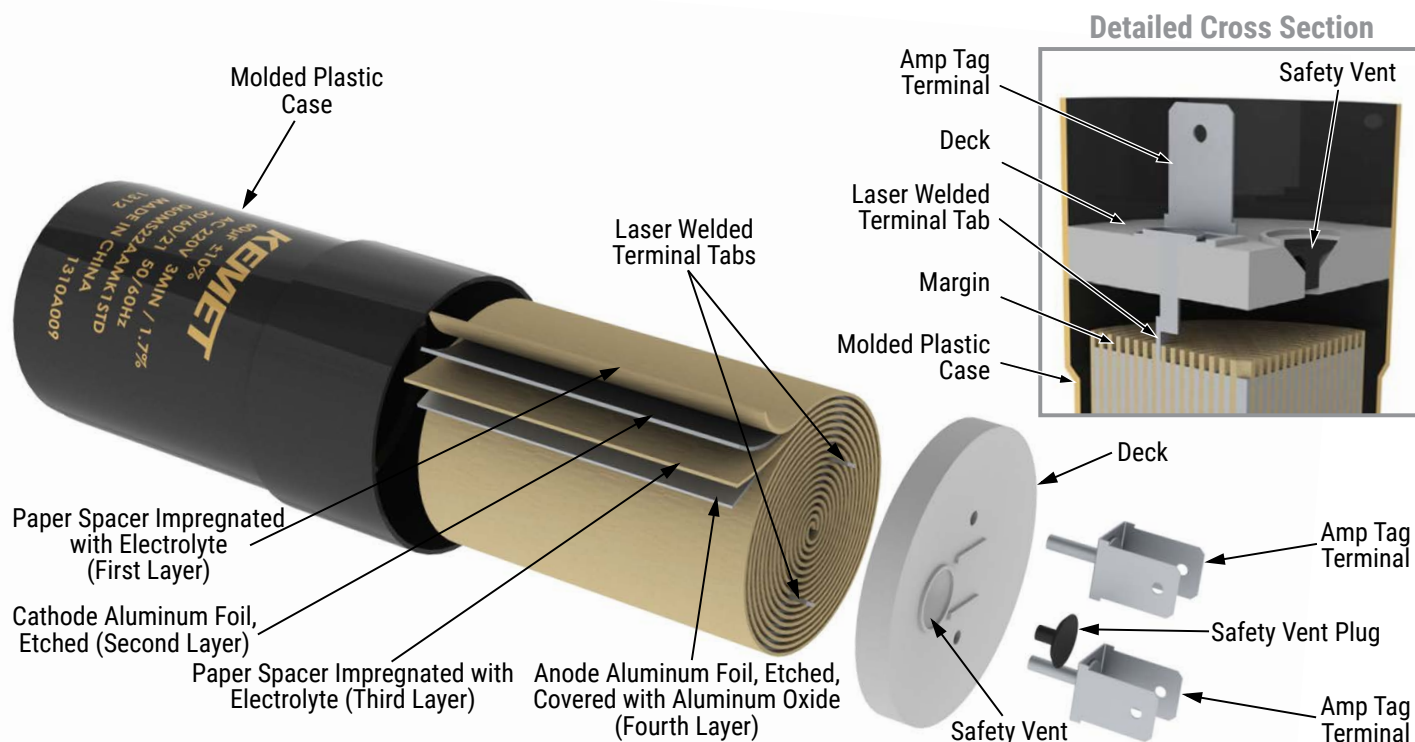
| VAC        | Rated Capacitance        |              | Capacitance Tolerance        | Case Size<br>D x L (mm) | Duty Cycle           |                      |                      | Part Number        | Approval   |            |
|------------|--------------------------|--------------|------------------------------|-------------------------|----------------------|----------------------|----------------------|--------------------|------------|------------|
|            | Minimum (µF)             | Maximum (µF) |                              |                         | 260 V <sub>RMS</sub> | 330 V <sub>RMS</sub> | 360 V <sub>RMS</sub> |                    | VDE        | CQC        |
| 260        | 25                       | 55           | -0/+25%                      | 38 x 75                 | 1.67%                |                      |                      | (1)MS26AAMA1STD    | -          | -          |
| 260        | 25                       | 60           | ±10%                         | 38 x 75                 | 1.67%                |                      |                      | (1)MS26AAMK1STD    | -          | -          |
| 260        | 35                       | 75           | -0/+25%                      | 38 x 90                 | 1.67%                |                      |                      | (1)MS26ABMA1STD    | -          | -          |
| 260        | 35                       | 85           | ±10%                         | 38 x 90                 | 1.67%                |                      |                      | (1)MS26ABMK1STD    | -          | -          |
| 260        | 50                       | 110          | -0/+25%                      | 38 x 116                | 1.67%                |                      |                      | (1)MS26ACMA1STD    | -          | -          |
| 260        | 55                       | 125          | ±10%                         | 38 x 116                | 1.67%                |                      |                      | (1)MS26ACMK1STD    | -          | -          |
| 260        | 25                       | 50           | -0/+25%                      | 38 x 75                 | 1.67%                | 0.55%                |                      | (1)MD26AAMA1STD    | x          | x          |
| 260        | 25                       | 55           | ±10%                         | 38 x 75                 | 1.67%                | 0.55%                |                      | (1)MD26AAMK1STD    | x          | x          |
| 260        | 40                       | 80           | -0/+25%                      | 38 x 90                 | 1.67%                | 0.55%                |                      | (1)MD26ABMA1STD    | x          | x          |
| 260        | 40                       | 80           | ±10%                         | 38 x 90                 | 1.67%                | 0.55%                |                      | (1)MD26ABMK1STD    | x          | x          |
| 260        | 90                       | 125          | -0/+25%                      | 38 x 116                | 1.67%                | 0.55%                | 0.33%                | (1)MD26ACMA1STD    | x          | x          |
| 260        | 90                       | 125          | ±10%                         | 38 x 116                | 1.67%                | 0.55%                | 0.33%                | (1)MD26ACMK1STD    | x          | x          |
| <b>VAC</b> | <b>Rated Capacitance</b> |              | <b>Capacitance Tolerance</b> | <b>Case Size</b>        | <b>Duty Cycle</b>    |                      |                      | <b>Part Number</b> | <b>VDE</b> | <b>CQC</b> |

(1) Insert capacitance code. Valid in increments of 1 µF between 30 µF and 100 µF, and in increments of 5 µF between 100 µF and 125 µF

## Marking



## Construction



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