Aluminum Capacitors
Power General Purpose Screw Terminals

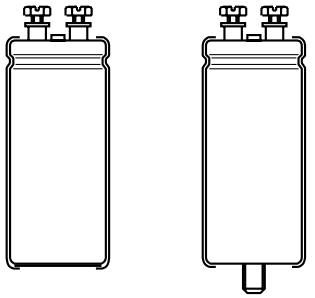

Fig.1 Component outline

FEATURES

- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Large types, cylindrical aluminum case, insulated with a blue sleeve
- Pressure relief in the sealing disc
- Efficient design

Pb-free

RoHS COMPLIANT

APPLICATIONS

- UPS
- Energy storage in medical or industrial pulse systems

MARKING

The capacitors are marked with the following information:

- Rated capacitance (in µF)
- Tolerance on rated capacitance, code letter in accordance with IEC 60062 (M for ± 20 %)
- Rated voltage (in V)
- Date code
- Name of manufacturer
- Code for factory of origin
- Code number

QUICK REFERENCE DATA	
DESCRIPTION	VALUE
	500
Nominal case size (Ø D x L in mm)	50 x 80 to 90 x 220
Rated capacitance range, C_R	1000 to 15 000 µF
Tolerance on C_R	± 20 %
Rated voltage range, U_R	400 to 450 V
Category temperature range	- 40 to + 85 °C
Endurance test at 85 °C	2000 hours
Useful life at 85 °C	2000 hours
Shelf life at 0 V, 85 °C	500 hours
Based on sectional specification	IEC 60384-4/EN 130300
Climatic category IEC 60068	40/085/56

SELECTION CHART FOR C_R, U_R AND RELEVANT NOMINAL CASE SIZES (Ø D x L in mm)

C_R (µF)	U_R (V)		
	400	420	450
1000	50 x 80	50 x 80	50 x 80
1200	50 x 80	50 x 80	50 x 80
1500	50 x 105	50 x 105	50 x 105
1800	50 x 105	50 x 105	50 x 105
2200	50 x 105 65 x 105	65 x 105	65 x 105
2700	65 x 105	65 x 105	65 x 105
3300	65 x 105	65 x 105	76 x 105
3900	65 x 105	76 x 105	76 x 105
4700	76 x 105	76 x 114	76 x 114
5600	76 x 114	76 x 130	76 x 146
6800	76 x 146	76 x 146	90 x 146
8200	90 x 146	90 x 146	76 x 220
10 000	76 x 220 90 x 146	76 x 220	76 x 220
12 000	76 x 220	-	90 x 220
15 000	90 x 220	90 x 220	-

DIMENSIONS in millimeters AND AVAILABLE FORMS

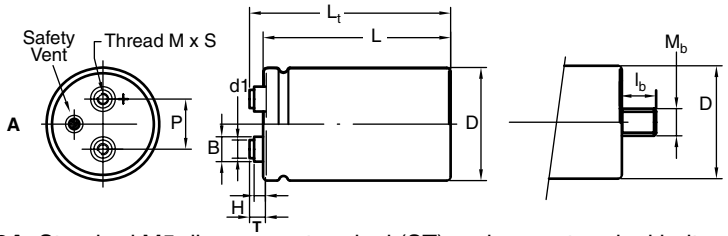

Fig. **2A**: Standard M5 disc: screw terminal (ST) and screw terminal bolt nut (STB)

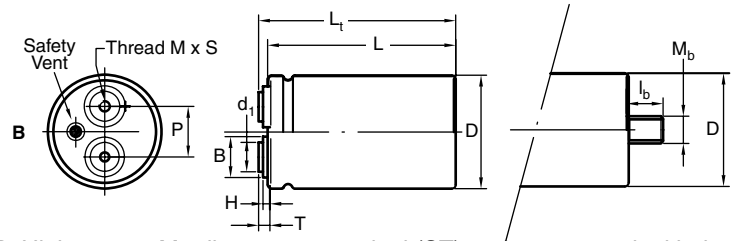

Fig. **2B**: High current M6 disc: screw terminal (ST) and screw terminal bolt nut (STB)

Maximum permissible torque which may be applied to the termination screws: 2 Nm for M5; 2.5 Nm for M6
For accessories refer to datasheet “Mounting Accessories”.
The capacitors are delivered with screws and washers.

Table 1

DIMENSIONS in millimeters, MASS AND PACKAGING QUANTITIES

DESIGN	DRAWING	L ± 1	L_t ± 1	D ± 1	P ± 0.3	T ± 0.2	H ± 0.3	B ± 0.3	d_1 ± 0.1	M	S - 0	Mb	l_b ± 0.1	MASS (g)	PACKING QTY
50 x 80	2A	82.8	88.8	51.0	22.2	7.1	4.8	11.0	7.9	M5	9.5	M12	16.0	200	25
50 x 105	2A	104.8	110.8	51.0	22.2	7.1	4.8	11.0	7.9	M5	9.5	M12	16.0	300	25
65 x 105	2A	104.8	110.7	65.0	28.5	7.0	4.6	11.9	7.9	M5	9.5	M12	16.0	480	16
65 x 105 HC	2B	104.8	109.2	65.0	28.5	5.5	3.5	18.0	13.0	M6	8.5	M12	16.0	480	16
76 x 105	2A	105.8	111.7	76.4	31.8	7.0	4.6	11.7	7.9	M5	9.5	M12	16.0	700	12
76 x 105 HC	2B	105.8	110.2	76.4	31.8	5.5	3.5	18.3	13.0	M6	8.5	M12	16.0	700	12
76 x 114	2A	115.8	121.7	76.4	31.8	7.0	4.6	11.7	7.9	M5	9.5	M12	16.0	800	12
76 x 114 HC	2B	115.8	120.2	76.4	31.8	5.5	3.5	18.3	13.0	M6	8.5	M12	16.0	800	12
76 x 146	2A	145.8	151.7	76.4	31.8	7.0	4.6	11.7	7.9	M5	9.5	M12	16.0	1000	12
76 x 146 HC	2B	145.8	150.2	76.4	31.8	5.5	3.5	18.3	13.0	M6	8.5	M12	16.0	1000	12
76 x 220	2A	219.8	225.7	76.4	31.8	7.0	4.6	11.7	7.9	M5	9.5	M12	16.0	1500	10
76 x 220 HC	2B	219.8	224.2	76.4	31.8	5.5	3.5	18.3	13.0	M6	8.5	M12	16.0	1500	10
90 x 146 HC	2B	150.1	155.4	89.4	31.8	7.9	0.0	13.0	13.0	M6	10.0	M12	16.0	1300	10
90 x 220 HC	2B	218.1	223.4	89.4	31.8	7.9	0.0	13.0	13.0	M6	10.0	M12	16.0	2000	10

Notes
- For bolt version holds:

1. L = L standard - 0.5 mm
2. L_t = L_t standard - 0.5 mm

ELECTRICAL DATA

SYMBOL	DESCRIPTION
C_R	rated capacitance at 100 Hz, tolerance ± 20 %
I_R	rated RMS ripple current at 100 Hz, 85 °C
I_{L5}	max. leakage current after 5 minutes at U_R
ESR	max. equivalent series resistance at 100 Hz
Z	max. impedance at 10 kHz

Note
- Unless otherwise specified, all electrical values in Tables 2 and 3 apply at T_{amb} = 20 °C, P = 86 to 106 kPa, RH = 45 to 75 %

ORDERING EXAMPLE

Electrolytic capacitor 500 series

4700 µF/400 V; ± 20 %

Nominal case size: Ø 76 x 105 mm;
STB version; high post M5 disc

Ordering code: MAL250056472E3

Former 12NC: 2222500 56472

Table 2

ELECTRICAL DATA AND ORDERING INFORMATION

U_R (V)	C_R 100 Hz (µF)	NOMINAL CASE SIZE Ø D x L (mm)	I_R 120 Hz 85 °C (A)	I_R 120 Hz 40 °C (A)	I_{L5} 5 min (mA)	ESR max. 120 Hz (mΩ)	Z max. 10 kHz (mΩ)	HIGH POST M5 DISC		HIGH CURRENT M6 DISC	
								ORDERING CODE ST MAL2500.....	ORDERING CODE STB MAL2500.....	ORDERING CODE ST MAL2500.....	ORDERING CODE STB MAL2500.....
400	1000	50 x 80	4.2	11.2	0.80	125	98	26102E3	66102E3	-	-
	1200	50 x 80	4.5	12.0	0.96	107	85	16122E3	56122E3	-	-
	1500	50 x 105	5.1	14.1	1.20	86	68	16152E3	56152E3	-	-
	1800	50 x 105	5.6	15.1	1.44	73	59	16182E3	56182E3	-	-
	2200	50 x 105	6.3	17.1	1.76	58	46	16222E3	56222E3	-	-
	2200	65 x 105	7.4	19.9	1.76	58	46	26222E3	66222E3	46222E3	86222E3
	2700	65 x 105	7.9	21.5	2.16	49	39	16272E3	56272E3	36272E3	76272E3
	3300	65 x 105	8.9	24.0	2.64	39	31	16332E3	56332E3	36332E3	76332E3
	3900	65 x 105	9.4	25.5	3.12	34	28	16392E3	56392E3	36392E3	76392E3
	4700	76 x 105	11.1	30.0	3.76	30	25	16472E3	56472E3	36472E3	76472E3
	5600	76 x 114	12.1	32.6	4.48	26	21	16562E3	56562E3	36562E3	76562E3
	6800	76 x 146	13.6	36.6	5.44	21	18	16682E3	56682E3	36682E3	76682E3
	8200	90 x 146	17.7	47.7	6.56	16	13	-	-	36822E3	76822E3
	10 000	76 x 220	17.0	45.8	8.00	15	12	16103E3	56103E3	36103E3	76103E3
	10 000	90 x 146	19.3	52.2	8.00	13	11	-	-	46103E3	86103E3
	12 000	76 x 220	17.8	48.1	9.60	13	11	16123E3	56123E3	36123E3	76123E3
	15 000	90 x 220	23.6	63.7	12.00	9	8	-	-	36153E3	76153E3
420	1000	50 x 80	4.3	11.5	0.84	105	74	14102E3	54102E3	-	-
	1200	50 x 80	4.6	12.4	1.01	90	65	14122E3	54122E3	-	-
	1500	50 x 105	5.3	14.4	1.26	72	52	14152E3	54152E3	-	-
	1800	50 x 105	5.7	15.3	1.52	62	46	14182E3	54182E3	-	-
	2200	65 x 105	7.5	20.4	1.85	49	35	14222E3	54222E3	34222E3	74222E3
	2700	65 x 105	8.1	21.9	2.27	42	31	14272E3	54272E3	34272E3	74272E3
	3300	65 x 105	9.1	24.6	2.78	33	24	14332E3	54332E3	34332E3	74332E3
	3900	76 x 105	10.7	28.8	3.28	29	22	14392E3	54392E3	34392E3	74392E3
	4700	76 x 114	11.7	31.5	3.95	25	19	14472E3	54472E3	34472E3	74472E3
	5600	76 x 130	12.8	34.6	4.71	21	16	14562E3	54562E3	34562E3	74562E3
	6800	76 x 146	13.8	37.2	5.72	18	14	14682E3	54682E3	34682E3	74682E3
	8200	90 x 146	17.6	47.6	6.89	14	10	-	-	34822E3	74822E3
	10 000	76 x 220	17.3	46.6	8.40	13	10	14103E3	54103E3	34103E3	74103E3
	15 000	90 x 220	24.1	65.0	12.60	8	6	-	-	34153E3	74153E3
450	1000	50 x 80	4.2	11.3	0.90	126	88	17102E3	57102E3	-	-
	1200	50 x 80	4.5	12.1	1.08	100	76	17122E3	57122E3	-	-
	1500	50 x 105	5.3	14.2	1.35	79	61	17152E3	57152E3	-	-
	1800	50 x 105	5.9	15.9	1.62	64	48	17182E3	57182E3	-	-
	2200	65 x 105	7.4	20.0	1.98	54	41	17222E3	57222E3	37222E3	77222E3
	2700	65 x 105	8.3	22.5	2.43	43	33	17272E3	57272E3	37272E3	77272E3
	3300	76 x 105	9.9	26.8	2.97	37	28	17332E3	57332E3	37332E3	77332E3
	3900	76 x 105	10.5	28.4	3.51	32	25	17392E3	57392E3	37392E3	77392E3
	4700	76 x 114	11.5	31.0	4.23	28	22	17472E3	57472E3	37472E3	77472E3
	5600	76 x 146	12.8	34.6	5.04	23	18	17562E3	57562E3	37562E3	77562E3
	6800	90 x 146	16.6	44.8	6.12	17	13	-	-	37682E3	77682E3
	8200	76 x 220	16.0	43.3	7.38	16	13	17822E3	57822E3	37822E3	77822E3
	10 000	76 x 220	17.0	45.8	9.00	14	11	17103E3	57103E3	37103E3	77103E3
	12 000	90 x 220	22.1	59.5	10.80	10	8	-	-	37123E3	77123E3

ADDITIONAL ELECTRICAL DATA		
PARAMETER	**CONDITIONS**	**VALUE**
Voltage		
Surge voltage	≥ 400 V versions	$U_s = 1.1 \times U_R$
Reverse voltage		$U_{rev} \leq 1$ V
Current		
Leakage current	After 1 minute at U_R	$I_{L1} \leq 0.006\ C_R \times U_R + 4\ \mu A$
	After 5 minutes at U_R	$I_{L5} \leq 0.002\ C_R \times U_R + 4\ \mu A$
Inductance		
Equivalent series inductance (ESL)	Case Ø D = 50 mm	typ. 16 nH
	Case Ø D = 65 mm	typ. 19 nH
	Case Ø D = 76 mm	typ. 20 nH
	Case Ø D = 90 mm	typ. 20 nH

Table 3

MULTIPLIER OF RIPPLE CURRENT (I_R) AS A FUNCTION OF FREQUENCY	
FREQUENCY (Hz)	**I_R MULTIPLIER**
	500
60	0.70
100	0.95
120	1.00
500	1.20
1000	1.30
≥ 10 000	1.40

Table 4

MULTIPLIER OF RIPPLE CURRENT (I_R) AS A FUNCTION OF TEMPERATURE	
TEMPERATURE (°C)	**I_R MULTIPLIER**
40	2.7
60	2.0
70	1.7
85	1.0

Table 5

TEST PROCEDURES AND REQUIREMENTS			
TEST		**PROCEDURE (quick reference)**	**REQUIREMENTS**
NAME OF TEST	**REFERENCE**		
Endurance	IEC 60384-4/ EN130300 subclause 4.13	T_{amb} = 85 °C; U_R applied; 2000 hours	ΔC/C: ± 10 % ESR ≤ 1.3 x spec. limit Z ≤ 2 x spec. limit I_{L5} ≤ spec. limit
Useful life	CECC 30301 subclause 1.8.1	T_{amb} = 85 °C; U_R and I_R applied; 2000 hours	ΔC/C: ± 30 % ESR ≤ 3 x spec. limit Z ≤ 3 x spec. limit I_{L5} ≤ spec. limit no short or open circuit, no visible damage total failure percentage: ≤ 3 %
Shelf life (storage at high temperature)	IEC 60384-4/ EN130300 subclause 4.17	T_{amb} = 85 °C; no voltage applied; 500 hours After test: U_R to be applied for 30 minutes, 24 to 48 hours before measurement	ΔC/C: ± 10 % ESR ≤ 1.2 x spec. limit I_{L5} ≤ 2 x spec. limit

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