

Aluminum Capacitors Power High Ripple Current Screw Terminals

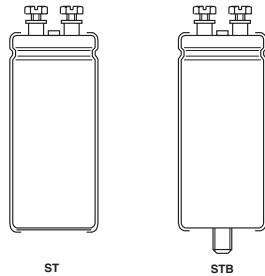


Fig.1 Component outline

FEATURES

- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Large types, cylindrical aluminum case, insulated with a blue sleeve
- Pressure relief in the sealing
- Long useful life



RoHS
COMPLIANT

APPLICATIONS

- Computer, telecommunications and industrial systems
- Smoothing and filtering
- Standard and switched mode power supplies

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 $\pm 20\%$)
- Rated voltage (in V)
- Date code (YYMM)
- Name of manufacturer
- Code for factory of origin
- '-' sign to identify the negative terminal, visible from the top and side of the capacitor
- Code number
- Climatic category in accordance with IEC 60068

QUICK REFERENCE DATA		
DESCRIPTION	VALUE	
	101	102
Nominal case size ($\varnothing D \times L$ in mm)	35 x 60 to 76 x 146	
Rated capacitance range (E6 series), C_R	220 to 330000 μF	
Tolerance on C_R	$\pm 20\%$	
Rated voltage range, U_R	25 to 100 V	200 to 450 V
Category temperature range	- 40 to + 85 °C	
Endurance test at 85 °C	2000 hours	
Useful life at 85 °C	10000 hours ($D \leq 50$ mm) 15000 hours ($D \geq 65$ mm)	10000 hours
Useful life at 40 °C, 1.4 x I_R applied	400000 hours ($D \leq 50$ mm) 600000 hours ($D \geq 65$ mm)	400000 hours
Shelf life at 0 V, 85 °C	500 hours	
Based on sectional specification	IEC 60 384-4/EN130300	
Climatic category IEC 60068	40/085/56	

SELECTION CHART FOR C_R , U_R AND RELEVANT NOMINAL CASE SIZES ($\varnothing D \times L$ in mm)										
C_R (μF)	U_R (V)									
	25	40	63	100	200	250	350	385	400	450
220	-	-	-	-	-	-	-	35 x 60	35 x 60	35 x 60
330	-	-	-	-	-	-	35 x 60	-	35 x 60	-
470	-	-	-	-	-	35 x 60	-	35 x 80	35 x 80	-
	-	-	-	-	-	-	35 x 80	-	35 x 105	35 x 105
680	-	-	-	-	35 x 60	35 x 80	-	35 x 105	35 x 105	-
	-	-	-	-	-	-	35 x 105	-	50 x 80	50 x 80
1000	-	-	-	-	35 x 80	35 x 80	-	50 x 80	50 x 80	50 x 80
	-	-	-	-	35 x 105	35 x 105	50 x 80	-	50 x 105	50 x 105
1500	-	-	-	-	35 x 105	35 x 105	-	-	-	50 x 105
	-	-	-	-	50 x 80	50 x 80	50 x 105	50 x 105	50 x 105	65 x 105
2200	-	-	-	35 x 60	50 x 80	50 x 80	50 x 105	-	-	65 x 105
	-	-	-	-	-	50 x 105	65 x 105	65 x 105	65 x 105	-
3300	-	-	-	35 x 60	50 x 80	50 x 105	-	-	65 x 105	76 x 105
	-	-	-	35 x 80	50 x 105	65 x 105	65 x 105	76 x 105	-	76 x 146
4700	-	-	35 x 60	35 x 80	-	65 x 105	76 x 105	76 x 105	76 x 105	76 x 146
	-	-	-	35 x 105	65 x 105	76 x 105	76 x 146	76 x 146	76 x 146	-
5600	-	-	-	-	-	-	-	-	-	76 x 146

SELECTION CHART FOR C_R, U_R AND RELEVANT NOMINAL CASE SIZES (∅ D × L in mm)										
C _R (μF)	U _R (V)									
	25	40	63	100	200	250	350	385	400	450
6800	-	-	35 x 60	35 x 105	65 x 105	76 x 105	-	-	-	-
	-	-	35 x 80	50 x 80	76 x 105	76 x 146	76 x 146	76 x 146	76 x 146	-
10000	-	35 x 60	35 x 80	50 x 80	76 x 105	76 x 105	-	-	-	-
	-	-	35 x 105	50 x 105	76 x 146	76 x 146	-	-	-	-
15000	35 x 60	35 x 60	35 x 105	50 x 105	76 x 146	-	-	-	-	-
	-	35 x 80	50 x 80	-	-	-	-	-	-	-
22000	35 x 60	35 x 80	50 x 80	65 x 105	-	-	-	-	-	-
	-	50 x 80	50 x 105	76 x 105	-	-	-	-	-	-
33000	35 x 80	35 x 105	50 x 105	76 x 105	-	-	-	-	-	-
	50 x 80	50 x 80	65 x 105	76 x 146	-	-	-	-	-	-
47000	35 x 105	50 x 80	65 x 105	-	-	-	-	-	-	-
	50 x 80	50 x 105	76 x 105	76 x 146	-	-	-	-	-	-
68000	50 x 80	50 x 105	65 x 105	-	-	-	-	-	-	-
	50 x 105	65 x 105	76 x 146	-	-	-	-	-	-	-
100000	50 x 105	65 x 105	-	-	-	-	-	-	-	-
	65 x 105	76 x 105	76 x 146	-	-	-	-	-	-	-
150000	65 x 105	76 x 105	-	-	-	-	-	-	-	-
	76 x 105	76 x 146	-	-	-	-	-	-	-	-
220000	65 x 105	-	-	-	-	-	-	-	-	-
	76 x 105	76 x 146	-	-	-	-	-	-	-	-
330000	76 x 146	-	-	-	-	-	-	-	-	-

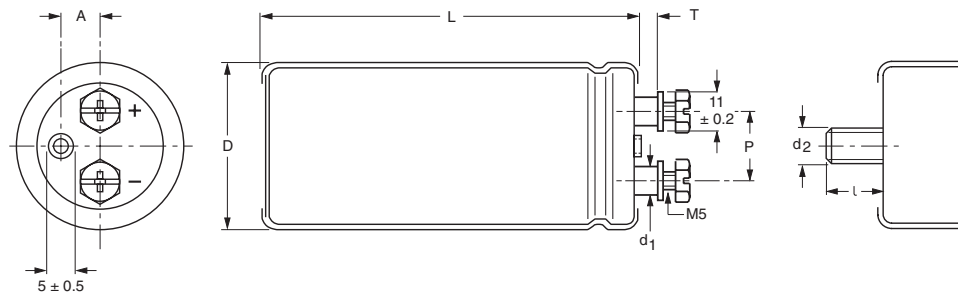
DIMENSIONS in millimeters AND AVAILABLE FORMS


Fig.2 Screw terminal (ST); screw terminal bolt (STB)

Maximum permissible torque which may be applied to the termination screws: 2 Nm.
 For accessories refer to datasheet "Mounting Accessories".
 The capacitors are delivered with screws and washers.

Table 1

DIMENSIONS in millimeters, MASS AND PACKAGING QUANTITIES										
NOMINAL CASE SIZE ∅ D × L	∅ D _{max}	L _{max}	P ± 0.3	A ± 0.5	d ₁ ± 0.2	T ± 0.5	d ₂ × l	MASS (g)	PACKAGING QUANTITIES (per box)	CARDBOARD BOX DIMENSIONS L × W × H
35 × 60	36	63	13	8	8	5.9	M8 × 12	75	25	196 × 192 × 110
35 × 80	36	81	13	8	8	5.9	M8 × 12	95	25	196 × 192 × 115
35 × 105	36	105	13	8	8	5.9	M8 × 12	130	25	196 × 192 × 140
50 × 80	51.5	83	22	12	8	5.9	M12 × 16	200	25	293 × 273 × 115
50 × 105	51.5	105	22	12	8	5.9	M12 × 16	300	25	293 × 273 × 140
65 × 105	66	105	28.5	16	8*	5.9*	M12 × 16	480	10	368 × 151 × 140
76 × 105	77	106	32	19	8*	5.9*	M12 × 16	700	10	418 × 173 × 140
76 × 146	77	146	32	19	8*	5.9*	M12 × 16	1000	10	418 × 173 × 180

* Terminals also available in High Current version. Contact manufacturer for mechanical dimensions.

ELECTRICAL DATA	
SYMBOL	DESCRIPTION
C_R	rated capacitance at 100 Hz, tolerance $\pm 20\%$
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 20 kHz

ORDERING EXAMPLE

Electrolytic capacitor 101 series
10000 $\mu\text{F}/40\text{ V}$; $\pm 20\%$
Nominal case size: $\varnothing 35 \times 60\text{ mm}$;
ST version, high post M5 disc
Catalog number: 2222 101 17103.

Note

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

Table 2

ELECTRICAL DATA AND ORDERING INFORMATION FOR 101 SERIES								
U_R (V)	C_R 100 Hz (μF)	NOMINAL CASE SIZE $\varnothing D \times L$ (mm)	I_R 100 Hz 85 °C (A)	I_{L5} 5 min (mA)	ESR max 100 Hz (m Ω)	Z MAX. 20 kHz (m Ω)	HIGH POST M5 DISC	
							CATALOG NUMBER ST 2222 101	CATALOG NUMBER STB 2222 101
25	15000	35 x 60	7.7	0.75	29	22	16153	56153
	22000	35 x 60	8.3	1.10	27	22	16223	56223
	33000	35 x 80	9.0	1.65	19	17	16333	56333
	33000	50 x 80	10.0	1.65	17	14	26333	66333
	47000	35 x 105	12.1	2.35	15	13	16473	56473
	47000	50 x 80	14.8	2.35	12	10	26473	66473
	68000	50 x 80	12.8	3.40	15	13	16683	56683
	68000	50 x 105	17.1	3.40	9	8	26683	66683
	100000	50 x 105	14.7	5.00	12	11	16104	56104
	100000	65 x 105	19.6	5.00	7	6	26104	66104
	150000	65 x 105	17.6	7.50	8	7	16154	56154
	150000	76 x 105	21.4	7.50	6	5	26154	66154
	220000	65 x 105	20.2	11.00	6	5	16224	56224
	220000	76 x 105	22.5	11.00	6	5	26224	66224
	330000	76 x 146	25.8	16.50	4	4	26334	66334
40	10000	35 x 60	7.1	0.80	31	23	17103	57103
	15000	35 x 60	7.8	1.20	28	22	17153	57153
	15000	35 x 80	8.7	1.20	22	17	27153	67153
	22000	35 x 80	9.4	1.76	20	17	17223	57223
	22000	50 x 80	11.2	1.76	19	15	27223	67223
	33000	35 x 105	11.0	2.64	15	13	17333	57333
	33000	50 x 80	13.7	2.64	13	10	27333	67333
	47000	50 x 80	14.6	3.76	12	10	17473	57473
	47000	50 x 105	15.9	3.76	10	8	27473	67473
	68000	50 x 105	16.9	5.44	9	8	17683	57683
	68000	65 x 105	18.1	5.44	7	6	27683	67683
	100000	65 x 105	19.2	8.00	7	6	17104	57104
	100000	76 x 105	21.3	8.00	7	6	27104	67104
	150000	76 x 105	20.5	12.00	7	6	17154	57154
	150000	76 x 146	24.0	12.00	5	5	27154	67154
	220000	76 x 146	24.5	17.60	5	5	27224	67224



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ELECTRICAL DATA AND ORDERING INFORMATION FOR 101 SERIES								
U _R (V)	C _R 100 Hz (μF)	NOMINAL CASE SIZE ∅ D × L (mm)	I _R 100 Hz 85 °C (A)	I _{L5} 5 min (mA)	ESR max 100 Hz (mΩ)	Z MAX. 20 kHz (mΩ)	HIGH POST M5 DISC	
							CATALOG NUMBER ST 2222 101	CATALOG NUMBER STB 2222 101
63	4700	35 x 60	5.9	0.59	42	25	18472	58472
	6800	35 x 60	6.6	0.86	38	25	18682	58682
	6800	35 x 80	7.3	0.86	30	19	28682	68682
	10000	35 x 80	8.1	1.26	27	19	18103	58103
	10000	35 x 105	8.8	1.26	22	14	28103	68103
	15000	35 x 105	9.7	1.89	19	14	18153	58153
	15000	50 x 80	12.1	1.89	16	11	28153	68153
	22000	50 x 80	11.1	2.77	19	15	18223	58223
	22000	50 x 105	14.3	2.77	12	9	28223	68223
	33000	50 x 105	12.9	4.16	14	12	18333	58333
	33000	65 x 105	16.5	4.16	9	6	28333	68333
	47000	65 x 105	15.6	5.92	10	8	18473	58473
	47000	76 x 105	18.6	5.92	8	6	28473	68473
	68000	76 x 105	20.0	8.57	7	6	18683	58683
	68000	76 x 146	21.9	8.57	6	5	28683	68683
	100000	76 x 146	23.4	12.60	5	5	28104	68104
100	2200	35 x 60	5.2	0.44	50	29	19222	59222
	3300	35 x 60	6.0	0.66	42	27	19332	59332
	3300	35 x 80	6.6	0.66	35	21	29332	69332
	4700	35 x 80	7.3	0.94	31	20	19472	59472
	4700	35 x 105	7.9	0.94	26	16	29472	69472
	6800	35 x 105	8.8	1.36	23	15	19682	59682
	6800	50 x 80	10.9	1.36	19	12	29682	69682
	10000	50 x 80	10.5	2.00	21	15	19103	59103
	10000	50 x 105	13.1	2.00	14	9	29103	69103
	15000	50 x 105	12.3	3.00	16	12	19153	59153
	22000	65 x 105	14.8	4.40	11	8	19223	59223
	22000	76 x 105	17.4	4.40	9	6	29223	69223
	33000	76 x 105	19.0	6.60	8	6	19333	59333
	33000	76 x 146	20.7	6.60	7	5	29333	69333
	47000	76 x 146	22.4	9.40	6	5	29473	69473

Table 3

ELECTRICAL DATA AND ORDERING INFORMATION FOR 102 SERIES								
U _R (V)	C _R 100 Hz (μF)	NOMINAL CASE SIZE ∅ D × L (mm)	I _R 100 Hz 85 °C (A)	I _{L5} 5 min (mA)	ESR max 100 Hz (mΩ)	Z MAX. 20 kHz (mΩ)	HIGH POST M5 DISC	
							CATALOG NUMBER ST 2222 102	CATALOG NUMBER STB 2222 102
200	680	35 x 60	3.5	0.27	207	136	12681	52681
	1000	35 x 80	4.4	0.40	144	95	12102	52102
	1000	35 x 105	4.7	0.40	140	91	22102	62102
	1500	35 x 105	5.5	0.60	100	67	12152	52152
	1500	50 x 80	6.2	0.60	106	74	22152	62152
	2200	50 x 80	8.0	0.88	67	44	12222	52222
	3300	50 x 80	8.9	1.32	50	35	12332	52332
	3300	50 x 105	9.9	1.32	46	32	22332	62332
	4700	65 x 105	12.5	1.88	37	26	22472	62472
	6800	65 x 105	15.2	2.72	25	18	12682	52682
	6800	76 x 105	16.9	2.72	25	18	22682	62682
	10000	76 x 105	19.9	4.00	18	13	12103	52103
	10000	76 x 146	20.4	4.00	18	13	22103	62103
	15000	76 x 146	24.1	6.00	12	9	12153	52153
250	470	35 x 60	3.1	0.24	250	152	13471	53471
	680	35 x 80	3.8	0.34	175	107	13681	53681
	1000	35 x 80	4.4	0.50	128	82	13102	53102
	1000	35 x 105	4.8	0.50	122	76	23102	63102
	1500	35 x 105	5.4	0.75	90	58	13152	53152
	1500	50 x 80	7.0	0.75	81	50	23152	63152
	2200	50 x 80	8.0	1.10	60	39	13222	53222
	2200	50 x 105	8.7	1.10	57	35	23222	63222
	3300	50 x 105	9.8	1.65	42	28	13332	53332
	3300	65 x 105	11.4	1.65	42	28	23332	63332
	4700	65 x 105	13.8	2.35	29	19	13472	53472
	4700	76 x 105	15.3	2.35	29	19	23472	63472
	6800	76 x 105	18.1	3.40	21	14	13682	53682
	6800	76 x 146	18.6	3.40	21	14	23682	63682
	10000	76 x 105	19.3	5.00	17	12	13103	53103
	10000	76 x 146	22.0	5.00	15	10	23103	63103
350	330	35 x 60	2.5	0.23	435	305	15331	55331
	470	35 x 80	3.1	0.33	308	216	25471	65471
	680	35 x 105	3.8	0.48	216	152	25681	65681
	1000	50 x 80	5.6	0.70	145	102	25102	65102
	1500	50 x 80	6.5	1.05	102	74	15152	55152
	1500	50 x 105	7.0	1.05	99	70	25152	65152
	2200	50 x 105	8.0	1.54	72	52	15222	55222
	2200	65 x 105	9.3	1.54	72	52	25222	65222
	3300	65 x 105	11.4	2.31	48	35	25332	65332
	4700	76 x 105	15.0	3.29	34	25	15472	55472
	4700	76 x 146	15.4	3.29	34	25	25472	65472
	6800	76 x 146	18.3	4.76	24	18	25682	65682



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ELECTRICAL DATA AND ORDERING INFORMATION FOR 102 SERIES								
U _R (V)	C _R 100 Hz (µF)	NOMINAL CASE SIZE ∅ D × L (mm)	I _R 100 Hz 85 °C (A)	I _{L5} 5 min (mA)	ESR max 100 Hz (mΩ)	Z MAX. 20 kHz (mΩ)	HIGH POST M5 DISC	
							CATALOG NUMBER ST 2222 102	CATALOG NUMBER STB 2222 102
385	220	35 x 60	2.1	0.17	575	380	18221	58221
	330	35 x 80	2.7	0.26	386	257	18331	58331
	470	35 x 80	3.1	0.37	279	188	18471	58471
	680	35 x 105	3.9	0.53	196	133	18681	58681
	1000	50 x 80	5.6	0.77	132	89	18102	58102
	1500	50 x 105	7.1	1.16	90	61	18152	58152
	2200	65 x 105	10.0	1.70	61	42	18222	58222
	3300	76 x 105	13.4	2.55	42	29	18332	58332
	4700	76 x 105	15.0	3.62	31	22	18472	58472
	4700	76 x 146	16.3	3.62	29	20	28472	68472
	6800	76 x 146	18.3	5.24	22	16	18682	58682
400	220	35 x 60	2.1	0.18	557	363	16221	56221
	330	35 x 60	2.5	0.26	383	254	16331	56331
	330	35 x 80	2.7	0.26	374	245	26331	66331
	470	35 x 80	3.1	0.38	271	180	16471	56471
	470	35 x 105	3.3	0.38	265	175	26471	66471
	680	35 x 105	3.9	0.55	191	128	16681	56681
	680	50 x 80	4.5	0.54	199	136	26681	66681
	1000	50 x 80	5.7	0.80	128	86	16102	56102
	1000	50 x 105	6.0	0.80	125	83	26102	66102
	1500	50 x 105	7.1	1.20	88	59	26152	66152
	2200	65 x 105	10.0	1.76	60	40	26222	66222
	3300	65 x 105	12.1	2.64	40	27	16332	56332
	3300	76 x 105	13.4	2.64	40	27	26332	66332
	4700	76 x 105	15.0	3.76	31	21	16472	56472
	4700	76 x 146	16.4	3.76	28	19	26472	66472
	6800	76 x 146	18.3	5.44	22	15	26682	66682
	450	220	35 x 60	2.1	0.20	503	313	17221
330		35 x 80	2.7	0.30	339	212	27331	67331
470		35 x 105	3.4	0.42	241	151	27471	67471
680		50 x 80	4.9	0.61	159	98	27681	67681
1000		50 x 80	5.7	0.90	118	75	17102	57102
1000		50 x 105	6.1	0.90	114	72	27102	67102
1500		50 x 105	7.1	1.35	81	52	17152	57152
1500		65 x 105	8.3	1.35	81	52	27152	67152
2200		65 x 105	10.1	1.98	55	35	17222	57222
2200		76 x 105	11.2	1.98	55	35	27222	67222
3300		76 x 105	13.5	2.97	37	24	17332	57332
3300		76 x 146	13.9	2.97	37	24	27332	67332
4700		76 x 146	16.4	4.23	26	17	17472	57472
5600		76 x 146	17.3	5.04	23	15	17562	57562



ADDITIONAL ELECTRICAL DATA		
PARAMETER	CONDITIONS	VALUE
Voltage		
Surge voltage	≤ 250 V versions	$U_s = 1.15 \times U_R$
	≥ 350 V versions	$U_s = 1.1 \times U_R$
Reverse voltage		$U_{rev} \leq 1 \text{ V}$
Current		
Leakage current in μA	after 1 minute at U_R	$I_{L1} \leq 0.006 C_R \times U_R$
	after 5 minutes at U_R	$I_{L5} \leq 0.002 C_R \times U_R$
Inductance		
Equivalent series inductance (ESL)	case $\varnothing D = 35 \text{ mm}$	typ. 13 nH
	case $\varnothing D = 50 \text{ mm}$	typ. 16 nH
	case $\varnothing D = 65 \text{ mm}$	typ. 19 nH
	case $\varnothing D = 76 \text{ mm}$	typ. 20 nH

RIPPLE CURRENT AND USEFUL LIFE

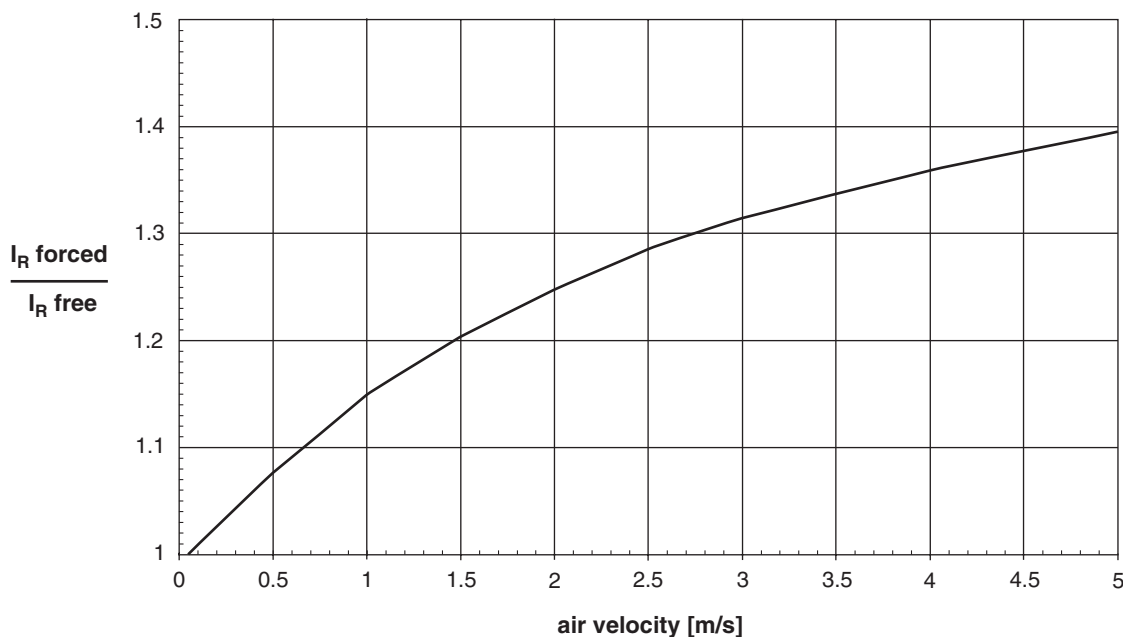


Fig.3 Multiplier of ripple current (I_r) as a function of air flow

MAXIMUM RIPPLE CURRENT			
PARAMETER	CONDITION	MAXIMUM RIPPLE CURRENT MULTIPLIER	VALUE
Ambient temperature (T_{amb})	70 °C	from nomogram; see fig. 4	1.6
Operating frequency (f)	400 Hz	from frequency ; table 4	1.3
Air flow	2 m/s	from air-flow; see fig. 3	1.25

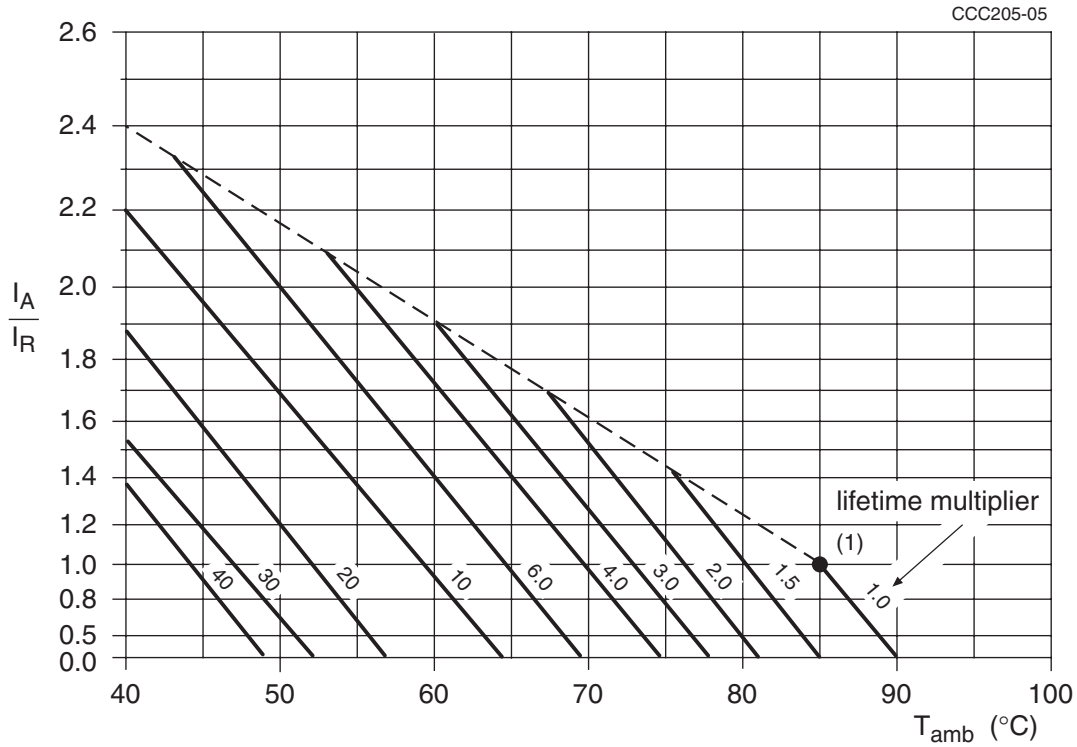
Note

Calculation example for 102 series. Maximum ripple current multiplier = 1.6 x 1.3 x 1.25 = 2.6



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I_A = actual ripple current at 100 Hz
 I_R = rated ripple current at 100 Hz and 85 °C

- (1) Useful life at 85 °C and I_R applied:
101 series: case $\varnothing D \leq 50$: 10000 hours
case $\varnothing D \geq 65$: 15000 hours
102 series: 10000 hours

Fig.4 Multiplier of useful life as a function of ambient temperature and ripple current load

Table 4

MULTIPLIER OF RIPPLE CURRENT (I_R) AS A FUNCTION OF FREQUENCY		
FREQUENCY (Hz)	I_R MULTIPLIER	
	101	102
50	0.85	0.90
100	1.00	1.00
200	1.10	1.20
400	1.15	1.30
1000	1.20	1.40
10000	1.30	1.50

Table 5

TEST PROCEDURES AND REQUIREMENTS			
TEST		PROCEDURE (quick reference)	REQUIREMENTS
NAME OF TEST	REFERENCE		
Endurance	IEC 60384-4/ EN130300 subclause 4.13	$T_{amb} = 85\text{ }^{\circ}\text{C}$; U_R applied; 2000 hours	$U_R \leq 100\text{ V}$; $\Delta C/C: \pm 15\%$ $U_R > 100\text{ V}$; $\Delta C/C: \pm 10\%$ $\tan \delta \leq 1.3 \times \text{spec. limit}$ $Z \leq 2 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$
Useful life	CECC 30301 subclause 1.8.1	$T_{amb} = 85\text{ }^{\circ}\text{C}$; U_R and I_R applied; 101 series: case $\varnothing D \leq 50$:10000 hours case $\varnothing D \geq 65$:15000 hours 102 series: 10000 hours	$U_R \leq 100\text{ V}$; $\Delta C/C: \pm 45\%$ $U_R > 100\text{ V}$; $\Delta C/C: \pm 30\%$ $\tan \delta \leq 3 \times \text{spec. limit}$ $Z \leq 3 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$ no short or open circuit, no visible damage total failure percentage: $U_R \leq 100\text{ V}: \leq 1\%$; $U_R > 100\text{ V}: \leq 3\%$
Shelf life (storage at high temperature)	IEC 60384-4/ EN130300 subclause 4.17	$T_{amb} = 85\text{ }^{\circ}\text{C}$; no voltage applied; 500 hours after test: U_R to be applied for 30 minutes, 24 to 48 hours before measurement	$\Delta C/C: \pm 10\%$ $\tan \delta \leq 1.2 \times \text{spec. limit}$ $I_{L5} \leq 2 \times \text{spec. limit}$



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