

# Aluminium electrolytic capacitors Power Ultra Long Life Snap-in

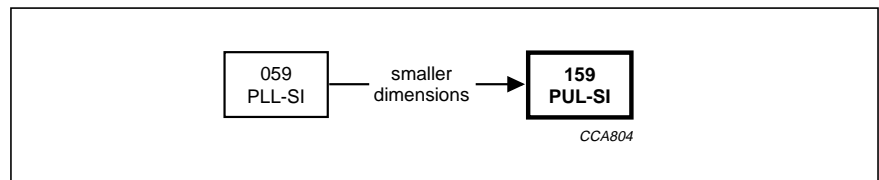
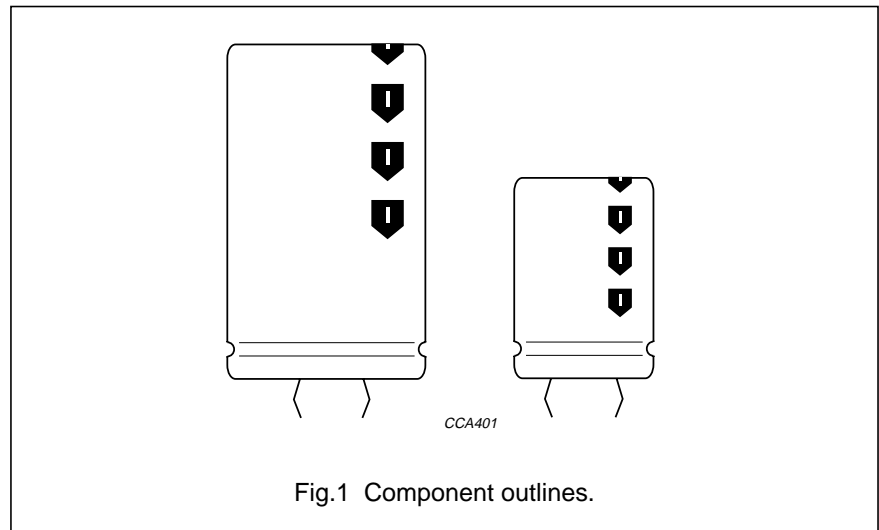
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### FEATURES

- Polarized aluminium electrolytic capacitors, non-solid
- Large types, very small dimensions, cylindrical aluminium case, insulated with a blue sleeve
- Pressure relief on the top of the aluminium case
- Charge and discharge proof
- Low ESR, high ripple current capability
- Useful life: 3 000 hours at 105 °C.

### APPLICATIONS

- General purpose, industrial and audio/video systems
- Smoothing and filtering
- Standard and switched mode power supplies
- Energy storage in pulse systems.



### QUICK REFERENCE DATA

DESCRIPTION	VALUE
Case size ( $\varnothing D_{nom} \times L_{nom}$ in mm)	22 × 25 to 35 × 50
Rated capacitance range (E6/E12 series), $C_R$	56 to 1800 $\mu F$
Tolerance on $C_R$	$\pm 20\%$
Rated voltage range, $U_R$	200 V, 250 V, 400 V, 450 V
Category temperature range	-25 to +105 °C
Endurance test at 105 °C	2000 hours
Load life at 105 °C	2000 hours
Useful life at 105 °C	3000 hours
Useful life at 40 °C and $1.6 \times I_R$ applied	300000 hours
Shelf life at 0 V, 105 °C	1000 hours
Based on sectional specification	IEC 384-4-1/CECC 30300
Climatic category IEC 68	25/105/56

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Selection chart for  $C_R$ ,  $U_R$  and relevant nominal case sizes ( $\varnothing D \times L$  in mm); preferred types in bold

$C_R$ ( $\mu\text{F}$ )	$U_R$ (V)			
	200	250	400	450
56	–	–	–	22 × 25
<b>68</b>	–	–	22 × 25	<b>22 × 30/25 × 25</b>
82	–	–	22 × 30	22 × 35
	–	–	25 × 25	–
<b>100</b>	–	–	<b>22 × 35</b>	<b>22 × 40</b>
	–	–	25 × 30	25 × 30/30 × 25
120	–	–	22 × 35	–
	–	–	25 × 30	25 × 35
	–	–	30 × 25	–
<b>150</b>	–	–	<b>22 × 40</b>	<b>25 × 40</b>
	–	–	25 × 35	30 × 30
	–	–	30 × 30	35 × 25
180	–	–	25 × 40	25 × 45
	–	–	30 × 30	30 × 35
	–	–	35 × 25	–
<b>220</b>	–	<b>22 × 30</b>	<b>25 × 45</b>	<b>30 × 40</b>
	–	25 × 25	30 × 35	35 × 30
	–	–	35 × 30	–
270	–	22 × 35	25 × 50	30 × 45
	–	25 × 30	30 × 40	35 × 35
	–	30 × 25	35 × 30	–
<b>330</b>	<b>22 × 30</b>	<b>22 × 40</b>	<b>30 × 45</b>	<b>30 × 50</b>
	–	25 × 30/30 × 25	35 × 35	35 × 40
390	22 × 35	25 × 35	30 × 50	35 × 45
	25 × 30	30 × 30	35 × 40	–
<b>470</b>	<b>22 × 40</b>	<b>25 × 40</b>	<b>35 × 45</b>	<b>35 × 50</b>
	30 × 25	30 × 30/35 × 25	–	–
560	–	25 × 45	35 × 50	–
	25 × 35	30 × 35	–	–
	30 × 30	35 × 30	–	–
<b>680</b>	<b>25 × 45</b>	<b>30 × 40</b>	–	–
	30 × 30	35 × 35	–	–
	35 × 25	–	–	–
820	25 × 50	30 × 45	–	–
	30 × 35	35 × 35	–	–
	35 × 30	35 × 40	–	–
<b>1000</b>	<b>30 × 45</b>	<b>35 × 40</b>	–	–
	35 × 35	35 × 45	–	–
1200	30 × 50	35 × 45	–	–
	35 × 35	35 × 50	–	–
<b>1500</b>	<b>35 × 45</b>	–	–	–
1800	35 × 50	–	–	–

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**MARKING**

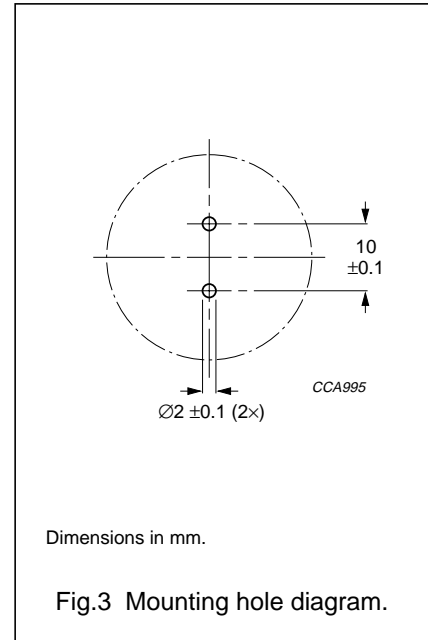
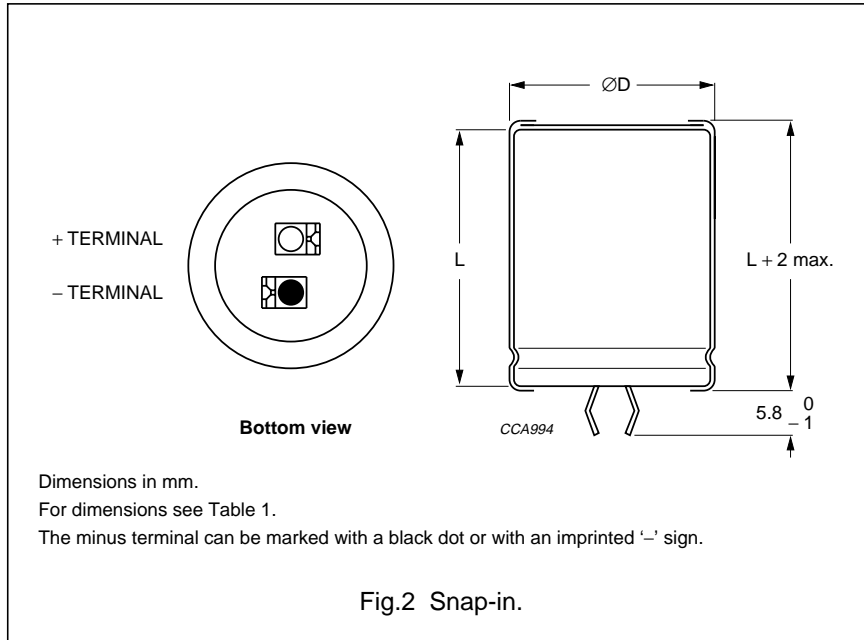
The capacitors are marked (where possible) with the following information:

- Rated capacitance (in  $\mu\text{F}$ )
- Tolerance code on rated capacitance (M for  $\pm 20\%$ )
- Rated voltage (in V)
- Climatic category in accordance with "IEC 68"
- Date code (year and week) in accordance with "IEC 62"
- Code for factory of origin
- Name of manufacturer
- '-' sign to indicate the negative terminal, visible from the top and side of the capacitor
- Code number (last 8 digits)
- Code for basic specification in accordance with "IEC 384-4-1" and "CECC 30301".

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## MECHANICAL DATA AND PACKAGING QUANTITIES



**Table 1** Physical dimensions, mass and packaging information; see Fig.2

NOMINAL CASE SIZE ØD × L (mm)	CASE CODE	ØD <sub>max</sub> (mm)	L <sub>max</sub> (mm)	MASS (g)	PACKAGING QUANTITIES (units per box)	CARDBOARD BOX DIMENSIONS l × w × h (mm)
22 × 25	2225	23	27	≈12	100	260 × 250 × 39
22 × 30	2230	23	32	≈16	100	260 × 250 × 44
22 × 35	2235	23	37	≈20	100	260 × 250 × 49
22 × 40	2240	23	42	≈23	100	260 × 250 × 54
25 × 25	2525	26	27	≈20	100	290 × 280 × 39
25 × 30	2530	26	32	≈22	100	290 × 280 × 44
25 × 35	2535	26	37	≈24	100	290 × 280 × 49
25 × 40	2540	26	42	≈27	100	290 × 280 × 54
25 × 45	2545	26	47	≈32	100	290 × 280 × 59
25 × 50	2550	26	52	≈38	100	290 × 280 × 64
30 × 25	3025	31	27	≈25	100	340 × 330 × 39
30 × 30	3030	31	32	≈30	100	340 × 330 × 44
30 × 35	3035	31	37	≈35	100	340 × 330 × 49
30 × 40	3040	31	42	≈40	100	340 × 330 × 54
30 × 45	3045	31	47	≈45	100	340 × 330 × 59
30 × 50	3050	31	52	≈50	100	340 × 330 × 64
35 × 25	3525	36	27	≈33	50	390 × 198 × 39
35 × 30	3530	36	32	≈40	50	390 × 198 × 44
35 × 35	3535	36	37	≈48	50	390 × 198 × 49
35 × 40	3540	36	42	≈55	50	390 × 198 × 54
35 × 45	3545	36	47	≈63	50	390 × 198 × 59
35 × 50	3550	36	52	≈72	50	390 × 198 × 64

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## ELECTRICAL DATA AND ORDERING INFORMATION

Unless otherwise specified, all electrical values in Table 2 apply at  $T_{amb} = 20\text{ }^{\circ}\text{C}$ ,  $P = 86\text{ to }106\text{ kPa}$ ,  $RH = 45\text{ to }75\%$ .

SYMBOL	DESCRIPTION
$C_R$	rated capacitance at 100 Hz
$I_R$	rated RMS ripple current at 120 Hz, 105 °C
$I_{L5}$	max. leakage current after 5 minutes at $U_R$
ESR	typ. equivalent series resistance at 100 Hz; note 1
Z	max. impedance at 10 kHz

## Ordering example

Electrolytic capacitor 159 series

1 000  $\mu\text{F}$ /200 V;  $\pm 20\%$

Nominal case size:  $\varnothing 30 \times 45\text{ mm}$

Catalogue number: 2222 159 42102.

## Note

- ESR at 120 Hz is approximately  $0.95 \times \text{ESR } 100\text{ Hz}$ .

**Table 2** Electrical data and ordering information; preferred types in **bold**

$U_R$ (V)	$C_R$ 100 Hz ( $\mu\text{F}$ )	NOMINAL CASE SIZE $\varnothing D \times L$ (mm)	CASE CODE	$I_R$ 120 Hz 105 °C (A)	$I_{L5}$ 5 min (mA)	TYP. ESR 100 Hz <sup>(1)</sup> (m $\Omega$ )	Z 10 kHz (m $\Omega$ )	CATALOGUE NUMBER 2222 ... ..
200	<b>330</b>	<b>22 × 30</b>	<b>2230</b>	1.08	0.66	450	500	<b>159 52331</b>
	390	22 × 35	2235	1.23	0.78	380	470	159 42391
	390	25 × 30	2530	1.23	0.78	390	470	159 52391
	<b>470</b>	<b>22 × 40</b>	<b>2240</b>	1.37	0.94	320	400	<b>159 32471</b>
	470	30 × 25	3025	1.27	0.94	370	400	159 52471
	560	25 × 35	2535	1.50	1.12	280	390	159 42561
	560	30 × 30	3030	1.52	1.12	290	390	159 52561
	<b>680</b>	<b>25 × 45</b>	<b>2545</b>	1.82	1.36	230	340	<b>159 42681</b>
	680	30 × 30	3030	1.59	1.36	260	340	159 52681
	680	35 × 25	3525	1.44	1.36	300	340	159 62681
	820	25 × 50	2550	2.04	1.64	190	240	159 32821
	820	30 × 35	3035	1.83	1.64	210	240	159 42821
	820	35 × 30	3530	1.77	1.64	230	240	159 52821
	<b>1000</b>	<b>30 × 45</b>	<b>3045</b>	2.23	2.00	170	225	<b>159 42102</b>
	1000	35 × 35	3535	2.04	2.00	190	225	159 52102
	1200	30 × 50	3050	2.47	2.40	140	190	159 42122
	1200	35 × 35	3535	2.07	2.40	180	190	159 52122
	<b>1500</b>	<b>35 × 45</b>	<b>3545</b>	2.56	3.00	130	155	<b>159 52152</b>
1800	35 × 50	3550	2.80	3.60	120	130	159 52182	

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$U_R$ (V)	$C_R$ 100 Hz ( $\mu$ F)	NOMINAL CASE SIZE $\varnothing D \times L$ (mm)	CASE CODE	$I_R$ 120 Hz 105 °C (A)	$I_{L5}$ 5 min (mA)	TYP. ESR 100 Hz <sup>(1)</sup> (m $\Omega$ )	Z 10 kHz (m $\Omega$ )	CATALOGUE NUMBER 2222 ... ..
250	<b>220</b>	<b>22 × 30</b>	<b>2230</b>	0.90	0.55	540	700	<b>159 43221</b>
	220	25 × 25	2525	0.90	0.55	560	700	159 53221
	270	22 × 35	2235	1.07	0.67	440	560	159 43271
	270	25 × 30	2530	1.08	0.67	450	560	159 53271
	270	30 × 25	3025	1.08	0.67	470	560	159 63271
	<b>330</b>	<b>22 × 40</b>	<b>2240</b>	1.20	0.82	360	430	<b>159 33331</b>
	330	25 × 30	2530	1.21	0.82	380	430	159 43331
	330	30 × 25	3025	1.19	0.82	410	430	159 53331
	390	25 × 35	2535	1.39	0.97	330	410	159 43391
	390	30 × 30	3030	1.41	0.97	330	410	159 53391
	<b>470</b>	<b>25 × 40</b>	<b>2540</b>	1.58	1.17	270	400	<b>159 33471</b>
	470	30 × 30	3030	1.48	1.17	330	400	159 43471
	470	35 × 25	3525	1.37	1.17	330	400	159 53471
	560	25 × 45	2545	1.78	1.40	240	310	159 43561
	560	30 × 35	3035	1.71	1.40	270	310	159 53561
	560	35 × 30	3530	1.67	1.40	260	310	159 63561
	<b>680</b>	<b>30 × 40</b>	<b>3040</b>	1.93	1.70	210	260	<b>159 43681</b>
	680	35 × 35	3535	1.92	1.70	210	260	159 53681
	820	30 × 45	3045	2.16	2.05	180	210	159 43821
	820	35 × 35	3535	1.97	2.05	200	210	159 53821
	820	35 × 40	3540	2.16	2.05	180	210	159 63821
	<b>1000</b>	<b>35 × 40</b>	<b>3540</b>	2.22	2.50	170	180	<b>159 53102</b>
	1000	35 × 45	3545	2.41	2.50	150	180	159 63102
	1200	35 × 45	3545	2.46	3.00	150	160	159 43122
	1200	35 × 50	3550	2.65	3.00	130	160	159 53122

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U <sub>R</sub> (V)	C <sub>R</sub> 100 Hz (μF)	NOMINAL CASE SIZE ∅D × L (mm)	CASE CODE	I <sub>R</sub> 120 Hz 105 °C (A)	I <sub>L5</sub> 5 min (mA)	TYP. ESR 100 Hz <sup>(1)</sup> (mΩ)	Z 10 kHz (mΩ)	CATALOGUE NUMBER 2222 ... ..
400	68	22 × 25	2225	0.51	0.27	1520	1950	159 56689
	82	22 × 30	2230	0.60	0.33	1200	1520	159 46829
	82	25 × 25	2525	0.60	0.33	1220	1520	159 56829
	<b>100</b>	<b>22 × 35</b>	<b>2235</b>	0.69	0.40	990	1240	<b>159 46101</b>
	100	25 × 30	2530	0.70	0.40	990	1240	159 56101
	120	22 × 35	2235	0.76	0.48	840	1100	159 46121
	120	25 × 30	2530	0.76	0.48	840	1100	159 56121
	120	30 × 25	3025	0.77	0.48	860	1100	159 66121
	<b>150</b>	<b>22 × 40</b>	<b>2240</b>	0.86	0.60	820	860	<b>159 36151</b>
	150	25 × 35	2535	0.89	0.60	670	860	159 46151
	150	30 × 30	3030	0.92	0.60	670	860	159 56151
	180	25 × 40	2540	1.01	0.72	560	700	159 36181
	180	30 × 30	3030	0.99	0.72	580	700	159 46181
	180	35 × 25	3525	0.96	0.72	620	700	159 56181
	<b>220</b>	<b>25 × 45</b>	<b>2545</b>	1.15	0.88	460	590	<b>159 46221</b>
	220	30 × 35	3035	1.15	0.88	480	590	159 56221
	220	35 × 30	3530	1.14	0.88	490	590	159 66221
	270	25 × 50	2550	1.31	1.08	380	550	159 46271
	270	30 × 40	3040	1.30	1.08	390	550	159 56271
	270	35 × 30	3530	1.21	1.08	420	550	159 66271
	<b>330</b>	<b>30 × 45</b>	<b>3045</b>	1.47	1.32	320	450	<b>159 56331</b>
	330	35 × 35	3535	1.40	1.32	340	450	159 66331
	390	30 × 50	3050	1.63	1.56	280	410	159 46391
	390	35 × 40	3540	1.57	1.56	290	410	159 56391
	<b>470</b>	<b>35 × 45</b>	<b>3545</b>	1.72	1.88	240	330	<b>159 56471</b>
	560	35 × 50	3550	1.84	2.24	210	280	159 56561

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$U_R$ (V)	$C_R$ 100 Hz ( $\mu$ F)	NOMINAL CASE SIZE $\varnothing D \times L$ (mm)	CASE CODE	$I_R$ 120 Hz 105 °C (A)	$I_{L5}$ 5 min (mA)	TYP. ESR 100 Hz <sup>(1)</sup> (m $\Omega$ )	Z 10 kHz (m $\Omega$ )	CATALOGUE NUMBER 2222 ... ..
450	56	22 × 25	2225	0.48	0.25	1630	1880	159 57569
	<b>68</b>	<b>22 × 30</b>	<b>2230</b>	0.56	0.30	1280	1530	<b>159 47689</b>
	68	25 × 25	2525	0.56	0.30	1290	1530	159 57689
	82	22 × 35	2235	0.64	0.36	1060	1290	159 57829
	<b>100</b>	<b>22 × 40</b>	<b>2240</b>	0.74	0.45	870	1050	<b>159 37101</b>
	100	25 × 30	2530	0.71	0.45	890	1050	159 47101
	100	30 × 25	3025	0.73	0.45	910	1050	159 57101
	120	25 × 35	2535	0.82	0.54	730	885	159 57121
	<b>150</b>	<b>25 × 40</b>	<b>2540</b>	0.95	0.67	590	705	<b>159 47151</b>
	150	30 × 30	3030	0.93	0.67	610	705	159 57151
	150	35 × 25	3525	0.91	0.67	650	705	159 67151
	180	25 × 45	2545	1.07	0.81	490	605	159 47181
	180	30 × 35	3035	1.06	0.81	510	605	159 57181
	<b>220</b>	<b>30 × 40</b>	<b>3040</b>	1.21	0.99	420	525	<b>159 47221</b>
	220	35 × 30	3530	1.14	0.99	450	525	159 57221
	270	30 × 45	3045	1.37	1.21	340	450	159 47271
	270	35 × 35	3535	1.32	1.21	370	450	159 57271
	<b>330</b>	<b>30 × 50</b>	<b>3050</b>	1.54	1.48	290	390	<b>159 47331</b>
	330	35 × 40	3540	1.49	1.48	300	390	159 57331
	390	35 × 45	3545	1.61	1.75	260	340	159 57391
<b>470</b>	<b>35 × 50</b>	<b>3550</b>	1.72	2.11	220	290	<b>159 57471</b>	

**Note**

- ESR at 120 Hz is approximately  $0.95 \times$  ESR 100 Hz.



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**Additional electrical data**

PARAMETER	CONDITIONS	VALUE
<b>Voltage</b>		
Surge voltage for short periods	≥400 V versions	$U_S = 1.1 \times U_R$
	≤250 V versions	$U_S = 1.15 \times U_R$
Reverse voltage		not allowed
<b>Current</b>		
Leakage current	after 5 minutes at $U_R$	$I_{L5} \leq 0.01 C_R \times U_R$
<b>Inductance</b>		
Equivalent series inductance (ESL)	all case sizes	typ. 19 nH
		max. 25 nH
<b>Dissipation factor</b>		
Tangent of loss angle (120 Hz)	all types	$\tan \delta \leq 0.15$

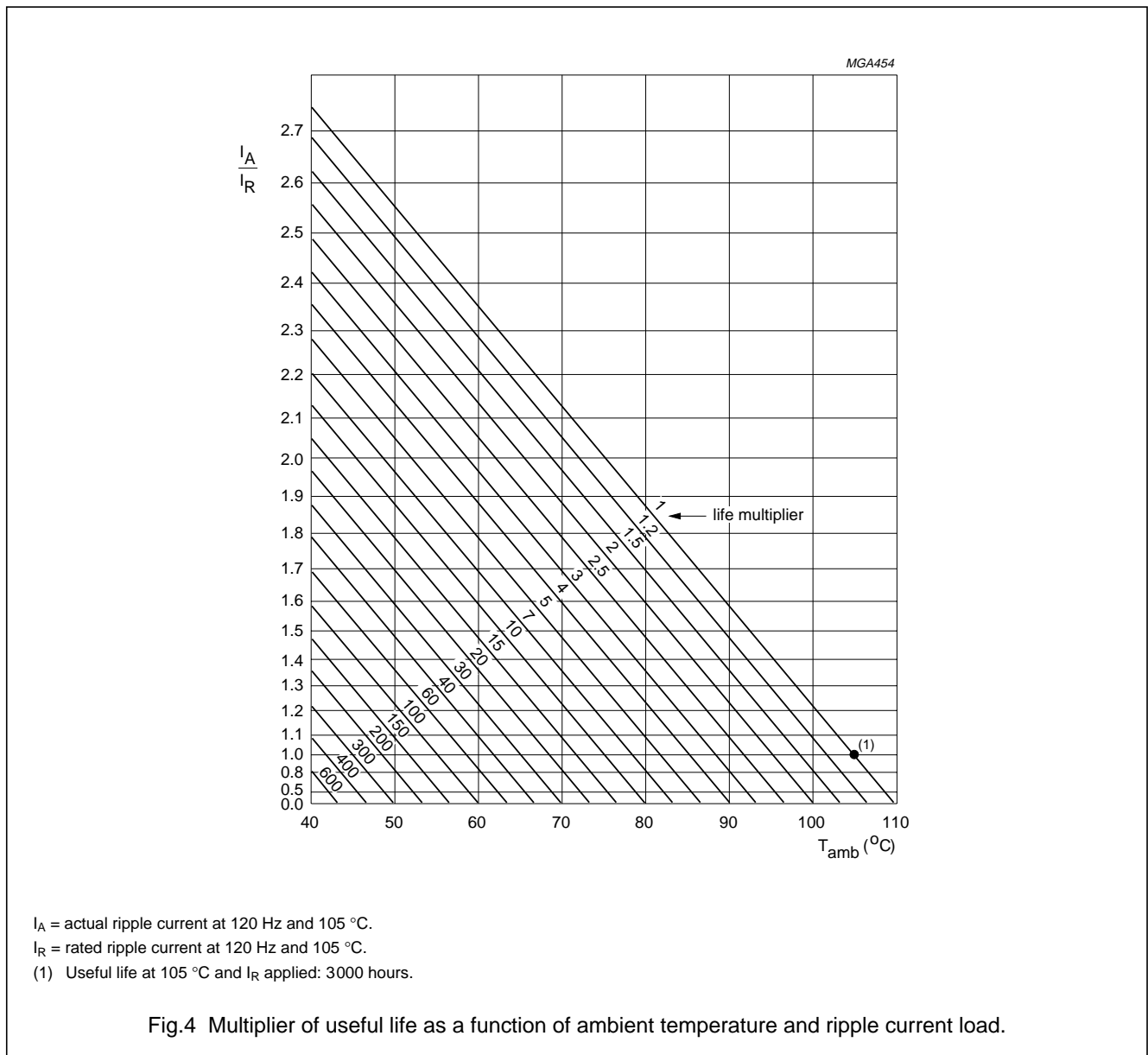
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**RIPPLE CURRENT AND USEFUL LIFE**

**Table 3** Multiplier of ripple current ( $I_R$ ) as a function of frequency

FREQUENCY (Hz)	$I_R$ MULTIPLIER
50	0.9
100	0.95
120	1.0
200	1.15
1000	1.3
$\geq 10000$	1.4



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### SPECIFIC TESTS AND REQUIREMENTS

General tests and requirements are specified in this handbook, Section "Tests and Requirements".

**Table 4** Test procedures and requirements

TEST		PROCEDURE (quick reference)	REQUIREMENTS
NAME OF TEST	REFERENCE		
Endurance	IEC 384-4/ CECC 30300 subclause 4.13	$T_{amb} = 105\text{ °C}$ ; $U_R$ applied; 2000 hours	$\Delta C/C: \pm 10\%$ $\tan \delta \leq 1.3 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$
Load life		$T_{amb} = 105\text{ °C}$ ; $U_R$ and $I_R$ applied; 2000 hours	$\Delta C/C: \pm 20\%$ $\tan \delta \leq 2 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$
Useful life	CECC 30301 subclause 1.8.1	$T_{amb} = 105\text{ °C}$ ; $U_R$ and $I_R$ applied; 3000 hours	$\Delta C/C: \pm 30\%$ $\tan \delta \leq 3 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$ total failure percentage: $\leq 3\%$
Shelf life (storage at high temperature)	IEC 384-4/ CECC 30300 subclause 4.17	$T_{amb} = 105\text{ °C}$ ; no voltage applied; 1000 hours  after test: $U_R$ to be applied for 30 minutes, 24 to 48 hours before measurement	$\Delta C/C: \pm 15\%$ $\tan \delta \leq 1.5 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$

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