

Aluminum Capacitors Power Ultra Long Life Snap-In

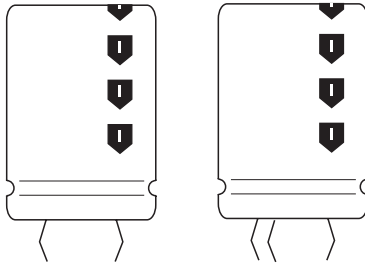


Fig.1 Component outlines.



QUICK REFERENCE DATA		
DESCRIPTION	VALUE	
Nominal case size ($\varnothing D \times L$ in mm)	22 \times 25 to 35 \times 60	
Rated capacitance range (E6/E12 series), C_R	56 to 1800 μF	
Tolerance on C_R	$\pm 20\%$	
Rated voltage range, U_R	200 V, 250 V	400 V, 450 V
Category temperature range	-40 to +105 $^{\circ}C$	-25 to +105 $^{\circ}C$
Endurance test at 105 $^{\circ}C$	2000 hours	
Load life at 105 $^{\circ}C$	2000 hours	
Useful life at 105 $^{\circ}C$	5000 hours	
Useful life at 40 $^{\circ}C$ and $1.6 \times I_R$ applied	500000 hours	
Shelf life at 0 V, 105 $^{\circ}C$	1000 hours	
Based on sectional specification	IEC 60384-4/EN130300	
Climatic category IEC 60068	40/105/56	25/105/56

FEATURES

- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Large types, very small dimensions, cylindrical aluminum case, insulated with a blue sleeve
- Low ESR, high ripple current capability
- Useful life: 5 000 hours at 105 $^{\circ}C$
- Keyed polarity version available.

APPLICATIONS

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

MARKING

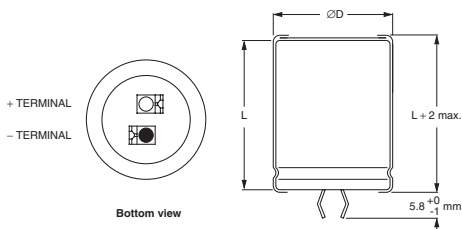
The capacitors are marked (where possible) with the following information:

- Rated capacitance (in μF).
- Tolerance code 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.

C_R (μF)	U_R (V)			
	200	250	400	450
56	-	-	-	22 \times 25
68	-	-	22 \times 25	22 \times 30/25 \times 25
82	-	-	22 \times 30	22 \times 35
	-	-	25 \times 25	-
100	-	-	22 \times 35	22 \times 40
	-	-	25 \times 30	25 \times 30/30 \times 25
120	-	-	22 \times 35	-
	-	-	25 \times 30	25 \times 35
	-	-	30 \times 25	-
150	-	-	22 \times 40	25 \times 40
	-	-	25 \times 35	30 \times 30
	-	-	30 \times 30	35 \times 25
180	-	-	25 \times 40	25 \times 45
	-	-	30 \times 30	30 \times 35
	-	-	35 \times 25	-

SELECTION CHART FOR C_R , U_R AND RELEVANT NOMINAL CASE SIZES ($\varnothing D \times L$ in mm)				
C_R (μF)	U_R (V)			
	200	250	400	450
220	-	22 x 30	25 x 45	30 x 40
	-	25 x 25	30 x 35	35 x 30
	-	-	35 x 30	-
270	-	22 x 35	25 x 50	30 x 45
	-	25 x 30	30 x 40	35 x 35
	-	30 x 25	35 x 30	-
330	22 x 30	22 x 40	30 x 45	30 x 50
	-	25 x 30/30 x 25	35 x 35	35 x 40
390	22 x 35	25 x 35	30 x 50	35 x 45
	25 x 30	30 x 30	35 x 40	-
470	22 x 40	25 x 40	35 x 45	35 x 50
	30 x 25	30 x 30/35 x 25	-	-
560	-	25 x 45	35 x 50	35 x 60
	25 x 35	30 x 35	-	-
	30 x 30	35 x 30	-	-
680	25 x 45	30 x 40	35 x 60	-
	30 x 30	35 x 35	-	-
	35 x 25	-	-	-
820	25 x 50	30 x 45	-	-
	30 x 35	35 x 35	-	-
	35 x 30	35 x 40	-	-
1000	30 x 45	35 x 40	-	-
	35 x 35	35 x 45	-	-
1200	30 x 50	35 x 45	-	-
	35 x 35	35 x 50	-	-
1500	35 x 45	-	-	-
1800	35 x 50	-	-	-

DIMENSIONS in millimeters AND AVAILABLE FORMS
TWO TERMINAL SNAP-IN



The minus terminal can be marked with a black dot or with an imprinted '−' sign.

Fig.2 Two terminal snap-in.

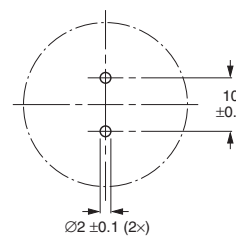
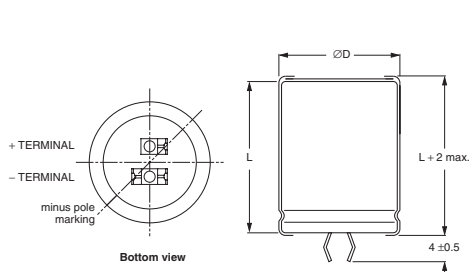


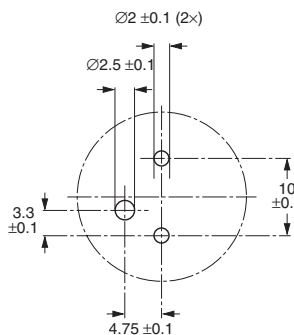
Fig.3 Mounting hole diagram.

THREE TERMINAL SNAP-IN



The negative terminal has **TWO** pins which are **BOTH** electrically connected.

Fig.4 Three terminal snap-in.



The 10 mm spacing of the 2 pin snap-in is used as the base layout and a third hole is added.

The third hole is closer to the negative primary hole so that polarization is always maintained, together with added mechanical stability.

Fig.5 Mounting hole diagram.



Table 1

DIMENSIONS in millimeters, MASS AND PACKAGING QUANTITIES					
NOMINAL CASE SIZE ØD × L	ØD _{max}	L _{max}	MASS (g)	PACKAGING QUANTITIES (units per box)	CARDBOARD BOX DIMENSIONS L × W × H
22 × 25	23	27	≈12	100	260 × 250 × 39
22 × 30	23	32	≈16	100	260 × 250 × 44
22 × 35	23	37	≈20	100	260 × 250 × 49
22 × 40	23	42	≈23	100	260 × 250 × 54
25 × 25	26	27	≈20	100	290 × 280 × 39
25 × 30	26	32	≈22	100	290 × 280 × 44
25 × 35	26	37	≈24	100	290 × 280 × 49
25 × 40	26	42	≈27	100	290 × 280 × 54
25 × 45	26	47	≈32	100	290 × 280 × 59
25 × 50	26	52	≈38	100	290 × 280 × 64
30 × 25	31	27	≈25	100	340 × 330 × 39
30 × 30	31	32	≈30	100	340 × 330 × 44
30 × 35	31	37	≈35	100	340 × 330 × 49
30 × 40	31	42	≈40	100	340 × 330 × 54
30 × 45	31	47	≈45	100	340 × 330 × 59
30 × 50	31	52	≈50	100	340 × 330 × 64
35 × 25	36	27	≈33	50	390 × 198 × 39
35 × 30	36	32	≈40	50	390 × 198 × 44
35 × 35	36	37	≈48	50	390 × 198 × 49
35 × 40	36	42	≈55	50	390 × 198 × 54
35 × 45	36	47	≈63	50	390 × 198 × 59
35 × 50	36	52	≈72	50	390 × 198 × 64
35 × 60	36	62	≈84	50	390 × 198 × 74

ELECTRICAL DATA	
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./max. equivalent series resistance at 100 Hz; note 1
Z	typ./max. impedance at 10 kHz

ORDERING EXAMPLES

Electrolytic capacitor 159 series

1000 µF/200 V; ±20%

Nominal case size: Ø30 × 45 mm

2-terminal snap-in:

Catalog number: 2222 159 42102.

3-terminal snap-in:

Catalog number: 2222 159 22102.

Note

- ESR at 120 Hz is approximately 0.95 × ESR 100 Hz.
- Unless otherwise specified, all electrical values in Table 2 apply at T_{amb} = 20 °C, P = 86 to 106 kPa, RH = 45 to 75%.

Table 2

ELECTRICAL DATA AND ORDERING INFORMATION										
U _R (V)	C _R 100 Hz (µF)	NOMINAL CASE SIZE ØD × L (mm)	I _R 120 Hz 105 °C (A)	I _{L5} 5 min (mA)	TYP. ESR 100 Hz ⁽¹⁾ (mΩ)	MAX. ESR 100 Hz ⁽¹⁾ (mΩ)	TYP. Z 10 kHz (mΩ)	MAX. Z 10 kHz (mΩ)	CATALOG NUMBER 2222 159	
									2-TERM.	3-TERM.
200	330	22 × 30	1.08	0.66	450	730	300	500	52331	72331
	390	22 × 35	1.23	0.78	380	610	280	470	42391	22391
	390	25 × 30	1.23	0.78	380	610	280	470	52391	72391
	470	22 × 40	1.37	0.94	300	505	240	400	32471	12471
	470	30 × 25	1.27	0.94	300	505	240	400	52471	72471
	560	25 × 35	1.50	1.12	260	425	235	390	42561	22561
	560	30 × 30	1.52	1.12	260	425	235	390	52561	72561
	680	25 × 45	1.82	1.36	210	350	205	340	42681	22681



ELECTRICAL DATA AND ORDERING INFORMATION											
U _R (V)	C _R 100 Hz (μF)	NOMINAL CASE SIZE ØD × L (mm)	I _R 120 Hz 105 °C (A)	I _{L5} 5 min (mA)	TYP. ESR 100 Hz ⁽¹⁾ (mΩ)	MAX. ESR 100 Hz ⁽¹⁾ (mΩ)	TYP. Z 10 kHz (mΩ)	MAX. Z 10 kHz (mΩ)	CATALOG NUMBER 2222 159		
									2-TERM.	3-TERM.	
200	680	30 × 30	1.59	1.36	210	350	205	340	52681	72681	
	680	35 × 25	1.44	1.36	210	350	205	340	62681	82681	
	820	25 × 50	2.04	1.64	180	290	145	240	32821	12821	
	820	30 × 35	1.83	1.64	180	290	145	240	42821	22821	
	820	35 × 30	1.77	1.64	180	290	145	240	52821	72821	
	1000	30 × 45	2.23	2.00	150	235	135	225	42102	22102	
	1000	35 × 35	2.04	2.00	150	235	135	225	52102	72102	
	1200	30 × 50	2.47	2.40	130	210	115	190	42122	22122	
	1200	35 × 35	2.07	2.40	130	210	115	190	52122	72122	
	1500	35 × 45	2.56	3.00	100	170	95	155	52152	72152	
	1800	35 × 50	2.80	3.60	90	150	80	130	52182	72182	
	250	220	22 × 30	1.00	0.55	540	1080	420	700	43221	23221
		220	25 × 25	1.00	0.55	540	1080	420	700	53221	73221
		270	22 × 35	1.07	0.67	440	880	335	560	43271	23271
270		25 × 30	1.08	0.67	440	880	335	560	53271	73271	
270		30 × 25	1.08	0.67	440	880	335	560	63271	83271	
330		22 × 40	1.20	0.82	360	720	255	430	33331	13331	
330		25 × 30	1.21	0.82	360	720	255	430	43331	23331	
330		30 × 25	1.19	0.82	360	720	255	430	53331	73331	
390		25 × 35	1.39	0.97	330	610	245	410	43391	23391	
390		30 × 30	1.41	0.97	330	610	245	410	53391	73391	
470		25 × 40	1.58	1.17	270	505	240	400	33471	13471	
470		30 × 30	1.57	1.17	270	505	240	400	43471	23471	
470		35 × 25	1.37	1.17	270	505	240	400	53471	73471	
560		25 × 45	1.78	1.40	230	425	185	310	43561	23561	
560		30 × 35	1.71	1.40	230	425	185	310	53561	73561	
560		35 × 30	1.67	1.40	230	425	185	310	63561	83561	
680		30 × 40	1.93	1.70	210	350	155	260	43681	23681	
680		35 × 35	1.92	1.70	210	350	155	260	53681	73681	
820		30 × 45	2.16	2.05	180	290	125	210	43821	23821	
820		35 × 35	1.97	2.05	180	290	125	210	53821	73821	
820		35 × 40	2.16	2.05	180	290	125	210	63821	83821	
1000		35 × 40	2.22	2.50	140	235	105	180	53102	73102	
1000		35 × 45	2.41	2.50	140	235	105	180	63102	83102	
1200		35 × 45	2.46	3.00	130	200	95	160	43122	23122	
1200		35 × 50	2.65	3.00	130	200	95	160	53122	73122	
400		68	22 × 25	0.51	0.27	1600	3200	1170	1950	56689	76689
		82	22 × 30	0.60	0.33	1200	2400	910	1520	46829	26829
		82	25 × 25	0.60	0.33	1200	2400	910	1520	56829	76829
	100	22 × 35	0.69	0.40	990	1980	740	1240	46101	26101	
	100	25 × 30	0.70	0.40	990	1980	740	1240	56101	76101	
	120	22 × 35	0.76	0.48	800	1600	660	1100	46121	26121	
	120	25 × 30	0.76	0.48	800	1600	660	1100	56121	76121	
	120	30 × 25	0.77	0.48	800	1600	660	1100	66121	86121	
	150	22 × 40	0.86	0.60	700	1400	510	860	36151	16151	
	150	25 × 35	0.89	0.60	700	1400	510	860	46151	26151	
	150	30 × 30	0.92	0.60	700	1400	510	860	56151	76151	
	180	25 × 40	1.01	0.72	590	1170	420	700	36181	16181	
	180	30 × 30	0.99	0.72	590	1170	420	700	46181	26181	
	180	35 × 25	0.96	0.72	590	1170	420	700	56181	76181	
	220	25 × 45	1.15	0.88	470	940	350	590	46221	26221	
	220	30 × 35	1.15	0.88	470	940	350	590	56221	76221	
	220	35 × 30	1.14	0.88	470	940	350	590	66221	86221	
	270	25 × 50	1.31	1.08	380	760	330	550	46271	26271	
	270	30 × 40	1.30	1.08	380	760	330	550	56271	76271	
	270	35 × 30	1.21	1.08	380	760	330	550	66271	86271	
	330	30 × 45	1.47	1.32	320	640	270	450	56331	76331	
	330	35 × 35	1.40	1.32	320	640	270	450	66331	86331	
	390	30 × 50	1.63	1.56	270	540	240	410	46391	26391	
	390	35 × 40	1.57	1.56	270	540	240	410	56391	76391	
	470	35 × 45	1.72	1.88	230	450	200	330	56471	76471	
	560	35 × 50	1.84	2.24	210	420	170	280	56561	76561	
	680	35 × 60	2.24	2.72	180	350	130	230	56681	76681	



ELECTRICAL DATA AND ORDERING INFORMATION										
U _R (V)	C _R 100 Hz (μF)	NOMINAL CASE SIZE ∅D × L (mm)	I _R 120 Hz 105 °C (A)	I _{L5} 5 min (mA)	TYP. ESR 100 Hz ⁽¹⁾ (mΩ)	MAX. ESR 100 Hz ⁽¹⁾ (mΩ)	TYP. Z 10 kHz (mΩ)	MAX. Z 10 kHz (mΩ)	CATALOG NUMBER 2222 159	
									2-TERM.	3-TERM.
450	56	22 × 25	0.48	0.25	1600	3200	1120	1880	57569	77569
	68	22 × 30	0.56	0.30	1200	2400	910	1530	47689	27689
	68	25 × 25	0.56	0.30	1200	2400	910	1530	57689	77689
	82	22 × 35	0.64	0.36	1100	2200	770	1290	57829	77829
	100	22 × 40	0.74	0.45	900	1800	630	1050	37101	17101
	100	25 × 30	0.71	0.45	900	1800	630	1050	47101	27101
	100	30 × 25	0.73	0.45	900	1800	630	1050	57101	77101
	120	25 × 35	0.82	0.54	750	1500	530	885	57121	77121
	150	25 × 40	0.95	0.67	600	1200	420	705	47151	27151
	150	30 × 30	0.93	0.67	600	1200	420	705	57151	77151
	150	35 × 25	0.91	0.67	600	1200	420	705	67151	87151
	180	25 × 45	1.07	0.81	500	1000	360	605	47181	27181
	180	30 × 35	1.06	0.81	500	1000	360	605	57181	77181
	220	30 × 40	1.21	0.99	370	740	310	525	47221	27221
	220	35 × 30	1.14	0.99	370	740	310	525	57221	77221
	270	30 × 45	1.37	1.21	350	700	270	450	47271	27271
	270	35 × 35	1.32	1.21	350	700	270	450	57271	77271
	330	30 × 50	1.54	1.48	300	600	230	390	47331	27331
	330	35 × 40	1.49	1.48	300	600	230	390	57331	77331
	390	35 × 45	1.61	1.75	250	500	200	340	57391	77391
470	35 × 50	1.72	2.11	210	420	170	290	57471	77471	
560	35 × 60	2.11	2.52	190	380	140	240	57561	77561	

Note

- ESR at 120 Hz is approximately 0.95 × ESR 100 Hz.

ADDITIONAL ELECTRICAL DATA		
PARAMETER	CONDITIONS	VALUE
Voltage		
Surge voltage	≥ 400 V versions	U _S = 1.1 × U _R
	≤ 250 V versions	U _S = 1.15 × U _R
Reverse voltage		≤ 1 V
Current		
Leakage current	after 5 minutes at U _R	I _{L5} ≤ 0.01 C _R × U _R
Inductance		
Equivalent series inductance (ESL)	all case sizes	typ. 19 nH
		max. 25 nH



RIPPLE CURRENT AND USEFUL LIFE

MGA 454

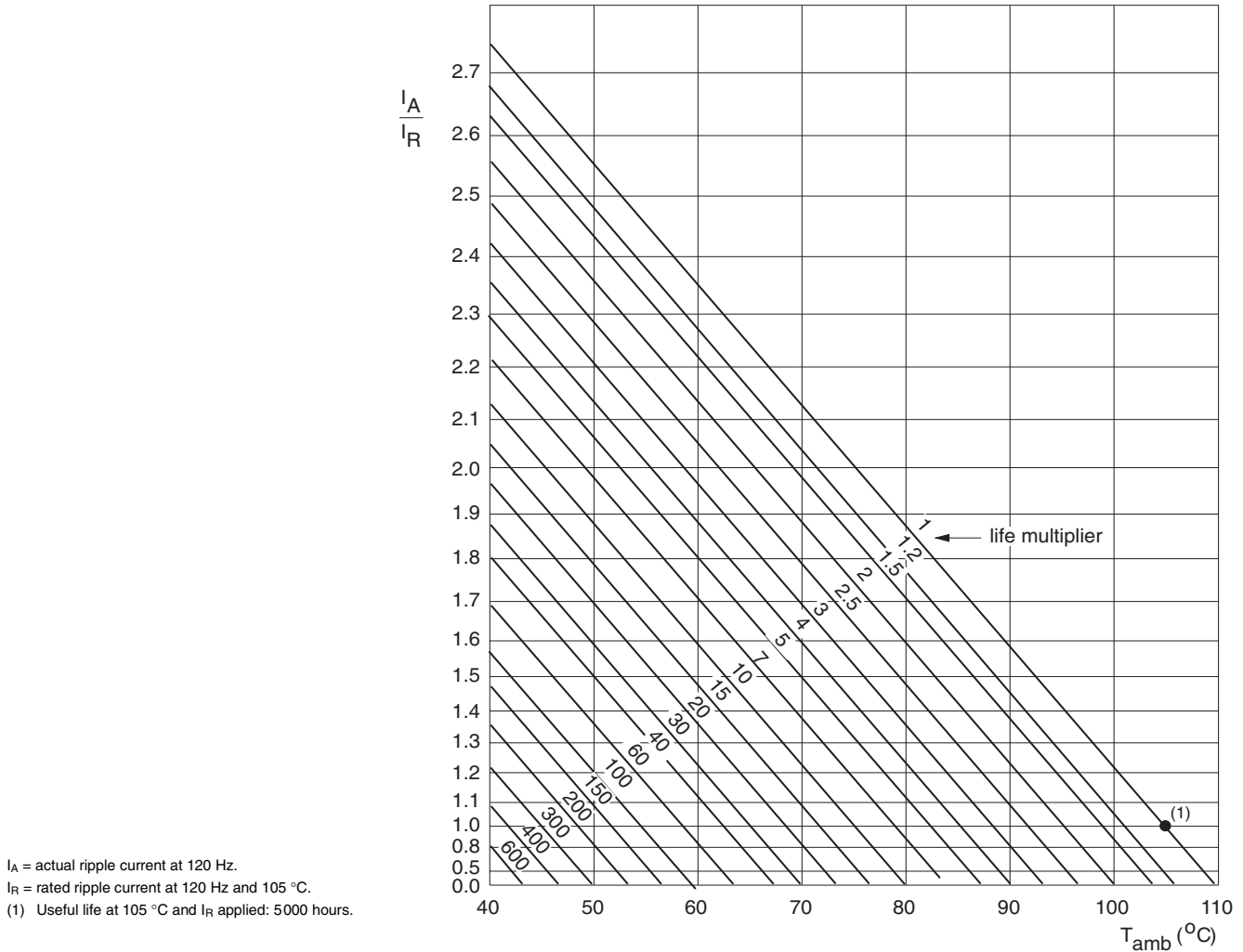


Fig.6 Multiplier of useful life as a function of ambient temperature and ripple current load.

Table 3

MULTIPLIER OF RIPPLE CURRENT (I_R) AS A FUNCTION OF FREQUENCY	
FREQUENCY (Hz)	I_R MULTIPLIER
50	0.90
100	0.95
120	1.00
200	1.15
1000	1.30
≥10000	1.40



Table 4

TEST PROCEDURES AND REQUIREMENTS			
TEST		PROCEDURE (quick reference)	REQUIREMENTS
NAME OF TEST	REFERENCE		
Endurance	IEC 60384-4/ EN130300 subclause 4.13	$T_{amb} = 105\text{ }^{\circ}\text{C}$; U_R applied; 2000 hours	$\Delta C/C: \pm 15\%$ $ESR \leq 1.3 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$
Load life		$T_{amb} = 105\text{ }^{\circ}\text{C}$; U_R and I_R applied; 2000 hours	$\Delta C/C: \pm 20\%$ $ESR \leq 2 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$
Useful life	CECC 30301 subclause 1.8.1	$T_{amb} = 105\text{ }^{\circ}\text{C}$; U_R and I_R applied; 5000 hours	$\Delta C/C: \pm 30\%$ $ESR \leq 3 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$ total failure percentage: $\leq 3\%$
Shelf life (storage at high temperature)	IEC 60384-4/ EN130300 subclause 4.17	$T_{amb} = 105\text{ }^{\circ}\text{C}$; no voltage applied; 1000 hours after test: U_R to be applied for 30 minutes, 24 to 48 hours before measurement	$\Delta C/C: \pm 15\%$ $ESR \leq 1.5 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$