Film Capacitors – Power Electronic Capacitors

General purpose applications

Series/Type:	**FilterCap MKD AC – Three phase**
Ordering code:	**B3237*E/F**
Date:	April 2025
Version:	03

Rated capacitance: 3 x 5 … 3 x 400 µF
Rated Voltage: 350 … 1415 V AC
RMS Voltage: 250 … 1000 V

Construction

- Metallized polypropylene film
- Aluminum can and top
- Filling material: Soft polyurethane resin (Non PCB)
- Diameter: 50/63.5/75/85/96/116/136 mm

Features

- Self-healing properties
- Low dissipation factor
- Overpressure disconnector
- Naturally air cooled (or forced air cooling)
- Protection Degree (indoor mounting)
    - IP00: B32375 and B32376 series
    - IP20: B32377 and B32378 series
- RoHS compatible
- UL Certified 🆄🅛

Application

- Input and output filters in inverter systems
- Filtering of harmonic distortion in power inverters

Terminals

- B32375E/F series: Fast-on terminals
- B32376E/F series: (M10) screw terminals
- B32377E/F series: (M5) clamp terminals Type A
- B32377E/F series: (M6) clamp terminals Type C
- B32378E/F series: (M5) clamp terminals Type D, Type E

Mounting

- Threaded stud on the bottom (M12)
- Optional (M16) for critical applications

Packing

- 50 mm diameter: 50 capacitors/box
- 63.5 mm diameter: 12 capacitors/box
- 75 mm diameter: 6 capacitors/box
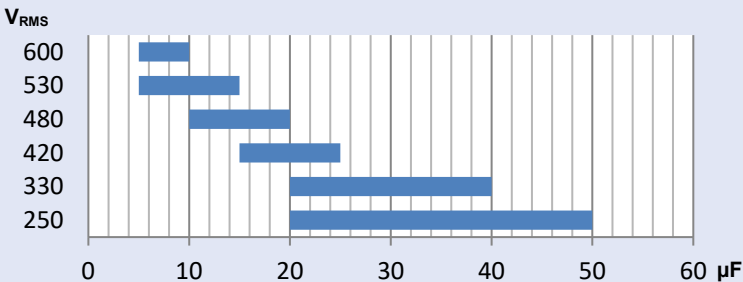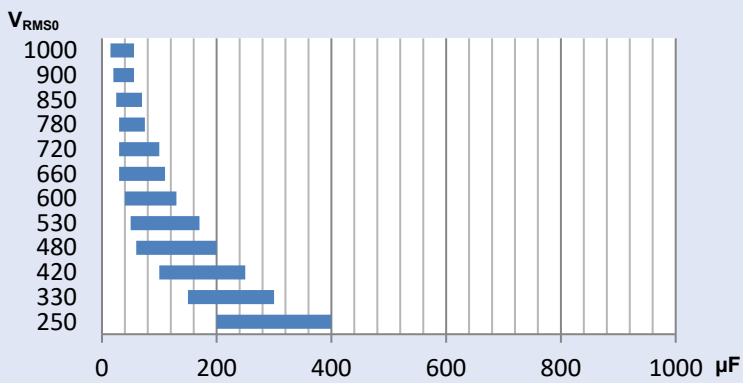- 85/96/116/136 mm diameter: 4 capacitors/box

B32375E/F   B32376E/F

B32377E/F   B32378E/F

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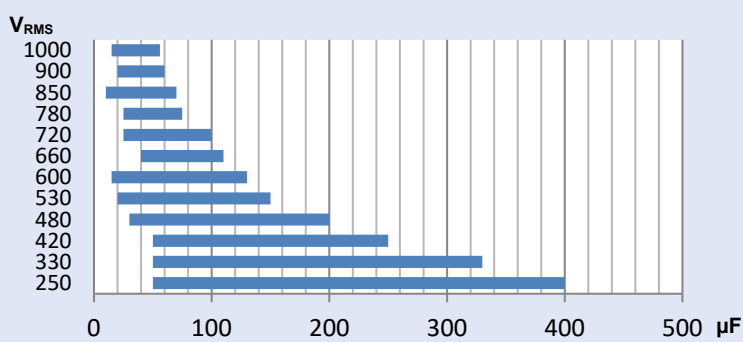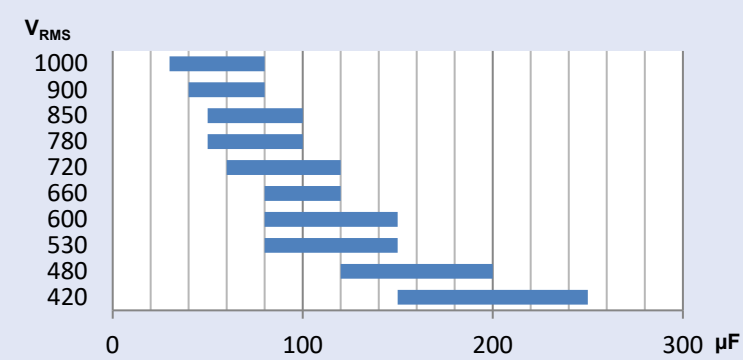
Specifications and characteristics

Rated capacitance C_R: 3 x 5 … 3 x 400 µF, Tolerance: ±5%

Technical data	
Type/series	**Voltage vs Capacitance**
B32375E/F **Fast-on terminals** **Delta connection,** **Partly upon request**	
B32376E/F **Screw terminals M10** **Delta connection** **Partly upon request**	
B32377E/F **Clamp terminals M5 & M6** **Delta connections** **Partly upon request**	
B32378E/F **Clamp terminals (M5)** **Star connection** **Partly upon request**	

Technical data and specifications

Reference standards	IEC 61071-2017, UL 810 5th, GB/T 17702-2021, RoHS compliance
Rated frequency f_R	50/60 Hz
Voltage V_{RMS} (line to line)	**Rated AC voltage V_N (line to line)**
250	350
330	460
420	590
480	680
530	750
600	850
660	935
720	1020
780	1100
850	1200
900	1270
1000	1415
Test data	
Voltage between terminals V_{TT}	2.15 • V_{RMS}, 2 s
Voltage between terminals and Case V_{TC}	4000 V AC, 10 s
Reliability data	
Lifetime expectancy (reference value)[1]	100 000 hours at +70 °C hotspot, rated voltage
Failure in time	100 FIT at 85°C hotspot, rated voltage
Climatic category 40/70/21 IEC60068-1	
Storage temperature T_{stg}	−40 ...+70 °C
Minimum operation ambient temperature T_{min}	−40 °C
Maximum operation ambient temperature T_{max}	+70 °C
Damp Heat Test T_{test}	21 days @ +40°C, 93% RH
Maximum hot spot temperature in capacitor T_{HS}	+85 °C
Max. permissible altitude	2000 m above sea level

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[1] Lifetime expectancy detail refer to Figure 10

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Mechanical characteristics	
Max. torque (for bottom stud)	M12: 12 Nm
	Optional M16 for critical application
Max. torque (for terminals)	B32376 (M10): 10 Nm
	B32377 Type A (M5): 2 Nm
	B32377 Type C (M6): 3.5 Nm
	B32378 (M5): 2 Nm
Max insertion and withdraw force (for fast-on terminal)	50 N
Installation position[2]	Vertical with terminals upright
Approvals	
B32375*, B32377 type A, series: **UL File no.: E487229, CCN:CYWT2/8**	UL 810, CSA C22.2, No 190, Max. 600 V_{RMS} (Line Voltage), 50/60Hz, "Protected", 10K AFC, max. +70 °C
B32377 type C:. **UL File no.: E487229, CCN:CYWT2/8**	UL 810, CSA C22.2, No 190, Max.1000 V_{RMS} (Line Voltage),50/60Hz, "Protected", 10K AFC, max. +70 °C

Structure of ordering code

First and second V_{RMS} figure

B3237　7　E　5　107　J　0　3　0

FilterCap MKD AC series

Terminal type:
5 = 6.3 mm x 0.8 mm (3x) fast-on terminals
6 = M10 (3x) screw terminals (delta connection)
7 = M5 (3x) clamp terminals (type A and B, delta connection)
7 = M6 (3x) clamp terminals (type C, delta connection)
8 = M5 (4x) clamp terminals (star connection)

Rev. status: any letter

Indicates accessories (any digit)

Coded capacitance value

Capacitance tolerance:
J = ±5%
K = ±10%

Rated capacitance:
$107 = 10 \times 10^7 \, pF = 100 \, \mu F$
$427 = 42 \times 10^7 \, pF = 420 \, \mu F$
$108 = 10 \times 10^8 \, pF = 1 \, mF$

1st figure V_{RMS}
2nd figure V_{RMS}

KLK2229-0-E

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[2] *Capacitors are designed to be mounted with terminals upright.* All tests during the approval of the series have been performed in vertical position. Capacitors *can be also installed in horizontal position, however, since it might have an impact in performance it is highly recommended by us and it is customer duty to do the assessment on the electrical and mechanical performance with the customer mechanical design, under specific customer working condition.*

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Electrical characteristics

B32375F series - fast-on terminals
UL certification (V_N / V_{RMS} line to line voltage)

V_N/V_{RMS} [3]	C_R	Ordering code	$I_{RMS,max}$ at 60°C [4]	$I_{RMS,max}$ at 70°C [5]	$\hat{I}$	I_s	R_{th} [6]	R_S [7]	Tanδ [8]	ESL [9]	D	H	Weight	Packing
V	µF		A	A	A	A	K/W	mΩ	×10⁻³	nH	mm	mm	kg	Unit
750/530	3 × 5	B32375F5505J030	15	11	330	900	7.8	4.2	1.5	150	50	127.5	0.31	50

B32376E series - M10 screw terminals
V_N / V_{RMS} line to line voltage

V_N/V_{RMS} [3]	C_R	Ordering code	$I_{RMS,max}$ at 60°C [4]	$I_{RMS,max}$ at 70°C [5]	$\hat{I}$	I_s	R_{th} [6]	R_S [7]	Tanδ [8]	ESL [9]	D	H	Weight	Packing
V	µF		A	A	A	A	K/W	mΩ	×10⁻³	nH	mm	mm	kg	Unit
750/530	3 × 100	B32376E5107J030	55	36	3950	11800	1.8	0.7	3.5	150	136	208	3.3	4
1020/720	3 × 100	B32376E7107J020	52 [10]	--	3200	9600	1.5	0.7	3.0	150	136	283	4.4	3

B32377E/F series - Clamp terminals
UL certification up to 1000 V_{RMS} (V_N / V_{RMS} line to line voltage)

V_N/V_{RMS} [3]	C_R	Ordering code	$I_{RMS,max}$ at 60°C [4]	$I_{RMS,max}$ at 70°C [5]	$\hat{I}$	I_s	R_{th} [6]	R_S [7]	Tanδ [8]	ESL [9]
V	µF		A	A	A	A	K/W	mΩ	×10⁻³	nH
460/330	3 × 50	B32377F3506J030	32	23	1500	4500	4.2	1.3	3.5	130
	3 × 60	B32377F3606J030	33	25	1300	4000	3.8	1.3	3.0	130
	3 × 70	B32377F3706J030	34	25	1500	4500	3.8	1.2	3.0	130
	3 ×100	B32377F3107J030	31	22	1400	4200	3.3	1.6	7.0	150
680/480	3 × 40	B32377F4406J080	32	22	1200	3600	3.8	1.3	3.0	130
	3 × 50	B32377F4506J080	29	20	1100	3300	3.4	1.8	3.5	150
	3 × 80	B32377F4806J080	33	22	1550	4650	2.7	1.4	6.0	150
	3 × 100	B32377F4107J080	44	27	1930	5790	2.3	0.9	6.0	130
	3 × 130	B32377E4137J081	52	34	2980	8900	1.9	0.6	5.5	130
	3 × 150	B32377E4157J081	50 [10]	--	2900	8700	1.9	0.7	7.0	130
	3 × 200	B32377E4207J081	59 [10]	--	4590	13700	1.7	0.5	7.5	130

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B32377E/F series - Clamp terminals

UL certification up to 1000 V_{RMS} (V_N / V_{RMS} line to line voltage)

V_N/V_{RMS} [3]	C_R	Ordering code	$I_{RMS,max}$ at 60°C [4]	$I_{RMS,max}$ at 70°C [5]	$\hat{I}$	I_s	R_{th} [6]	R_S [7]	Tanδ [8]	ESL [9]
V	μF		A	A	A	A	K/W	mΩ	×10⁻³	nH
750/530	3 × 20	B32377F5206J030	31	23	930	2700	4.2	1.4	2.0	130
	3 × 25	B32377F5256J030	34	25	980	2700	3.8	1.3	2.0	150
	3 × 30	B32377F5306J030	34	24	900	2700	3.5	1.4	2.5	150
	3 × 50	B32377F5506J031	42	29	1680	5000	2.8	1.0	2.5	100
	3 × 75	B32377E5756J031	56	38	2530	7500	2.2	0.5	3.5	100
	3 × 100	B32377E5107J031	47	29	2770	8300	2.0	0.8	5.0	100
	3 × 120	B32377E5127J031	60	38	3500	10500	1.7	0.6	3.0	130
	3 × 133	B32377E5137J331	61	39	3720	11100	1.7	0.5	5.0	130
850/600	3 × 15	B32377F6156J000	31	23	900	2700	4.2	1.4	2.5	150
1020/720	3 × 30	B32377F7306J021	45	30	1580	4700	2.8	0.8	2.5	100
1100/780	3 × 35	B32377E7356J080	45	30	2000	6000	2.2	0.9	2.0	130
	3 × 60	B32377E7606J080	51	29	2620	7860	1.7	0.8	2.5	150
	3 × 75	B32377E7756J080	52[10]	--	2760	8280	1.6	0.7	3.0	130
1200/850	3 × 42	B32377E8426J050	64	39	2580	7740	1.8	0.4	2.5	130
	3 × 55.8	B32377E8566J050	54	28	2630	7890	1.7	0.5	3.0	150
1415/1000	3 × 40	B32377E1406J000	51	28	1800	5600	1.6	0.9	2.0	150

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[3] V_N Rated AC Voltage (line to line) / V_{RMS} (line to line), complete explanation in the section Terms

[4] Max permissible $I_{RMS,max}$ current at +60 ºC for $T_{HS} \leqslant$ +85 ºC, $\Delta T_{max} \leqslant$ 25 K, considering a harmonic spectrum up to 10 kHz.

$I_{RMS,max}$ derating vs temperature refer to the *permissible current versus ambient temperature curve*

[5] Max permissible $I_{RMS,max}$ current at +70 ºC for $T_{HS} \leqslant$ +85 ºC, $\Delta T_{max} \leqslant$ 15 K, considering a harmonic spectrum up to 10 kHz.

　$I_{RMS,max}$ derating vs temperature refer to the *permissible current versus ambient temperature curve*

[6] Thermal resistance ambient to HS, considering natural convection (10 W/(m². K)), terminals without temperature fixation and bottom screw connected to a piece with big thermal inertia

[7] Series resistance -R_S- at 1 kHz is a typical value (only valid for low frequency range), model schematic refers to Figure 8

[8] Max tan δ at 1 kHz

[9] ESL at 1 MHz (typical value)

[10] Climatic category 40/60/21

Dimensions and Packing
B32377E/F series - Clamp terminals
UL certification up to 1000 V_{RMS} (V_N / V_{RMS} line to line voltage)

V_N/V_{RMS} [3]	C_R	Ordering code	D	H	Terminal	Weight	Packing
V	µF		mm	mm	type	kg	Unit
460/330	3 × 50	B32377F3506J030	75	163	A	0.8	6
	3 × 60	B32377F3606J030	75	200	A	1.0	6
	3 × 70	B32377F3706J030	75	200	A	1.0	6
	3 ×100	B32377F3107J030	75	275	A	1.4	6
680/480	3 × 40	B32377F4406J080	75	200	A	1.0	6
	3 × 50	B32377F4506J080	75	245	A	1.2	6
	3 × 80	B32377F4806J080	85	275	A	1.8	4
	3 × 100	B32377F4107J080	96	275	A	2.2	4
	3 × 130	B32377E4137J081	116	253	C	3.1	4
	3 × 150	B32377E4157J081	116	283	C	3.3	4
	3 × 200	B32377E4207J081	136	253	C	4.0	4
750/530	3 × 20	B32377F5206J030	75	163	A	0.8	6
	3 × 25	B32377F5256J030	75	200	A	1.0	6
	3 × 30	B32377F5306J030	75	230	A	1.2	6
	3 × 50	B32377F5506J031	96	200	A	1.7	4
	3 × 75	B32377E5756J031	116	208	C	2.6	4
	3 × 100	B32377E5107J031	116	238	C	2.9	4
	3 × 120	B32377E5127J031	136	238	C	3.8	4
	3 × 133	B32377E5137J331	136	253	C	4.0	4
850/600	3 × 15	B32377F6156J000	75	163	A	0.8	6
1020/720	3 × 30	B32377F7306J021	96	200	A	1.7	4
1100/780	3 × 35	B32377E7356J080	116	208	C	2.6	4
	3 × 60	B32377E7606J080	136	238	C	3.8	4
	3 × 75	B32377E7756J080	136	283	C	4.4	4
1200/850	3 × 42	B32377E8426J050	136	208	C	3.3	4
	3 × 55.8	B32377E8566J050	136	238	C	3.8	4
1415/1000	3 × 40	B32377E1406J000	136	283	C	4.4	4

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The electrical parameters of the types listed in the subsequent tables can be provided upon request.

B32375F series - fast-on terminals, parameters upon request
UL certification (V_N / V_{RMS} line to line voltage)

V_N/V_{RMS} [3]	C_R	Ordering code	D	H
V	µF		mm	mm
350/250	3×20	B32375F2206J050	50.0	127.5
	3×30	B32375F2306J050	63.5	127.5
	3×40	B32375F2406J050	63.5	127.5
	3×50	B32375F2506J050	63.5	150.5
460/330	3×20	B32375F3206J030	50.0	127.5
	3×30	B32375F3306J030	63.5	127.5
	3×40	B32375F3406J030	63.5	150.5
590/420	3×15	B32375F4156J020	63.5	127.5
	3×20	B32375F4206J020	63.5	127.5
	3×25	B32375F4256J020	63.5	150.5
680/480	3×10	B32375F4106J080	63.5	127.5
	3×15	B32375F4156J080	63.5	127.5
	3×20	B32375F4206J080	63.5	150.5
750/530	3×8	B32375F5805J030	63.5	127.5
	3×10	B32375F5106J030	63.5	127.5
	3×15	B32375F5156J030	63.5	150.5
850/600	3×5	B32375F6505J000	63.5	127.5
	3×10	B32375F6106J000	63.5	150.5

B32376E series - M10 screw terminals, parameters upon request
V_N / V_{RMS} line to line voltage

V_N/V_{RMS} [3]	C_R	Ordering code	D	H
V	µF		mm	mm
350/250	3×200	B32376E2207J050	116	208
	3×300	B32376E2307J050	116	238
	3×400	B32376E2407J050	136	238
460/330	3×150	B32376E3157J030	116	208
	3×200	B32376E3207J030	116	238
	3×300	B32376E3307J030	136	238

B32376E series - M10 screw terminals, parameters upon request
V_N / V_{RMS} line to line voltage

V_N/V_{RMS} [3] V	C_R μF	Ordering code	D mm	H mm
590/420	3×100	B32376E4107J020	116	208
	3×200	B32376E4207J020	136	238
	3×250	B32376E4257J020	136	253
680/480	3×60	B32376E4606J080	116	171
	3×150	B32376E4157J080	136	208
	3×200	B32376E4207J080	136	253
750/530	3×50	B32376E5506J030	116	171
	3×170	B32376E5177J030	136	283
850/600	3×40	B32376E6406J000	116	171
	3×100	B32376E6107J000	136	238
	3×130	B32376E6137J000	136	283
935/660	3×30	B32376E6306J060	116	171
	3×75	B32376E6756J060	116	238
	3×110	B32376E6117J060	136	283
1020/720	3×30	B32376E7306J020	116	208
	3×75	B32376E7756J020	136	238
1100/780	3×30	B32376E7306J080	116	208
	3×50	B32376E7506J080	136	208
	3×75	B32376E7756J080	136	283
1200/850	3×25	B32376E8256J050	116	208
	3×56	B32376E8566J050	136	253
	3×70	B32376E8706J050	136	283
1270/900	3×20	B32376E9206J000	116	208
	3×40	B32376E9406J000	136	238
	3×56	B32376E9566J000	136	283
1415/1000	3×15	B32376E1156J000	116	208
	3×30	B32376E1306J000	136	208
1415/1000	3×56	B32376E1566J000	136	283

B32377E/F series - Clamp terminals, parameters upon request
UL certification up to 1000 V_{RMS} (V_N / V_{RMS} line to line voltage)

V_N/V_{RMS} [3] V	C_R µF	Ordering code	D mm	H mm	Terminal type
350/250	3×60	B32377F2606J050	75	163	A
	3×70	B32377F2706J050	75	163	A
	3×84	B32377F2846J050	75	163	A
	3×100	B32377F2107J050	75	200	A
	3×150	B32377F2157J050	75	230	A
	3×160	B32377F2167J050	75	230	A
	3×200	B32377F2207J051	96	230	A
	3×250	B32377F2257J051	96	275	A
	3×300	B32377E2307J051	116	238	C
	3×330	B32377E2337J051	116	238	C
	3×400	B32377E2407J051	116	283	C
460/330	3×80	B32377F3806J030	75	230	A
	3×120	B32377F3127J030	85	245	A
	3×150	B32377F3157J030	96	245	A
	3×200	B32377E3207J031	116	238	C
	3×250	B32377E3257J031	116	283	C
	3×300	B32377E3307J031	136	238	C
	3×330	B32377E3337J031	136	238	C
590/420	3×50	B32377F4506J020	75	200	A
	3×60	B32377F4606J020	75	230	A
	3×70	B32377F4706J020	75	245	A
	3×80	B32377F4806J020	75	275	A
	3×100	B32377F4107J020	85	275	A
	3×150	B32377E4157J021	116	238	C
	3×200	B32377E4207J021	116	283	C
	3×250	B32377E4257J021	136	253	C
680/480	3×30	B32377F4306J080	75	200	A
	3×60	B32377F4606J080	75	275	A
680/480	3×70	B32377F4706J080	85	245	A
	3×74	B32377F4746J080	96	230	A
	3×138	B32377E4137J881	116	253	C
	3×170	B32377E4177J081	136	238	C

✦TDK

B32377E/F series - Clamp terminals, parameters upon request
UL certification up to 1000 V_{RMS} (V_N / V_{RMS} line to line voltage)

V_N/V_{RMS} [3] V	C_R µF	Ordering code	D mm	H mm	Terminal type
750/530	3×40	B32377F5406J030	75	275	A
	3×45	B32377F5456J030	75	275	A
	3×62	B32377E5626J031	116	208	C
	3×70	B32377E5706J031	116	208	C
	3×80	B32377E5806J031	136	208	C
	3×150	B32377E5157J031	136	283	C
850/600	3×20	B32377F6206J000	85	163	A
	3×25	B32377F6256J000	96	163	A
	3×30	B32377F6306J000	96	163	A
	3×38	B32377F6386J000	96	200	A
	3×50	B32377F6506J000	96	230	A
	3×70	B32377F6706J000	85	350	A
	3×83	B32377E6836J001	136	208	C
	3×90	B32377E6906J001	136	238	C
	3×100	B32377E6107J001	136	238	C
	3×130	B32377E6137J001	136	283	C
935/660	3×40	B32377E6406J060	116	208	C
	3×50	B32377E6506J060	116	238	C
	3×60	B32377E6606J060	116	253	C
	3×70	B32377E6706J060	116	283	C
	3×75	B32377E6756J060	116	283	C
	3×80	B32377E6806J060	116	283	C
	3×90	B32377E6906J060	136	253	C
	3x100	B32377E6107J060	136	253	C
	3x110	B32377E6117J060	136	283	C
1020/720	3×25	B32377F7256J021	96	200	A
	3×34	B32377F7346J021	96	230	A
	3×38	B32377F7386J020	116	208	C
	3×40	B32377E7406J020	116	208	C
	3×50	B32377E7506J020	116	238	C
	3×56	B32377E7566J020	116	253	C
	3×60	B32377E7606J020	116	283	C

B32377E/F series - Clamp terminals, parameters upon request
UL certification up to 1000 V_{RMS} (V_N / V_{RMS} line to line voltage)

V_N/V_{RMS} [3]	C_R	Ordering code	D	H	Terminal
V	µF		mm	mm	type
1020/720	3×65	B32377E7656J020	116	283	C
	3×75	B32377E7756J020	136	238	C
	3x100	B32377E7107J020	136	283	C
1100/780	3x25	B32377F7256J081	96	230	A
	3x29	B32377F7296J081	96	245	A
	3x30	B32377E7306J080	116	208	C
	3x40	B32377E7406J080	116	238	C
	3x47	B32377E7476J080	116	253	C
	3×50	B32377E7506J080	116	283	C
	3×56	B32377E7566J080	116	283	C
	3×70	B32377E7706J080	136	253	C
1200/850	3×10	B32377F8106J051	96	163	A
	3×15	B32377F8156J051	96	200	A
	3×20	B32377F8206J051	96	230	A
	3×25	B32377E8256J050	116	208	C
	3×31	B32377E8316J050	116	208	C
	3×35	B32377E8356J050	116	238	C
	3×60	B32377E8606J050	136	253	C
	3×70	B32377E8706J050	136	283	C
1270/900	3×20	B32377E9206J000	116	208	C
	3×25	B32377E9256J000	116	208	C
	3×30	B32377E9306J000	116	238	C
	3×35	B32377E9356J000	116	253	C
	3×40	B32377E9406J000	136	238	C
	3×45	B32377E9456J000	136	253	C
	3×50	B32377E9506J000	136	283	C
	3×56	B32377E9566J000	136	283	C
	3×60	B32377E9606J000	136	313	C
1415/1000	3×15	B32377E1156J000	116	208	C
	3×20	B32377E1206J000	116	208	C
	3×25	B32377E1256J000	116	253	C
	3×30	B32377E1306J000	136	238	C
	3×35	B32377E1356J000	136	253	C

B32377E/F series - Clamp terminals, parameters upon request
UL certification up to 1000 V_{RMS} (V_N / V_{RMS} line to line voltage)

V_N/V_{RMS} [3]	C_R	Ordering code	D	H	Terminal
V	µF		mm	mm	type
1415/1000	3×45	B32377E1456J000	136	283	C
	3×50	B32377E1506J000	136	313	C
	3×56	B32377E1566J000	136	358	C

B32378E series - Clamp terminals, parameters upon request
V_N / V_{RMS} line to line voltage

V_N/V_{RMS} [3]	C_R	Ordering code	D	H	Terminal
V	µF		mm	mm	type
590/420	3×150	B32378E4157J020	116	154	D
	3×200	B32378E4207J020	116	177	D
	3×250	B32378E4257J020	116	214	D
680/480	3×100	B32378E4127J080	116	154	D
	3×150	B32378E4157J080	116	154	D
	3×200	B32378E4207J080	116	214	D
750/530	3×80	B32378E5806J030	116	154	D
	3×100	B32378E5107J030	116	154	D
	3×120	B32378E5127J030	116	154	D
	3×150	B32378E5157J030	116	177	D
850/600	3×80	B32378E6806J000	116	154	D
	3×100	B32378E6107J000	116	154	D
	3×120	B32378E6127J000	116	177	D
	3×150	B32378E6157J000	116	214	D
935/660	3×80	B32378E6806J060	116	154	E
	3×100	B32378E6107J060	116	177	E
	3×120	B32378E6127J060	116	214	E
1020/720	3×60	B32378E7606J020	116	154	E
	3×70	B32378E7706J020	116	154	E
	3×80	B32378E7806J020	116	177	E
	3×100	B32378E7107J020	116	177	E
1020/720	3×120	B32378E7127J020	116	214	E
1100/780	3×50	B32378E7506J080	116	154	E
	3×60	B32378E7606J080	116	177	E
	3×70	B32378E7706J080	116	177	E

B32378E series - Clamp terminals, parameters upon request

V_N / V_{RMS} line to line voltage

V_N/V_{RMS} [3] V	C_R µF	Ordering code	D mm	H mm	Terminal type
1100/780	3×80	B32378E7806J080	116	214	E
	3×100	B32378E7107J080	116	214	E
1200/850	3×50	B32378E8506J050	116	177	E
	3×60	B32378E8606J050	116	177	E
	3×70	B32378E8706J050	116	214	E
	3×80	B32378E8806J050	116	214	E
	3×100	B32378E8107J050	116	244	E
1270/900	3×40	B32378E9406J000	116	177	E
	3×60	B32378E9606J000	116	214	E
	3×80	B32378E9806J000	116	244	E
1415/1000	3×30	B32378E1306J000	116	177	E
	3×60	B32378E1606J000	116	244	E
	3×80	B32378E1806J000	116	259	E

Display of ordering codes for TDK Electronics products

The ordering code for one and the same product can be represented differently in data sheets, data books, other publications, on the company website, or in order-related documents such as shipping notes, order confirmations and product labels. **The varying representations of the ordering codes are due to different processes employed and do not affect the specifications of the respective products**. Detailed information can be found on the Internet under www.tdk-electronics.tdk.com/orderingcodes

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Electrical characteristics: Clearance and creepage distances

Series	Diameter D	Max. height H_{max}	Terminal to terminal		Terminal to case	
			Min. clearance mm	Min. creepage mm	Min. clearance mm	Min. creepage mm
	mm	mm				
B32375E/F Type A	50/63.5	185	9.5	12.7	8.0	12.7
B32376E/F	116	350	19.1	19.1	19.1	19.1
B32377E/F Type A	75/85/96/116/136	350	14.0	14.0	17.0	18.0
B32377E/F Type C	116/136	350	19.1	19.1	19.1	19.1
B32378E/F Type D	116/136	356	14.0	14.0	18.0	19.1
B32378E/F Type E	116/136	356	19.1	19.1	19.1	19.1

Permissible current versus ambient temperature curve

B32377F4406J080
Current derating @ T_{HS} = +85 °C
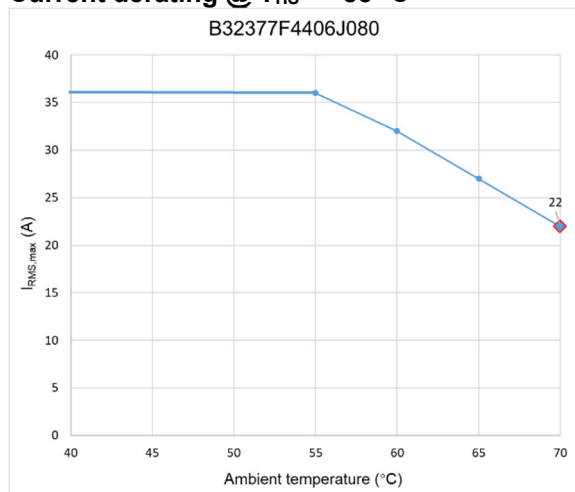
B32377E4137J081
Current derating @ T_{HS} = +85 °C

Please read *Cautions and warnings* and
Important notes at the end of this document.
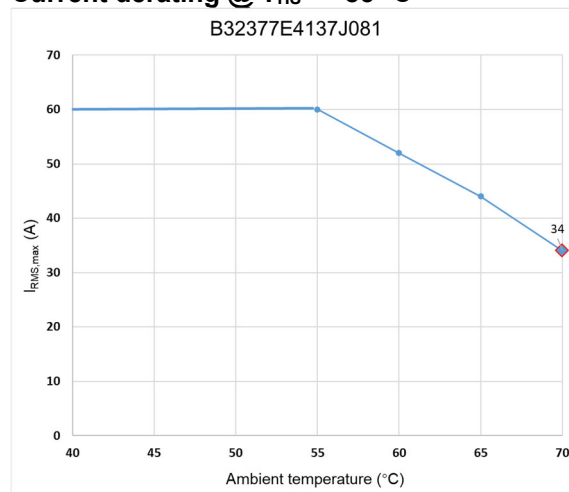
B32377E4157J081
Current derating @ T_{HS} = +85 °C
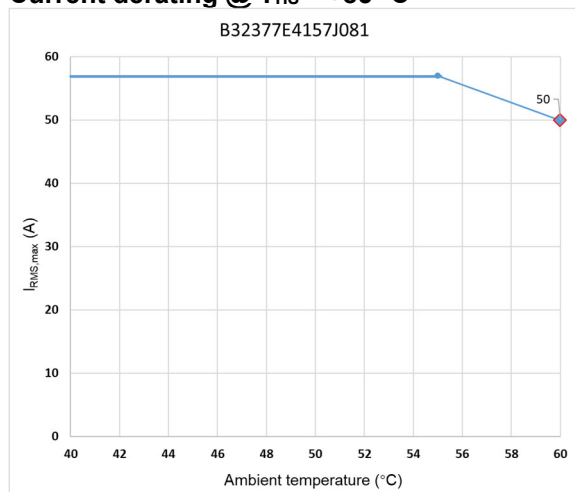
B32377E4207J081
Current derating @ T_{HS} = +85 °C
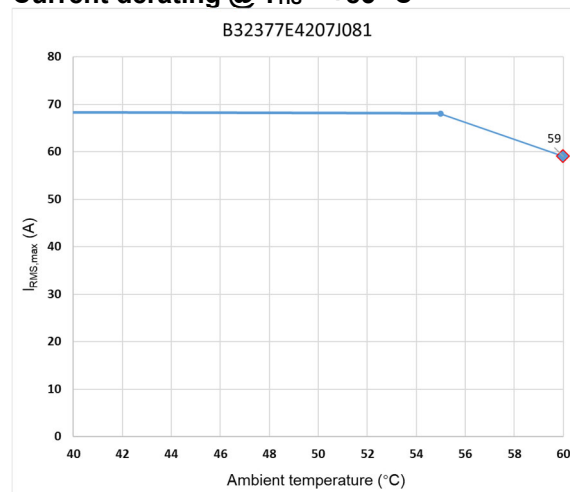
B32377E5107J031
Current derating @ T_{HS} = +85 °C
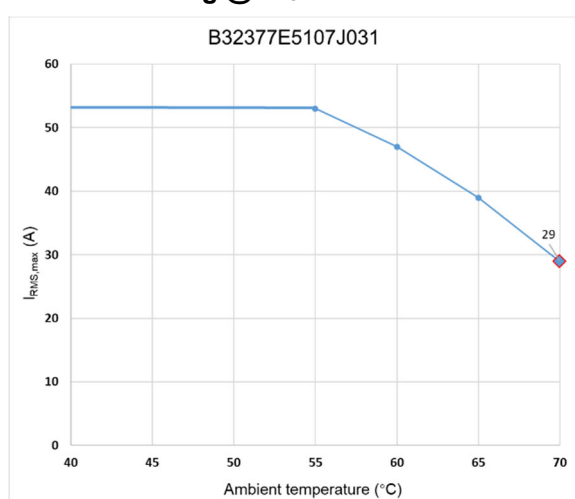
B32377E8556J050
Current derating @ T_{HS} = +85 °C
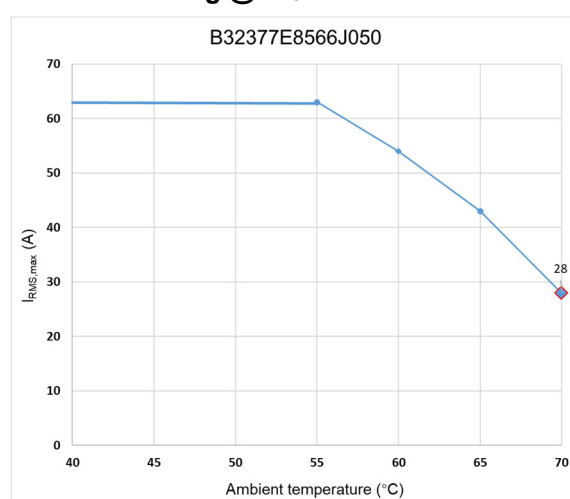
Permissible current versus ambient temperature curve for other types upon request.

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Label Information:
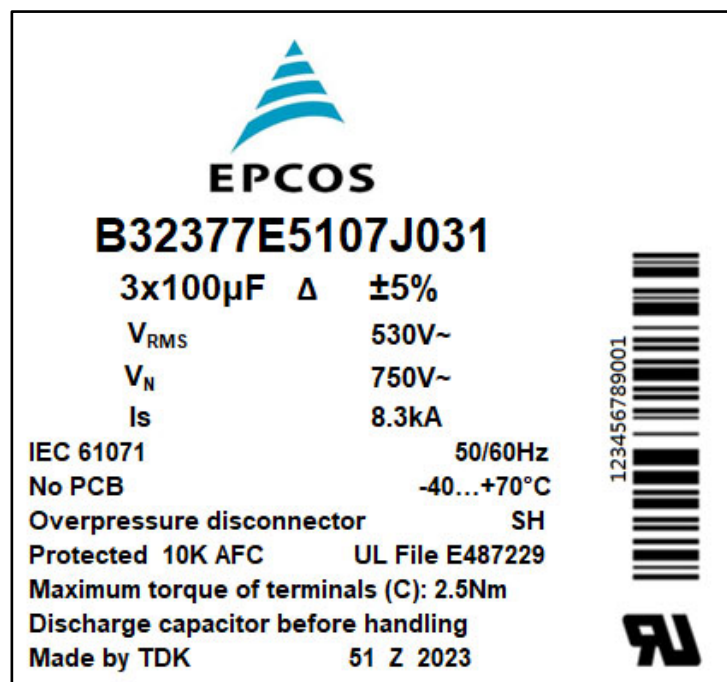
Date code explanation
WW Z YYYY: production week (e.g.: CW:09)
WW **Z** YYYY: produced in Zhuhai (China)
WW Z **YYYY**: production year (e.g.: 2023)

Bar code explanation
Bar code consists of batch number and serial number.
Batch number: 9 digits (e.g.: 123456789)
Serial number: 3 digits (e.g.: 001)

Terminal type explanation
Terminals (A): type A terminals
Terminals (C): type C terminals
Terminals (D): type D terminals
Terminals (E): type E terminals

Dimensional drawings

B32375E/F – fast-on terminal, delta connection
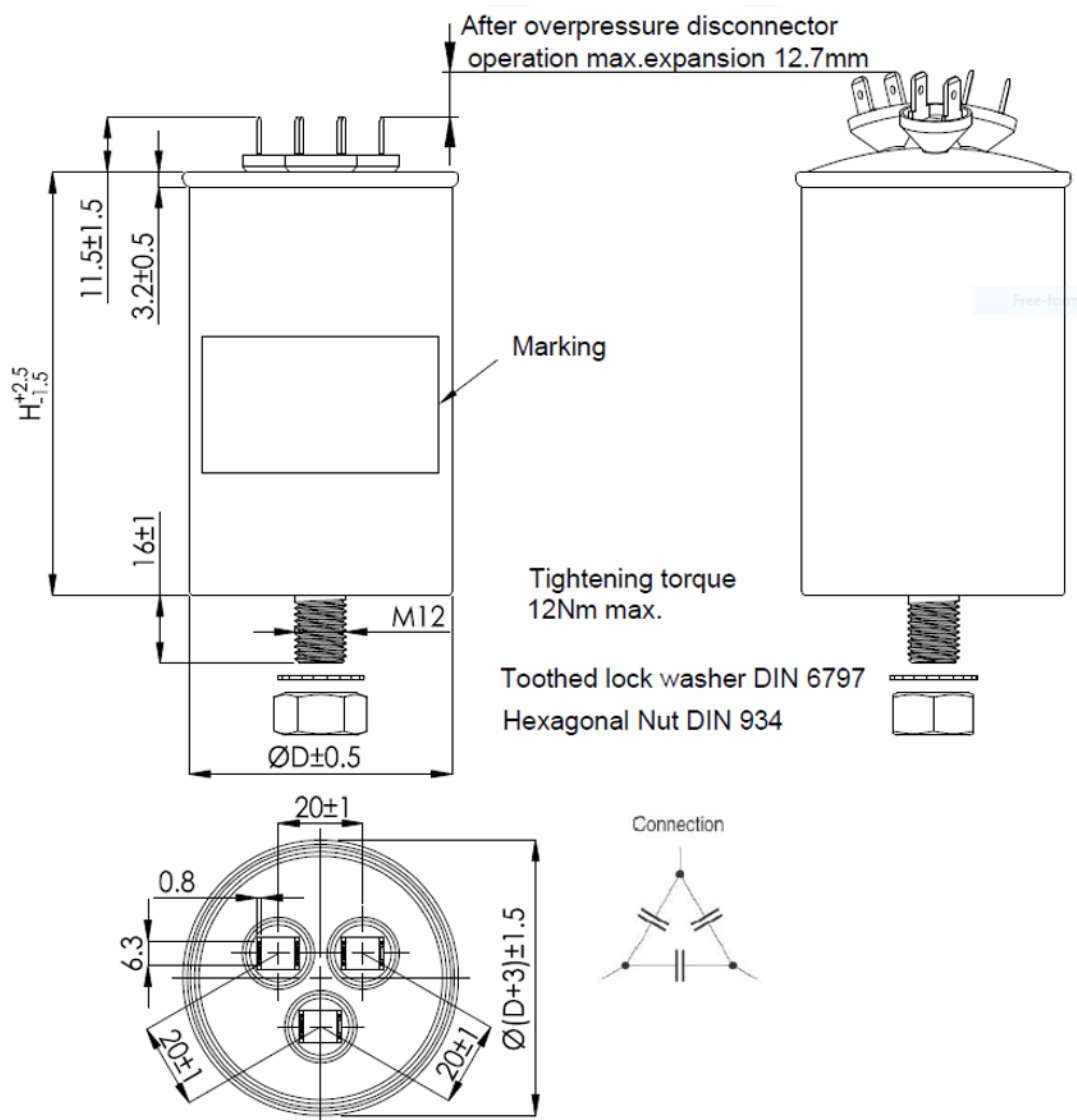
B32376E/F – M10 screw terminal, delta connection
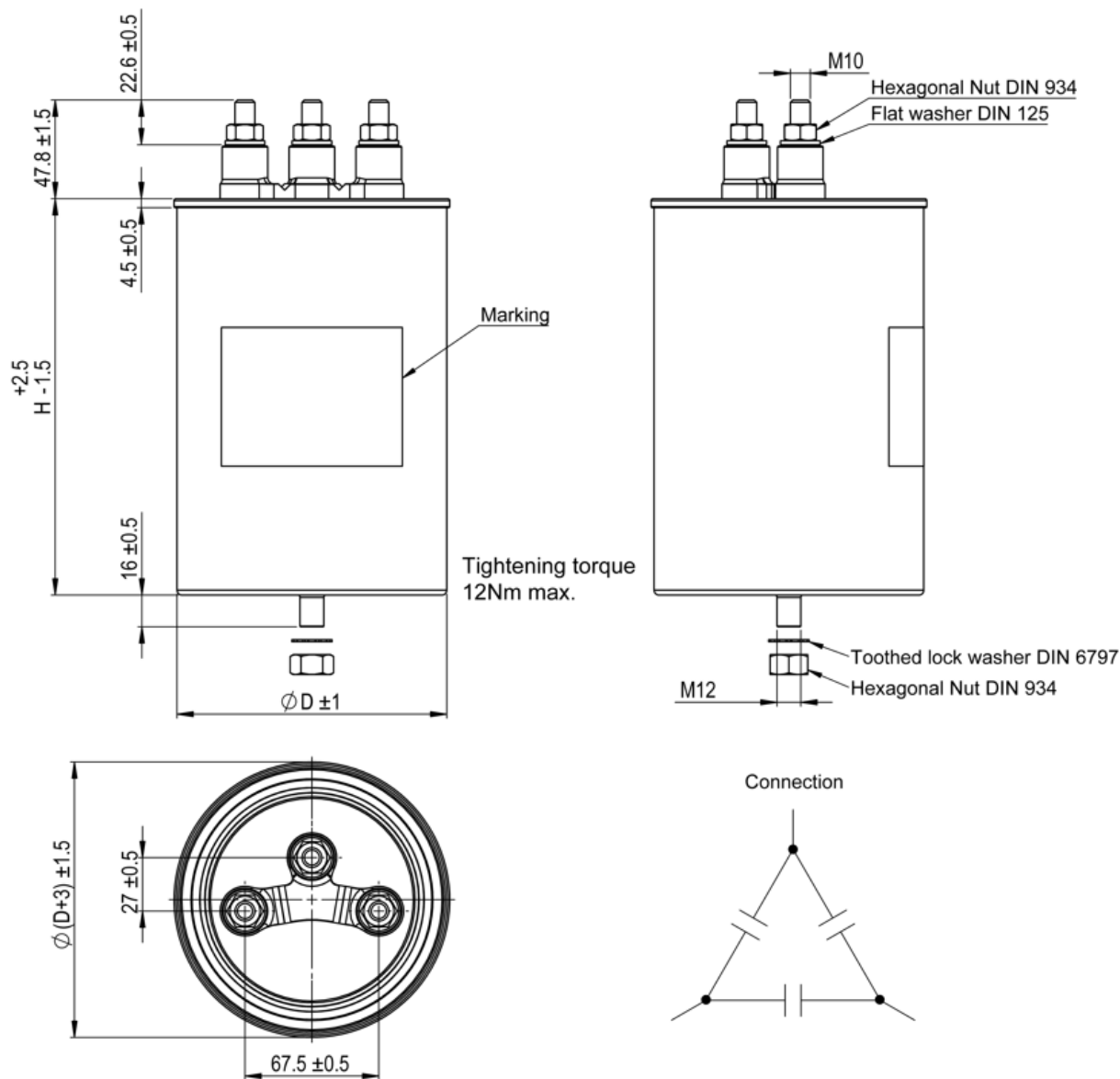
B32377E/F – M5 clamp terminal type A, delta connection

44±1

After overpressure disconnector
operation max.expansion 12.7mm

Marking

4.5±0.5

(H+35)±3

$H^{+2.5}_{-1.5}$

Tightening torque
12 Nm max.

16±0.5

ØD±0.5

M12

Toothed lock washer DIN 6797

Hexagonal Nut DIN 934

Connection

30±0.5

M5 screw
Tightening torque 2Nm max.

19.5±1

44.5±1

Ø(D+3)±1.5

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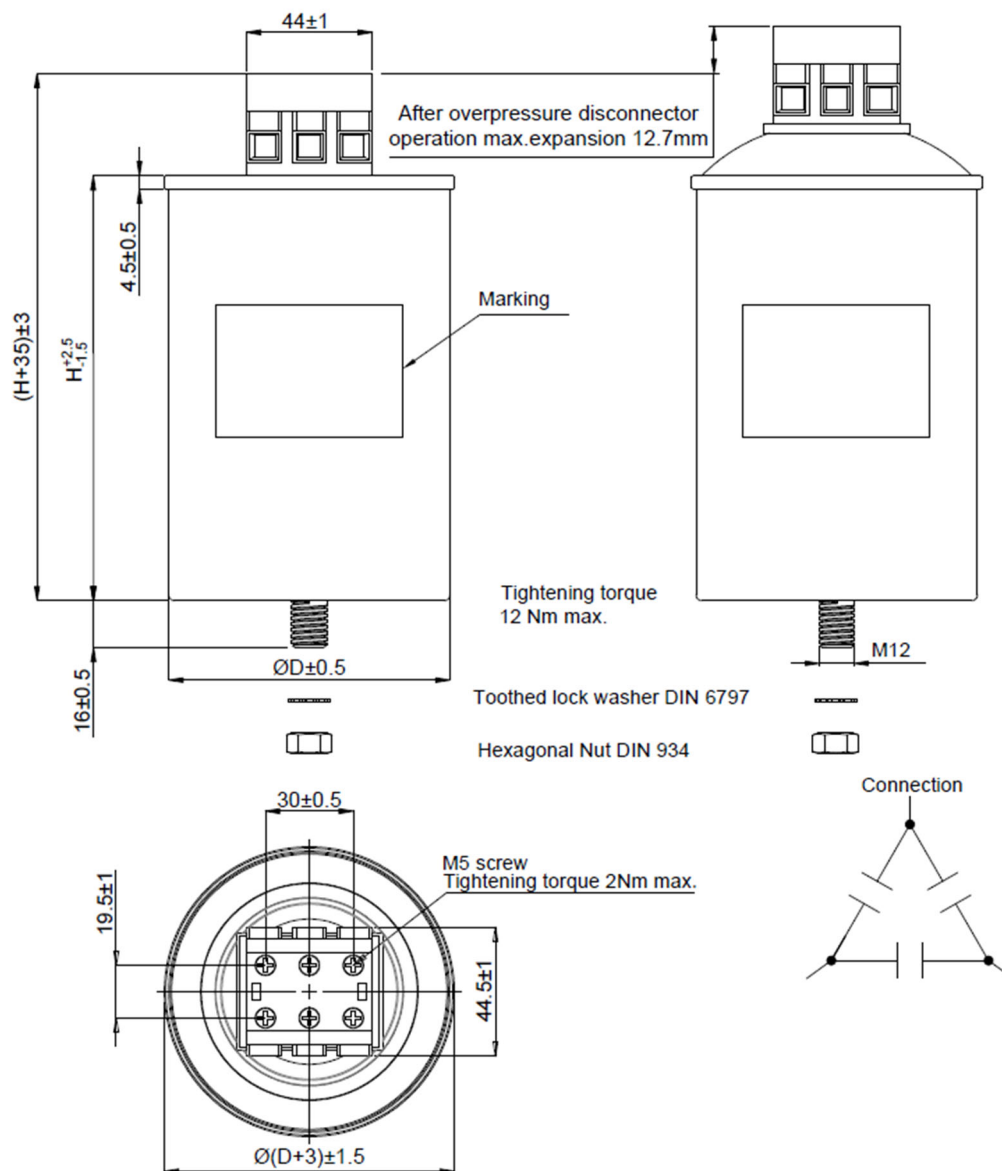
B32377E/F – M6 clamp terminal type C, delta connection

Please read *Cautions and warnings* and   Page 22 of 41
Important notes at the end of this document.
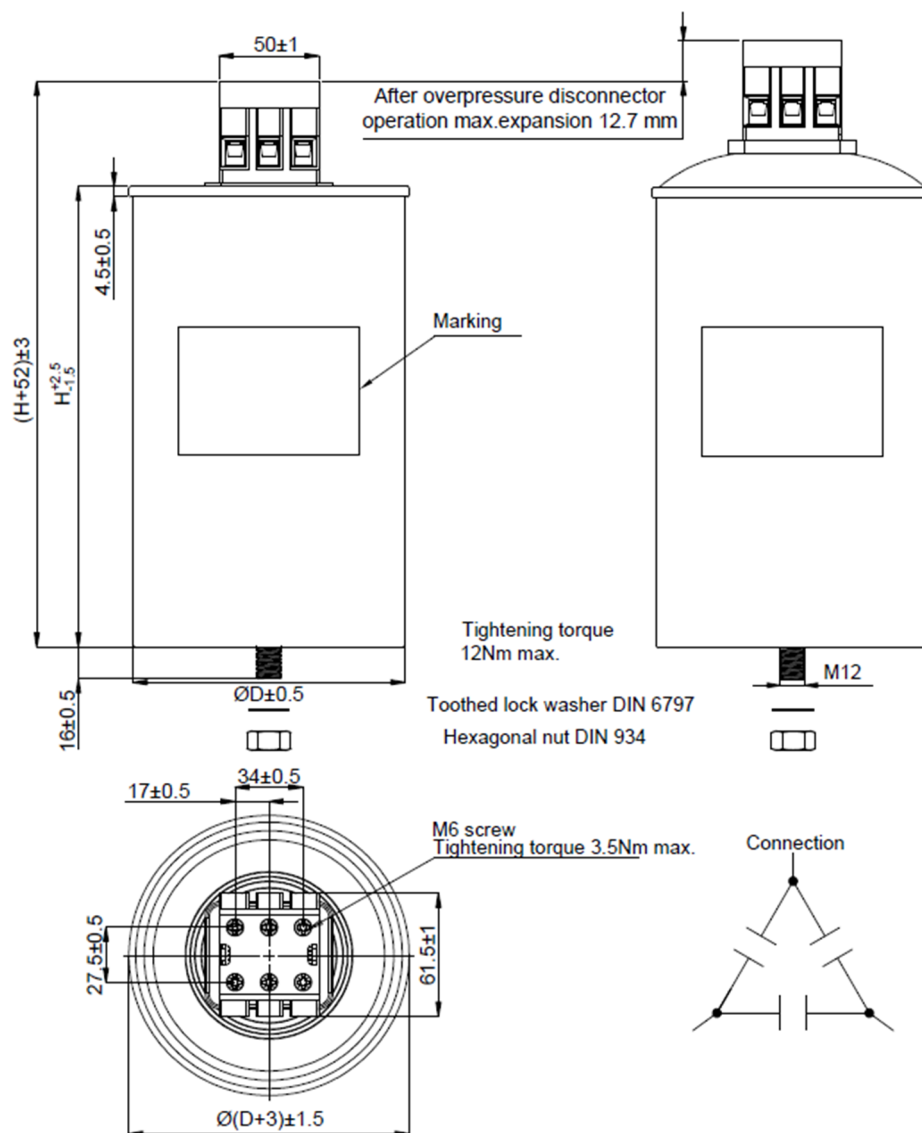
B32378E/F – M5 clamp terminal type D, star connection with neutral
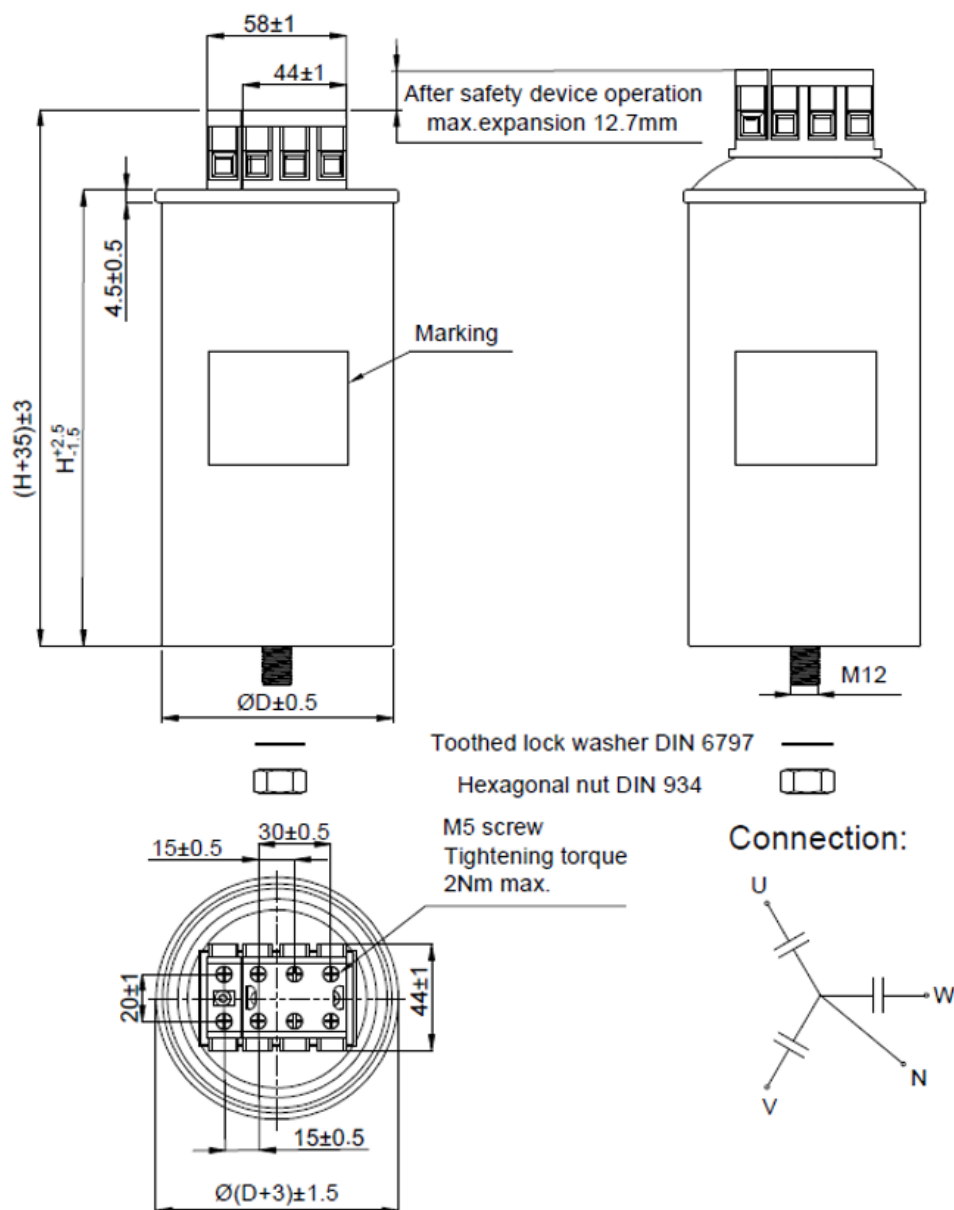
B32378E/F – M5 clamp terminal type E, star connection with neutral

After overpressure disconnector operation max.expansion 12.7mm

Marking

Tightening torque 12Nm max.

Toothed lock washer DIN 6797
Hexagonal nut DIN 934

Connection:

8x M5 screw
Tightening torque 2 Nm max.

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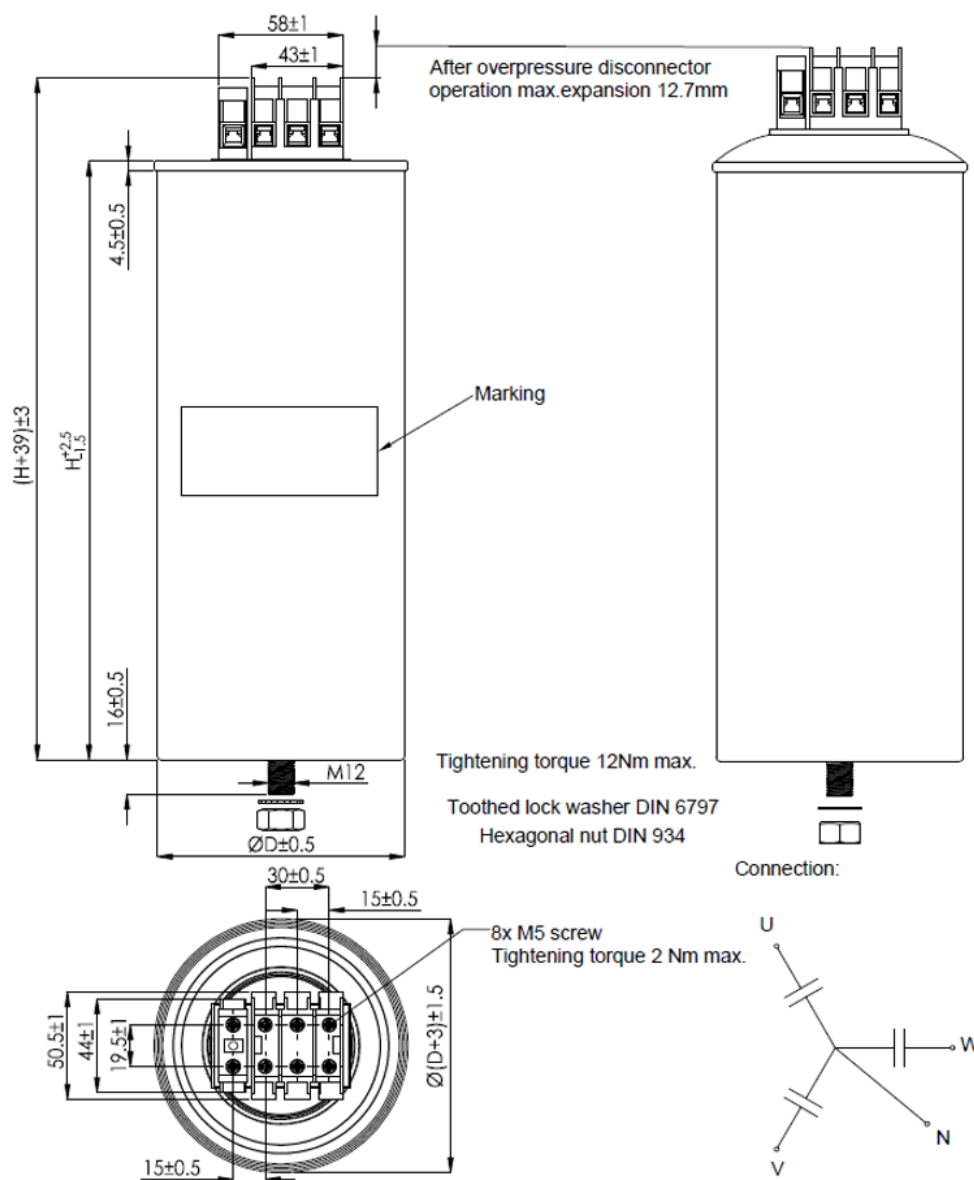
Terms

Design

The winding element of the MKD capacitor consists of metallized polypropylene film. This winding construction achieves low losses and a high pulse-current withstand capability. Soft PU resin is used for impregnation of the capacitor.

Contacting

The end faces of the windings are contacted by metal spraying to ensure a reliable and low-inductance connection between the leads and layers. The leads are welded or soldered to these end faces, brought out through insulating elements (plastic) and soldered to the terminals.

Filler material

All hollows between the windings and between the windings and the case are filled with a fluid. Besides increasing dielectric strength, this improves heat dissipation from inside a capacitor. The filler material that we use is free of PCB and halogens.

Self-healing

All MKD capacitors are self-healing, i.e. voltage breakdowns heal in a matter of microseconds and hence do not produce a short circuit.

Breakdowns can occur under heavy electrical load as a result of weaknesses or pores in the dielectric. The integrity of self-healing capacitors is not affected by such breakdowns.
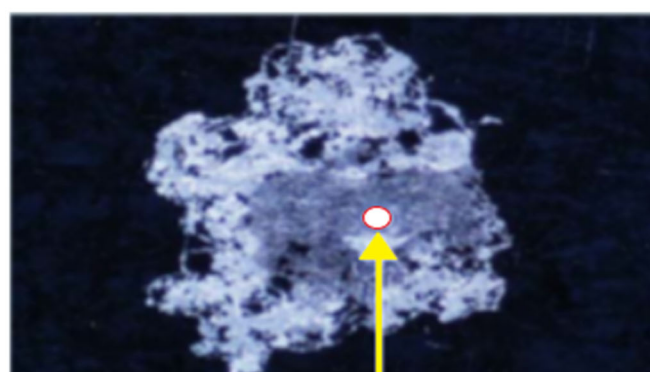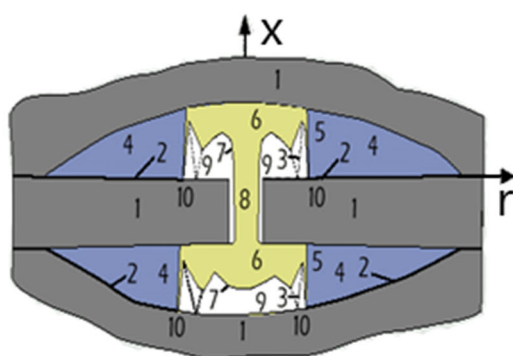
1. Dielectric (Polypropylene)
2. Metallization
3. Material-displacing shock wave
4. Air gap with metal vapor
5,6. Plasma zone

7. Boundary layer between gas-phase dielectric and plasma zones
8. Puncture channel
9. Gas-phase dielectric
10. Zone of displaced metallization and dielectric

Figure 1: Description of self-healing technology

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When a breakdown occurs, the dielectric in a breakdown channel is broken down into its atomic components by the electric arc that forms between the electrodes. At high temperatures of as much as 6000 K, a plasma is created that explodes out of the channel region and pushes the dielectric layers apart. The actual self-healing process starts with the continuation of the electric arc in the propagating plasma. Here the metal layers are removed from the metal edges by evaporation. Insulation areas are formed. The rapid expansion of the plasma beyond the areas of insulation and its cooling in the areas of less field strength allow the discharge to extinguish after a few microseconds.

The area of insulation that is created is highly resistive and voltage-proof for all operating requirements of the capacitor. The self-healing breakdown is limited in current and so it does not represent a short circuit. The self-healing process is so brief and low in energy that the capacitor also remains fully functional during the breakdown.

Characteristics

Equivalent circuit diagram

Any real capacitor can be modelled by the following schematic:
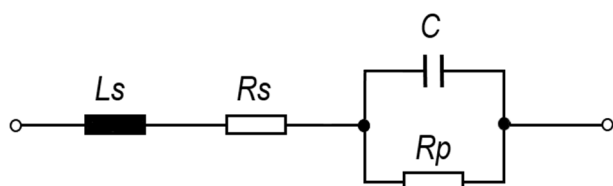
Figure 2: Equivalent circuit diagram

Symbol	Description	Unit
Ls	series inductance	H
Rs	series resistance, due to contacts (leads, sprayed metal and film metallization)	Ω
Rp	parallel resistance, due to insulation resistance	Ω
C	capacitance	F

C and L_S are magnitudes that vary in the frequency domain (AC).
R_P is a magnitude defined in DC (insulation resistance).

Rated capacitance C_R

It is referred to a test temperature of +20 ℃ and a measuring frequency range of 50 Hz to 1 kHz.

Capacitance tolerance range

It is the range within which the actual capacitance may differ from rated capacitance. The actual capacitance is to be measured at a temperature of +20 °C. This range results from variances in materials and manufacturing processes. The standard manufacturing tolerance for PP film capacitors is ±10% or 'K' tolerance or ±5%, 'J' tolerance.

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Temperature dependence of capacitance

The capacitance variation in the permissible temperature range is not linear, but it is reversible, the characteristic change in capacitance ΔC/C as a function of test temperature is shown as follows:
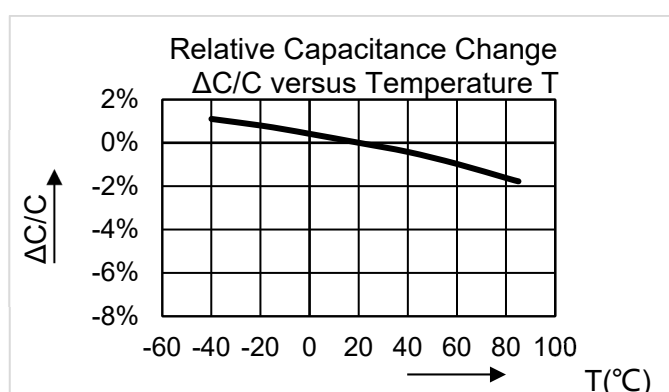

Figure 3: Temperature dependence of capacitance

Capacitance drift

Capacitance is subject to irreversible in addition to reversible changes, i.e. capacitance drift, the sum of all time-dependent, irreversible changes of capacitance during operating life. This variation is stated in percent of the value at delivery. The typical figure is +1/−3%.

Rated AC voltage V_N

The maximum operating peak recurrent voltage of either polarity of a reversing type waveform for which the capacitor has been designed.
Unlike what is common in other standard (e.g. B32304* 3–phase capacitor series for PFC application) the rated voltage V_N **is not the RMS** value, but the maximum or peak value of the capacitor voltage. The voltage at which the capacitor may be operated is dependent on other factors (especially current and frequency) besides rated voltage.

Voltage V_{RMS}

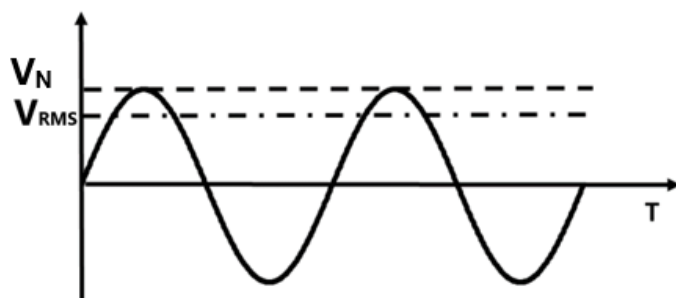It is the Root Mean Square (RMS) voltage of maximum permissible value of sinusoidal AC voltage in continuous operation.

Figure 4: Voltage V_{RMS}

Non-recurrent surge voltage V$_S$

A peak voltage induced by a switching or any other disturbance of the system which is allowed for a limited number of times and for durations shorter than the basic period.
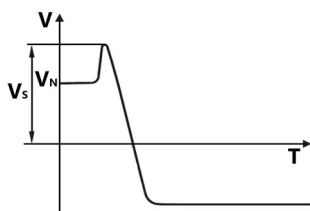

Figure 5: Non-recurrent surge voltage V$_S$

Maximum duration: 50 ms/pulse
Maximum number of occurrences: 1000 (during load)

Max. Recurrent peak voltage û

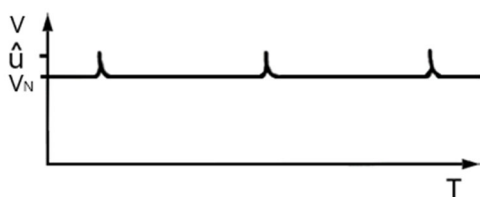This is the permissible, max. recurrent peak voltage that may appear for max.1% of the period.

Figure 6: Max. Recurrent peak voltage û

Symmetric alternating voltage $\hat{u}_{ac}$

The peak values of a symmetrical alternating voltage applied to the capacitor is a decisive factor for the dielectric losses.

$$\text{For AC capacitors: } \hat{u}_{ac} = V_N$$

Insulation voltage V$_i$

It is the RMS rated value of the insulation voltage of capacitive elements and terminals to case or earth.
If not specified, the RMS value of the insulating voltage is equivalent to the rated voltage divided by $\sqrt{2}$.

Maximum current I$_{RMS,max}$

It is the maximum RMS current for continuous operation which, at rated temperature and for given harmonic distortion, will lead to a maximum hot-spot temperature (T$_{HS}$) of +85°C.
Note that RMS current with different harmonic distortions could generate different self-heating temperatures. A higher current than I$_{RMS,max}$ value could be possible if the hot-spot temperature (T$_{HS}$) is lower than +85 °C. On the contrary, same RMS current with more harmonic distortions at higher frequency could have higher self-heating temperature that makes T$_{HS}$ higher than +85 °C (dangerous for capacitor). For that reason, **we strongly suggest end customers to qualify capacitor using samples with thermocouples (upon request) in order to verify the real operating temperature inside of capacitor under real application or to check with TDK company for detail discussions.**
Maximum peak current Î

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It is the maximum current amplitude which occurs instantaneously during continuous operation. The maximum peak current and the maximum rate of voltage rise $(dV/dt)_{max}$ on a capacitor are related as follows:

$$\hat{I} = C_R \cdot \left(\frac{dV}{dt}\right)_{max}$$

Maximum surge current I_s

It is the peak non-repetitive current induced by switching or any other disturbance of the system permitted for a limited number of times, at durations shorter than the basic period.

$$I_s = C_R \cdot \left(\frac{dV}{dt}\right)_s$$

Maximum duration: 50 ms/pulse
Maximum number of occurrences: 1000 (during load)

Fault current (AFC)

It is a failure mode in which capacitor is intentionally internally faulted to represent dielectric breakdown that would occur within the capacitor over time.

The fault current test is intended to address protection of the capacitor from available fault currents over the life of the capacitor. The maximum fault current test levels represent a complete internal dielectric breakdown in the capacitor with the maximum fault current available. The lower fault current test levels represent the various stages of internal dielectric breakdown during the life of the capacitor where the available fault current will be less.

Self-inductance L_{self}

The self-inductance is produced by the inductance of the terminals and the windings. Because of the special kind of contacting in self-healing capacitors (large area metal spraying covering all windings), the self-inductance is particularly low. It allows the resonance frequency to be determined:

$$f = \frac{1}{2\pi\sqrt{L_{self} \cdot C_R}}$$

The resonance frequency is high for all capacitors accordingly.

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Insulation Resistance (R_{ins})

The dielectric of a capacitor has a large area and a short length. Even if the material is a good isolator there always flows a certain current between the charged electrodes (the current increases exponentially with the temperature). This leakage can be described as a parallel resistance with a high value, an Insulation Resistance.
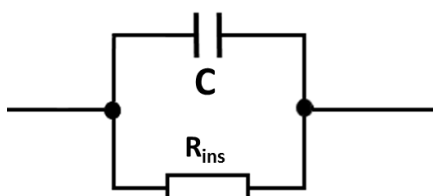

Figure 7: Insulation Resistance (R_{ins})

Insulation resistance and self-discharge time constant

The insulation values for the individual components according to the capacitance are stated as an insulation resistance R_{ins} in MΩ or a self-discharge time constant τ in seconds.

$$\tau = R_{ins} \cdot C_R$$

Series resistance R_S

Resistive losses occur in the electrodes in the contacting and in the inner wiring. These are comprised in the series resistance R_S of a capacitor.

The series resistance R_S generates the ohmic losses ($I^2 \times R_S$) in a capacitor. It is largely independent of frequency. The figures stated in selection charts apply to +20°C capacitor temperature.
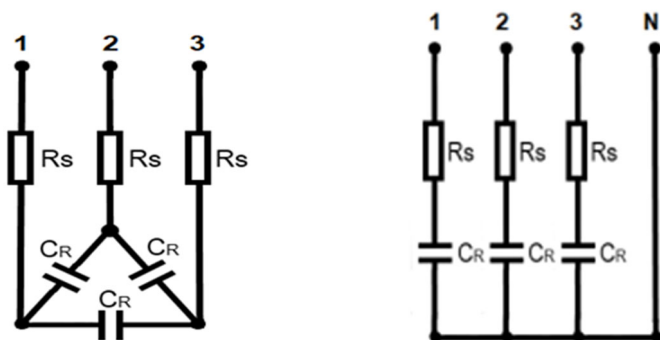
a) Delta connection model   b) Star connection model

Figure 8: Resistance model of 3 Phase capacitor

Dissipation factor tan δ

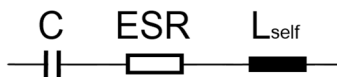The equivalent circuit diagram used for the losses in a capacitor can be shown as follows:

Figure 9: Simplified equivalent circuit diagram of a capacitor

Symbol	Description	Unit
C	Capacitor	F
L_{self}	Self-inductance	H
ESR	Equivalent series resistance, representing the entire active power in capacitor	Ω

The self-inductance and capacitance of a capacitor produce its resonance frequency (natural frequency).

$$\tan \delta(f) = \tan \delta_0 + Rs \cdot \omega \cdot C$$

From the frequency dependence of the equivalent series resistance can be derived:

$$ESR = \frac{\tan \delta}{\omega \cdot C} = Rs + \frac{\tan \delta_0}{\omega \cdot C}$$

Symbol	Description	Unit
tan δ	Dissipation factor of capacitor	-
tan δ_0	Dissipation factor of dielectric	-
R_S	Series resistance	Ω

Dielectric dissipation factor tan δ₀

The dissipation factor tan δ_0 of the dielectric is assumed to be constant for all capacitors in their frequency range of use. The figures stated in data sheets apply to rated operation.

Expected FIT rate λ

The FIT (Failure In Time) of a component is defined as the number of expected failures in 10^9 hours of operation.

The FIT rate is calculated on the basis of the number of components operating in the field and the estimated hours of operation. Field failure information is taken into consideration for this calculation which is updated every year.

Thermal design

In order to scale a capacitor correctly for a particular application, the permissible ambient temperature versus maximum current must be determined as explained along this chapter.

Introducing power dissipation (P) and thermal resistance (R_{th}) concepts are required for this estimation.

Calculation of power dissipation P

At each frequency the power dissipation P is composed of the dielectric losses (P_D) and the resistive losses (P_R).

Generally, a secondary sinusoidal AC voltage can be used for calculating with sufficient accuracy, besides fundamental frequency.

$$P\left(f_i\right) = P_D\left(f_i\right) + P_R(f_i)$$

Which can be also calculated as:

$$P\left(f_i\right) = I\left(f_i\right)^2 \cdot ESR(f_i)$$

Dielectric losses (P_D) at each frequency f_i can be calculated as follows:

$$P_D(f_i) = V(f_i)^2 \cdot 2\pi \cdot f_i \cdot C \cdot tan\,\delta_0 = \frac{I\left(f_i\right)^2}{2 \cdot \pi \cdot f_i \cdot C} \cdot tan\,\delta_0$$

Symbol	Description	Unit
$V(f_i)$	RMS voltage at frequency f_i applied to capacitor	V
$I(f_i)$	RMS current at frequency f_i applied to capacitor	A
f_i	Frequency	Hz
C	Capacitance	F
tan δ_0	Dissipation factor of dielectric	-

Note: value of dielectric losses (P_D) at frequencies much higher than fundamental frequency are negligible.

Resistive losses (P_R) at each frequency f_i can be calculated as follows:

$$P_R(f_i) = I\left(f_i\right)^2 \cdot R_s$$

Symbol	Description	Unit
$I(f_i)$	RMS current at frequency f_i applied to capacitor	A
R_S	Series resistance	Ω

The total power dissipation P will be:

$$P = \sum_i [P_D(f_i) + P_R(f_i)]$$

Which can be also simplified as follows:

$$P = P_D(f_0) + \sum_i P_R(f_i) = (V_{RMS}^2 \cdot 2\pi \cdot f_0 \cdot C \cdot tan\,\delta_0) + (I^2 \cdot R_s)$$

Or alternatively:

$$P = \sum_i [I(f_i)^2 \cdot ESR(f_i)]$$

Symbol	Description	Unit
V_{RMS}	RMS voltage at fundamental frequency f_0 applied to capacitor	V
I	Total RMS current applied to capacitor	A
f_0	Fundamental frequency	Hz
C	Capacitance	F
$ESR(f_i)$	Equivalent Series Resistance at frequency f_i	Ω
$tan\,\delta_0$	Dissipation factor of dielectric	-

Thermal resistance R_{th}

The thermal resistance is defined as the ratio of a temperature difference and the power dissipation produced in a capacitor. The decisive factor here is ΔT where the temperature difference between an external reference point of the coolant (e.g. air) surrounding the capacitor and the hot spot (zone with highest temperature occurring in the component). In a steady state:

$$R_{th} = \frac{\Delta T}{P}$$

Symbol	Description	Unit
R_{th}	Thermal resistance (ambient to hotspot)	K/W
ΔT	Temperature difference between hotspot and ambient	K
P	Power dissipation	W

Thermal design: Estimation of hot-spot temperature in capacitor (T_{HS})

As a basic rule of thermal design, hotspot can never exceed a maximum temperature of +85 ºC, what means:

$$T_{HS} = T_{amb} + \Delta T = T_{amb} + (P \cdot R_{th}) \leq +85\,°C$$

Symbol	Description	Unit
T_{amb}	Ambient temperature around capacitor	ºC
ΔT	Temperature difference between hot-spot temp. and ambient	K
P	Power dissipation	W
R_{th}	Thermal resistance (ambient to hot-spot)	K/W

Else, maximum currents can be taken from the diagram of *Permissible current versus ambient temperature.*

Thermal design example

Capacitor electrical parameters		
Reference	B32377F5306J030	
V_{RMS}	530	V (50Hz)
$I_{RMS,max}$	24	A (+70ºC)
Capacitance	3×30	µF
R_s	1.4	mΩ
R_{th}	3.5	K/W
tan δ_0	0.0002	-

Operating conditions		
V_{RMS}	530	V (50Hz)
Fundamental frequency (f_0)	50	Hz
Ripple frequency (f_1)	2,000	Hz
I_{RMS} total (line current)	18	A
T_{amb}	40	ºC

1) Verification of initial requirements

    a. I_{RMS} total = 18 A ≤ 24 A
    b. V_{RMS} = 530 V ≤ 530 V

2) Estimation of T_{HS}

$$I_0(50\ Hz)Phase\ current = 530 \cdot 2\pi \cdot 50 \cdot 30 \cdot 10^{-6} = 5\ A$$

$$I_0(50\ Hz)Line\ current = \sqrt{3} \cdot 5 = 8.7\ A$$

$$I_{RMS\ total}(Phase\ current) = I_{RMS\ total}(Line\ current)/\sqrt{3}$$

$$I_{RMS\ total}(Phase\ current) = \frac{18}{\sqrt{3}} = 10.4\ A$$

$$I_1(2\,kHz)(Phase\ current) = \sqrt{10.4^2 - 5^2} = 9.1\ A$$

$$I_1(2\,kHz)(Line\ current) = \sqrt{3} \cdot 9.1 = 15.8\ A$$

$$P_D(50\,Hz)\ for\ 3phase = \frac{(I_0(50\,Hz)Phase\ current)^2}{2 \cdot \pi \cdot f_0 \cdot Capacitance} \cdot tan\delta0 \cdot 3$$

$$P_D(50\,Hz)\ for\ 3\ phase = \frac{5^2}{2 \cdot \pi \cdot 50 \cdot 30 \cdot 10^{-6}} \cdot 0.0002 \cdot 3 = 1.588\ W$$

$$P_D(2\,kHz)\ for\ 3\ phase = \frac{(I_1(2\,kHz)(Phase\ current))^2}{2 \cdot \pi \cdot f_1 \cdot Capacitance} \cdot tan\delta0 \cdot 3$$

$$P_D(2\,kHz)\ for\ 3\ phase = \frac{9.1^2}{2 \cdot \pi \cdot 2,000 \cdot 30 \cdot 10^{-6}} \cdot 0.0002 \cdot 3 = 0.132\ W$$

$$P_R(50\,Hz)\ for\ 3\ phase = (I_0(50\,Hz)Line\ current)^2 \cdot Rs \cdot 3$$

$$P_R(50\,Hz)\ for\ 3\ phase = 8.7^2 \cdot 0.0014 \cdot 3 = 0.314\ W$$

$$P_R(2\,kHz)\ for\ 3\ phase = (I_1(2\,kHz)(Line\ current))^2 \cdot Rs \cdot 3$$

$$P_R(2\,kHz)\ for\ 3\ phase = 15.8^2 \cdot 0.0014 \cdot 3 = 1.046\ W$$

$$P = P_D(50\,Hz) + P_D(2\,kHz) + P_R(50\,Hz) + P_R(2\,kHz)$$

$$P = 1.588 + 0.132 + 0.314 + 1.046 = 3.081\ W$$

$$\Delta T = P \cdot R_{th} = 3.081 \cdot 3.5 = 10.8\ K$$

$$T_{HS} = T_{amb} + \Delta T = 40 + 10.8 = 50.8\ ℃ \leq 85\ ℃$$

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Important notes at the end of this document.
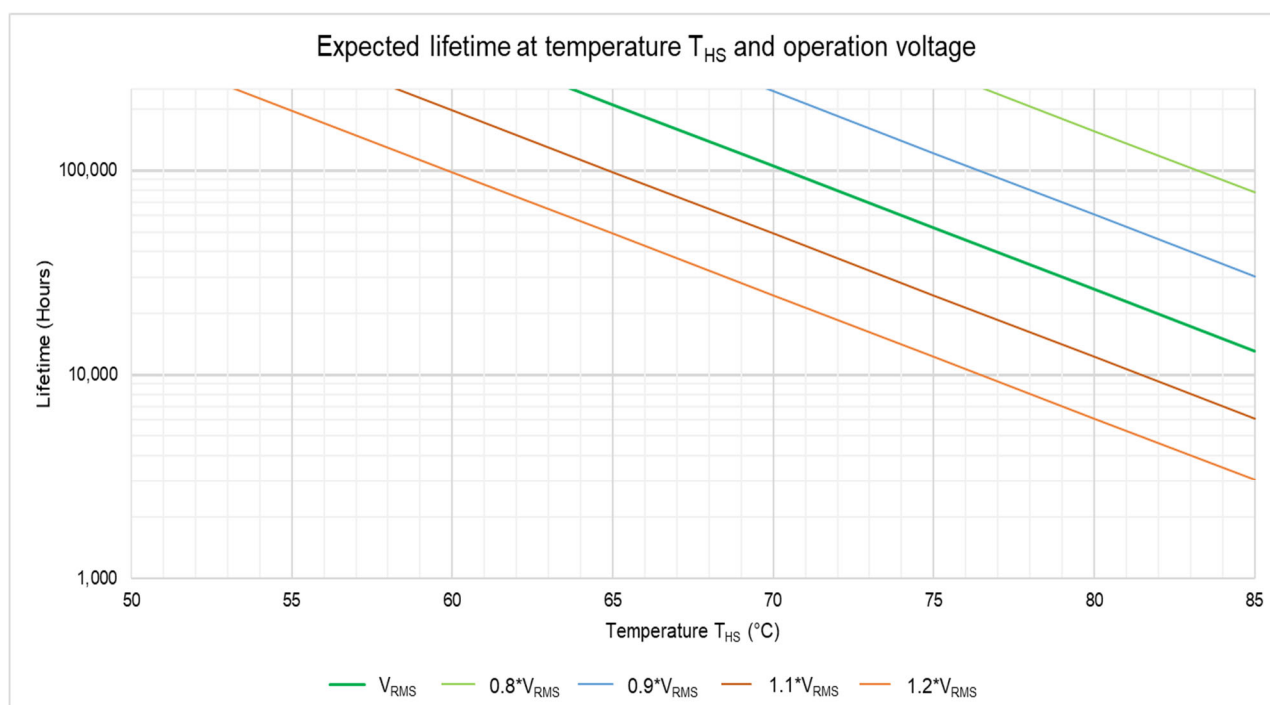
Lifetime Expectancy Graphs

Figure 10: Expected lifetime in hours at different hotspot temperatures (T_{HS}) and voltages V_{RMS}.

Lifetime estimations are typical values derived from lifetime tests based on TDK internal standards or mutually agreed test methods and are intended for guidance purposes only. The useful life does not constitute a warranty of any kind or a prolongation of the agreed warranty period.

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General

- In case of dents of more than 1 mm depth or any other mechanical damage, capacitors must not be used at all.

- Check tightness of the connections/terminals periodically.

- The energy stored in capacitors may be lethal. To prevent any chance of shock, discharge and short-circuit the capacitor before handling.

- Failure to follow cautions may result, worst case, in premature failures, bursting and fire.

- Protect the capacitor properly against over current and short circuit.

- TDK Electronics is not responsible for any kind of possible damage to persons or objects due to improper installation and application of capacitors for power electronics.

Safety

- Electrical or mechanical misapplication of capacitors may be hazardous. Personal injury or property damage may result from bursting of the capacitor or from expulsion melted material due to mechanical disruption of the capacitor.

- Ensure good, effective grounding for capacitor enclosures.

- Observe appropriate safety precautions during operation (self-recharging phenomena and the high energy contained in capacitors).

- Handle capacitors carefully, because they may still be charged even after disconnection.

- The terminals of capacitors connected bus bars and cables as well as other devices may also be energized after disconnecting.

- Follow good engineering practices.

- When power capacitors are used, suitable measures must always be taken to eliminate possible danger to humans, animals and property both during operation and when a failure occurs. This applies to capacitors both with and without protective devices. Regular inspection and maintenance by trained personnel is therefore essential

- The maximum permissible fault current (AFC) of 10 kA in accordance with the UL 810 standard must be assured by the application.

Handling

Do not handle the capacitor before it is discharged! When handling the capacitor, do not take the capacitor from the terminal. This can cause accidents in case the capacitor is charged and additionally the terminal could break.

Thermal load

After installation of the capacitor it is necessary to verify that the maximum hot-spot temperature is not exceeded at extreme service conditions.

Installation

Capacitors must be installed in a cool and well-ventilated place, away from objects that radiate heat, or from direct sunlight. Within high-power inverter systems the capacitors usually produce the smallest portion of the total losses, and the permissible operating temperatures are low compared to power semiconductors, reactors and resistors. So, the distance between capacitor and heating sources must be far enough to prevent the capacitor from overheating.

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In case of space constraint to make the best possible use of capacitors, technically and economically, it is advisable to supply forced cooling air.

Mechanical protection

The capacitor has to be installed in a way that mechanical damages and dents in the aluminum can be avoided.

Connecting

Ensure firm fixing of terminals, fixing torque to be applied as per individual specification.

In any case, the maximum specified terminal current may not be exceeded. Please refer to the technical data of the specific series.

Grounding

The threaded bottom stud of the capacitor must be used for grounding. In case grounding is done via metal chassis where the capacitor is mounted on, the layer of varnish beneath the washer and nut should be removed. In case, capacitor with plastic case, this is not applicable. Ensure the tightening torque does not exceed the specified limit.

Maintenance recommendation

Disregarding the following measures may result in severe operation failures, bursting and fire:

- Check tightness of the connections/terminals periodically.

- Clean the terminals/bushings periodically to avoid short circuits due dust or other contamination.

- Ensure the current does not exceed the limit.

- In case of a current above the nominal current check your application for modification.

- Check the temperature of energized capacitors. In case of excessive temperature of individual capacitors, it is recommended to replace this capacitor, as this could be an indication for loss factor increase, which is a sign for reaching end of life.

Storage and operating conditions

Do not use or store capacitors in corrosive atmosphere, especially where chloride gas, sulfide gas, acid, alkali, salt or the like are present. In dusty environments regular maintenance and cleaning especially of the terminals is required to avoid conductive path between phases and/or phases and ground.

- Capacitors must not be stored in high temperatures and/or high humidity, we recommend the following storage conditions

    - Temperature between -40 °C ~ +40 °C
    - Humidity <= 80% RH as average per year

- Storage should not exceed 2 years (from the date code printed on the capacitor). After 1 year of storage time, capacitors must be checked electrically.

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Overpressure disconnector

To ensure full functionality of an overpressure disconnector, the following must be observed:

1. The elastic elements must not be hindered, i.e.

■ Connecting lines must be flexible leads (cables).

■ There must be sufficient space (min. 20 mm) for expansion above the connections.

■ Metal cover must not be retained by rigid parts, like: bus bars.

2. Stress parameters of the capacitor must be within the IEC 61071-2017 specification.

NOTE 1 As the actual conditions can be significantly different in service, the behavior at the end of life may also be different. Stored energy expected short-circuit current, duration of failure current (and so on) has to be considered in the application. Compliance with IEC61071-5.16 does not guarantee safe end of life of a capacitor.

NOTE 2 Successful completion of the IEC61071-5.16 test is not sufficient to guarantee the total safe failure of the components in service. For this reason, there is a residual risk of fire and/or explosions that has to be carefully taken in consideration.

Lifetime expectancy

As a rule, TDK Electronics is unfamiliar with individual customer applications or less familiar with them than the customers themselves. The results will not contain the various influences which might occur in respect to TDK products, when TDK products will be incorporated into the customer application. For these reasons, it is ultimately incumbent on the customer to check and decide whether a TDK product with the properties described in the product specification is suitable for use in a particular customer application.

We also point out that in individual cases a malfunction of electronic components or failure before the end of their usual service life cannot be completely ruled out in the current state of the art, even if they are operated as specified. In customer applications requiring a very high level of operational safety and especially in customer applications in which the malfunction or failure of an electronic component could endanger human life or health (e.g. in accident prevention or life-saving systems), it must therefore be ensured by means of suitable design of the customer application or other action taken by the customer (e.g. installation of protective circuitry or redundancy) that no injury or damage is sustained by third parties in the event of malfunction or failure of an electronic component.

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The following applies to all products named in this publication:

1. Some parts of this publication contain **statements about the suitability of our products for certain areas of application**. These statements are based on our knowledge of typical requirements that are often placed on our products in the areas of application concerned. We nevertheless expressly point out **that such statements cannot be regarded as binding statements about the suitability of our products for a particular customer application.** As a rule we are either unfamiliar with individual customer applications or less familiar with them than the customers themselves. For these reasons, it is always ultimately incumbent on the customer to check and decide whether a product with the properties described in the product specification is suitable for use in a particular customer application.

2. We also point out that **in individual cases, a malfunction of electronic components or failure before the end of their usual service life cannot be completely ruled out in the current state of the art, even if they are operated as specified.** In customer applications requiring a very high level of operational safety and especially in customer applications in which the malfunction or failure of an electronic component could endanger human life or health (e.g. in accident prevention or life-saving systems), it must therefore be ensured by means of suitable design of the customer application or other action taken by the customer (e.g. installation of protective circuitry or redundancy) that no injury or damage is sustained by third parties in the event of malfunction or failure of an electronic component.

3. **The warnings, cautions and product-specific notes must be observed.**

4. In order to satisfy certain technical requirements, **some of the products described in this publication may contain substances subject to restrictions in certain jurisdictions (e.g. because they are classed as hazardous)**. Useful information on this will be found in our Material Data Sheets on the Internet (www.tdk-electronics.tdk.com/material). Should you have any more detailed questions, please contact our sales offices.

5. We constantly strive to improve our products. Consequently, **the products described in this publication may change from time to time**. The same is true of the corresponding product specifications. Please check therefore to what extent product descriptions and specifications contained in this publication are still applicable before or when you place an order.

   We also **reserve the right to discontinue production and delivery of products**. Consequently, we cannot guarantee that all products named in this publication will always be available. The aforementioned does not apply in the case of individual agreements deviating from the foregoing for customer-specific products.

6. Unless otherwise agreed in individual contracts, **all orders are subject to our General Terms and Conditions of Supply.**

7. **Our manufacturing sites serving the automotive business apply the IATF 16949 standard.** The IATF certifications confirm our compliance with requirements regarding the quality management system in the automotive industry. Referring to customer requirements and customer specific requirements ("CSR") TDK always has and will continue to have the policy of respecting individual agreements. Even if IATF 16949 may appear to support the acceptance of unilateral requirements, we hereby like to emphasize that **only requirements mutually agreed upon can and will be implemented in our Quality Management System.** For clarification purposes we like to point out that obligations from IATF 16949 shall only become legally binding if individually agreed upon.

8. The trade names EPCOS, CarXield, CeraCharge, CeraDiode, CeraLink, CeraPad, CeraPlas, CSMP, CTVS, DeltaCap, DigiSiMic, FilterCap, FormFit, InsuGate, LeaXield, MediPlas, MiniBlue, MiniCell, MKD, MKK, ModCap, MotorCap, PCC, PhaseCap, PhaseCube, PhaseMod, PhiCap, PiezoBrush, PlasmaBrush, PowerHap, PQSine, PQvar, SIFERRIT, SIFI, SIKOREL, SilverCap, SIMDAD, SiMic, SIMID, SineFormer, SIOV, SurfIND, ThermoFuse, WindCap, XieldCap are **trademarks registered or pending** in Europe and in other countries. Further information will be found on the Internet at www.tdk-electronics.tdk.com/trademarks.

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