THE „LEAN“ BUFFER CIRCUIT

COMPACT DESIGN

3-Phase Frequency converters with Low-Capacitance DC-Link (LCDC)

Robots, elevators, assembly lines, processing centers, tooling machines - high process speed and further improvement of automation levels are unthinkable without frequency controlled AC drives. And it would not be possible to achieve the optimum operating characteristics at an economically feasible utilization level of available resources.

Most of the contemporary 3-phase frequency converters are working with a DC link, mainly using electrolytic capacitors to buffer the DC voltage. When selecting the electrolytic capacitors, the dominating criteria are the AC current load and the required operating life time. As a rule, this leads to the installation of large banks of electrolytic capacitors even though the large capacitance as such would not even be necessary for the buffering.

These days, decentralized motors with integrated drive are becoming more and more popular. The advantages of this topology are more intelligent and flexible interconnection and control of the individual systems, as well as simplified and more convenient maintenance conditions. At the same time, developers are tasked to improve the technical performance of the electronic drives, reduce their mechanical dimensions and - of course - cost.

The „LCDC“ (DC buffer circuit with small capacitance) complies with all these requirements and has become available thanks to the high density DC film capacitors designed and manufactured by ELECTRONICON.

Example:

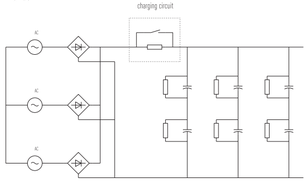
A 1.5kW frequency converter with electrolytic capacitors, pic 1a.

A comparable solution using LCDC is shown in pic 1b.

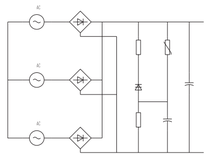
- **LESS COMPONENTS, WEIGHT AND COST**
- **REDUCED POWER LOSSES**
- **ENHANCED RELIABILITY (LOW FIT RATE)**
- **LONG OPERATING LIFE**

The following compares a DC link with electrolytic capacitors and MKP film capacitors of our E61 series by the example of a **5kW drive** ($T_{ambient}$ = 70°C, target life time = 50.000 h):

DC link with electrolytic capacitors
Pic 2a



LCDC link with MKP capacitors
Pic 2b



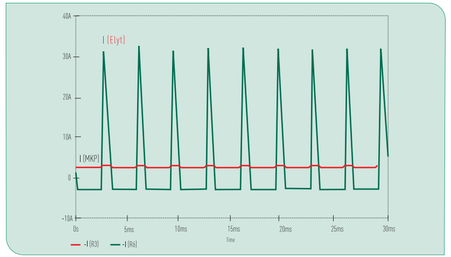
DIMENSIONS AND TECHNICAL FEATURES (5kW)

	Elyt* 1300µF/450V	E61 48µF/900V
ESR/300Hz	110 mΩ	4.3 mΩ
I_{rms}/300Hz	8 A	35 A
D × L	40 × 96 mm	50 × 57 mm
Volume per unit	120 cm³	112 cm³
Weight per unit	170 g	120 g
Required quantity	6	1
Total volume installed	6 × 120 cm³ = 720 cm³	112 cm³
Total weight installed	6 × 170 g = 1020 g	120 g

* example: market-leading Japanese manufacturer

INTERACTIONS WITH MAINS

The comparison of mains currents in pic.3 shows that the necessity for filtering is substantially reduced as well:



COST ADVANTAGES

Presuming that the expenses for the sharing resistors and the charging circuit of the electrolytic capacitors equals more or less the cost of the additional buffering for the MKP circuit, we can achieve a cost reduction by factor 5 when using MKP capacitors instead of electrolytic capacitors. This does not yet consider indirect savings by improved reliability of the final product, reduced power losses a.o.

YOU WOULDN’T HAVE THOUGHT:

SIMPLY BETTER

Film capacitors can save space and cost in your DC Link

The capacitors of the E61 series are optimized for use in DC Link circuits with high rms and surges currents. The pin terminals allow for direct integration into your printed circuit board.

Along with their high specific ratio of capacitance to volume, they offer excellent self-healing without loss of capacitance, long term stability, and long storability.

The winding is placed inside a flame retardant housing filled with solid resin (PUR). In order to minimize self-inductance and dimensions, the E61-capacitors are not equipped with an internal fail-safe device. Capacitors with their comparably high fire load (appr. 40MJ/kg) do always bear a certain risk of collateral damage in the event of a failure. It is therefore necessary to place them in uncritical environment or integrate other proper measures of prevention.

Technical Data:

Standards ..... IEC 61071, optional IEC 61881
can ..... plastic
mounting position ..... optional
filling material ..... solid, based on vegetable oil, non-PCB
internal protection ..... none
fire load ..... 40 MJ/kg
C_N tolerance ..... ±5%
insulation strength C × R_{is} ..... 5000 s
$tan\delta_0$ ..... $2x10^{-4}$
operating temperatures
Θ_{min} Θ_{max} ..... -40 ... +85°C
$\Theta_{HOTSPOT}$ ..... ≤ 85°C
storing temperature ..... -40 ... +85°C
FIT Rate ..... 50 FIT
(reference service life 100 000 h, $\Theta_{HOTSPOT}$ ≤ 70°C)

C_N µF	R_S mΩ	R_{th} K/W	I_{max} A	Î kA	I_S kA	W_R W_S	L_e nH	D_1 × H (mm)	Design	m kg	Order no.
U_N 500V DC			**U_T 230V**			**U_S 750V**			**U_{BB} 750V DC**		
85	2	10.9	35	1.1	3.3	11.9	45	50 × 57	P3	0.12	E61.G57-853P30
195	3.4	7.4	32	1.1	3.3	24.4	66	50 × 95	P3	0.18	E61.G95-204P30
260	5.2	6.1	30	1.1	3.3	32.5	85	50 × 120	P3	0.21	E61.G12-264P30
U_N 700V DC			**U_T 230V**			**U_S 1050V**			**U_{BB} 1050V DC**		
58	1.9	10.9	30	0.9	2.7	14.2	45	50 × 57	P3	0.12	E61.G57-583P30
142	3.5	7.4	32	0.93	2.8	34.8	66	50 × 95	P3	0.18	E61.G95-144P30
190	4.7	6.1	25	0.91	2.73	46.6	85	50 × 120	P3	0.21	E61.G12-194P30
U_N 900V DC			**U_T 300V**			**U_S 1350V**			**U_{BB} 1350V DC**		
36	2.4	10.9	35	0.7	2.1	14.6	45	50 × 57	P3	0.12	E61.G57-363P30
45	2.1	10.9	35	0.8	2.4	18.2	45	50 × 57	P3	0.12	E61.G57-453P30
48	2.2	10.9	35	0.85	2.55	19.4	45	50 × 57	P3	0.12	E61.G57-483P30
112	4.1	7.4	32	0.84	2.52	43.7	66	50 × 95	P3	0.18	E61.G95-114P30
155	6	6.1	30	0.85	2.55	62.8	85	50 × 120	P3	0.21	E61.G12-164P31
U_N 1100V DC			**U_T 300V**			**U_S 1650V**			**U_{BB} 1650V DC**		
30	2.8	10.9	20	0.64	1.92	18.2	45	50 × 57	P3	0.12	E61.G57-303P30
73	4.5	7.4	25	0.66	1.98	44	66	50 × 95	P3	0.18	E61.G95-733P30
100	6.1	6.1	25	0.66	1.98	60.5	85	50 × 120	P3	0.21	E61.G12-104P30
U_N 1300V DC			**U_T 300V**			**U_S 1950V**			**U_{BB} 1950V DC**		
12	4	10.9	20	0.38	1.14	10	45	50 × 57	P3	0.12	E61.G57-123P30
16.5	3	10.9	20	0.47	1.41	14	45	50 × 57	P3	0.12	E61.G57-173P30
40.5	5.7	7.4	25	0.49	1.47	34	66	50 × 95	P3	0.18	E61.G95-413P30
55	7.7	6.1	25	0.49	1.47	46	85	50 × 120	P3	0.21	E61.G12-553P30