

Laminations and EK Core Packages from MUMETALL[®], VACOPERM[®] und PERMENORM[®]

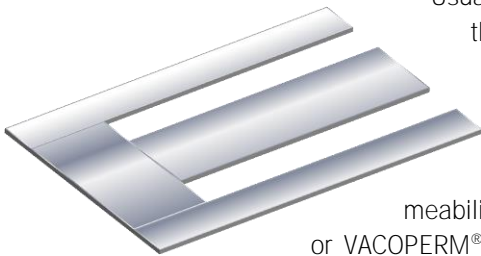
Introduction

SEKELS GmbH is the exclusive distributor for core packages made of NiFe alloys (MUMETALL[®], VACOPERM[®], PERMENORM[®]) and SiFe alloys (TRAFOPERM[®]) from VACUUMSCHMELZE GmbH & Co. KG (Germany).

Availability / Product discontinuation

Laminations and core packages made of the listed NiFe alloys are no longer available in all dimensions and strip thicknesses. Please contact us to check the current delivery situation.

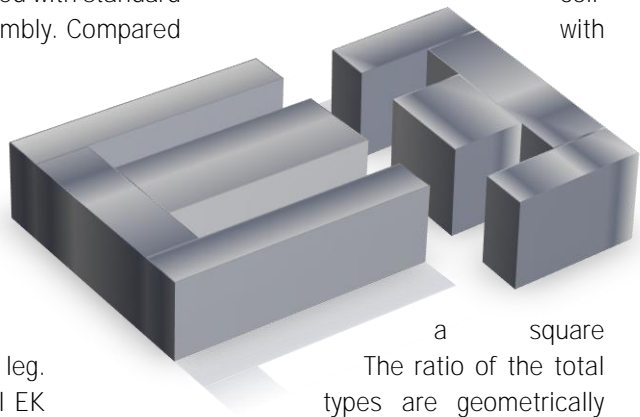
Standard laminations are described in DIN EN 61021 in a variety of sizes and grades. They are stamped from a pre-material strip of the respective thickness and finished by a consequent annealing process to optimize the magnetic properties. A thin oxide layer which has been formed during the annealing process is typically sufficient as interlayer isolation. Especially with thin laminations careful handling is required in order to not reduce or destroy the magnetic properties by elastic or plastic deformation.



Usually laminations are stacked in alternating directions in order to reduce the effective air gap. The possible effective permeability depends, besides from the alloy of course, from the size and shape of the laminations, which both influence the ratio between the mean magnetic path length and the effective air gap (shearing). ED and U laminations exhibit the lowest shearing effect and allow the highest permeability values. In combination with the high permeability alloys MUMETALL[®] or VACOPERM[®] 100, they are especially suitable for chokes or transformers which

need a high inductivity.

Core packages are produced by stacking single laminations and finishing the package by impregnation, welding or mechanical interlocking. This allows, combined with standard coil-formers, a fast and cost-effective production and assembly. Compared alternated stacked individual laminations, core packages show lower effective permeabilities even when they are face grinded. They are however especially suitable for applications which need tolerated A_L values, like e.g. chokes with pre-magnetization.



Standard core packages are described in DIN EN 61021. The EK types, stacked from EE laminations, are optimized for an effective build-up. They feature ground area, and a square cross-section of the middle leg. core cross section to the winding space is 1:1,55. All EK similar.

Additionally SEKELS GmbH is offering customer-specific laminations and packages, from prototyping to high quantity production.

Alloys and sizes

Out of the huge verity of soft magnetic alloys, NiFe alloys fill the gap between the SiFe alloys for standard 50/60 Hz applications, and ferrites, powder alloys or amorphous and nanocrystalline alloys for higher frequencies. They are especially suitable for applications with high demands on permeability/inductivity, iron losses or e.g. harmonic distortion. Packages from SiFe alloys are especially suitable for applications with tolerated A_L -values.



SEKELS GmbH
Dieselstrasse 6
61239 Ober-Mörlen
Germany

Tel.: +49 (0) 6002 9379-0
Fax: +49 (0) 6002 9379-79
mail@sekels.de
www.sekels.de

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The basic material properties of the alloys are listed in **table 1**. Please note that coercivity and permeability values have been measured with ring cores after optimal magnetic annealing treatment. For core packages these values are lowered by mechanical treatment and geometrical influences. Practical values are defined in the “Magnetic Qualities”.

Table 1: Basic material properties of soft magnetic alloys for laminations and core packages

Alloy	Composition	μ_r (0,4 A/m, 50 Hz)	$H_{c, stat}$ [A/m]	B_s [T]	T_c [°C]	Density [g/cm ³]
MUMETALL®	80 % NiFe	ca. 30000	3	0,8	400	8,7
VACOPERM 100®	80 % NiFe	ca. 60000	2	0,78	400	8,7
PERMENORM 5000 H2®	50 % NiFe	ca. 10000	10	1,55	440	8,25
TRAFOPERM N2®	3 % SiFe	ca. 1600 (1,2 A/m)	25	2,03	750	7,65

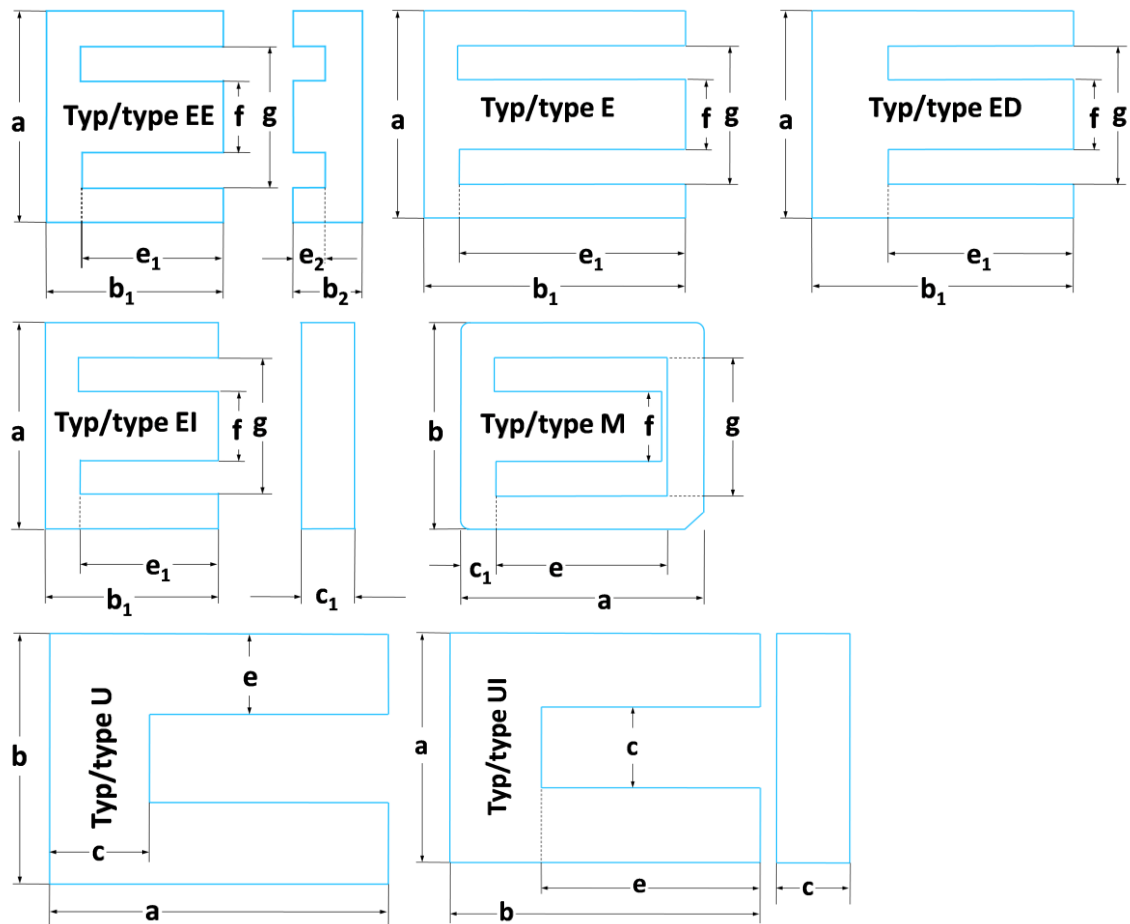
Table 2: Nominal sizes of DIN laminations (selection)

DIN type	a	b(1)	b2	C(1)	e(1)	e2	f	g
	<i>mm</i>	<i>mm</i>	<i>mm</i>	<i>mm</i>	<i>mm</i>	<i>mm</i>	<i>mm</i>	<i>Mm</i>
EE 12,6	12,6	8,6	4	-	6,7	2,1	3,8	8,8
EE 16	16	11	5	-	8,6	2,6	4,8	11,2
EE 20	20	14	6	-	11	3	6	14
EE 25	25	17	8	-	13,2	4,2	7,6	17,4
EE 32	32	22	10	-	17,2	5,2	9,6	22,4
EE 40	40	28	12	-	22	6	12	28
ED 12,6	12,6	17	-	-	12,9	-	3,8	8,8
ED 16	16	21	-	-	16,1	-	4,8	11,2
ED 20	20	26	-	-	20	-	6	14
ED 25	25	33	-	-	25,2	-	7,6	17,4
ED 32	32	42	-	-	32,2	-	9,6	22,4
E 12,6	12,6	12,6	-	-	10,7	-	3,8	8,8
E 16	16	16	-	-	13,6	-	4,8	11,2
E 20	20	20	-	-	17	-	6	14
E 25	25	25	-	-	21,2	-	7,6	17,4
E 32	32	32	-	-	27,2	-	9,6	22,4
EI 30	30	20	-	5	15	-	10	20
EI 38	38,4	25,6	-	6,4	19,2	-	12,8	25,6
EI 42	42	28	-	7	21	-	14	28
EI 48	48	32	-	8	24	-	16	32
M 20	20	20	-	3,5	13	-	5	13
M 22	22	20	-	3,5	15	-	5	13
M 30	30	30	-	5	20	-	7	20
M 30z	30	28	-	5	20	-	7	18
M 42	42	42	-	6	30	-	12	30
M 55	55	55	-	8,5	38	-	17	38
M 65	65	65	-	10	45	-	20	45
M 74	74	74	-	11,5	51	-	23	51



M 85	85	85	-	14,5	56	-	29	56
M 102	102	102	-	17	68	-	34	68
U 25/10	25	10	-	5	2,5	-	-	-
U 35/14	35	14	-	7	3,5	-	-	-
U 51/20	51	20	-	10	5	-	-	-
U 71/28	71	28	-	14	7	-	-	-
U 102/40	102	40	-	20	10	-	-	-
U 41/20	41	20	-	10	5	-	-	-
U 57/28	57	28	-	14	7	-	-	-
U 82/40	82	40	-	20	10	-	-	-
UI 30	30	40	-	10	30	-	-	-
UI 39	39	52	-	13	39	-	-	-
UI 48	48	64	-	16	48	-	-	-
UI 60	60	80	-	20	60	-	-	-
Tolerances	$\pm 1/2$ IT12	$\pm 1/2$ IT12	$\pm 1/2$ IT12	-	+0 IT 12	+0 IT 12	+0 IT11	+0 IT 11

Terms see drawings. $b_3 = b_1 + b_2$. $e_3 = e_1 + e_2$.



SEKELS GmbH
 Dieselstrasse 6
 61239 Ober-Mörlen
 Germany

Tel.: +49 (0) 6002 9379-0
 Fax: +49 (0) 6002 9379-79
 mail@sekels.de
 www.sekels.de

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Table 3: Nominal sizes of the EK core packages

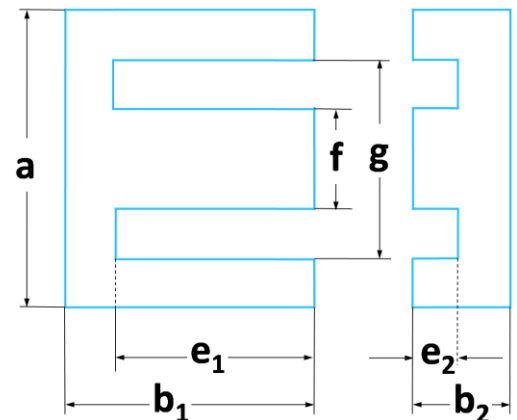
DIN type	a	b1	b2	b3	e1	e2	e3	f	g	h_p for strip thickness (mm)			
										0,1	0,2	0,35	
EK 12,6	12,6	8,6	4	12,6	6,7	2,1	8,8	-	3,8	8,8	3,8	3,8	-
EK 16	16	11	5	16	8,6	2,6	11,2		4,8	11,2	4,8	4,8	
EK 20	20	14	6	20	11	3	-	14	6	14	6	6	6
EK 25	25	17	8	25	13,2	4,2	-	17,4	7,6	17,4	7,6	7,6	7,6
EK 25 L	25	17	17	34	13,2	13,2	-	26,4	7,6	17,4	7,6	7,6	7,6
EK 32	32	22	10	32	17,2	5,2	-	22,4	9,6	22,4	9,6	9,6	9,6
EK 32L	32	22	22	44	17,2	17,2	-	34,4	9,6	22,4	9,6	9,6	9,6
EK 40	40	28	12	40	22	6	-	28	12	28	12	12	12
EK 40L	40	28	28	56	22	22	-	44	12	28	12	12	12
Mass-toleranzen	$\pm 1/2$ IT13	-	-	$\pm 1/2$ IT14	-	-	$\pm 1/2$ IT13	$\pm 1/2$ IT14	\pm IT11	$\pm 1/2$ IT12	0/- IT13	0/- IT14	0/- IT15

Terms see drawing.

h_p is the height of the core package.

$$b_3 = b_1 + b_2$$

$$e_3 = e_1 + e_2$$



Magnetic Quality

The Magnetic Quality defines the magnetic limiting values and the testing conditions.

Laminations: For laminations, these are the permeability μ_4 , measured with a field strength of 4 mA/cm (equal to 0,4 A/m in SI units) and a frequency of 50 Hz. The measurement is done as random examination with stacked laminations.

Due to the shearing effect, permeabilities with stacked laminations are lower compared to shapes with a closed magnetic circuit, like e.g. tape-wound cores or stamped rings. The relatively highest effective permeabilities are achieved with alternately stacked ED and U laminations, which behave similar to closed shapes up to magnetic saturation. With M, EI and E laminations, the air gap influence significantly increases when half of the saturation flux density is reached due to material saturation in the basis area.

The standard grades are listed in **table 4**. Often special grades with higher permeability values are possible. Please contact us if you require further information.

Core packages: The standard qualities for packages without air gap (face grinded) appoint a lower limiting A_L value (for historical reasons -15 %). The standard qualities for packages with air gap define the nominal A_L value and the allowed tolerances. **Please see tables 5 & 6.**



SEKELS GmbH
Dieselstrasse 6
61239 Ober-Mörlen
Germany

Tel.: +49 (0) 6002 9379-0
Fax: +49 (0) 6002 9379-79
mail@sekels.de
www.sekels.de

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Special qualities are available on request, either with higher A_L values, or with additional measurements of e.g. the iron losses, or the apparent power. Please contact us, if you require further information.

Table 4: Standard Magnetic Qualities of laminations

Strip thickness	MUMETALL® A - 052			VACOPERM® 100 B - 050			PERMENORM® 5000 H2 H2 - 050		
	0,1 mm	0,2 mm	0,35 mm	0,1 mm	0,2 mm	0,35 mm	0,1 mm	0,2 mm	0,35 mm
DIN type	Minimum permeability values								
EE 12,6	7500	5500	4000	11000	7000	5000	2700	2200	1800
EE 16	9000	7000	5500	13500	10000	7000	2700	2400	2200
EE 20	10000	9000	7000	16500	13500	10000	3000	2700	2400
EE 25	11000	10000	8000	18000	15000	1200	3000	3000	2700
EE 32	12000	12000	10000	20000	18000	15000	3000	3000	3000
EE 40	13500	13500	12000	22000	20000	17000	3300	3000	3000
ED 12,6	13500	12000	10000	22000	20000	13500	3300	3000	3000
ED 16	15000	13500	12000	24000	22000	18000	3600	3300	3300
ED 20	15000	15000	13500	27000	24000	20000	3600	3300	3300
ED 25	16000	16000	15000	30000	30000	22000	3600	3600	3600
ED 32	16500	16500	16500	30000	33000	24000	3600	3600	3600
E 12,6	10000	9000	8000	18000	15000	10000	3000	2700	2400
E 16	11000	11000	10000	20000	18000	13500	3000	2700	2700
E 20	-	12000	11000	-	20000	15000	-	3000	2700
E 25	-	13500	12000	-	24000	18000	-	3000	3000
E 32	-	15000	13500	-	27000	20000	-	3000	3000
EI 30	-	11000	10000	-	18000	15000	-	3000	2700
EI 38	-	12000	11000	-	22000	16500	-	3000	3000
EI 42	-	12000	12000	-	22000	18000	-	3000	3000
EI 48	-	13500	12000	-	24000	20000	-	3300	3000
M 20	13500	-	-	22000	-	-	3300	-	-
M 22	13500	-	-	22000	-	-	3300	-	-
M 30	13500	-	-	24000	-	-	3600	-	-
M 30z	13500	-	-	24000	-	-	3600	-	-
M 42	15000	15000	15000	27000	30000	24000	3600	3600	3600
M 55	15000	15000	15000	30000	30000	27000	3600	3600	3600
M 65	15000	15000	15000	30000	30000	27000	3600	3600	3600
M 74	15000	15000	15000	30000	30000	27000	3600	3600	3600
M 85	15000	15000	15000	30000	30000	27000	3600	3600	3600
M 102	15000	15000	15000	30000	30000	27000	3600	3600	3600
UI 30	13500	13500	13500	24000	24000	20000	3600	3300	3300
UI 39	-	15000	13500	-	27000	22000	-	3300	3300
UI 48	-	16500	15000	-	30000	24000	-	3600	3300
UI 60	-	18000	15000	-	33000	24000	-	3600	3600



SEKELS GmbH
 Dieselstrasse 6
 61239 Ober-Mörlen
 Germany

Tel.: +49 (0) 6002 9379-0
 Fax: +49 (0) 6002 9379-79
 mail@sekels.de
 www.sekels.de

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Table 5: Standard magnetic qualities for core packages without air gap. Lower tolerance limit -15 %, measuring frequency 50/60 Hz, excitation $B_{peak} = 2$ mT for MUMETALL® and PERMENORM®, 6 mT for TRAFOPERM®.

Type	Contact pressure $\pm 10\%$ N	A - 066 MUMETALL®		H2 - 066 PERMENORM® 5000 H2		N2 - 066 TRAFOPERM® N2	
		A_L (nH)	μ	A_L (nH)	μ	A_L (nH)	μ
EK 12,6	6,3	2000	3630	1000	1820	-	-
EK 16	10	3150	4500	1250	1780	-	-
EK 20	16	5000	5750	2000	2300	1000	1150
EK 25, 25L	25	6300	5730	2500	2270	1250	1140
EK 32, 32L	40	10000	7140	3150	2250	1600	1140
EK 40, 40L	63	12500	7350	4000	2350	2000	1170

Table 6: Standard magnetic qualities for core packages with air gap. Measuring frequency 50 Hz or 300 Hz, excitation $B_{peak} = 2$ mT. Contact pressure as in table 5.

Type	Magnetic Quality	MUMETALL®: A - 060 ; PERMENORM® 5000 H2: H2 - 060 ; TRAFOPERM® N2: N2 - 060										
		\pm tolerance for A_L -values in nH										
<i>A_L-values</i>		160	200	250	315	400	500	630	800	1000		
EK 12,6	A - 060	16	16	20	20	25	-					
	H2 - 060	12,5			-							
	N2 - 060	10										
EK 16	A - 060	12,5	12,5	12,5	16	16	20	20	25	-		
	H2 - 060	10	10			20	-					
	N2 - 060					-						
EK 20	A - 060	10	10	12,5	12,5	12,5	16	16	16	20		
	H2 - 060	8		10	10			10	20	-		
	N2 - 060								-			
EK 25 EK 25L	A - 060	10	10	10	10	12,5	12,5	12,5	16	16		
	H2 - 060	8	8			10	10			10	10	20
	N2 - 060									10	10	-
EK 32 EK 32L	A - 060	10	10	10	10	10	10	10	10	12,5		
	H2 - 060	8	8	8	8	8		10	10	12,5		
	N2 - 060					8						
EK 40 EK 40L	A - 060	-	10	10	10	10	10	10	10	10		
	H2 - 060	-	8	8	8	8		10	10	10		
	N2 - 060	8				8		8				

Form parameters and calculation data for laminations

The form parameters and calculation data allow to determine the maximum number of turns, the copper resistance, wire length, inductivity and the dc time constant for different wire diameters. Please note that due to variances of the coil formers and tolerances of the core package, practical values may deviate.



Table 7: Form parameters of laminations (selection). The values are valid for MUMETALL® in strip thickness 0,2 mm.

DIN type	h_p	l_{Fe}	A_{Fe}	A_F	M_{Fe}	m_{Fe}	A_{Cu}	l_{Cu}	m_{Cu}	AL/μ_r	A_R (20°C)
	<i>mm</i>	<i>cm</i>	<i>cm²</i>	<i>cm²</i>	<i>g</i>	<i>g</i>	<i>cm²</i>	<i>cm</i>	<i>g</i>	<i>nH</i>	<i>$\mu\Omega$</i>
EE 12,6	3,8	3,0	0,13	1,1	0,2	3,4	0,07	2,8	1,7	0,5	71
EE 16	4,8	3,8	0,21	1,8	0,3	7	0,12	3,5	3,6	0,7	51
EE 20	6	4,8	0,32	2,9	0,5	14	0,19	4,3	7	0,8	39
EE 25	7,6	6,0	0,52	4,5	0,8	27	0,30	5,4	14	1,1	30
EE 32	9,6	7,7	0,83	7,4	1,3	55	0,54	6,8	32	1,4	22
EE 40	12	9,6	1,30	11,5	2,0	108	0,87	8,4	65	1,7	16
ED 12,6	3,8	3,5	0,13	1,5	0,3	3,91	0,07	2,8	2	0,5	71
ED 16	4,8	4,3	0,21	2,3	0,4	8	0,12	3,5	4	0,6	51
ED 20	6	5,4	0,32	3,6	0,6	15	0,19	4,3	7	0,8	39
ED 25	7,6	6,8	0,52	5,8	1,0	31	0,30	5,4	14	1,0	30
ED 32	9,6	8,7	0,83	9,3	1,6	63	0,54	6,8	32	1,2	22
E 12,6	3,8	3,0	0,13	1,1	0,2	3,4	0,07	2,8	2	0,5	71
E 16	4,8	3,8	0,21	1,7	0,3	7	0,12	3,5	4	0,7	51
E 20	6	4,8	0,32	2,6	0,5	14	0,19	4,3	7	0,8	39
E 25	7,6	6,0	0,52	4,2	0,7	27	0,30	5,4	14	1,1	30
E 32	9,6	7,7	0,83	6,8	1,2	55	0,54	6,8	32	1,4	22
EI 30	10	6,0	0,90	6,0	1,0	47	0,26	6,4	15	1,9	41
EI 38	12,8	7,7	1,47	9,8	1,7	99	0,45	8,1	32	2,4	30
EI 42	14	8,4	1,76	11,8	2,0	129	0,55	8,8	43	2,6	27
EI 48	16	9,6	2,30	15,4	2,7	192	0,74	10,0	65	3,0	23
EI 54	18	10,8	2,92	19,4	3,4	274	0,95	11,1	95	3,4	20
M 20	5	4,7	0,23	3,0	0,5	9	0,17	4,3	7	0,6	42
M 22	5	5,1	0,23	3,2	0,6	10	0,20	4,7	9	0,6	39
M 30	7	7,2	0,44	6,4	1,1	27	0,48	6,4	27	0,8	23
M 30z	7	7,0	0,44	6,2	1,1	27	0,40	6,4	23	0,8	27
M 42	12	10,2	1,30	12,2	2,1	115	1,07	8,8	84	1,6	14
M 55	17	13,1	2,60	22,3	3,9	296	1,64	11,3	166	2,5	12
M 65	20	15,5	3,60	31,0	5,4	485	2,38	13,3	282	2,9	9
M 74	23	17,6	4,76	40,5	7,0	729	3,09	15,0	413	3,4	8
M 85	29	19,7	7,57	57,1	9,9	1297	3,28	17,1	502	4,8	9
M 102	34	23,8	10,40	80,9	14,1	2154	5,20	20,4	945	5,5	7
U 25/10	5	5,5	0,11	1,5	0,3	5,4	0,36	3,3	11	0,3	16
U 35/14	7	7,7	0,22	2,9	0,5	15	0,75	4,5	30	0,4	10
U 51/20	10	11,2	0,45	6,1	1,1	44	1,69	6,4	96	0,5	6
U 71/28	14	15,6	0,88	11,9	2,1	120	3,48	8,8	272	0,7	4
U 41/20	10	9,2	0,45	5,1	0,9	36	1,24	6,4	71	0,6	9
U 57/28	14	12,8	0,88	9,9	1,7	98	2,56	8,8	201	0,9	6
U 82/40	20	18,4	1,80	20,4	3,5	288	5,61	12,3	616	1,2	4



UI 30	10	12,0	0,90	12,0	2,1	94	1,20	8,4	90	0,9	12
UI 39	13	15,6	1,52	20,3	3,5	206	2,13	10,7	204	1,2	9
UI 48	16	19,2	2,30	30,7	5,3	385	3,34	13,1	390	1,5	7
UI 60	20	24,0	3,60	48,0	8,4	752	5,41	16,2	781	1,9	5

- h_p is the stacking height according to DIN EN 61021
- l_{Fe} is the mean magnetic path length, calculated from the average of the geometric maximum and minimum path without radii
- A_{FE} is the effective iron cross section, calculated for MUMETALL[®], respectively VACOPERM[®] 100 in strip thickness 0,2 mm and a stacking factor of 90 %
- A_F is the surface area of a single lamination
- M_{Fe} is the weight of a single lamination in strip thickness 0,2 mm, MUMETALL[®], respectively VACOPERM[®] 100. Due to process-inherent influences, the weight tolerance is about $\pm 10\%$
- m_{Fe} is the weight of a stacked lamination package of core height h_p , calculated for MUMETALL[®], respectively VACOPERM[®] 100 in strip thickness 0,2 mm, a density of 8,7 g/cm³, and a stacking factor of 90 %
- A_{Cu} is the effective copper cross section, calculated with copper filling factors between 30 % for smaller sizes, and 45 % for bigger sizes
- l_{Cu} is the mean copper length of a single turn, calculated from the core shape. Depending from the coil former practical values may deviate
- m_{Cu} is the copper weight, calculated with $m_{Cu} (g) = l_{Cu} (cm) \times A_{Cu} (cm^2) \times \delta_{Cu} (g/cm^3)$. $\delta_{Cu} = 8,92 g/cm^3$
- A_L/μ_r gives, multiplied with the permeability values from Table 3 (Magnetic Qualities), the minimum A_L value in nH
- A_R is the so-called resistance factor. $A_R = \rho_{Cu} * l_{Cu}/A_{Cu}$. The ratio A_L/A_R is the dc time constant. The dc time constant is the time to reach 63,2 % of the final value after switching on a dc current. ρ_{Cu} is the temperature dependent specific electrical resistance of copper



Form parameters and calculation data for core packages

The form parameters and calculation data allow to determine the maximum number of turns, the copper resistance, wire length, inductivity and the dc time constant for different wire diameters. Please note that due to variances of the coil formers and tolerances of the core package, practical values may deviate.

Table 8: Form parameters of EK core packages. The values are valid for PERMENORM® 5000 H2 in strip thickness of 0,35 mm. For other thicknesses or alloys, the core cross section A_{Fe} need to be corrected by the stacking factor, and the core weight m_{Fe} need to be corrected by the specific weight. For details see Table 9.

DIN-type	$h_{p,min}$	l_{Fe}	A_{Fe}	m_{Fe}	l_{Cu}	A_{Cu}	m_{Cu}	A_R
	<i>mm</i>	<i>cm</i>	<i>cm²</i>	<i>g</i>	<i>cm</i>	<i>cm²</i>	<i>g</i>	<i>μΩ</i>
EK 12,6	3,8	3,0	0,14	3,4	2,8	0,06	1,6	74,7
EK 16	4,8	3,8	0,22	6,9	3,5	0,12	3,7	49,8
EK 20	6,0	4,8	0,34	13,4	4,3	0,19	7,3	38,8
EK 25	7,6	6,0	0,54	26,8	5,3	0,31	14,8	29,0
EK 25L		7,8		34,8		0,49	23,0	18,4
EK 32	9,6	7,7	0,87	54,9	6,8	0,53	32,0	21,9
EK 32L		10,0		72,0		0,83	50,0	13,9
EK 40	12,0	9,6	1,35	107,2	8,4	0,86	64,0	16,7
EK 40L		12,7		142,9		1,39	104,0	10,3

$h_{p,min}$ is the minimum core height according to DIN EN 61021

l_{Fe} is the mean magnetic path length

A_{Fe} is the effective core cross section, calculated for PERMENORM® 5000 H2 in strip thickness of 0,35 mm, and a stacking factor of 94 %

m_{Fe} is the core mass, calculated for PERMENORM® 5000 H2 in strip thickness of 0,35 mm, a specific weight of 8,25 g/cm³, and a stacking factor of 94 %

l_{Cu} is the mean copper path length

A_{Cu} is the effective copper cross section, calculated with a copper filling factor of 50 %

m_{Cu} is the copper mass. $m_{Cu} (g) = l_{Cu} (cm) \times A_{Cu} (cm^2) \times \delta_{Cu} (g/cm^3)$. $\delta_{Cu} = 8,92 g/cm^3$

A_R is the so-called resistance factor. $A_R = \rho_{Cu} \cdot l_{Cu}/A_{Cu}$. The ratio A_L/A_R is the dc time constant. The dc time constant is the time to reach 63,2 % of the final value after switching on a dc current.


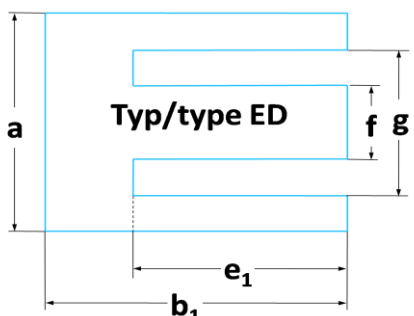
Table 9: Stacking factors and specific weight, correction factors for core mass m_{Fe}

Strip thickness (mm)	Stacking factors for core packages			Correction factors for core mass		
	0,35	0,2	0,1	0,35	0,2	0,1
MUMETALL®, VACOPERM® 100	94 %	94 %	92 %	1,05	1,05	1,03
PERMENORM® 5000 H2	94 %	94 %	92 %	1,00	1,00	0,98
TRAFOPERM® N2	92 %	92 %	90 %	0,91	0,91	0,89



Data sheets for laminations

For each available core packages SEKELS supplies a data sheet with all important information on request. Please see the following example:

		<h3 style="margin: 0;">Datenblatt für Kernbleche</h3> <h4 style="margin: 0;">Data sheet for laminations</h4>					
<p style="margin: 0;">Dieses Datenblatt wurde auf Basis der technischen Unterlagen der Vacuumschmelze GmbH & Co.KG generiert</p> <p style="margin: 0;"><i>This data sheet was generated on basis of the technical data from Vacuumschmelze GmbH & Co.KG</i></p>							
Sachnummer (Bestellnummer) / Part Number :				S60221-A2220-A002			
Typ <i>type</i>	Material <i>alloy</i>	Banddicke <i>strip thickness</i> (mm)	Magnetqualität <i>magnetic quality</i>		μ _{4,min}	Gewicht ¹⁾ <i>weight</i> ¹⁾ (g)	
ED 20	Vacoperm 100	0,1	B - 050	Standard	27000	0,31	
Stück per kg ¹⁾ <i>pieces per kg</i> ¹⁾						3193	
Abmessungen (mm) und Toleranzen/ <i>dimensions (mm) and tolerances :</i>							
a	b(1)	b2	C(1)	e1	e2	f	g
20,00	26,00	-	-	20,00	-	6,00	14,00
± 1/2 IT12	± 1/2 IT12	± 1/2 IT12	-	+0 IT 12	+0 IT 12	0/- IT11	+0 IT 11
							
<p>Skizze ohne Maßstab vereinfacht <i>Draft w/o scale simplified</i></p> <p>¹⁾ gerechnet mit Nenn-Banddicke. Produktionsbedingte Gewichtsschwankungen sind möglich ¹⁾ <i>calculated with the nominal strip-thickness. Process depending mass tolerances are possible</i></p>							
<p>Kern - Kenngrößen für gestapelte Kernbleche (Richtwerte, nur zur Information): <i>Form parameters and core constants for stacked laminations(guideline values, for information only):</i></p>							
Stappelhöhe <i>package height</i>	h _p (mm):	6,00	A _L (gerechnet mit μ _{4,min}) <i>A_L (calculated with μ_{4,min})</i>	A _L (nH):	19226		
Eisenquerschnitt <i>iron cross section</i>	A _{Fe} (cm ²):	0,31	Kupferquerschnitt <i>copper cross section</i>	A _{Cu} (cm ²):	0,19		
Mittl. Eisenweg <i>mean iron path</i>	l _{Fe} (cm):	5,4	Mittl. Kupferweglänge <i>mean copper path</i>	l _{Cu} (cm):	4,3		
Kerngewicht ¹⁾ <i>core mass</i> ¹⁾	m _{Fe} (g):	16,0	Kupfergewicht <i>copper mass</i>	m _{Cu} (g):	7,3		
Widerstandsfaktor bei 20 °C <i>resistance factor at 20 °C</i>	A _R (μΩ):	39	DC-Zeitkonstante bei 20 °C <i>DC time constant at 20 °C</i>	τ ₀ (ms):	496		
Widerstandsfaktor bei 100 °C <i>resistance factor at 100 °C</i>	A _R (μΩ):	52	DC-Zeitkonstante bei 100 °C <i>DC time constant at 100 °C</i>	τ ₀ (ms):	366		



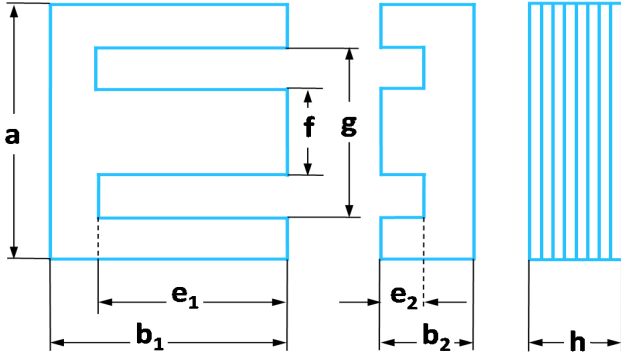
SEKELS GmbH
Dieselstrasse 6
61239 Ober-Mörlen
Germany

Tel.: +49 (0) 6002 9379-0
Fax: +49 (0) 6002 9379-79
mail@sekels.de
www.sekels.de

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Data sheets for core packages

For each available core packages SEKELS GmbH supplies a data sheet with all important information on request. Please see the following example:

SEKELS		Datenblatt für Blechpakete Data sheet for lamination packages					
Dieses Datenblatt wurde auf Basis der technischen Unterlagen der Vacuumschmelze GmbH & Co. KG generiert <i>This data sheet was generated on basis of the technical data from Vacuumschmelze GmbH & Co. KG</i>							
Sachnummer (Bestellnummer) / Part Number :			S60311-G5125-V002		plan / face-ground		
Typ type	Material alloy	Banddicke strip thickness (mm)	A_L (nH):	Toleranz tolerance	Magnetqualität magnetic quality		
EK 25	Trafoperm N2	0,1	1600	- 15%	N2 - 065	Spezial	
Abmessungen (mm) und Toleranzen/dimensions (mm) and tolerances :							
a	b1	b2	e1	e2	f	g	h
25,00	17,00	8,00	13,20	4,20	7,60	17,40	7,60
± 1/2 IT13	-	-	-	-	± IT11	± 1/2 IT12	?/? IT 15
 <p style="text-align: right;">Skizze ohne Maßstab Draft w/o scale</p>							
Kern - Kenngrößen (Richtwerte, nur zur Information): <i>Form parameters and core constants (guideline values, for information only):</i>							
Eisenquerschnitt <i>iron cross section</i>	A_{Fe} (cm ²):	0,52	Kupferquerschnitt <i>copper cross section</i>	A_{Cu} (cm ²):	0,31		
Mittl. Eisenweg <i>mean iron path</i>	l_{Fe} (cm):	6,00	Mittl. Kupferweglänge <i>mean copper path</i>	l_{Cu} (cm):	5,30		
Kerngewicht ¹⁾ <i>core mass ¹⁾</i>	m_{Fe} (g):	23,86	Kupfergewicht <i>copper mass</i>	m_{Cu} (g):	14,66		
Widerstandsfaktor bei 20 °C <i>resistance factor at 20 °C</i>	A_R (μΩ):	29,1	DC-Zeitkonstante bei 20 °C ²⁾ <i>DC time constant at 20 °C ²⁾</i>	τ_0 (ms):	55,0		
Widerstandsfaktor bei 100 °C <i>resistance factor at 100 °C</i>	A_R (μΩ):	39,3	DC-Zeitkonstante bei 100 °C ²⁾ <i>DC time constant at 100 °C ²⁾</i>	τ_0 (ms):	40,7		

¹⁾ gerechnet mit Nenn-Banddicke. Produktionsbedingte Gewichtsschwankungen sind möglich

¹⁾ calculated with the nominal strip-thickness. Process depending mass tolerances are possible

²⁾ gerechnet mit A_L - Nennwert

²⁾ calculated with nominal A_L - value



SEKELS GmbH
Dieselstrasse 6
61239 Ober-Mörlen
Germany

Tel.: +49 (0) 6002 9379-0
Fax: +49 (0) 6002 9379-79
mail@sekels.de
www.sekels.de

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About us

SEKELS GmbH develops, produces and trades technical products which are mostly related with magnetism. With a team of about 25 employees, more than half of them being physicists or engineers, SEKELS presently serves ca. 600 customers worldwide.

As an expert distributor of German VACUUMSCHMELZE GmbH & Co. KG we are offering an in-depth knowledge of their product lines and the applications, are available for technical consultation and provide the fast availability of samples and series deliveries through comprehensive stock keeping and worldwide logistics.

SEKELS develops, designs and produces customer-specific laminations and core packages, magnetic shielding and shielding systems, inductive components and magnet systems - from prototyping to series deliveries.

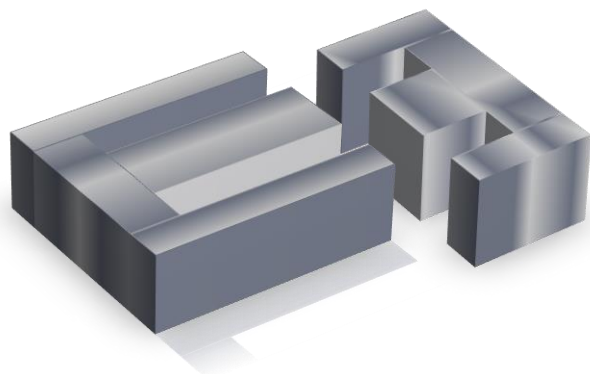
All parts, components and systems are either produced in Germany, or with quality partners in Eastern Europe based on our technical specifications. We are DIN EN ISO 9001:2015 certified and familiar with the relevant norms and standards.

Our address

SEKELS GmbH
Dieselstrasse 6
D-61239 Ober-Mörlen
phone +49 (0) 6002 9379-0
fax +49 (0) 6002 9379-79
mail@sekels.de
www.sekels.de

Your partner for core packages and laminations

Mr. Markus Habicht
Tel. +49 (0) 6002 9379-20
Fax +49 (0) 6002 9379-79
mhabicht@sekels.de



SEKELS GmbH
Dieselstrasse 6
61239 Ober-Mörlen
Germany

Tel.: +49 (0) 6002 9379-0
Fax: +49 (0) 6002 9379-79
mail@sekels.de
www.sekels.de

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