Electrical steel strip grades and coating systems

High-performance materials.
Unparalleled precision.

WAELZHOLZ

YOUR FUTURE IS WHAT DRIVES US. ELECTRICAL STEEL STRIP GRADES FOR NEW IDEAS.

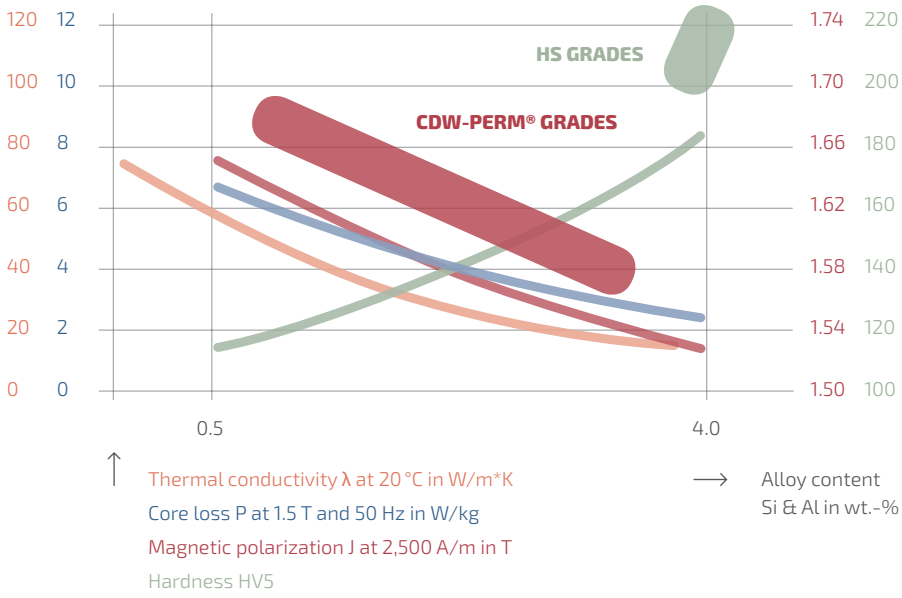
Our customers inspire us each and every day with their ideas for the electric drive systems and generators of tomorrow. We meet the resulting challenges with high-performance, non-grain oriented electrical steel strip and with services tailored to their individual needs. This is how we help our customers enter a very important market – the future.

Our philosophy: Tailor-made materials

What are your material requirements? Extremely thin electrical steel strip for high-frequency applications, perhaps only 0.10 millimeters thick? Excellent dimensional accuracy within the range of a few thousandths of a millimeter? High-strength electrical steel strip with a yield strength of over 500 MPa? Or do you maybe need combination coatings made of insulating varnish and bonding varnish? Whether your goal is efficiency, performance, speed, scalability, lightweight construction or a combination of these factors – come and talk to us about it.

The demands placed on electrical machines are wide-ranging and must always be viewed in conjunction with the respective purpose of application. This is why we combine our electrical steel expertise with our extensive knowledge of the industrial, energy, and automotive sectors. In this context, we support customers at all stages of the value chain. Our mission is to actively assist our customers in opening up new markets by developing innovative solutions together. And we will stop at nothing to achieve it.

ELECTRICAL STEEL STRIP GRADES. FOR EVERY OCCASION.



We offer a wide range of electrical steel strip grades. And you benefit from the fact that we can provide you with exactly the material that has the right magnetic properties for your own specific application. This is important because it ensures that you not only obtain the performance you require from the electrical steel strip, but also an exceptional level of efficiency. We can make the best possible use of this potential if our customers get us involved at an early stage of development.

↗ **For further information visit**
waelzholz.com/electrical-steel-strip

01 Continuous annealing furnace:
The electrical steel strip is annealed in a continuous process in order to adjust its magnetic and mechanical properties.

02 Spectrum of electrical steel strip properties:
Important properties of Waelzholz's electrical steel strip grades, such as thermal conductivity, core losses, magnetic polarization, and hardness as a function of the alloy content, at a glance.

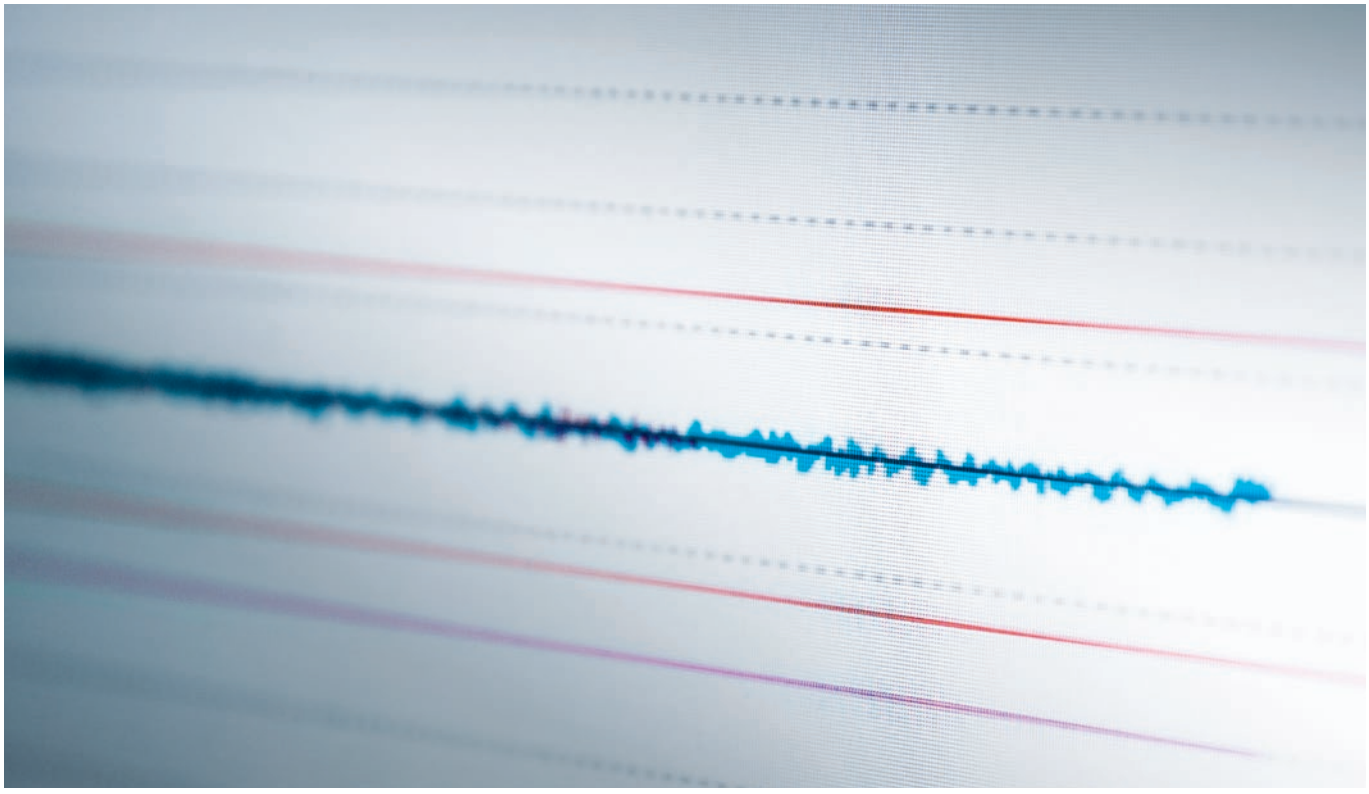
NO grades

(according to DIN EN 10303)

Electrical steel strip according to DIN EN 10303

Grade[1)]	Nominal thickness	Max. core loss			Min. mechanical properties		
		1.0 T/400 Hz	1.0 T/700 Hz	1.0 T/1,000 Hz	$R_{p0,2}$	R_m	A_{80}
	in mm	in W/kg	in W/kg	in W/kg	in MPa	in MPa	in %
NO 10	0.10	13	25	39	330	450	12
NO 15	0.15	14	25	43	330	450	12
NO 20-13	0.20	13	29	48	420	500	10
NO 20-15	0.20	15	32	55	330	450	13
NO 25-14	0.25	14	34	62	420	500	12
NO 25-17	0.25	17	40	67	330	450	13
NO 27-15	0.27	15	37	68	420	500	12
NO 27-18	0.27	18	42	70	330	450	13
NO 30-16	0.30	16	41	71	420	500	12
NO 30-19	0.30	19	45	75	330	450	13
NO 35-19	0.35	19	43	77	420	500	12
NO 35-22	0.35	22	48	85	330	450	13

Max. width: 1,000 mm. [1)] Adjustments to magnetic and mechanical properties possible after consultation.



High frequencies. High demands.

Waelzholz's particularly thin NO grades offer low core losses at high frequencies. Our top grades achieve magnetic properties that go well beyond the standard specifications. Like our NO 30-15 grade with a strip thickness of 0.3 mm that achieves a core loss of max. 15 W/kg at 400 Hz and 1 T. The exceptional dimensional accuracy of just a few thousandths of a millimeter also guarantees extremely homogeneous stacking.

NO grade delivery types

Pancake coils		
Width	in mm	20 - 1,000
Coil weight	in kg/mm strip width	max. 20
Inner diameter	in mm	508
Oscillated wound coils		
Strip width	in mm	7 - 70
Coil weight	in kg	max. 3,500
Coil width	in mm	250 - 550
Inner diameter	in mm	400
Cut-to-length sheets		
Width of sheets	in mm	400 - 1,000
Length of sheets	in mm	400 - 2,500

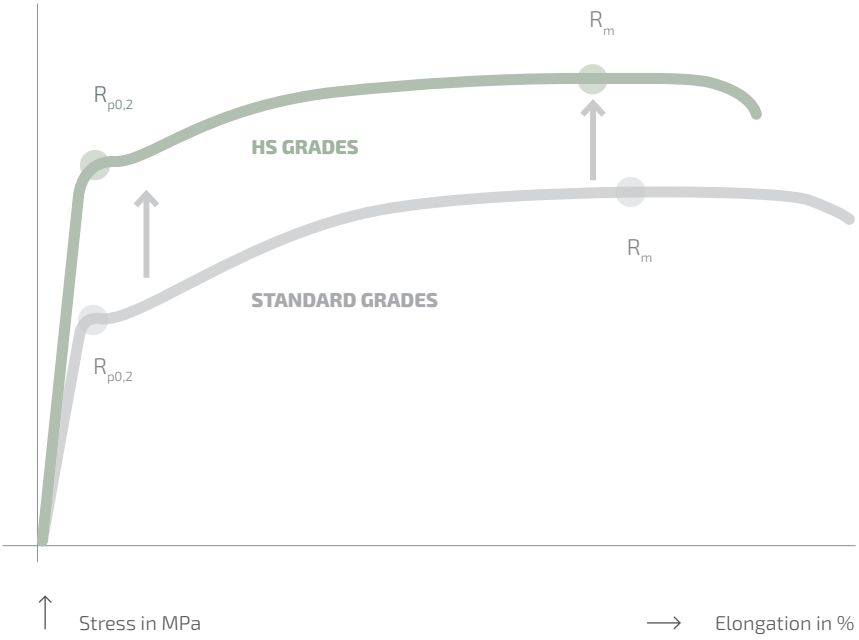
Tolerances

Thickness				
Nominal thickness	in mm	0.1	0.15 - 0.30	0.35
Deviation from nominal thickness	in mm	+/- 0.01	+/- 0.02	+/- 0.03
Thickness deviation over strip width (measurement 30 mm from edge)	in mm	+/- 0.01	+/- 0.015	+/- 0.02

Special thicknesses and special tolerances upon request

Width				
Nominal width	in mm	≤ 150	> 150 / ≤ 500	> 500 / ≤ 1,000
Deviation from nominal width	in mm	+ 0.4/-0	+ 0.6/-0	+1.5/-0
Steel sheet				
Deviation from sheet length	in %	+ 0.5/- 0 of the nominal value (max. 6 mm)		

HS grades



High-strength. For extreme mechanical stress.

Increasingly high motor speeds of up to 25,000 rpm require electrical steel strip that exhibits exceptional mechanical strength. Through a special alloy, we increase the tensile strength of our NO grades and achieve yield strengths of over 500 MPa. This is why our HS (high-strength) grades can be found, for example, in high-frequency automotive drives systems.

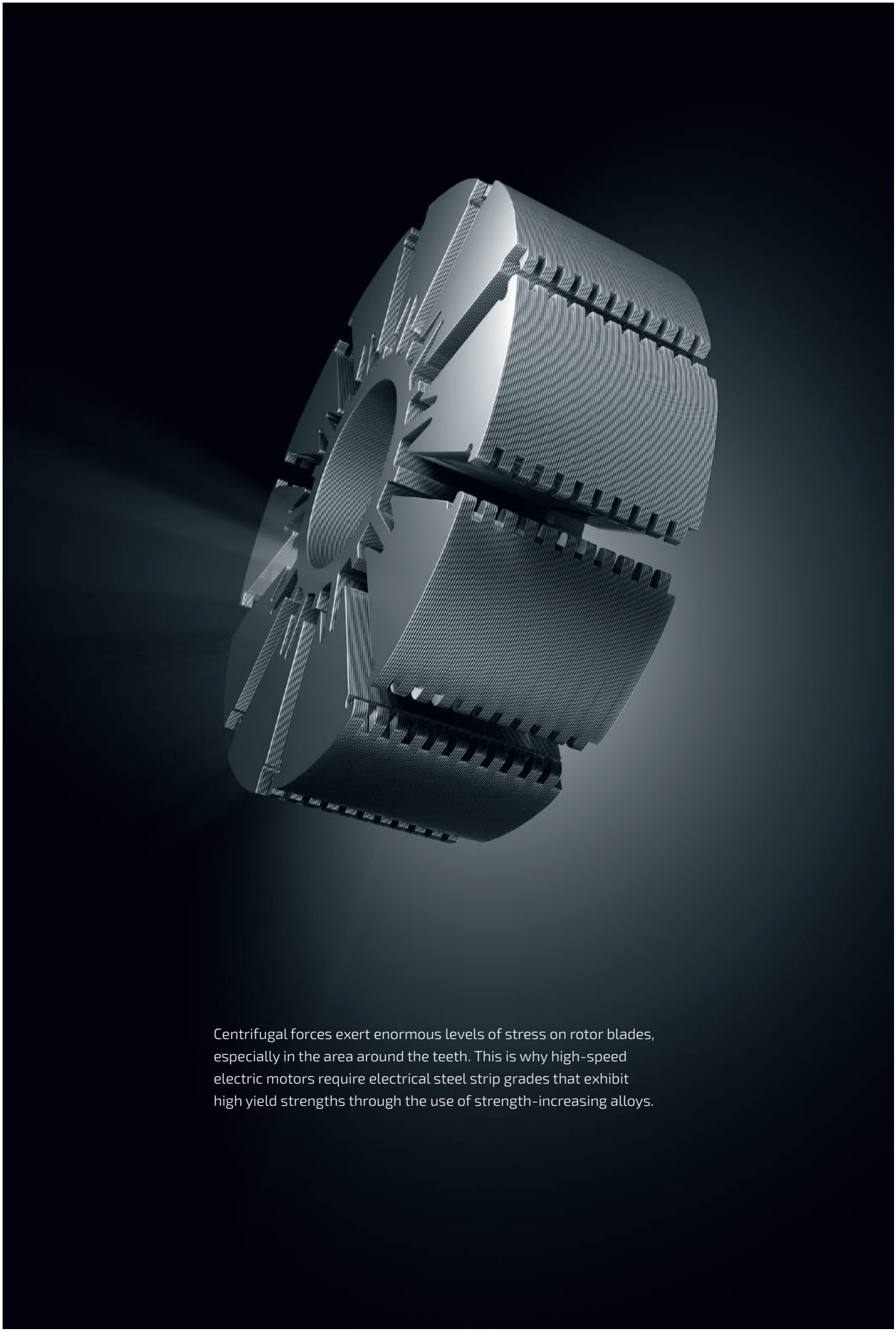
01 Stress-strain diagram: HS grades are suitable for high-speed applications due to their robustness.

02 Rotor stack

Examples of electrical steel strip high-strength grades

Grade[1)]	Nominal thickness	Max. core loss			Min. mechanical properties			Min. magnetic polarization at
		1.5 T/50 Hz	1.0 T/400 Hz	1.0 T/1.000 Hz	$R_{p0.2}$	R_m	A_{80}	2.500 A/m
	in mm	in W/kg	in W/kg	in W/kg	in MPa	in MPa	in %	in T
NO 20-20 HS	0.20	/	20	63	500	590	16	1.47
NO 35-28 HS	0.35	/	28	100	500	590	16	1.47
M530-65A HS	0.65	5.3	/	/	500	590	16	1.47

[1)] More high-strength variations available upon request.



Centrifugal forces exert enormous levels of stress on rotor blades, especially in the area around the teeth. This is why high-speed electric motors require electrical steel strip grades that exhibit high yield strengths through the use of strength-increasing alloys.

CDW-PERM® grades

CDW-PERM® grades (High-Permeability/-Polarization) are used for high-performance electric drives that require a high degree of polarization. Thanks to their high level of permeability, these exhibit excellent magnetizability. They are also particularly efficient to use, as they allow significantly higher levels of polarization compared to standard grades with the same energy input. The high thermal conductivity of CDW-PERM® grades offers an advantage when it comes to the dissipation of operating heat, especially in the case of high-performance electric motors.

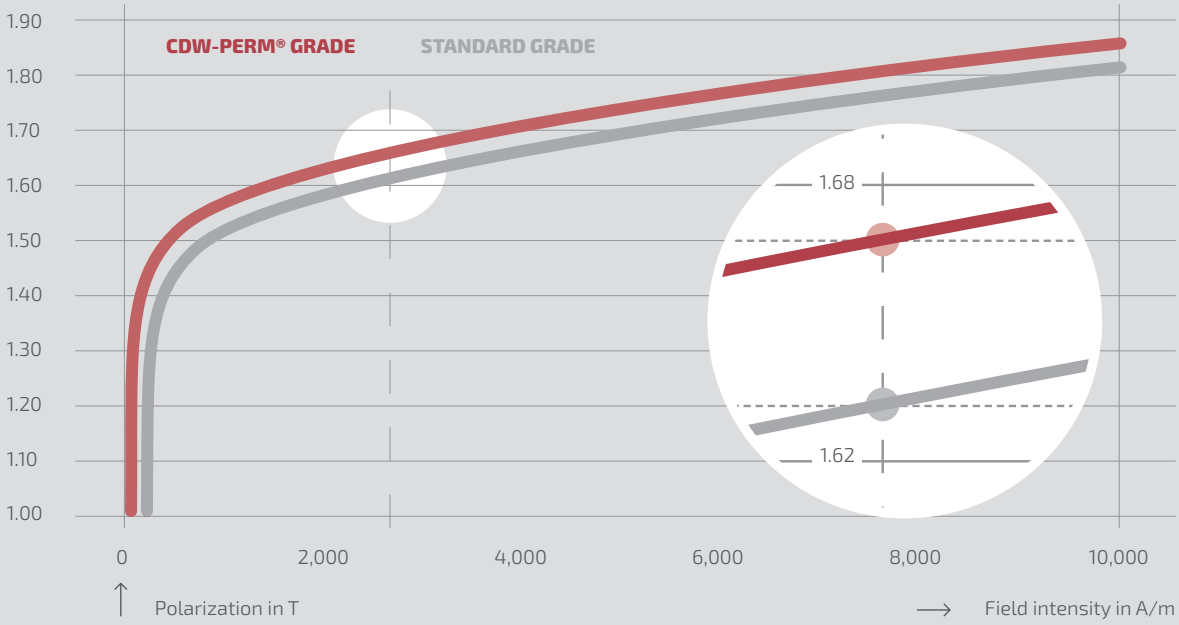
Magnetic properties of CDW-PERM® grades

Grade	Min. magnetic polarization at 2,500 A/m according to		Typ. yield strength $R_{p0,2}$	Typ. tensile strength R_m	Typ. elongation A_{80}	Typ. hardness HV5	Thermal conductivity λ
	DIN EN 10106	Waelzholz					
	in T	in T	in MPa	in MPa	in %		in W/mK
Nominal thickness: 0.50 mm							
CDW-PERM® M350-50A	1.50	1.56	340	470	29	160	24.5
CDW-PERM® M400-50A	1.53	1.58	340	470	29	160	24.5
CDW-PERM® M470-50A	1.54	1.59	300	430	30	135	30.3
CDW-PERM® M530-50A	1.56	1.61	300	430	30	135	30.3
CDW-PERM® M600-50A	1.57	1.62	295	415	34	130	34.6
CDW-PERM® M700-50A	1.60	1.65	295	415	34	130	34.6
CDW-PERM® M800-50A	1.60	1.65	295	415	34	130	34.6
CDW-PERM® M940-50A	1.62	1.66	295	415	34	130	34.6
Nominal thickness: 0.65 mm							
CDW-PERM® M400-65A	1.52	1.57	335	460	30	165	24.5
CDW-PERM® M470-65A	1.53	1.58	340	470	30	165	24.5
CDW-PERM® M530-65A	1.54	1.59	340	470	30	165	24.5
CDW-PERM® M600-65A	1.56	1.61	300	430	32	140	30.3
CDW-PERM® M700-65A	1.57	1.62	295	415	34	130	34.6
CDW-PERM® M800-65A	1.60	1.66	295	415	34	130	34.6
CDW-PERM® M1000-65A	1.61	1.66	295	415	34	130	34.6
Nominal thickness: 1.00 mm							
CDW-PERM® M1400-100A	1.60	1.66	295	415	34	130	34.6

More torque. Thanks to highly permeable materials.

Thanks to their excellent polarization properties, CDW-PERM® grades are used in applications that require higher levels of torque, for example.

01 Greater efficiency: Our CDW-PERM® grades' higher levels of polarization compared to standard grades offer our customers excellent magnetizability and, as a result, greater performance with the same energy input.



Electrical steel strip

(according to DIN EN 10106)

Electrical steel strip according to DIN EN 10106

Grade		Max. core loss at		Min. magnetic polarization at			Waelzholz production averages			Density[1]
		1.5 T/50 Hz	1.0 T/50 Hz[2]	2,500 A/m	5,000 A/m	10,000 A/m	$R_{p0,2}$	R_m	HV5	
DIN EN 10027-1	DIN EN 10027-2	in W/kg	in W/kg	in T	in T	in T	in MPa	in MPa		in kg/dm³
Nominal thickness: 0.35 mm										
M235-35A[3]	1.0890	2.35	0.95	1.49	1.60	1.70	430	560	215	7.60
M250-35A[3]	1.0800	2.50	1.00	1.49	1.60	1.70	360	510	200	7.60
M270-35A[3]	1.0801	2.70	1.10	1.49	1.60	1.70	350	500	190	7.65
M300-35A	1.0804	3.00	1.20	1.49	1.60	1.70	345	490	170	7.65
M330-35A	1.0803	3.30	1.30	1.49	1.60	1.70	335	480	155	7.65
Nominal thickness: 0.50 mm										
M250-50A[3]	1.0891	2.50	1.05	1.49	1.60	1.70	430	560	215	7.60
M270-50A[3]	1.0806	2.70	1.10	1.49	1.60	1.70	360	510	200	7.60
M290-50A[3]	1.0807	2.90	1.15	1.49	1.60	1.70	350	500	190	7.60
M310-50A	1.0808	3.10	1.25	1.49	1.60	1.70	345	490	180	7.65
M330-50A	1.0809	3.30	1.35	1.49	1.60	1.70	335	480	160	7.65
M350-50A	1.0810	3.50	1.50	1.50	1.60	1.70	330	475	155	7.65
M400-50A	1.0811	4.00	1.70	1.53	1.63	1.73	325	465	150	7.70
M470-50A	1.0812	4.70	2.00	1.54	1.64	1.74	320	460	145	7.70
M530-50A	1.0813	5.30	2.30	1.56	1.65	1.75	315	450	140	7.70
M600-50A	1.0814	6.00	2.60	1.57	1.66	1.76	310	440	135	7.75
M700-50A	1.0815	7.00	3.00	1.60	1.69	1.77	300	430	130	7.80
M800-50A	1.0816	8.00	3.60	1.60	1.70	1.78	295	420	125	7.80
M940-50A	1.0817	9.40	4.20	1.62	1.72	1.81	280	400	120	7.85
Nominal thickness: 0.65 mm										
M310-65A[3]	1.0892	3.10	1.25	1.49	1.60	1.70	430	560	215	7.60
M330-65A[3]	1.0819	3.30	1.35	1.49	1.60	1.70	350	500	190	7.60
M350-65A	1.0820	3.50	1.50	1.49	1.60	1.70	345	485	175	7.60
M400-65A	1.0821	4.00	1.70	1.52	1.62	1.72	340	480	160	7.65
M470-65A	1.0823	4.70	2.00	1.53	1.63	1.73	335	475	155	7.65
M530-65A	1.0824	5.30	2.30	1.54	1.64	1.74	325	465	150	7.70
M600-65A	1.0825	6.00	2.60	1.56	1.66	1.76	315	450	140	7.75
M700-65A	1.0826	7.00	3.00	1.57	1.67	1.76	310	440	135	7.75
M800-65A	1.0827	8.00	3.60	1.60	1.70	1.78	300	430	130	7.80
M1000-65A	1.0829	10.00	4.40	1.61	1.71	1.80	280	400	120	7.80
Nominal thickness: 1.00 mm										
M600-100A	1.0893	6.00	2.60	1.53	1.63	1.72	340	485	180	7.60
M700-100A	1.0894	7.00	3.00	1.54	1.64	1.73	330	475	160	7.65
M800-100A	1.0895	8.00	3.60	1.56	1.66	1.75	320	460	150	7.70
M1000-100A	1.0896	10.00	4.40	1.58	1.68	1.76	295	420	125	7.80
M1300-100A	1.0897	13.00	5.80	1.60	1.70	1.78	280	400	120	7.80

[1] Density can be calculated on the basis of the chemical composition of the alloy. [2] Not obligatory acc. to DIN EN 10106. [3] Max. width: 1,000 mm.

Classic precision.
And even more precise on request.

Our range of grades of DIN EN 10106-compliant non-grain oriented electrical steel strip extends from low-alloy steels with good permeability and thermal conductivity to high-alloy steels with low core losses. The dimensional tolerances correspond to the specifications of EN 10106, but can also be fine-tuned to meet your requirements. HS versions of these grades are available on request.

Comparison of standards

Max. core loss at		Denomination of grades according to common international standards						
1.5 T/50 Hz in W/kg	1.5 T/60 Hz in W/lbs	DIN EN 10106 (2007)	IEC 404-8-4 (1998)	JIS C2552 (2000)	GOST 21427.2 (1983)	ASTM A677-07 (2007)	AISI (1983)	GB/T2521 (1996)
Nominal thickness: 0.35 mm								
2.35	1.35	M235-35A		35A230				35W230
2.50	1.45	M250-35A	250-35A5	35A250	2413	36F145	M-15	35W250
2.70	1.55	M270-35A	270-35A5	35A270	2412	36F155	M-19	35W270
3.00	1.75	M300-35A	300-35A5	35A300	2411	36F175	M-22	35W300
3.30	1.85	M330-35A	330-35A5			36F185	M-36	35W330
Nominal thickness: 0.50 mm								
2.50	1.45	M250-50A						50W250
2.70	1.65	M270-50A	270-50A5	50A270	2414	47F165	M-15	50W270
2.90	1.80	M290-50A	290-50A5	50A290	2413	47F180	M-19	50W290
3.10	1.90	M310-50A	310-50A5	50A310	2412	47F190	M-22	50W310
3.30	2.00	M330-50A	330-50A5	50A330		47F200	M-27	50W330
3.50	2.10	M350-50A	350-50A5	50A350	2411	47F210	M-36	50W350
4.00	2.40	M400-50A	400-50A5	50A400	2216	47F240	M-43	50W400
4.70	2.80	M470-50A	470-50A5	50A470	2214	47F280		50W470
5.30	3.00	M530-50A	530-50A5		2212		M-45	50W540
6.00	3.45	M600-50A	600-50A5	50A600	2112			50W600
7.00	4.00	M700-50A	700-50A5	50A700	2111	47F400	M-47	50W700
8.00	4.50	M800-50A	800-50A5	50A800	2011	47F450		50W800
9.40		M940-50A		50A1000				50W1000
Nominal thickness: 0.65 mm								
3.10	1.90	M310-65A						65W600
3.30	2.00	M330-65A				64F200		65W700
3.50	2.10	M350-65A	350-65A5			64F210	M-19	65W800
4.00	2.35	M400-65A	400-65A5			64F235	M-27	65W1000
4.70	2.75	M470-65A	470-65A5			64F275	M-43	65W1300
5.30	3.20	M530-65A	530-65A5		2312	64F320		65W1600
6.00	3.45	M600-65A	600-65A5		2212		M-45	
7.00	4.00	M700-65A	700-65A5		2212			
8.00	5.00	M800-65A	800-65A5	65A800	2122	64F500	M-47	
10.00	5.50	M1000-65A	1000-65A5	65A1000		64F550		
Nominal thickness: 1.00 mm								
6.00	3.45	M600-100A						
7.00	4.00	M700-100A						
8.00	4.50	M800-100A						
10.00	5.40	M1000-100A						
13.00	7.50	M1300-100A						

Tolerances

Thickness					
Nominal thickness	in mm	0.35	0.50	0.65	1.00
Deviation from nominal thickness	in %	+/- 8	+/- 8	+/- 6	+/- 6
	in mm	+/- 0.03	+/- 0.04	+/- 0.04	+/- 0.06
Thickness deviation over strip width (measurement 30 mm from edge)	in mm	+ 0.02	+ 0.02	+ 0.03	+ 0.03

Special thicknesses and special tolerances upon request

Width						
Nominal width	in mm	< 150	≥ 150 / ≤ 300	> 300 / ≤ 600	> 600 / ≤ 1,000	> 1,000
Deviation from nominal width	in mm	+ 0.2 - 0	+ 0.3 - 0	+ 0.5 - 0	+1.0 - 0	+1.5 - 0

Steel sheet		
Deviation from sheet length	in %	+ 0.5/- 0 of the nominal value (max. 6 mm)

DIN EN 10106 grade delivery types

Pancake coils		
Width	in mm	20 - 1,270
Coil weight	in kg/mm strip width	max. 20
Inner diameter	in mm	508

Oscillated wound coils		
Strip width	in mm	7 - 70
Coil weight	in kg	max. 3,500
Coil width	in mm	250 - 550
Inner diameter	in mm	400

Cut-to-length sheets		
Width of sheets	in mm	400 - 1,250
Length of sheets	in mm	400 - 2,500

Pole sheets and soft magnetic iron

Defined properties. Tailor-made for your application.

Pole sheets according to DIN EN 10265 are characterized by high degrees of polarization and thus strong magnetic fields combined with high yield strengths. We offer a wide range of these standard materials with precisely defined properties.

For the use in electrical switching systems, we also manufacture mild magnetic steel in various grades (RFe grades) according to DIN 17405 and DIN EN 10304. These possess defined levels of coercivity.

Pole sheets according to DIN EN 10265

Grade	Material number	Min. yield strength $R_{p0,2}$ in MPa	Min. tensile strength R_m in MPa	Min. elongation A_{80} in %	Min. magnetic polarization at 5,000 A/m in T	Min. magnetic polarization at 15,000 A/m in T
250-100-TF 183	1.0280	250	375	16	1.60	1.83
300-100-TF 182	1.0281	300	390	15	1.55	1.82
350-100-TF 181	1.0282	350	440	13	1.52	1.81
400-100-TF 180	1.0283	400	460	10	1.50	1.80

Mild magnetic steel (Rfe grades)

Grade according to DIN 17405	Grade according to DIN EN 10304	Material number	Max. coercive field strength after reference annealing in A/m	Max. hardness in HV	Min. magnetic polarization at 500 A/m in T	Delivery condition
RFe 120	M120	1.1012	120	150	1.30	GT / GB
RFe 100	M100	1.1013	100	150	1.30	GT / GB
RFe 80	M80	1.1014	80	150	1.30	GT / GB
RFe 40	M40	1.1016	40	150	1.35	GT / GB

INSULATE, PROTECT, CONNECT. OUR COATING SYSTEMS.

We have developed a wide range of coating systems for our customers. These include classic insulating varnishes, bonding varnish, combination coatings, and other special solutions. The coating systems combine different benefits with regard to further processing and the use of electrical steel strip. One of our main areas of expertise is combining the right electrical steel strip and coating system for your application. Contact us to find out what benefits we can achieve for you with our coating systems.

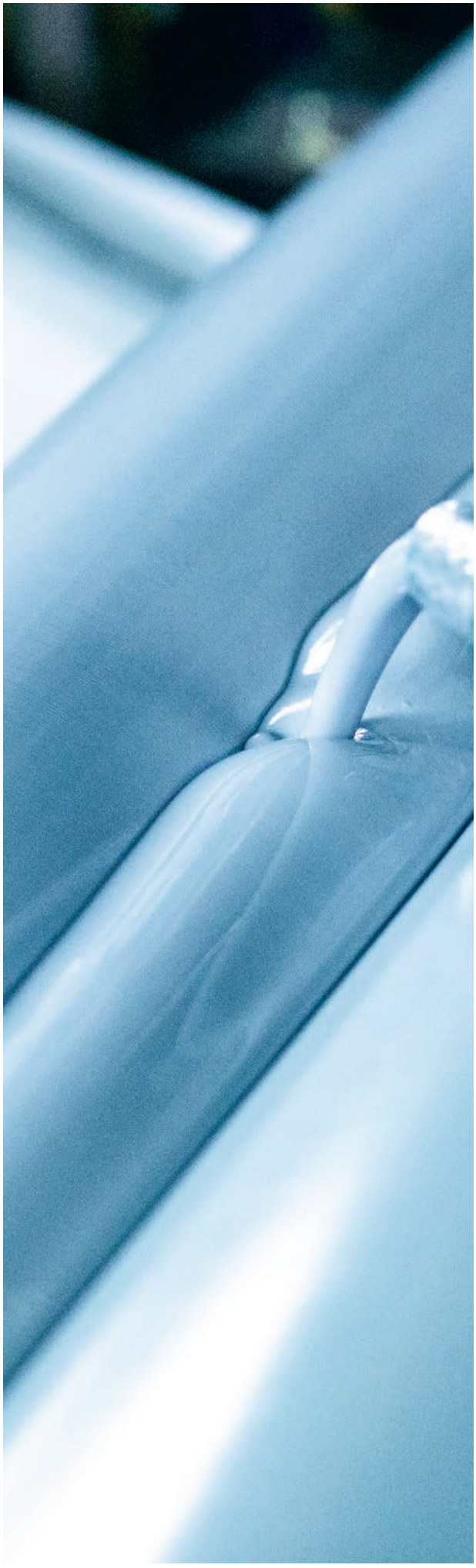
Coating systems

ASTM class	IEC class	Waelzholz coating type	Color	Thickness per side in µm	Continuous thermal resistance under air IEC 60404-12 in °C	Annealing resistance under inert gas IEC 60404-12 in °C	Surface resistance ASTM 717 in Ω • cm²/lam	Chemical resistance DIN 8944	Weldability SEP 1210
C-3	EC-3	PH3	golden yellow	1 - 7	180	-	10 - 200	resistant	-
		PE75W (bonding varnish)	transparent	3 - 6	180[1)]	-	/	/	-
		PE49 (bonding varnish)	transparent	3 - 6	180[1)]	-	/	/	-
		PE75W-Fast (fast-bonding varnish)	transparent	3 - 6	180[1)]	-	/	/	-
		PE49-Rapid (fast-bonding varnish)	transparent	3 - 6	180[1)]	-	/	/	-
C-5	EC-5	AN50	transparent	0.5 - 1.5	210	600	5 - 50	resistant	+
		AN50 S	transparent	0.5 - 1.5	210	600	5 - 50	resistant	++
		AN50 V	grey	0.5 - 5	210	800	> 50	resistant	+
		AN8	grey	1 - 4	270	600	20 - 200	resistant	+
C-6	EC-6	PH2	grey	2 - 7	180	500	> 10,000	resistant	-
		PH2 FF	grey	2 - 7	180	500	> 10,000	resistant	-
		PH20	grey	1 - 3	180	500	> 10,000	resistant	-

[1)] Thermal class acc. to IEC 60404-12

- less suitable + suitable ++ extremely suitable

01 Precision: Applying a coating to electrical steel strips requires a highly accurate control system to create a homogeneous layer on the surface of the strip.



Versatile. And precisely tailored to the application.

Every electrical steel strip application has its own specific requirements. This is why we offer our customers a wide range of insulating varnishes. This allows us to precisely match the choice of insulating coating to the application. In this context, the focus is not only on insulating the electrical steel strips, but also, for example, on corrosion protection, chemical resistance, or thermal stability. Consideration is also given to aspects of further processing such as the steel's ability to be punched or welded. As with our electrical steel strip, you have the choice between the existing standard systems and systems developed specifically for your requirements.

The environment. Always in mind.

The focus of our development activities is on a combination of organic and inorganic coatings that we can use to precisely define desired properties. In addition to the high functionality of the coating systems, environmental protection is an important aspect for us in the production of the coatings. That is why we only produce water-soluble coatings.

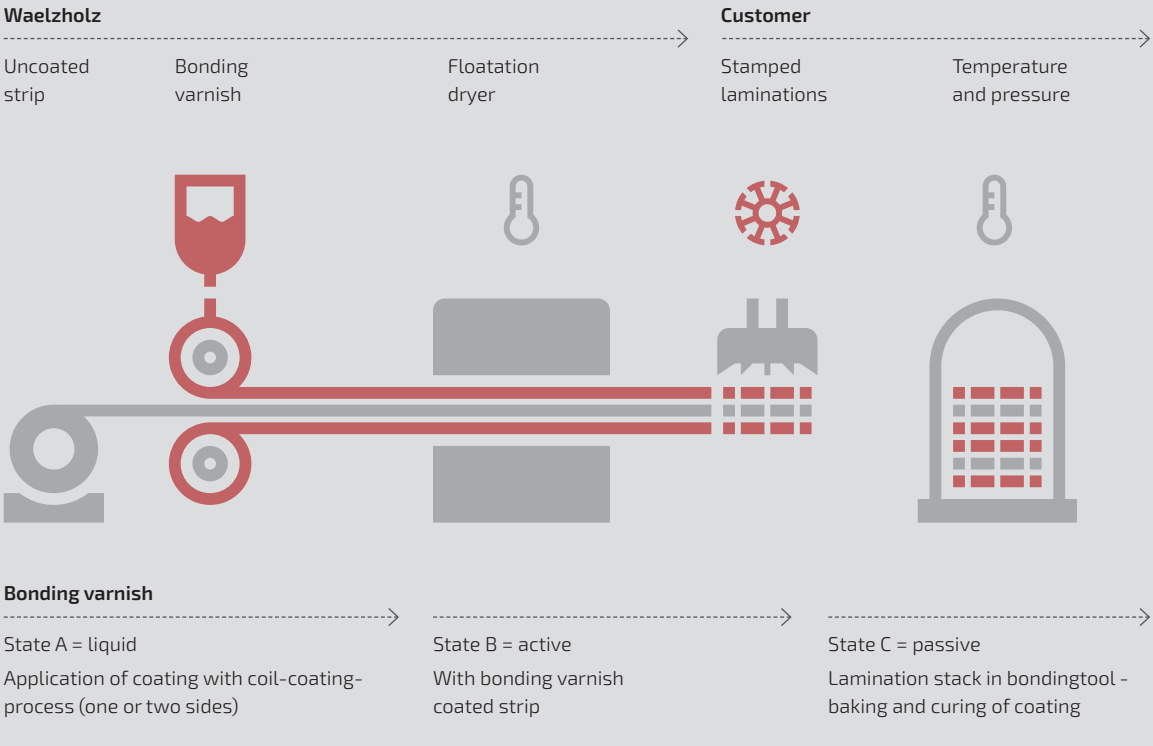
Bonding varnish

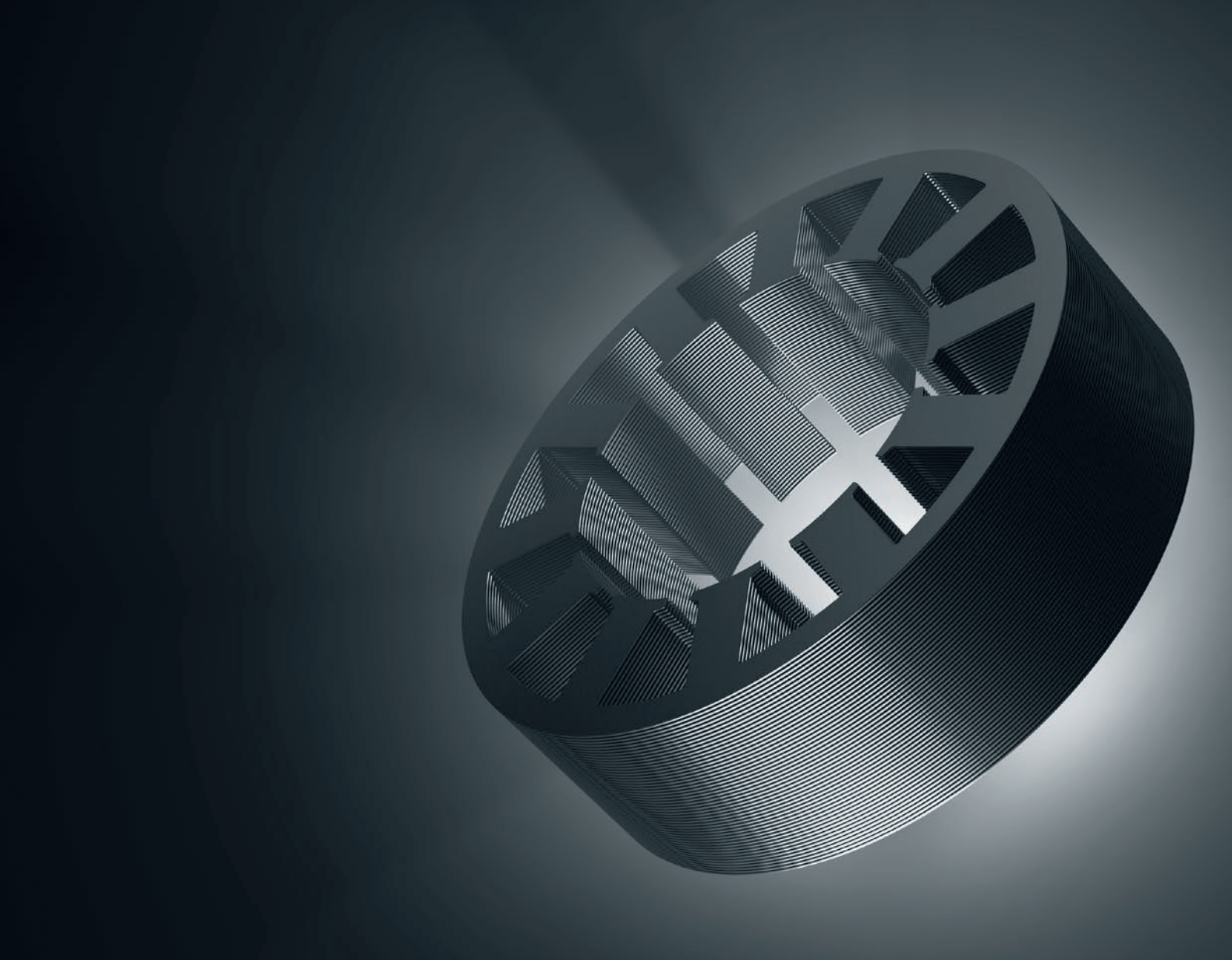
Failure-free connection. Undisturbed magnetic flux.

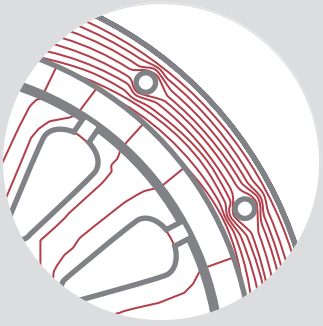
The performance of lamination stacks for electric motors and generators is determined by the magnetic flux, among other factors. In order to fully tap the potential of the lamination stack, this needs to be as undisturbed as possible. However, welds, punch stacking, or rivets are all disturbing connections that impair the magnetic flux. But this is not the case when bonding with bonding varnish – here the stacks are simply glued together by the bonding varnish without affecting the electrical steel strip's fundamental material properties.

Beyond that, the bonding varnish technology combines a great number of other benefits. With bonding varnish the punchability of the steel strip is improved, which enables the realization of complex geometries. In the baking process, compact and waterproof lamination stacks with no varnish discharge are formed. On top of that, the risk of stack humming during later use, which can occur with the other bonding methods, is eliminated with bonding varnish.

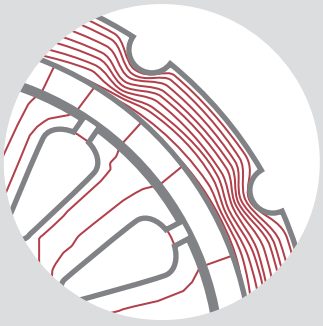
01 Lamination stack production process with bonding varnish
02 Stator stack with bonding varnish
03 Undisturbed magnetic flux with sheets coated with bonding varnish



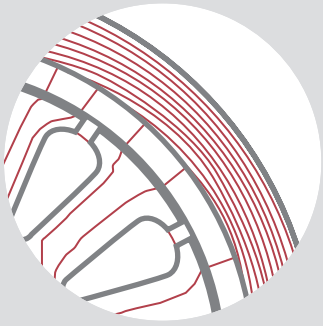




Disturbed magnetic flux
due to rivets



Disturbed magnetic flux
due to welds



Bonding varnish:

Undisturbed magnetic flux
due to abscene of irregulations

Special Coatings

Exact. Tailored to your needs.

Many projects require individual coating systems that are designed to meet the specific requirements of the area of application. This can include, for example, a special degree of insulation or a certain layer thickness. If necessary, we can develop such a system to meet specific customer needs. In addition, we also combine various coating systems to exploit the respective properties of the individual systems together. An example is the synthesis of insulating varnish and bonding varnish – this custom coating combines excellent insulating properties with the bonding varnish bonding technology. In this case, the common combination of C-6 coating and bonding varnish offers an extremely high degree of insulating resistance with an undisturbed magnetic flux.

Conversion table

Size	Unit from	to	Conversion factor
Magnetic polarization	T = Wb/m^2 = Vs/m^2	Wb/cm^2 = Vs/cm^2	10^{-4}
	T	G	10^4
	T	lines/square inch	6.45×10^4
	Vs/cm^2	T	10^4
	G	T	10^{-4}
	lines/square inch	T	1.55×10^{-5}
Magnetic field intensity	A/m	A/cm	0.01
	A/m	Oe	0.0126
	A/m	ampere-turns/inch	0.0254
	A/cm	A/m	100
	Oe	A/m	79.6
	ampere-turns/inch	A/m	39.4
Core loss	W/kg	W/lb	0.454
	W/lb	W/kg	2.2046
	W/kg (50 Hz)	W/kg (60 Hz)	1.266
	W/kg (60 Hz)	W/kg (50 Hz)	0.79
	W/kg (50 Hz)	W/lb (60 Hz)	0.574
	W/lb (60 Hz)	W/kg (50 Hz)	1.737
Tensile strength	MPa	kp/mm^2	0.102
	MPa	psi	145
	kp/mm^2	MPa	9.81
	psi	MPa	6.90×10^{-3}
Force	N = kgm/s^2	kp	0.102
	kp	N = kgm/s^2	9.81
Weight	g	ounce	0.0353
	kg	pound	2.2046
	ounce	g	28.4
	pound	kg	0.454
Length	mm	inch	0.0394
	inch	mm	25.4
Area	cm^2	square inch	0.155
	square inch	cm^2	6.45
Volume	cm^3	cubic inch	0.061
	cubic inch	cm^3	16.387
Temperature	°C	°F	1.8 + 32
	°F	°C	0.556 - 17.8

MORE THAN ELECTRICAL STEEL STRIP AND COATING SYSTEMS

Discover our wide range of tailor-made steel materials and our worldwide services.

High-quality electrical steel strip from Waelzholz forms the basis of many of our customers' sophisticated products. Our goal has been and continues to be the provision of customized steel materials in this sector. If nothing else, we achieve this through our comprehensive expertise in the development and production of our wide range of materials for highly diverse applications.

As a technology leader for sophisticated steel strip solutions, we rely on uncompromising premium quality. Solution-oriented engineering and services for all phases of the value-added chain make us a reliable partner worldwide.

↗ For further information visit
waelzholz.com/company

OUR MATERIALS AT A GLANCE

PRODUCT GROUP	VARIATIONS	CUSTOMER BENEFIT
Cold rolled steel strip	DC-grade steel , micro-alloyed steel, case-hardening steel, steel for hardening and tempering, spring steel or fine blanking grades: alloyed or as standard grades	Unparalleled dimensional accuracy, good formability, suitable for heat treatment, high elasticity, optimal combination of tensile strength and formability
Hardened and tempered steel strip	Martensite, bainite, sorbite	Hardness, homogeneity, spring properties, high resistance to wear, substitution of piece hardening
High-strength steel strip	High-strength, micro-alloyed fine grained steel	High resistance to wear and good formability at the same time
Surface-coated steel strip	With a phosphate layer refined case-hardening or DC-grade steel	Implementation of complex, multi-stage forming operations, prolonged service life of the forming tool
Profiles	Over 250 different profile shapes made of steel strip or wire	Tailored geometries, cross-sections tailored to customer products and processes
Electrical steel strip	NO grades, HS grades, CDW-PERM® grades, DIN EN 10106, DIN EN 10303, bonding varnish, fast-bonding varnish or insulating varnish	Thermal conductivity, low core losses, high magnetic polarization, hich mechanical durability at high speeds, undisturbed magnetic flux due to elimination of imperfections, improved insulation resistance
Flat wire products	Wide range of materials from spring steel to hardened and tempered steel strip	Prolonged service life thanks to a mill edge, high tensile strength and even bending properties
Stainless precision steel strip	Corrosion-resistant steel, upon request with special alloys	Resistance to corrosion, acids, or heat

Customized materials for your industry

Our customers develop future-oriented products in the key industries of today and tomorrow. Here, innovative material solutions are an essential foundation. We know and understand our customers' industries and their requirements – from mobility to energy to multifaceted industrial applications..

We combine this industry expertise with our excellent engineering competence and fine-tuned production processes. Our extensive range of production lines in combination with state-of-the-art and intelligently networked measuring and control technology allows us to produce materials with outstanding properties and to reliably achieve reproducible quality in all areas. This is how we develop and produce one thing in particular for our customers: Unparalleled quality..

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waelzholz.com/steel-materials

An international orientation has characterized the successful development of our company since the very start. Today 2,300 employees in Europe, North and South America, and Asia produce more than 780,000 tons of high-quality steel strip and profiles annually.

First choice when it comes to the future of cold rolled steel strip. Worldwide.

Personal relationships, the digital networking of our production sites and consistently high process standards are what counts when it comes to providing our customers with engineering, production and supply chain management expertise in unparalleled high-quality. Regardless of time and place, anywhere in the world.

This is how we pursue our long-term strategy: continuing consequently our journey as a medium-sized, independent, family-owned company with the development of customized material solutions. So that in the tradition of long-term partnerships we will remain our customers' first choice when it comes to the future of cold rolled steel strip.

For further information visit
↗ waelzholz.com/contact-partner

WELL POSITIONED

Locations worldwide	13 locations in Europe, North and South America, and Asia
Employees worldwide	2,300
Sales volume steel materials	780,000 tons/year
Share of production outside of Europe	33 %
International share of sales	65 %

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2023-08