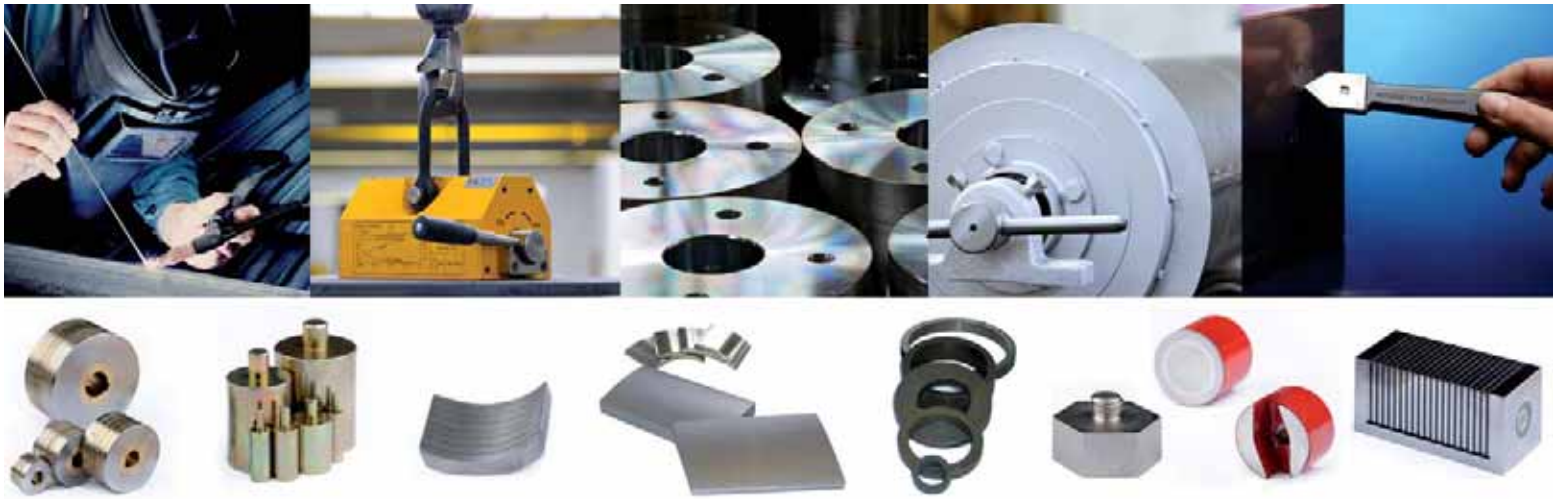
Tridelta
Magnetsysteme GmbH



PRODUCT CATALOG

Permanent Magnets & Magnet Systems

Version 10/2010

A member of TRIDELTA Group

As part of the TRIDELTA Group, Tridelta Magnetsysteme GmbH makes the products with the vertical range of manufacturing in terms of permanent magnet technology. For more than 50 years, the company has been a leader in the German market. Due to its technological competence and innovative spirit, the company has been enjoying a good reputation with developers, designers and purchasers domestically and internationally for the past 90 years. The goal of TRIDELTA's innovative magnet technology is to lower its customers' production costs. Through continuous research and development as well as constructive dialog with customers, TRIDELTA plans and implements trendsetting magnet systems for the most stringent of requirements.

The fields of application of flexible and affordable TRIDELTA magnet products are almost unlimited and nowhere close to being exhausted.

Examples:

- Magnets for sensors
- Magnets for safety engineering
- Coupling systems
- Motor stators and rotors with permanent magnets
- Loudspeaker systems
- Holding magnet systems
- Stacking and conveying components
- Separation rollers and overbelt magnets
- Hysteresis breaks
- Handling magnets for sheet metal processing
- Lifting magnets

The diverse application spectrum of TRIDELTA magnets and magnet systems is reflected in its wide range of satisfied customer, and the scope of applications testifies to the flexibility of Tridelta Magnetsysteme GmbH. Starting to cooperate at an early stage often opens up new ways of technical and economic solution optimization.
TRIDELTA will provide you with consultation at every level and with all of its expertise in planning and implementation.

MPA NRW
Certified Qualified Management System according to DIN EN ISO 9001, Reg. No.: MPA NRW Q 234

1920 1928 1938 1970 1975 1992 1997 2000

OERSTIT® The Material for temperature-resistant Permanent Magnets

Many applications require highly temperature-resistant magnets and TRIDELTA Oerstit magnets are perfectly suited in such cases. Developed about 80 years ago, these magnets have been continuously improved according to the latest technology available.
Today, OERSTIT® is a household name for high quality AlNiCo-materials with the highest temperature resistance. Eight typical types of material are described in the following table. Additional materials are available upon request.

Magnetic properties

Material[1] Trade name TRIDELTA		Max. energy product		Remanence flux density		Coercitivity				Rel. Permeability	Operating Temperature[2]	Saturation field strength
Nomenclature according to DIN 17410/IEC 404-8-1		$(BH)_{max}$ kJ/m³	MGOe	B_r mT	G	H_{cB} kA/m	kOe	H_{cJ} kA/m	kOe	μ_p	T_{max} °C	H_s kA/m
Oerstit 500 G[3]	a min	38	4,8	1190	11900	48	0,6	49	0,6	3,2	500	270
AlNiCo 38/5	typ	40	5,0	1240	12400	50	0,6	51	0,6			
Oerstit 500 S	a min	36	4,5	1150	11500	47	0,6	48	0,6	3,7	500	270
AlNiCo 36/5	typ	38	4,8	1200	12000	49	0,6	50	0,6			
Oerstit 1800	a min	39	4,9	700	7000	140	1,75	148	1,85	2,0	550	800
AlNiCo	typ	43	5,4	730	7300	148	1,85	156	1,95			
Oerstit 450	a min	39	4,9	820	8200	111	1,4	115	1,4	2,2	550	600
AlNiCo 39/12	typ	43	5,4	860	8600	120	1,5	125	1,6			
Oerstit 400	a min	29	3,6	990	9900	56	0,7	58	0,7	4,3	500	270
AlNiCo 29/6	typ	32	4,0	1090	10900	58	0,7	60	0,8			
Oerstit 260	i min	19	2,4	600	6000	95	1,2	102	1,3	2,8	550	450
AlNiCo 19/10	typ	21	2,6	650	6500	100	1,3	107	1,4			
Oerstit 160	i min	12	1,5	650	6500	53	0,7	57	0,7	4,5	500	270
AlNiCo 12/6	typ	14	1,8	700	7000	60	0,8	64	0,8			
Oerstit 120	i min	8	1,0	480	4800	48	0,6	50	0,63	4,5	500	250
AlNiCo 8/5	typ	9	1,1	500	5000	52	0,65	54	0,68			

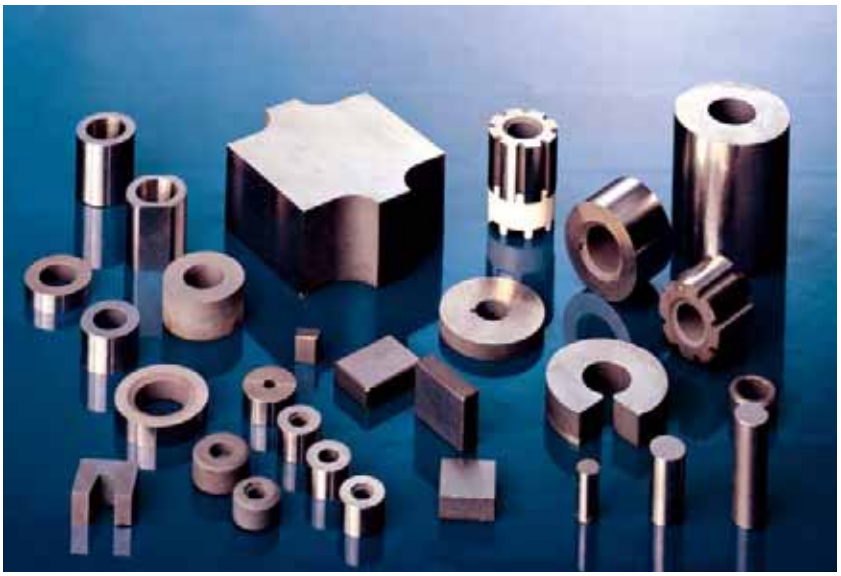
1) a = anisotropic, i = isotropic, typ. = typical values, min = minimum values

2) The maximum operating temperature is dependent on the geometry of the system.

3) Cast magnets

Magnet Manufacturing

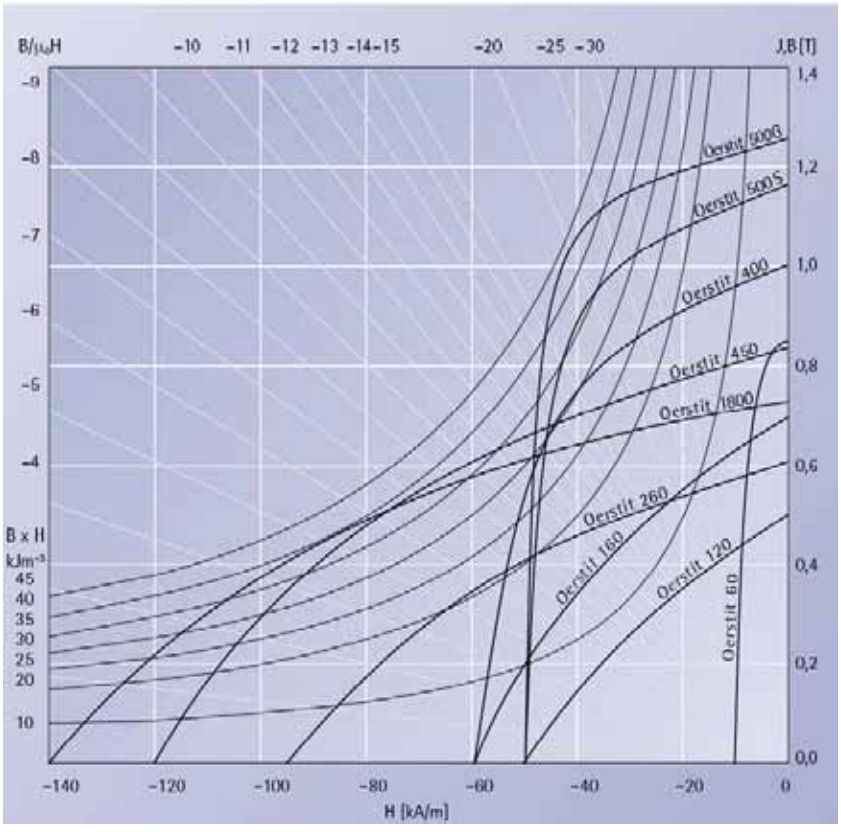
Temperature-resistant Oerstit magnets are made by smelting and casting alloys or by powder-metallurgical processes. There are several Oerstit materials used in the production of isotropic and anisotropic magnets. Their magnetic properties in a magnetic system largely depend on the shape and geometry of the magnets.
The Oerstit powder mix is pressed into moldings, which are then sintered at high temperatures in a vacuum or in inert gas. During this process the desired alloys are formed. Raw magnets are heated up again for homogenization and then cooled down to room temperature, following an exact cool-down procedure. In case of anisotropic materials this procedure is done inside an axial magnetic field to create a preferred direction. The final step is tempering. To avoid oxidation all heat treatment processes are conducted under inert gas.



Magnet Shapes

The possible selection of shapes is nearly unlimited and largely dependent on customer requirements. TRIDELTA Oerstit magnets can be made in any shapes allowing the use of powder-metallurgical processes or casting. We supply cuboids, cylindrical shapes, rings, segments and other shapes. It is also possible to supply bore holes, recesses, grooves, etc. from powder-based magnets. The only requirement is that they run parallel to the pressing direction.

Average demagnetizations curves of Oerstit magnets at room temperature



Temperature Behavior

Oerstit magnets are especially suited for applications in which the magnetic field must be temperature-resistant to the greatest possible extent.
A mong all other permanent magnet materials the magnetic properties of Oerstit materials are the ones least affected by temperature. That is their particular advantage. The maximum service temperature is 550°C. Some Oerstit grades, mainly Oerstit 450, were successfully used at even higher temperatures. Oerstit material is not irreversibly affected by low temperatures either.

SECOLIT® - The temperature-resistant Material for High-Quality Permanent Magnets

Growing performance requirements on the part of customers are TRIDELTA's starting point for many product innovations. They were also the reason for the development of magnetic materials supplied under the SECOLIT® brand. They are characterized by a very high energy product and great temperature stability. SECOLIT® materials are permanent magnets based on intermetallic, ferromagnetic compounds of rare earths, preferably Samarium (Sm) with Cobalt (Co).

Magnetic properties

Material[1] Trade name TRIDELTA	Max. energy product		Remanence flux density		Coercitivity				Rel. permeability	Operating temperature[2]	Temperature coefficient		Saturation field strength
Nomenclature according to DIN 17410/IEC 404-8-1	$(BH)_{max}$ kJ/m³	MGOe	B_r mT	G	H_{cB} kA/m	kOe	HcJ kA/m	kOe	µp	T_{max} °C	$TK(B)_r$ %/K	$TK(H)_{cJ}$ %/K	H_s kA/m
Secolit 215 a typ Seco 200/160	200	25	1050	10500	780	9,8	1600	20,5	1,07	350	-0,029	-0,23	4000
Secolit 220 a typ Seco 220/120	220	28	1100	11000	780	9,8	1200	15,4	1,07	350	-0,029	-0,23	4000
Secolit 170 a typ Seco 160/120	170	22	910	9100	700	8,8	>1800	>20	1,04	250	-0,042	-0,25	2500

1) a = anisotropic, typ. = typical values

2) The maximum maximum operating temperature is depend on the geometry of the system.

Physical properties

Material	Density	Elasticity module	Deflection strength	Compressive strength	Hardness	Electrical resistivity	Specific heat	Thermal conductivity	Curie-temperature	Coefficient of linear expansion parallel to the pref. direction	Coefficient of linear expansion vertical to the pref. direction
	g/cm³	E kN/mm²	F_B N/mm²	F_P N/mm²	HRC	ρ µΩ/cm	c J/kg K	λ W/m K	Tc °C	$\Delta l/l$ 10^{-6}/K	$\Delta l/l$ 10^{-6}/K
Secolit 215 Secolit 220	8,3	120	120	800	600-750	85	280	12	800	8	11
Secolit 170	8,4	160	180	1000	550-750	55	360	13	720	6	13

Magnet Manufacturing

Secolit is created from pulverized alloys, which are molded while being subjected to a magnetic field. The products of this process are referred to as green bodies.
These green bodies are sintered at various temperatures (depending on the grade) in a vacuum or an inert gas environment, achieving between 96% and 99% of the theoretical density. For optimum formation of the magnetic properties, the raw magnets are then subjected to a heat treatment.

Magnet Shapes

TRIDELTA Secolit Magnets can be made in all press-producible shapes. We supply cuboids, cylindrical shapes, rings, segments and other shapes. It is also possible to supply bore holes, recesses, grooves, etc. The only requirement is that they run parallel to the pressing direction. Upon request we will check if a pressing tool is available for the desired geometry.

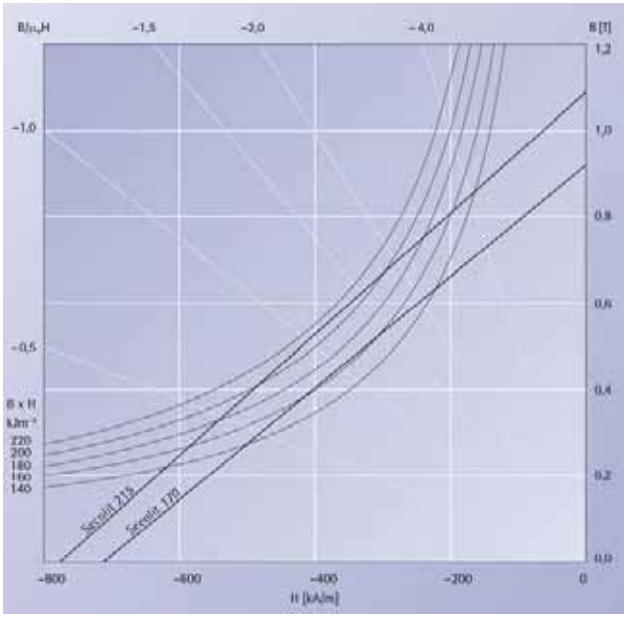
Cutting

Apart from compression molding it is also possible to shape magnets indirectly. The separation cutting process can be used to make high quality and precise miniature solenoids. TRIDELTA offers customized solutions for cuboids and profiles. Using diamond tools, the individual pieces, weighing approximately 30mg, are cut out of larger block magnets.

Magnetic Properties

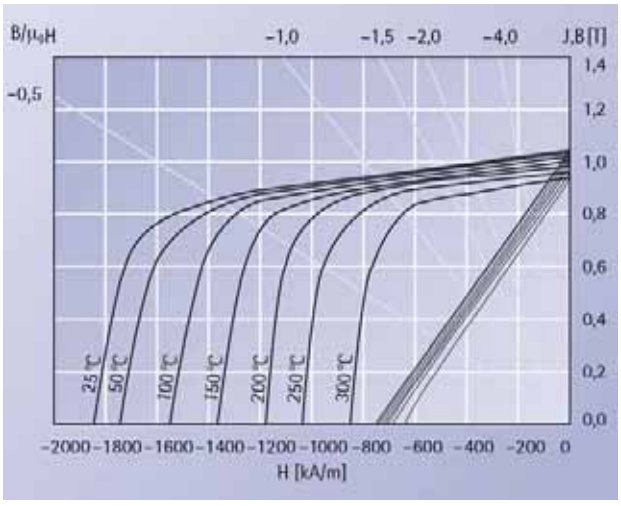
Secolit is anisotropic and can only be magnetized in the preferential direction.
Achievable magnetic properties of TRIDELTA Secolit magnets are also influenced by their shape and size.

Typical demagnetization curves of Secolit magnets at room temperature

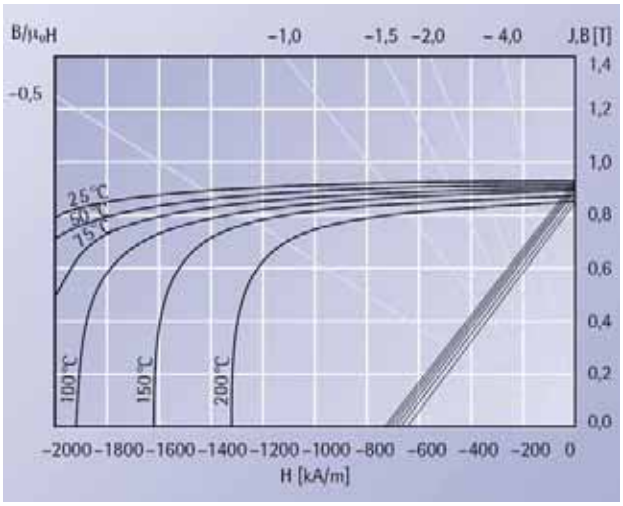


Secolit 215, 170

Typical demagnetization curves of Secolit grades depending on temperature



Secolit 215



Secolit 170

NEOLIT® – The innovative Material for High Performance Permanent Magnets

As TRIDELTA we are obligated to ensure a high production standard with new technologies while simultaneously narrowing the spread of product parameters to avoid oversizing and additional processing costs. Thereby, costs are reduced on the manufacturing side, but also on the user side. The compact isotropic and anisotropic Neolit magnets consist of the intermetallic, ferromagnetic compound neodymium, iron and boron. Tridelta Magnetsysteme GmbH is the only European company making these magnets using the hot and warm flow pressing process, developed by Magnequench USA.

Magnet Manufacturing

The Neolit starting powders are made in the "melt-spin" process, in which liquid molten mass is sprayed onto a fast spinning roller and quenched at a very steep temperature gradient.

The nano-crystalline tinsels constitute the basis of Neolit powder. For the production of permanent magnets, Neolit powder is cold pressed and then hot compressed, creating a completely dense isotropic magnet (Neolit NQ 2E and 2F).

Anisotropic magnets with a nano-crystalline structure are created by an additional warm deformation process. (Neolit NQ 3E, 3F and 3G).

Magnetic properties

Material[1] Trade name TRIDELTA	Max. energy product		Remanence flux density		Coercitivity				Rel. permeability	Operating temperature[2]	Temperature coefficient		Saturation field strength
	$(BH)_{max}$ kJ/m³	MGOe	B_r mT	G	H_{cB} kA/m	kOe	HcJ kA/m	kOe	µp	T_{max} °C	$TK(B)_r$ %/K	$TK(H)_{cJ}$ %/K	H_S kA/m
Neolit NQ 3E a typ	290	36,5	1270	12700	915	11,5	1040	13	1,09	150	-0,1	-0,6	>2600
Neolit NQ 3E a typ	280	35	1230	12300	915	11,5	1350	17	1,07	180	-0,09	-0,6	>2800
Neolit NQ 3G a typ	245	30	1150	11500	860	10,8	1800	23	1,05	200	-0,09	-0,6	>3200
Neolit NQ 2E i typ	110	13,8	800	8000	560	7,0	1400	18	1,15	180	-0,1	-0,5	>3200
Neolit NQ 2F i typ	110	13,8	800	8000	560	7,0	1600	20	1,15	200	-0,09	-0,5	>3200

1) a = anisotropic, i = isotropic, typ. = typical values

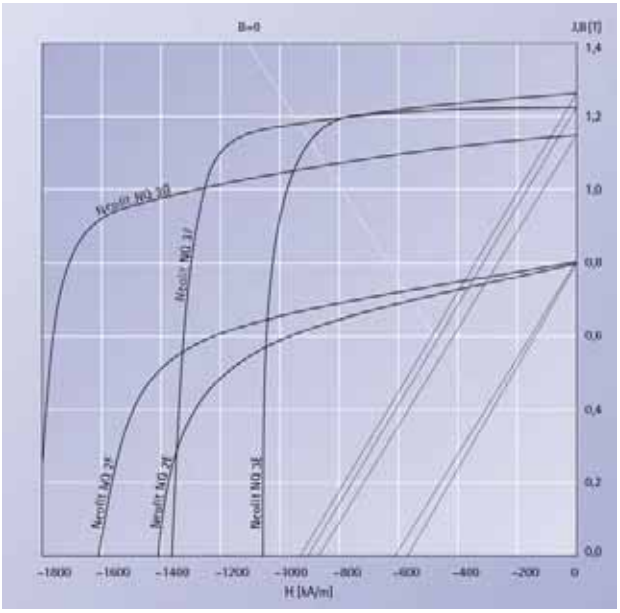
2) The maximum maximum operating temperature is depend on the geometry of the system.

Special Features of Neolit Magnets

The hot pressing and warm deformation processes offer the following distinct advantages compared with the standard sinter process:

- Final-size forming with tight geometric tolerances and without costly reworking processes such as grinding
- Lower corrosion tendency resulting in better long-term stability
- Narrower spread of magnetic properties (Br and Hcb)
- Radial preferred direction in case of segment magnets

Typical demagnetization curves of Neolit magnets at room temperature



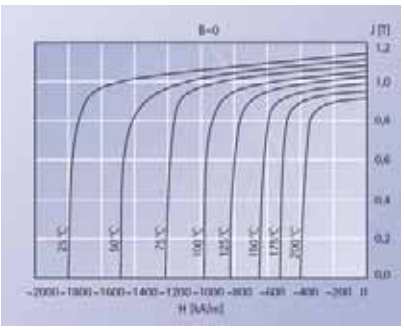
Temperature Behavior

The maximum service temperature of Neolit magnets depends on the operating point, which is operating by the shearing of the passive magnetic circuit and opposing field loads.

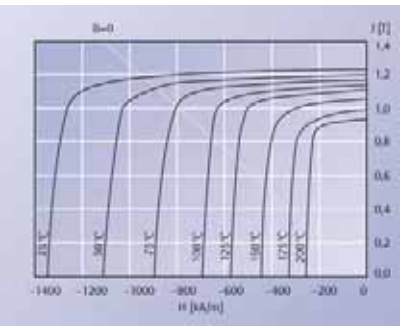
If the operating point remains in the straight region of the demagnetization curves, there will be no irreversible demagnetization effects.

If the so-called bending field strength, after which the demagnetization characteristics are no longer linear, is exceeded, demagnetization will take place and can only be removed by re-magnetization.

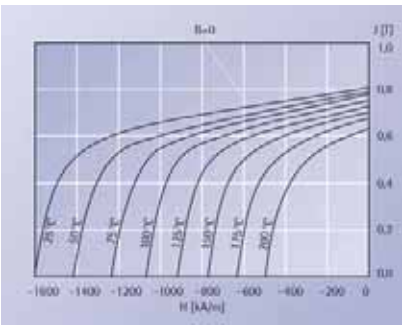
Typical demagnetization curves J=f(H) for various Neolit grades, depending on temperature



Neolit NQ 3G



Neolit NQ 3F



Neolit NQ 2F

NERONIT® – The sintered NdFeB Material for High Performance Permanent Magnets

Additional to the Neolit magnets TRIDELTA offers sintered neodymium-iron-boron magnets, since the hot molding process is not suitable for all geometries.
Neronit powder is created from pulverized alloys. Pellets are made in a powder press while being subjected to a magnetic field. Afterwards the pellets are sintered into raw magnets.
The raw magnets are heat-treated to achieve optimum formation of magnetic properties.

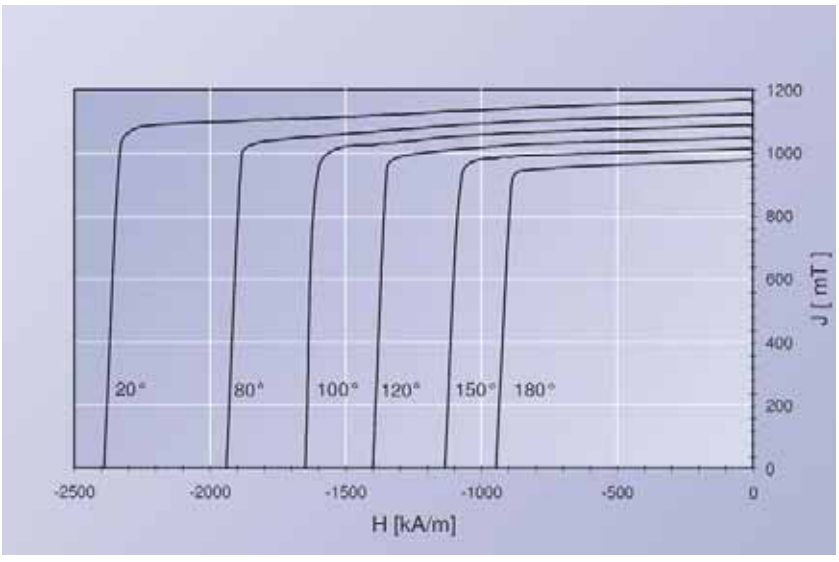
Stability and Surface Protection

Due to their chemical composition (high iron content) and their crystalline structure, Neronit magnets are very sensitive to environmental influences.
For that reason TRIDELTA offers all grades in low-corrosion material as well. A portion of the iron content is replaced with cobalt and other materials to substantially decrease the corrosion tendency.
Alternatively, we offer all types of surface coating to prevent harmful environmental influence.

When making your request, please select the desired coating:

- Galvanic coating with Ni, Cu, Sn, Zn, Al, Ag or combinations thereof
- Epoxy resin, sprayed or electrodeposition coated
- Parylene coating
- PTFE – coated magnets

Magnetic properties (example) Neronit 240/240



Magnetic properties

Material Trade name TRIDELTA	Q-Nomen-clature	Remanence flux density Br [T]		Coercitivity H_{CB} [kA/m]		Coercitivity H_{CJ} [kA/m]	Max. energy product $(BH)_{max}$ [kJ/m^3]		Operating temperature [°C] (L/D>0,7)
		Min	Typ	Min	Typ	Min	Min	Typ	
Neronit 260/95	N35	1,17	1,22	840	890	955	263	270	80
Neronit 290/95	N38	1,22	1,26	840	890	955	287	290	80
Neronit 330/95	N45	1,35	1,37	840	890	955	334	350	80
Neronit 370/95	N50	1,40	1,46	840	890	875	370	385	80
Neronit 260/110	N35M	1,17	1,22	836	890	1115	263	270	100
Neronit 280/110	N38M	1,22	1,26	859	915	1115	279	295	100
Neronit 320/110	N42M	1,30	1,33	859	915	1115	318	325	100
Neronit 330/110	N45M	1,33	1,37	859	915	1115	334	350	100
Neronit 260/135	N35H	1,17	1,22	836	890	1350	263	270	120
Neronit 280/135	N38H	1,22	1,26	859	915	1350	279	295	120
Neronit 320/135	N42H	1,30	1,33	859	915	1350	318	385	120
Neronit 330/135	N44H	1,33	1,36	859	915	1350	334	342	120
Neronit 260/160	N33SH	1,14	1,17	812	875	1590	239	255	150
Neronit 280/160	N35SH	1,17	1,22	836	890	1590	263	270	150
Neronit 320/160	N38SH	1,22	1,26	859	915	1590	279	290	150
Neronit 330/160	N44SH	1,33	1,36	859	915	1590	334	342	150
Neronit 200/200	N28UH	1,04	1,08	780	812	1990	199	205	180
Neronit 260/200	N35UH	1,17	1,22	836	890	1990	263	270	180
Neronit 280/200	N38UH	1,22	1,25	860	895	1990	287	300	180
Neronit 200/240	N28EH	1,04	1,08	780	812	2390	199	205	200
Neronit 240/240	N33EH	1,14	1,17	812	875	2390	239	245	200
Neronit 260/240	N35EH	1,17	1,22	836	825	2390	263	270	200
Neronit 220/280	N30AH	1,08	1,15	804	900	2790	223	235	200
Neronit 250/280	N35AH	1,14	1,17	812	875	2790	250	255	200

The maximum operating temperature is dependent on the geometry of the system.

Other grades available upon request.

Plastic-Bonded Magnets made of NEOLIT® and OXILIT®

We use Neolit and Oxit powders for the production of plastic-bonded magnets. Such magnets can be made in a compression molding process by mixing and compressing alloy powder with synthetic resin and curing it at 150°C.

A special process is used to achieve high filling levels, leading to high remanence and mechanical strength despite using lowest amounts of synthetic resins. Another possibility for producing plastic-bonded magnets is compounding powder with plastics, followed by an injection process. Magnets produced in this way show a higher plastic content than molded magnets.

Magnetic properties

Material[1] Trade name TRIDELTA	Max. energy product		Remanence flux density		Coercitivity				Rel. permeability	Operating temperature[2]	Temperature coefficient		Saturation field strength
	$(BH)_{max}$ kJ/m³	MGOe	B_r mT	G	H_{cB} kA/m	kOe	HcJ kA/m	kOe	µp	T_{max} °C	$TK(B)_r$ %/K	$TK(H)_{cJ}$ %/K	H_s kA/m
Oxilit SP 50 i typ	5	0,6	175	1750	110	1,3	180	2,25	1,05	80	-0,2	0,4	1000
Oxilit SP 65 i typ	6,5	0,8	195	1950	100	1,25	140	1,75	1,05	80	-0,2	0,4	1000
Oxilit SP 110 i typ	11	1,35	240	2400	150	1,9	220	2,75	1,05	80	-0,2	0,4	1000
Neolit SP 280 i typ	28	3,5	420	4200	300	3,8	650	8,2	1,15	110	-0,13	0,4	>3000
Neolit SP 445 i typ	44,5	5,5	530	5300	350	4,4	720	9	1,15	120	-0,13	-0,4	>3000
Neolit NQ 1A p typ	70	8,75	630	6300	425	5,3	1200	15	1,15	110	-0,13	-0,4	>3000
Neolit NQ 1B p typ	83	10,3	720	7200	455	5,7	760	9,5	1,22	110	-0,12	-0,4	>2800
Neolit NQ 1C p typ	64	8	630	6300	420	5,3	1450	18,1	1,15	125	-0,08	-0,4	>3500
Neolit NQ 1D p typ	73	9	670	6700	445	5,6	920	11,5	1,22	110	-0,08	-0,4	>3000

i = (injected) sprayed | p = (pressed) | typ. = typical magnet values | SP 110 and SP 445 = anisotropic

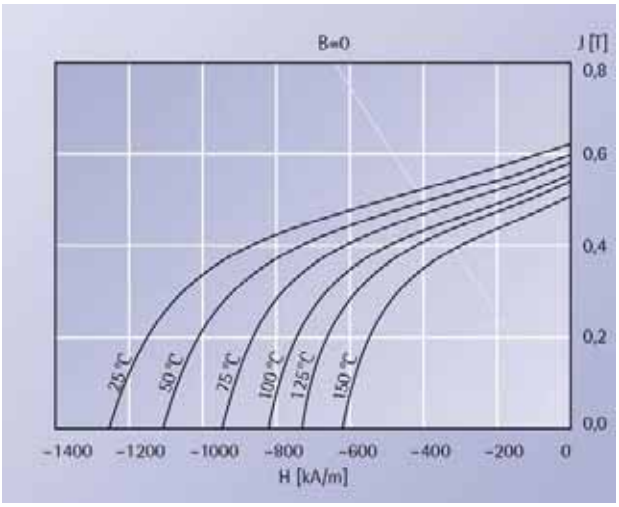
1) The maximum operating temperature is dependent on the geometry of the system.

Chemical and Mechanical Properties

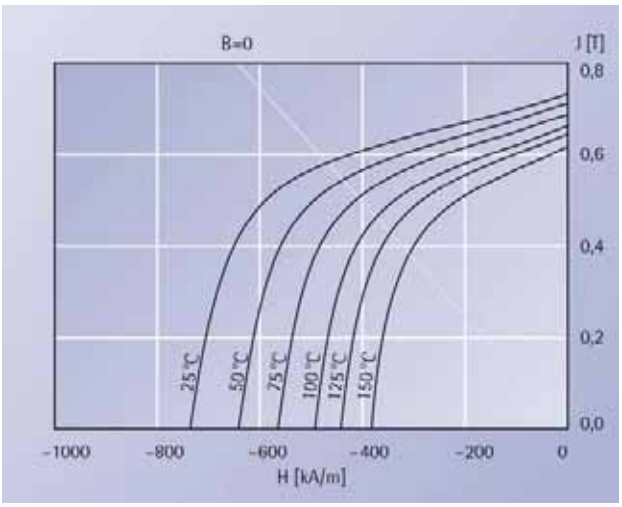
Chemical and mechanical properties are determined by the type of plastic used as well as its percentage amount, whereas the density is determined by the filling level.
Since the mechanical stability is mainly determined by the plastic structure, a lower plastic portion and a higher powder portion will result in lower stability and high remanence. Therefore, a compromise must be found between the magnetic and mechanical properties. This compromise is often governed by the magnet's shape as well.

Shaping

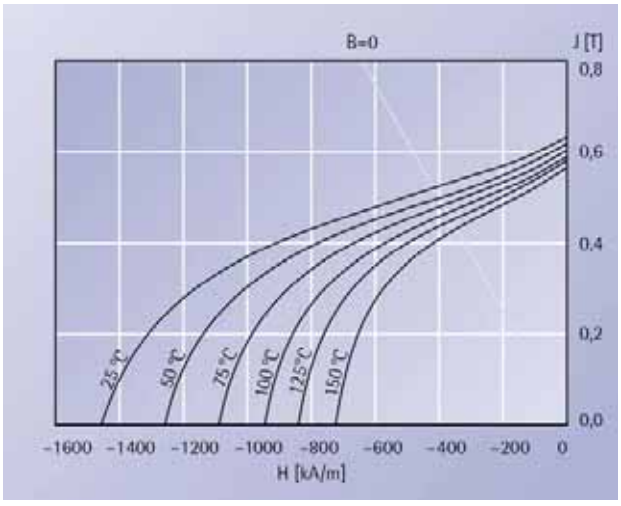
TRIDELTA pressed-magnets can be made in all press-producible shapes. We supply cuboids, cylindrical shapes, rings, segments and other shapes. It is also possible to supply bore holes, recesses, grooves, etc.
The only requirement is that they run parallel to the pressing direction. Injected magnets are available in all shapes achievable by this technology. Dimensional tolerances are very tight, which makes reworking processes unnecessary. This makes it possible, for example, to insert shafts into bore holes with very tight tolerances as well as external components such as magnetic yokes.



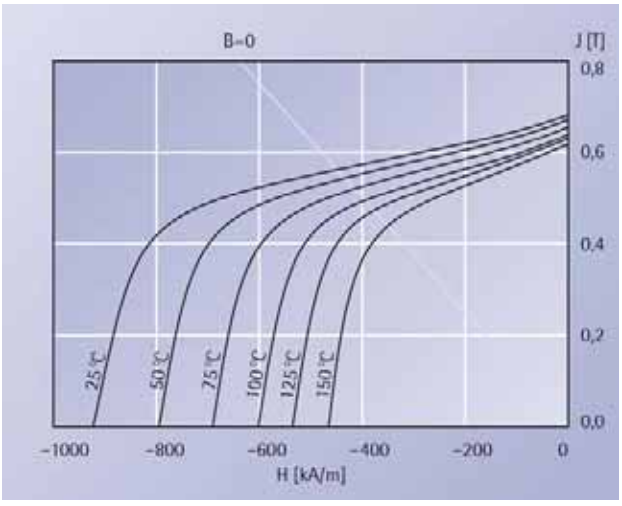
Neolit NQ 1A



Neolit NQ 1B



Neolit NQ 1C

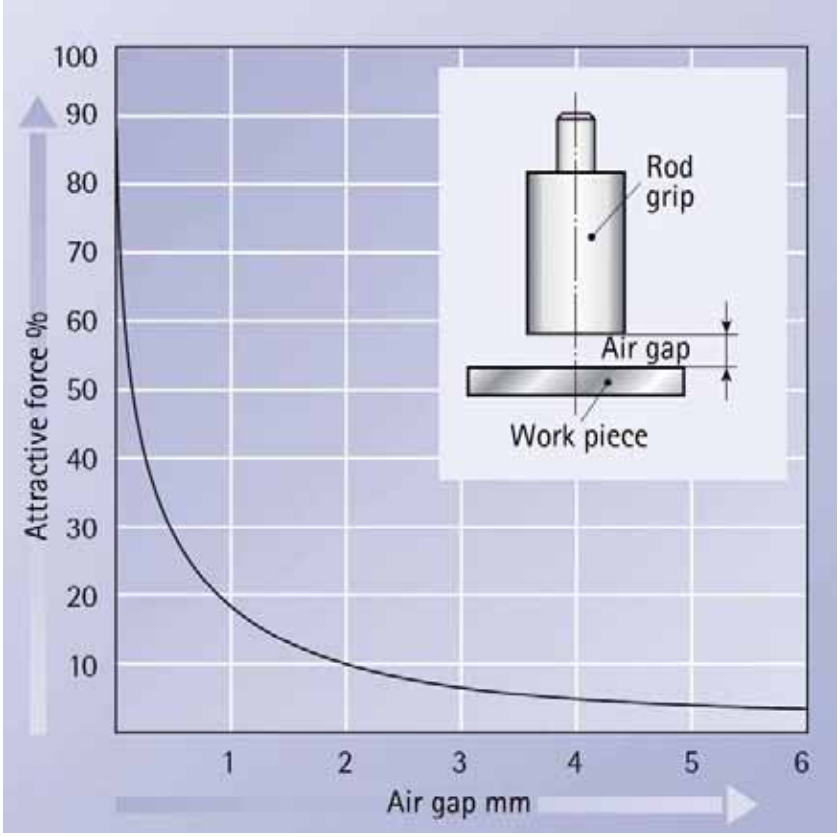


Neolit NQ 1D

Holding magnets made from OXIT®, OERSTIT®, SECOLIT®, NERONIT® – Optimum Materials for a wide range of tasks

TRIDELTA holding magnet systems (grips) simplify daily work in many industry sectors. Operating safely and without wear they are used is assembly, attachment, transport and fixation processes. They are successfully used by many companies for a wide range of clamping tasks.

Their quality is based on more than 90 years of experience in the production of DEW and Thyssen stainless steel magnets. Today, TRIDELTA continues the tradition of making high-performance holding magnets. They are mainly used for clamping ferromagnetic work pieces in a desired position to perform work and measuring processes easily, safely, accident-free and without the need for complicated clamping tools. TRIDELTA holding magnets critically contribute to streamlining production processes.



Available Types:

In this catalog you will find the most widely used types of holding magnet systems. However, we also supply grips with threaded ends, bore holes, stainless steel casing, etc. as well as any imaginable customized solution you may desire.

Attractive Forces

The attractive forces listed in the tables are minimum values at room temperature. They are achieved at vertical pull and full area contact between grip and a work piece of sufficient thickness and made from soft iron or low carbon steel.

In case of dirty pole areas or uneven surfaces, air gaps may form which significantly reduce holding forces. It is recommended, therefore, to ensure that pole areas are kept clean.

The holding magnets described here are non-ageing and retain their holding power for an indefinite period of time. The only influences capable of weakening holding forces are excessive temperature and strong magnetic fields, with the exception of Secolit grips, which are up to 4 times more resistant against such influences.

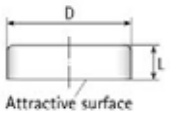
Various iron materials in the work piece have an influence on holding power according to their permeability (magnetic conductivity). Increased amounts of additives and alloy components will lower permeability and there-by holding forces. Increased surface roughness will lead to significant holding force losses due to the decreased area of magnet application. As the air gap widens, the magnets' holding power suffers.

Magnetically non-conductive intermediate material layers produce the same effect as an air gap. Please contact us if you have reason to believe that long-term temperature influence or thermal variation may cause malfunctions in your application. The same is true for chemical influences.

Flat grip magnets made from Oxit

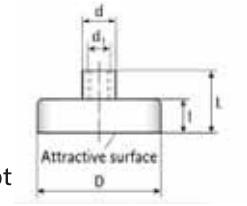
A ceramic permanent magnet material called Oxit 380 is used for the production of Oxit flat pot magnets. A soft iron pot, which is necessary for magnetic yoke, also provides shielding. The low height of flat grip magnets often creates design advantages. The material used makes flat grip magnets very economical. Even in long-term applications, Oxit flat grip magnets can be exposed to temperatures of up to +180°C without structural changes. When heating the magnet to this temperature there may be a drop in holding power by 30 to 40%. However, this process is reversible and there is no build up of holding power loss.

Possibilities of attachment:
- Pressing
- Adhesion
- Screw attachment



Flat grip magnet WITHOUT threaded spigot

Order no.	Size in mm		Weight	Attractive force
	D[1]	L[1]	g	N
106 401	10	4,5	3	4
106 402	13	4,5	5	10
106 403	16	4,5	6	20
106 404	20	6	10	30
106 405	25	7	17	40
106 406	32	7	28	80
106 407	40	8	52	110
106 408	50	10	100	200
106 409	63	14	220	280
106 410[3]	80	18	460	500
106 411[3]	100	22	900	900
106 412[3]	125	26	1650	1300



Flat grip magnet WITH threaded spigot

Order no.	Size in mm			Weight	Attractive force
	D[2]/d	L/l[2]	Threaded d1)/length	g	N
106 501	10/6	11,5/4,5	M 3/5	5	4
106 502	13/6	11,5/4,5	M 3/5	7	10
106 503	16/6	11,5/4,5	M 3/5	8	20
106 504	20/6	13/6	M 3/5	12	30
106 505	25/8	15/7	M 4/6	19	40
106 506	32/8	15/7	M 4/6	31	80
106 507	40/10	18/8	M 5/8	55	110
106 508	50/12	22/10	M 6/10	105	200
106 509	63/15	30/14	M 8/14	230	280
106 510[3]	80/20	34/18	M 10/14	470	500
106 511[3]	100/22	42/22	M 12/17	920	900
106 512[3]	125/25	50/26	M 14/20	1700	1300

1) Tolerances:

For D: 106 401 to 106 405: ± 0.15 mm
106 406 to 106 409: ± 0.2 mm
106 410 to 106 412: ± 0.25 mm

For L: 106 401 to 106 405: ± 0.1 mm
106 406 to 106 409: ± 0.15 mm
106 410 to 106 412: ± 0.2 mm

2) Tolerances:

For D: 106 501 to 106 505: ± 0.15 mm
106 506 to 106 509: ± 0.2 mm
106 510 to 106 512: ± 0.25 mm

For l: 106 501 to 106 505: ± 0.1 mm
106 506 to 106 509: ± 0.15 mm
106 510 to 106 512: ± 0.2 mm

3) Hair cracks in the surface of the magnet and slight misalignment of mounting in the casing are technically unavoidable. However, both have no effect on the performance of the magnet.

Rod Magnets and flat grips made from Secolit/Neronit

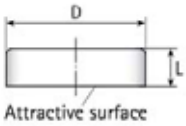
Secolit / Neronit is a rare earth alloy (e.g. samarium or neodymium) with cobalt or iron. Compared with other alloys it increases holding power three to five-fold, while maintaining physical size! Alternatively, it can reduce physical size while maintaining the desired holding force.

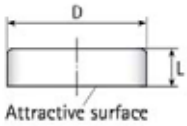
Rod Magnets and flat grips made from Secolit can be exposed to temperatures of up to 220°C, even over long periods, without suffering structural changes in the magnet's material. Increasing temperature to this level may lead to a 15% to 20% reduction in holding power. However, this process is reversible and there is no buildup of losses.

Secolit/Neronit must never be directly molded into iron, since this would lead to a magnetic short circuit and holding power losses. The spacing between an iron wall and the magnet's bottom and circumference listed in the table (rod magnets) must be followed implicitly.

Secolit flat grips have a soft iron pot which is necessary for magnetic yoke and provides shielding. The low height provides design advantages.

Possibilities of attachment:
- Pressing
- Adhesion
- Screw attachment





Flat grip with Secolit

Order no.	Size in mm		Weight	Attractive force
	in mm D[4]	L[5]	g	N
131 001	6	4,5	1	5
131 002	8	4,5	2	12
131 003	10	4,5	3	25
131 004	13	4,5	5	50
131 005	16	4,5	6,5	80
131 006	20	6,0	14,5	120
131 007	25	7,0	27	200
131 008	32	7,0	44	350

Flat grip with Neronit

Order no.	Size in mm		Weight	Attractive force
	D[4]	L[5]	ca g	N
133 901	6	4,5	1	6
133 902	8	4,5	2	18
133 903	10	4,5	3	30
133 904	13	4,5	5	60
133 905	16	4,5	6,5	100
133 906	20	6,0	14,5	150
133 907	25	7,0	27	270
133 908	32	7,0	44	480

4) Tolerances:
131 001 and 131 002: ± 0.1 mm
131 003 to 131 007: ± 0.15 mm
131 008: ± 0.2 mm
133 901 and 133 902: ± 0.1 mm
133 903 to 133 907: ± 0.15 mm
133 908: ± 0.2 mm

5) Tolerances:
131 001 and 131 007: ± 0.1 mm
131 008: ± 0.15 mm
133 901 and 133 907: ± 0.1 mm
133 908: ± 0.15 mm

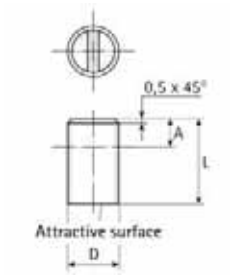
Rod magnets Secolit WITH and WITHOUT fitting tolerance

Order no. with fitting tolerance	Order no. without fitting tolerance	Size in mm			Weight	Attractive force	Distance of magnet from iron casing
h 6		D[1)]	L[1)]	A[2)]	g	N	in mm[3]
126 701	123 001	6	20	10	4	6	1,5
126 702	123 002	8	20	10	8	10	1,5
126 703	123 003	10	20	8	12	40	2,0
126 704	123 004	13	20	6	20	60	2,5
126 705	123 005	16	20	2	32	125	3,0
126 706	123 006	20	25	5	60	250	4,0
126 707	123 007	25	35	7	138	400	5,0
126 708	123 008	32	40	5	261	600	6,0

1) Tolerance: ± 0.2 mm

2) The rod magnet can be shortened by A without holding force losses.

3) Applies to the outside surface. Applies to backside only if the grip magnet was shortened by measurement A.

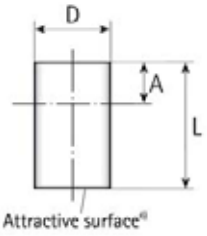


Rod magnets Neronit WITH and WITHOUT fitting tolerance

Order no. with fitting tolerance	Order no. without fitting tolerance	Size in mm			Weight	Attractive force	Distance of magnet from iron casing
h 6		D[1)]	L[1)]	A[2)]	g	N	in mm[3]
133 951	134 001	6	20	10	4	7	1,5
133 952	134 002	8	20	10	8	12	1,5
133 953	134 003	10	20	8	12	45	2,0
133 954	134 004	13	20	6	20	70	2,5
133 955	134 005	16	20	2	32	150	3,0
133 956	134 006	20	25	5	60	300	4,0
133 957	134 007	25	35	7	138	500	5,0
133 958	134 008	32	40	5	261	720	6,0

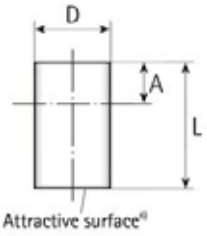
Rod magnets Oerstit WITH fitting tolerance

Order no.	Size in mm			Weight	Attractive force
	D[1)]	L[1)]	A[2)]	g	N
106 001	6	10	2	2	1,5
106 002	8	12	3	4	3,5
106 003	10	16	6	9	7,0
106 004	13	18	7	17	10,0
106 005	16	20	5	29	18,0
106 006	20	25	6	57	42,0
106 007	25	30	5	110	96,0
106 008	32	35	3	200	180,0
106 009	40	45	5	420	240,0
106 010	50	50	2	720	420,0
106 011	63	60	5	1340	660,0



Rod magnets Oerstit WITHOUT fitting tolerance

Order no.	Size in mm			Weight	Attractive force
	D[3)]	L[3)]	A[2)]	g	N
106 101	6	20	12	4	1,5
106 102	8	20	11	7	3,5
106 103	10	20	10	11	7,0
106 104	13	20	9	19	10,0
106 105	16	20	5	29	18,0
106 106	20	25	6	57	42,0
106 107	25	35	10	140	96,0
106 108	32	40	8	240	180,0
106 109	40	50	10	500	240,0
106 110	50	60	12	900	420,0
106 111	63	65	10	1480	660,0



1) Tolerances:
for D: h 6
for L: ± 0.2 mm

2) You can shorten the rod grip by measurement A, without losing holding power.

3) Tolerances:
for D: 106 101 to 106 106: ± 0.2 mm
106 107 to 106 111: ± 0.3 mm
for L: ± 0.2 mm

6) Do not remove more than 2 mm from the holding surface, since this would lead to significant holding power losses.

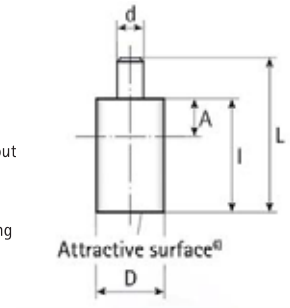
Rod magnets Oerstit WITH Pin

Order no.	Size in mm			Weight	Attractive force
	D[4]/d[4]	L[4]/l[4]	A[5]	g	N
106 301	6/3	28/20	12	4	1,5
106 302	8/3	28/20	11	7	3,5
106 303	10/4	28/20	10	12	7,0
106 304	13/4	28/20	9	20	10,0
106 305	16/5	28/20	5	30	18,0
106 306	20/6	33/25	6	60	42,0
106 307	25/8	45/35	10	140	96,0
106 308	32/10	50/40	8	250	180,0
106 309	40/15	70/50	10	520	240,0
106 310	50/18	85/60	12	950	420,0
106 311	63/20	95/65	10	1580	660,0

4) Tolerances:
for D: 106 301 to 106 306: ± 0.2 mm
106 307 to 106 311: ± 0.3 mm
for L and l: ± 0.2 mm
for d: – 0.2 mm

5) You can shorten the pin by measurement A, without losing holding power.

6) Do not remove more than 2mm from the holding surface, since this would lead to significant holding power losses.



General Ordering Information

The grip magnet type required for a specific task is determined by the existing operating conditions.

Before ordering please check the following:
- required holding force
- installation options
- thermal loads
- magnetic loads

Based on this information the type-range suitable for your application can be selected.

Technical Consultation

Our technical engineers will be happy to help you with special questions regarding application options of gripper magnets and magnet systems for streamlining production processes.

Rod grips made from Oerstit

The AlNiCo permanent magnet material Oerstit 500 is used for the production of Oerstit rod grips. A soft iron pot and a non-magnetic sleeve provide the necessary magnetic yoke and shielding.
Oerstit grip magnets can be used in applications with long-term exposure to temperatures of up to +450°C, without suffering structural changes in the magnetic material. When exposed to this temperature, holding power losses of 30% to 40% may occur. However, this process is reversible and there is no continuous build-up holding power losses.

Attachment options:
- Pressing
- Shrinking
- Soldering
- rivet arrachment of pin
- screw attachment after forming a threading

Special Holding Systems made from OXIT®, SECOLIT ® and NERONIT®

TRIDELTA Magnetsysteme specializes in the manufacturing of holding magnet systems for very special customer requirements. For example, we have produced holding systems with neodymium magnets for extremely challenging environmental conditions. This was achieved by completely encapsulating the magnetic material with magnetic stainless steel as a magnetic yoke material and brass. TRIDELTA also successfully made holding systems for the high vacuum range and without using plastic or gas-emitting adhesives.

Fully encapsulated flat grip magnet with Neolit

Flat grip magnet with Secolit

Special rod magnet with Neronit

Oerstit special holding systems (red series)

Please contact us if you have special requirements for a holding system. Our technicians will assist in developing the optimum solution for your application. We manufacture small and large quantities.

Magnet systems can be glued, flanged, welded or cast in plastic or zinc die-cast. We select the optimum and most cost-effective material, depending on the required holding force and service temperature.

Magnetic Bath Clamp for gripping ferromagnetic parts

TRIDELTA magnets and magnet systems are based on decades of production experience of the Thyssen magnet manufacturing company. This is also true for magnetic galvanizing bath clamps, which were specially developed for galvanic baths, hardening plants, staining plants, etc.
Sometimes ferromagnetic work pieces separate from their suspension. Picking up these work pieces with hooks and shovels is awkward and time-consuming.

Bath clamps are a practical and proven solution:

Using their extraordinarily strong holding power and far-reaching magnetic field, they pull in the work pieces, even when they are not directly touching the magnet. A non-magnetic spacer ensures that the bath clamp does not attach to the walls or the bottom of the ferromagnetic bath container, despite its outstanding magnetic properties. The permanent material used for the bath clamp is guaranteed to retain its undiminished function for decades.

Manual Destacker Greifix, with and without belt

Function

The holding force a magnet system exerts on a piece of sheet metal is dependent on the shape and size of the sheet.
If the sheet is too thin, it will result in saturation of the sheet, which serves as a magnetic yoke. Lines of force will leak and pull on other sheets in a stack. To make sure only one sheet is pulled up from the stack, Greifix destacker type series 105690 and 131000 feature multiple pole pitch and narrow pole spacing. Best performance is achieved at a total holding force of 200 N and vertical pull for sheets of up to 2 mm in thickness.

Application

The Greifix manual destacker is pulled over the work glove and held by a belt. It rests comfortably in the palm of your hand and can be worn by right- and left-handed people alike.
To lift metal sheets from a stack the hand is placed flat on a corner of the sheet. The sheet is pulled up by the magnet and can be lifted easily or pushed over the edge of the stack. Tilting the hand upward will easily separate the Greifix from the sheet.

Construction

The Greifix' plastic or Zamac housing features two wide, lateral eyelets for the attachment of leather or plastic belts.

Product Designation

- Type series 131 000 / 131 200 for sheet metal of up to 2 mm in thickness (plastic)
- Type series 105 690 / 105 797 for sheet metal of up to 2 mm in thickness (zamac)

Greifix Manual Destacker with Handle

Function

For lifting metal sheets above 2 mm in thickness we recommend the Tridelta manual destacker with 2-pole pitch and maximum holding force, since there is no danger of magnetic saturation and extension of the magnetic field to the metal sheets below. The Greifix type 105700 features a holding force of 450 N at vertical pull and is suitable for manual destacking of metal sheets of up to 5 mm in thickness. Type 105701 with a holding force of 850N is used for metal sheets of more than 5 mm in thickness.

Use

The Greifix manual destacker is placed on a corner of metal sheet. Now the sheet can be lifted from the stack. The unit can be removed by bending it. For larger sheets we recommend the use of two destackers.

Construction

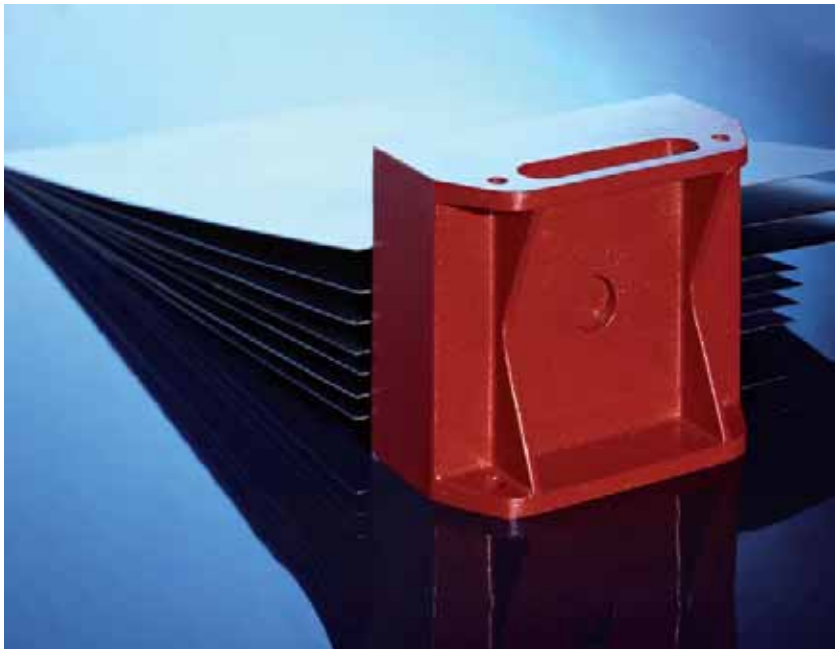
The shielded, circular permanent magnet system features a handle with a plastic ball end.

Product Designation

- Type series 105 700 for sheets of more than 2 mm and up to 5 mm in thickness
- Type series 105 701 for sheets of more than 5mm in thickness

Spreader Magnet Systems for Sheet Metal Fabrication

Tridelta Magnetsysteme specializes in the development of diverse magnet systems to streamline or simplify work processes in plants and workshops. Tridelta Magnetsysteme GmbH originated from the Thyssen stainless steel plants and Thyssen Magnettechnik Dortmund and due to its technical competence convinces developers, designers and purchases domestically and internationally. Their trendsetting magnet systems are the result of continuous research and development as well as cooperation with customers.



Magnetic Destacking of sheet metal

Sheet metal fabrication and processing are subject to problems when attempting to lift metal sheets off a stack.
Magnet systems are a proven solution. They penetrate the stack laterally with a strong magnetic flow and magnetize the individual sheets in homopolar fashion. Since poles of the same polarity repel each other, the sheets are lifted by the force of the magnets alone. Accident hazards that inevitably exist when destacking, gripping and inserting steel sheet metal are significantly reduced.

Permanent Magnet Spreaders available from stock

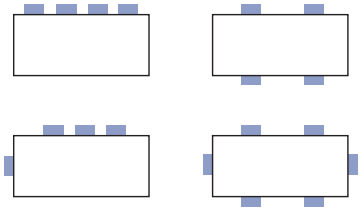
Apart from stock types we offer 50 other different dimensions of permanent magnet spreaders.
Depending on sheet thickness and adhesion forces by grease and oil we can make the spreaders with the appropriate magnet materials.
Request our spreader list or visit our website at **www.tridelta.de.**

Installation Instructions for Spreader Magnets

- The spreader magnet must stick out at least 25 mm beyond the sheet stack.
- **Spreading at one side of the stack:**
  The magnet poles must be positioned vertically
- **Spreading on two opposing sides of the stack:**
  There should be 1 to 2 mm of spacing between sheets and spreader magnets, to avoid jamming.
- **All-around spreading:**
  During assembly make sure that n-poles and s-poles are installed next to each other. The length of the spreader magnets should be different to avoid cancelling out magnetic forces.
- To avoid short circuits, spreader magnets should not be installed flush in iron parts, but be attached with metal bracketson the back. Two small spreader magnets are more effective than one large magnet.

Stock Types

Order no.	Size in mm						Weight (piece/kg)	thickness of a sheet or plate
	a	b	c	d	e	f		
105 660	150	125	ca. 85	110	ca 70	Ø6,5	3,5	< 0,3 mm
105 661	180	150	ca. 100	130	ca 80	Ø8,5	6,5	0,3-0,6 mm
105 662	220	180	ca. 120	155	ca 95	Ø8,5	11,0	0,6-1,2 mm



Electric Spreader Magnets

Permanent magnetic spreaders generate a specific magnetic flow in sheet metal, depending on the sheet's thickness. Their advantage is that their spreading power can be adjusted from 0 - 100%. Moreover, electric spreaders can be turned off completely to eliminate system-inherent holding forces. Please see page 35 of this catalog for current regulators required to operate electric spreaders.

Spreader Types

Spreader magnets are offered in different dimensions and a duty cycle of 30%.
They are suitable for spreading metal sheets from 0.5 to 3 mm in thickness. All types are standard-fitted with coils and temperature sensors, which should be monitored by the operator to avoid coil overheating.

Series 2
for sheet thickness of 2 mm (dry)

width: B=112 mm depth: T= 90 mm		Winding: M8x15 deep B1=50 mm	
Order no.	L [mm]	l1 [mm]	Weight [kg]
2.-SP.E-112x200	200	100	14,0
2.-SP.E-112x250	250	100	17,5
2.-SP.E-112x300	300	100	21,0
2.-SP.E-112x350	350	100	24,5
2.-SP.E-112x400	400	100	28,0
2.-SP.E-112x450	450	100	31,5
2.-SP.E-112x500	500	100	35,0
2.-SP.E-112x550	550	100	38,5

Series 3
for sheet thickness of 3 mm (dry)

width: B=152 mm depth: T= 90 mm		Winding: M8x10 deep B1=100 mm	
Order no.	L [mm]	l1 [mm]	Weight [kg]
3.-SP.E-152x300	300	100	29,0
3.-SP.E-152x350	350	100	34,0
3.-SP.E-152x400	400	100	39,0
3.-SP.E-152x450	450	100	44,0
3.-SP.E-152x500	500	100	49,0
3.-SP.E-152x550	550	100	53,0
3.-SP.E-152x600	600	100	58,0

Pneumatic Spreader Magnets

Electric power is not always available in production plants. Our compressed air spreaders are an outstanding alternative if the spreading effect needs to be adjusted and attracting forces are very disruptive. Even if the required duty cycle is 100%, a pneumatic spreader is the right choice.
This spreader type combines the ruggedness of a permanent magnet spreader with the possibilities of an electric spreader.
The spreader magnets are fitted with highly coercive permanent magnets and do not require electrical power.
The double-action pneumatic cylinder allows the disconnection of magnetic force. This will release the sheet metal stack for switching purposes. The slide plate (stainless steel housing) located between the magnets and the metal sheets, reduces friction and simplifies destacking. The two bolts secured with cotter pins guide the magnetic element in the housing and enable magnetic force adjustment through disc placement. The cotter pins are secured with wire. Thereby the spreading effect and the holding force are adjusted by changing the spacing between magnets and sheet metal.

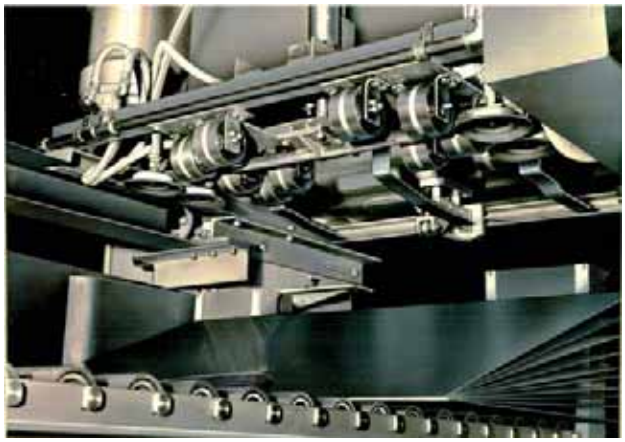
Function

Pneumatic spreader magnets are designed for separating metal sheets of up to 10 mm in thickness and are suitable for any sheet metal format. The ability of adjusting the magnetic force enables the separation of sheets of different thickness. It is also possible to separate large metal sheets if the spreaders are applied in groups at a spacing of 900 mm.

Types

We currently offer four sizes of pn-spreaders in the standard series. They are supplied as PnSp-124 (pneumatic spreader magnet, width mm).
The four sizes all have a width of 124 mm and only vary in height:
Height 1: 325 mm
Height 2: 425 mm
Height 3: 525 mm
Height 4: 635 mm

Permanent Magnetic Wheels



Areas of Application:

Magnetic wheels with Oerstit, Oxit or Neolit magnets transport ferromagnetic sheet metal, pipes and profiles even under the most difficult of circumstances. For example, the use of magnetic wheels is advantageous for the following applications:

1.) Feeding of sheet metal and removal of sheet scrap in semi- or fully automatic punches or presses in sheet metal fabrication plants.

2.) In case of feeding or removal of metal sheets in metal printing machines, magnetic wheels contribute to process automation.

Even at high speeds, metal sheets, pipes, rods, profiles, etc. are transported safely and slip-free with magnetic wheels in roller mills, drawing plants, hardening plants and galvanic plants. In flame cutting machines, magnetic wheels feed metal sheets as track rollers on steep walls or even overhead.

Types:

Smooth surface magnetic wheels are produced in 4 types:

Type series 100900

Oxit-magnetic wheels with 2-pole pitch (max. service temp. 100°C) with ferrite magnets

Type series 100400

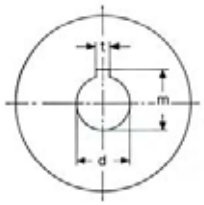
Oerstit-magnetic wheels with 2-pole pitch (max. service temp. 400°C) with AlNiCo magnets

Type series 140100

Neolit-magnetic wheels with 2-pole pitch (max. service temp. 80°C) with neodymium magnets

Type series 100900

Oxit-magnetic wheels with 4-pole pitch (max. service temp. 100°C) with ferrite magnets-



Magnetic wheels with 2-pole pitch are designed for transporting work pieces with a wall thickness of 2mm. The holding forces indicated in the dimension tables are achieved, if the sheet thickness is approxi-mately the same as the roller width. Magnetic wheels with 4-pole pitch are suitable for sheets with less than 2 mm in thickness. Strong paint or corrosion contamination on the sheet surface will likely lead to holding force losses.

The holding force indicated in the tables is vertical lifting force. The shifting force is only 10% to 30% of the vertical lifting force. This must be taken into account when selecting magnetic wheels for a specific application.

Type series of Oxit-magnet wheels with 2-pole pitch, suitable for a maximum service temperature von100°C

Order no.	Diameter D in mm	width B in mm	borehole d	borehole d_{max}	Spline groove m in mm	Spline groove t in mm	Attractive force in N
100 901	25 ±0,1	16±0,5	8±0,015	10	8,6±0,1	3±0,03	29
100 902	32 ±0,1	18±0,5	10±0,015	12	11,1±0,1	4±0,03	39
100 903	40 ±0,1	20±0,5	12±0,018	15	13,1±0,1	4±0,03	59
100 904	50 ±0,1	25±0,5	16±0,018	18	17,3±0,1	5±0,03	118
100 905	63 ±0,15	32±0,5	20±0,021	23	21,7±0,1	6±0,03	177
100 906	80 ±0,15	40±0,5	25±0,021	30	26,7±0,1	8±0,03	343
100 907	100 ±0,2	50±0,5	30±0,021	35	31,7±0,1	8±0,03	540

Type series OERSTIT-Magnetic wheels with 2-pole pitch

Order no.	Diameter D in mm	Width B in mm	Borehole d	Borehole d_{max}	Spline groove m in mm	Spline groove t in mm	Attractive force in N
100 401	25 ±0,1	16±0,5	8±0,015	10	8,6±0,1	3±0,03	30
100 402	32 ±0,1	18±0,5	10±0,015	12	11,1±0,1	4±0,03	40
100 403	40 ±0,1	20±0,5	12±0,018	15	13,1±0,1	4±0,03	60
100 404	50 ±0,1	25±0,5	16±0,018	18	17,3±0,1	5±0,03	120
100 405	63 ±0,15	32±0,5	20±0,021	23	21,7±0,1	6±0,03	180
100 406	80 ±0,15	40±0,5	25±0,021	30	26,7±0,1	8±0,03	350
100 407	100 ±0,2	50±0,5	30±0,021	35	31,7±0,1	8±0,03	540

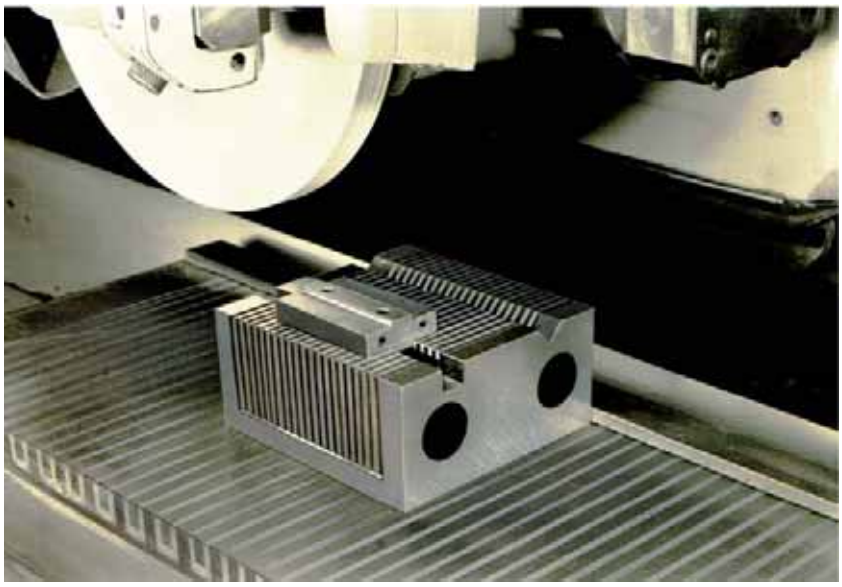
Type series NEOLIT-Magnetic wheels with 2-pole pitch

Order no.	Diameter D in mm	Width B in mm	Borehole d	Borehole d_{max}	Spline groove m in mm	Spline groove t in mm	Attractive force in N
140 101	25 ±0,1	16±0,5	8±0,015	10	8,6±0,1	3±0,03	60
140 102	32 ±0,1	18±0,5	10±0,015	12	11,1±0,1	4±0,03	80
140 103	40 ±0,1	20±0,5	12±0,018	15	13,1±0,1	4±0,03	120
140 104	50 ±0,1	25±0,5	16±0,018	18	17,3±0,1	5±0,03	240
140 105	63 ±0,15	32±0,5	20±0,021	23	21,7±0,1	6±0,03	355
140 106	80 ±0,15	40±0,5	25±0,021	30	26,7±0,1	8±0,03	690
140 107	100 ±0,2	50±0,5	30±0,021	35	31,7±0,1	8±0,03	1080

Type series Oxit-Magnetic wheels with 4-pole pitch

Order-No.	Diameter D in mm	Width B in mm	Borehole d	Borehole d_{max}	Spline groove m in mm	Spline groove t in mm	Attractive force in N
100 501	25 ±0,1	15±0,3	10±0,015	12	10,6±0,1	3±0,03	25
100 502	32 ±0,1	15±0,3	10±0,015	13	11,1±0,1	4±0,03	35
100 503	40 ±0,1	27±0,3	12±0,018	16	13,1±0,1	4±0,03	50
100 504	50 ±0,1	27±0,3	12±0,018	18	13,1±0,1	4±0,03	75
100 505	63 ±0,15	39±0,3	16±0,021	22	17,3±0,1	5±0,03	100
100 506	80 ±0,15	39±0,3	20±0,021	28	21,7±0,1	6±0,03	140
100 507	100 ±0,2	51±0,3	25±0,021	42	26,7±0,1	8±0,03	190

Permanent Magnet Clamping Blocks made of Oxit and Secolit



Advantages of using clamping blocks

- For the creation of special clamping surfaces, clamping blocks can be ground down and polished (vertically) by about 50% without significant adverse effect on holding force.
- The low acquisition costs of clamping blocks make it possible to keep pre-profiled blocks ready as spares for applications requiring repeated high precision clamping such as the production of stamps for punching or pressing tools.
- For dimensional tests, clamping blocks can be removed from the machine together with the work piece and then be processed further.
- After use, the clamping block can be cleaned with a rubber squeegee to remove iron particles.

Areas of Application:

In tool making and similar plants, often, very small steel and iron work pieces with complex shapes have to be processed. Secure and correct clamping of these work pieces can be challenging.
Normal magnetic clamping plates are unsuitable for very thin parts, since the poles are spaced too far apart.

The clamping block consists of a permanent magnet system with close pole pitch, which has a magnetic holding effect on two to three surfaces. The other iron surfaces of the clamping block are used for setting, e.g. onto a magnetic chuck of a surface grinding machine. Multiple, closely spaced poles ensure that even thin-walled work pieces are penetrated by multiple lines of force, without causing magnetic oversaturation.
Therefore, the work pieces are held securely and are able to resist thrust forces occurring during grinding.

Supply Forms and Ordering Types of Clamping Blocks

Magnetic-material	Type no.	Size in mm[1]			Max. angular deflection[1]	Attractive surfaces	Wight
		length l	width b	height h		in mm	kg
OXIT SECOLIT	103 201 132 700	99 ±0,15	100 ±0,15	49 ±0,15	10'	1 surface 100x99 2 surfaces 99x49	3,2
OXIT SECOLIT	103 202 132 701	99 ±0,15	50 ±0,15	49 ±0,15	10'	2 surfaces 99x49 1 surface 99x50	1,6
OXIT SECOLIT	103 203 132 702	100 ±0,15	25 ±0,15	25 ±0,15	10'	2 surfaces 100x25	0,4
OXIT	103 204	100 ±0,15	25 ±0,15	25 ±0,15	10'	2 surfaces 100x25	0,4

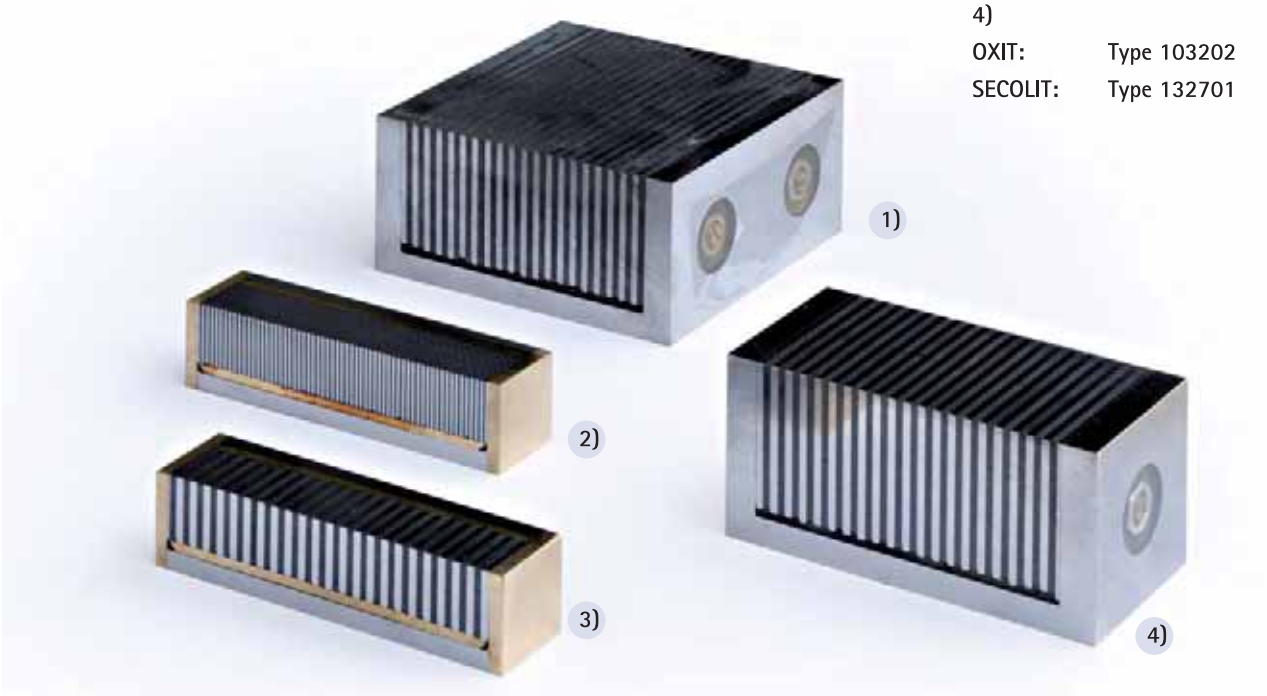
1) Tighter tolerances are available at additional charge.

Types:

Clamping blocks are manufactured in three sizes and two material grades:
Types 103201 to 103204 in our Oxit material grade and types 132700 to 132702 in our Secolit material grade.

Secolit clamping blocks possess twice the holding force, compared with our standard Oxit type and are therefore particularly suited for work pieces that are difficult to hold.

1)
OXIT: Type 103201
SECOLIT: Type 132700
2)
OXIT: Type 103204
3)
OXIT: Type 103203
SECOLIT: Type 132702
4)
OXIT: Type 103202
SECOLIT: Type 132701



Permanent Magnet Welding Aids

TRIDELTA magnets and magnet systems simplify everyday work in many industry sectors. Providing a high degree of safety and without wear and tear, they are used for assembly, attachment, transport and fixation. TRIDELTA terminal clamps and workpiece holders are successfully used particularly for welding processes. They have evolved from our proven former Thyssen Edelstahlwerke program, which is continued by Tridelta Magnetsysteme.

Permanent Magnet Terminal Clamps

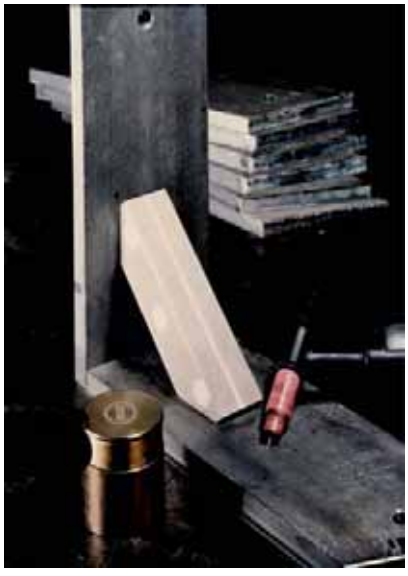
Instead of using standard mechanical screw-type or terminal clamps, permanent magnet clamps use a cable to connect the workpiece to the welding power source.
After connecting the cable, the terminal clamp is placed on the metallically clean surface of the workpiece. The clamp's holding force is engineered in such way that it provides proper contact. The clamp cannot slide or fall off. To remove it from the workpiece it is sufficient to bend the handle slightly.
TRIDELTA terminal clamps are insensitive to normal welding temperatures.

Types:
The permanent magnet terminal clamp **Klemmax** is universally usable. Its three holding surfaces are designed in such way that it is capable of securely holding round and flat workpieces during welding. This is also guaranteed by the optimum holding force of 700 N (measured on 5 to 20 mm thick sheet metal). We guarantee a maximum current carrying capacity of 400 A up to 35% duty cycle. Klemmax is simple to use and the welding cables connect easily: The terminal clamp is supplied ready-to-use, with a clamp sleeve and a clamp screw.
Klemmax impresses with its long service life. Contaminated holding surfaces can be cleaned simply by grinding.

Order no.	Max. current cerrying capacity A	Wight ca kg	Dia-meter mm	Attrac-tive force N	Suitable for workpieces	Cable connection
106 290	250	1,1	56	350	with plane contact surfaces	handle with clip
106 390	500	2,2	70	560	with plane contact surfaces	handle with clip
103 164	400	1,1	-	700	with plane + round contact surfaces	handle

Permanent Magnet Workpiece Holder

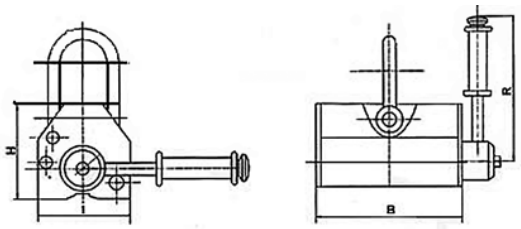
Permanent magnet workpiece holders simplify assembly tasks during welding by fixating autogenously and electrically connected workpieces. Their magnetic holding force is effective on the inclined front surfaces and the rectangular base surfaces. Thereby workpieces can be held at a right angle and in one plane. Magnetic workpiece holders have a practically unlimited lifetime and their shape is adapted to the requirements of their working environment.



Order no.	Size in mm highest length	Width	Hight	Weight ca kg	Suitable for workpieces
106 490	160	40	40	1,5	with flat surfaces

Mechanically switchable permanent Lifting Magnets

For lifting flat and cylindrical steel parts.
Lifting forces are based on a material thickness of at least 20 mm (flat material).



Characteristics:

- simple design
- easy to use
- Extraordinary holding power at small unit size by using NdFeB magnets
- non-decreasing holding power
- also usable for transporting round parts by using v-shaped recesses in the holding surface

Use:

In assembly applications lifting magnets can pick up and lift ferromagnetic parts such as blocks, cylinders and pipes. They are particularly useful for loading and unloading tasks and therefore ideal lifting devices for warehouses, workshops, tool making plants, production plants, wharfs, etc.

Operation:

In disconnected state the magnet is placed on the ferromagnetic part to be transported. It is then activated by turning the switch lever. A locking device on the lever prevents inadvertent deactivation. Now, transport can begin.
Deactivation: Release the clamping device, turn the switch lever, the magnet becomes non-magnetic and the transported part is released.

Overview of mechanically switchable lifting magnets

Series	Order no.	Rated lifting strength (N)	Cylindrical lifting strength (N)	Max. pull-off strength (N)	L	B	H	R	Operating temperature °C	Weight kg
PMQZQ 100	831 689	1000	500	3500	62	92	67	126	<80	3
PMQZQ 300	831 690	3000	1500	10500	92	162	91	155	<80	10
PMQZQ 600	831 691	6000	3000	21000	122	232	117	196	<80	24
PMQZQ 1000	831 692	10000	5000	35000	176	258	163	285	<80	50
PMQZQ 2000	831 693	20000	10000	70000	234	378	212	426	<80	125
PMQZQ 3000	831 694	30000	15000	105000	286	458	261	521	<80	220
PMQZQ 6000	831 695	60000	30000	210000	430	600	355	180	<80	420

Permanent Electrical Lifting Magnets

Scope of Application

Electrically switchable lifting magnets are used in all applications where ferromagnetic workpieces or parts are lifted, moved and placed down. Loads are held safely by the installed permanent magnets. Electrical power is not required to transport loads securely, but only to put them down.

Function

Through their poles, permanent magnets establish a magnetic field which attracts ferromagnetic parts. The holding force is independent of electrical power and remains steady during power losses. Only when the control voltage is activated in the electric coil, the holding force is cancelled by suppressing the magnetic field, and the load is placed down.

The holding force curve on page 34 shows that the holding forces of lifting magnets are dependent upon the air gap and the load's material thickness. This must be taken into account when picking up a load.

System Design of 2-pole and 3-pole Magnet Systems

TRIDELTA produces lifting magnets designed as 2-pole and 3-pole magnet systems. In the 2-pole system permanent magnets are glued in the space between the two poles and the magnetic yoke. Every pole is surrounded by an electric coil, covered with chromium-nickel sheet metal. The system is protected by a durable stainless steel sheath.

The 3-pole systems consist of a durable stainless steel sheath forming the two external poles, between which the permanent magnets are glued in. The center pole, which is surrounded by an electric coil, is covered with chromium-nickel sheet metal. If deep penetration is required for the load in question, 2-pole systems should be selected.

3-pole systems are preferable for large surface thin-material loads. Our engineers will be happy to help you in selecting the right system for your load.

Standard types LHM 3-pole

Series 1	Attractive force kN	Power W	Width B-mm	Length L-mm	Height H-mm	Weight kg
170/200	4,0	85	170	200	95	23
170/300	7,0	130	170	300	95	34
170/400	10,0	175	170	400	95	46
170/500	13,0	220	170	500	95	57

Series 2	Attractive force kN	Power W	Width B-mm	Length L-mm	Height H-mm	Weight kg
250/500	20,0	238	250	500	130	115
250/600	25,0	410	250	600	130	138
250/700	30,0	482	250	700	130	160
250/800	35,0	554	250	800	130	185

Series 3	Attractive force kN	Power W	Width B-mm	Length L-mm	Height H-mm	Weight kg
400/800	50,0	545	400	800	170	380
400/900	60,0	615	400	900	170	425
400/1000	70,0	685	400	1000	170	475

H=Magnet height without load or battery housing

Standard-types LHM 2-pole

Series 1	Attractive force kN	Power W	Width B-mm	Length L-mm	Height H-mm	Weight kg
114/200	3,0	250	114	200	90	10
114/300	4,0	370	114	300	90	17
114/400	5,0	440	114	400	90	24
114/500	6,0	530	114	500	90	30

Series 2	Attractive force kN	Power W	Width B-mm	Length L-mm	Height H-mm	Weight kg
205/400	16,0	540	205	400	130	56
205/500	21,0	680	205	500	130	70
205/600	26,0	820	205	600	130	84
205/700	31,0	950	205	700	130	98

Series 3	Attractive force kN	Power W	Width B-mm	Length L-mm	Height H-mm	Weight kg
310/500	27,0	740	310	500	180	140
310/600	35,0	890	310	600	180	165
310/700	43,0	1050	310	700	180	180
310/800	50,0	1200	310	800	180	195

Series 4	Attractive force kN	Power W	Width B-mm	Length L-mm	Height H-mm	Weight kg
410/810	60,0	1200	410	810	240	380
410/910	70,0	1296	410	910	240	420
410/1010	80,0	1450	410	1010	240	460

Types

Several sizes with holding forces ranging from 4 kN to 70 kN (according to VDE 0580) are available.

Electric power can be supplied through mains connection 230V/50Hz, 3 x 400 V/50Hz as well as 160-200V DC through a constant current regulator or a battery.

Lifting magnets with mains power connection have an integrated current regulator located in the switch box and are connected to the mains power network through an electric connection cable and an on/off switch.

The constant current regulator supplied by Tridelta can be used to power several lifting magnets.

The TRIDELTA current regulator with constant current output was designed specifically for switching electrically switchable lifting magnets.

The inexpensive 1Q-controller with pulse-width modulation is characterized by its highly controlling accuracy and monitoring functions, which are displayed optically. There are two power types: 12 A and 25 A.

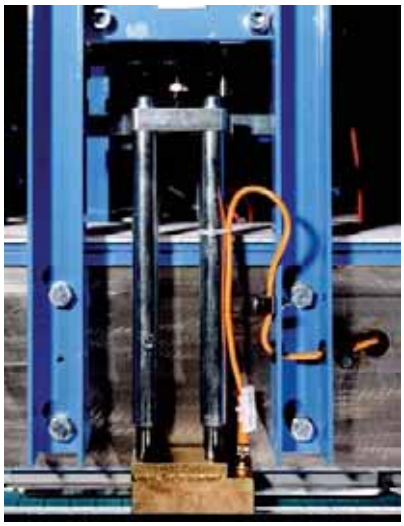
It is also possible to partially compensate the magnet system to separate sheet metal.

Battery-powered lifting magnets are powered by the installed battery. A battery monitor shows the remaining charge. The battery is charged by the supplied charging unit.

Switchable Small Displacement Magnet Systems

Scope of Application

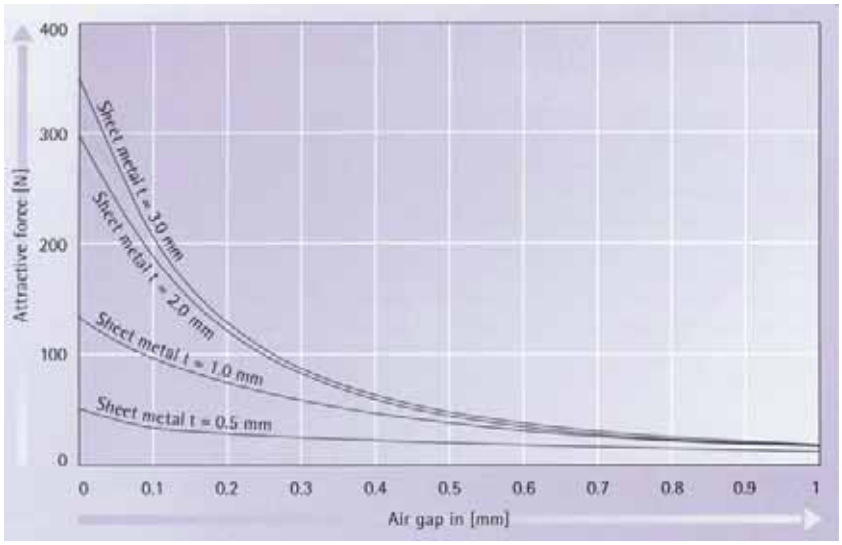
Manufacturers in the automation sector often have to test new technologies to fulfill their customers' special requirements.
Particularly in case of handling devices and robots it is possible to move ferromagnetic parts by magnetic force. Up to now, gripping pliers and pneumatic suction devices have been used for these purposes. However, both of these solutions have clear disadvantages in operational practice. Gripping pliers are subject to mechanical wear. The parts to be transported have to be positioned correctly and various gripping pliers must be used for various part geometries. Pneumatic suction devices are faced with challenges regarding cost and part cleanliness.
Tridelta Magnetsysteme offers a compact, switchable magnet system with high-quality neodymium-iron-boron materials for all ferromagnetic holding applications.



Function

Through their poles, permanent magnets establish a magnetic field which attracts ferromagnetic parts. The holding force is independent of the supplied electrical power and remains steady during power losses. Only when the control voltage is activated in the electric coil, the holding force is cancelled by suppressing the magnetic field, and the load is placed down. By using state-of-the-art magnet materials, very strong holding forces are achieved at small physical sizes.

Attractive force depending on the airgrap



Constant Current Regulators for switchable Magnet Systems

These magnet systems are switchable permanent magnet systems, supplied with an electric coil for the suppression or compensation of magnetic flux. The system requires an exact and constant current, independent of coil temperature. For this application TRIDELTA offers two types of lifting magnets.

Current Regulator for Small-Load Magnet Systems

Function

This current regulator with constant current output is specifically designated for the operation of switchable magnet systems for handling tasks. The regulator uses a full bridge circuit (4Q) and supplies a maximum output current of 4.5 A to compensate the magnetic field of the permanent magnets. It is also possible to amplify the permanent magnet's magnetic field by running the coil in "support" mode.

Thereby, metal sheets can be attracted at a distance or oil-related adhesion forces overcome.

Current Regulator for Lifting Magnet Systems with 12 and 25 A

The TRIDELTA current regulator for 12 or 25 A is a constant current regulator with one output and two target value settings, switched by an external controller.

Depending on output power several magnet systems can be connected simultaneously. The controller and power circuits are separated potential-free by optocouplers and DC/DC converters, achieving feedback-free and undisturbed operation. However, in case of disturbances due to impermissible operating conditions, such disturbances will be displayed. Power is supplied by a 3-phase transformer and a B6-rectifier. The current regulator is CE-certified according to the stray radiation directive. It is required, however, that the supply cable between the current regulator and the magnet system be shielded.

Flat Separators for Dry Bulk

TRIDELTA magnetic separators are manufactured in company standard types (see image). The various requirements for magnetic force and capture height of these standard sizes are ensured by using our Oerstit or Oxit materials.

Apart from these standard sizes, TRIDELTA Magnetsysteme also supplies customized separators with rare earths, high performance materials such as Secolit or Neolit, for customer-specific separation applications. These separators fulfill very high requirements in terms of separating ability and are suitable for the cleaning of highly viscous liquids such as marmalade. Even after decades of use, the holding power of magnetic separators will remain constant.

Installation and Cleaning Instructions:

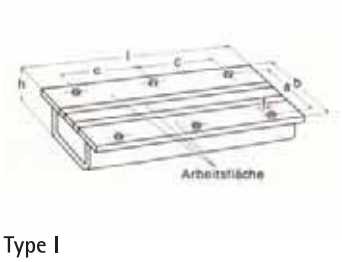
Magnetic separators are fitted with mounting holes and can be installed in vibrating conveyors or in the chute in front of sieves or other respective plants.

If possible, magnetic separators should be installed in a location with:

- the smallest migration speed,
- the lowest layer height of the material to be separated.

When installing multiple type II magnet systems to form a capturing unit, it is important to make sure that magnet systems of the same polarity are strung together. To rule out errors, the north poles of the magnet systems are marked by the letter "N".

Separators can be cleaned by simply wiping off any ferromagnetic material.



Type I

Type II

Magnetic Separators for Dry Bulk

Variations	Type no.	Dimension in mm l	b	h	c*)	a	f**)	Weight kg	Material	Max. operating temperat. °C	Catching hight in mm for Paper clip 1,5g	coin 3g	coin 4g
I	108 322	100	150	44	75	120	7	1,5	alternatively OERSTIT 120 or OERSTIT 500	120	40 bzw. 60	30 bzw. 40	30 bzw. 40
	108 323	150	150	44	100	120	7	2,2					
	108 324	250	150	44	150	120	7	3,8					
	108 325	400	150	44	150	120	7	5,0					
II	105 660	125	150	82	110	67	6,5	4,0	Oxit 360	120	80	60	55
	105 661	150	180	95	130	75	8,5	6,5			100	75	60
	105 662	180	220	116	155	92	8,5	12,0			120	90	80

*) Normally, there are 4 mounting holes.
Only type 108 325 has 6 mounting holes.

**) Countersink 90°, depth: 3 mm

Magnetic Separators for Dry Bulk

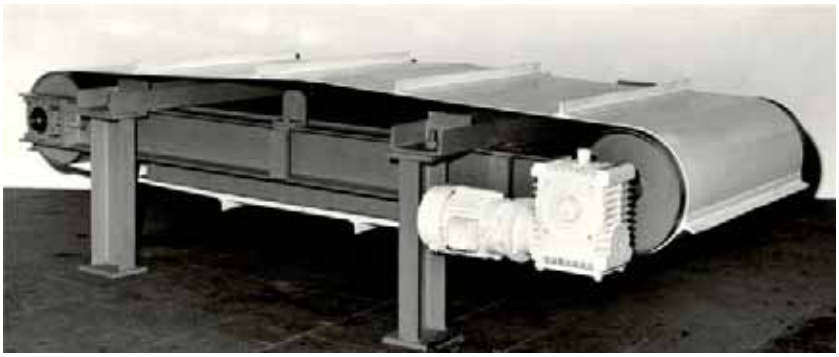
For the purpose of separating dry bulk on conveyor belts, Tridelta Magnetsysteme manufactures so-called overbelt magnets.
You can choose from two types:

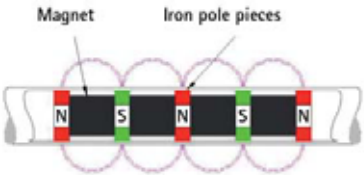
Overbelt Magnets WITHOUT Independent Cleaning

Overbelt magnets without discharge belts are enlarged plate magnets. Permanent magnets are installed in iron housings. The magnets are arranged in such way as to create a strong magnetic field toward the work surface.
These systems are predominantly used above conveyor belts or chutes (which have to be made of non-magnetic material in that location). Iron parts are separated from dry bulk and stick to the magnet. Cleaning is done manually in intervals appropriate for the material's respective degree of contamination.

Overbelt Magnets WITH Independent Cleaning

Such overbelt magnets are designed as follows: a rugged steel frame construction is fitted with return and drive drums for a belt with additional discharge strips. The overbelt magnet block is mounted to the inside so that the iron parts separated from the dry bulk are automatically ejected from the discharge belt.
These overbelt magnets are used as crossband dischargers above conveyor belts or as chutes or in conveyor systems at the transfer station between conveyors, or in similar applications.
The selection of size and magnetic force is governed by the iron contamination, conveyor speed as well as the layer thickness of dry bulk on the conveyor. Our engineers will be happy to assist you with selecting the right components and sizes for your magnet systems.





Magnetic Filter Rods

To remove ferromagnetic contamination such as nails and wire pieces from dry bulk, it may be sufficient to use a grating made from our magnetic filter rods.
For this and similar applications, TRIDELTA supplies filter rods with high-energy magnets made from neodymium-iron-boron with the following dimensions:

Dia 25 x 100 mm
Dia 25 x 150 mm
Dia 25 x 200 mm
Dia 25 x 250 mm
Dia 25 x 300 mm
Dia 25 x 350 mm
Dia 25 x 400 mm
Dia 25 x 450 mm
Dia 25 x 500 mm

For attachment the welded end caps have been fitted with tapped holes. Special models with threaded pins are also possible.
Apart from the dimensions mentioned here, TRIDELTA is also capable of supplying any custom dimensions. Complete filter gratings can be manufactured upon request as well.

Separation Rollers

A lot of dry bulk is transported by conveyor belts and refilling stations. In such cases larger amounts of ferromagnetic contamination such as filings, wire pieces or iron abrasion can be filtered out very economically by using separation rollers.
TRIDELTA supplies various types of such magnet systems, since they separate iron parts reliably and prevent hazards for persons and machines.

Permanent magnetic separation rollers consist of a fixed magnet system. Depending on its size it is effective in an angle between 120°- 270°, creating a large non-magnetic zone. A stainless steel sheathing with discharge strips rotates around this magnet system. Dry bulk is fed to the separation roller in tangential direction. While it leaves the separation roller in a parable shape, magnetic contamination is attracted by the stainless steel sheathing and ejected by the discharge strip in the null zone at the end of the magnetic field.

Separation rollers are distinguished by their application area and the type of material to be separated.

TRIDELTA manufactures three types of separation rollers:

- **Weak field separation rollers with B ≤ 200 mT**

  Application: iron ore sorting, metal sorting, pre-separator
  Separation material: iron parts with a unit weight of > 20 g, ores with varying iron content

- **Medium field separation rollers with 200 mT ≤ B ≥ 650 mT**

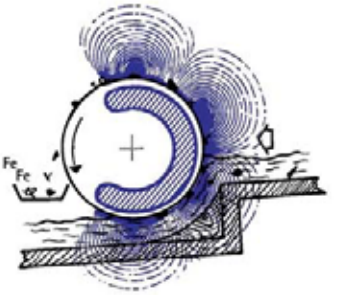
  Application: sorting of complex ores, shredder material, milling material.

  Separation material: iron parts with a unit weight of > 0.5 g

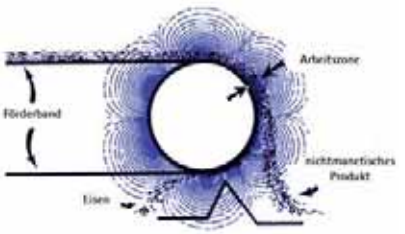
- **Strong field separation rollers with 650 mT ≤ B ≥ 1000 mT**

  Application: sorting of fine dry bulk, cooling lubricants, dry bulk with para-magnetic content
  Separation material: iron parts with sizes of 50 µm

Permanent magnetic separation rollers are manufactured in diameters of 200, 318 and 400 mm and in widths ranging from 200 – 2000 mm.
Based on years of experience, our engineers are able to select the necessary diameter and width. Please visit our website for a form requesting the necessary information.



We also supply customized solutions for wet-separation applications.



It is also possible to provide head drums constructions for installation in conveyor belt systems.

As your partner, TRIDELTA responds quickly and reliably to your requirements, in order to find the right solution to your problem.
The TRIDELTA team would be happy to meet you personally for consultation.

Permanent Magnetic Couplings for Drive Technology

Classification and Principle

The use of permanent magnet couplings is not only very cost-effective, but also very reliable. They operate free of wear and tear, contactless and maintenance-free. They show low bearing friction in central rotary couplings and have an almost unlimited lifespan under normal conditions. In general, they are mainly used in applications where an absolute separation of drive and output is required.

Permanent magnetic couplings can be classified in three basic types:

- **Synchronous couplings which include disc and concentrating ring couplings**
- **Hysteresis couplings**
- **Eddy current couplings**

All types of couplings and brakes are subject to the same power equation:

P1- Pv - P2= 0

P1 is the power flowing to the drive side,
P2 is the power draining from the drive side,
Pv is the power loss caused by the transformation mechanism in the coupling.

In synchronous couplings Pv=0, since slip S=0. On the drive and output sides permanent magnets with the same even number of poles face each other mirror-symmetrically (front face couplings; image 1) or rotationally symmetrically (central rotary couplings; p. 42/ image2).

Disk Coupling made of Oxit

The application possibilities are similar to those of central rotary couplings mentioned below. However, separating walls can be flat and even. It is important to note that the relatively strong axial force must be absorbed by suitable bearings.

If loosely magnetizes magnet rings are purchased for the installation of front face couplings, it must be ensured that the distance between the rings (as in our packaging) is not reduced, in order to preserve their magnetic properties. Also make sure the magnets are not taken out of alignment before they are covered by the magnetic yoke housing.

Disk Coupling made of Oxit 360

Order no.	torque in Nm with air gap L_L in mm				Magnet dimension			Dimension of magnet and iron casing	
	1	3	5	10	Outer Ø mm	Inner Ø mm	Height mm	Outer Ø mm	Height mm
106 070	0,10	0,07	0,05	0,02	41 ± 0,6	24 ± 0,6	8	50 ± 0,2	9,5 ± 0,15
106 071	0,35	0,23	0,17	0,07	53 ± 0,7	23 ± 0,5	8	63 ± 0,2	10 ± 0,15
106 072	0,80	0,60	0,44	0,24	68 ± 1,5	32 ± 0,7	10	80 ± 0,25	13 ± 0,2
106 073	1,75	1,25	1,00	0,45	84 ± 4,0	32 ± 1,0	12	100 ± 0,25	16 ± 0,2
106 074	2,85	2,40	1,90	1,05	100 ± 2,0	50 ± 1,0	15	125 ± 0,25	20 ± 0,2
106 075	7,80	6,35	4,80	2,60	124 ± 3,0	56 ± 3,0	18	150 ± 0,3	24 ± 0,2
106 076	9,50	8,00	6,00	3,80	140 ± 2,0	70 ± 1,0	21	165 ± 0,3	27 ± 0,2

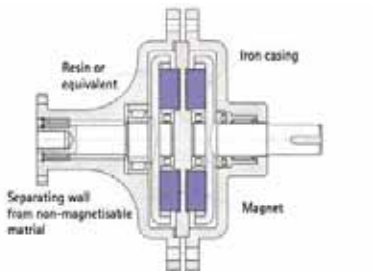


Image 1 Disk Coupling

Disk coupling made of Neolit / Secolit

Disk coupling made of Neolit / Secolit

Order no.	Torque in Nm with air gap L_L in mm					Dimension of magnet and iron casing	
	1	2	4	6	8	Outer Ø mm	Height mm
140 051	1,8	1,25	0,7	0,4	0,2	45	15
140 052	2,8	2,0	1,07	0,6	0,3	50	15
140 053	3,8	2,7	1,46	0,8	0,4	60	20
140 054	6,3	4,5	2,3	1,2	0,5	75	25
140 055	10,2	8,0	4,1	2,14	1,3	94	25
140 056	21	17,8	12,6	8	5	108	25
140 057	35	28,3	15,3	9,1	6	130	40

Disk couplings made from Neolit (Seco-lit for custom models) are delivered with the coupling halves mounted inside the iron magnetic yoke. The specification of the bore hole in the iron enclosure can be submitted upon ordering and will be custom crafted for the respective shaft ends. Coupling halves can also be purchased without bore hole, so you can manufacture them yourself. Using extremely strong neodymium-iron-boron magnets it is possible to accept an axial misalignment of 5 mm and parallel deviation of 2-3° without suffering significant torque losses. Moreover, drive vibrations are not transferred to the output.

Concentric Ring Couplings made of Oxit / Secolit / Neolit

Concentric ring couplings are preferred for applications where rotary kinetic energy must be transferred through walls glandlessly. If an electrically conductive separation wall is used, eddy currents are induced. Usually, the separating wall is designed as a so-called gap pot. Thereby, eddy current losses are created, which reduce the maximum coupling torque in dependence on speed. Eddy currents also create heat losses in the gap pot, which might make cooling necessary. The additional eddy current losses must be provided by the drive, which must be taken into account when selecting motor size. The magnetic couplings must be optimized to make good use of the permanent magnet material.

TRIDELTA offers a number of Oxit 100 coupling magnets for the manufacturing of central rotary couplings. The ring combinations shown in the table below are only magnetic rings. Iron enclosures and displacement as well as the gap pot are not included.

Concentric Ring Couplings made of Secolit including separating wall (Gap pot)

1) External magnetic rotor
2) Internal magnetic rotor
3) Gap pot with flange

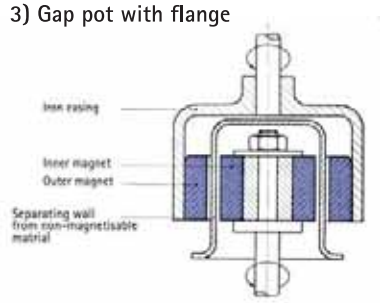


Image2 Concentric Ring Coupling

Series	Torque	Internal rotor	External rotor		Total length
	in Nm	Outer Ø mm	Outer Ø mm	Inner Ø mm	in mm
ZDK-3	3	42	49	68	65
ZDK-8	8	58	66	90	80
ZDK-16	16	58	66	90	110
ZDK-30	30	88	97	120	115
ZDK-65	65	122	132	164	120

Additionally, we offer some sizes of central rotary couplings with rare earths magnets. These systems are complete, ready-to-install couplings, including gap pot.

The respective shaft connection measurements for drive and output side should be indicated upon request/order.

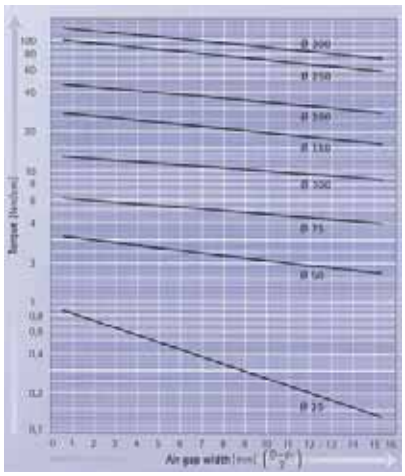
Temperature Behavior of Magnets

The operating range of Oxit and Neolit couplings is between -30°C and +100°C. When lowering or increasing the operating temperature the transferable torque values decrease or increase in linear fashion by approximately 0.4% per °C for Oxit and 0.6% per °C for Neolit.

The operating range of Secolit is between -190°C and +250°C. Torque values increase or decrease by 0.2% per °C. The respective coupling recovers its original values at room temperature, since the temperature effect is reversible.

We are able to provide special AlNiCo couplings for temperatures above 250°C. Such Oerstit couplings can be used for permanent temperatures of up to 400°C.

Torque per cm of axial coupling length, depending on the operating air gap



Parameter: Outside-Ø of the inner coupling parts d1
Intermediate measurements of Ø d1 and large air gaps are possible, as well as encapsulation of the inner part.

Using field-numeric programs, we have calculated a number of couplings and entered the results into the following table. This should give the user an idea of the coupling's approximate space requirements. For central rotary couplings the axial length should be at least four times the air gap length.
Since magnetic flux leakage occurs predominantly in the face areas, these areas do not fully contribute to the torque.

Permanent Magnet Axial Push Couplings and other special types

Apart from regular couplings for the transfer of rotation, Tridelta Magnetsysteme also manufactures couplings capable of transferring linear motion. As with rotary couplings the transfer of thrusting motions is force-locked by permanent magnet materials.
Depending on the application and the operating temperature, magnetic materials made from rare earths (Secolit or Neronit) are used.

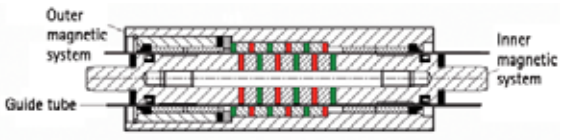
Advantages:

- Coupling is effective in both directions
- Force transmission by permanent magnets without mechanical connection
- The interacting magnet systems can be hermetically sealed

For a special application Tridelta Magnetsysteme has combined this type of coupling with a central rotary coupling, achieving the transmission of a stipulated torque and an axial thrusting motion simultaneously.
For its customers, Tridelta Magnetsysteme GmbH implements any technically possible coupling application.

Our expert engineers would be happy to provide consultation for your own coupling application.

Schematic of a loaded thrust coupling

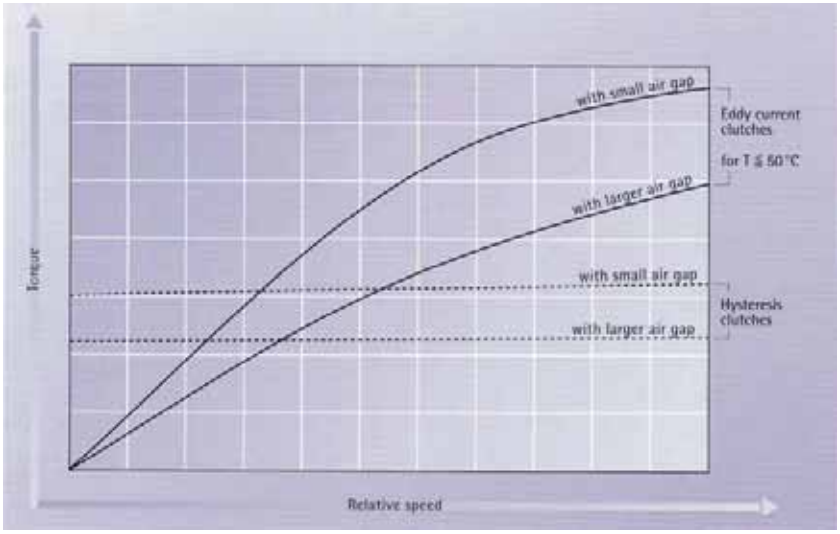


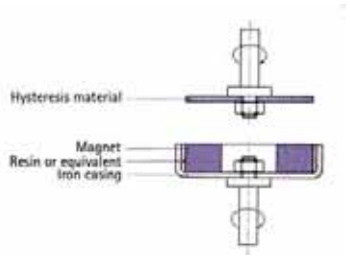
(The iron pole discs are displayed in color to identify the poles.)

Hysteresis Couplings/Clutches

The use of hysteresis couplings is sensible in cases where a constant torque must be transmitted throughout a wide rpm range.
In hysteresis couplings manufactured by Tridelta, which can also function as brakes, the non-magnetic hysteresis material, e.g. Oerstit 70, is opposed by a magnetized permanent magnet material such as Oxit 360, Secolit or Neolit. Material combinations are varied depending on the application and the desired torque.
The torque or braking torque of the hysteresis combination is largely independent of the relative rpm and already fully present at very low relative rpm.
The following image shows this dependency for two different air gaps between drive and output side.
In practice, however, it becomes apparent that at higher relative speeds the torque increases less quickly, due to an overlapping eddy current moment.

Relative RPM over torque





If required, the torque can be controlled by axial shifting, i.e. changing the air gap and thereby the effective flux.
Make sure that there is no iron behind the Oerstit 70 hysteresis disc, since that will significantly reduce the transferable torque. The space between hysteresis disc and iron parts must be at least 15 mm.

Hysteresis Couplings made of Oxit, Secolit and Oerstit

Order no.	Torque in Ncm* with air gap L_L in mm			Magnet dimension			Dimension of magnet and iron casing		Bore in iron casing	Hysteresis disc dimensions		
	1,0	1,5	2,0	Outer Ø mm	Inner Ø mm	Height mm	Outer Ø mm	Height mm	Ø mm	Outer Ø mm	Inner Ø mm	Height mm
106 330	1,2	0,7	0,4	41±0,6	24±0,6	8	50±0,2	9,5±0,15	-	42±0,2	6,4±0,2	4-0,2
106 331	2,3	1,9	1,5	53±0,7	23±0,5	8	63±0,2	10±0,15	-	55±0,2	8,4+0,2	4-0,2
106 332	9,5	8	6	68±1,5	32±0,7	10	80±0,25	13±0,2	-	70±0,2	8,4+0,2	4-0,2
106 333	20	15	12	84±4,0	32±1,0	12	100±0,25	16±0,2	-	85±0,2	10,5+0,2	4-0,2
106 334	35	31	27	100±2,0	50±1,0	15	125±0,25	20±0,2	-	105±0,2	10,5+0,2	4-0,2
106 335	70	55	42	124±3,0	56±3,0	18	150±0,3	24±0,2	-	130±0,2	13,0+0,2	4-0,2
106 336	115	103	90	140±2,0	70±1,0	21	165±0,3	27±0,2	-	145±0,2	13,0+0,2	4-0,2

* 1 Ncm = 0,00738 ft lbs

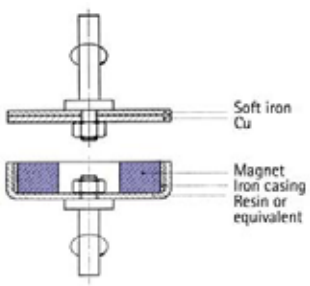
Eddy Current Couplings/Clutches

In contrast to the drive and brake elements described above, eddy current couplings create the moment through a relative speed between drive and output side. The transferable moment, therefore, increases along with the relative speed. The schematic "Relative RPM over Torque" on page 43 shows the moment progression for two different air gaps.

In practice the rings or segments made from permanent magnet materials have multipole magnetization and are opposed by 2-5 mm copper discs. For magnetic reasons the copper discs have a magnetic yoke in the form of soft iron discs with a thickness of 2 – 6 mm.

The following table shows transferable moments of eddy current couplings for different air gaps and three different relative speeds. The indicated values are based on room temperature, achieved by cooling the copper disc during measurement. Eddy current couplings are influenced by the temperature coefficient of the magnet as well as the coefficient of the copper. Since eddy current couplings heat up considerably as speed increases, due to the formation of eddy currents, the transferable torque decreases considerably depending on temperature.

In the absence of cooling, eddy current couplings can heat up to 200°C at the copper disc, at relative speeds of 1000 rpm, which in turn causes torque to drop by up to 50%. The occurring losses are partly reversible and can be compensated by re-magnetization. If the temperature is kept below 50°C, torque only drops by about 10%.



Eddy current couplings made from Oxit 360, Secolit and Cu/Fe

Order-No.	Torque in Ncm* with Air gap L_L in mm			With relative speed n	Magnet dimensions			Dimension of magnet and iron casing		Bore in iron casing	Eddy current unit			
				1/min.	Outer	Inner	Height	Outer	Height		Outer	Inner	Cu-thickn.	Fe-thickn.
	0,5	1,0	2,0		Ø mm	Ø mm	mm	Ø mm	mm	Ø mm	Ø mm	Ø mm	Ø mm	mm
106 450	1,0 2,0 2,8	0,8 1,6 2,2	0,6 1,1 1,5	500 1000 1500	41 ± 0,6	24 ± 0,6	8	50 ± 0,2	9,5 ± 0,15	-	50	6,4	2	2
106 451	4,9 9,3 13	3,8 7,5 10,5	2,5 5 7	500 1000 1500	53 ± 0,7	23 ± 0,5	8	63 ± 0,2	10 ± 0,15	-	63	8,4	2	2
106 452	26 47 59	19 35 47	14 25 35	500 1000 1500	68 ± 1,5	32 ± 0,7	10	80 ± 0,2	13 ± 0,2	-	80	8,4	2	3
106 453	75 130 160	56 100 120	42 75 93	500 1000 1500	84 ± 4,0	32 ± 1,0	12	100 ± 0,25	16 ± 0,2	-	100	10,5	2	3
106 454	140 190 230	120 170 210	90 130 155	500 750 1000	100 ± 2,0	50 ± 1,0	15	125 ± 0,25	20 ± 0,2	-	125	10,5	3	4
106 455	450 580 650	380 500 580	300 400 470	500 750 1000	124 ± 3,0	56 ± 3,0	18	150 ± 0,3	24 ± 0,2	-	150	13,0	3	4
106 456	600 760 800	520 670 700	400 510 530	500 750 1000	140 ± 2,0	70 ± 1,0	21	165 ± 0,3	27 ± 0,2	-	165	13,0	3	4

* 1 Ncm = 0,00738 ft lbs

Technical Consulting and Sample Delivery

All couplings and brakes can be supplied ready-to-install. However, it is also possible to send us the magnets' covers or mounts for installation and magnetization. Depending on shape and size as well as the number of consecutive rings, the external rings of central rotary couplings can be mounted to the covers in different ways.

For that reason it is necessary to send us drawings of the intended magnet ring covers along with your request, so that we can determine the best mounting method.

For eddy current couplings, hysteresis couplings and brakes it is recommended to use a test model, since the moment curves can change depending on the application, e.g. due to heat influence. Our technical experts would be happy to assist you with specific questions regarding the use of magnetic coupling.

Magnetic Brakes – Optimum Processing of Endless Products

TRIDELTA manufactures special solutions for various industry sectors, some of them customized to specific requirements.
We have more than 30 years of experience, for example in the tire-manufacturing industry.

Classification and Principle

The use of permanent magnet brakes is not only very cost-effective, but very reliable as well. Permanent magnet brakes work free of wear and tear, contactless, maintenance-free and have an almost unlimited lifespan under normal conditions.

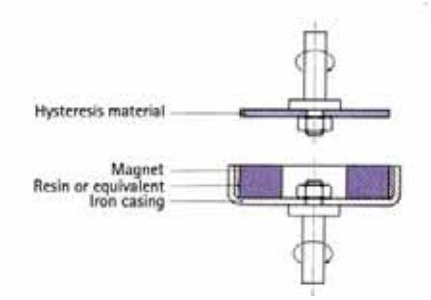
Permanent magnet brakes can be distinguished by **two basic principles**:

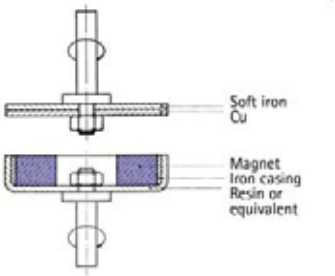
· Hysteresis Brakes

The use of hysteresis brakes in sensible in applications where a constant moment must be transferred throughout a wide rpm range. In our hysteresis brakes the non-magnetized hysteresis material, e.g. Oerstit 160, is opposed by a magnetized permanent magnet material such as Neolit NQ3F.
The material combinations vary depending on the application and the desired moment.

· Eddy Current Brakes

In contrast with the brake type described above, in eddy current brakes the moment is created through the relative speed between the drive side and the stationary brake side. The transferred moment therefore increases with relative speed. Eddy current brakes heat up as the rpm increases. At speeds exceeding approx. 1000 rpm (depending on construction) a cooling system should be used.





The image on the right shows a brake used for keeping the tension force of an unwinding station at a constant level.
The type shown is a hysteresis brake with a maximum brake moment of 80 Ncm, which was produced for the tire-manufacturing industry in the 1980s.

Adjustable Hysteresis Brake for winding wires of all types

Many users want to be able to adjust or vary the brake torque. Therefore, we also produce brakes allowing adjustment of the space between brake disk and permanent magnet. For unwinding wires of any type we manufacture our adjustable hysteresis brake (item no. 136582, see right). The maximum adjustment range can be modified additionally by selecting the respective magnetic material. In the tire manufacturing industry a maximum adjustment range of 150 Ncm has proven to be sufficient for unwinding wire cord by using ferrite. With high-performance permanent magnets made from neodymium-iron-boron the adjustment range can be extended to 500 Ncm.

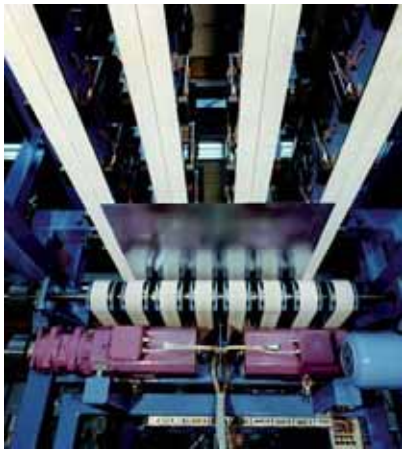
Mechanically controlled Eddy Current Brake for unwinding endless material

TRIDELTA developed a new, patented permanent magnet brake, that combines all the advantages of permanent magnet brakes such as contactless, maintenance-free, low-noise, wear and tear-free and brake wear-free operation with a simple, mechanic control unit and without the need for elaborate and complicated electronic devices.

The brake's control process is such that the wire coil is mounted on the brake-shaft and connected to an actuator, so that the coil is unable to turn without the shaft. Now the wire is fed across the moveable dancer roller. The deflection roller is kept in a specific, adjustable position by using compressed air and a rolling diaphragm cylinder. Due to the fixed connection of the pivot axis to the brake system, every position of the deflection roller is associated with a clearly defined braking force. The unwinding process starts, the deflection roller adjusts to a position and tension builds up in the wire. If the deflection roller changes position (due to wire locking or looser winding), there will be a change in braking force, but the wire tension remains the same. Once the deflection roller returns to its original position, the wire coil is retarded in the same way it was in the beginning. Additionally, it is now also possible for the rpm to change. In a normal brake system this would not necessitate a change of braking force, but definitely a change in tension due to the connection between rotation speed variation and the wire coil's inertia. Thereby, the brake is able to independently compensate for rotation speed variations without affecting tension force.
(item no. 139800, max. torque is 700 Ncm at 100 rpm).

Magnetic Toothed Belt Conveyor for Sheet Metal Transport

The magnetic toothed belt conveyor is a magnetic conveyor for overlying or suspended transport of plane-adjusted, magnetic boards. The conveyor is assembled as a double system from individual components of 300 mm or 600 mm (standard dimensions). The individual systems are mounted to a central supply carrier. Boards are transported on a toothed belt. Depending on the application the systems can be switchable or non-switchable.



nominal width 100 mm, gear wheel 258 mm; tooth pitch 20 mm, nominal torque 250 Nm; nominal speed 300 rpm, axial deflection max 3 mm; angular deflection max 2°; drive over spline shaft DIN ISO 14

Conveyor Construction

Supporting frame

- Aluminum bar profiles with mounting devices
- The conveyor system can be assembled to the desired system by mechanically connecting individual bar profiles (max. 6 m) with a standard measurement of 300 mm
- The conveyor must be supported at intervals of 2,500 mm. Maximum unsupported length is 1,500 mm.

Driving roller

- Complete unit for mounting to the conveyor support frame with integrated flexible shaft coupling
- Force transmission is done without rotation offset
- Due to the coupling's design, radial and angular shift of the drive roller, which may lead to tension and damage of the coupling, are compensated

Magnet Systems

All systems are permanent-magnetic and fitted with high-quality magnetic materials. The suppressor-magnet system is a switchable permanent magnet system, fitted with an electric coil to compensate magnetic flux. The coil is equipped with a temperature monitor. The electrical supply cable with kink protection is fed through the conveyor's supporting frame and wired to a separate switch box. It is also possible to use a non-switchable system.

Due to the modular design, the systems are only distinguished by their function:

- Permanent magnet system (not switchable)
- Suppressor magnet system (switchable)
- Length: 300 mm and 600 mm as a double system
- Welded steel frame, primed and varnished
- Sliding surfaced to reduce coefficient of friction, hard chrome plated

Toothed belt

The toothed belt runs across the magnet systems to transport sheet metal. The belt's nominal width is 100 mm. It is made of endless, abrasion-resistant polyurethane and steel cord carrier. The sliding surfaces are used to reduce the coefficient of friction with the polyamide fabric.

Progress in Details: Combined Magnet / Vacuum Toothed Belt Conveyor

The magnet / vacuum toothed belt conveyor is a combined conveyor for overlying and suspended transport of plane-adjusted, magnetic and non-magnetic boards.

The difference between this conveyor and the above-mentioned one is the toothed belt. It is fitted with vacuum pockets. The belt's nominal width is 100 m and it features inside sealing lips for vacuum transfer. The vacuum pockets on the belt are made of soft but durable polyurethane. Vacuum is generated by a vacuum injector for each system. The maximum usable sheet metal thickness for this conveyor is 2 mm.

Magnetic Polarity Indicator

TRIDELTA magnets and magnet systems, whose quality is based on decades of production experience of the Thyssen Magnetfabrik in Dortmund, simplify everyday work in many production and processing plants. This is also true for the reliable Tridelta magnetic polarity indicator. It simply, quickly and reliably determines the polarity of permanent and electric magnets. As the tip of the polarity indicator is placed near the magnetic pole, the indicator window will show "S" for south pole or "N" for north pole.

This reliable and easy to operate device is indispensible for all industry and research areas dealing with magnetic applications.

Permanent Magnetic Concrete Cover Tester

to determine the thickness of concrete covers through steel inserts, according to DIN 104

The concrete cover tester is based on permanent magnets and was manufactured by Tridelta as a reliable and easy to use checking device.

For example, the device can be used to prevent construction damage according to DIN 1045 (minimum dimensions of a concrete cover in relation to environmental conditions) by using it to reliably determine the thickness of concrete covers through steel inserts.

Magnetic testing means:

- Non-destructive testing is possible for cover thickness of up to 20 mm (without determination of rod diameter and steel grade)
- The result is very reliable; independent of dimension and the type of steel insert
- Dirt and dust have no influence on the measurement
- The device uses a simple process and simple, rugged construction
- Anyone can use the device without previous training

Important for:

- Architects
- Building authorities
- Construction companies
- Procurement offices
- Concrete plants
- Pre-fabricated concrete plants
- Concrete drilling companies
- Expert consultants
- Material testing authorities
- Installation companies
- Experts

Other applications:

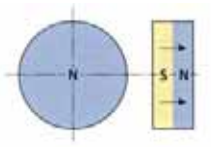
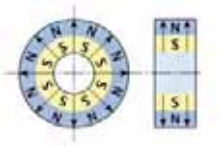
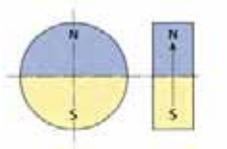
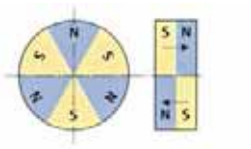
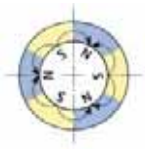
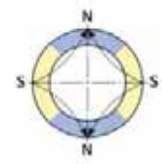
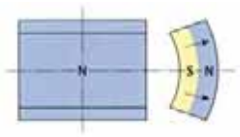
- Motorways
- Railway
- Armed forces
- Fire brigade
- Harbors
- Nuclear power plants
- Waterways

and others

Magnetization and Magnetization Types

Upon request we supply parts in magnetized and non-magnetized form. In many cases and particularly for individual magnets it may be sensible to use non-magnetized versions, in order to simplify transport and installation and to avoid the attraction of ferromagnetic particles. Moreover, low-coercive materials (Oerstit) are subject to the risk of magnetic weakening due to reciprocal influence. In case of highly coercive magnets (Secolit, Neolit) magnetization is often no longer possible after system installation and no reciprocal weakening will occur. Oxit / Oxilit materials can be supplied in magnetized or non-magnetized form.

Magnetization types:

	axial	all isotropic materials and all anisotropic materials
	radial	all isotropic materials
	diametric	all isotropic materials; also anisotropic (diametric preferential direction)
	2n-pole on both front surfaces	all isotropic materials; anisotropic Oxit/ Neronit and Oerstit (axial preferential direction)
	Inner circumference 2n-pole (lateral)	all isotropic materials
	Outer circumference 2n-pole (lateral)	all isotropic materials
	radial	all isotropic materials and Neolit NQ3

ANISOTROPY
Preferred direction of a material property. A material's property shows different values in different directions.

ANISOTROPIC MAGNETS
Anisotropic magnets have a preferred direction of magnetism, impressed on them during manufacturing.

WORKING POINT
A point on the demagnetization curve whose B and H values are decisive for the magnet's dimensions. If B and H are multiplied and the result is a maximum, it is the maximum magnetic energy available for transformation into mechanical work per cm^3 of magnet volume.

A/m = amp per meter. The unit of magnetic field strength.

B
Symbol for magnetic flux density.
Unit: Tesla

(B·H) max – Value
Maximum multiplication result of flux density B and field strength H. It corresponds with the largest rectangle under the demagnetization curve. In many cases it is also the optimum operating point.

CURIE-TEMPERATURE
The temperature at which ferromagnetic material becomes completely non-magnetic.

DIAMAGNETISM
Magnetic material property. The magnetic field inside this material is marginally weaker than the external field (permeability < 1)

MAX. OPERATING TEMPERATURE
Highest temperature a magnet may be exposed to without permanent loss of magnetization.

IRREVERSIBLE
If magnetic properties change irreversibly, e.g. by temperature influence, the B value does not return to its original value when returning to the original temperature.

DEMAGNETIZATION
Decrease of magnetization due to an opposing field, a weakening alternating field or temperature influence.

DEMAGNETIZATION CURVE
The second quadrant of the hysteresis loop. It is used to describe significant magnetic properties of permanent magnet material.

FLUX DENSITY B
The number or magnetic field lines per unit area, measured in Tesla.

GAUSS
Former unit for magnetization or flux density.

H
Symbol for magnetic field strength.
Unit: Amp per meter

HYSTERESIS LOOP
The hysteresis loop displays the dependency of magnetic flux or polarization and magnetic field strength.

INDUCTION
Property of a magnetic field, which creates (induces) a voltage in an electric conductor which each alternation.

ISOTROPIC MAGNETS
Isotropic magnets do not have a preferred direction. Type and direction of magnetization can be freely selected.

COERCIVE FIELD STRENGTH
Resistance of a magnet against demagnetizing influences, corresponding with the field strength necessary to completely demagnetize a magnet. The higher the coercive field strength, the better the demagnetization resistance of a magnet.

AIR GAP
Space between the poles of a magnet or magnet systems in which a usable magnetic field exists.

MAGNETIC FIELD STRENGTH
Quantitative description of a magnetic field in terms of strength and direction.

MAGNETIC FLUX
The magnetic flux is the total number of magnetic lines of force in a specific cross section. The magnetic flux cannot be measured directly, but must be determined my measuring an induced electric voltage in a measuring coil.

MAGNETIZING
The process of alignment the elementary magnetic areas through an external magnetic field.

MAGNETIC POLE
Area of a magnet through which magnetic lines of force escape.

MAXWELL
Former unit for magnetic flux.

OERSTED
Former unit for magnetic field strength.

PERMEABILITY
Magnetic conductivity or permeability of a magnet.

POLARIZATION
Field size describing the condition of a ferromagnetic material under the influence of a magnetic field.

REMANENCE
Flux density remaining in a fully saturated magnet.

REVERSIBLE
A reversible temperature behavior means for example, that a magnet recovers its original value after being heated up and than cooled down.

SATURATION
Highest possible polarization of a magnet.

SINTERED MAGNET
A permanent magnet made from a mixture of magnetizable powders, which are pressed into shape and heated in vacuum.

TEMPERATURE COEFFICIENT
Indicates the reversible reduction of remanence in percent per 1°C temperature increase, based on 20°C.

TESLA
Unit of magnetic flux.
1 Tesla (T)= 10^4 G = 1 Vs/m^2

PREFERRED DIRECTION
Targeted alignment of magnetic areas in a specific direction.

WEBER
Unit of magnetic flux.

EDDY CURRENT
Electric current induced in an electric conductor by an alternating magnetic field.

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