KENDRION

WE MAGNETISE THE WORLD

Industrial Line

Electro holding magnets for industrial applications

INDUSTRIAL MAGNETIC SYSTEMS BINDER

Kendrion - Industrial Magnetic Systems

We develop solutions!

Kendrion develops, manufactures and markets high-quality electromagnetic and mechatronic systems and components for industrial and automotive applications. For over a century we have been engineering precision parts for the world's leading innovators in passenger cars, commercial vehicles and industrial applications.

As a leading technology pioneer, Kendrion invents, designs and manufactures complex components and customised systems as well as local solutions on demand. Committed to the engineering challenges of tomorrow, taking responsibility for how we source, manufacture and conduct business is embedded into our culture of innovation. Rooted in Germany and headquartered in the Netherlands, our expertise extends across Europe to the Americas and Asia. Created with passion and engineered with precision.

In the business unit **Industrial Magnetic Systems (IMS)** the focus lies on electromagnetic actuators and mechatronic assemblies for applications in power engineering, safety engineering, machine building, automation technology and other industries. With the experience of our traditional brands Binder, Neue Hahn Magnet and Thoma Magnettechnik we are successful in our markets as an industry expert with a high technological competence.

We offer you both customer-specific and standardised products. Our assemblies are based on powerful and reliable single-stroke, holding, locking, spreader, control, rotary, vibratory solenoids and solenoid valves.
We always think in terms of solutions.

Our strength lies in new developments for our customers. Our engineers are specialists for innovative products with optimum technical properties. Furthermore, we develop mechanical assemblies, modern drive electronics and sensor systems to your requirements.

Our products are manufactured in Germany at the parent companies Donaueschingen and Engelswies as well as in the USA, China and Romania. This ensures efficient project management and a needs-oriented delivery for our internationally operating customers.

By means of segmented production areas we can implement both small quantities and large series with an optimum degree of automation.

We guarantee top quality.
All products are tested and developed in compliance with the norm DIN VDE 0580 for electromagnetic devices and components or according to industry-specific standards of our customers. In many cases our products are tested and certified by external associations. among others according to the CSA, VdS and ATEX guidelines.
Our quality management system is certified according to DIN EN ISO 9001 and our environmental management system fulfils the norm ISO 14001.

With our subsidiaries in Switzerland, Austria, Italy, the USA, China and our worldwide distribution network we are your ideal partner on site.

Kendrion – We magnetise the world

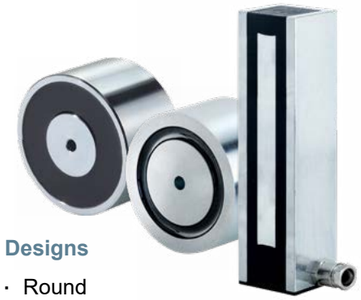
www.kendrion.com

Industrial Line - Direct Current Hoding Solenoids

The DC holding solenoids of the Industrial Line are divided into two different designs and variants.
They are available in round or rectangular design resp. in the systems "electromagnetic holding solenoids" and "permanent magnetic holding solenoids".

Electromagnetic Holding Solenoids

Electromagnetic holding solenoids are pot magnets and consist of a magnet housing and a DC-excited coil. In switched-on state the open magnetic circuit allows to hold resp. span ferromagnetic workpieces. When the voltage is switched off the workpiece to be held falls off. Potential remanence, especially with light parts, can be avoided by attaching a non-magnetic foil. The holding system works with a very low operating current and without wear (maintenance-free).



Designs

- Round
- Rectangular
- Flat design
- Ring-shaped

Permanent Magnetic Holding Solenoids

These holding solenoids consist of a permanent magnetic holding system to hold ferromagnetic workpieces and of an excitation winding which neutralizes the magnetic field at the holding surface when switched on. Due to this principle these holding solenoids are preferably used where long holding times are required and the device is switched on for short times only. Furthermore, they are used as safety magnets in transportation devices as loads are held reliably even in the case of power failure.

Designs

- Round
- Rectanguar (bar shaped)

In both systems the maximum holding forces are only reached depending on the surface roughness of the material, the material thickness and in case of full coverage (air gap = 0mm). Furthermore, the holding forces refer to 90% nominal voltage and warmed up condition.

The following basic data are defined as standard:

Nominal Voltage	Duty Cycle	Protection class
▪ 24 Volt, DC	▪ Electromagnetic holding solenoids 100% ▪ Permanent magnetic holding solenoids 25% 100%	▪ IP 65 = device (protection against dust and hose water) ▪ IP 54 = device (protection against dust and splashing water) ▪ IP 00 = electrical connection (no protection) ▪ IP 20 = electrical connection over termina (protection against foreign substances)

If the application is based on different conditions the holding force is reduced accordingly. Depending on the design the holding surface can be partly zinced or rather polished. Therefore, the customer may have to ensure corrosion protection.

The solenoids are manufactured and tested acc. **DIN VDE 0580**.
Depending on the quantities required other voltages and modifications are possible at extra cost.
Design subject to change.

Product portfolio

Electromagnetic Holding Solenoids Series GTB

This series includes a complete product range of round solenoids.

These solenoid systems are preferably used in fixture construction and in the industrial areas automation, transportation and handling.

Features

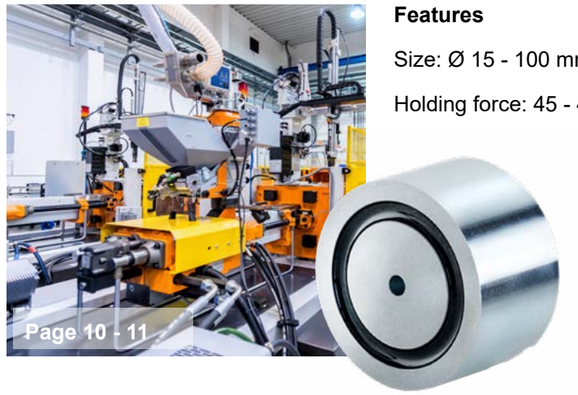
Size: Ø 15 - 250 mm

Holding force: 36 - 30,000 N

Electromagnetic Holding Solenoids Series GTH

Compared to the series GTB these solenoids offer a higher holding force with similar dimensions. This is achieved by a larger dimensioning of the central pole.

These solenoid systems are preferably used in machine and tool manufacture, where air gap adjustments are not required.



Features

Size: Ø 15 - 100 mm

Holding force: 45 - 4,890 N

Electromagnetic Holding Solenoids Series 10 331

This series excels by its extremely flat design and a through-hole for spindle or shaft attachment.

This series is preferably used in the handling and robotics area, where installation space is narrow, flat and limited by the customer.

Features

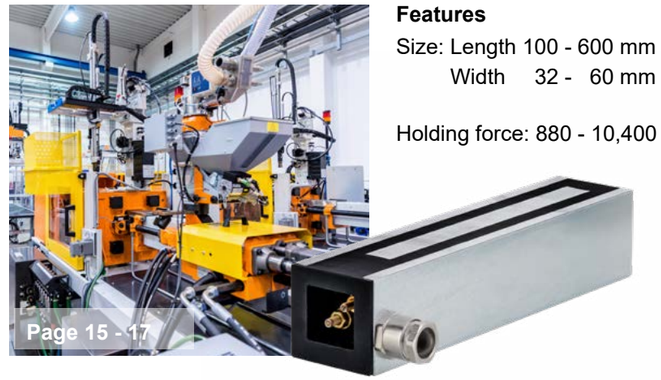
Size: Ø 56 / 110 and 170 mm

Holding force: 750 - 5,000 N

Electromagnetic Holding Solenoids Series 10 310

The electromagnetic holding bars are DC holding systems. The magnetic circuit which is open in switched on condition allows to hold ferromagnetic workpieces.

These solenoid systems are preferably used in general machine building, for handling and in safety technology for machine building.



Features

Size: Length 100 - 600 mm
Width 32 - 60 mm

Holding force: 880 - 10,400 N

Permanent Magnetic Holding Solenoid Series 01 310

These permanent magnetic holding rods are electrically switchable holding solenoids.

These systems are preferably used where long holding times without energy consumption are required and a load or workpieces must be held reliably and safely in the case of power failure.

Features

Size: Length 150 mm or 200 mm
Width 60 mm

Holding force: 1,000 - 1,530 N

Permanent Magnetic Holding Solenoid Series 01 320 / PEM

These permanent magnetic holding solenoids are electrically switchable holding systems.

These systems are used where in currentless state a load, a workpiece or machine parts must be held reliably and safely.

Features

Size: Ø 12 - 150 mm

Holding force: 8 - 3,500 N

Electromagnetic Holding Solenoid Series GTB

This series includes a complete product range of round solenoids.

As connections there are free braids resp. cables for GT100B and higher. With sizes GT025B to GT080B a terminal is also possible.

The coil is potted with resin (protection class IP65) resp. unpotted (protection class IP54). The complete magnet housing including holding surface is zinced. The mounting is achieved by acentral thread at the rear side of the housing.

Application

These solenoid systems are preferably used in fixture constructionand in the industrial areas automation, transportation and handling.

Lateral force loading equates to a displacement force F_v of approximately 1/4 F_H.

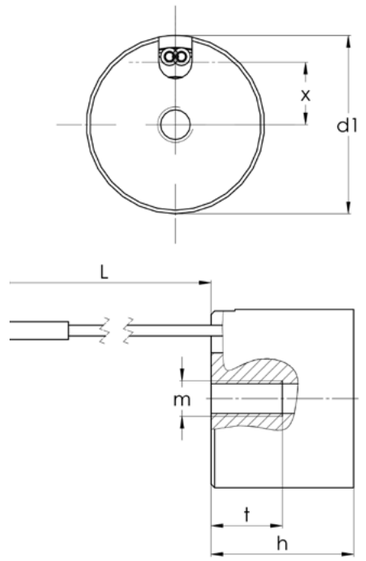
Advantages

- Maximum Holding force with low air gaps
- Compact design
- Manifold conection options
- Optimised copper and iron ratio

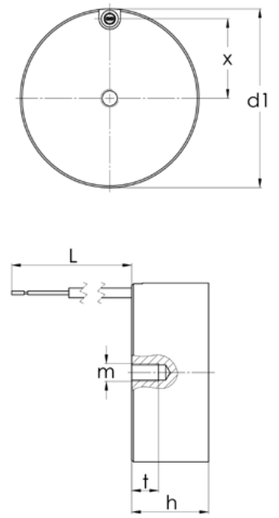
Technical Data	▪ Standard nominal voltage: 24 V DC ▪ Duty cycle: 100% ED ▪ Insulation class: E
Accessories	▪ You find suitable anchor plates on page 23

Cross sections

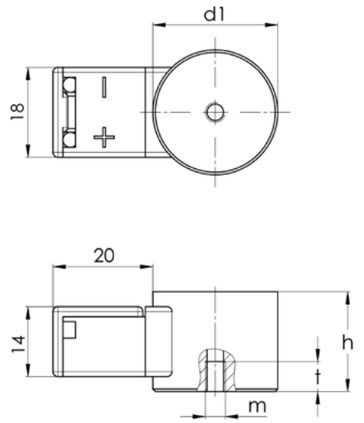
Type GT015B bis GT090B
with free braids



Type GT100B to GT250B
with cable



Type GT025B to GT080B
with terminal



Technical Data

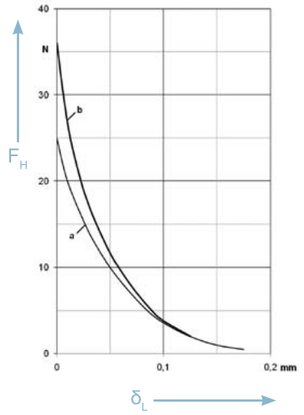
Designation	Diameter (d1) x height (h) [mm]	Max. holding force [N]	Nominal power [W]	Thickness counter plate [mm]	Thread (m) x depth (t) [mm]	Clearance (x) [mm]	Cable- / Lead length (L) [mm]	Weight [kg]
GT015B011	15 x 12	36	2	2	M3x6	5.5	200	0.02
GT018B001	18 x 11	45	1.4	2	M3x5	6.5	200	0.02
GT025B001	25 x 20	140	3.1	3	M4x6	10	200	0.06
GT032B001	32 x 22	230	3.5	3.6	M4x6	13.5	200	0.1
GT040B001	40 x 25.5	475	5.1	4.5	M5x8	17	200	0.2
GT050B001	50 x 27	750	6.2	6	M5x8	21.5	200	0.3
GT063B001	63 x 30	1,000	7.9	7	M8x12	27	200	0.6
GT070B001	70 x 35	1,500	12	8	M8x12	29	200	0.9
GT080B001	80 x 38	1,800	14.9	10	M8x12	34	200	1.2
GT090B001	90 x 42	2,400	14	10	M8x12	37	200	1.7
GT100B001	100 x 43	3,400	20.6	10.5	M10x15	45	300	2
GT150B001	150 x 56	9,000	37	17	M16x24	57	300	6
GT180B001	180 x 63	15,000	49	21	M24x36	71	300	10
GT250B001	250 x 80	30,000	90	29	M24x36	98	300	26

Special voltage configurations are available on request
+49 7575 208 0 or sales-ims@kendrion.com

Holding Force Curves

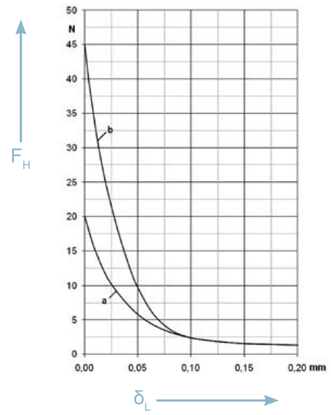
Holding forces F_H depending on air gap δ_L between holding solenoid and workpiece and on the indicated layer thickness of the counter plate.
The values are valid for workpieces of material S235JR with 100% coverage of the holding surface, 90% of nominal voltage and self-heating.

GT015B011



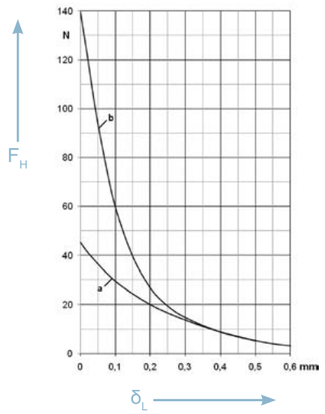
Layer thickness ≙ Material thickness:
a = 1 mm b = 2 mm

GT018B001



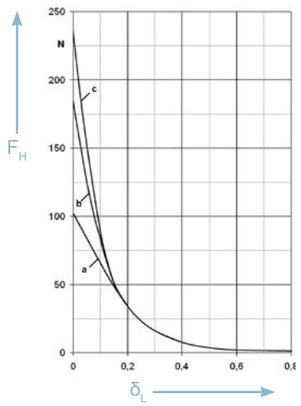
Layer thickness ≙ Material thickness:
a = 1 mm b = 3 mm

GT025B001



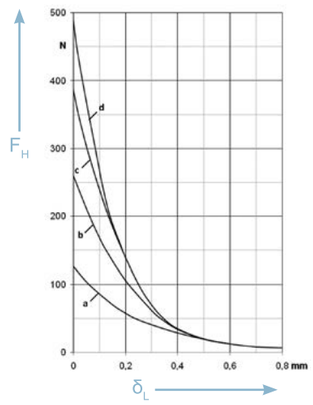
Layer thickness ≙ Material thickness:
a = 1 mm b = 2 mm

GT032B001



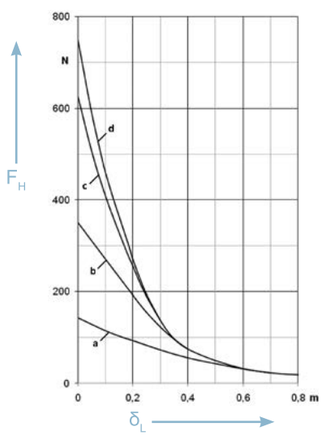
Layer thickness ≙ Material thickness:
a = 1 mm b = 2 mm
c = 3.6 mm

GT040B001



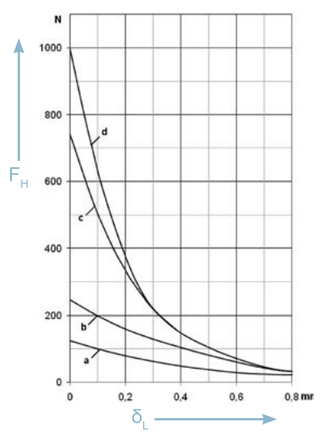
Layer thickness ≙ Material thickness:
a = 1 mm b = 2 mm
c = 3 mm d = 4.5 mm

GT050B001



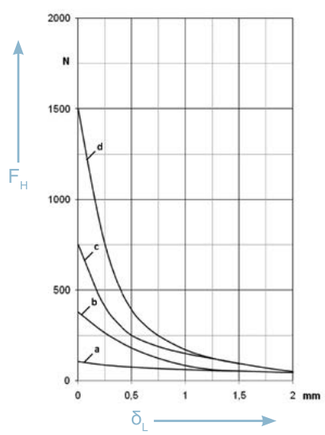
Layer thickness ≙ Material thickness:
a = 1 mm b = 2 mm
c = 4 mm d = 6 mm

GT063B001



Layer thickness ≙ Material thickness:
a = 1 mm b = 2 mm
c = 4 mm d = 7 mm

GT070B001

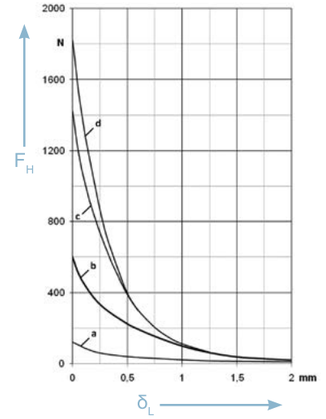


Layer thickness ≙ Material thickness:
a = 1 mm b = 3 mm
c = 5 mm d = 8 mm

Holding Force Curves

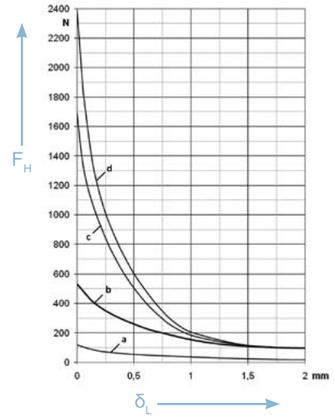
Holding forces F_H depending on air gap δ_L between holding solenoid and workpiece and on the indicated layer thickness of the counter plate.
The values are valid for workpieces of material S235JR with 100% coverage of the holding surface, 90% of nominal voltage and self-heating.

GT080B001



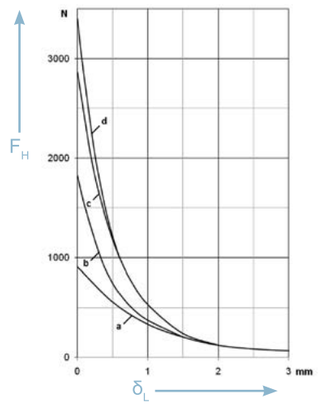
Layer thickness ≙ Material thickness:
a = 1 mm b = 3 mm
c = 6 mm d = 10 mm

GT090B001



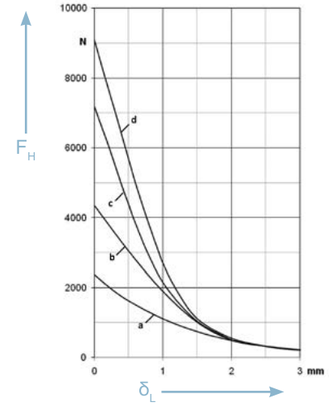
Layer thickness ≙ Material thickness:
a = 1 mm b = 3 mm
c = 6 mm d = 10 mm

GT100B001



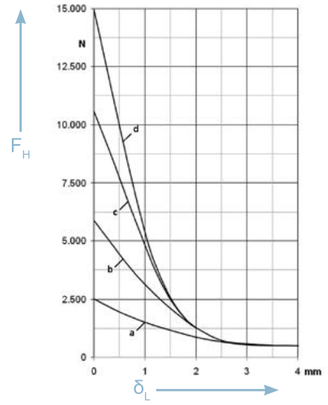
Layer thickness ≙Material thickness:
a = 3.5 mm b = 5.5 mm
c = 7.5 mm d = 10.5 mm

GT150B001



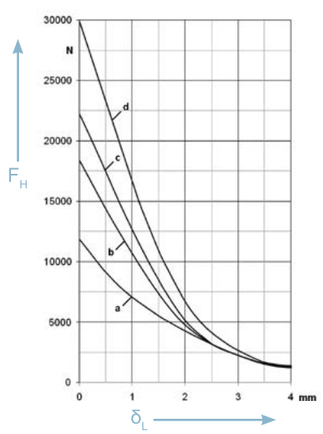
Layer thickness ≙ Material thickness:
a = 5 mm b = 8 mm
c = 12 mm d = 17 mm

GT180B001



Layer thickness ≙ Material thickness:
a = 5 mm b = 9 mm
c = 13 mm d = 21 mm

GT250B001



Layer thickness ≙ Material thickness:
a = 13 mm b = 18 mm
c = 21 mm d = 29 mm

Electromagnetic Holding Solenoid Series GTH

Compared to the series GTB these solenoids offer a higher holding force with similar dimensions. This is achieved by a larger dimensioning of the central pole.

The electrical connection is made by free braids. The coil is vacuum potted, the magnet housing is zinced and the holding surface is polished. The mounting is achieved by a central thread at the rear side of the housing.

Application

These solenoid systems are preferably used in machine and tool manufacture, where air gap adjustments are not required. Please observe, that the complete functioning of the divice is only guaranteed if the counter plate is places exactly.

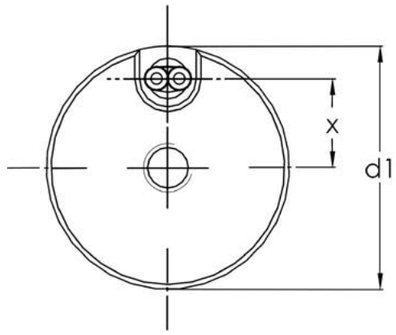
Lateral force loading equates to a displacement force F_v of approximately 1/4 F_H.

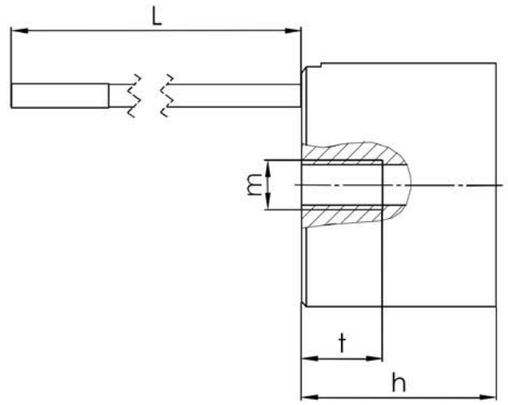
Advantages

- High holding force with low power consumption
- Compact design
- Optimised copper and iron ratio
- Strong holding force with direct mounting of the counter plate

Technical Data	▪ Standard nominal voltage: 24 V DC ▪ Duty cycle: 100% ED ▪ Insulation class: E
Accessories	▪ You find suitable anchor plates on page 23

Cross Section





Technical Data

Designation	Diameter (d1) x height (h) [mm]	Max. holding force [N]	Nominal power [W]	Thickness counter plate [mm]	Thread (m) x depth (t) [mm]	Clearance (x) [mm]	Cable- / Lead length (L) [mm]	Weight [kg]
GT015H050	15 x 12	45	1.4	1.5	M3x5	5.2	200	0.01
GT020H030	20 x 15	112	2.2	2.5	M3x5	7.5	200	0.03
GT025H060	25 x 20	240	3.2	3.5	M4x6	9	200	0.06
GT030H060	30 x 25	355	4.1	4	M4x6	11	200	0.10
GT040H060	40 x 27	740	5.9	6	M5x8	14.5	200	0.20
GT050H170	50 x 30	1,250	7.5	7.5	M6x9	18	200	0.40
GT060H050	60 x 35	1,730	10.3	8.5	M8x12	22	200	0.70
GT070H130	70 x 35	2,310	12.1	10.5	M10x14	25	200	1.00
GT080H040	80 x 38	3,190	14.9	12	M12x18	29	200	1.40
GT090H050	90 x 42	3,880	17.8	13	M14x21	33	200	1.80
GT100H030	100 x 40	4,890	18.4	14.4	M16x24	36	200	2.20

Special voltage configurations are available on request
+49 7575 208 0 or sales-ims@kendrion.com

Electromagnetic Holding Solenoid
Series 10 331

This series excels by its extremely flat design and a through-hole for spindle or shaft attachment.

The connection is made by free braids on the rear of the housing. The magnet housing is zinced and the coil is vacuum potted. The mounting is achieved by means of one resp. several central bores which are accessible from the pole surface.

Application

This series is preferably used in the handling and robotics area, where installation space is narrow, flat and limited by the customer.

Lateral force loading equates to a displacement force F_v of approximately 1/4 F_H.

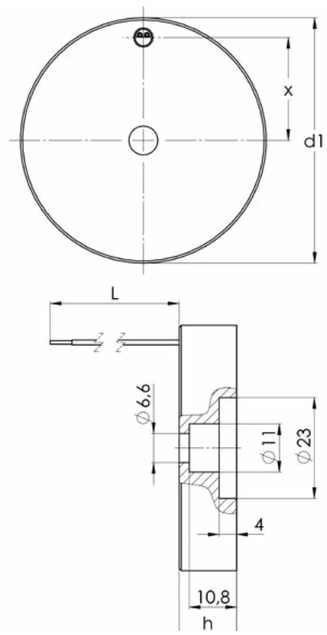
Advantages

- High holding force with low power consumption
- Extremely flat design

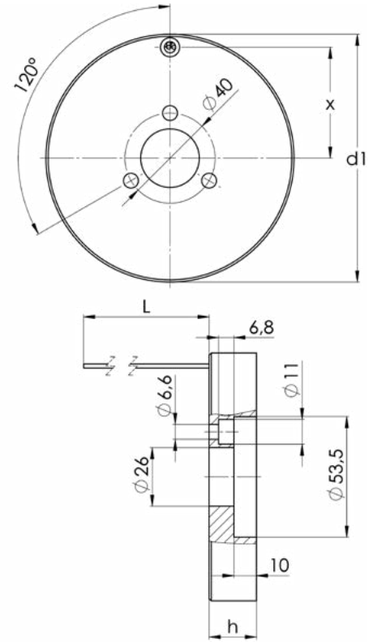
Technical Data	▪ Standard nominal voltage: 24 V DC ▪ Duty cycle: 100% ED ▪ Insulation class: E
Accessories	▪ You find suitable anchor plates on page 23

Cross Sections

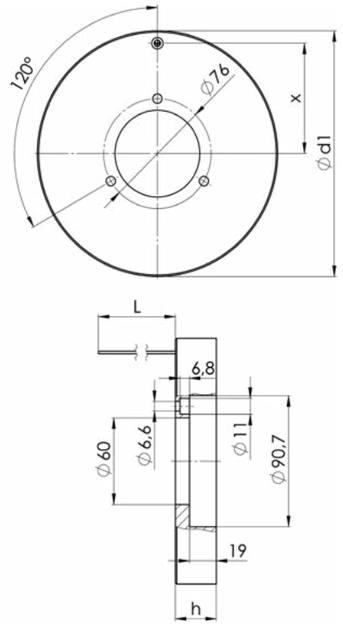
Type 10 33106A00



Type 10 33111A00



Type 10 33117A00



Technical Data

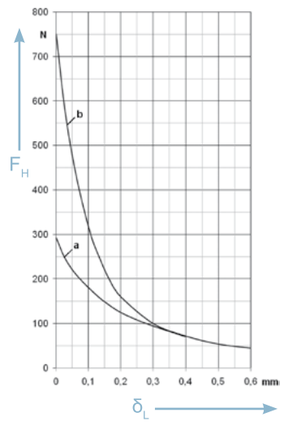
Designation	Diameter (d1) x height (h) [mm]	Max. holding force [N]	Nominal power [W]	Thickness counter plate [mm]	Thread (m) x depth (t) [mm]	Clearance (x) [mm]	Cable- / Lead length (L) [mm]	Weight [kg]
10 33106A00	56 x 13	750	7.1	4	11	24	300	0.20
10 33111A00	110 x 21	2,050	14.7	6	3 x 11	50	300	1.00
10 33117A00	170 x 29	5,000	31.4	10	3 x 11	77	300	3.00

Special voltage configurations are available on request
+49 7575 208 0 or sales-ims@kendrion.com

Holding Force Curves

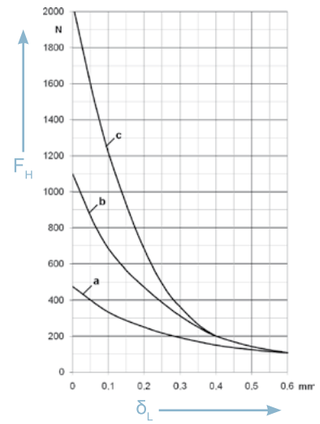
Holding forces F_H depending on air gap δ_L between holding solenoid and workpiece and on the indicated layer thickness of the counter plate. The values are valid for workpieces of material S235JR with 100% coverage of the holding surface, 90% of nominal voltage and warmed up condition (appr. 70 K excessive temperature without additional heat dissipation).

10 33106A00



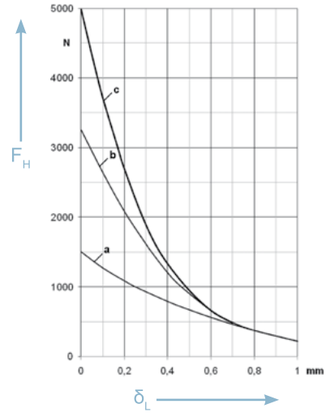
Layer thickness ≙ Material thickness:
a = 1.5 mm b = 4 mm

10 33111A00



Layer thickness ≙ Material thickness:
a = 1 mm b = 3 mm
c = 6 mm

10 33117A00



Layer thickness ≙ Material thickness:
a = 2 mm b = 4 mm
c = 10 mm

Electromagnetic Holding Solenoid Series 10 310

Application

The electromagnetic holding rods are DC holding systems. The magnetic circuit which is open in switched on condition allows to hold ferromagnetic workpieces.

The electrical connection is made at two connecting screws which are easily accessible within the device and can be reached via a Pg gland. This gland can be screwed in alternately from the side or from the bottom.

The coil is vacuum potted, the magnet housing is zinced and the holding surface is ground. For mounting there are thread bores at the bottom side of the device.

These solenoid systems are preferably used in general machine building, for handling and in safety technology for machine building.

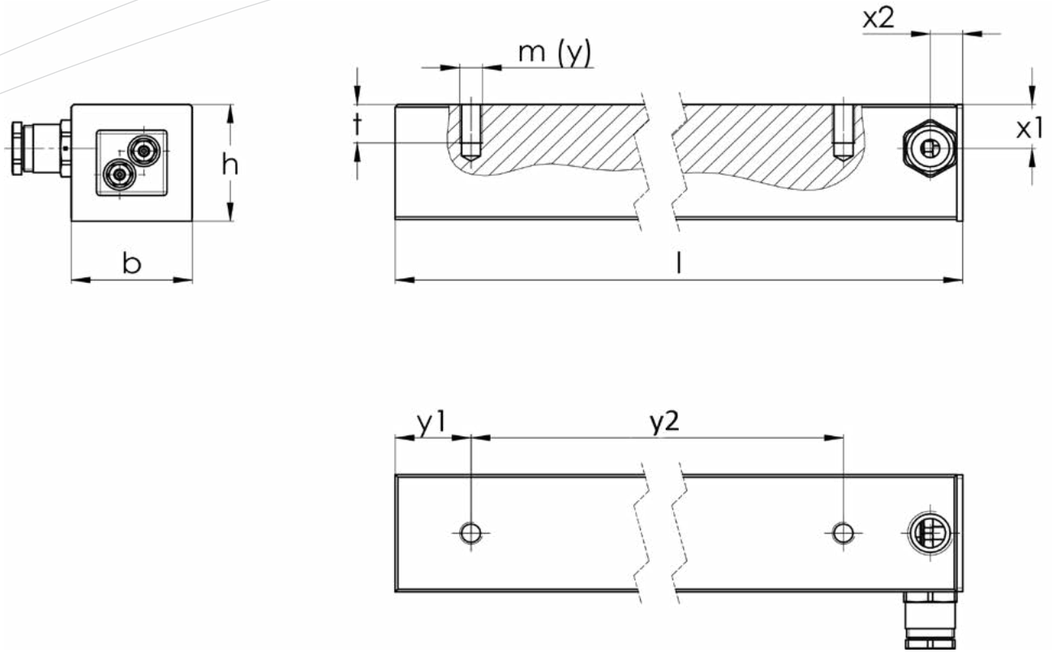
Lateral force loading equates to a displacement force F_v of approximately 1/4 F_H.

Advantages

- High holding force with low power consumption
- Compact design
- Manifold conection options

Technical Data	
	▪ Standard nominal voltage: 24 V DC ▪ Duty cycle: 100% ED ▪ Insulation class: E ▪ Pg-cable gland: HELUTOP HT-MS / M12 x 1,5

Cross Section



Technical Data

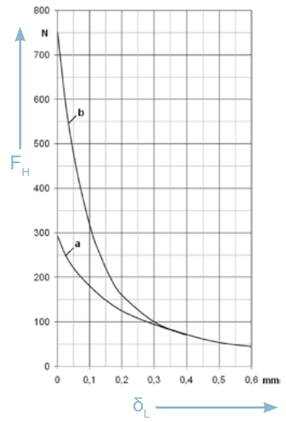
Designation	Length (l) x width (b) x hight (h) [mm]	Max. holding force [N]	Nominal Power [W]	Thickness counter plate [mm]	Thread (m) x depth (t) [mm]	Number of threads (y)	Clearance (y_1) [mm]	Clearance (y_2) [mm]	Clearance (x_1) [mm]	Clearance (x_2) [mm]	Weight [kg]
10 31001A1	101.5 x 32 x 31	880	6.5	8	M6x10	2	20	50	12	8.5	0.60
10 31002A1	151.5 x 32 x 31	1,500	10.5	8	M6x10	3	20	50	12	8.5	1.00
10 31003A1	201.5 x 32 x 31	2,100	12.9	8	M6x10	4	20	50	12	8.5	1.20
10 31004A1	401.5 x 32 x 31	4,700	24	8	M6x10	7	20	50	12	8.5	2.60
10 31005A1	501.5 x 32 x 31	6,000	30.6	8	M6x10	9	20	50	12	8.5	3.20
10 31006A1	601.5 x 32 x 31	7,200	45.7	8	M6x10	11	20	50	12	8.5	4.00
10 31007A00	151.5 x 60 x 49	2,600	22.3	10	M8x12	2	30	75	18	10	2.20
10 31008A00	202 x 60 x 49	3,750	30.2	10	M8x12	2	35	120	18	10	3.10
10 31009A00	502 x 60 x 49	10,400	64.9	10	M8x12	4	35	140	18	10	8.00

Special voltage configurations are available on request
+49 7575 208 0 or sales-ims@kendrion.com

Holding Force Curves

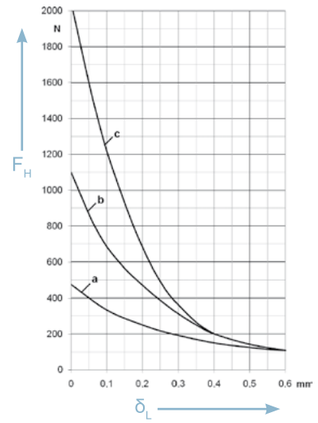
Holding forces F_H depending on air gap δ_L between holding solenoid and workpiece and on the indicated layer thickness of the counter plate. The values are valid for workpieces of material S235JR with 100% coverage of the holding surface, 90% of nominal voltage and warmed up condition (appr. 70 K excessive temperature without additional heat dissipation).

10 31001A1



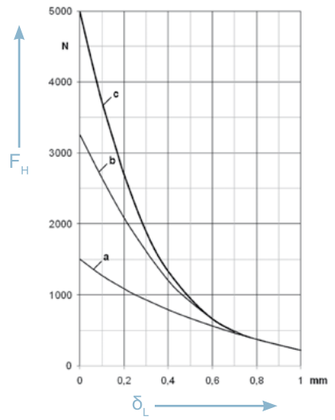
Layer thickness ≙ Material thickness:
a = 1.5 mm b = 4 mm

10 31002A1



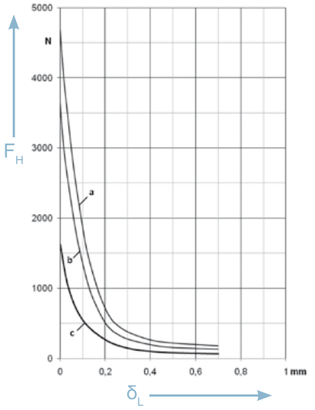
Layer thickness ≙ Material thickness:
a = 1 mm b = 3 mm
c = 6 mm

10 31003A1



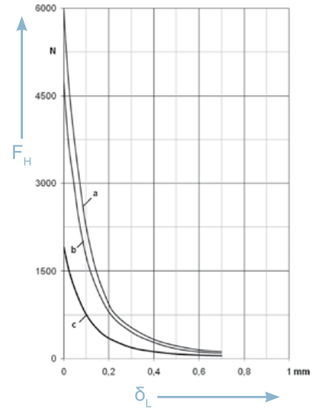
Layer thickness ≙ Material thickness:
a = 2 mm b = 4 mm
c = 10 mm

10 31004A1



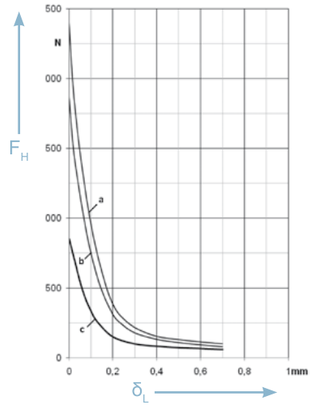
Layer thickness ≙ Material thickness:
a = 8 mm b = 3 mm
c = 1.5 mm

10 31005A1



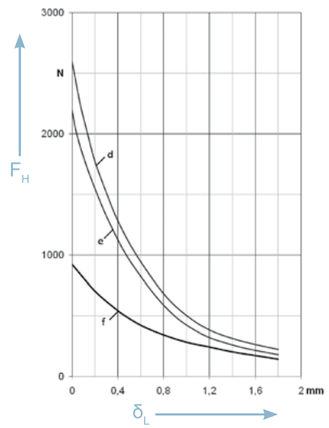
Layer thickness ≙ Material thickness:
a = 8 mm b = 3 mm
c = 1.5 mm

10 31006A1



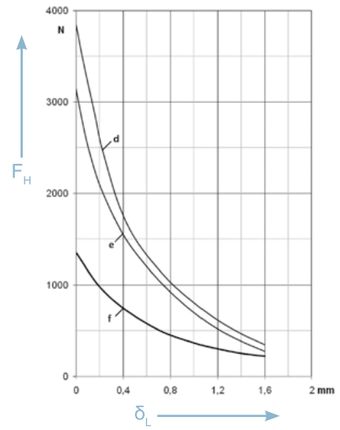
Layer thickness ≙ Material thickness:
a = 8 mm b = 3 mm
c = 1.5 mm

10 31007A00



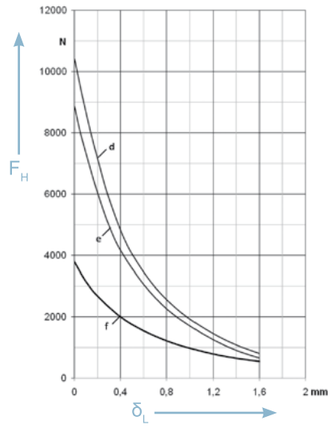
Layer thickness ≙ Material thickness:
d = 10 mm e = 5 mm
f = 2.5 mm

10 31008A00



Layer thickness ≙ Material thickness:
d = 10 mm e = 5 mm
f = 2.5 mm

10 31009A00



Layer thickness ≙ Material thickness:
d = 10 mm e = 5 mm
f = 2.5 mm

Permanent Magnetic Holding Solenoid
Series 01 310

These permanent magnetic holding rods are electrically switchable holding solenoids. They consist of a permanent magnet and a DC-excited coil (vacuum potted) to neutralize the permanent magnetic field at the pole surface. The open magnetic circuit allows to hold ferromagnetic workpieces.

The electrical connection is made at two connecting screws which are easily accessible within the device and can be reached via a Pg gland.

This gland can be screwed in alternately from the side or from the bottom. The coil is vacuum potted, the magnet housing is zinced and the holding surface is ground. For mounting there are thread bores at the bottom side of the device.

Application

These systems are preferably used where long holding times without energy consumption are required and a load or workpieces must be held reliably and safely in the case of power failure.

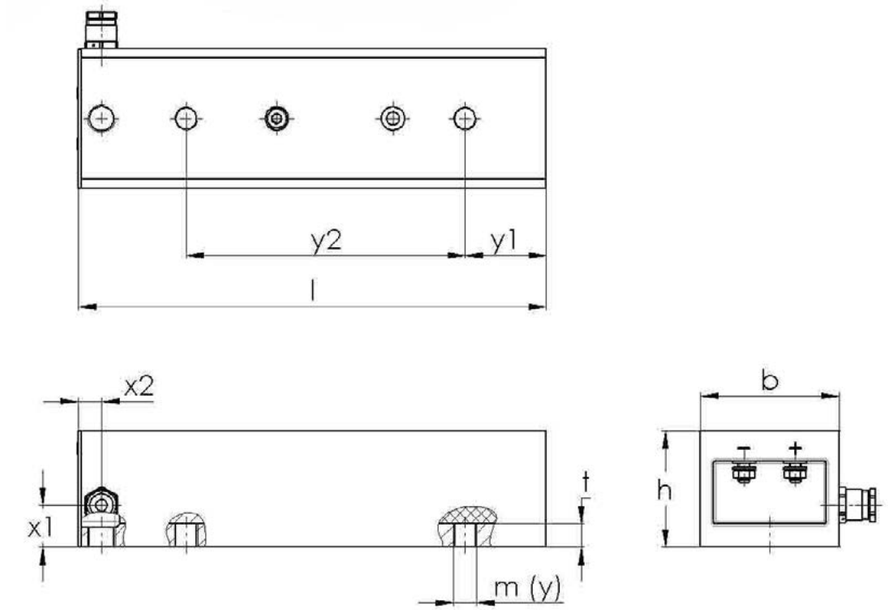
Lateral force loading equates to a displacement force F_v of approximately 1/4 F_H.

Advantages

- Saving of energy by currentless holding
- High holding force
- No remanent magnetization after neutralization
- Safe holding even in the case of power failure

Technical Data	▪ Standard nominal voltage: 24 V DC ▪ Duty cycle: 25% ED ▪ Insulation class: E ▪ Pg-cable gland: HELUTOP HT-MS / M12 x 1,5
Safety note	▪ The attractive or repulsive forces of the permanent magnet can cause skin-contusion through sudden collide, even with larger distances. Therefore always wear protective gloves and glasses.

Cross Section



Technical Data

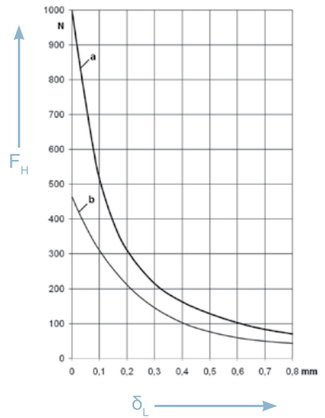
Designation	Length (l) x width (b) x hight (h) [mm]	Max. holding force [N]	Nominal Power [W]	Thickness counter plate [mm]	Thread (m) x depth (t) [mm]	Number of threads (y)	Clearance (y_1) [mm]	Clearance (y_2) [mm]	Clearance (x_1) [mm]	Clearance (x_2) [mm]	Weight [kg]
01 31007A00	151.5 x 60 x 50	1000	27.9	6	M8x10	2	30	75	18	9.5	2.20
01 31008A00	201.5 x 60 x 50	1530	40	6	M8x10	2	35	120	18	9.5	3.00

Special voltage configurations are available on request
+49 7575 208 0 or sales-ims@kendrion.com

Holding Force Curves

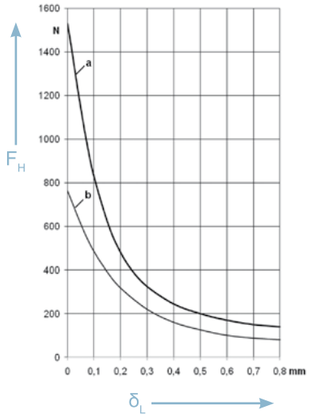
Holding forces F_H depending on air gap δ_L between holding solenoid and workpiece and on the indicated layer thickness of the counter plate. The values are valid for workpieces of material S235JR with 100% coverage of the holding surface and warmed up condition.

01 31007A00



Layer thickness ≙ Material thickness:
a = 6 mm b = 3 mm

01 31008A00



Layer thickness ≙ Material thickness:
a = 8 mm b = 3 mm

Permanent Magnetic Holding Solenoid
Series 01 320 / PEM

These permanent magnetic holding solenoids are electrically switchable holding systems. They consist of a permanent magnet and a DC-excited coil to neutralize the permanent magnetic field at the pole surfaces. The open magnetic circuit allows to hold ferromagnetic workpieces.

The connection is made by free braids resp. cables for 01 320010B and higher. The coil is vacuum potted, the magnet housing is zinced and the holding surface is ground.

The mounting is achieved by central bores on the bottom.

Applications

These systems are used where in currentless state a load, a workpiece or machine parts must be held reliably and safely.

Lateral force loading equates to a displacement force F_v of approximately 1/4 F_H.

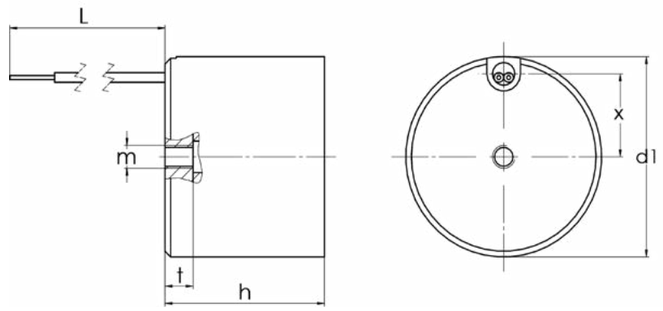
Advantages

- Saving of energy by currentless holding
- High holding force
- No remanent magnetization after neutralization
- Safe holding even in the case of power failure

Technical Data	▪ Standard nominal voltage: 24 V DC ▪ Duty cycle: 25% ED / 100% ED ▪ Insulation class: E
Safety note	▪ The attractive or repulsive forces of the permanent magnet can cause skin-contusion through sudden collide, even with larger distances. Therefore always wear protective gloves and glasses.
Accessories	▪ You find suitable anchor plates on page 23

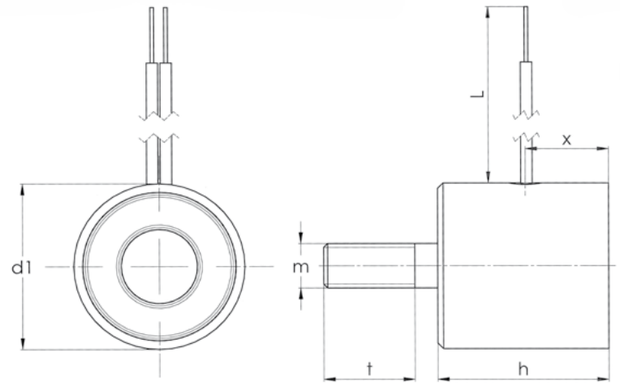
Technical Data

Designation	Diameter (d1) x height (h) [mm]	Max. holding force [N]	Nominal power [W]	Thickness counter plate [mm]	Thread (m) x depth (t) [mm]	Clearance (x) [mm]	Cable- / Lead length (L) [mm]	Weight [kg]
Series 01 320...B; 24 V DC; 25% ED								
01 32002B00	20 x 22	40	3.6	2.5	M4x4.5	10	200	0.04
01 32003B00	35 x 28	160	4.6	3	M4x5	15	200	0.15
01 32005B00	55 x 36	420	8.9	4.5	M5x5	23	200	0.50
01 32007B00	70 x 45	720	13.3	6	M8x5	30	200	0.90
01 32009B00	90 x 48	1,200	21.7	7.5	M8x7.5	39	200	1.50
01 32010B00	105 x 56	1,600	28	9	M10x10	47	300	2.70
01 32015B00	150 x 63	3,500	40.5	12.5	M16x16	68	300	6.40
Series 01 32003A1; 24 V DC; 100% ED								
01 32003A1	32.2 x 40	260	6.2	4	M4x4.7	13	200	0.2



Special voltage configurations are available on request
+49 7575 208 0 or
sales-ims@kendrion.com

Designation	Diameter (d1) x height (h) [mm]	Max. holding force [N]	Nominal power [W]	Thickness counter plate [mm]	Thread (m) x depth (t) [mm]	Clearance (x) [mm]	Cable- / Lead length (L) [mm]	Weight [kg]
Series PEM; 24V DC; 100% ED / 15% ED								
PEM1213A	12 x 13	8	1.0	2.0	M4x10	6.5	130	0.01
PEM1515A	15 x 15	30	1.5	2.0	M4x10	7.5	130	0.02
PEM2020A	20 x 20	60	2.0	2.5	M5x12	10	130	0.04
PEM2525A (15% ED)	25 x 25	140	9.6	3.5	M6x15	14	130	0.08

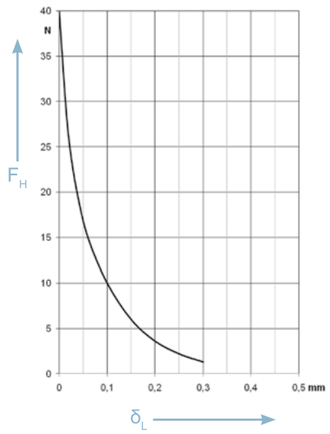


Special voltage configurations are available on request
+49 7575 208 0 or
sales-ims@kendrion.com

Holding Force Curves

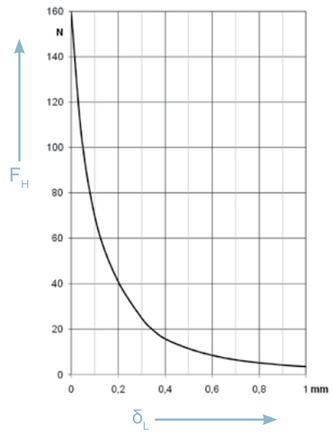
Holding forces F_H depending on air gap δ_L between holding solenoid and workpiece and on the indicated layer thickness of the counter plate. The values are valid for workpieces of material S235JR with 100% coverage of the holding surface and warmed up condition.

01 32002B00



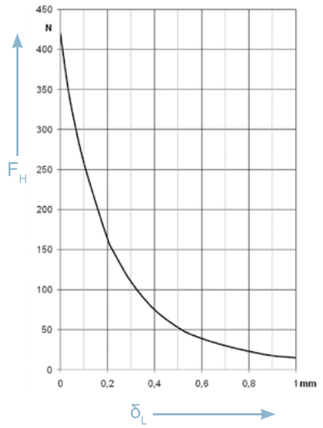
Layer thickness ≙ Material thickness: 2.5 mm

01 32003B00



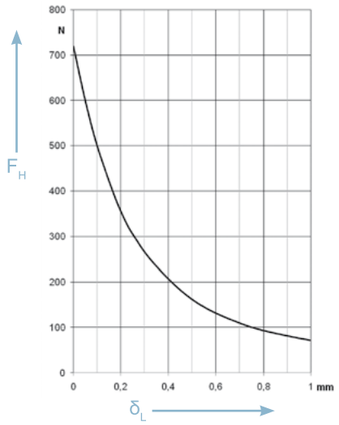
Layer thickness ≙ Material thickness: 3 mm

01 32005B00



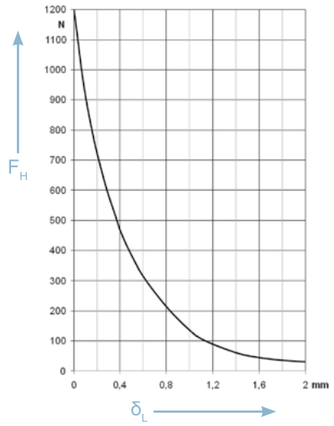
Layer thickness ≙ Material thickness: 4.5 mm

01 32007B00



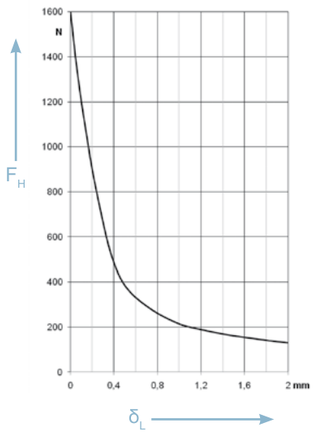
Layer thickness ≙ Material thickness: 6 mm

01 32009B00



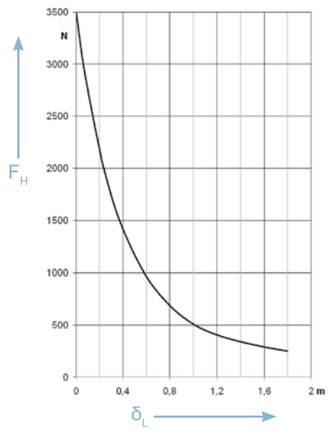
Layer thickness ≙ Material thickness: 5 mm

01 32010B00



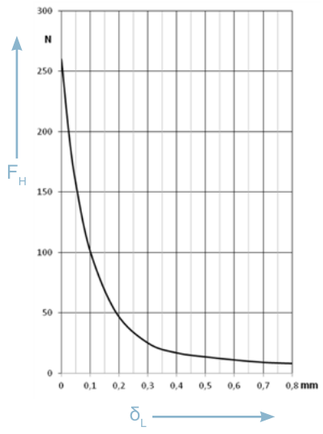
Layer thickness ≙ Material thickness: 9 mm

01 32015B00



Layer thickness ≙ Material thickness: 7.5 mm

01 32003A1



Layer thickness ≙ Material thickness: 9 mm

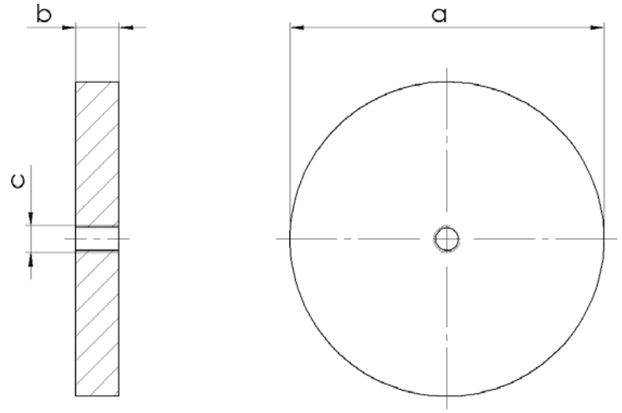
Accessories

Anchor Plates

The anchor plate has to be selected according to the size of the holding solenoid. The plates are designed for the optimum holding forces and are larger in diameter than the corresponding holding solenoids. This allows for an easier fixation on the solenoidwhile mounting.

If the anchor thickness is smaller or materials with an inferior surface quality are used the holding force is reduced. The complete anchor is protected against corrosion by a zinc layer. The mounting is achieved by a through-going thread boring.

Cross Section



Designation	Dimensions [mm] Diameter (a) x thickness (b)	Mounting thread (c)
GT015B001-200	17 x 4	M3
GT018B001-200	22 x 4	M3
GT025B001-200	28 x 4	M4
GT032B001-200	37 x 4	M4
GT040B001-200	42 x 7	M5
GT050B001-200	58 x 8	M5
GT063B001-200	65 x 10	M6
GT070B001-200	72 x 11	M8
GT080B001-200	82 x 13	M10
GT090B001-200	92 x 14	M10
GT100B001-200	107 x 15	M12

Ferromagnetic

Magnetic properties of substances with a permeability μr » 1.

Open Magnetic Circuit

The entirety of all parts penetrated by the magnetic flux Φ which is supplemented by the workpiece (anchor).

Magnetic Pole N (North) S (South)

The place where the magnetic flux leaves resp. enters the holding solenoid.

Holding Force F_H

The force required to tear off a workpiece perpendicular to the holding surface when the device is switched on. The details in the data sheets refer to the total holding surface and an optimal material thickness.

Displacement Force F_V

The force required to displace a workpiece parallel to the holding surface when the device is switched on. Depending on the quality of the workpiece surface it amounts to 20...30% of F_H ($^1/_4$ F_H).

Air Gap δ_L

The mean distance between the holding surface of the solenoid and the bearing area of the workpiece. Shape and roughness of the surfaces facing each other and non-magnetic substances between them (e.g. galvanic coatings, varnish, scale) determine its size.

Remanence

The holding force remaining between holding solenoid and workpiece when the device is switched off without reversion of polarity. Depending on the workpiece and material it amounts to 20 and 40% of F_H.

Insulation Class

Depending on the permanent heat resistance the insulation classes are divided acc. DIN VDE 0580.

Thermal Class Insulation Class Temperature Class	Maximum permitted limit temperature
Y	95 °C
A	105 °C
E	120 °C
B	130 °C
F	155 °C
H	180 °C

Reversion of Polarity

Reduction of the remanence remaining between holding surface and workpiece by means of a time or current dosed reverse pulse.

Demagnetization

Reduction of the field intensity H_C. in the workpiece. It involves a polarity reversal with decreasing amplitude.

Relative Duty Cycle ED

The ratio between duty cycle and circular-trip time, e.g. expressed in per cent (% ED). In general, the electromagnetic holding solenoids are designed for 100% ED and Permanent Magnetic Holding Solenoids are designed for 25%.

Warmed Up Condition

The excessive temperature identified acc. DIN VDE 0580, increased by the reference temperature. Unless otherwise indicated the reference temperature is 35°C.

Protection Class

Designates the kind of shielding of the device against outer influences.

IP 6 5
Code letters
Code no. 1
Code no. 2

Code no. 1	Scope of protection Protection against contact / foreign substances
0	no protection
1	protection against large foreign substances
2	protection against medium-sized foreign substances
3	protection against small foreign substances
4	protection against grain-shaped foreign substances
5	protection against dust deposit
6	protection against dust penetration

Code no. 2	Scope of protection Protection against water
0	no protection
1	protection against vertical dripping water
2	protection against dripping water falling at an angle
3	protection against spray water
4	protection against splashing water
5	protection against hose water
6	protection against flooding
7	protection during immersion
8	protection during submersion

Magnetic Flux Φ

Every permanent magnetic holding solenoid or electromagnetic holding solenoid generates a magnetic field at the holding surface between the north and south poles. By covering it with a workpiece the open magnetic circuit is closed and the usable magnetic flux F is increased. The number of lines of force penetrating a random surface A vertically per cm^2 is the flux density or the magnetic induction B .

$$\emptyset = B * A$$

The higher the magnetic flux Φ penetrating the workpiece is in case the holding surface remains unchanged or the higher induction B is the higher will be holding force F_H.

$$F_H = \left(\frac{B}{5000}\right)^2 * (A_1 + A_2)$$

It is determined by the unfavourable resistance in the magnetic circuit. So the maximum holding force a workpiece can achieve depands on:

- the size of its bearing area
- its material properties
- the roughness of its bearing area
- the covering of the magnetic holding surface in per cent
- the air gap δ_L

Workpiece and Bearing Area

The bearing area is the contact area with which the workpiece rests on the holding solenoid. It does not always equal the size of the workpiece. The holding force per surface unit of a holding solenoid is almost identical across thetotal holding surface.

Particularly by the size of its bearing area the workpiece determines the maximum holding force to be achieved.

Workpiece and Material

The components of the holding solenoids which carry the magnetic flux are out of soft iron of high permeability. Due to the high magnetic conductivity of these parts the maximum holding force to be achieved depends, among other things, on the permeability of the workpiece. The workpieces differ in their structural constitution and composition. Additions of carbon, chrome, nickel, manganese, molybdenum, copper, etc. reduce the magnetic conductivity. In addition, the holding force is reduced if workpieces are hardened. The higher the hardness the more unfavourable is the magnetic conductivity.

$$B = f(H)$$

Fixing and grouping

Using several holding solenoids

a) A non-rigid fixing is required for every holding solenoid so that each one can adapt to uneven surfaces (Fig. 1).

b) Every holding solenoid should be springmounted below a transverse rail to dampen the stroke acceleration so that in the case of uneven bearing surfaces the difference between the loads carried by the individual magnets does not vary too greatly (Fig.2).

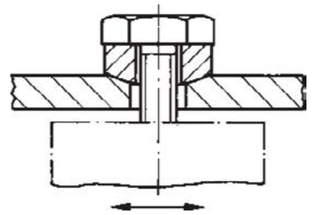


Fig. 1: Individual fixing

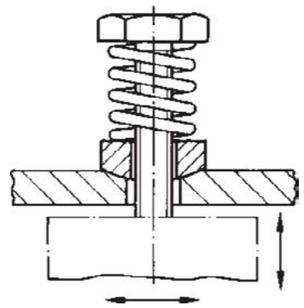


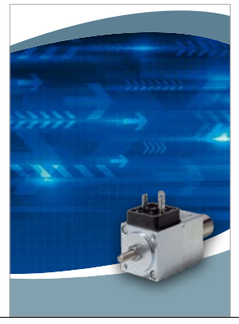
Fig. 2:Ideal fixing for group of magnets

Overview of Catalogue

Linear Solenoids

Classic Line

- single-stroke solenoids
- compact design
- individual fixing
- mono- and bistable version

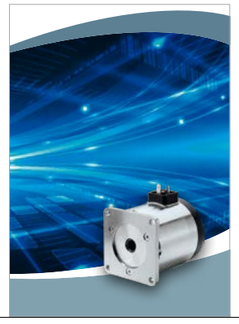


High Performance Line

- square single-stroke solenoids
- high force with small installation space
- modular system
- short pull-in times

High Power Line

- round single-stroke solenoids
- high forces and stroke travels
- short switching times
- also reversible solenoids

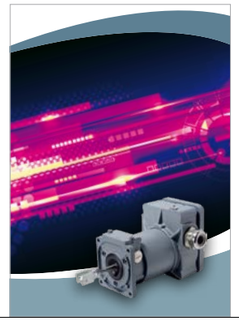


Control Power Line

- control solenoids
- extremely fast
- switching
- short strokes
- precise switching

Elevator Line

- spreader solenoids
- especially designed for elevator brakes
- extremely high forces
- any mounting position



ATEX Line

- explosion-proof solenoids
- prevent the occurrence of sparks and light arcs
- dynamic and reliable switching

Locking Line

- locking solenoids
- high transverse forces
- integrated feedback of locking function
- compact design

System Line

- operated by AC
- extremely short activation times
- very high pull-in forces

Electro Holding Magnets

Hahn CQ Line

- door holding magnet
- design and functionality
- VdS, CE, EN 1155,
- EN 14637 tested
- great variety

Industrial Line

- industrial holding magnets
- high holding force with low power consumption
- compact design
- variable connections

Oscillating Solenoids

Oscillating Line

- vibratory solenoids
- wide product range for transportation of bulk material
- low wear
- compact design

Custom Solutions

- **Rotary solenoids**
- **Assemblies**
- **Customer-specific solutions**

Please contact us for special or customer-specific solutions.

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WE MAGNETISE THE WORLD

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We will find the best solution for you.

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