



WE MAGNETISE THE WORLD



ATEX Line

Explosion-proofed linear solenoids



INDUSTRIAL MAGNETIC SYSTEMS



We develop solutions!

Kendrion develops, manufactures and markets high-quality electromagnetic 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. We are committed to the engineering challenges of tomorrow and taking responsibility for how we source, manufacture and conduct business is embedded into our culture of innovation. Rooted in Germany, headquartered in the Netherlands and listed on the Amsterdam stock exchange, Kendrion's 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



ATEX Line - Explosion-proofed linear solenoids

Kendrion is a manufacturer of ATEX linear solenoids which are primarily used where sparking constitutes a significant safety hazard. These explosive areas with flammable gases and vapors are found in mining, in refineries, on oil platforms or in other chemical plants.

This product line of Kendrion complies with the European ATEX guideline 2014/34/EU for devices and protection systems intended for proper use in explosive areas.

This was tested by the Physical-Technical Federal Institute (Physikalisch-Technische Bundesanstalt, PTB) resp. by the IBExU (Institute for Safety Technology) according to EN 60079.

Ex-Solenoids with Ignition Protection Type „Increased Safety”, Ex “e”

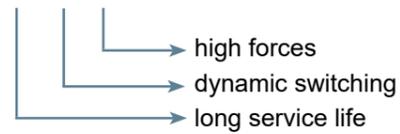
The most important requirement for explosion-proof solenoids is to prevent the ignition of an explosive atmosphere in the operational environment. This means that the solenoid may neither reach temperatures above the temperature class of potentially occurring gases nor form electrically or mechanically induced sparks.

All linear solenoids which Kendrion offers for explosion protection are compliant with the ignition protection type “**Increased Safety**”, Ex “**e**”. For this purpose special design precautions have been taken to shield the coil inside the solenoid from its environment.

Furthermore, the components of the solenoid were designed to achieve an extremely high temperature resistance. Thus, the Ex-solenoids can be used in the temperature class T4 (up to + 135°C).

ATEX Line Linear Solenoids for Explosion Protection

Kendrion offers a wide portfolio of standard linear solenoids in Ex-design. The electromagnetic actuators convince through:



The ATEX linear solenoid consists of a pot magnet and a connector housing providing a connection for the protective conductor according to EN 60079.

Both the steel housing and the aluminum connector housing are designed in the ignition protection type "e". The models from size 10 on also have a mounting base. The Ex-solenoids are suitable for use at an ambient temperature of -20°C to +40°C (with type 41 03E13K03 from -20°C to +35°C). Depending on the rated current the solenoid must be operated with a suitable upstream fuse resp. with a motor protection switch provided by the customer. Furthermore, a varistor must ensure that the breaking voltage is not exceeded.

Protection class

- IP54 EN 60529

Ex-Identification

- II 2G Ex eb IIC T4 Gb

Admission

- Product Type 41 01E: PTB 16 ATEX 2010 X
- Product Type 41 03E: IBExU 16 ATEX 1220 X

ATEX



- ATEX is a commonly used synonym for the ATEX guidelines of the European Union. The name is derived from the French term ATmosphère EXplosive. The directive encompasses explosion protection guidelines 2014/34/EU for devices and 1999/92/EG for operations. ATEX guidelines are devised by the Director General of the EU commission Enterprise and Industry in cooperation with the member states, standardization organizations (CEN, CENELEC) and so called known organizations such as BAM, PTB, or TUEV to name examples from Germany.

Please find the EU type examination certificates and the operating manuals for our specified products on the following page: <https://www.kendrion-ims.com>

Explosion-proofed linear solenoids Type 41 01E

Devices of the **series type 41 01E** are direct-acting solenoids which due to their special design are suitable for use in explosion-prone areas.

The explosion protection was approved with the EU type examination certificate PTB 03 ATEX 2175 X of the "Physikalisch-Technische Bundesanstalt Braunschweig" (Federal Metrology Institute in Brunswick, Germany).

The housing as well as the connection have the protection class IP54.



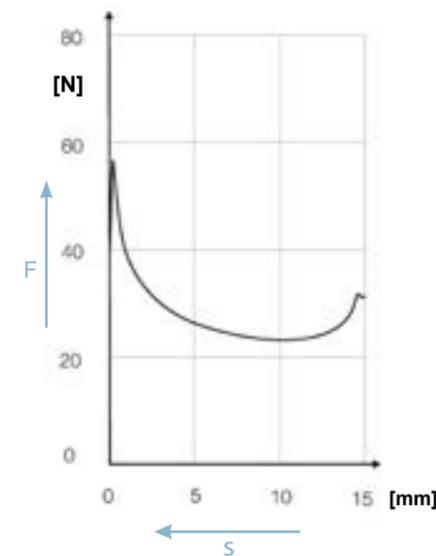
Technical Data

Type	Hight x Length [mm]	Rated voltage [V DC]	Rated power [W]	Stroke [mm]	Force [N]	Duty cycle [%]
41 01E06K00	123 x 230	24	21	15	20	100
41 01E07K00	133 x 240	24	25	20	30	100
41 01E09K00	150 x 260	24	32	20	50	100

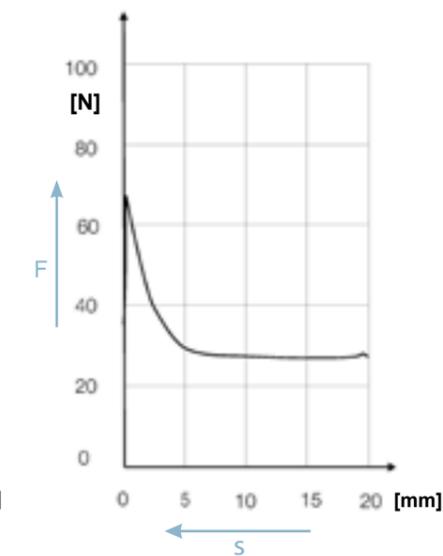
Stroke Force Curves

The power indicated is reached at 90% of the rated voltage. The solenoids can be installed in any position, but the force transfer should be in axial direction only. The values for the duty cycles are reference values and apply for rated voltage, warmed-up condition and load with 70% of the magnetic force of the device.

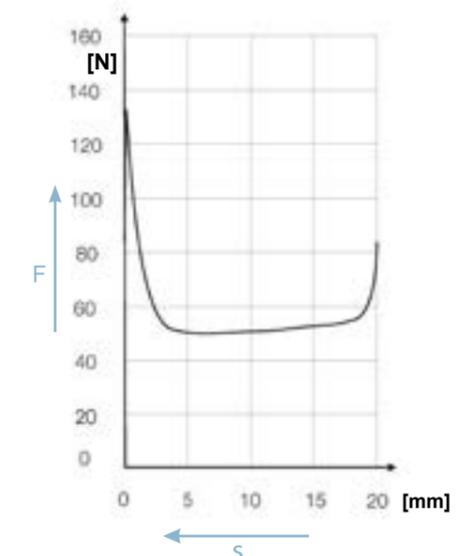
41 01E06K00



41 01E07K00



41 01E09K00



Other voltages are available on request
+49 771 8009 3770 or sales-ims@kendrion.com

Explosion-proofed linear solenoids Type 41 03E

Devices of the **series type 41 03E** are direct-acting solenoids with mounting socket which due to their special design are suitable for use in explosion-prone areas.

The explosion protection was approved with the EU type examination certificate PTB 03 ATEX 2175 X of the "Institut für Sicherheitstechnik" (Institute for safety technology) in Feiberg, Germany.

The housing as well as the connection have the protection class IP54.



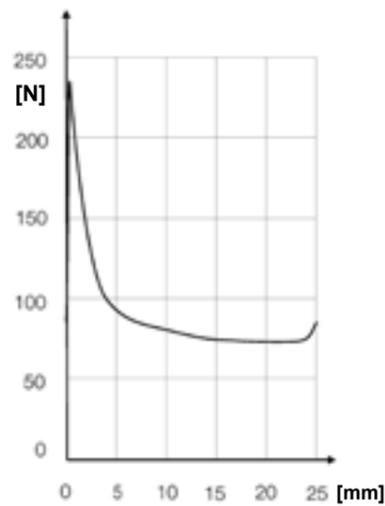
Technical Data

Type	Height x Length [mm]	Rated voltage [V DC]	Rated power [W]	Stroke [mm]	Force [N]	Duty cycle [%]
41 03E10K00	150 x 285	24 110	50 47	25	60	100
41 03E11K00	116 x 315	24	40	30	75	100
41 03E11K03	115 x 215	200	48	15	160	100
41 03E13K00	180 x 315	24 110 180 205	56 60 63 62	30	120	100
41 03E13K03	180 x 315	200	59	15	240	100
41 03E14K00	180 x 410	24	77	40	150	100
41 03E16K00	210 x 475	24	83	50	160	100
41 03E18K00	205 x 490	24	106	50	250	100

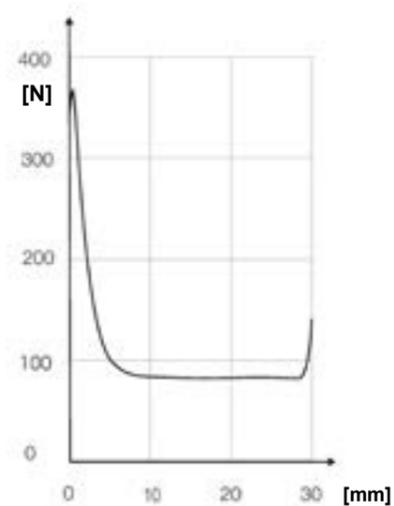
Stroke Force Curves

The power indicated is reached at 90% of the rated voltage. The solenoids can be installed in any position, but the force transfer should be in axial direction only. The values for the duty cycles are reference values and apply for rated voltage, warmed-up condition and load with 70% of the magnetic force of the device.

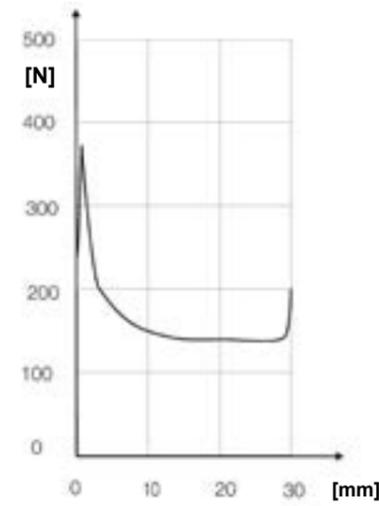
41 03E10K00



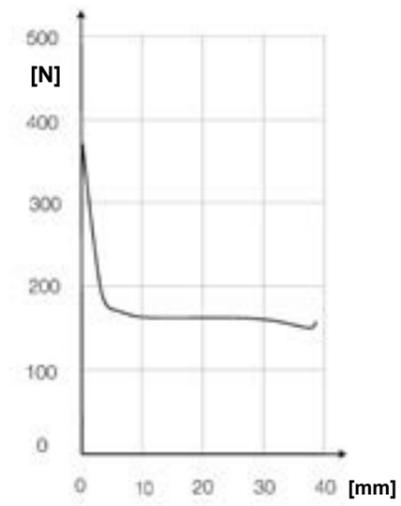
41 03E11K00



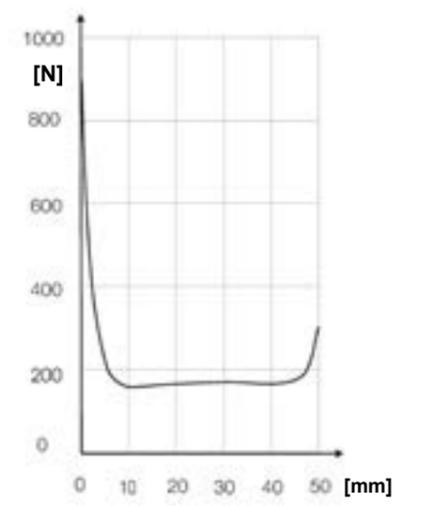
41 03E13K00



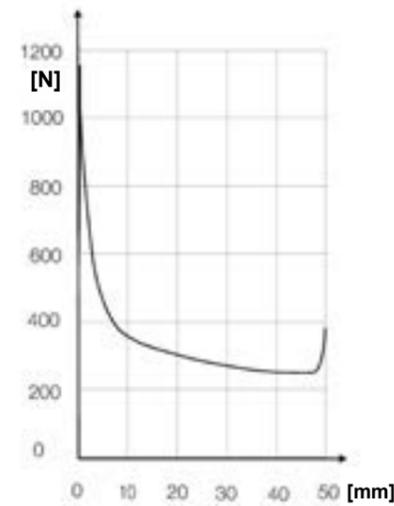
41 03E14K00



41 03E16K00



41 03E18K00



Other voltages are available on request
+49 771 8009 3770 or sales-ims@kendrion.com

Thermal Classes

As shown in the table below thermal classes are classified according to DIN VDE 0580 / 11.2011 into insulation classes on the basis of their longterm thermal stability. Depending on the type our linear solenoids are manufactured in thermal classes E, B and F. If required by the application most devices can also be delivered in thermal class H.

Thermal class	Limit temperature °C	Limit overtemperature °C
Y	90	50
A	105	65
E	120	80
B	130	90
F	155	115
H	180	140

Protection Classes [IP]

Protection classes are indicated by a short symbol consisting of the two invariable code letters IP and two code letters for the degree of protection. The protection classes indicated are determined according to IEC 60529. They apply to protection against contact and against penetration of foreign substances. The second code letter applies to protection against penetration of water.

In case the protection class of e.g. the electrical connection deviates from that of the solenoid the protection class of the connection is indicated separately, e.g. housing IP 54, connection IP 00.

Code Letters Protection against contact and foreign substances	
0	no protection
1	protection against big 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 Letters 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 flooding

Code Letters Protection against water	
6	protection against flooding
7	protection against immersion
8	protection against submersion

Rated Modes of Operation

Continuous operation is the operation during which the duty cycle is so long that the SteadyState temperature is reached.

Intermittent operation is the operation during which duty-cycle and currentless break alternate in regular and irregular intervals, the breaks being so short that the device cannot cool down to the reference temperature.

Short time operation is the operation during which the duty cycle is so short that the SteadyState time is not reached. The currentless break is so long that the solenoid cools down to the reference temperature.

Technical Terms Related to Electricity

The rated voltage (U_N) is the voltage with which the solenoid is operated in normal operation.

The rated power (P_N) is the power which results from the rated voltage and the rated current with DC solenoids of a coil temperature of 20°C.

The rated current (I_N) is the current which results from the rated voltage (U_N) and the resistance (R₂₀) with a coil temperature of 20°C.

Technical Terms Related to Force

Magnetic force is the exploitable mechanical force reduced by the friction which is generated in stroke direction. The magnetic force is safely reached with 90% rated voltage and maximum warming. With rated voltage the listed values rise by approx. 20%.

Stroke force is the magnetic force which acts outside taking the respective component of armature weight into consideration.

Holding force is the magnetic force in stroke end position with DC-solenoids; with AC-solenoids it is the average value of the magnetic force periodically fluctuating with the alternating current in stroke end position.

Reset force is the force required to reset the armature into stroke start position after switching off the excitation current.

Relative duty cycle (% ED) is the ratio between duty cycle and cycle time in per cent. It is calculate according to the following formula:

$$\% ED = (\text{duty cycle} / \text{cycle time}) * 100$$

In order to calculate the relative duty cycle the preferred value of the cycle time acc. DIN VDE 0580 item 3.2.2 of 5 minutes is usually taken as a basis.

If the cycle time is irregular the relative duty cycle is determined from the ratio between the sum of the duty cycles and the sum of the cycle times over a longer period of operation.

The maximum values of the duty cycle must not be exceeded. If the relative duty cycle was determined and its value exceeds the permitted maximum value acc. DIN VDE the higher %-ED has to be selected into the range of which the duty cycle fits in. (Tables 1 and 2)

Playing time is the sum of the duty cycle and the currentless break. For DC single-stroke solenoids the playing time is max. 5 minutes = 300s. This equals 12 switchings / hour. The minimum playing time is limited by the actuation and release times in connection with the relative duty cycle. For a playing time of 300s there are maximum values for the duty cycle which must not be exceeded. In case the permitted duty cycle is exceeded a solenoid of the next higher relative duty cycle has to be selected.

If the duty cycle of 180s is exceeded the solenoid has to be selected for 100% duty cycle (continuous energization) or in special cases of the duty cycle calculated from the on/off ratio needs to be adapted by a proper selection of the magnetic coil. If the playing time is irregular the relative duty cycle is determined from the ratio between the added duty cycles and the added playing times over a longer **period of operation**.

By **playing sequence** we understand a single or periodically returning sequence of values for playing time.

Fuse Protection

Due to the differences in power consumption depending on the stroke an effective fuse protection of the AC solenoids is not possible. If some protection has to be provided please refer to the following formula:

$$I = \frac{\text{KVA open} \times 1000}{2 \times U} \quad [\text{A}]$$

A delayed fuse has to be used.

Frequency

Normally the coil is designed for a connection to 50 Hz. A solenoid with a rated frequency of 50 Hz may possibly be connected with the same voltage to a higher frequency. It has to be observed, however, that the magnetic force is reduced (appr. 30%). The use of a lower frequency is to be avoided as not only the force but also the heating increases (max. values 40 to 60 Hz). An adaptation to a lower frequency is possible on request, without a substantial modification of the magnetic forces specified in the list.

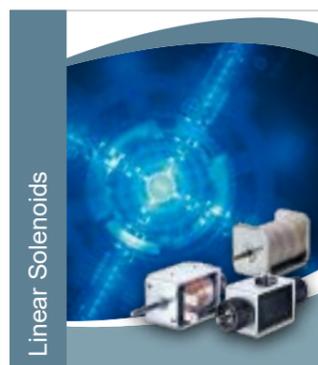
Relative duty cycle (% ED)	5	15	25	40	60	100
Permitted maximum duty cycle (s)	15	45	75	120	180	random

Table 1

Switching number (S / h)	12		120		300		600		1200		3000	
	300		30		12		6		3		1.2	
Cycle time (s)	300		30		12		6		3		1.2	
% ED	t _{on}	t _{off}										
5	15	285	1.5	28.5	0.6	11.4	0.3	5.7	0.15	2.85	0.06	1.14
15	45	255	4.5	25.5	1.8	10.2	0.9	5.1	0.45	2.55	0.18	1.02
40	120	180	12.0	18.0	4.8	7.2	2.4	3.6	1.20	1.80	0.48	0.72
60	180	120	18.0	12.0	7.2	4.8	3.6	2.4	1.80	1.20	0.72	0.48
100	random											

Table 2

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

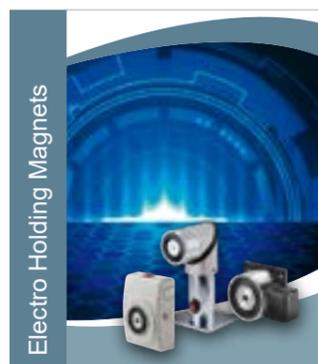


Locking Line

- 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

If you do not find what you are looking for, please feel free to contact us!
We will find the best solution for you.

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