



SMALL COMPONENTS • BIG SOLUTIONS

2023 CATALOGUE

AXIS  **STUIFMEEL**
DRIVEN BY MOTION



The company

In NAFSA S.L. we have a long experience in the design, manufacture and sale of all types of industrial solenoids, holding electromagnets and electromagnetic locking bolts.

Since its founding in 1996 NAFSA has been characterized by offering to its customers customized solutions. A large part of our production consists of electromagnets designed specifically for customers or adaptations of standard models.



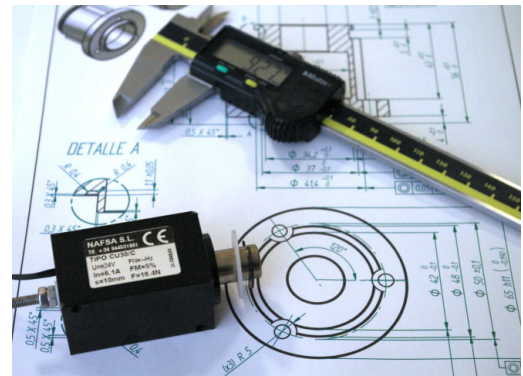
R + D Technical department

NAFSA has a highly qualified technical department, specialized in developing new products in close collaboration with our customers.

In NAFSA we have also understood the innovation as a must. In this sense, our production processes are constantly improves thanks our R&D and production departments, highly qualified and specialiced in the development of new products adapted to customer's needs.

Quality

In NAFSA we understand the quality as a basic requirement to guarantee our customer's expectatives. This is the result of an integral management, involving both our staff and suppliers within this philosophy. Our quality system is assured according to UNE-EN-ISO-9001norm granted by Lloyd's Register Quality.



Main production centers

In Nafsa we have two production centers.

The headquarters are in Gernika-Spain and since 2009, we join with Ingeniería Magnética Aplicada (IMA) a Joint Venture company called IMA&NAFSA in Ningbo (China).

HEADQUARTERS AND PRODUCTION PLANT:

NAFSA

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48300 Gernika - Bizkaia - Spain
T +34 94 453 10 61 ; Email: elec@nafsa.es

PRODUCTION PLANT:

IMA NAFSA CHINA CO.LTD.

Yinzhou Investment&business Industrial,
Ningbo 315104 - China

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● Push and pull electromagnets

Every product made by NAFSA fulfills the European Directive 2006/95/CEE about the electrical appliances and certain voltage limits.

Made according to the following norms: DIN VDE0580, UNE-EN 60204-1, NFC79300.

● BASIC CONCEPTS

● FORCE

Magnetic Force (F_m):

It is the force developed by the solenoid measured in the stroke direction.

Effective Force (F_h):

It is the magnetic force (F_m) after adding or subtracting the plunger and the spring weight.

Final magnetic Force:

It is the magnetic force obtained in the solenoid after finishing the stroke using standard power .

Remanent Force:

It is the force remaining after switching off the current.

Returning Force:

It is the force needed to make plunger back to its initial position, after turning off the power.

● STROKE

Magnetic Stroke (s):

It is the distance the plunger has to do from its initial position to the final one.

Initial Position (s_1):

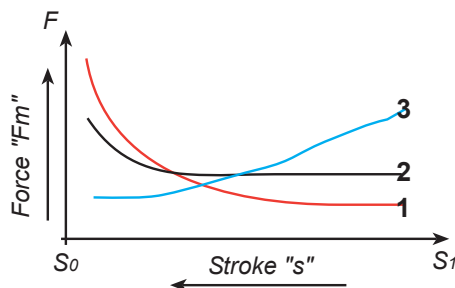
It is the position in which the plunger starts the stroke and where it comes back after return movement.

Final Position (s_0):

It is the position the plunger reaches after finishing the stroke, being the stroke at 0mm.

Characteristic curve- Magnetic Force- Stroke:

It is the graphic about the magnetic force according to the plunger stroke. You can distinguish three characteristic curves in final position (s_0) direction.



- 1- Rising curve:suitable to work against spring
- 2- Horizontal curve: suitable to work against constant forces
- 3- Decreasing curve: manufactured under demand.

● VOLTAGE, CURRENT AND POWER

Standard Voltage (U_n):

This is the value supposed for the solenoid correct performance. A variation between +5% and -10% is admitted.

Standard Current (I_n):

It is the electrical current going through the coil at the standard voltage, being the coil temperature 20°C. The current in amperes is calculated dividing the Power (W) shown in the catalogs by the standard voltage (U_n).

Standard Absorbed power (P_n):

It is the power absorbed by the coil being fed at the standard voltage and 20°C (coil temperature).It is calculated multiplying standard voltage (U_n) and standard current (I_n).

Resistance:

Manufacturing tolerance will be $\pm 10\%$.

Maximum performance room temperature: 45°C.

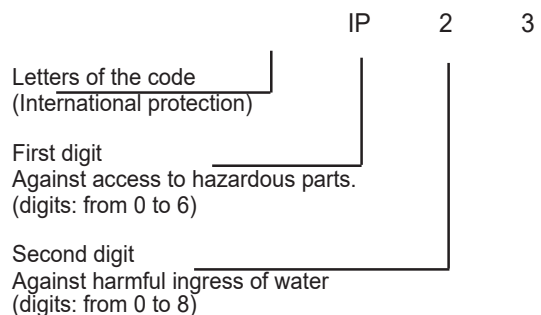
Protection types:

All material surfaces are protected against corrosion by using galvanotecnic treatments, following the UNE-EN 12329 norm.

Protection against ingress of solid objects, such as dust, accidental contact or water-CEI-IEC 60529 (IP code) norms.

DESIGNATIONS:

IP code disposition according to EN 60529 norm.
Protection rates provided by steam casing.

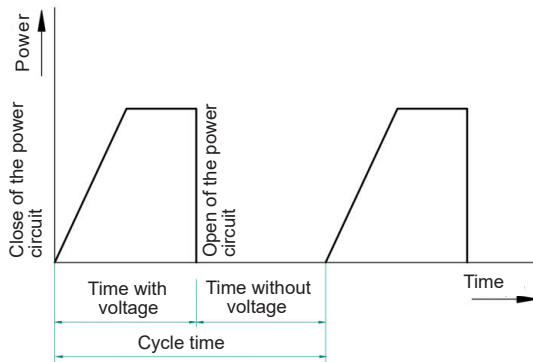


NOTE: The higher the value of the digits is, the higher the protection will be.

Under demand: we can adapt our products to different rates of protections specified in the data sheets.

• Push and pull electromagnets

• PERFORMANCE CYCLES



Time with voltage:

Time passed between connection and breaking.

Time without voltage:

Time passed between breaking and connection.

Cycle time:

Time passed adding the time with voltage to the time without.

A programme time:

One or some cycles that happen repetitively.

Working cycle:

The movement the plunger makes from initial (S1) to final position (S0), and from final to initial position.

Number of cycles:

The number of performance cycles.

Cycle frequency:

The duty-cycle per hour.

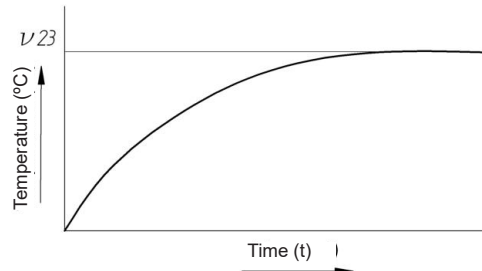
Duty-cycle(ED%):

It is the result of dividing time connected between the total cycle expressed as a percentage.

• PERFORMANCE CONDITIONS

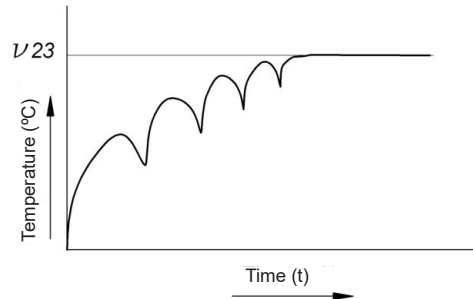
Continuous operation:

The duration of the solenoid on is so long that the performance temperature is achieved. For this kind of performance, solenoids with 100% duty-cycle (ED) must be selected.



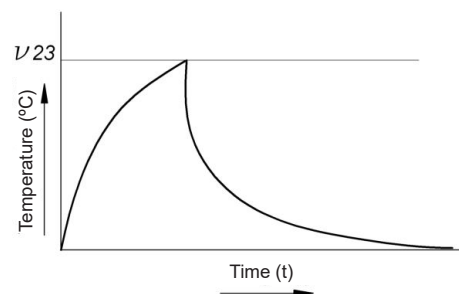
Intermittent Operation:

In this type of operation mode, the time on and off alternate, following a regular or irregular pattern. The time off is so short, that the solenoid cannot get cooled to the room temperature.



Short time operation:

The time on is so short that the solenoid cannot get the working temperature. The time off is long enough for the solenoid to get cold and achieve the room temperature.



How to obtain the duty-cycle (ED%):

$$ED\% = \frac{\text{Time with voltage}}{\text{Time with voltage} + \text{Time without voltage}} \times 100 = \frac{\text{Time with voltage}}{\text{A cycle time}} \times 100$$

Example: Time under voltage: 1 second ; Time without voltage: 4 seconds

$$ED\% = \frac{1}{1 + 4} \times 100 = 20\%$$

It is desirable choosing higher duty-cycle than the one obtained in the formula to avoid overheating. Depending on the force needed different duty cycles can be chosen such as ED% 25%, 40% or 100%.

● Push and pull electromagnets

● TEMPERATURE AND INSULATION

Insulation class:

It is the working temperature limit of the materials used in the solenoid manufacture. Normally, insulation class B is used (130°C). These temperature limit may admit a variation of 5K (K=5°C). Under demand, we can manufacture our products in class F (155°C) even class H (180°C)

Insulation class chart:

Insulation class	Temperature limit (C°) V ₂₁	Heating limit (K) (Room temperature 35 C°)
Y	90	50
A	105	65
E	120	80
B	130	90
F	155	115
H	180	140
C	200	>200

Reference temperature V₁₁ (°C):

It is the constant temperature of the solenoid without voltage.
Sometimes it can be different from V₁₃.

Minimum room temperature V₁₂ (°C):

The lowest temperature admitted to the correct working of solenoid.

Room temperature V₁₃ (°C):

The temperature of the place where the solenoid is going to work.

Maximum room temperature V₁₄ (°C):

The highest admitted room temperature for the correct solenoid performance.

Room temperature range DV₁₅ (°C):

It is the difference between maximum and minimum admitted room temperature.

Initial temperature at the beginning of the test V₁₆ (°C):

Room temperature at the beginning of the test.

Temperature limit V₂₁ (°C):

The maximum admitted temperature for each solenoid.

Temperature limit range DV₂₂ (°C):

Difference between V₂₁ and V₁₂.

Working temperature V₂₃ (°C):

Temperature reached by the solenoid when it is under constant nominal voltage. $V_{23}=V_{13}+DV_{31}$

Temperature rise DV₃₁ (°C):

It is the temperature difference between initial room temperature and the working temperature

Final temperature rise DV₃₂ (°C):

It is the temperature rise on the solenoid above room temperature due to constant voltage on the coil.

Limit temperature rise DV₃₃ (°C):

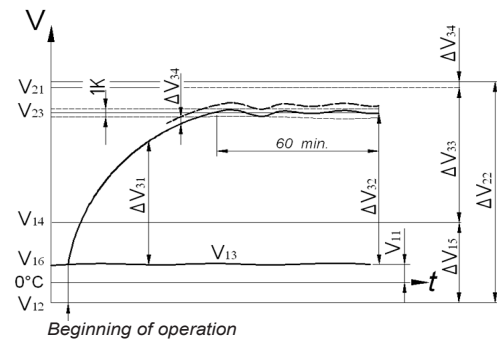
The maximum admitted temperature over the room and coil temperature working at nominal voltage.

Difference between hotspots DV₃₄ (°C):

It's the difference between the average and maximum temperatures on the coil.

Temperature graphic:

The temperature are shown in C° and the temperature differences in K (5°C)



REMARKS: We consider the temperature balance is reached when the temperature variation in 60 minutes is less than 1K.

● WORKING ROOM CONDITIONS

Room temperature:

Room temperature must be equal or less than 40°C and its average during 24h cannot be higher than 35°C. Furthermore, the temperature cannot be lower than -5°C.

Altitude:

The altitude where the solenoid is installed cannot be higher than 1000m above sea level.

Environment conditions:

NAFSA solenoids must be protected from environments containing a huge quantity of dust, dirt, corrosive gases, steam, sea air, etc...

Relative humidity:

The humidity in the environment must be under 50% at 40°C. At lower temperature higher relative humidity can be admitted, for example at 20°C- 90% humidity. Occasional condensation in the environment must be avoided.

Treatment against corrosion:

The coatings used by NAFSA can range from 25 hours to 400 hours in salt spray chamber. Zinc coated solenoids (resistance up to 200 hours salt spray chamber) such as ER, ERC, ECM, ERD, ERB, ECI series and Holding electromagnet. Solenoids with Cathodolysis or Geomet (resistance up to 400 hours in salt spray chamber) such as ECH, CU, ECR series.

Under demand we can apply other coatings according to the requirements of each application.

Special working conditions:

If normal working conditions cannot be assured, special solutions will be adapted, such as stronger insulation, special coating or protection... The temperature limit admitted will depend on the limit of the insulation materials used in the coil.

● Holding electromagnets

Every product made by NAFSA fulfils the European Directive about electrical appliances and certain voltage limits. Made according to the following norms: DIN VDE 0580, UNE-EN 60204-1 y NFC79300

● Holding electromagnets TYPES

Electropermanent holding electromagnets with incorporated magnet:

The attraction and holding of the ferromagnetic material is made by permanent magnets incorporated in the product. It has not got any plunger, its magnetic circuit is opened. Apart from the permanent magnets there is a coil mounted in, when this is fed, cancels part of the magnet field of the magnets allowing to loose the piece. When the coil feeding stops, the product recovers its initial force.

Electromagnetic holding electromagnets:

The attraction and holding of the ferromagnetic material is made when the coil is turned on. It has not got any plunger, its magnetic circuit is open. When the coil is turned off, the piece drops.

● BASIC CONCEPTS

Ferromagnetism:

It is the magnetic property of the materials with $\mu_r \gg 1$ permeability.

Magnetic poles: (North =N) (South =S).
Attraction faces: where the ferromagnetic materials are held, and the points where the magnetic flux (F) goes in and out.

Holding force (Fm):

The force perpendicular to the attraction faces needed to hold the attracted piece.

It is shown in the specification sheets and it refers to the whole contact face.

Side force (FL):

It is the parallel force needed to loose the attracted piece.

Depending on the finish of the attracted piece, the force (FL) may vary between 20% and 35% of the holding force (Fm).

Air gap (dL):

It is the medium distance between the attraction face of the holding electromagnets and the ferromagnetic piece surface.

The shape and the roughness of these two surfaces and the non-magnetic materials between them, such as galvanic protection, dust, etc... determine its value.

Standard Voltage(Un):

It is the value for which the holding electromagnet coil has been made.

Duty-cycle (ED%):

It is the value obtained dividing the connection time and the total cycle duration expressed in %. Standard holding electromagnets are prepared for a ED100% duty-cycle.

Remanence (Br):

It is the force the electromagnet uses to hold the ferromagnetic piece after cancelling the magnetic field. Its approximate value is 5% of Fm depending on the piece (size, roughness, material, etc..)

Polarity inversion:

To cancel the remanent magnetism of the attraction face in electromagnetic holding electromagnets after cutting voltage feeding, a reversal of polarity with limited duration and intensity is needed.

Standard power demand(Pn):

It is what each holding electromagnets demands.

Hot rate:

Holding electromagnet temperature rising over determined room temperature due to power absorption under voltage. If nothing against is indicated, temperature for reference will be 35°C.

Material insulation class:

Correspondence between coil insulation and a temperature limitation of the material used for coils manufactured. Normally, B thermal class insulation (130°C) is used.

Maximum performance room temperature:

45°C.

Protection types:

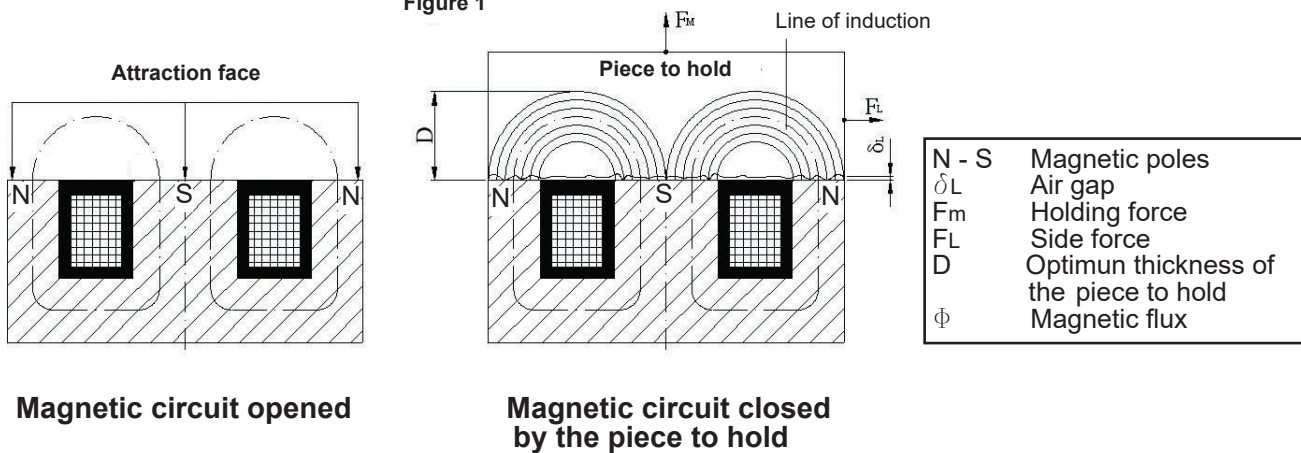
This products have protection against corrosion using galvanic treatments. UNE-EN 12329 Norm. Protection against intrusion of solid object dust, accidental contact and water.. CEI-IEC 60529 (IP code) Norm.

To obtain the duty-cycle (ED%):

$$ED\% = \frac{\text{Time on}}{\text{Time on} + \text{Time off}} \times 100 = \frac{\text{Time on}}{\text{A cycle duration}}$$

• Holding electromagnets

Figure 1



Magnetic flux Φ :

These electromagnets generate on the surface of the piece to hold a magnetic field between North and South poles.

When bringing near the piece to hold to the magnetic circuit, it is closed by it, so the magnetic flux increases. The number of force lines per cm² that crosses perpendicular a surface, is the flux density also called magnetic induction B.

Piece to hold and surface of contact: Surface of contact between the electromagnet and the piece to hold is the attraction face of the holding electromagnet, and the surface of the piece to be held will be the one in contact with holding electromagnet's attraction face.

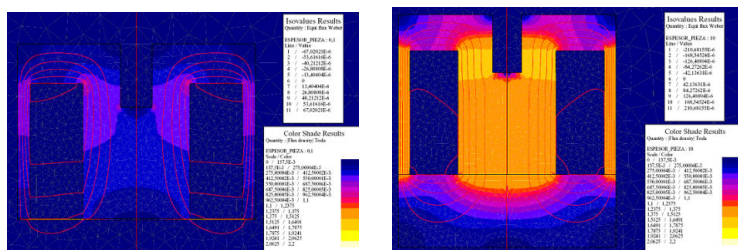
Holding force on the attraction surface is practically constant.

The piece to hold determines the maximum holding force value (F_m). It depends on the size and thickness of its contact surface.

For a field intensity H determined by a magnet or a coil, the induction that can be reached depends on the material type to handle. $B=f(H)$. See figure 2.

In the same electromagnet the holding forces may vary due to the magnetic properties of the material to hold. Among other things, saturation induction of the material determines the maximum holding force.

Magnetic field and field lines behaviour depending on the thickness of the piece to hold.



Piece thickness 0,2mm

Piece thickness 10mm

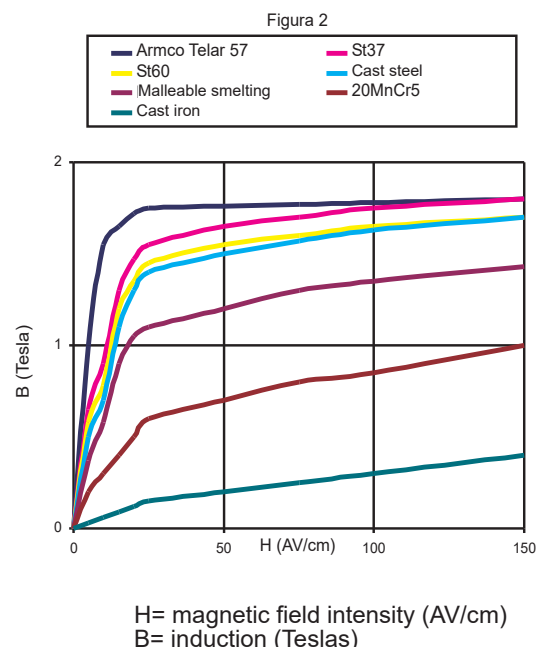
The material of the piece to hold:

Material used in electromagnets manufacturing where the magnetic field takes place, is made of soft iron, with high magnetic permeability.

Internal structure and composition vary depending on the different materials. Carbon impurities, chrome, nickel, manganese, molybdenum, copper, plumb, etc... reduce the magnetic conductivity. The tempered pieces present a further reduction of the holding force, the harder tempered is, the worse conductivity will be.

Imantation curve of several materials.

Figure 2



• Precautions

• VARIATIONS IN THE VOLTAGE:

Admitted variations on the standard voltage are +5% and -10%.

The value of the standard voltage appears in the data label of the solenoid.

Higher voltage than +5%:

It can produce an increase of the push force, that could cause a greater impact between the plungers. This can affect the life expectancy of the solenoid, also produce an increase in the temperature of solenoid and also damaging the coil and the supply leads.

Depending on the value of the overvoltage, the coil may be damaged.

Lower voltage than -10%:

The push force decreases and the response time is delayed.

Measures to be taken:

Select the solenoid taking into account the variations in the supply voltage.

If you want to work with higher voltage margin, the coil must be adapted from the design phase by NAFSA.

• VOLTAGE PEAKS GENERATED IN THE DISCONNECTING OF THE COIL:

Damages in the control elements by voltage peaks when the voltage's shutdown:

The power to the solenoid control elements of high sensitivity can be damaged due to these peaks that can be between 5 and 10 times higher than the value of standard voltage.

Measures to be taken:

Protection devices must be added such as free wheel diodes, varistor...

Read coil protection page 121.

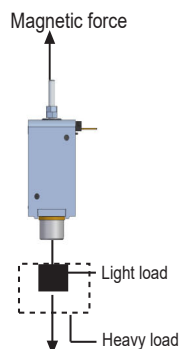
DIFFERENCES BETWEEN THE VALUE OF THE FORCE AND THE LOAD TO BE DISPLACED:

Solenoid force far superior to the work load:

The plunger impacts strongly, so this can affect the life expectancy.

Electromagnet force slightly greater than the work load:

The magnetic force and the response time will decrease.



Measures to be taken:

Select the solenoid depending on the load, with a security margin between 2 and 3.

Example: If the load to be displaced is 10N, should be selected a solenoid with a force of 20-30N.

Read data sheet for each product.

• LIMITATION OF POWER:

Insufficient power supply:

If the power supply designed to feed the solenoid has less power than the demanded by the same, the force will be less than what is specified in the technical data sheet.

Measures to be taken:

Ensure that the power supply has higher power available than the one demanded by the electromagnet.

INFLUENCE OF WIRING IN THE OPERATION OF SOLENOID:

In a low resistance solenoid (eg. low voltage, low duty cycle) if the supply lead is very long and has high resistance, this resistance can be added to the coil of the solenoid, this decreases the force values shown in the datasheets.

Measures to be taken:

The power supply must be installed as near as possible of the solenoid.

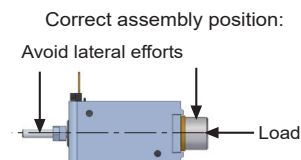
ASSEMBLY:

The solenoid assembly respect load and additional pieces:

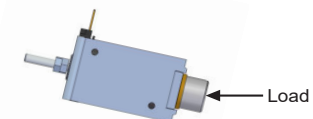
It is recommended to assemble the solenoid on the same axis of the load, avoiding lateral forces on the plunger, that might shorten the life of the sliding guides.

Measures to be taken:

Ensure the load does not produce lateral efforts or interfering in the displacement.



Incorrect assembly position::



Selecting and assembly of the fixing elements:

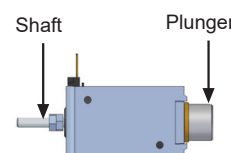
Ensure the fixing elements do not interfere in the displacement of the solenoid.

Avoid the use of very long screws that may reach contact the coil.

For the appropriate thread depth, read each product's data sheet.

Adjust the assembly position and use of accessories on the same axis of sliding:

Make sure that during installation of auxiliary parts on the shaft and plunger of the solenoid, this one does not become damaged or does not lose manufactured concentricity between the shaft and the plunger.

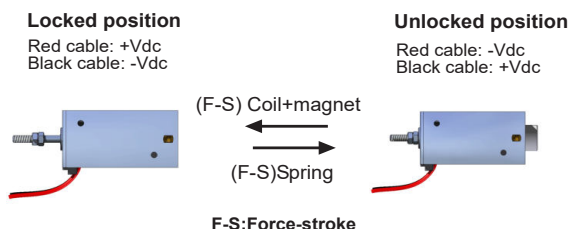


• Precautions

• POLARIZED COIL CONNECTION:

In solenoids with magnets system is needed to polarize properly the coil such as ERB, ERDI, ECI VM and VM / ND series.

Example: Working principle of ERB serie depending on polarization.



• FREQUENCY OF USE IN NUMBER OF CYCLES (only for the solenoids, the holding magnet are exempt):

The number of cycles of life depends on the materials used to manufacture the slide guides, the conditions of use, installation, loads ...

Measures to be taken:

If the number of operations is high (> 200 cycles per day), we recommend using solenoids with friction bearing with teflon layer.

Example: ERC, CU, ECH, ECR series.

If any doubt consult the technical department of NAFSA.

• NOT RESPECTING OF DUTY-CYCLES:

In case of not respecting the duty-cycles indicated for each solenoid, two things can happen:
1) The solenoid is longer time under voltage than the one indicated on duty cycle:

This can burn the coil and melt the plastic materials, therefore, the guides may not slide properly and the solenoid is disabled.

2) The solenoid is less time under voltage than indicated in the duty-cycle:

The coil generates less heat and it is beneficial for the solenoid.

• ENVIROMENTAL WORKING CONDITIONS:

Adhesion of oil, dust and other strange materials in the slide guides of the solenoid:

If materials such as oils, dust or other material ingress the sliding guides this can influence in the pushing or pulling force as well as in the response time, with the possibility that the solenoid doesn't work properly by seizure.

The solenoid should be away from water, dust and hard environments in general, unless they are specifically designed for this type of application. Some materials are less resistant to acids or other chemical agents.

Measures to be taken:

Complementary protective measures must be taken and we must adapt the design for each case.

Room temperature higher than 35°C:

The higher the room temperature is (V13), the higher the final temperature of the solenoid will be (V23), this means less force. Read page 1.3, paragraph "Temperature and Insulation".

Measures to be taken in case of problems:

Select a solenoid with a higher duty-cycle, read page 1.2, paragraph "How to obtain the duty-cycle":

• PHYSICAL PHENOMENONS THAT MAY AFFECT THE WORKING OF SOLENOID:

Magnetism:

Pay attention on the mounting position and direction of the solenoid, and if it is surrounded by sources of magnetic fields generation, which can influence in the magnetic circuit of the solenoid.

Measures to be taken:

The solenoid should be away enough from the source of magnetic fields generation.

Temperature influence on the associated electronics:

Due to the heat generated by the solenoid, components with less resistance to heat, such as semiconductors, can be damaged.

If the solenoid is assembled in a sealed box the heat should be controlled.

Measures to be taken:

Select a solenoid with a higher duty cycle, so less heat will be generated for the same time of use.

• FUSION OF PROTECTION ELEMENTS (thermal switch, varistors, diodes...):

The overvoltages or the use of voltages higher than the normal ones, can destroy the protection elements of the solenoid.

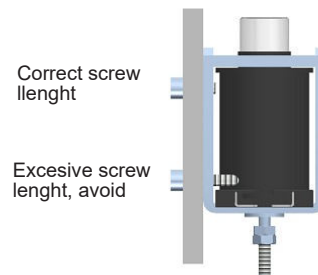
Measures to be taken:

Add preventive measures in the supply circuit to prevent abnormal power flows from reaching the coil or using resettable thermal fuses.

Verify that the supply voltage corresponds with the standard of the product.

• DAMAGED COIL BY EXCESSIVE LENGTH OF THE FIXATION SCREWS:

If the length of the screws is too long, they can get into the coil, breaking the copper wire. This can create short-circuit in the coil.



• BROKEN LEADS :

Avoid pulling from supply leads, terminals...

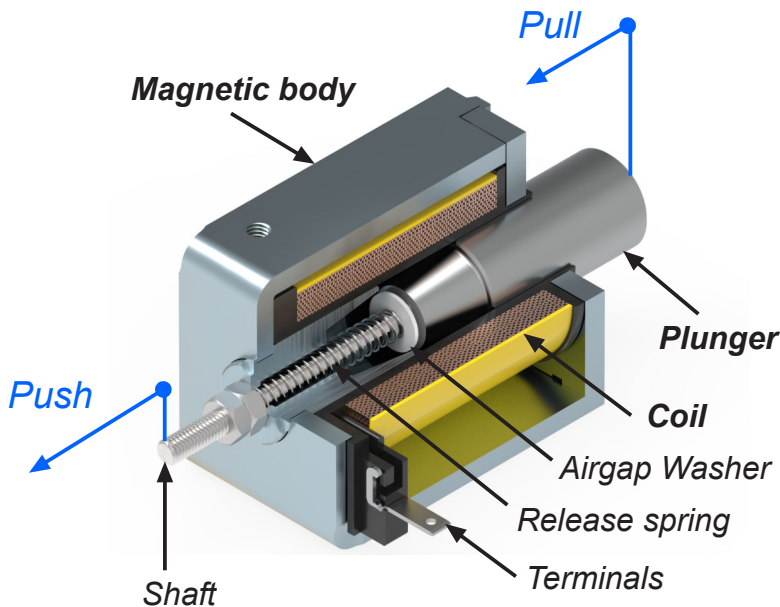
Operating time

Type	Operating time (ms)	Duty-cycle					Type	Operating time (ms)	Duty-cycle				
		100%	40%	25%	15%	5%			100%	40%	25%	15%	5%
ER15/C	T opening	30	28	26	26	25	ERC60-10/C	T opening	182	130	122	107	104
	T release	31	26	25	25	25		T release	117	85	81	72	70
ER20/C	T opening	36	30	27	27	25	ERC60-20/C	T opening	190	137	129	114	112
	T release	25	22	21	21	19		T release	124	93	88	79	78
ER21/C	T opening	47	39	39	36	36	CU20/C	T opening	32	26	26	24	23
	T release	35	31	31	29	29		T release	28	25	25	24	24
ER25/C	T opening	50	40	37	37	35	CU30/C	T opening	61	53	42	42	41
	T release	34	28	26	26	25		T release	44	39	33	33	32
ER30/C	T opening	64	51	49	46	46	CU40/C	T opening	125	98	92	86	82
	T release	41	33	32	30	30		T release	75	60	57	54	51
ER30/CT	T opening	65	52	49	46	46	ECM13-03/E	T opening	29	20	19	17	15
	T release	42	35	33	32	32		T release	15	14	14	14	13
ER35/C	T opening	71	56	55	50	48	ECM13-03/T	T opening	29	20	19	17	15
	T release	48	40	40	37	36		T release	15	14	14	14	13
ER40/CT	T opening	156	117	109	106	101	ECM13-10/E	T opening	40	34	32	29	27
	T release	103	81	76	75	72		T release	29	28	27	26	26
ER45-05/C	T opening	127	75	72	70	70	ECM13-10/T	T opening	40	34	32	29	27
	T release	59	45	44	42	42		T release	29	28	27	26	26
ER45-15/C	T opening	111	87	83	81	81	ECM19/E	T opening	44	40	38	37	34
	T release	68	54	53	51	51		T release	39	39	38	38	36
ER48/T	T opening	125	102	90	82	76	ECM19/T	T opening	44	40	38	37	34
	T release	83	69	62	57	53		T release	39	39	38	38	36
ER50-15/C	T opening	127	96	81	81	80	ECM25/E	T opening	67	57	51	47	41
	T release	82	62	53	53	53		T release	65	63	60	58	55
ER60-05/C	T opening	181	128	120	105	102	ECM25/T	T opening	67	57	51	47	41
	T release	111	80	75	66	65		T release	65	63	60	58	55
ER60-10/C	T opening	187	134	126	111	108	ECH40-10	T opening	117	95	84	79	77
	T release	117	85	81	72	70		T release	70	57	51	48	46
ER60-10/CT	T opening	187	134	126	111	108	ECH50-16	T opening	203	160	137	127	116
	T release	119	87	83	74	72		T release	131	106	92	86	80
ER60-20/C	T opening	196	143	135	120	117	ECH65-15	T opening	291	228	198	196	181
	T release	126	95	90	81	80		T release	181	143	125	124	115
ERC25-04/CC	T opening	43	35	33	30	28	ECH75-20	T opening	410	352	284	269	241
	T release	25	20	19	17	16		T release	256	222	181	172	156
ERC30/C	T opening	61	48	45	43	43	ECH90-25	T opening	651	488	417	332	307
	T release	41	33	32	30	30		T release	399	301	259	208	193
ERC35/C	T opening	64	52	52	49	46	ECH110-45	T opening	784	592	517	504	456
	T release	45	37	37	36	34		T release	485	371	326	318	290
ERC45-50-15/C	T opening	110	84	81	73	72	ECH150-40	T opening	1272	985	877	829	773
	T release	68	53	52	50	47		T release	781	610	545	517	484
ERC50/15	T opening	122	91	76	73	71	TEST CONDITIONS: Opening time: -Solenoid supplied under standard voltage -Coil stabilized at its working temperature -Load tested: the 70% of the solenoid force -Horizontal assembly position -Standard stroke for each type -Test temperature 20°C						
	T release	80	62	53	51	50							

Any variation on these test conditions can change the operating time

• ER SERIES

ER serie electromagnets are simple effect linear solenoids where the stroke movement from initial to final position is made by electromagnetic forces, the return to initial position is made by external force or by a spring incorporated to the solenoid.



Structure, main basic elements:

Magnetic body:

It is the metal **carcase** containing the **coil**, the core and the fixing holes of the solenoid.

Coil:

It receives the electric energy to create the magnetic field.

Plunger:

It is the piece that moves inside the **coil**, and it has a non-magnetic **shaft** fixed to it.

To work pulling, the element to activate must be fixed to the **plunger**. To work pushing, the element to activate must be fixed to the **shaft**.

• Datasheet rated values conditions (According to DIN VDE 0580):

The values of the magnetic force (F_m) depending on the stroke, are obtained in the following conditions:

Room temperature = 35°C

Coil stabilized at its working temperature.

Rated voltage equal to 90% of the standard one.

Solenoid working in horizontal position.

Effective force (F_h) is obtained from magnetic force (F_m).

-When the solenoid pulls upwards:

$Effective\ force = Magnetic\ force - Plunger\ weight$

-When the solenoid pulls downwards:

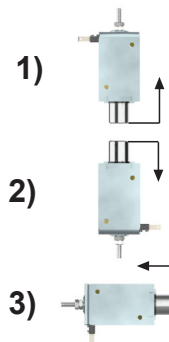
$Effective\ force = Magnetic\ force + Plunger\ weight$

-When the solenoid pulls in horizontal position:

$Effective\ force = Magnetic\ force$

-For the units with incorporated return spring:

$Effective\ force = Magnetic\ force - Spring\ force \pm Plunger\ weight$



• **Important:**
The fixation screws do not have to exceed the wall of the magnetic body not to damage the coil



• Terminals placement with fixing holes as reference:



The mounting of the specification sheets is the standard one, under demand they can be mounted in the different positions shown above. It must be specified in the order. Under demand, terminals can be replaced by flying leads.

• ER series: Force-stroke Chart

Type	Stroke (mm)		Duty-cycle					Return Spring force (N)
			100%	40%	25%	15%	5%	
ER15/C	Beginning of stroke $s_1=5$	Magnetic force "F _m " (N)	0.3	0.5	0.8	1	2.5	-
	End of stroke $s_0=0$		4.9	7.9	9.8	12.2	16.5	-
ER20/C	Beginning of stroke $s_1=5$		0.8	2.1	2.8	4.1	6.8	0.25
	End of stroke $s_0=0$		2.6	4.9	6.2	7.7	11.2	0.44
ER21/C	Beginning of stroke $s_1=10$		1.3	2.3	3.1	4.1	6.2	0.2
	End of stroke $s_0=0$		1.8	2.9	3.8	5	7.4	0.4
ER25/C	Beginning of stroke $s_1=5$		2.5	5.4	7.5	10	17	0.29
	End of stroke $s_0=0$		7.1	17.3	21.3	24.4	31.9	0.65
ER30/C	Beginning of stroke $s_1=8$		2.9	5.6	7.8	11.4	19.7	0.59
	End of stroke $s_0=0$		7.7	12	13.8	21.5	35	1.57
ER30/CT	Beginning of stroke $s_1=8$		2.8	5.5	7.7	11.3	19.6	0.59
	End of stroke $s_0=0$		7.6	11.9	13.7	21.4	34.9	1.57
ER35/C	Beginning of stroke $s_1=12$		1.5	4,3	7.5	10.6	17.3	0.39
	End of strokes $s_0=0$		4.5	10.9	14.7	16.6	31	1.57
ER40/CT	Beginning of stroke $s_1=5$		2.9	6.5	13	16.5	43	-
	End of stroke $s_0=0$		26.1	41.5	68.4	74.5	121.8	-
ER45-05/C	Beginning of stroke $s_1=5$		0.1	6.3	10.6	14.4	35	3
	End of stroke $s_0=0$		59.9	113.3	160.6	192.5	234.5	3.62
ER45-15/C	Beginning of stroke $s_1=15$		3.3	7,3	10	15.5	27	1.76
	End of stroke $s_0=0$		9.3	20.8	31.9	45.3	71.3	3.62
ER48/T	Beginning of stroke $s_1=8$		9.1	19.5	26.7	32.5	45.1	-
	End of stroke $s_0=0$		36.2	42.8	48.4	50.4	65.4	-
ER50-15/C	Beginning of stroke $s_1=15$		6.7	13	16	23	37	1.76
	End of stroke $s_0=0$		22.5	41	52.7	67.9	99.3	3.62
ER50-15/CT	Beginning of stroke $s_1=15$		6.5	12.8	15.8	22.8	36.8	1.76
	End of stroke $s_0=0$		22.3	40.8	52.5	67.7	99.1	3.62
ER60-05/C	Beginning of stroke $s_1=5$		7	18	28	47	96	3.76
	End of stroke $s_0=0$		155	192	296	346	382	4.3
ER60-10/C	Beginning of stroke $s_1=10$		12	24	32	44	80	3.21
	End of stroke $s_0=0$		55.6	95.5	121.7	152.5	200.8	4.3
ER60-10/CT	Beginning of stroke $s_1=10$		11.6	23.6	31.6	43.6	79.6	3.21
	End of stroke $s_0=0$		55.1	95.1	121.3	152.1	200.4	4.3
ER60-20/C	Beginning of stroke $s_1=20$		9.2	16.7	21.5	28.5	50	2.12
	End of stroke $s_0=0$		27.2	60.5	87.7	103.6	150.2	4.3

The values of force-stroke and the return spring are in Newton (N), solenoid in horizontal position and without return spring.

• CUSTOMIZATION ER SERIES

The models described in the catalogue are standard and minimum manufacturing batches are not required. However, there is the possibility of customizing them to suit better customer's needs. See below some of the most common customizations.

If any modification is needed, please ask NAFSA about the possibility and the minimum manufacturing batch required.

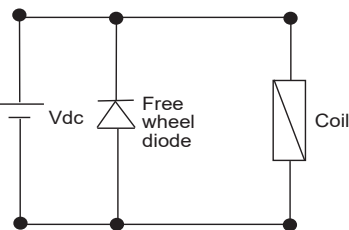
1. ELECTRICAL CUSTOMIZATION:

a) Integrated electronics over the coil:

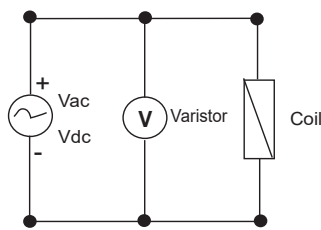
a.1) For peak suppression

Examples:

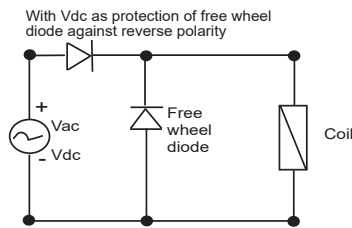
*Free wheel diode



*Varistor



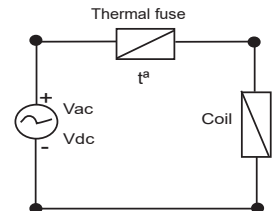
*Free wheel diode+second diode to protect the free wheel diode against reverse polarity



a.2) Thermal protection

Examples:

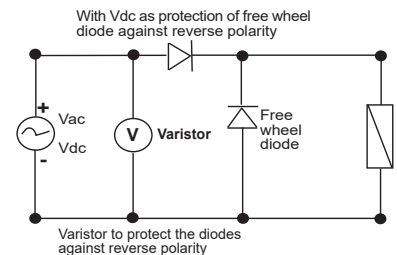
*The thermic resettable polyswitches are used in coils with low duty cycles against overheating, caused by long time under voltage and not respected the duty cycle times. It can be used also as timer.



a.3) For rectification

Examples:

*Half wave rectification, with free wheel diode and varistor input protection.



a.4) PWM electronics integration:

It consists on feeding the electromagnet through an electronic PWM (Pulse width modulation). This device will initially provide the solenoid with its nominal voltage and after a while, which will be higher than the one needed to complete it's stroke, the voltage entering to the solenoid will be reduced by the PWD to the selected ratio. For instance, the most common reduction ratio values are 1:2 or 1:3. Once the voltage is reduced it will be maintained in it's value until the supply to the solenoid is off, once off, the system resets and when the solenoid works again, the cycle is repeated.

The idea is to make the solenoid to be 100% duty-cycle, but with a big force when the stroke has to be done, the force of a reduced duty cycle, as per example 25%, so it can be feeded long as required but without the risk of burning.

The solution is used when the initial stroke force in a 100% duty-cycle solenoid isn't enough or in those cases where a lower heating of the solenoid is required. For example, a 12Vdc and ED100% solenoid can be feeded at 24VDC throught an PWM electronic and if it has 1:2 ratio, the solenoid will first see the 24VDC so it will complete the stroke with 4 times more power, so with the force of a 25% duty cycle, then when the voltage is reduced to 12VDC the duty cycle will be 100%.

b) Cable length modification and terminal or connector mounted over cables:

In all ER models terminals can be replaced by supply cables. The standard length of cables is 250mm, this dimension can be modified to customer requirement.

Likewise, many different kind of terminals or connectors may be added to the cables.

c) Intermediate duty-cycle manufacturing:

NAFSA can manufacture any intermediate duty-cycle from 0 to 100, but the viability depends on the model and the voltage associated with it. For any special requeriment, please ask NAFSA .

2. INSULATION CLASS CUSTOMIZATION:

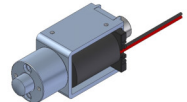
In the ER serie maximum insulation class can be obtained is F (155°C),

3. PROTECTION RATE IP (EN60529) CUSTOMIZATION:

Standard models are IP00, but IP40 can be obtained to the mechanical part and IP65 to the electrical part by coil overmolding process.

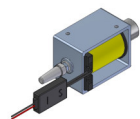
*PWD over coil

Example 1:
ER30CCREC

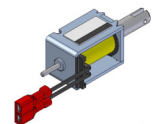


*PWD over the cables

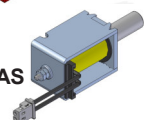
Example 2:



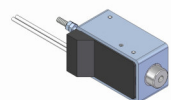
Example 3:
ER20CCF



Example 4:
ER20-07.01.CCSAS



Example 5:



NOTE: All this customizations cannot be applied to all models, ask NAFSA for each case.

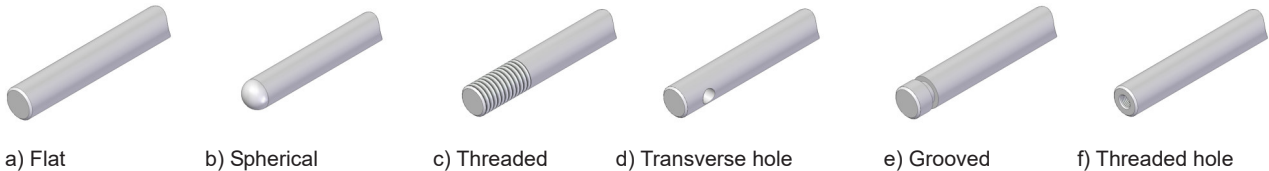
• CUSTOMIZATION ER SERIES

The models described in the catalogue are standard and minimum manufacturing batches are not required. However, there is the possibility of customizing them to suit better customer's needs. See below some of the most common customizations.

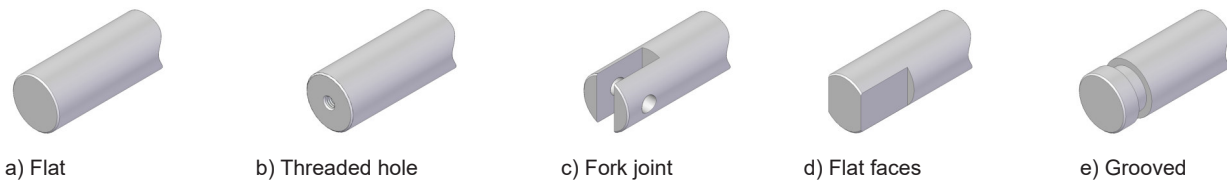
If any modification is needed, please ask NAFSA about the possibility and the minimum manufacturing batch required.

4. MECHANICAL CUSTOMIZATION:

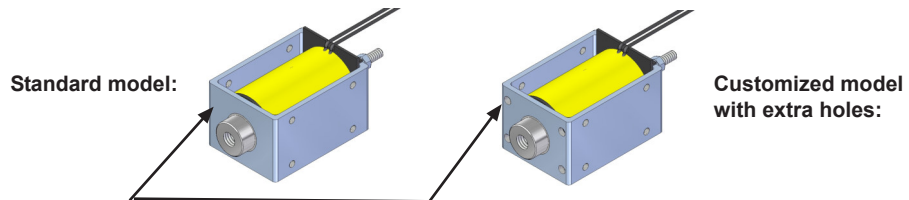
4.1) Shaft modifications: Length and shape can be modified. If it has not any function, it can be removed depending on the model, this would mean use exterior springs instead of internal ones.



4.2) Plunger modifications: Length and shape can be modified



4.3) Fixing holes modification:



4.4) Return spring force modification:

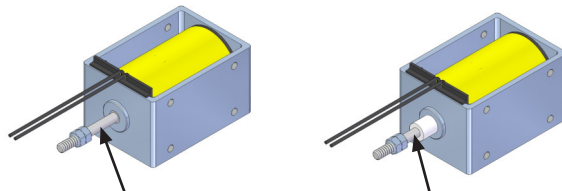
ER series electromagnets are linear simple effect solenoids, where the stroke movement from initial to the final position is made by electromagnetic forces, and the return to initial position takes place because of external forces or an incorporated spring (depending on the type). The force of the spring is limited to returning the plunger to the initial position. If more force is required, spring can be modified but we will have to take in mind the duty-cycle. Each duty-cycle has a limitation to increase the spring force, as this force will be deducted to the solenoid push/pull force.

In the cases that spring is not required, solenoid can be ordered without spring or it can be removed manually.

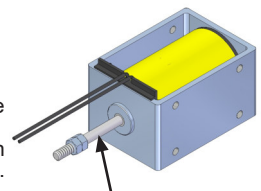
4.5) Stroke modifications:

The standard stroke is limited by the usefull length of shaft, in some cases the stroke can be modified: decreasing or increasing it in case that solenoid has enough ativation force. These modifications can be made by customer or NAFSA.

Example:
Stroke decrease:
Inserting a plastic bearing, this can be made by NAFSA or the customer

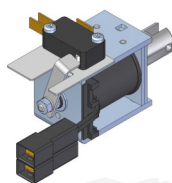


Example:
Stroke increase:
Shaft has been enlarged to increase the stroke, This modification only can be made by NAFSA.



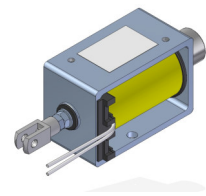
4.6) Position detection system integration:

Example:
ER45-10/BT1



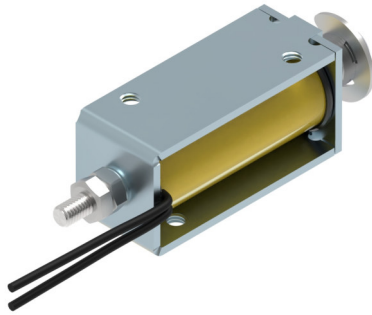
4.7) Fastening element added as Fork joints DIN71752:

Example:
ER45-10/E



NOTE: All this customizations cannot be applied to all models, ask NAFSA for each case.

ER 15/C TYPE



Protection rate: **IP00**
 Insulation class: **B (130°C)**
 Reference cycle: **2 minutes**
 Standard stroke (s): **5 mm**
 Temperature rise " ΔV_{31} ": **70°C**
 Working temperature: **-10 to 45°C**
 Work: **Push / Pull**

Release spring NOT
 incorporated on standard
 product

(ED) Duty-cycle ED(%)	100	40	25	15	5
(P20) Power at 20°C (W)	3	7.5	12	20	60
(Fm) Solenoid force (N) 1)	0.3	0.5	0.8	1	2.5
Max time under voltage(s)	Inf	48	30	18	6
Opening time (ms) 2)	30	28	26	26	25
Release time (ms) 3)	31	26	25	25	25
Plunger weight (Kg)	0.011				
Solenoid weight (Kg)	0.039				

1) Fm Solenoid force is given according to VDE0580 without deducting the spring force or the plunger weight if vertical mounting.

2) Time is given on these conditions: Coil supplied under nominal voltage ; Stabilized in it's working temperature ; Load 70% of the solenoid force ; Horizontal assembly ; Standard stroke initial position; 20°C ambient temperature.

3) Time is given on these conditions: without load on shaft ; Horizontal assembly ; Standard stroke initial position.

Duty-cycle ED%	Standard voltages										Under demand			
	VDC								VAC		VDC		VAC	
	6	12	24	48	100	125	205	110	230		Min	Max	Min	Max
100	o	o	o	o	x	x	x	x	x		3	55	x	x
40	o	o	o	o	x	x	x	x	x		3	85	x	x
25	o	o	o	o	o	x	x	x	x		3	105	x	x
15	o	o	o	o	o	o	x	x	x		6	135	x	x
5	o	o	o	o	o	o	o	x	x		6	230	x	x

Layout: o = Available ; x = Unavailable

- Voltage under demand:
 They can be manufactured at voltages between the maximum and minimum voltage values shown in the chart.

- The duty cycles described in the chart are standard, they can be manufactured in any intermediate value.

- If any customization from the original is needed, please ask us.

- Earthing is recommended if the metallic parts are accessible.

Ordering code: ER15/C --V ED---% - Mounting position

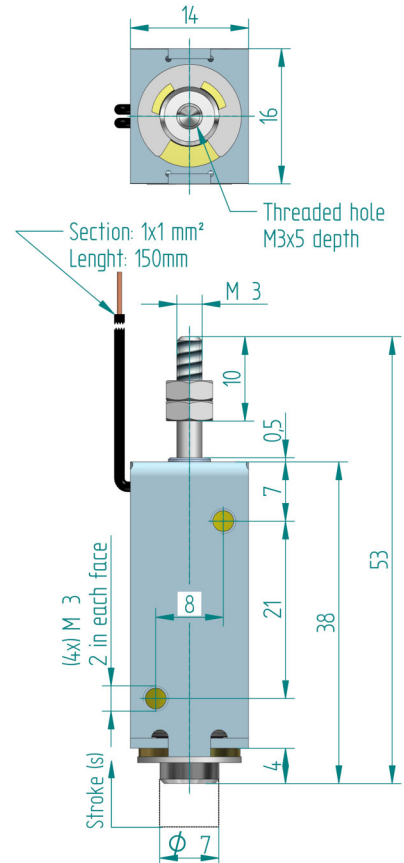


A Voltage: 24Vdc; Duty cycle: ED100%; Mounting position A:
 ER15/C 24Vdc ED100% A

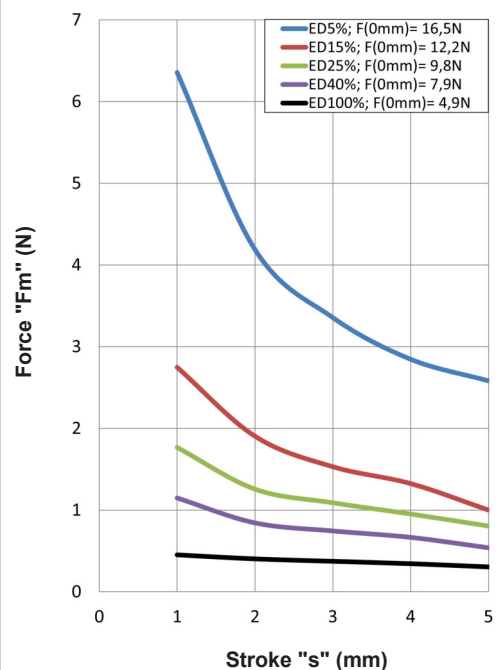


B Voltage: 48Vdc; Duty cycle: ED15%; Mounting position B:
 ER15/C 48Vdc ED15% B

Solenoid under voltage (s=0mm position)



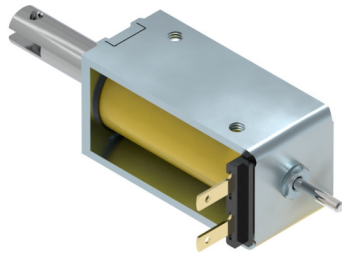
Force-stroke curve



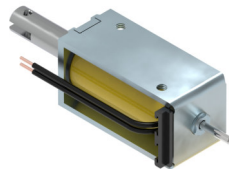
Calculation of the effective force:
 see pages 1 and 10.

For fixation and mounting positions: see page 10

ER 21/C TYPE



Cables version:
● ER21/CC



s = 1x0.22mm²
L = 250mm

Protection rate: **IP00**
Insulation class: **B (130°C)**
Reference cycle: **2 minutes**
Standard stroke (s): **10 mm**
Temperature rise "ΔV₃₁": **70°C**
Working temperature: **-10 to 45°C**
Work: **Push / Pull**

Release spring will be incorporated by defect

Standard spring force:
Fs(s=0mm) = 0.4N
Fs(s=10mm) = 0.2N

(ED) Duty-cycle ED(%)	100	40	25	15	5
(P20) Power at 20°C (W)	6	14	24	35	100
(Fm) Solenoid force (N) 1)	1.3	2.3	3.1	4.1	6.2
Max time under voltage(s)	Inf	48	30	18	6
Opening time (ms) 2)	47	39	39	36	36
Release time (ms) 3)	35	31	31	29	29
Plunger weight (Kg)	0.012				
Solenoid weight (Kg)	0.062				

1) Fm Solenoid force is given according to VDE0580 without deducting the spring force or the plunger weight if vertical mounting.

2) Time is given on these conditions: Coil supplied under nominal voltage ; Stabilized in it's working temperature ; Load 70% of the solenoid force ; Horizontal assembly ; Standard stroke initial position ; 20°C ambient temperature.

3) Time is given on these conditions: Standard spring ; without load on shaft ; Horizontal assembly ; Standard stroke initial position.

Duty-cycle ED%	Standard voltages										Under demand			
	VDC								VAC		VDC		VAC	
	6	12	24	48	100	125	205	110	230		Min	Max	Min	Max
100	o	o	o	o	o	x	x	x	x		3	110	x	x
40	o	o	o	o	o	o	x	x	x		4	165	x	x
25	o	o	o	o	o	o	o	x	x		5	220	x	x
15	o	o	o	o	o	o	o	x	x		6	230	x	x
5	x	o	o	o	o	o	o	x	x		9	230	x	x

Layout: o = Available ; x = Unavailable

- Voltage under demand:
They can be manufactured at voltages between the maximum and minimum voltage values shown in the chart.

- The duty cycles described in the chart are standard, they can be manufactured in any intermediate value.

- If any customization from the original is needed, please ask us.

- Earthing is recommended if the metallic parts are accessible.

Ordering code: ER21/C --V ED---% - Mounting position - Spring



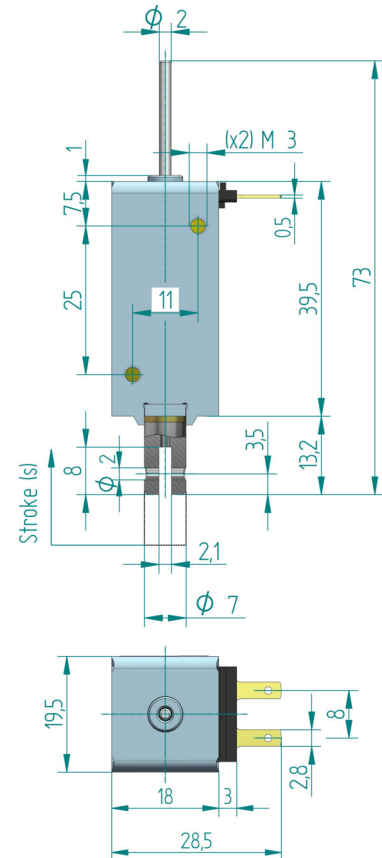
A Voltage: 24Vdc; Duty cycle: ED100%; Position A; With spring:
ER21/C 24Vdc ED100% A RS



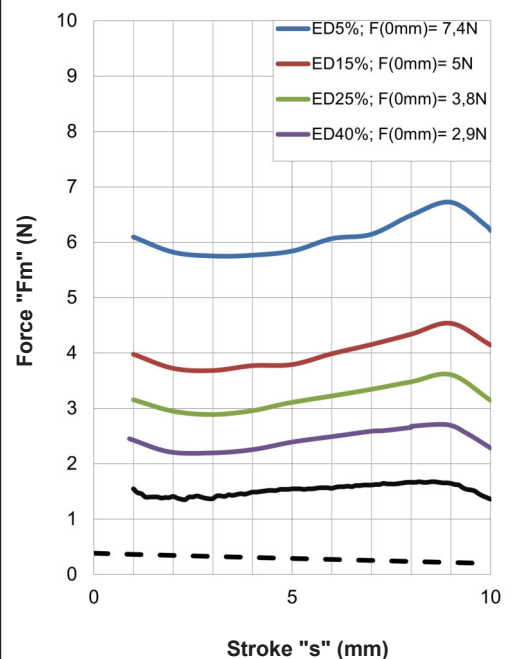
B Voltage: 12Vdc; Duty cycle: ED15%; Position B; Without spring:
ER21/C 12Vdc ED15% B RN

Spring yes: **RS** ; Spring no: **RN**

Solenoid under voltage (s=0mm position)



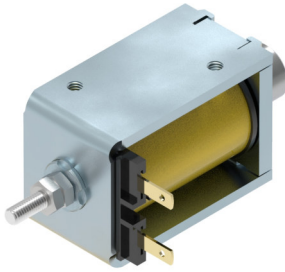
Force-stroke curve



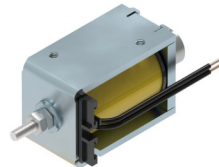
Calculation of the effective force:
see pages 1 and 10

For fixation and mounting positions: see page 10

• ER 25/C TYPE



Cables version:
• ER25/CC



$s = 1 \times 0.22 \text{ mm}^2$
 $L = 250 \text{ mm}$

Protection rate: **IP00**
Insulation class: **B (130°C)**
Reference cycle: **3 minutes**
Standard stroke (s): **5 mm**
Temperature rise " ΔV_{31} ": **70°C**
Working temperature: **-10 to 45°C**
Work: **Push / Pull**

Release spring will be incorporated by defect

Standard spring force:
 $F_s(s=0 \text{ mm}) = 0.65 \text{ N}$
 $F_s(s=5 \text{ mm}) = 0.29 \text{ N}$

(ED) Duty-cycle ED(%)	100	40	25	15	5
(P20) Power at 20°C (W)	7.5	17	25	38	95
(Fm) Solenoid force (N) 1)	2.5	5.4	7.5	10	17
Max time under voltage(s)	Inf	72	45	27	9
Opening time (ms) 2)	50	40	37	37	35
Release time (ms) 3)	34	28	26	26	25
Plunger weight (Kg)	0.015				
Solenoid weight (Kg)	0.085				

1) Fm Solenoid force is given according to VDE0580 without deducting the spring force or the plunger weight if vertical mounting.

2) Time is given on these conditions: Coil supplied under nominal voltage ; Stabilized in it's working temperature ; Load 70% of the solenoid force ; Horizontal assembly ; Standard stroke initial position; 20°C ambient temperature.

3) Time is given on these conditions: Standard spring ; without load on shaft ; Horizontal assembly ; Standard stroke initial position.

Duty-cycle ED%	Standard voltages										Under demand			
	VDC								VAC		VDC		VAC	
	6	12	24	48	100	125	205	110	230	Min	Max	Min	Max	
100	o	o	o	o	o	o	x	x	x	3	140	x	x	
40	o	o	o	o	o	o	o	x	x	5	220	x	x	
25	o	o	o	o	o	o	o	x	x	5	230	x	x	
15	o	o	o	o	o	o	o	x	x	6	230	x	x	
5	x	o	o	o	o	o	o	x	x	9	230	x	x	

Layout: o = Available ; x = Unavailable

- Voltage under demand:
They can be manufactured at voltages between the maximum and minimum voltage values shown in the chart.

- The duty cycles described in the chart are standard, they can be manufactured in any intermediate value.

- If any customization from the original is needed, please ask us.

- Earthing is recommended if the metallic parts are accessible.

Ordering code: ER25/C --V ED---% - Mounting position - Spring



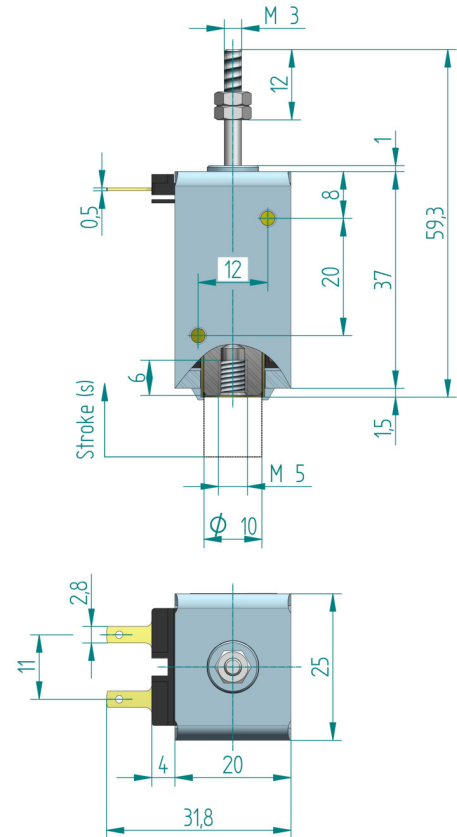
Voltage: 24Vdc; Duty cycle: ED100%; Position A; With spring:
ER25/C 24Vdc ED100% A RS



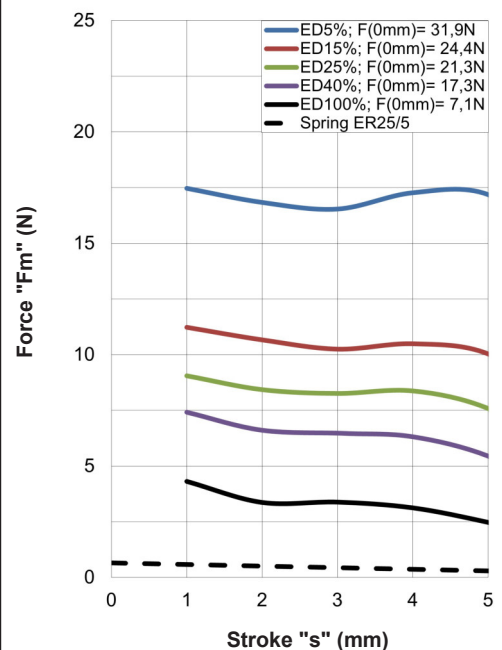
Voltage: 48Vdc; Duty cycle: ED15%; Position B; Without spring:
ER25/C 48Vdc ED15% B RN

Spring yes: RS ; Spring no: RN

Solenoid under voltage (s=0mm position)



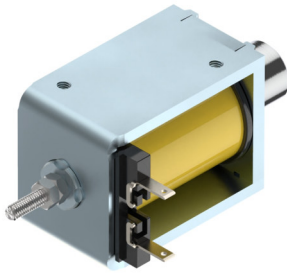
Force-stroke curve



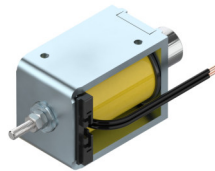
Calculation of the effective force:
see pages 1 and 10

For fixation and mounting positions: see page 10

ER 30/C TYPE



Cables version:
● ER30/CC



s = 1x0.5mm²
L = 250mm

Protection rate: **IP00**
Insulation class: **B (130°C)**
Reference cycle: **3 minutes**
Standard stroke (s): **8 mm**
Temperature rise "ΔV₃₁": **70°C**
Working temperature: **-10 to 45°C**
Work: **Push / Pull**

Release spring will be incorporated by defect

Standard spring force:
Fs(s=0mm) = 1.6N
Fs(s=8mm) = 0.6N

(ED) Duty-cycle ED(%)	100	40	25	15	5
(P20) Power at 20°C (W)	8	20	30	50	120
(Fm) Solenoid force (N) 1)	2.9	5.6	7.8	11.4	19.7
Max time under voltage(s)	Inf	72	45	27	9
Opening time (ms) 2)	64	51	49	46	46
Release time (ms) 3)	41	33	32	30	30
Plunger weight (Kg)	0.025				
Solenoid weight (Kg)	0.140				

1) Fm Solenoid force is given according to VDE0580 without deducting the spring force or the plunger weight if vertical mounting.

2) Time is given on these conditions: Coil supplied under nominal voltage ; Stabilized in it's working temperature ; Load 70% of the solenoid force ; Horizontal assembly ; Standard stroke initial position; 20°C ambient temperature.

3) Time is given on these conditions: Standard spring ; without load on shaft ; Horizontal assembly ; Standard stroke initial position.

Duty-cycle ED%	Standard voltages									Under demand				
	VDC								VAC		VDC		VAC	
	6	12	24	48	100	125	205	110	230	Min	Max	Min	Max	
100	o	o	o	o	o	o	x	o	o	3	230	24	230	
40	o	o	o	o	o	o	o	o	o	5	230	50	230	
25	o	o	o	o	o	o	o	o	o	6	230	75	230	
15	o	o	o	o	o	o	o	x	o	6	230	125	230	
5	x	o	o	o	o	o	o	x	x	9	230	x	x	

Layout: o = Available ; x = Unavailable

- Voltage under demand:
They can be manufactured at voltages between the maximum and minimum voltage values shown in the chart.

- To feed in alternating current the solenoid will have a rectifier incorporated in the coil.

- The duty cycles described in the chart are standard, they can be manufactured in any intermediate value.

- If any customization from the original is needed, please ask us.

- Earthing is recommended if the metallic parts are accessible.

Ordering code: ER30/C --V ED---% - Mounting position - Spring



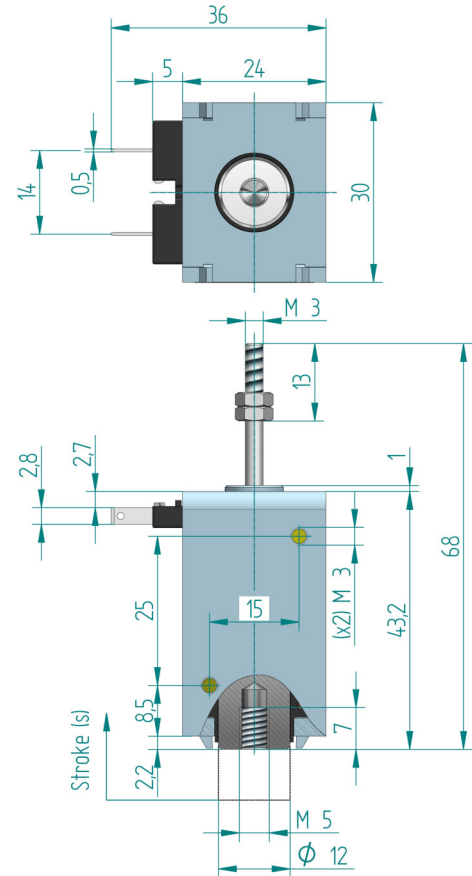
A Voltage: 24Vdc; Duty cycle: ED100%; Position A; With spring:
ER30/C 24Vdc ED100% A RS



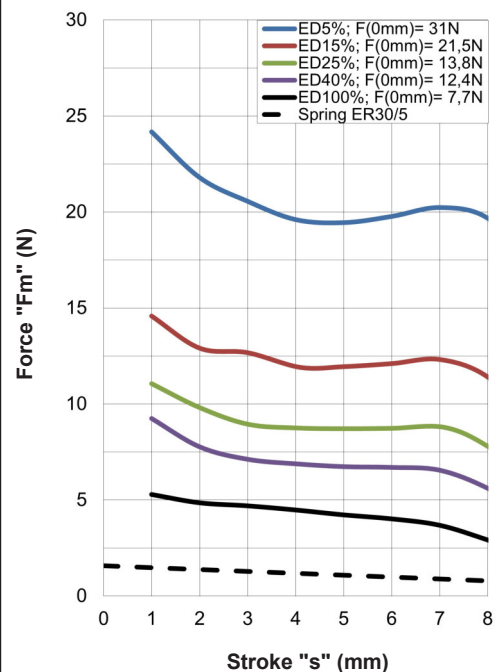
B Voltage: 48Vdc; Duty cycle: ED15%; Position B; Without spring:
ER30/C 48Vdc ED15% B RN

Spring yes: **RS** ; Spring no: **RN**

Solenoid under voltage (s=0mm position)



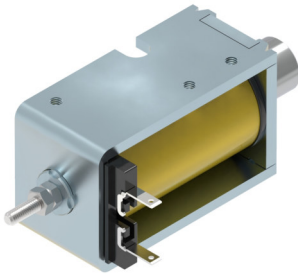
Force-stroke curve



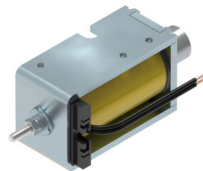
Calculation of the effective force:
see pages 1 and 10

For fixation and mounting positions: see page 10

ER 35/C TYPE



Cables version:
● ER35/CC



s = 1x0.5mm²
L = 250mm

Protection rate: **IP00**
Insulation class: **B (130°C)**
Reference cycle: **3 minutes**
Standard stroke (s): **12 mm**
Temperature rise "ΔV₃₁": **70°C**
Working temperature: **-10 to 45°C**
Work: **Push / Pull**

Release spring will be incorporated by defect

Standard spring force:
Fs(s=0mm) = 1.6N
Fs(s=8mm) = 0.4N

(ED) Duty-cycle ED(%)	100	40	25	15	5
(P20) Power at 20°C (W)	9	20	35	60	150
(Fm) Solenoid force (N) 1)	1.5	4.3	7.5	10.6	17.3
Max time under voltage(s)	Inf	72	45	27	9
Opening time (ms) 2)	71	56	55	50	48
Release time (ms) 3)	48	40	40	37	36
Plunger weight (Kg)	0.034				
Solenoid weight (Kg)	0.170				

1) Fm Solenoid force is given according to VDE0580 without deducting the spring force or the plunger weight if vertical mounting.

2) Time is given on these conditions: Coil supplied under nominal voltage ; Stabilized in its working temperature ; Load 70% of the solenoid force ; Horizontal assembly ; Standard stroke initial position ; 20°C ambient temperature.

3) Time is given on these conditions: Standard spring ; without load on shaft ; Horizontal assembly ; Standard stroke initial position.

Duty-cycle ED%	Standard voltages										Under demand			
	VDC								VAC		VDC		VAC	
	6	12	24	48	100	125	205	110	230		Min	Max	Min	Max
100	o	o	o	o	o	o	o	o	o		4	230	36	230
40	o	o	o	o	o	o	o	o	o		5	230	75	230
25	o	o	o	o	o	o	o	o	o		6	230	105	230
15	x	o	o	o	o	o	o	x	o		8	230	180	230
5	x	o	o	o	o	o	o	x	o		12	230	x	x

Layout: o = Available ; x = Unavailable

- Voltage under demand:
They can be manufactured at voltages between the maximum and minimum voltage values shown in the chart.

- To feed in alternating current the solenoid will have a rectifier incorporated in the coil.

- The duty cycles described in the chart are standard, they can be manufactured in any intermediate value.

- If any customization from the original is needed, please ask us.

- Earthing is recommended if the metallic parts are accessible.

Ordering code: ER35/C --V ED---% - Mounting position - Spring



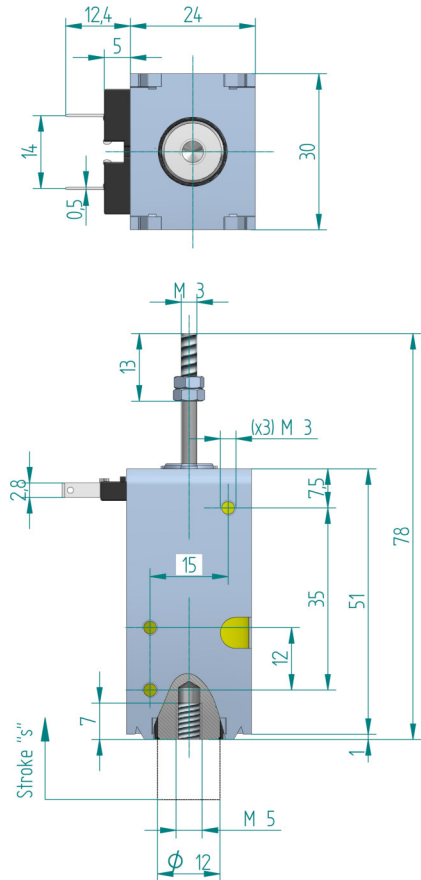
Voltage: 24Vdc; Duty cycle: ED100%; Position A; With spring:
ER35/C 24Vdc ED100% A RS



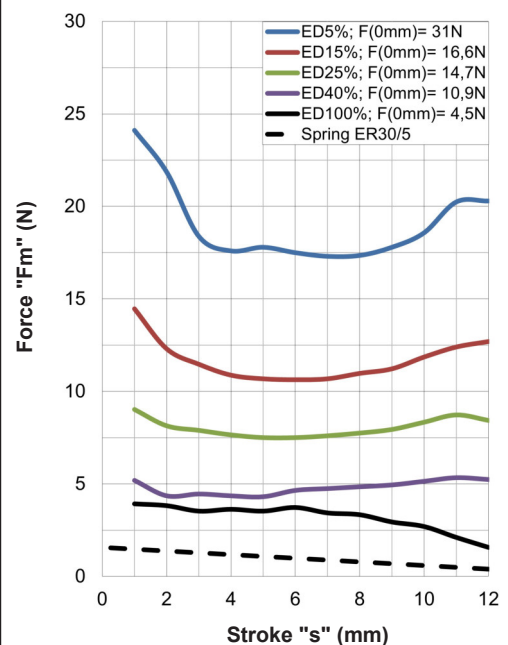
Voltage: 48Vdc; Duty cycle: ED15%; Position B; Without spring:
ER35/C 48Vdc ED15% B RN

Spring yes: RS ; Spring no: RN

Solenoid under voltage (s=0mm position)



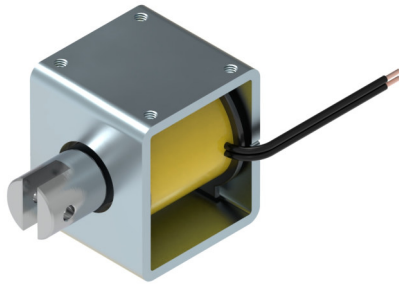
Force-stroke curve



Calculation of the effective force:
see pages 1 and 10

For fixation and mounting positions: see page 10

ER 40/CT TYPE



Protection rate: **IP00**
 Insulation class: **B (130°C)**
 Reference cycle: **3 minutes**
 Standard stroke (s): **15 mm**
 Temperature rise " ΔV_{31} ": **70°C**
 Working temperature: **-10 to 45°C**
 Work: **Pull**

Release spring NOT
 incorporated on standard
 product

(ED) Duty-cycle ED(%)	100	40	25	15	5
(P20) Power at 20°C (W)	13	27	44	76	218
(Fm) Solenoid force (N) 1)	2.9	6.5	13	16.5	43
Max time under voltage(s)	Inf	72	45	27	9
Opening time (ms) 2)	156	117	109	106	101
Release time (ms) 3)	103	81	76	75	72
Plunger weight (Kg)	0.065				
Solenoid weight (Kg)	0.368				

1) Fm Solenoid force is given according to VDE0580 without deducting the spring force or the plunger weight if vertical mounting.

2) Time is given on these conditions: Coil supplied under nominal voltage ; Stabilized in it's working temperature ; Load 70% of the solenoid force ; Horizontal assembly ; Standard stroke initial position; 20°C ambient temperature.

3) Time is given on these conditions: without load on shaft ; Horizontal assembly ; Standard stroke initial position.

Duty-cycle ED%	Standard voltages										Under demand			
	VDC								VAC		VDC		VAC	
	6	12	24	48	100	125	205	110	230		Min	Max	Min	Max
100	o	o	o	o	o	o	o	o	o		6	230	31	230
40	x	o	o	o	o	o	o	o	o		8	230	64	230
25	x	o	o	o	o	o	o	o	o		9	230	104	230
15	x	o	o	o	o	o	o	x	o		11	230	180	230
5	x	x	o	o	o	o	o	x	x		24	230	x	x

Layout: o = Available ; x = Unavailable

- Voltage under demand:
 They can be manufactured at voltages between the maximum and minimum voltage values shown in the chart.

- To feed in alternating current the solenoid will have a rectifier incorporated in the coil.

- The duty cycles described in the chart are standard, they can be manufactured in any intermediate value.

- If any customization from the original is needed, please ask us.

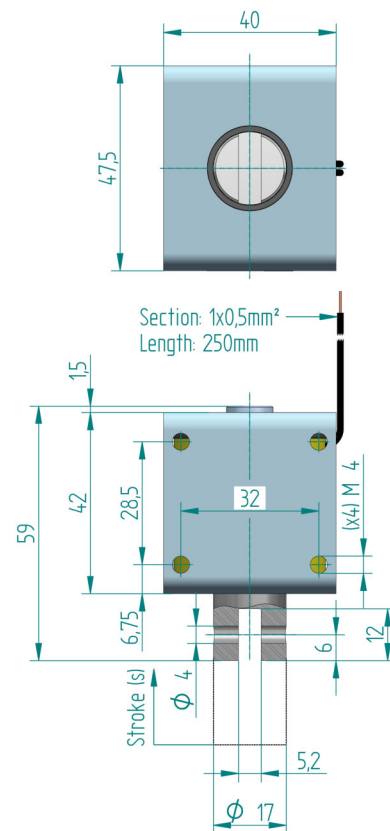
- Earthing is recommended if the metallic parts are accessible.

Ordering code: ER40/CT --V ED---%

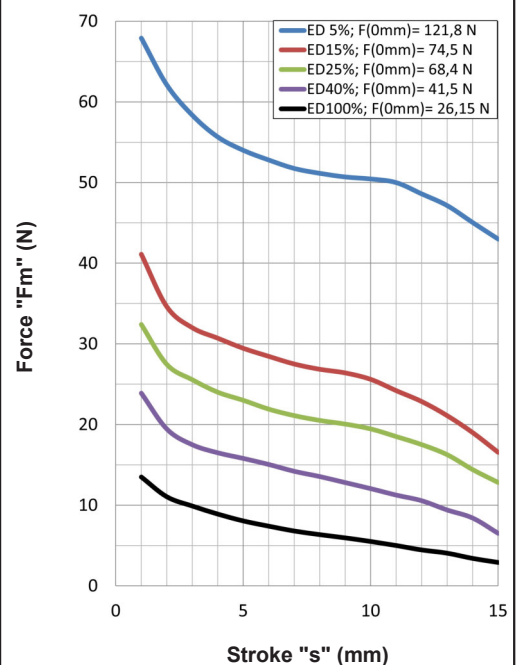
A Voltage: 24Vdc; Duty cycle: ED100%:
ER40/CT 24Vdc ED100%

B Voltage: 48Vdc; Duty cycle: ED15%:
ER40/CT 48Vdc ED15%

Solenoid under voltage (s=0mm position)



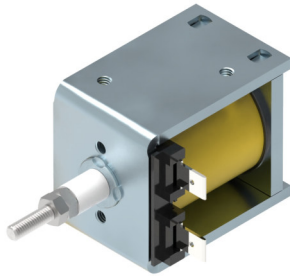
Force-stroke curve



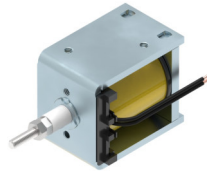
Calculation of the effective force:
 see pages 1 and 10

For fixation and mounting positions: see page 10

• ER 45-05/C TYPE



Cables version:
● ER45-05/CC



s = 1x0.5mm²
L = 250mm

Protection rate: **IP00**
Insulation class: **B (130°C)**
Reference cycle: **3 minutes**
Standard stroke (s): **5 mm**
Temperature rise "ΔV₃₁": **70°C**
Working temperature: **-10 to 45°C**
Work: **Push / Pull**

Release spring will be incorporated by defect

Standard spring force:
Fs(s=0mm) = 3.6N
Fs(s=5mm) = 3N

(ED) Duty-cycle ED(%)	100	40	25	15	5
(P20) Power at 20°C (W)	12	30	48	80	240
(Fm) Solenoid force (N) 1)	0.1	6.3	10.6	14.4	35
Max time under voltage(s)	Inf	72	45	27	9
Opening time (ms) 2)	127	75	72	70	70
Release time (ms) 3)	59	45	44	42	42
Plunger weight (Kg)	0.059				
Solenoid weight (Kg)	0.285				

1) Fm Solenoid force is given according to VDE0580 without deducting the spring force or the plunger weight if vertical mounting.

2) Time is given on these conditions: Coil supplied under nominal voltage ; Stabilized in its working temperature ; Load 70% of the solenoid force ; Horizontal assembly ; Standard stroke initial position ; 20°C ambient temperature.

3) Time is given on these conditions: Standard spring ; without load on shaft ; Horizontal assembly ; Standard stroke initial position.

Duty-cycle ED%	Standard voltages										Under demand			
	VDC										VDC		VAC	
	6	12	24	48	100	125	205	110	230		Min	Max	Min	Max
100	o	o	o	o	o	o	o	o	o	o	5	230	34	230
40	x	o	o	o	o	o	o	o	o	o	7	230	86	230
25	x	o	o	o	o	o	o	x	o	o	9	230	136	230
15	x	o	o	o	o	o	o	x	o	o	11	230	230	230
5	x	x	o	o	o	o	o	x	x	o	16	230	x	x

Layout: o = Available ; x = Unavailable

- Voltage under demand:
They can be manufactured at voltages between the maximum and minimum voltage values shown in the chart.

- To feed in alternating current the solenoid will have a rectifier incorporated in the coil.

- The duty cycles described in the chart are standard, they can be manufactured in any intermediate value.

- If any customization from the original is needed, please ask us.

- Earthing is recommended if the metallic parts are accessible.

Ordering code: ER45-05/C --V ED---% - Mounting position - Spring



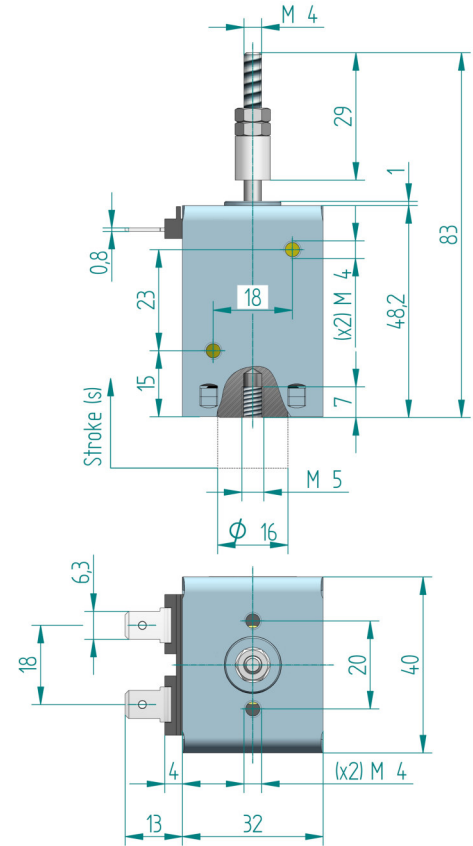
A Voltage: 24Vdc; Duty cycle: ED100%; Position A; With spring:
ER45-05/C 24Vdc ED100% A RS



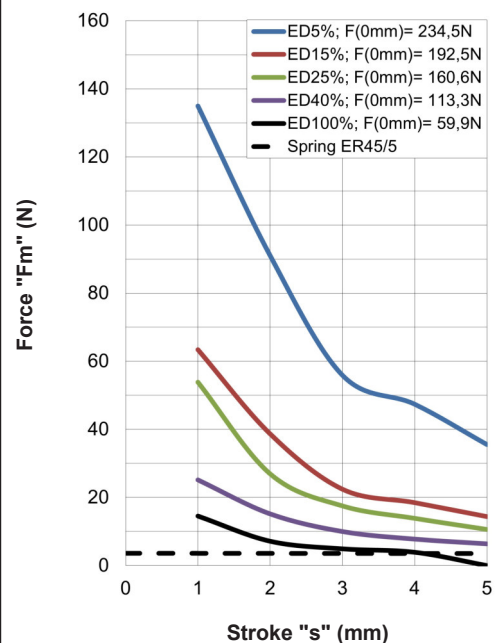
B Voltage: 48Vdc; Duty cycle: ED15%; Position B; Without spring:
ER45-05/C 48Vdc ED15% B RN

Spring yes: **RS** ; Spring no: **RN**

Solenoid under voltage (s=0mm position)



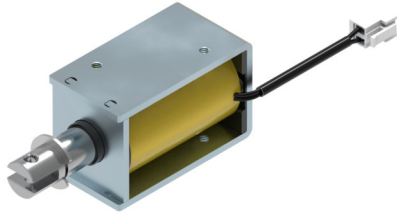
Force-stroke curve



Calculation of the effective force:
see pages 1 and 10

For fixation and mounting positions: see page 10

• ER 48/T TYPE



Protection rate: **IP00**
 Insulation class: **B (130°C)**
 Reference cycle: **3 minutes**
 Standard stroke (s): **8 mm**
 Temperature rise " ΔV_{31} ": **70°C**
 Working temperature: **-10 to 45°C**
 Work: **Pull**

Release spring NOT
 incorporated on standard
 product

(ED) Duty-cycle ED(%)	100	40	25	15	5
(P20) Power at 20°C (W)	15	35	54	89	271
(Fm) Solenoid force (N) 1)	9.1	19.5	26.7	32.5	45.1
Max time under voltage(s)	Inf	72	45	27	9
Opening time (ms) 2)	125	102	90	82	76
Release time (ms) 3)	83	69	62	57	53
Plunger weight (Kg)	0.066				
Solenoid weight (Kg)	0.292				

1) Fm Solenoid force is given according to VDE0580 without deducting the spring force or the plunger weight if vertical mounting.

2) Time is given on these conditions: Coil supplied under nominal voltage ; Stabilized in it's working temperature ; Load 70% of the solenoid force ; Horizontal assembly ; Standard stroke initial position; 20°C ambient temperature.

3) Time is given on these conditions: without load on shaft ; Horizontal assembly ; Standard stroke initial position.

Duty-cycle ED%	Standard voltages										Under demand			
	VDC								VAC		VDC		VAC	
	6	12	24	48	100	125	205	110	230		Min	Max	Min	Max
100	o	o	o	o	o	o	o	o	o		5	230	34	230
40	x	o	o	o	o	o	o	o	o		7	230	86	230
25	x	o	o	o	o	o	o	x	o		9	230	136	230
15	x	o	o	o	o	o	o	x	o		11	230	230	230
5	x	x	o	o	o	o	o	x	x		16	230	x	x

Layout: o = Available ; x = Unavailable

- Voltage under demand:
 They can be manufactured at voltages between the maximum and minimum voltage values shown in the chart.

- To feed in alternating current the solenoid will have a rectifier incorporated in the coil.

- The duty cycles described in the chart are standard, they can be manufactured in any intermediate value.

- If any customization from the original is needed, please ask us.

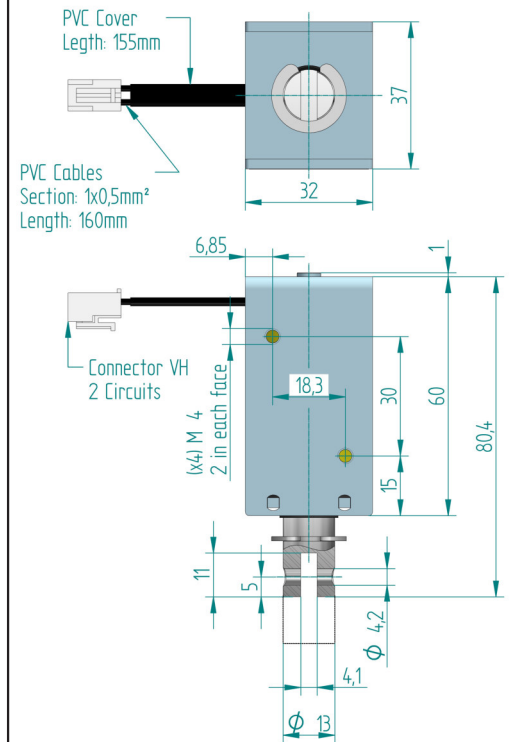
- Earthing is recommended if the metallic parts are accessible.

Ordering code: ER48/T --V ED---%

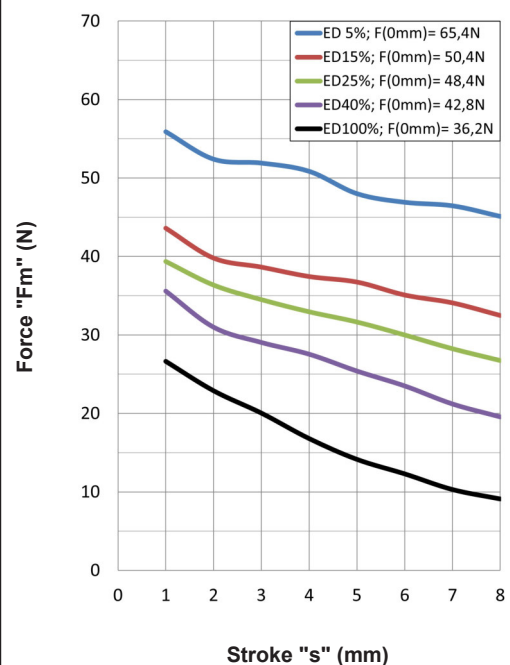
Voltage: 24Vdc; Duty cycle: ED100%:
 ER48/T 24Vdc ED100%

Voltage: 48Vdc; Duty cycle: ED15%:
 ER48/T 48Vdc ED15%

Solenoid under voltage (s=0mm position)



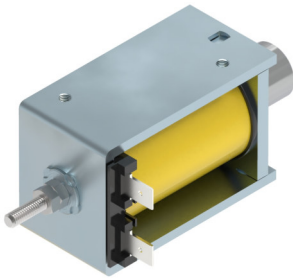
Force-stroke curve



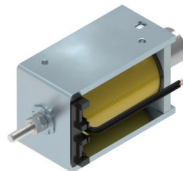
Calculation of the effective force:
 see pages 1 and 10

For fixation and mounting positions: see page 10

• ER 50-15/C TYPE



Cables version:
● ER50-15/CC



s = 1x0.5mm²
L = 250mm

Protection rate: **IP00**
Insulation class: **B (130°C)**
Reference cycle: **3 minutes**
Standard stroke (s): **15 mm**
Temperature rise "ΔV₃₁": **70°C**
Working temperature: **-10 to 45°C**
Work: **Push / Pull**

Release spring will be
incorporated by defect

Standard spring force:
Fs(s=0mm) = 3.6N
Fs(s=8mm) = 1.7N

(ED) Duty-cycle ED(%)	100	40	25	15	5
(P20) Power at 20°C (W)	14	35	56	93	280
(Fm) Solenoid force (N) 1)	6.7	13	16	23	37
Max time under voltage(s)	Inf	72	45	27	9
Opening time (ms) 2)	127	96	81	81	80
Release time (ms) 3)	82	62	53	53	53
Plunger weight (Kg)	0.071				
Solenoid weight (Kg)	0.365				

1) Fm Solenoid force is given according to VDE0580 without deducting the spring force or the plunger weight if vertical mounting.

2) Time is given on these conditions: Coil supplied under nominal voltage ; Stabilized in it's working temperature ; Load 70% of the solenoid force ; Horizontal assembly ; Standard stroke initial position; 20°C ambient temperature.

3) Time is given on these conditions: Standard spring ; without load on shaft ; Horizontal assembly ; Standard stroke initial position.

Duty-cycle ED%	Standard voltages										Under demand			
	VDC								VAC		VDC		VAC	
	6	12	24	48	100	125	205	110	230		Min	Max	Min	Max
100	o	o	o	o	o	o	o	o	o		6	230	41	230
40	x	o	o	o	o	o	o	o	o		9	230	100	230
25	x	o	o	o	o	o	o	x	o		11	230	160	230
15	x	x	o	o	o	o	o	x	o		15	230	230	230
5	x	x	o	o	o	o	o	x	x		24	230	x	x

Layout: o = Available ; x = Unavailable

- Voltage under demand:
They can be manufactured at voltages between the maximum and minimum voltage values shown in the chart.

- To feed in alternating current the solenoid will have a rectifier incorporated in the coil.

- The duty cycles described in the chart are standard, they can be manufactured in any intermediate value.

- If any customization from the original is needed, please ask us.

- Earthing is recommended if the metallic parts are accessible.

Ordering code: ER50-15/C --V ED---% - Mounting position - Spring



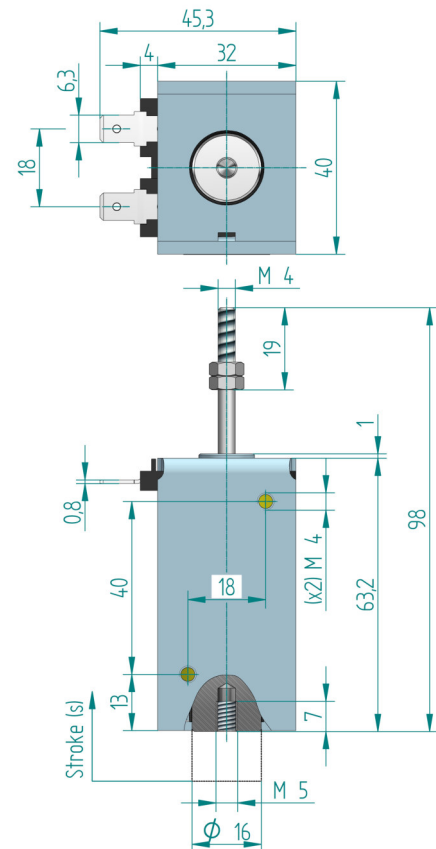
Voltage: 24Vdc; Duty cycle: ED100%; Position A; With spring:
ER50-15/C 24Vdc ED100% A RS



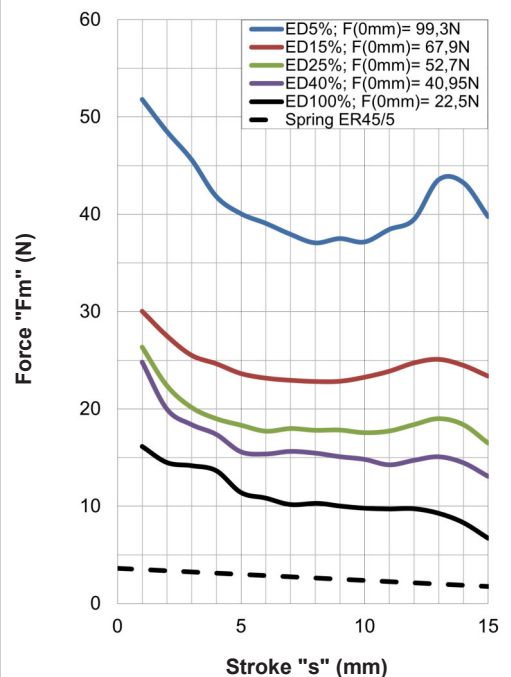
Voltage: 48Vdc; Duty cycle: ED15%; Position B; Without spring:
ER50-15/C 48Vdc ED15% B RN

Spring yes: RS ; Spring no: RN

Solenoid under voltage (s=0mm position)



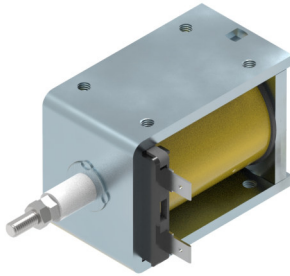
Force-stroke curve



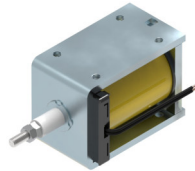
Calculation of the effective force:
see pages 1 and 10

For fixation and mounting positions: see page 10

• ER 60-05/C TYPE



Cables version:
• ER60-05/CC



s = 1x1mm²
L = 250mm

Protection rate: **IP00**
Insulation class: **B (130°C)**
Reference cycle: **5 minutes**
Standard stroke (s): **5 mm**
Temperature rise "ΔV₃₁": **70°C**
Working temperature: **-10 to 45°C**
Work: **Push / Pull**

Release spring will be incorporated by defect

Standard spring force:
Fs(s=0mm) = 4.3N
Fs(s=5mm) = 3.7N

(ED) Duty-cycle ED(%)	100	40	25	15	5
(P20) Power at 20°C (W)	18	45	70	110	280
(Fm) Solenoid force (N) 1)	7	18	28	47	96
Max time under voltage(s)	Inf	120	75	45	15
Opening time (ms) 2)	181	128	120	105	102
Release time (ms) 3)	111	80	75	66	65
Plunger weight (Kg)	0.117				
Solenoid weight (Kg)	0.650				

1) Fm Solenoid force is given according to VDE0580 without deducting the spring force or the plunger weight if vertical mounting.

2) Time is given on these conditions: Coil supplied under nominal voltage ; Stabilized in it's working temperature ; Load 70% of the solenoid force ; Horizontal assembly ; Standard stroke initial position; 20°C ambient temperature.

3) Time is given on these conditions: Standard spring ; without load on shaft ; Horizontal assembly ; Standard stroke initial position.

Duty-cycle ED%	Standard voltages									Under demand				
	VDC								VAC		VDC		VAC	
	6	12	24	48	100	125	205	110	230	Min	Max	Min	Max	
100	x	o	o	o	o	o	o	o	o	7	230	48	230	
40	x	o	o	o	o	o	o	x	o	11	230	125	230	
25	x	x	o	o	o	o	o	x	o	13	230	200	230	
15	x	x	o	o	o	o	o	x	x	16	230	x	x	
5	x	x	o	o	o	o	o	x	x	24	230	x	x	

Layout: o = Available ; x = Unavailable

- Voltage under demand:
They can be manufactured at voltages between the maximum and minimum voltage values shown in the chart.

- To feed in alternating current the solenoid will have a rectifier incorporated in the coil.

- The duty cycles described in the chart are standard, they can be manufactured in any intermediate value.

- If any customization from the original is needed, please ask us.

- Earthing is recommended if the metallic parts are accessible.

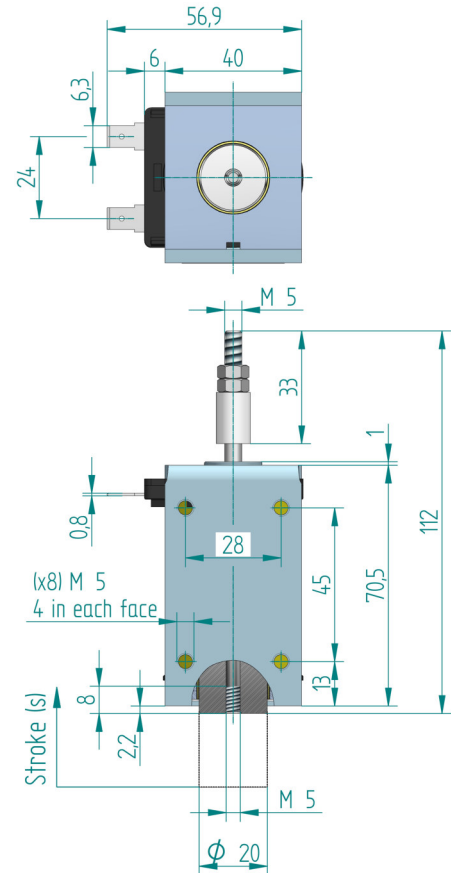
Ordering code: ER60-05/C --V ED---% - Spring

Voltage: 24Vdc; Duty cycle: ED100%; With spring:
ER60-05/C 24Vdc ED100% RS

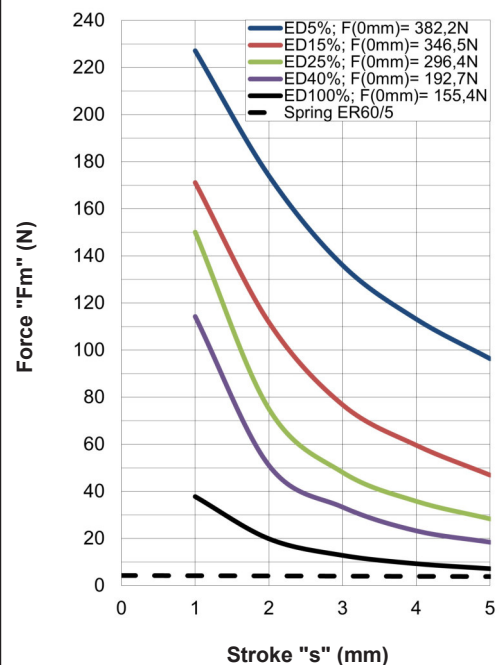
Voltage: 48Vdc; Duty cycle: ED15%; Without spring:
ER60-05/C 48Vdc ED15% RN

Spring yes: RS ; Spring no: RN

Solenoid under voltage (s=0mm position)



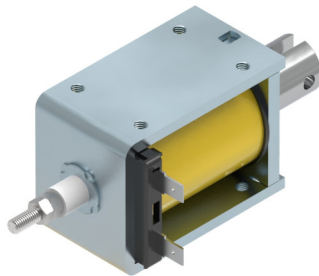
Force-stroke curve



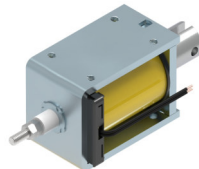
Calculation of the effective force:
see pages 1 and 10

For fixation and mounting positions: see page 10

• ER 60-10/CT TYPE



Cables version:
● ER60-10/CTC



s = 1x1mm²
L = 250mm

Protection rate: **IP00**
Insulation class: **B (130°C)**
Reference cycle: **5 minutes**
Standard stroke (s): **10 mm**
Temperature rise "ΔV₃₁": **70°C**
Working temperature: **-10 to 45°C**
Work: **Push / Pull**

Release spring will be incorporated by defect

Standard spring force:
Fs(s=0mm) = 4.3N
Fs(s=10mm) = 3.2N

(ED) Duty-cycle ED(%)	100	40	25	15	5
(P20) Power at 20°C (W)	18	45	70	110	280
(Fm) Solenoid force (N) 1)	11.6	23.6	31.6	43.6	79.6
Max time under voltage(s)	Inf	120	75	45	15
Opening time (ms) 2)	187	134	126	111	108
Release time (ms) 3)	119	87	83	74	72
Plunger weight (Kg)	0.148				
Solenoid weight (Kg)	0.681				

1) Fm Solenoid force is given according to VDE0580 without deducting the spring force or the plunger weight if vertical mounting.

2) Time is given on these conditions: Coil supplied under nominal voltage ; Stabilized in it's working temperature ; Load 70% of the solenoid force ; Horizontal assembly ; Standard stroke initial position; 20°C ambient temperature.

3) Time is given on these conditions: Standard spring ; without load on shaft ; Horizontal assembly ; Standard stroke initial position.

Duty-cycle ED%	Standard voltages									Under demand				
	VDC								VAC		VDC		VAC	
	6	12	24	48	100	125	205	110	230	Min	Max	Min	Max	
100	x	o	o	o	o	o	o	o	o	7	230	48	230	
40	x	o	o	o	o	o	o	x	o	11	230	125	230	
25	x	x	o	o	o	o	o	x	o	13	230	200	230	
15	x	x	o	o	o	o	o	x	x	16	230	x	x	
5	x	x	o	o	o	o	o	x	x	24	230	x	x	

Layout: o = Available ; x = Unavailable

- Voltage under demand:
They can be manufactured at voltages between the maximum and minimum voltage values shown in the chart.

- To feed in alternating current the solenoid will have a rectifier incorporated in the coil.

- The duty cycles described in the chart are standard, they can be manufactured in any intermediate value.

- If any customization from the original is needed, please ask us.

- Earthing is recommended if the metallic parts are accessible.

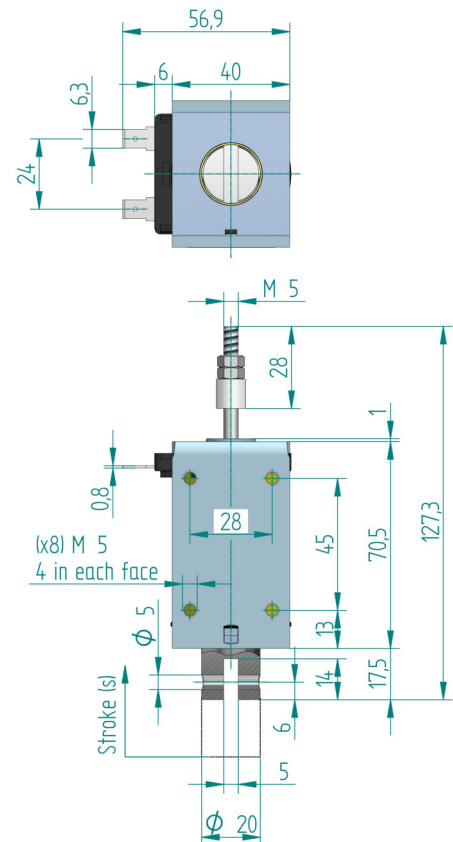
Ordering code: ER60-10/CT --V ED---% - Spring

Voltage: 24Vdc; Duty cycle: ED100%; With spring:
ER60-10/CT 24Vdc ED100% RS

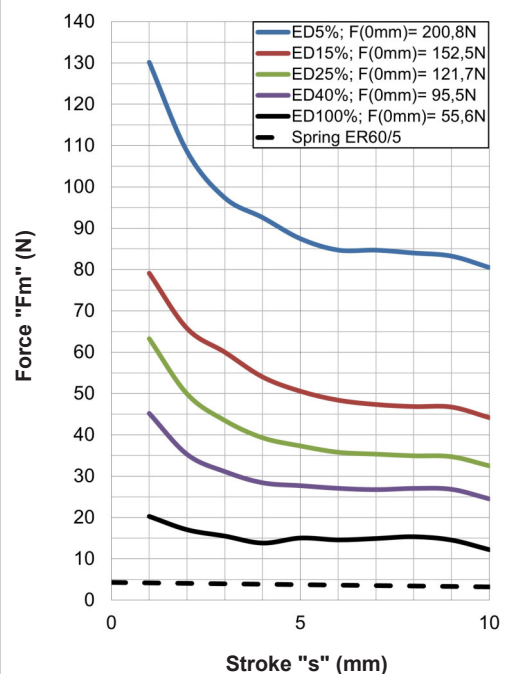
Voltage: 48Vdc; Duty cycle: ED15%; Without spring:
ER60-10/CT 48Vdc ED15% RN

Spring yes: RS ; Spring no: RN

Solenoid under voltage (s=0mm position)



Force-stroke curve

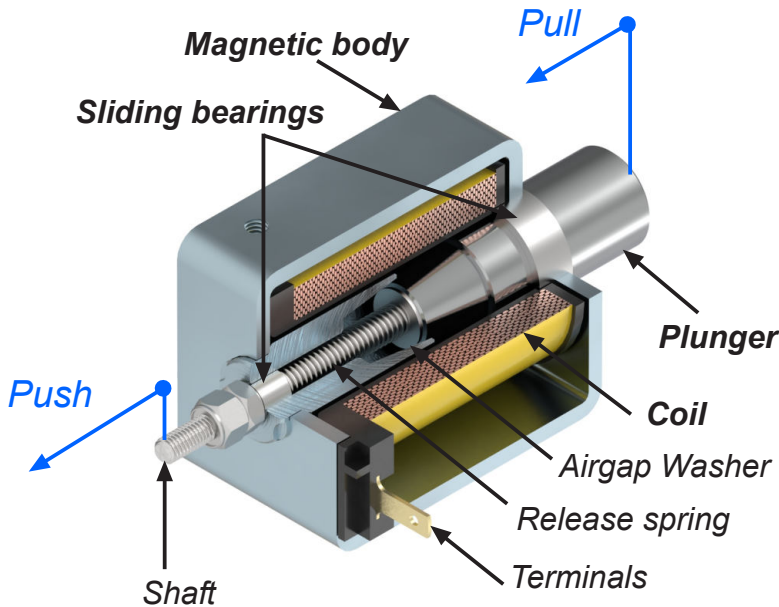


Calculation of the effective force:
see pages 1 and 10

For fixation and mounting positions: see page 10

• ERC SERIES

ERC serie electromagnets are simple effect linear solenoids where the stroke movement from initial to final position is made by electromagnetic forces, the return to initial position is made by external force or by a spring incorporated to the solenoid. They are similar to ER series but with a higher life expressed in number of cycle due to its guide made in friction bearing with teflon layer.



Structure, main basic elements:

Magnetic body:

It is the metal **carcase** containing the **coil**, the core and the fixing holes of the solenoid and the sliding bearings.

Coil:

It receives the electric energy to create the magnetic field.

Plunger:

It is the piece that moves inside the **coil**, and it has a non-magnetic **shaft** fixed to it.

To work pulling, the element to activate must be fixed to the **plunger**. To work pushing, the element to activate must be fixed to the **shaft**.

Sliding bearings:

They are the components which guide the plunger.

• Datasheet rated values conditions (According to DIN VDE 0580):

The values of the magnetic force (F_m) depending on the stroke, are obtained in the following conditions:

Room temperature = 35°C

Coil stabilized at its working temperature.

Rated voltage equal to 90% of the standard one.

Solenoid working in horizontal position.

Effective force (F_h) is obtained from magnetic force (F_m).

-When the solenoid pulls upwards:

$Effective\ force = Magnetic\ force - Plunger\ weight$

-When the solenoid pulls downwards:

$Effective\ force = Magnetic\ force + Plunger\ weight$

-When the solenoid pulls in horizontal position:

$Effective\ force = Magnetic\ force$

-For the units with incorporated return spring:

$Effective\ force = Magnetic\ force - Spring\ force \pm Plunger\ weight$

NOTE: When mounting position 3) slide bearings abrasion is bigger than mounting options 1) and 2)

• Terminals placement with fixing holes as reference:



Important:
The fixation screws do not have to exceed the wall of the magnetic body not to damage the coil



The mounting of the specification sheets is the standard one, under demand they can be mounted in the different positions shown above. It must be specified in the order. Under demand, terminals can be replaced by flying leads.

• ERC series: Force-stroke Chart

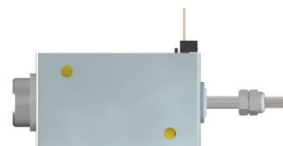
Type	Stroke (mm)		Duty-cycle					Return Spring force (N)
			100%	40%	25%	15%	5%	
ERC25-04/CC	Beginning of stroke $s_1=4$	Magnetic force "Fm" (N)	4.4	8.2	10.6	14	23	2
	End of stroke $s_0=0$		12.4	17.6	20.6	25.4	36.8	3.6
ERC30/C	Beginning of stroke $s_1=8$		3	6	9	12	21	0.6
	End of stroke $s_0=0$		10	15	19	24	35	1.6
ERC35/C	Beginning of stroke $s_1=12$		2.6	5.8	7.9	10.5	21	0.8
	End of stroke $s_0=0$		5.6	9.5	12.9	18	27.7	2
ERC45-50-15/C	Beginning of stroke $s_1=15$		4.5	9.3	12	16	32	1.8
	End of stroke $s_0=0$		16	33	42	50	83	3.6
ERC50-15/C	Beginning of stroke $s_1=15$		6.8	12.8	17	23	43	1.8
	End of stroke $s_0=0$		20	34	42	52	76	3.6
ERC60-10/C	Beginning of stroke $s_1=10$		19	33	43	56	94	3.2
	End of stroke $s_0=0$		81	119	140	160	191	4.3
ERC60-20/C	Beginning of stroke $s_1=20$		11	19	24	32	57	2.1
	End of stroke $s_0=0$		56	86	106	124	160	4.3

The values of force-stroke and the return spring are in Newton (N), solenoid in horizontal position and without return spring.

Beginning of stroke (s_1)



End of stroke (s_0)



• CUSTOMIZATION ERC SERIES

The models described in the catalogue are standard and minimum manufacturing batches are not required. However, there is the possibility of customizing them to suit better customer's needs. See below some of the most common customizations.

If any modification is needed, please ask NAFSA about the possibility and the minimum manufacturing batch required.

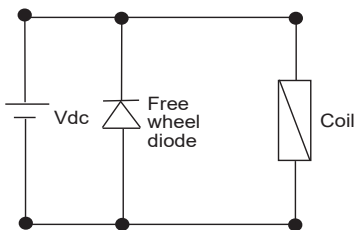
1. ELECTRICAL CUSTOMIZATION:

a) Integrated electronics over the coil:

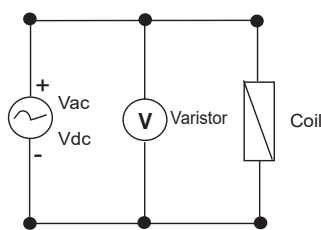
a.1) For peak suppression

Examples:

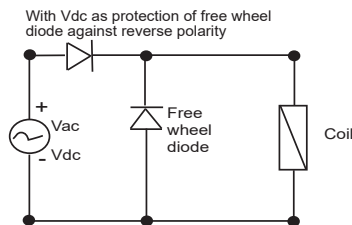
*Free wheel diode



*Varistor



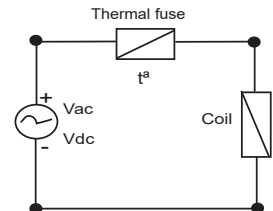
*Free wheel diode+second diode to protect the free wheel diode against reverse polarity



a.2) Thermal protection

Examples:

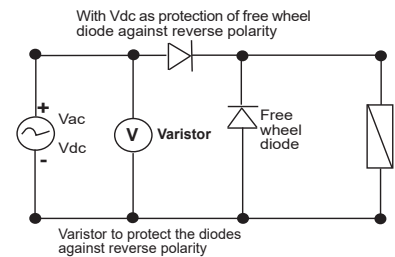
*The thermic resettable polyswitches are used in coils with low duty cycles against overheating, caused by long time under voltage and not respected the duty cycle times. It can be used also as timer.



a.3) For rectification

Examples:

*Half wave rectification, with free wheel diode and varistor input protection.



a.4) PWM electronics integration:

It consists on feeding the electromagnet through an electronic PWM (Pulse width modulation). This device will initially provide the solenoid with its nominal voltage and after a while, which will be higher than the one needed to complete its stroke, the voltage entering to the solenoid will be reduced by the PWD to the selected ratio. For instance, the most common reduction ratio values are 1:2 or 1:3. Once the voltage is reduced it will be maintained in its value until the supply to the solenoid is off, once off, the system resets and when the solenoid works again, the cycle is repeated.

The idea is to make the solenoid to be 100% duty-cycle, but with a big force when the stroke has to be done, the force of a reduced duty cycle, as per example 25%, so it can be feeded long as required but without the risk of burning.

The solution is used when the initial stroke force in a 100% duty-cycle solenoid isn't enough or in those cases where a lower heating of the solenoid is required. For example, a 12Vdc and ED100% solenoid can be feeded at 24VDC through an PWM electronic and if it has 1:2 ratio, the solenoid will first see the 24VDC so it will complete the stroke with 4 times more power, so with the force of a 25% duty cycle, then when the voltage is reduced to 12VDC the duty cycle will be 100%.

b) Cable length modification and terminal or connector mounted over cables:

In all ERC models terminals can be replaced by supply cables. The standard length of cables is 250mm, this dimension can be modified to customer requirement.

Likewise, many different kind of terminals or connectors may be added to the cables.

c) Intermediate duty-cycle manufacturing:

NAFSA can manufacture any intermediate duty-cycle from 0 to 100, but the viability depends on the model and the voltage associated with it. For any special requirement, please ask NAFSA.

2. INSULATION CLASS CUSTOMIZATION:

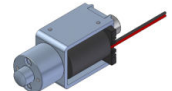
In the ER series maximum insulation class can be obtained is F (155°C),

3. PROTECTION RATE IP (EN60529) CUSTOMIZATION:

Standard models are IP00, but IP40 can be obtained to the mechanical part and IP65 to the electrical part by coil overmolding process.

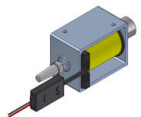
*PWD over coil

Example 1:

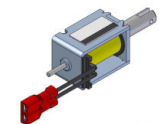


*PWD over the cables

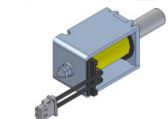
Example 2:



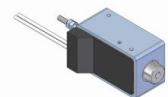
Example 3:



Example 4:



Example 5:



NOTE: All this customizations cannot be applied to all models, ask NAFSA for each case.

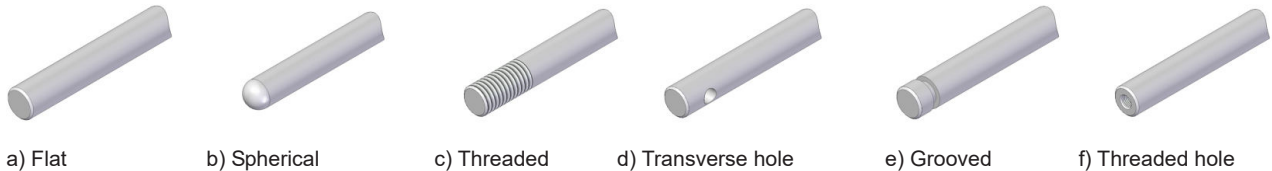
• CUSTOMIZATION ERC SERIES

The models described in the catalogue are standard and minimum manufacturing batches are not required. However, there is the possibility of customizing them to suit better customer's needs. See below some of the most common customizations.

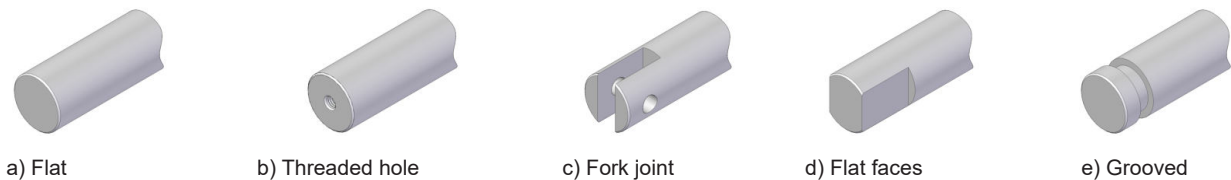
If any modification is needed, please ask NAFSA about the possibility and the minimum manufacturing batch required.

4. MECHANICAL CUSTOMIZATION:

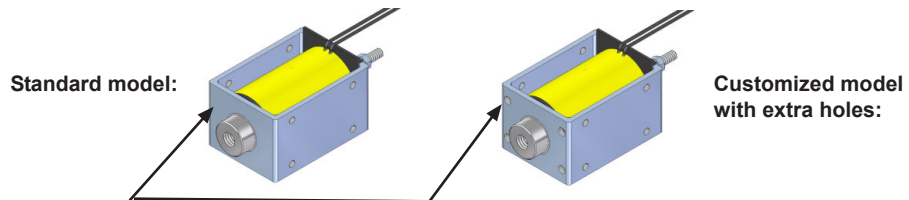
4.1) Shaft modifications: Length and shape can be modified. If it has not any function, it can be removed depending on the model, this would mean use exterior springs instead of internal ones.



4.2) Plunger modifications: Length and shape can be modified



4.3) Fixing holes modification:



4.4) Return spring force modification:

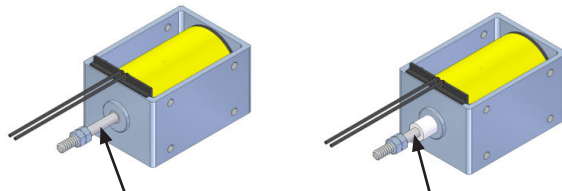
ER series electromagnets are linear simple effect solenoids, where the stroke movement from initial to the final position is made by electromagnetic forces, and the return to initial position takes place because of external forces or an incorporated spring (depending on the type). The force of the spring is limited to returning the plunger to the initial position. If more force is required, spring can be modified but we will have to take in mind the duty-cycle. Each duty-cycle has a limitation to increase the spring force, as this force will be deducted to the solenoid push/pull force.

In the cases that spring is not required, solenoid can be ordered without spring or it can be removed manually.

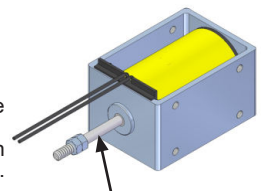
4.5) Stroke modifications:

The standard stroke is limited by the usefull length of shaft, in some cases the stroke can be modified: decreasing or increasing it in case that solenoid has enough ativation force. These modifications can be made by customer or NAFSA.

Example:
Stroke decrease:
Inserting a plastic bearing, this can be made by NAFSA or the customer

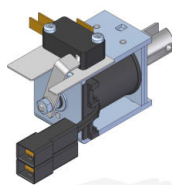


Example:
Stroke increase:
Shaft has been enlarged to increase the stroke, This modification only can be made by NAFSA.



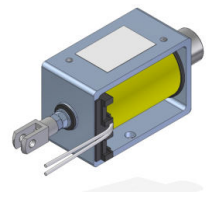
4.6) Position detection system integration:

Example:



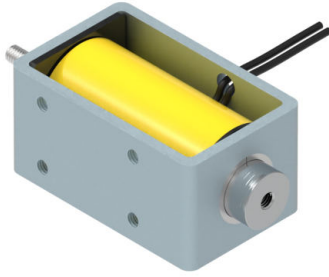
4.7) Fastening element added as Fork joints DIN71752:

Example:

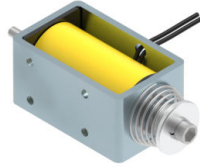


NOTE: All this customizations cannot be applied to all models, ask NAFSA for each case.

ERC 25-04/CC TYPE



Outer spring version:
● ERC25-04/CC RS



$F_s(s=0\text{mm}) = 3.6 \text{ N}$
 $F_s(s=4\text{mm}) = 2 \text{ N}$

Inner spring version:
● ERC25-04/CC RSI

Standard spring force:
 $F_s(s=0\text{mm}) = 0.85 \text{ N}$
 $F_s(s=4\text{mm}) = 0.55 \text{ N}$

Protection rate: **IP00**
Insulation class: **B (130°C)**
Reference cycle: **3 minutes**
Standard stroke (s): **4 mm**
Temperature rise " ΔV_{31} ": **70°C**
Working temperature: **-10 to 45°C**
Work: **Push / Pull**

(ED) Duty-cycle ED(%)	100	40	25	15	5
(P20) Power at 20°C (W)	6.3	15	25	40	123
(Fm) Solenoid force (N) 1)	4.3	8.2	10.6	14	23
Max time under voltage(s)	Inf	72	45	27	9
Opening time (ms) 2)	43	35	33	30	28
Release time (ms) 3)	25	20	19	17	16
Plunger weight (Kg)	0.020				
Solenoid weight (Kg)	0.110				

1) Fm Solenoid force is given according to VDE0580 without deducting the spring force or the plunger weight if vertical mounting.

2) Time is given on these conditions: Coil supplied under nominal voltage ; Stabilized in its working temperature ; Load 70% of the solenoid force ; Horizontal assembly ; Standard stroke initial position; 20°C ambient temperature.

3) Time is given on these conditions: without load on shaft ; Horizontal assembly ; Standard stroke initial position.

Duty-cycle ED%	Standard voltages										Under demand			
	VDC										VDC		VAC	
	6	12	24	48	100	125	205	110	230		Min	Max	Min	Max
100	o	o	o	o	o	o	o	o	o	o	3	200	24	230
40	o	o	o	o	o	o	o	o	o	o	3	230	50	230
25	o	o	o	o	o	o	o	o	o	o	3	230	75	230
15	o	o	o	o	o	o	o	o	o	o	3	230	125	230
5	x	o	o	o	o	o	o	o	o	o	9	230	x	x

Layout: o = Available ; x = Unavailable

- Voltage under demand:
They can be manufactured at voltages between the maximum and minimum voltage values shown in the chart.

- To feed in alternating current the solenoid will have a rectifier incorporated in the coil.

- The duty cycles described in the chart are standard, they can be manufactured in any intermediate value.

- If any customization from the original is needed, please ask us.

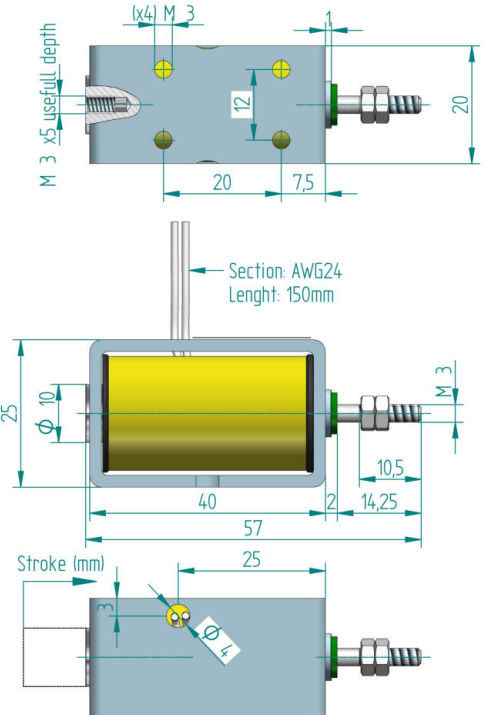
- Earthing is recommended if the metallic parts are accessible.

Ordering code: ERC25-04/CC --V ED---% - Spring

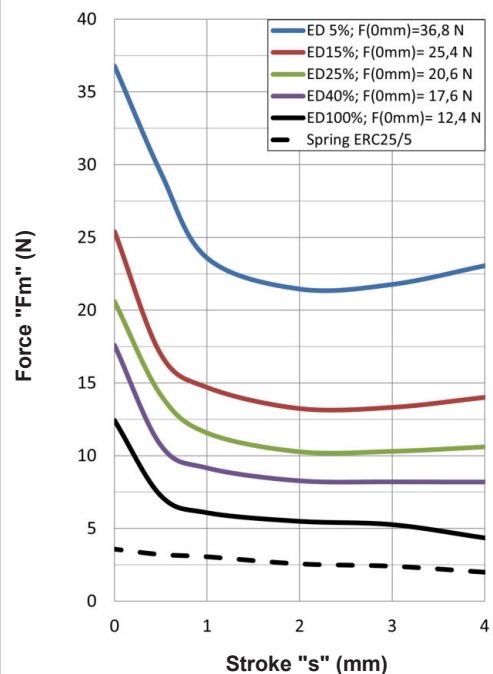
Voltage: 24Vdc; Duty cycle: ED100%; With spring:
ERC25-04/CC 24Vdc ED100% RS or ERC25-04/CC 24VDC ED100% RSI

Voltage: 48Vdc; Duty cycle: ED15%; Without spring:
ERC25-04/CC 48Vdc ED15% RN

Solenoid under voltage (s=0mm position)



Force-stroke curve

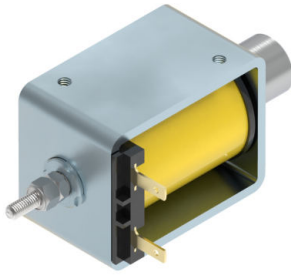


Calculation of the effective force:
see pages 1 and 31

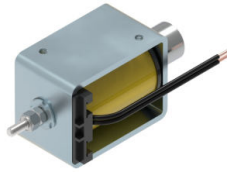
Outer spring yes: RS ; Inner spring yes: RSI ; Spring no: RN

For fixation and mounting positions: see page 31

• ERC 30/C TYPE



Cables version:
• ERC30/CC



s= 1x0.5mm²
L= 250mm

Protection rate: **IP00**
Insulation class: **B (130°C)**
Reference cycle: **3 minutes**
Standard stroke (s): **8 mm**
Temperature rise "ΔV₃₁": **70°C**
Working temperature: **-10 to 45°C**
Work: **Push / Pull**

Release spring will be incorporated by defect

Standard spring force:
Fs(s=0mm) = 1.6N
Fs(s=8mm) = 0.6N

(ED) Duty-cycle ED(%)	100	40	25	15	5
(P20) Power at 20°C (W)	8	20	30	50	120
(Fm) Solenoid force (N) 1)	3	6	9	12	21
Max time under voltage(s)	Inf	72	45	27	9
Opening time (ms) 2)	61	48	45	43	43
Release time (ms) 3)	41	33	32	30	30
Plunger weight (Kg)	0.025				
Solenoid weight (Kg)	0.130				

1) Fm Solenoid force is given according to VDE0580 without deducting the spring force or the plunger weight if vertical mounting.

2) Time is given on these conditions: Coil supplied under nominal voltage ; Stabilized in it's working temperature ; Load 70% of the solenoid force ; Horizontal assembly ; Standard stroke initial position; 20°C ambient temperature.

3) Time is given on these conditions: Standard spring ; without load on shaft ; Horizontal assembly ; Standard stroke initial position.

Duty-cycle ED%	Standard voltages										Under demand			
	VDC								VAC		VDC		VAC	
	6	12	24	48	100	125	205	110	230		Min	Max	Min	Max
100	o	o	o	o	o	o	x	o	o		3	230	24	230
40	o	o	o	o	o	o	o	o	o		5	230	50	230
25	o	o	o	o	o	o	o	o	o		6	230	75	230
15	o	o	o	o	o	o	o	x	o		6	230	125	230
5	x	o	o	o	o	o	o	x	o		9	230	x	x

Layout: o = Available ; x = Unavailable

- Voltage under demand:
They can be manufactured at voltages between the maximum and minimum voltage values shown in the chart.

- To feed in alternating current the solenoid will have a rectifier incorporated in the coil.

- The duty cycles described in the chart are standard, they can be manufactured in any intermediate value.

- If any customization from the original is needed, please ask us.

- Earthing is recommended if the metallic parts are accessible.

Ordering code: ERC30/C --V ED---% - Mounting position - Spring



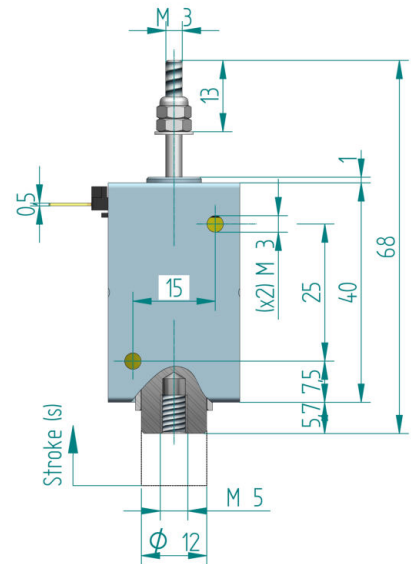
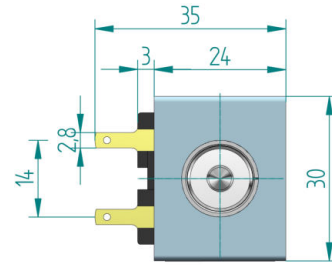
Voltage: 24Vdc; Duty cycle: ED100%; Position A; With spring:
ERC30/C 24Vdc ED100% A RS



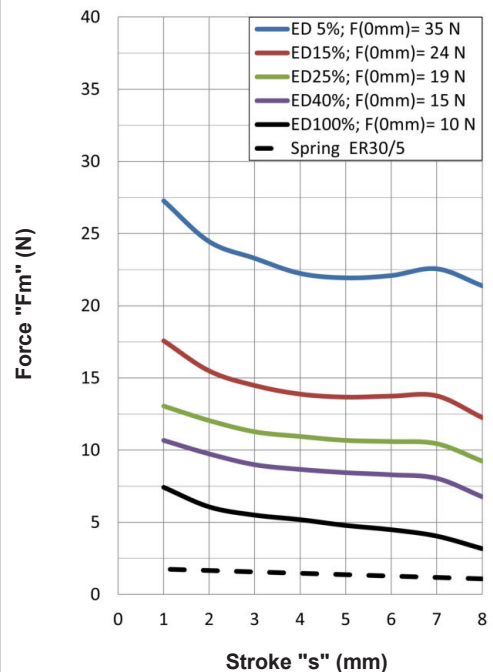
Voltage: 48Vdc; Duty cycle: ED15%; Position B; Without spring:
ERC30/C 12Vdc ED15% B RN

Spring yes: **RS** ; Spring no: **RN**

Solenoid under voltage (s=0mm position)



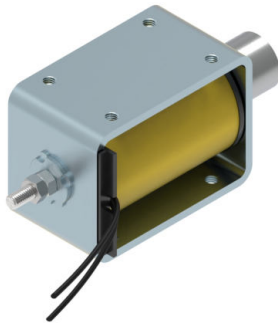
Force-stroke curve



Calculation of the effective force:
see pages 1 and 31

For fixation and mounting positions: see page 31

• ERC 60-20/C TYPE



Protection rate: **IP00**
 Insulation class: **B (130°C)**
 Reference cycle: **5 minutes**
 Standard stroke (s): **20 mm**
 Temperature rise " ΔV_{31} ": **70°C**
 Working temperature: **-10 to 45°C**
 Work: **Push / Pull**

Release spring will be incorporated by defect

Standard spring force:
 $F_s(s=0\text{mm}) = 4.3\text{N}$
 $F_s(s=20\text{mm}) = 2.1\text{N}$

(ED) Duty-cycle ED(%)	100	40	25	15	5
(P20) Power at 20°C (W)	18	45	70	110	280
(Fm) Solenoid force (N) 1)	11	19	24	32	57
Max time under voltage(s)	Inf	120	75	45	15
Opening time (ms) 2)	190	137	129	114	112
Release time (ms) 3)	124	93	88	79	78
Plunger weight (Kg)	0.110				
Solenoid weight (Kg)	0.660				

1) Fm Solenoid force is given according to VDE0580 without deducting the spring force or the plunger weight if vertical mounting.

2) Time is given on these conditions: Coil supplied under nominal voltage ; Stabilized in its working temperature ; Load 70% of the solenoid force ; Horizontal assembly ; Standard stroke initial position; 20°C ambient temperature.

3) Time is given on these conditions: Standard spring ; without load on shaft ; Horizontal assembly ; Standard stroke initial position.

Duty-cycle ED%	Standard voltages									Under demand				
	VDC								VAC		VDC		VAC	
	6	12	24	48	100	125	205	110	230	Min	Max	Min	Max	
100	x	o	o	o	o	o	o	o	o	7	230	48	230	
40	x	o	o	o	o	o	o	x	o	11	230	125	230	
25	x	x	o	o	o	o	o	x	o	13	230	200	230	
15	x	x	o	o	o	o	o	x	x	16	230	x	x	
5	x	x	o	o	o	o	o	x	x	24	230	x	x	

Layout: o = Available ; x = Unavailable

- Voltage under demand:
 They can be manufactured at voltages between the maximum and minimum voltage values shown in the chart.

- To feed in alternating current the solenoid will have a rectifier incorporated in the coil.

- The duty cycles described in the chart are standard, they can be manufactured in any intermediate value.

- If any customization from the original is needed, please ask us.

- Earthing is recommended if the metallic parts are accessible.

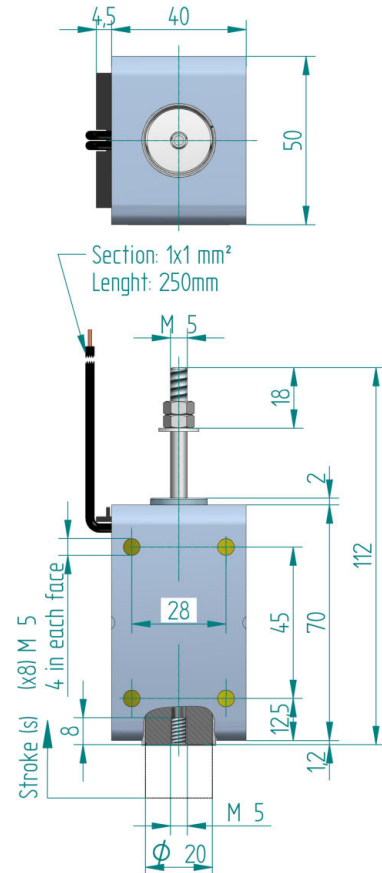
Ordering code: ERC60-20/C --V ED---% - Spring

Voltage: 24Vdc; Duty cycle: ED100%; With spring:
 ERC60-20/C 24Vdc ED100% RS

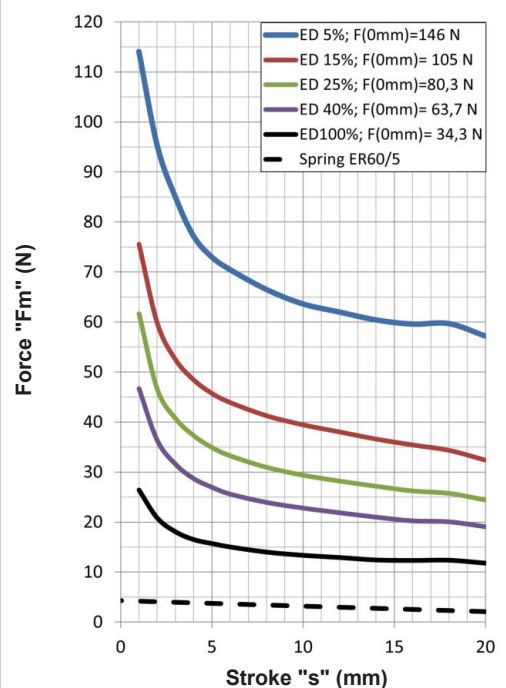
Voltage: 48Vdc; Duty cycle: ED15%; Without spring:
 ERC60-20/C 48Vdc ED15% RN

Spring yes: RS ; Spring no: RN

Solenoid under voltage (s=0mm position)



Force-stroke curve

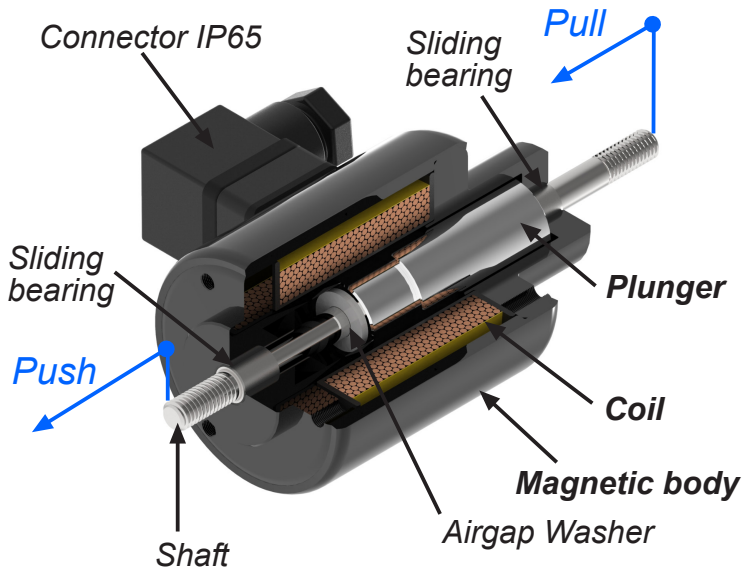


Calculation of the effective force:
 see pages 1 and 31

For fixation and mounting positions: see page 31

• ECH SERIES

ECH serie electromagnets are simple effect linear solenoids, where the stroke movement from initial to final position is made by the electromagnetic forces, the return to the initial position is made by external forces or by a spring which is incorporated to the solenoid (see specification sheet for each type).



Structure, main basic elements:

Magnetic body:

It is the metal **carcase** containing the **coil**, the core and the fixing holes of the solenoid.

Coil:

It receives the electric energy to create the magnetic field.

Plunger:

It is the piece that moves inside the **coil**, and it has a non-magnetic **shaft** fixed to it.

To work pulling, the element to activate must be fixed to the **plunger**. To work pushing, the element to activate must be fixed to the **shaft**.

• Datasheet values rated conditions (According to DIN VDE 0580):

The values of the magnetic force (F_m) depending on the stroke, are obtained in the following conditions:

Room temperature = 35°C

Coil stabilized at its working temperature.

Rated voltage equal to 90% of the nominal one.

Solenoid working in horizontal position.

Effective force (F_h) is obtained from magnetic force (F_m) adding or subtracting the plunger weight.

1) When the solenoid pulls upwards:

$Effective\ force = Magnetic\ force - Plunger\ weight$

2) When the solenoid pulls downwards:

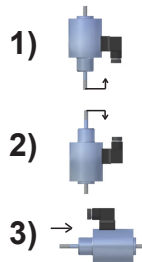
$Effective\ force = Magnetic\ force + Plunger\ weight$

3) When the solenoid pulls in horizontal position:

$Effective\ force = Magnetic\ force$

-For the units with return spring incorporated:

$Effective\ force = Magnetic\ force - Spring\ force \pm Plunger\ weight$



NOTE: When working position 3) sliding bearings abrasion is bigger than working positions 1) and 2)

Disposition of the connector every 90°, available to be changed by the user: under demand the connectors can be replaced by flying leads.



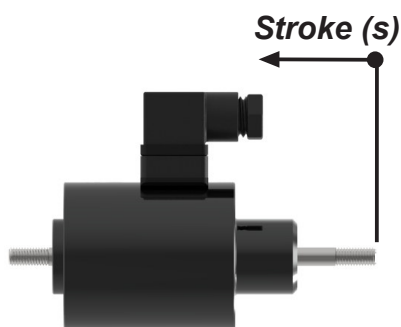
Electrical conection: DIN43650A connector (2 poles + Earth) ; For details see Pages 110 to 117

• ECH series: Force-stroke Chart

Type	Stroke (mm)		Duty-cycle					Return Spring force (N)
			100%	40%	25%	15%	5%	
ECH40-10	Beginning of stroke $s_1=10$	Magnetic force "Fm" (N)	9.5	18	23	30	50	2
	End of stroke $s_0=0$		10.4	16	19.5	27	43	4.4
ECH50-16	Beginning of stroke $s_1=16$		18.5	30	41	56	92	2.7
	End of stroke $s_0=0$		44	84	104	133	193	4.4
ECH65-15	Beginning of stroke $s_1=15$		46	73	91	118	177	5.4
	End of stroke $s_0=0$		152	199	252	303	385	21.7
ECH75-20	Beginning of stroke $s_1=20$		57	93	114	150	258	7
	End of stroke $s_0=0$		159	245	298	363	524	37
ECH90-25	Beginning of stroke $s_1=25$		85	126	163	205	341	18
	End of stroke $s_0=0$		265	379	501	578	837	48.5
ECH110-45	Beginning of stroke $s_1=45$		75	150	165	240	460	
	End of stroke $s_0=0$		550	730	800	940	1300	
ECH150-40	Beginning of stroke $s_1=40$		250	480	580	780	1300	
	End of stroke $s_0=0$		1100	1500	1850	2200	2800	

The values of force-stroke and the return spring are in Newton (N), solenoid in horizontal position and without return spring.

Beginning of stroke (s_1)



End of stroke (s_0)



• ECH SERIES

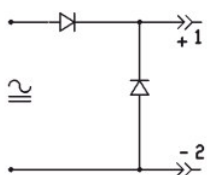
The models described in the catalogue are standard and minimum manufacturing batches are not required. However, there is the possibility of customizing them to suit better customer's needs. See below some of the most common customizations.

If any modification is needed, please ask NAFSA about the possibility and the minimum manufacturing batch required.

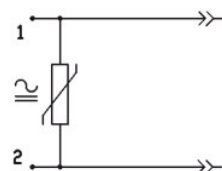
1. ELECTRICAL CUSTOMIZATION:

a) Integrated electronics only in versions with DIN43650A connector:

a.1) For peak suppression Examples:

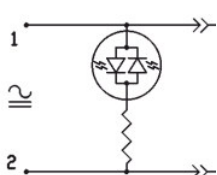


Free wheel diode+second diode to protect the free wheel diode against reverse polarity.

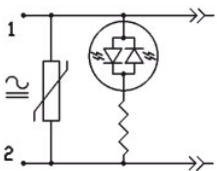


Varistor

a.2) Power display Examples:

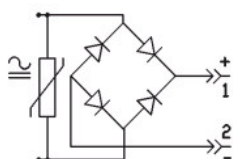


Connector under voltage display by LED

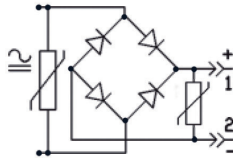


Varistor+LED display

a.3) For rectification Examples:



4 diodes with varistor at the input



4 diodes with double varistor.

b) DIN43650A connectors replacement by supply cables



Example1:
ECH40-10 M

Example 2:
ECH50-16 CCB



Example 3:
ECH65-18 P

c) Intermediate duty-cycle manufacturing:

NAFSA can manufacture any intermediate duty-cycle from 0 to 100, but the viability depends on the model and the voltage associated with it. For any special requirement, please ask NAFSA .

2. INSULATION CLASS CUSTOMIZATION:

Depending on the model, insulation class can be increased until H (180°C), this change is limited to voltages less than 48VDC, this usually involves DIN43650A connectors replacement by cables, cable glands or another type of connectors. For any special requirement, please ask NAFSA .

3. PROTECTION RATE CUSTOMIZATION IP (EN60529):

Standard models are IP40, but protecting the shaft and its guides IP54 can be obtained.



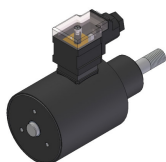
Example 4:
ECH150-40 F



Example 5:
ECH65-15 F

4. MECHANICAL CUSTOMIZATION

a) Shaft modifications:



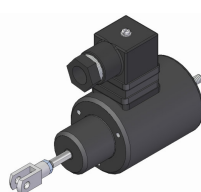
Example 6:
ECH75-20E
Modification of ECH75-20, the shaft has been plucked, from $\varnothing 12$ to $\varnothing 14$, and one of the thread has been removed

b) Stroke modifications:



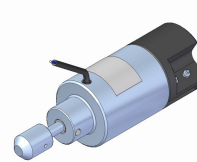
Example 7:
ECH50-20
Modification of ECH50-16, stroke has been increased from 16mm to 20mm

c) Fastening element added as Fork joints DIN71752



Example 8:
ECH50-16+Fork joints
Modification of ECH50-16, DIN71752 fork joint has been added

d) Detection system added



Example 9:
ECH40-10 BD
One lid that includes final position detection microswitch has been added.

• ECH 40-10 TYPE



Protection rate: **IP40**
 Insulation class: **B (130°C)**
 Reference cycle: **3 minutes**
 Standard stroke (s): **10 mm**
 Temperature rise " ΔV_{31} ": **70°C**
 Working temperature: **-10 to 45°C**
 Work: **Push / Pull**

Release spring will be incorporated by defect

Standard spring force:
 $F_s(s=0\text{mm}) = 4.4\text{N}$
 $F_s(s=10\text{mm}) = 2\text{N}$

(ED) Duty-cycle ED(%)	100	40	25	15	5
(P20) Power at 20°C (W)	13	30	45	75	210
(Fm) Solenoid force (N) 1)	9	14	17	23	38
Max time under voltage(s)	Inf	72	45	27	9
Opening time (ms) 2)	117	95	84	79	77
Release time (ms) 3)	70	57	51	48	46
Plunger weight (Kg)	0.047				
Solenoid weight (Kg)	0.416				

1) Fm Solenoid force is given according to VDE0580 without deducting the spring force or the plunger weight if vertical mounting.

2) Time is given on these conditions: Coil supplied under nominal voltage ; Stabilized in it's working temperature ; Load 70% of the solenoid force ; Horizontal assembly ; Standard stroke initial position; 20°C ambient temperature.

3) Time is given on these conditions: Standard spring ; without load on shaft ; Horizontal assembly ; Standard stroke initial position.

Duty-cycle ED%	Standard voltages										Under demand			
	VDC										VDC		VAC	
	6	12	24	48	100	125	205	110	230		Min	Max	Min	Max
100	o	o	o	o	o	o	o	o	o		4	250	18	230
40	o	o	o	o	o	o	o	o	o		6	250	43	230
25	x	o	o	o	o	o	o	o	o		9	250	65	230
15	x	o	o	o	o	o	o	o	o		10	250	105	230
5	x	o	o	o	o	o	o	x	x		12	250	x	x

Layout: o = Available ; x = Unavailable

- Voltage under demand:
 They can be manufactured at voltages between the maximum and minimum voltage values shown in the chart.

- To feed in alternating current the solenoid will have a rectifier incorporated in the connector.

- The duty cycles described in the chart are standard, they can be manufactured in any intermediate value.

- If any customization from the original is needed, please ask us.

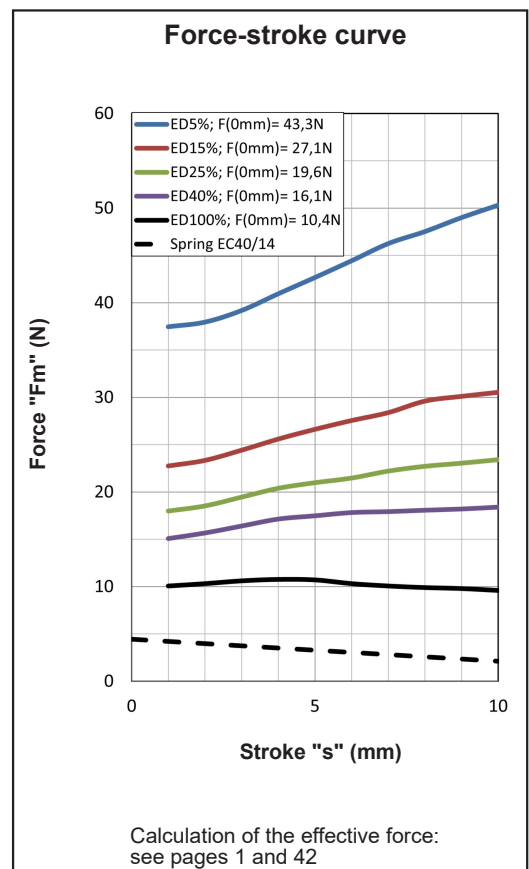
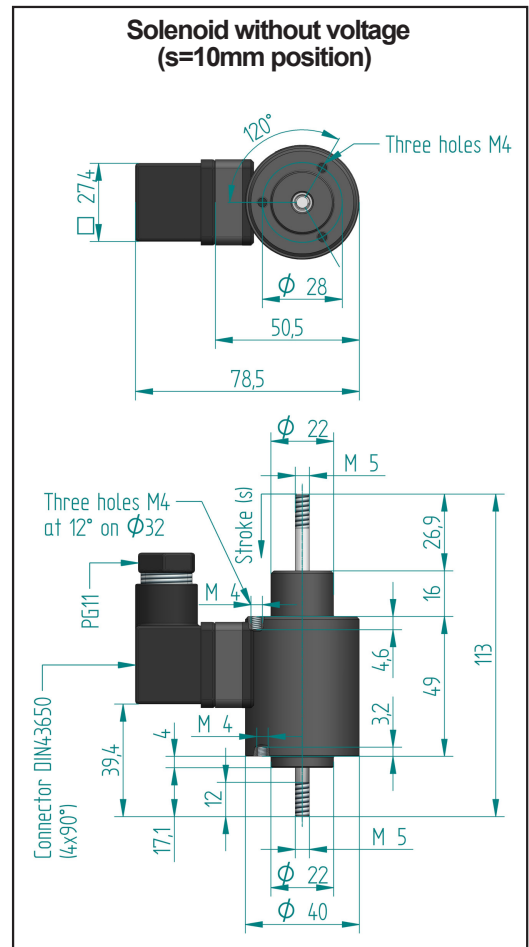
- Earthing is recommended if the metallic parts are accessible.

Ordering code: ECH40-10 --V ED---% - Spring

Voltage: 24Vdc; Duty cycle: ED100%; With spring:
 ECH40-10 24Vdc ED100% RS

Voltage: 48Vdc; Duty cycle: ED15%; Without spring:
 ECH40-10 48Vdc ED15% RN

Spring yes: **RS** ; Spring no: **RN**



For fixation and mounting positions: see page 42

• ECH 50-16 TYPE



Protection rate: **IP40**
 Insulation class: **B (130°C)**
 Reference cycle: **3 minutes**
 Standard stroke (s): **16 mm**
 Temperature rise " ΔV_{31} ": **70°C**
 Working temperature: **-10 to 45°C**
 Work: **Push / Pull**

Release spring will be incorporated by defect

Standard spring force:
 $F_s(s=0\text{mm}) = 4.4\text{N}$
 $F_s(s=10\text{mm}) = 2.7\text{N}$

(ED) Duty-cycle ED(%)	100	40	25	15	5
(P20) Power at 20°C (W)	19	45	68	120	325
(Fm) Solenoid force (N) 1)	13	18	26	41	72
Max time under voltage(s)	Inf	72	45	27	9
Opening time (ms) 2)	203	160	137	127	116
Release time (ms) 3)	131	106	92	86	80
Plunger weight (Kg)	0.120				
Solenoid weight (Kg)	0.750				

1) Fm Solenoid force is given according to VDE0580 without deducting the spring force or the plunger weight if vertical mounting.

2) Time is given on these conditions: Coil supplied under nominal voltage ; Stabilized in it's working temperature ; Load 70% of the solenoid force ; Horizontal assembly ; Standard stroke initial position; 20°C ambient temperature.

3) Time is given on these conditions: Standard spring ; without load on shaft ; Horizontal assembly ; Standard stroke initial position.

Duty-cycle	Standard voltages									Under demand				
ED%	VDC								VAC		VDC		VAC	
	6	12	24	48	100	125	205	110	230	Min	Max	Min	Max	
100	o	o	o	o	o	o	o	o	o	6	250	25	230	
40	x	o	o	o	o	o	o	o	o	10	250	59	230	
25	x	o	o	o	o	o	o	o	o	12	250	90	230	
15	x	x	o	o	o	o	o	x	o	16	250	156	230	
5	x	x	o	o	o	o	o	x	x	24	250	x	x	

Layout: o = Available ; x = Unavailable

- Voltage under demand:
 They can be manufactured at voltages between the maximum and minimum voltage values shown in the chart.

- To feed in alternating current the solenoid will have a rectifier incorporated in the connector.

- The duty cycles described in the chart are standard, they can be manufactured in any intermediate value.

- If any customization from the original is needed, please ask us.

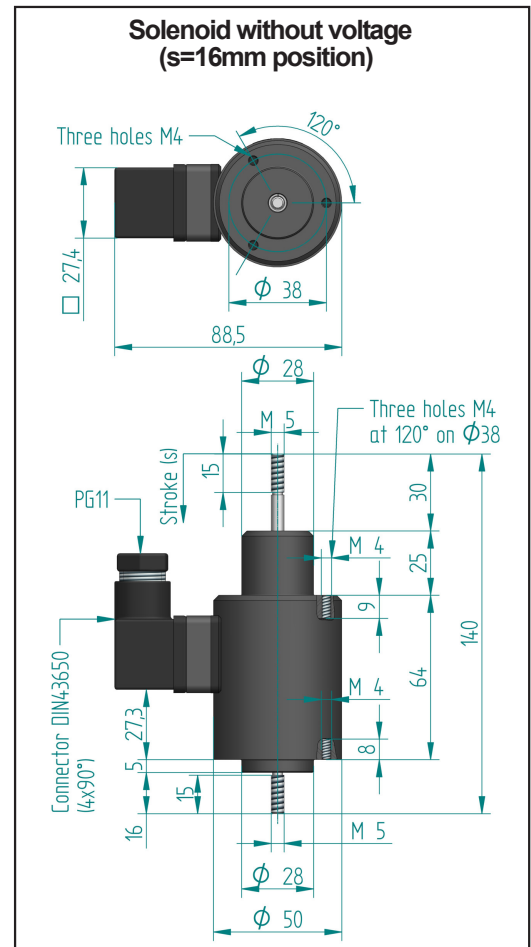
- Earthing is recommended if the metallic parts are accessible.

Ordering code: ECH50-16 --V ED---% - Spring

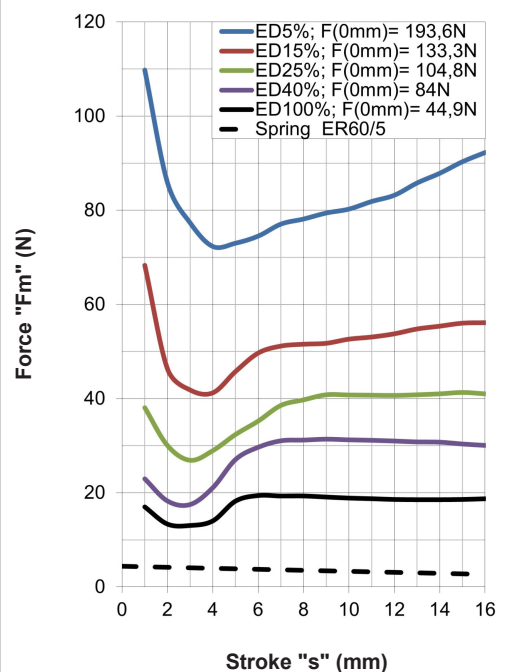
Voltage: 24Vdc; Duty cycle: ED100%; With spring:
 ECH50-16 24Vdc ED100% RS

Voltage: 48Vdc; Duty cycle: ED15%; Without spring:
 ECH50-16 48Vdc ED15% RN

Spring yes: **RS** ; Spring no: **RN**



Force-stroke curve



Calculation of the effective force:
 see pages 1 and 42

For fixation and mounting positions: see page 42

• ECH 65-15 TYPE



Protection rate: **IP40**
 Insulation class: **B (130°C)**
 Reference cycle: **3 minutes**
 Standard stroke (s): **15 mm**
 Temperature rise " ΔV_{31} ": **70°C**
 Working temperature: **-10 to 45°C**
 Work: **Push / Pull**

With spring:
• ECH65-15/RS



Optional spring force:
 $F_s(s=0\text{mm}) = 21.7\text{N}$
 $F_s(s=15\text{mm}) = 5.4\text{N}$

Release spring NOT
 incorporated in standard
 product.

(ED) Duty-cycle ED(%)	100	40	25	15	5
(P20) Power at 20°C (W)	30	75	110	185	545
(Fm) Solenoid force (N) 1)	38	64	80	99	162
Max time under voltage(s)	Inf	72	45	27	9
Opening time (ms) 2)	291	228	198	196	181
Release time (ms) 3)	181	143	125	124	115
Plunger weight (Kg)	0.190				
Solenoid weight (Kg)	1.7				

1) Fm Solenoid force is given according to VDE0580 without deducting the spring force or the plunger weight if vertical mounting.

2) Time is given on these conditions: Coil supplied under nominal voltage ; Stabilized in it's working temperature ; Load 70% of the solenoid force ; Horizontal assembly ; Standard stroke initial position; 20°C ambient temperature.

3) Time is given on these conditions: without load on shaft ; Horizontal assembly ; Standard stroke initial position.

Duty-cycle ED%	Standard voltages										Under demand			
	VDC										VDC		VAC	
	6	12	24	48	100	125	205	110	230		Min	Max	Min	Max
100	x	o	o	o	o	o	o	o	o		8	250	39	230
40	x	o	o	o	o	o	o	o	o		12	250	98	230
25	x	x	o	o	o	o	o	x	o		15	250	143	230
15	x	x	o	o	o	o	o	x	o		19	250	185	230
5	x	x	o	o	o	o	o	x	x		24	250	x	x

Layout: o = Available ; x = Unavailable

- Voltage under demand:
 They can be manufactured at voltages between the maximum and minimum voltage values shown in the chart.

- To feed in alternating current the solenoid will have a rectifier incorporated in the connector.

- The duty cycles described in the chart are standard, they can be manufactured in any intermediate value.

- If any customization from the original is needed, please ask us.

- Earthing is recommended if the metallic parts are accessible.

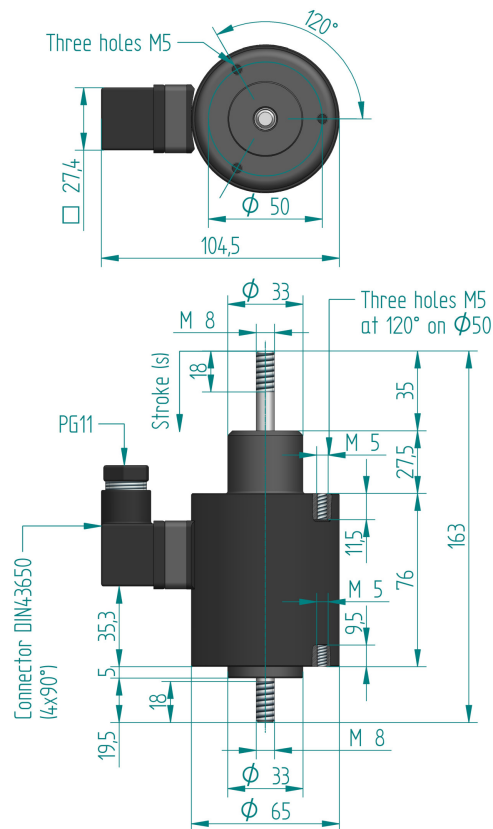
Ordering code: ECH65-15 --V ED---% - Spring

Voltage: 24Vdc; Duty cycle: ED100%; With spring:
 ECH65-15 24Vdc ED100% RS

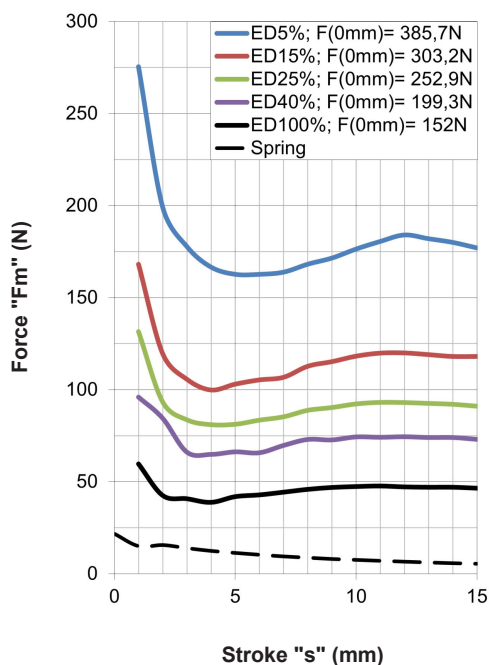
Voltage: 48Vdc; Duty cycle: ED15%; Without spring:
 ECH65-15 48Vdc ED15% RN

Spring yes: RS ; Spring no: RN

Solenoid without voltage
 (s=15mm position)



Force-stroke curve



Calculation of the effective force:
 see pages 1 and 42

For fixation and mounting positions: see page 42

• ECH 75-20 TYPE



Protection rate: **IP40**
 Insulation class: **B (130°C)**
 Reference cycle: **5 minutes**
 Standard stroke (s): **20 mm**
 Temperature rise " ΔV_{31} ": **70°C**
 Working temperature: **-10 to 45°C**
 Work: **Push / Pull**

With spring:
• ECH75-20/RS



Optional spring force:
 $F_s(s=0\text{mm}) = 37\text{N}$
 $F_s(s=20\text{mm}) = 7\text{N}$

Release spring NOT
 incorporated in standard
 product.

(ED) Duty-cycle ED(%)	100	40	25	15	5
(P20) Power at 20°C (W)	48	110	165	265	755
(Fm) Solenoid force (N) 1)	57	93	114	150	258
Max time under voltage(s)	Inf	120	75	45	15
Opening time (ms) 2)	410	352	284	269	241
Release time (ms) 3)	256	222	181	172	156
Plunger weight (Kg)	0.375				
Solenoid weight (Kg)	3				

1) Fm Solenoid force is given according to VDE0580 without deducting the spring force or the plunger weight if vertical mounting.

2) Time is given on these conditions: Coil supplied under nominal voltage ; Stabilized in it's working temperature ; Load 70% of the solenoid force ; Horizontal assembly ; Standard stroke initial position; 20°C ambient temperature.

3) Time is given on these conditions: without load on shaft ; Horizontal assembly ; Standard stroke initial position.

Duty-cycle ED%	Standard voltages									Under demand				
	VDC								VAC		VDC		VAC	
	6	12	24	48	100	125	205	110	230	Min	Max	Min	Max	
100	x	o	o	o	o	o	o	o	o	12	250	30	230	
40	x	x	o	o	o	o	o	o	o	17	250	70	230	
25	x	x	o	o	o	o	o	o	o	21	250	105	230	
15	x	x	o	o	o	o	o	x	o	24	250	170	230	
5	x	x	x	o	o	o	o	x	x	37	250	x	x	

Layout: o = Available ; x = Unavailable

- Voltage under demand:
 They can be manufactured at voltages between the maximum and minimum voltage values shown in the chart.

- To feed in alternating current the solenoid will have a rectifier incorporated in the connector.

- The duty cycles described in the chart are standard, they can be manufactured in any intermediate value.

- If any customization from the original is needed, please ask us.

- Earthing is recommended if the metallic parts are accessible.

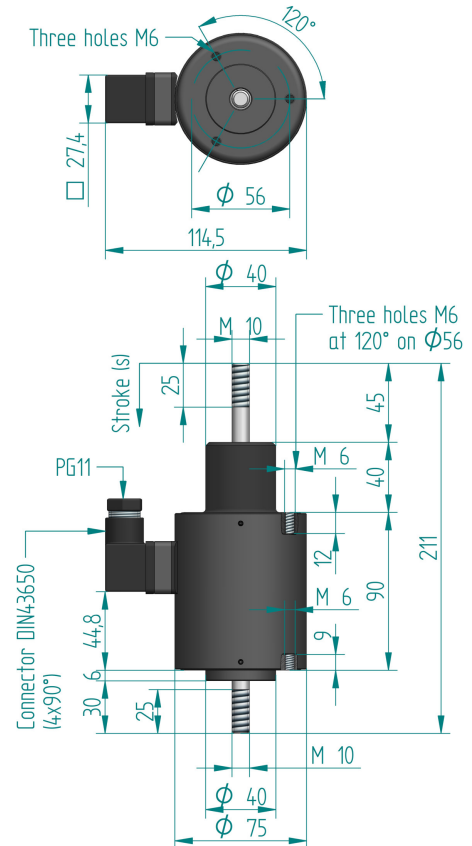
Ordering code: ECH75-20 --V ED---% - Spring

Voltage: 24Vdc; Duty cycle: ED100%; With spring:
 ECH75-20 24Vdc ED100% RS

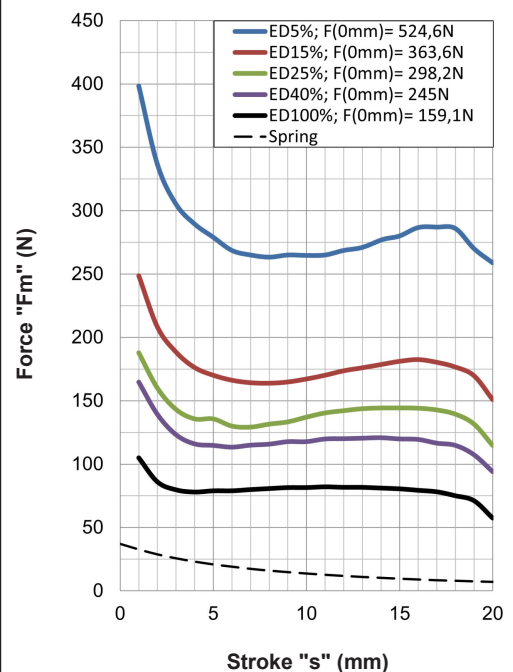
Voltage: 48Vdc; Duty cycle: ED15%; Without spring:
 ECH75-20 48Vdc ED15% RN

Spring yes: RS ; Spring no: RN

Solenoid without voltage
 (s=20mm position)



Force-stroke curve



Calculation of the effective force:
 see pages 1 and 42

For fixation and mounting positions: see page 42

• ECH 90-25 TYPE



Protection rate: **IP40**
 Insulation class: **B (130°C)**
 Reference cycle: **5 minutes**
 Standard stroke (s): **25 mm**
 Temperature rise " ΔV_{31} ": **70°C**
 Working temperature: **-10 to 45°C**
 Work: **Push / Pull**

With spring:
• ECH90-25/RS



Optional spring force:
 $F_s(s=0\text{mm}) = 48.5\text{N}$
 $F_s(s=15\text{mm}) = 18\text{N}$

Release spring NOT
 incorporated in standard
 product.

(ED) Duty-cycle ED(%)	100	40	25	15	5
(P20) Power at 20°C (W)	55	125	190	300	900
(Fm) Solenoid force (N) 1)	72	110	150	190	300
Max time under voltage(s)	Inf	120	75	45	15
Opening time (ms) 2)	651	488	417	332	307
Release time (ms) 3)	399	301	259	208	193
Plunger weight (Kg)	0.650				
Solenoid weight (Kg)	5.2				

1) Fm Solenoid force is given according to VDE0580 without deducting the spring force or the plunger weight if vertical mounting.

2) Time is given on these conditions: Coil supplied under nominal voltage ; Stabilized in it's working temperature ; Load 70% of the solenoid force ; Horizontal assembly ; Standard stroke initial position; 20°C ambient temperature.

3) Time is given on these conditions: without load on shaft ; Horizontal assembly ; Standard stroke initial position.

Duty-cycle ED%	Standard voltages										Under demand			
	VDC								VAC		VDC		VAC	
	6	12	24	48	100	125	205	110	230		Min	Max	Min	Max
100	x	o	o	o	o	o	o	o	o		12	250	28	230
40	x	x	o	o	o	o	o	o	o		18	250	60	230
25	x	x	o	o	o	o	o	o	o		22	250	95	230
15	x	x	o	o	o	o	o	x	o		24	250	150	230
5	x	x	o	o	o	o	o	x	x		24	250	x	x

Layout: o = Available ; x = Unavailable

- Voltage under demand:
 They can be manufactured at voltages between the maximum and minimum voltage values shown in the chart.

- To feed in alternating current the solenoid will have a rectifier incorporated in the connector.

- The duty cycles described in the chart are standard, they can be manufactured in any intermediate value.

- If any customization from the original is needed, please ask us.

- Earthing is recommended if the metallic parts are accessible.

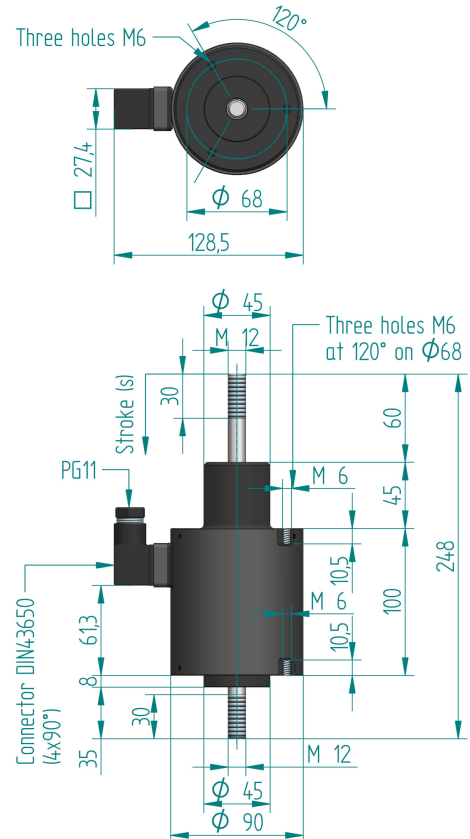
Ordering code: ECH90-25 --V ED---% - Spring

Voltage: 24Vdc; Duty cycle: ED100%; With spring:
 ECH90-25 24Vdc ED100% RS

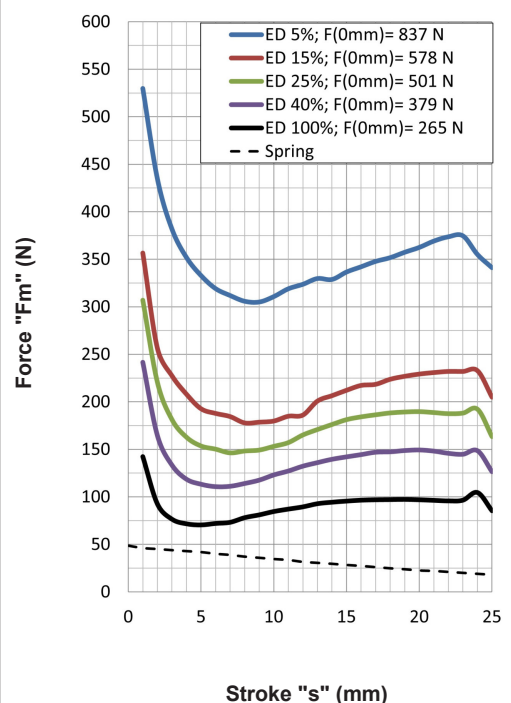
Voltage: 48Vdc; Duty cycle: ED15%; Without spring:
 ECH90-25 48Vdc ED15% RN

Spring yes: RS ; Spring no: RN

Solenoid without voltage
 (s=25mm position)



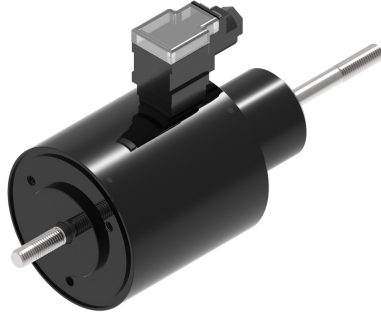
Force-stroke curve



Calculation of the effective force:
 see pages 1 and 42

For fixation and mounting positions: see page 42

• ECH 110-45 TYPE



Protection rate: **IP40**
 Insulation class: **B (130°C)**
 Reference cycle: **5 minutes**
 Standard stroke (s): **45 mm**
 Temperature rise " ΔV_{31} ": **70°C**
 Working temperature: **-10 to 45°C**
 Work: **Push / Pull**

Release spring NOT
 incorporated in standard
 product.

(ED) Duty-cycle ED(%)	100	40	25	15	5
(P20) Power at 20°C (W)	76	175	260	420	1260
(Fm) Solenoid force (N) 1)	75	150	165	240	460
Max time under voltage(s)	Inf	120	75	45	15
Opening time (ms) 2)	784	592	517	504	456
Release time (ms) 3)	485	371	326	318	290
Plunger weight (Kg)	1.1				
Solenoid weight (Kg)	7.3				

1) Fm Solenoid force is given according to VDE0580 without deducting the spring force or the plunger weight if vertical mounting.

2) Time is given on these conditions: Coil supplied under nominal voltage ; Stabilized in it's working temperature ; Load 70% of the solenoid force ; Horizontal assembly ; Standard stroke initial position; 20°C ambient temperature.

3) Time is given on these conditions: without load on shaft ; Horizontal assembly ; Standard stroke initial position.

Duty-cycle ED%	Standard voltages										Under demand			
	VDC								VAC		VDC		VAC	
	6	12	24	48	100	125	205	110	230		Min	Max	Min	Max
100	x	o	o	o	o	o	o	o	o		12	250	45	230
40	x	x	o	o	o	o	o	o	o		19	250	105	230
25	x	x	o	o	o	o	o	x	o		23	250	155	230
15	x	x	x	o	o	o	o	x	o		29	250	230	230
5	x	x	x	o	o	o	o	x	x		48	250	x	x

Layout: o = Available ; x = Unavailable

- Voltage under demand:
 They can be manufactured at voltages between the maximum and minimum voltage values shown in the chart.

- To feed in alternating current the solenoid will have a rectifier incorporated in the connector.

- The duty cycles described in the chart are standard, they can be manufactured in any intermediate value.

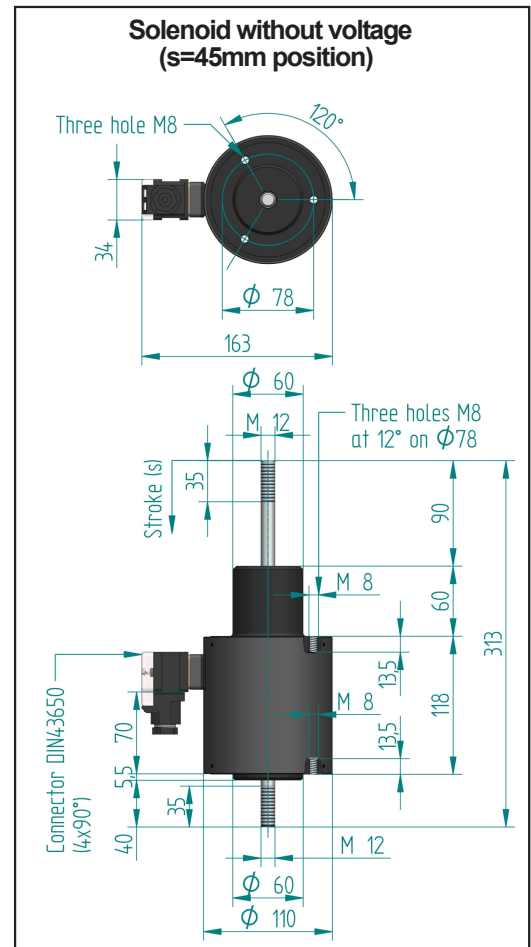
- If any customization from the original is needed, please ask us.

- Earthing is recommended if the metallic parts are accessible.

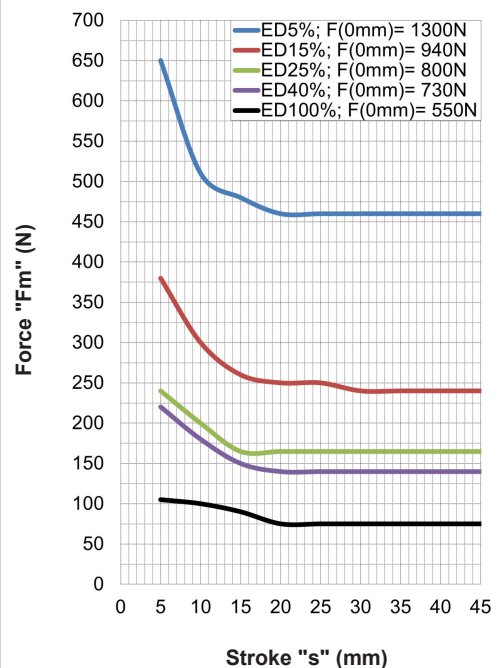
Ordering code: ECH110-45 --V ED---%

Voltage: 24Vdc; Duty cycle: ED100%;
 ECH110-45 24Vdc ED100%

Voltage: 48Vdc; Duty cycle: ED15%;
 ECH110-45 48Vdc ED15%



Force-stroke curve



Calculation of the effective force:
 see pages 1 and 42

For fixation and mounting positions: see page 42

• ECH 150-40 TYPE



Protection rate: **IP40**
 Insulation class: **B (130°C)**
 Reference cycle: **5 minutes**
 Standard stroke (s): **40 mm**
 Temperature rise " ΔV_{31} ": **70°C**
 Working temperature: **-10 to 45°C**
 Work: **Push / Pull**

Release spring NOT
 incorporated in standard
 product.

(ED) Duty-cycle ED(%)	100	40	25	15	5
(P20) Power at 20°C (W)	120	290	460	750	2200
(Fm) Solenoid force (N) 1)	250	480	580	780	1300
Max time under voltage(s)	Inf	120	75	45	15
Opening time (ms) 2)	1272	985	877	829	773
Release time (ms) 3)	781	610	545	517	484
Plunger weight (Kg)	4.6				
Solenoid weight (Kg)	21				

1) Fm Solenoid force is given according to VDE0580 without deducting the spring force or the plunger weight if vertical mounting.

2) Time is given on these conditions: Coil supplied under nominal voltage ; Stabilized in it's working temperature ; Load 70% of the solenoid force ; Horizontal assembly ; Standard stroke initial position; 20°C ambient temperature.

3) Time is given on these conditions: without load on shaft ; Horizontal assembly ; Standard stroke initial position.

Duty-cycle ED%	Standard voltages										Under demand			
	VDC								VAC		VDC		VAC	
	6	12	24	48	100	125	205	110	230		Min	Max	Min	Max
100	x	x	o	o	o	o	o	o	o		20	250	72	230
40	x	x	x	o	o	o	o	x	o		29	250	175	230
25	x	x	x	o	o	o	o	x	o		36	250	230	230
15	x	x	x	o	o	o	o	x	x		46	250	x	x
5	x	x	x	x	o	o	o	x	x		80	250	x	x

Layout: o = Available ; x = Unavailable

- Voltage under demand:
 They can be manufactured at voltages between the maximum and minimum voltage values shown in the chart.

- To feed in alternating current the solenoid will have a rectifier incorporated in the connector.

- The duty cycles described in the chart are standard, they can be manufactured in any intermediate value.

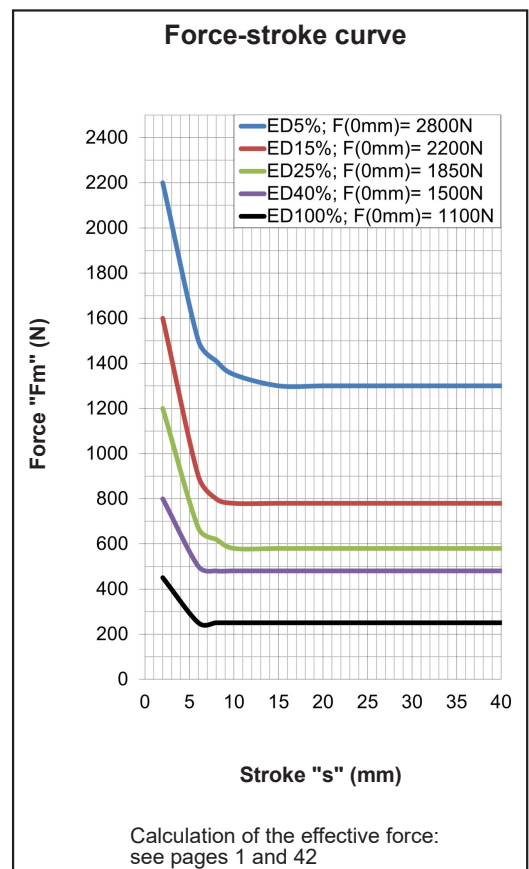
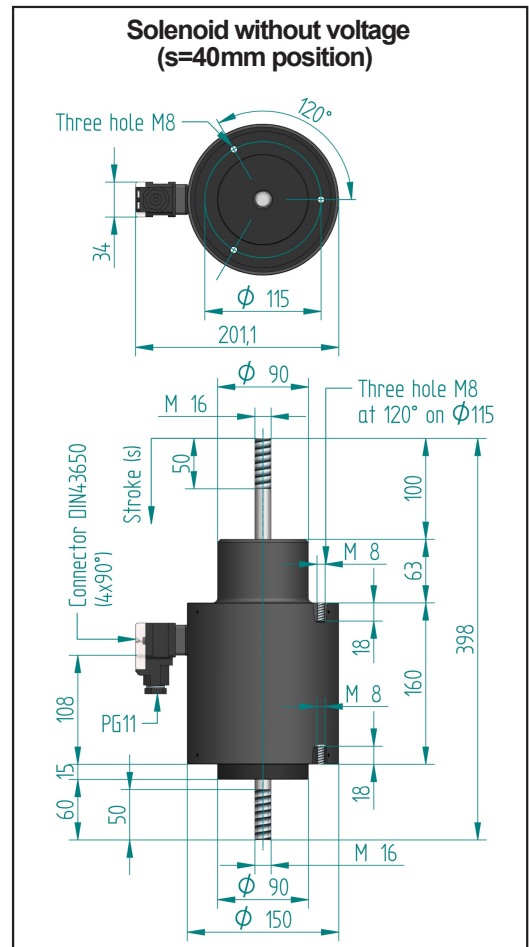
- If any customization from the original is needed, please ask us.

- Earthing is recommended if the metallic parts are accessible.

Ordering code: ECH110-45 --V ED---%

Voltage: 24Vdc; Duty cycle: ED100%;
 ECH110-45 24Vdc ED100%

Voltage: 48Vdc; Duty cycle: ED15%;
 ECH110-45 48Vdc ED15%

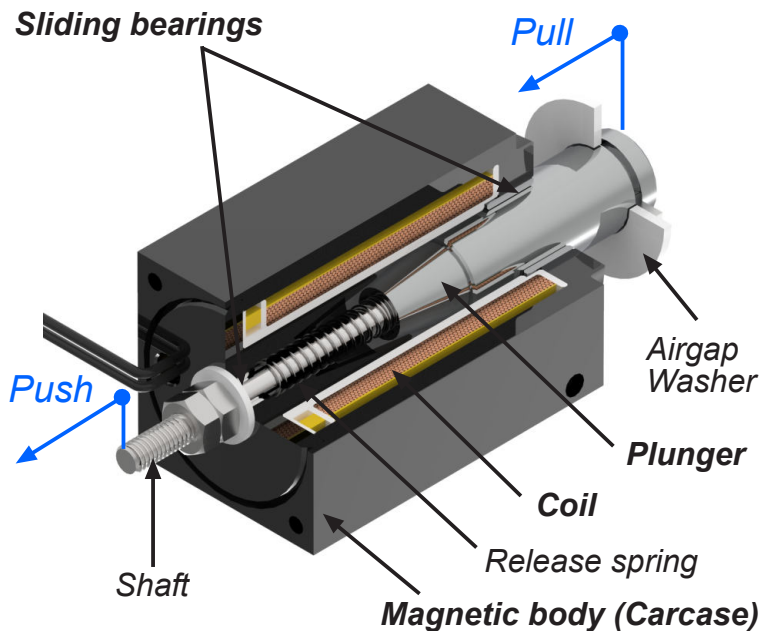


For fixation and mounting positions: see page 42

• CU SERIES

CU serie electromagnets are simple effect linear solenoids in which the stroke from initial to final position is made by electromagnetic forces, and the return to the initial position is made by external forces or the spring incorporated in the solenoid.

Its structural features make these units able to have a long mechanical life, so applications where the number of cycles is high are appropriate for these solenoids.



Structure, basic elements:

Magnetic body (Carcase):

It is the metal piece containing the excitation coil, the core and the fixation holes of the solenoid.

Coil:

It receives the electrical energy to create the magnetic field.

Plunger:

It is the piece that moves inside along the coil and it has got a non-magnetic shaft fixed to the plunger. To work pulling, the element to activate must be fixed to the plunger. To work pushing, the element to activate must be fixed to the shaft.

Sliding bearing:

They are the guide of the plunger, and abrasion resistant.

• Datasheet rated values conditions (According to DIN VDE 0580):

The values of the magnetic force (F_m) depending on the stroke, are obtained in the following conditions:

Room temperature = 35°C

Coil stabilized at its working temperature.

Rated voltage equal to 90% of the standard one.

Solenoid working in horizontal position.

Effective force (F_h) is obtained from magnetic force (F_m).

-When the solenoid pulls upwards:

$Effective\ force = Magnetic\ force - Plunger\ weight$

-When the solenoid pulls downwards:

$Effective\ force = Magnetic\ force + Plunger\ weight$

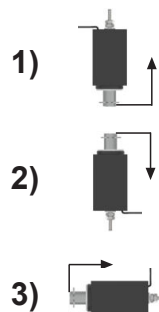
-When the solenoid pulls in horizontal position:

$Effective\ force = Magnetic\ force$

-For the units with incorporated return spring:

$Effective\ force = Magnetic\ force - Spring\ force \pm Plunger\ weight$

NOTE: When working position 3) slide bearings abrasion is bigger than working positions 1) and 2)



• CU series: Force-stroke Chart

Type	Stroke (mm)		Duty-cycle					Return Spring force (N)
			100%	40%	25%	15%	5%	
CU20/C	Beginning of stroke $s_1=6$	Magnetic force "Fm" (N)	0.9	2.1	2.5	3.1	5.5	0.2
	End of stroke $s_0=0$		1.5	3.5	4.2	6.1	8.8	0.5
CU30/C	Beginning of stroke $s_1=10$		2.6	3.8	7.3	9.9	17	0.95
	End of stroke $s_0=0$		12	15	21.7	27	37	1.44
CU40/C	Beginning of stroke $s_1=15$		7.8	13.5	17.3	23	41.7	1.7
	End of stroke $s_0=0$		15.7	24.5	31.2	38.4	59	3.2

The values of magnetic force and the return spring are in Newton (N), solenoid in horizontal position and without return spring.

Beginning of stroke (s_1)



End of stroke (s_0)



● CUSTOMIZATION CU SERIES

The models described in the catalogue are standard and they are not subject to minimum manufacturing batches, however there is the possibility of customizing them to suit better for the customer requirements, below are some of the most common customizations.

If any modification is required, please ask NAFSA about the possibility of adopting it for the model of interest and the minimum manufacturing batch required.

1. ELECTRICAL CUSTOMIZATION

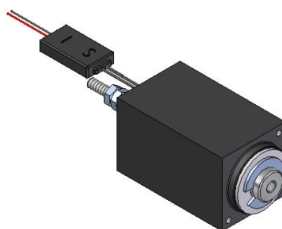
a) Combination of solenoids with PWM electronics:

It consists on feeding the electromagnet through an electronic PWM (Pulse width modulation). This device will initially provide the solenoid with its nominal voltage and after a while, which will be higher than the one needed to complete its stroke, the voltage entering to the solenoid will be reduced by the PWM to the selected ratio.

For instance, the most common reduction ratio values are 1:2 or 1:3. Once the voltage is reduced it will be maintained in its value until the supply to the solenoid is off, once off, the system resets and when the solenoid works again, the cycle is repeated.

The idea is to make the solenoid to be 100% duty-cycle, but with a big force when the stroke has to be done, the force of a reduced duty cycle, as per example 25%, so it can be feeded long as required but without the risk of burning.

The solution is used when the initial stroke force in a 100% duty-cycle solenoid isn't enough or in those cases where a lower heating of the solenoid is required. For example, a 12Vdc and ED100% solenoid can be feeded at 24VDC through an PWM electronic and if it has 1:2 ratio, the solenoid will first see the 24VDC so it will complete the stroke with 4 times more power, so with the force of a 25% duty cycle, then when the voltage is reduced to 12VDC the duty cycle will be 100%.



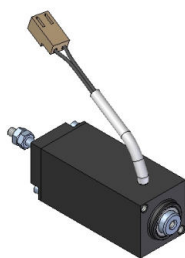
*PMD integrated in the cables

**NOTE: In CU serie PMD technology can not be integrated in the coil

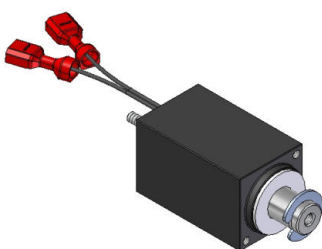
b) Cable length modification and terminal or connector mounted over cables:

All CU models have supply cables, its length can be modified to customer requirement. Likewise many kind of terminals or connectors can be added to the cables.

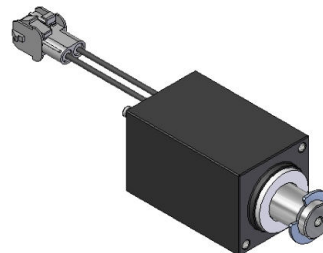
Example 1:



Example 2:



Example 3:



c) Intermediate duty-cycle manufacturing:

NAFSA can manufacture any intermediate duty-cycle from 0 to 100, but the viability depends on the model and the voltage associated with it. For any special requirement, please ask NAFSA.

2. INSULATION CLASS CUSTOMIZATION:

Depending on the model, insulation class can be increased until H (180°C), this change is limited to voltages less than 48VDC. For any special requirement, please ask NAFSA.

3. PROTECTION RATE CUSTOMIZATION IP (EN60529):

Standard models are IP40, after overmolding coil, IP65 can be obtained for the coil.

NOTE: All this customizations cannot be applied to all models, ask NAFSA for each case.

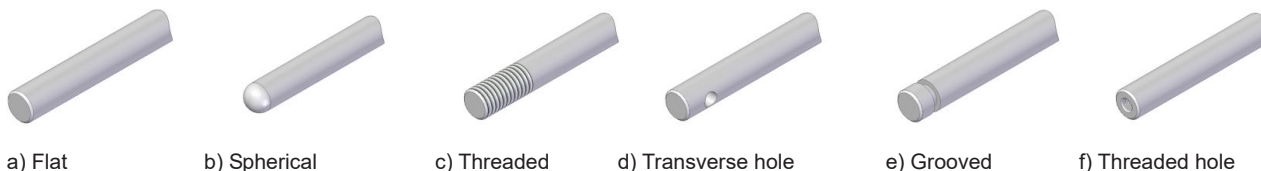
• CUSTOMIZATION CU SERIES

The models described in the catalogue are standard and minimum manufacturing batches are not required. However, there is the possibility of customizing them to suit better customer's needs. See below some of the most common customizations.

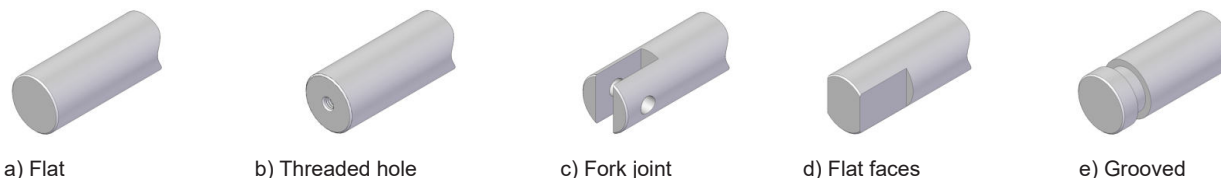
If any modification is needed, please ask NAFSA about the possibility and the minimum manufacturing batch required.

4. MECHANICAL CUSTOMIZATION:

4.1) Shaft modifications: Length and shape can be modified. If it has not any function, it can be removed depending on the model, this would mean use exterior springs instead of internal ones.



4.2) Plunger modifications: Length and shape can be modified.



4.3) Return spring force modification:

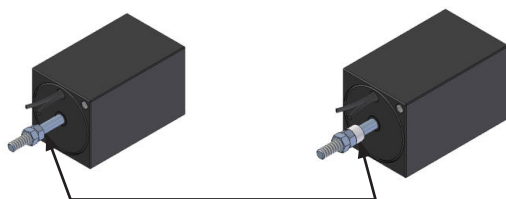
CU series electromagnets are linear simple effect solenoids, where the stroke movement from initial to the final position is made by electromagnetic forces, and the return to initial position takes place because of external forces or an incorporated spring (depending on the type). The force of the spring is limited to returning the plunger to the initial position. If more force is required, spring can be modified but we will have to take in mind the duty-cycle. Each duty-cycle has a limitation to increase the spring force, as this force will be deducted to the solenoid push/pull force.

In the cases that spring is not required, solenoid can be ordered without spring or it can be removed manually.

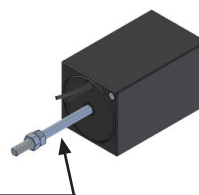
4.4) Stroke modifications:

The standard stroke is limited by the usefull length of shaft, in some cases the stroke can be modified: decreasing or increasing it in case that solenoid has enough activation force. These modifications can be made by customer or NAFSA.

Example:
Stroke decrease:
Inserting a plastic bearing, this can be made by NAFSA or the customer

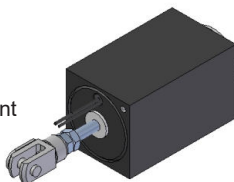


Example:
Stroke increase:
Shaft has been enlarged to increase the stroke, This modification only can be made by NAFSA



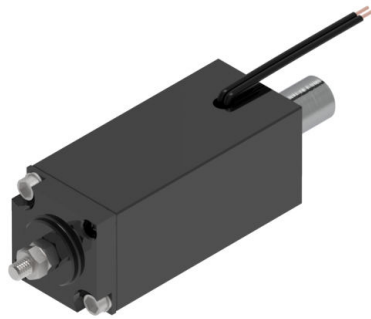
4.5) Fastening element added as Fork joints DIN71752:

Example:
CU30/C with Fork joint



NOTE: All this customizations cannot be applied to all models, ask NAFSA for each case.

• CU 20/C TYPE



Protection rate: **IP40**
 Insulation class: **B (130°C)**
 Reference cycle: **3 minutes**
 Standard stroke (s): **6 mm**
 Temperature rise " ΔV_{31} ": **70°C**
 Working temperature: **-10 to 45°C**
 Work: **Push / Pull**

Release spring will be incorporated by defect

Standard spring force:
 $F_s(s=0\text{mm}) = 0.5\text{N}$
 $F_s(s=6\text{mm}) = 0.2\text{N}$

(ED) Duty-cycle ED(%)	100	40	25	15	5
(P20) Power at 20°C (W)	4	10	16	26	80
(Fm) Solenoid force (N) 1)	0.9	2.1	2.5	3.1	5.5
Max time under voltage(s)	Inf	72	45	27	9
Opening time (ms) 2)	32	26	26	24	23
Release time (ms) 3)	28	25	25	24	24
Plunger weight (Kg)	0.018				
Solenoid weight (Kg)	0.110				

1) Fm Solenoid force is given according to VDE0580 without deducting the spring force or the plunger weight if vertical mounting.

2) Time is given on these conditions: Coil supplied under nominal voltage ; Stabilized in its working temperature ; Load 70% of the solenoid force ; Horizontal assembly ; Standard stroke initial position ; 20°C ambient temperature.

3) Time is given on these conditions: Standard spring ; without load on shaft ; Horizontal assembly ; Standard stroke initial position.

Duty-cycle ED%	Standard voltages									Under demand			
	VDC							VAC		VDC		VAC	
	6	12	24	48	100	125	205	110	230	Min	Max	Min	Max
100	o	o	o	o	o	x	x	x	x	3	110	x	x
40	o	o	o	o	o	o	x	x	x	3	175	x	x
25	o	o	o	o	o	o	o	x	x	3	220	x	x
15	o	o	o	o	o	o	o	x	x	4	250	x	x
5	o	o	o	o	o	o	o	x	x	6	250	x	x

Layout: o = Available ; x = Unavailable

- Voltage under demand:
 They can be manufactured at voltages between the maximum and minimum voltage values shown in the chart.

- To feed in alternating current the solenoid will have an external rectifier.

- The duty cycles described in the chart are standard, they can be manufactured in any intermediate value.

- If any customization from the original is needed, please ask us.

- Earthing is recommended if the metallic parts are accessible.

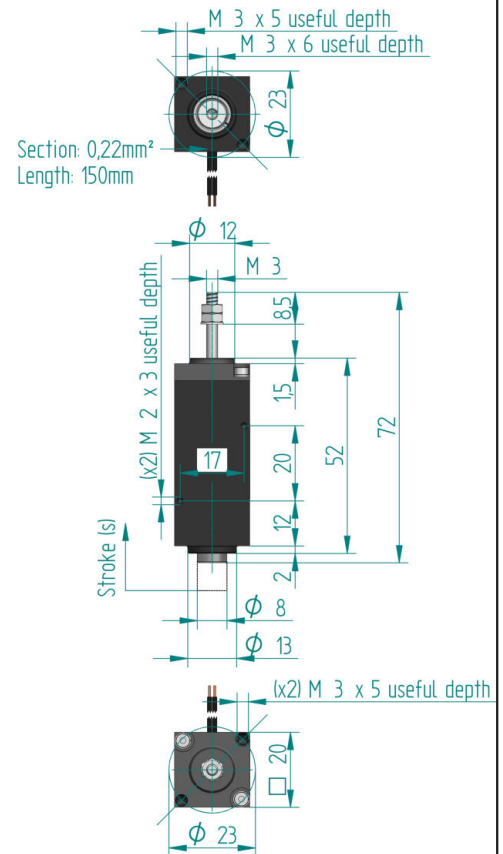
Ordering code: CU20/C --V ED---% - Spring

Voltage: 24Vdc; Duty cycle: ED100%; With spring:
 CU20/C 24Vdc ED100% RS

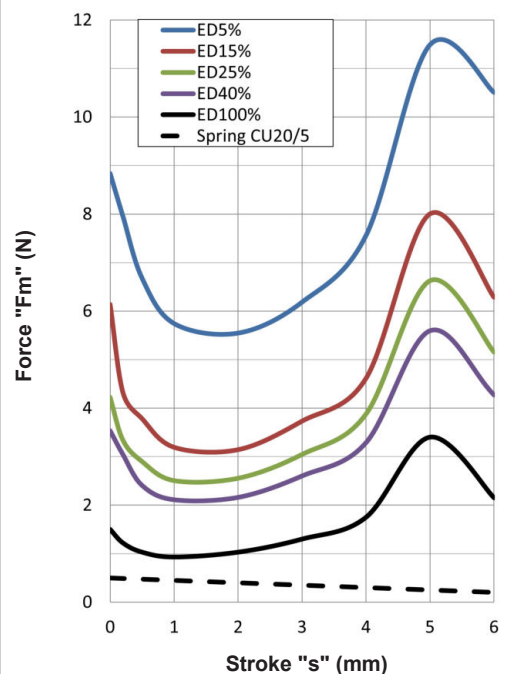
Voltage: 12Vdc; Duty cycle: ED15%; Without spring:
 CU20/C 12Vdc ED15% RN

Spring yes: RS ; Spring no: RN

Solenoid under voltage (s=0mm position)



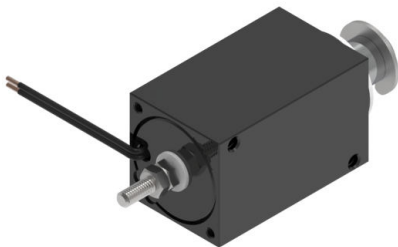
Force-stroke curve



Calculation of the effective force:
 see pages 1 and 52

For fixation and mounting positions: see page 52

• CU 30/C TYPE



Protection rate: **IP40**
 Insulation class: **B (130°C)**
 Reference cycle: **3 minutes**
 Standard stroke (s): **10 mm**
 Temperature rise " ΔV_{31} ": **70°C**
 Working temperature: **-10 to 45°C**
 Work: **Push / Pull**

Release spring will be incorporated by defect

Standard spring force:
 $F_s(s=0\text{mm}) = 1.44\text{N}$
 $F_s(s=10\text{mm}) = 0.95\text{N}$

(ED) Duty-cycle ED(%)	100	40	25	15	5
(P20) Power at 20°C (W)	7.2	18	30	53	150
(Fm) Solenoid force (N) 1)	2.6	3.8	7.3	9.9	17.2
Max time under voltage(s)	Inf	72	45	27	9
Opening time (ms) 2)	61	53	42	42	41
Release time (ms) 3)	44	39	33	33	32
Plunger weight (Kg)	0.040				
Solenoid weight (Kg)	0.290				

1) Fm Solenoid force is given according to VDE0580 without deducting the spring force or the plunger weight if vertical mounting.

2) Time is given on these conditions: Coil supplied under nominal voltage ; Stabilized in its working temperature ; Load 70% of the solenoid force ; Horizontal assembly ; Standard stroke initial position ; 20°C ambient temperature.

3) Time is given on these conditions: Standard spring ; without load on shaft ; Horizontal assembly ; Standard stroke initial position.

Duty-cycle ED%	Standard voltages									Under demand				
	VDC								VAC		VDC		VAC	
	6	12	24	48	100	125	205	110	230	Min	Max	Min	Max	
100	o	o	o	o	o	o	o	o	x	3	250	24	125	
40	o	o	o	o	o	o	o	o	x	4	250	48	125	
25	o	o	o	o	o	o	o	o	x	5	250	110	125	
15	o	o	o	o	o	o	o	x	x	6	250	x	x	
5	x	o	o	o	o	o	o	x	x	12	250	x	x	

Layout: o = Available ; x = Unavailable

- Voltage under demand:
 They can be manufactured at voltages between the maximum and minimum voltage values shown in the chart.

- To feed in alternating current the solenoid will have an external rectifier.

- The duty cycles described in the chart are standard, they can be manufactured in any intermediate value.

- If any customization from the original is needed, please ask us.

- Earthing is recommended if the metallic parts are accessible.

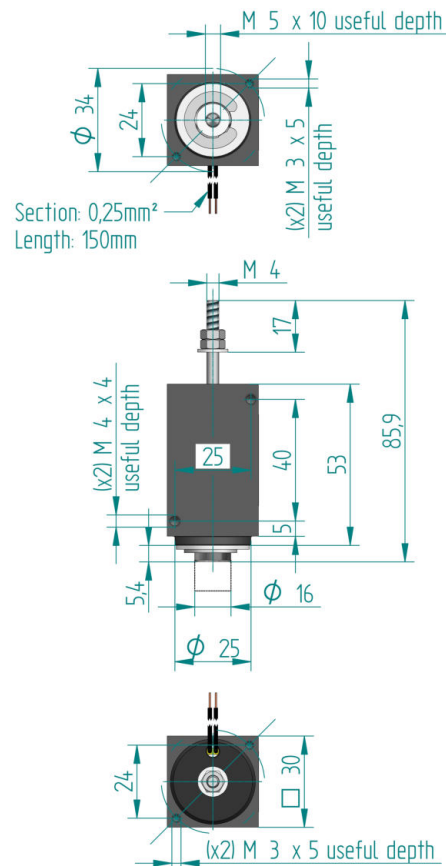
Ordering code: CU30/C --V ED---% - Spring

Voltage: 24Vdc; Duty cycle: ED100%; With spring:
 CU30/C 24Vdc ED100% RS

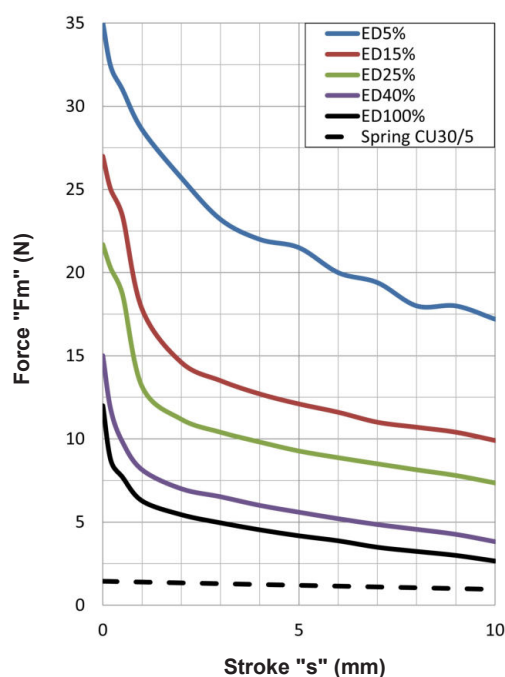
Voltage: 12Vdc; Duty cycle: ED15%; Without spring:
 CU30/C 12Vdc ED15% RN

Spring yes: **RS** ; Spring no: **RN**

Solenoid under voltage (s=0mm position)



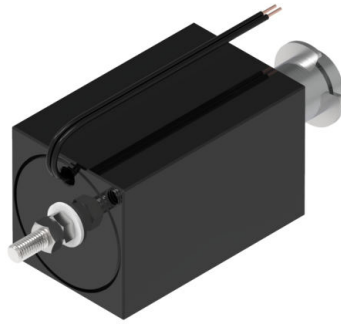
Force-stroke curve



Calculation of the effective force:
 see pages 1 and 52

For fixation and mounting positions: see page 52

• CU 40/C TYPE



Protection rate: **IP40**
 Insulation class: **B (130°C)**
 Reference cycle: **3 minutes**
 Standard stroke (s): **15 mm**
 Temperature rise " ΔV_{31} ": **70°C**
 Working temperature: **-10 to 45°C**
 Work: **Push / Pull**

Release spring will be incorporated by defect

Standard spring force:
 $F_s(s=0\text{mm}) = 3.2\text{N}$
 $F_s(s=15\text{mm}) = 1.7\text{N}$

(ED) Duty-cycle ED(%)	100	40	25	15	5
(P20) Power at 20°C (W)	13	30	48	82	247
(Fm) Solenoid force (N) 1)	7.8	13.5	17	23	41
Max time under voltage(s)	Inf	72	45	27	9
Opening time (ms) 2)	125	98	92	86	82
Release time (ms) 3)	75	60	57	54	51
Plunger weight (Kg)	0.085				
Solenoid weight (Kg)	0.665				

1) Fm Solenoid force is given according to VDE0580 without deducting the spring force or the plunger weight if vertical mounting.

2) Time is given on these conditions: Coil supplied under nominal voltage ; Stabilized in it's working temperature ; Load 70% of the solenoid force ; Horizontal assembly ; Standard stroke initial position; 20°C ambient temperature.

3) Time is given on these conditions: Standard spring ; without load on shaft ; Horizontal assembly ; Standard stroke initial position.

Duty-cycle ED%	Standard voltages										Under demand			
	VDC								VAC		VDC		VAC	
	6	12	24	48	100	125	205	110	230		Min	Max	Min	Max
100	o	o	o	o	o	o	o	o	x		6	250	48	125
40	x	o	o	o	o	o	o	o	x		9	250	48	125
25	x	o	o	o	o	o	o	x	x		12	250	x	x
15	x	o	o	o	o	o	o	x	x		24	250	x	x
5	x	x	o	o	o	o	o	x	x		24	250	x	x

Layout: o = Available ; x = Unavailable

- Voltage under demand:
 They can be manufactured at voltages between the maximum and minimum voltage values shown in the chart.

- To feed in alternating current the solenoid will have an external rectifier.

- The duty cycles described in the chart are standard, they can be manufactured in any intermediate value.

- If any customization from the original is needed, please ask us.

- Earthing is recommended if the metallic parts are accessible.

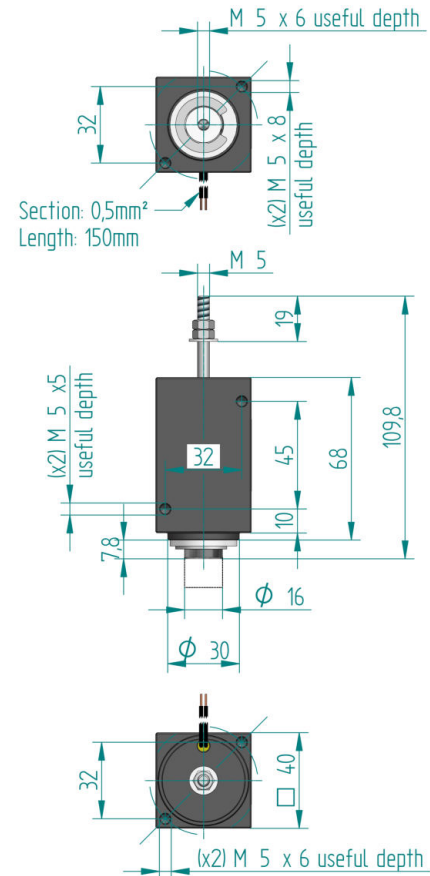
Ordering code: CU40/C --V ED---% - Spring

Voltage: 24Vdc; Duty cycle: ED100%; With spring:
 CU40/C 24Vdc ED100% RS

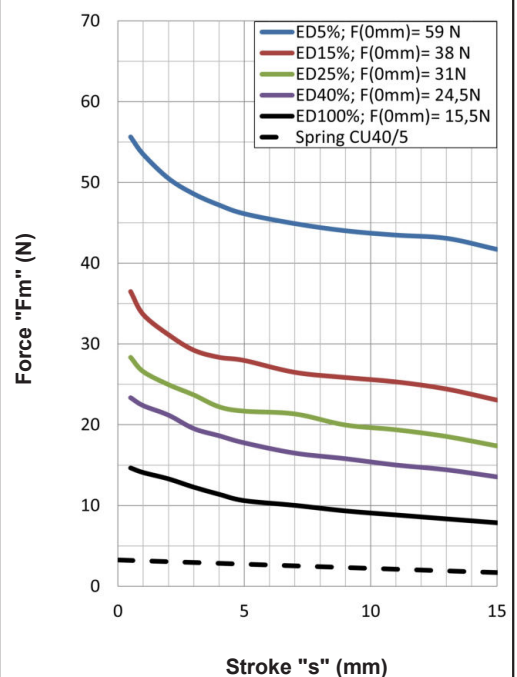
Voltage: 12Vdc; Duty cycle: ED15%; Without spring:
 CU40/C 12Vdc ED15% RN

Spring yes: RS ; Spring no: RN

Solenoid under voltage (s=0mm position)



Force-stroke curve

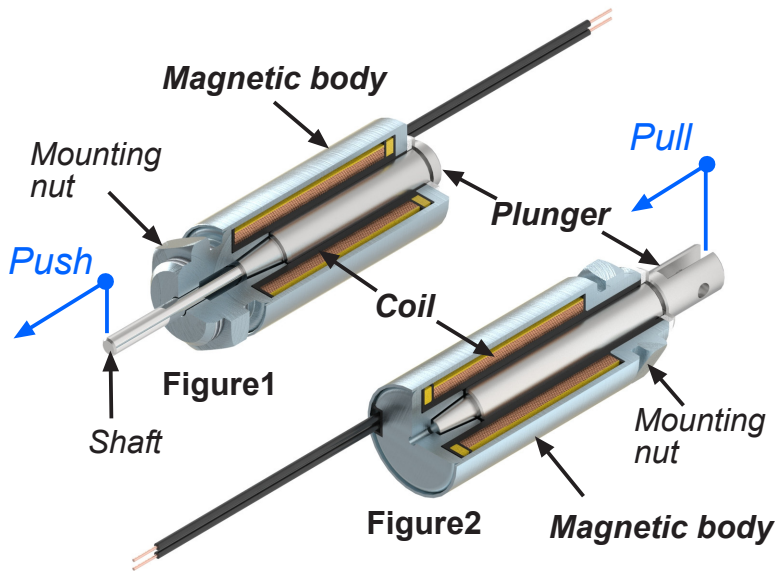


Calculation of the effective force:
 see pages 1 and 52

For fixation and mounting positions: see page 52

• ECM SERIES

ECM serie electromangets are linear simple effect solenoids, where the stroke movement from initial to the final position is made by electromagnetic forces, and the return to initial position takes place because of external forces or an incorporated spring (depending on the type). Its desing makes it perfect to be mounted on panels.



Structure, basic elements:

Magnetic body:

The metal piece containing the coil, the core and the fixation.

Coil:

It receives the electrical energy to create the magnetic field.

Plunger:

It is the piece that moves inside along the coil, it can have a non-magnetic shaft fixed to it. To pull (fig.2), the element to activate must be fixed to the plunger. To push (fig.1), the element to activate must be fixed to the shaft.

Mounting nut:

To fix the solenoid in the unit, a hole on the panel where the solenoid is mounted must be done, the hole must be lightly bigger than the mounting metric. To complete the mounting of the solenoid, tighten the nut.

• Datasheet rated values conditions (According to DIN VDE 0580):

The values of the magnetic force (F_m) depending on the stroke, are obtained in the following conditions:

Room temperature = 35°C

Coil stabilized at its working temperature.

Rated voltage equal to 90% of the standard one.

Solenoid working in horizontal position.

Effective force (F_h) is obtained from magnetic force (F_m).

-When the solenoid pulls upwards:

$Effective\ force = Magnetic\ force - Plunger\ weight$

-When the solenoid pulls downwards:

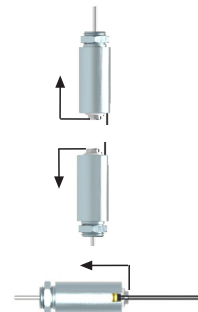
$Effective\ force = Magnetic\ force + Plunger\ weight$

-When the solenoid pulls in horizontal position:

$Effective\ force = Magnetic\ force$

-For the units with incorporated return spring:

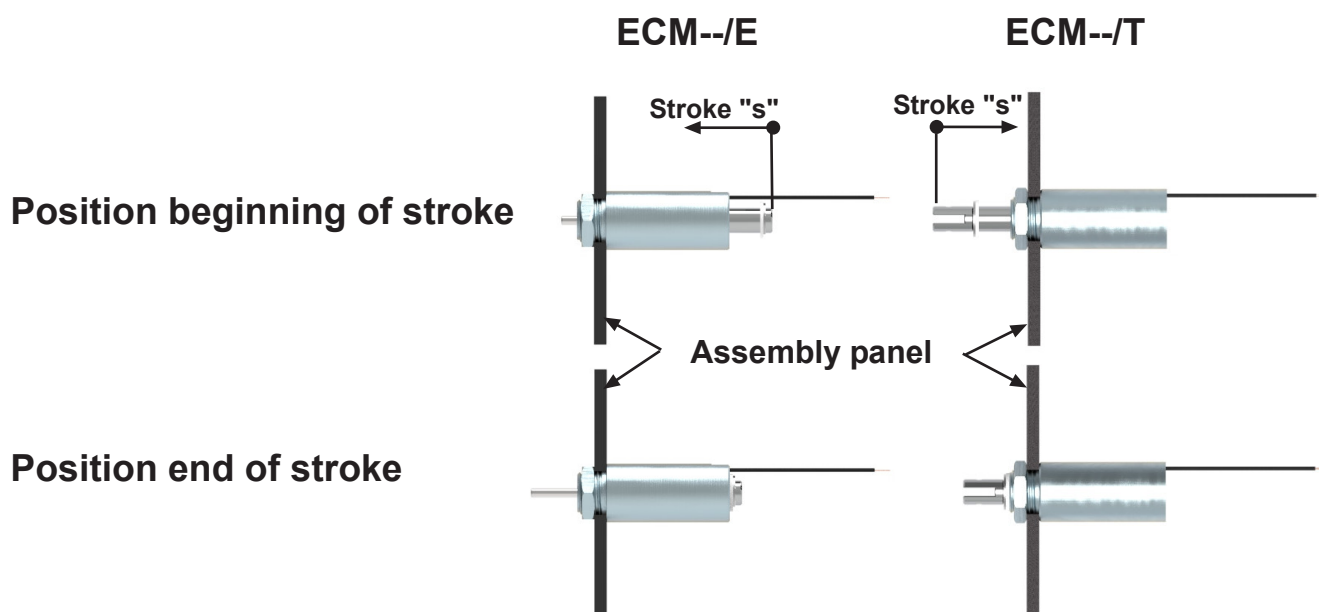
$Effective\ force = Magnetic\ force - Spring\ force \pm Plunger\ weight$



● ECM series: Force-stroke Chart

Type	Stroke (mm)		Duty-cycle					Return Spring force (N)
			100%	40%	25%	15%	5%	
ECM13-03/E	Beginning of stroke $s_1=3$	Magnetic force "Fm" (N)	0.02	0.08	0.12	0.2	0.5	
	End of stroke $s_0=0$		0.15	0.43	0.69	1	2.29	
ECM13-03/T	Beginning of stroke $s_1=3$		0.02	0.08	0.12	0.2	0.5	
	End of stroke $s_0=0$		0.15	0.43	0.69	1	2.29	
ECM13-10/E	Beginning of stroke $s_1=10$		0.15	0.3	0.4	0.7	1.7	
	End of stroke $s_0=0$		1.85	2.5	2.75	2.94	4.22	
ECM13-10/T	Beginning of stroke $s_1=10$		0.15	0.3	0.4	0.7	1.7	
	End of stroke $s_0=0$		1.85	2.5	2.75	2.94	4.22	
ECM19/E	Beginning of stroke $s_1=10$		0.5	1.2	2	3.2	6.6	0.1
	End of stroke $s_0=0$		7	12	14.4	16.7	24	0.18
ECM19/T	Beginning of stroke $s_1=10$		0.5	1.2	2	3.2	6.6	
	End of stroke $s_0=0$		7	12	14.4	16.7	24	
ECM25/E	Beginning of stroke $s_1=12$		0.6	1.5	2.3	3.4	8.4	0.8
	End of stroke $s_0=0$		10.5	16.7	19.5	22.5	32	2
ECM25/T	Beginning of stroke $s_1=12$		0.6	1.5	2.3	3.4	8.4	
	End of stroke $s_0=0$		10.5	16.7	19.5	22.5	32	

The values of magnetic force and the return spring are in Newton (N), solenoid in horizontal position and without return spring.



• CUSTOMIZATION ECM SERIES

The products described in the catalogue are standard and minimum manufacturing batches are not required. However, there is the possibility of customizing them to suit better customer's needs. See below some of the most common customizations.

If any modification is needed, please ask NAFSA about the possibility and the minimum manufacturing batch required.

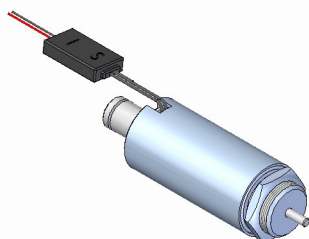
1. ELECTRICAL CUSTOMIZATION

a) PWM electronics integration:

It consists on feeding the electromagnet through an electronic PWM (Pulse width modulation). This device will initially provide the solenoid with it's nominal voltage / intensity and after a while, which will be higher than the one needed to complete it's stroke, the voltage entering to the solenoid will be reduced by the PWD to the selected ratio.

For instance, the most common reduction ratio values are 1:2 or 1:3. Once the voltage / intensity is reduced it will be maintained in this last value until the supply to the solenoid is off, once off, the system resets and when the solenoid works again, the cycle is repeated.

The solution is used when the initial stroke force in a 100% duty-cycle solenoid isn't enough or in those cases where a lower heating of the solenoid is required. For example, a 12Vdc and ED100% solenoid can be feeded at 24VDC through an PWM electronic and if it has 1:2 ratio, the solenoid will first see the 24VDC so it will complete the stroke with 4 times more power and with the force of a 25% duty cycle, then when the voltage is reduced to 12VDC the duty cycle will be 100%.



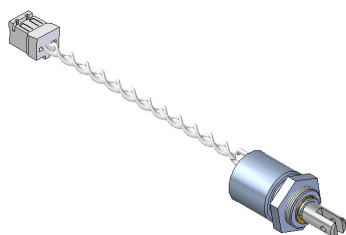
*PWD over cables

**NOTE: In the ECM serie the PWD can not be integrated in the coil

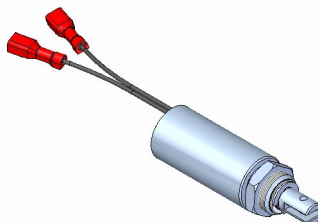
b) Cable length modification and terminal or connector mounted over cables:

All ECM models have supply cables, this length can be modified to customer requirement. Likewise, many kind of terminals or connectors can be added to the cables.

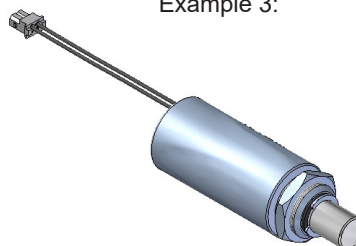
Example 1:



Example 2:



Example 3:



c) Intermediate duty-cycle manufacturing:

NAFSA can manufacture any intermediate duty-cycle from 0 to 100, but the viability depends on the model and the voltage associated with it. For any special requeriment, please ask NAFSA .

2. INSULATION CLASS CUSTOMIZATION:

For the ECM series, the standard manufacturing insulation class is B (130°C), the maximum we can customize this ECM series is to F (155°C).

3. PROTECCIÓN RATE IP (EN60529) CUSTOMIZATION:

Standard models are IP30, after overmolding the coils, IP34 can be obtained.

NOTE: All this customizations cannot be applied to all models, ask NAFSA for each case.

• CUSTOMIZATION ECM SERIES

The products described in the catalogue are standard and minimum manufacturing batches are not required. However, there is the possibility of customizing them to suit better customer's needs. See below some of the most common customizations.

If any modification is needed, please ask NAFSA about the possibility and the minimum manufacturing batch required.

4. MECHANICAL CUSTOMIZATION

4.1) Shaft modifications: Length and shape can be modified.



a) Flat



b) Spherical



c) Threaded



d) Transverse hole



e) Grooved

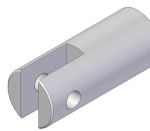
4.2) Plunger modifications: Length and shape can be modified.



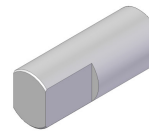
a) Flat



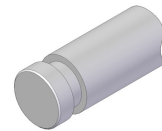
b) Threaded hole



c) Fork joint



d) Flat faces



e) Grooved

4.3) Return spring force modification:

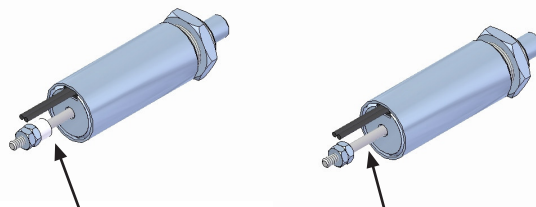
ECM serie electromagnets are linear simple effect solenoids, where the stroke movement from initial to the final position is made by electromagnetic forces, and the return to initial position takes place because of external forces or an incorporated spring (depending on the type). The force of the spring is limited to returning the plunger to the initial position. If more force is required, spring can be modified but the duty cycle will have to be taken in mind. Each duty-cycle has a limitation to increase the spring force, as this force will be deducted to the solenoid push/pull force (F_m).

In the cases that spring is not required, solenoid can be ordered without spring or it can be removed manually.

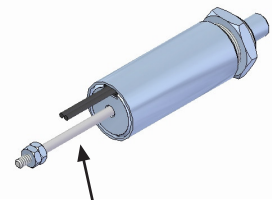
4.4) Stroke modifications:

The standard stroke is limited by the usefull length of shaft, in some cases the stroke can be modified: decreasing or increasing it in case that solenoid has enough activation force. These modifications can be made by customer or NAFSA.

Example:
Stroke decrease:
Inserting a plastic bearing, this can be made by NAFSA or the customer



Example:
Stroke increase:
Shaft has been enlarged to increase the stroke, This modification only can be made by NAFSA.



NOTE: All this customizations cannot be applied to all models, ask NAFSA for each case.

• ECM 13-03/E TYPE



Protection rate: **IP30**
 Insulation class: **B (130°C)**
 Reference cycle: **2 minutes**
 Standard stroke (s): **3 mm**
 Temperature rise " ΔV_{31} ": **70°C**
 Working temperature: **-10 to 45°C**
 Work: **Push**

Release spring NOT
 incorporated in standard
 product.

(ED) Duty-cycle ED(%)	100	40	25	15	5
(P20) Power at 20°C (W)	1	2.5	4	6.6	20
(Fm) Solenoid force (N) 1)	0.02	0.08	0.12	0.2	0.5
Max time under voltage(s)	Inf	48	30	18	6
Opening time (ms) 2)	29	20	19	17	15
Release time (ms) 3)	15	14	14	14	13
Plunger weight (Kg)	0.004				
Solenoid weight (Kg)	0.025				

1) Fm Solenoid force is given according to VDE0580 without deducting the spring force or the plunger weight if vertical mounting.

2) Time is given on these conditions: Coil supplied under nominal voltage ; Stabilized in it's working temperature ; Load 70% of the solenoid force ; Horizontal assembly ; Standard stroke initial position; 20°C ambient temperature.

3) Time is given on these conditions: without load on shaft ; Horizontal assembly ; Standard stroke initial position.

Duty-cycle ED%	Standard voltages									Under demand				
	VDC								VAC		VDC		VAC	
	6	12	24	48	100	125	205	110	230	Min	Max	Min	Max	
100	o	o	o	x	x	x	x	x	x	1.5	24	x	x	
40	o	o	o	o	x	x	x	x	x	1.5	48	x	x	
25	o	o	o	o	x	x	x	x	x	1.5	48	x	x	
15	o	o	o	o	x	x	x	x	x	1.5	48	x	x	
5	o	o	o	o	o	x	x	x	x	3	110	x	x	

Layout: o = Available ; x = Unavailable

- Voltage under demand:
 They can be manufactured at voltages between the maximum and minimum voltage values shown in the chart.

- The duty cycles described in the chart are standard, they can be manufactured in any intermediate value.

- If any customization from the original is needed, please ask us.

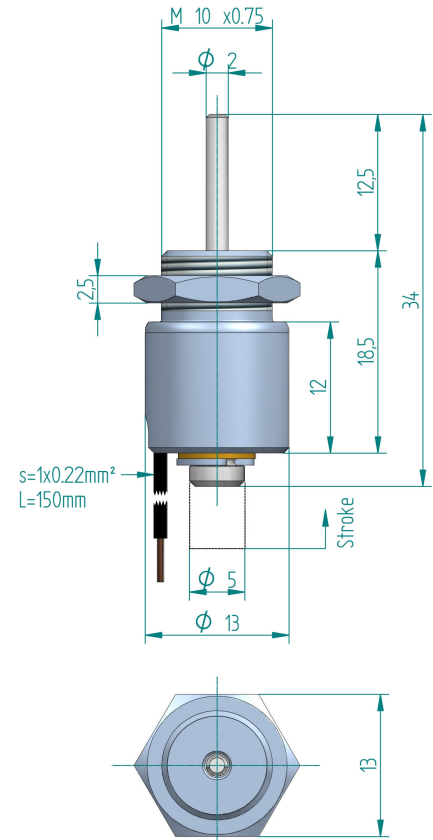
- Earthing is recommended if the metallic parts are accessible.

Ordering code: ECM13-03/E --V ED---%

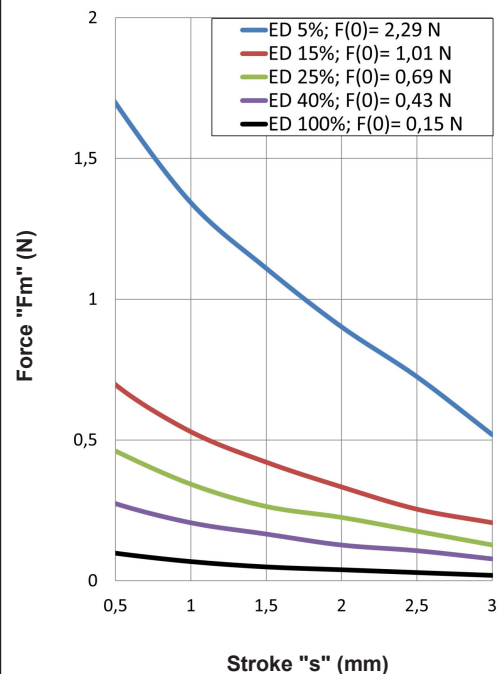
Voltage: 24Vdc; Duty cycle: ED100%:
 ECM13-03/E 24Vdc ED100%

Voltage: 12Vdc; Duty cycle: ED15%:
 ECM13-03/E 12Vdc ED15%

Solenoid under voltage (s=0mm position)



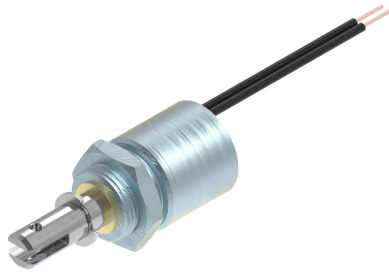
Force-stroke curve



Calculation of the effective force:
 see pages 1 and 59

For fixation and mounting positions: see page 59

• ECM 13-03/T TYPE



Protection rate: **IP30**
 Insulation class: **B (130°C)**
 Reference cycle: **2 minutes**
 Standard stroke (s): **3 mm**
 Temperature rise " ΔV_{31} ": **70°C**
 Working temperature: **-10 to 45°C**
 Work: **Pull**

Release spring NOT
 incorporated in standard
 product.

(ED) Duty-cycle ED(%)	100	40	25	15	5
(P20) Power at 20°C (W)	1	2.5	4	6.6	20
(Fm) Solenoid force (N) 1)	0.02	0.08	0.12	0.2	0.5
Max time under voltage(s)	Inf	48	30	18	6
Opening time (ms) 2)	29	20	19	17	15
Release time (ms) 3)	15	14	14	14	13
Plunger weight (Kg)	0.004				
Solenoid weight (Kg)	0.025				

1) Fm Solenoid force is given according to VDE0580 without deducting the spring force or the plunger weight if vertical mounting.

2) Time is given on these conditions: Coil supplied under nominal voltage ; Stabilized in it's working temperature ; Load 70% of the solenoid force ; Horizontal assembly ; Standard stroke initial position; 20°C ambient temperature.

3) Time is given on these conditions: without load on shaft ; Horizontal assembly ; Standard stroke initial position.

Duty-cycle ED%	Standard voltages									Under demand				
	VDC								VAC		VDC		VAC	
	6	12	24	48	100	125	205	110	230	Min	Max	Min	Max	
100	o	o	o	x	x	x	x	x	x	1.5	24	x	x	
40	o	o	o	o	x	x	x	x	x	1.5	48	x	x	
25	o	o	o	o	x	x	x	x	x	1.5	48	x	x	
15	o	o	o	o	x	x	x	x	x	1.5	48	x	x	
5	o	o	o	o	o	x	x	x	x	3	110	x	x	

Layout: o = Available ; x = Unavailable

- Voltage under demand:
 They can be manufactured at voltages between the maximum and minimum voltage values shown in the chart.

- The duty cycles described in the chart are standard, they can be manufactured in any intermediate value.

- If any customization from the original is needed, please ask us.

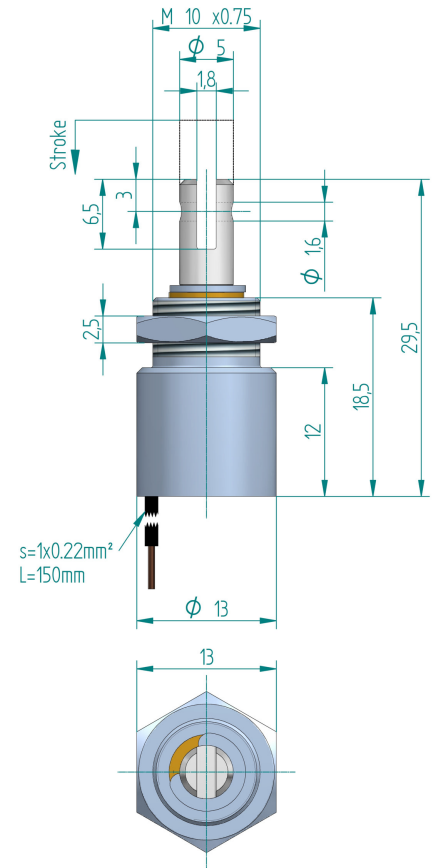
- Earthing is recommended if the metallic parts are accessible.

Ordering code: ECM13-03/T --V ED---%

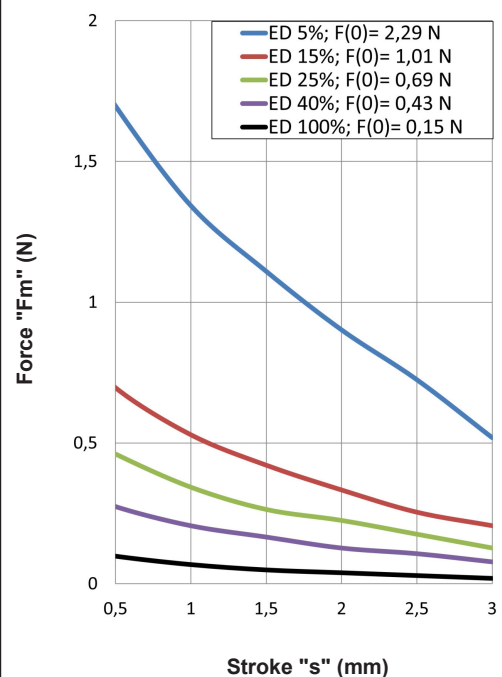
Voltage: 24Vdc; Duty cycle: ED100%:
 ECM13-03/T 24Vdc ED100%

Voltage: 12Vdc; Duty cycle: ED15%:
 ECM13-03/T 12Vdc ED15%

Solenoid under voltage (s=0mm position)



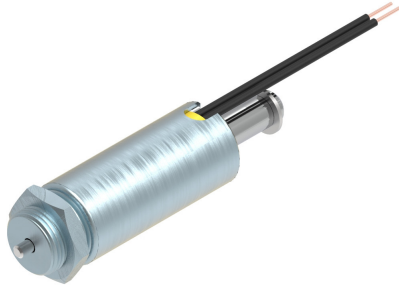
Force-stroke curve



Calculation of the effective force:
 see pages 1 and 59

For fixation and mounting positions: see page 59

• ECM 13-10/E TYPE



Protection rate: **IP30**
 Insulation class: **B (130°C)**
 Reference cycle: **2 minutes**
 Standard stroke (s): **10 mm**
 Temperature rise " ΔV_{31} ": **70°C**
 Working temperature: **-10 to 45°C**
 Work: **Push**

Release spring NOT
 incorporated in standard
 product.

(ED) Duty-cycle ED(%)	100	40	25	15	5
(P20) Power at 20°C (W)	3.3	10	16	26	80
(Fm) Solenoid force (N) 1)	0.15	0.3	0.4	0.7	1.7
Max time under voltage(s)	Inf	48	30	18	6
Opening time (ms) 2)	40	34	32	29	27
Release time (ms) 3)	29	28	27	26	26
Plunger weight (Kg)	0.010				
Solenoid weight (Kg)	0.040				

1) Fm Solenoid force is given according to VDE0580 without deducting the spring force or the plunger weight if vertical mounting.

2) Time is given on these conditions: Coil supplied under nominal voltage ; Stabilized in it's working temperature ; Load 70% of the solenoid force ; Horizontal assembly ; Standard stroke initial position; 20°C ambient temperature.

3) Time is given on these conditions: without load on shaft ; Horizontal assembly ; Standard stroke initial position.

Duty-cycle ED%	Standard voltages									Under demand				
	VDC								VAC		VDC		VAC	
	6	12	24	48	100	125	205	110	230	Min	Max	Min	Max	
100	o	o	o	o	x	x	x	x	x	1.5	48	x	x	
40	o	o	o	o	o	o	x	x	x	3	125	x	x	
25	o	o	o	o	o	o	x	x	x	3	125	x	x	
15	o	o	o	o	o	o	o	x	x	5	205	x	x	
5	o	o	o	o	o	o	o	x	x	6	250	x	x	

Layout: o = Available ; x = Unavailable

- Voltage under demand:
 They can be manufactured at voltages between the maximum and minimum voltage values shown in the chart.

- The duty cycles described in the chart are standard, they can be manufactured in any intermediate value.

- If any customization from the original is needed, please ask us.

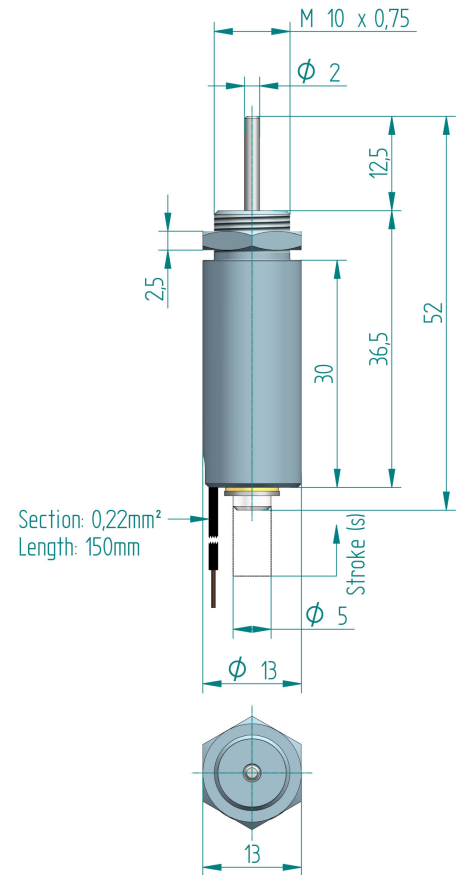
- Earthing is recommended if the metallic parts are accessible.

Ordering code: ECM13-10/E --V ED---%

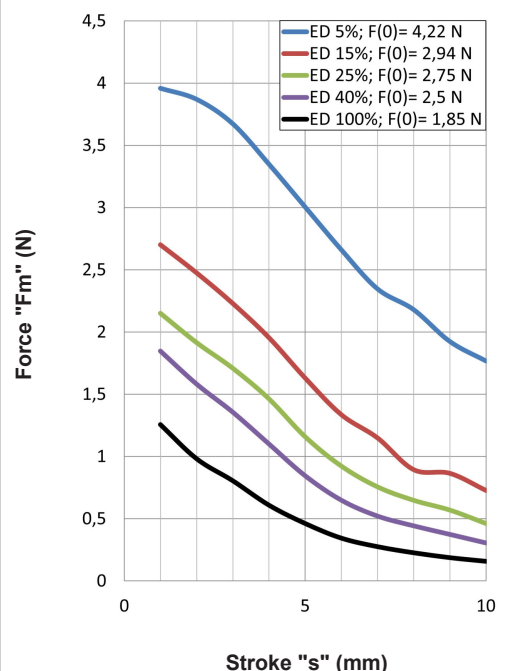
Voltage: 24Vdc; Duty cycle: ED100%:
 ECM13-10/E 24Vdc ED100%

Voltage: 12Vdc; Duty cycle: ED15%:
 ECM13-10/E 12Vdc ED15%

Solenoid under voltage (s=0mm position)



Force-stroke curve



Calculation of the effective force:
 see pages 1 and 59

For fixation and mounting positions: see page 59

• ECM 13-10/T TYPE



Protection rate: **IP30**
 Insulation class: **B (130°C)**
 Reference cycle: **2 minutes**
 Standard stroke (s): **10 mm**
 Temperature rise " ΔV_{31} ": **70°C**
 Working temperature: **-10 to 45°C**
 Work: **Pull**

Release spring NOT
 incorporated in standard
 product.

(ED) Duty-cycle ED(%)	100	40	25	15	5
(P20) Power at 20°C (W)	3.3	10	16	26	80
(Fm) Solenoid force (N) 1)	0.15	0.3	0.4	0.7	1.7
Max time under voltage(s)	Inf	48	30	18	6
Opening time (ms) 2)	40	34	32	29	27
Release time (ms) 3)	29	28	27	26	26
Plunger weight (Kg)	0.010				
Solenoid weight (Kg)	0.040				

1) Fm Solenoid force is given according to VDE0580 without deducting the spring force or the plunger weight if vertical mounting.

2) Time is given on these conditions: Coil supplied under nominal voltage ; Stabilized in its working temperature ; Load 70% of the solenoid force ; Horizontal assembly ; Standard stroke initial position; 20°C ambient temperature.

3) Time is given on these conditions: without load on shaft ; Horizontal assembly ; Standard stroke initial position.

Duty-cycle ED%	Standard voltages										Under demand			
	VDC								VAC		VDC		VAC	
	6	12	24	48	100	125	205	110	230		Min	Max	Min	Max
100	o	o	o	o	x	x	x	x	x		1.5	48	x	x
40	o	o	o	o	o	o	x	x	x		3	125	x	x
25	o	o	o	o	o	o	x	x	x		3	125	x	x
15	o	o	o	o	o	o	o	x	x		5	205	x	x
5	o	o	o	o	o	o	o	x	x		6	250	x	x

Layout: o = Available ; x = Unavailable

- Voltage under demand:
 They can be manufactured at voltages between the maximum and minimum voltage values shown in the chart.

- The duty cycles described in the chart are standard, they can be manufactured in any intermediate value.

- If any customization from the original is needed, please ask us.

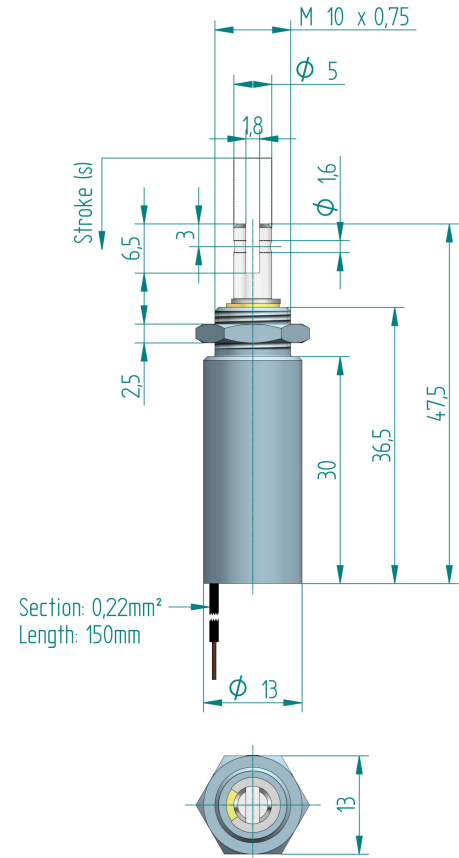
- Earthing is recommended if the metallic parts are accessible.

Ordering code: ECM13-10/T --V ED---%

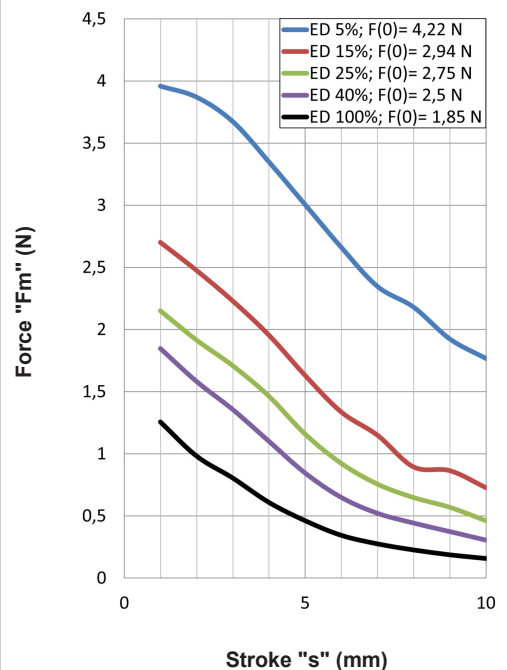
Voltage: 24Vdc; Duty cycle: ED100%:
 ECM13-10/T 24Vdc ED100%

Voltage: 12Vdc; Duty cycle: ED15%:
 ECM13-10/T 12Vdc ED15%

Solenoid under voltage (s=0mm position)



Force-stroke curve



Calculation of the effective force:
 see pages 1 and 59

For fixation and mounting positions: see page 59

● ECM 19/E TYPE



Protection rate: **IP30**
 Insulation class: **B (130°C)**
 Reference cycle: **2 minutes**
 Standard stroke (s): **10 mm**
 Temperature rise " ΔV_{31} ": **70°C**
 Working temperature: **-10 to 45°C**
 Work: **Push**

Release spring NOT
 incorporated in standard
 product. Available under
 demand.

(ED) Duty-cycle ED(%)	100	40	25	15	5
(P20) Power at 20°C (W)	7	17	28	45	140
(Fm) Solenoid force (N) 1)	0.5	1.2	2	3.2	6.6
Max time under voltage(s)	Inf	48	30	18	6
Opening time (ms) 2)	44	40	38	37	34
Release time (ms) 3)	39	39	38	38	36
Plunger weight (Kg)	0.020				
Solenoid weight (Kg)	0.080				

1) Fm Solenoid force is given according to VDE0580 without deducting the spring force or the plunger weight if vertical mounting.

2) Time is given on these conditions: Coil supplied under nominal voltage ; Stabilized in it's working temperature ; Load 70% of the solenoid force ; Horizontal assembly ; Standard stroke initial position; 20°C ambient temperature.

3) Time is given on these conditions: without load on shaft ; Horizontal assembly ; Standard stroke initial position.

Duty-cycle ED%	Standard voltages										Under demand			
	VDC								VAC		VDC		VAC	
	6	12	24	48	100	125	205	110	230		Min	Max	Min	Max
100	o	o	o	o	o	o	x	x	x		3	125	x	x
40	o	o	o	o	o	o	o	x	x		3	230	x	x
25	o	o	o	o	o	o	o	x	x		5	250	x	x
15	o	o	o	o	o	o	o	x	x		5	250	x	x
5	x	o	o	o	o	o	o	x	x		9	250	x	x

Layout: o = Available ; x = Unavailable

- Voltage under demand:
 They can be manufactured at voltages between the maximum and minimum voltage values shown in the chart.

- The duty cycles described in the chart are standard, they can be manufactured in any intermediate value.

- If any customization from the original is needed, please ask us.

- Earthing is recommended if the metallic parts are accessible.

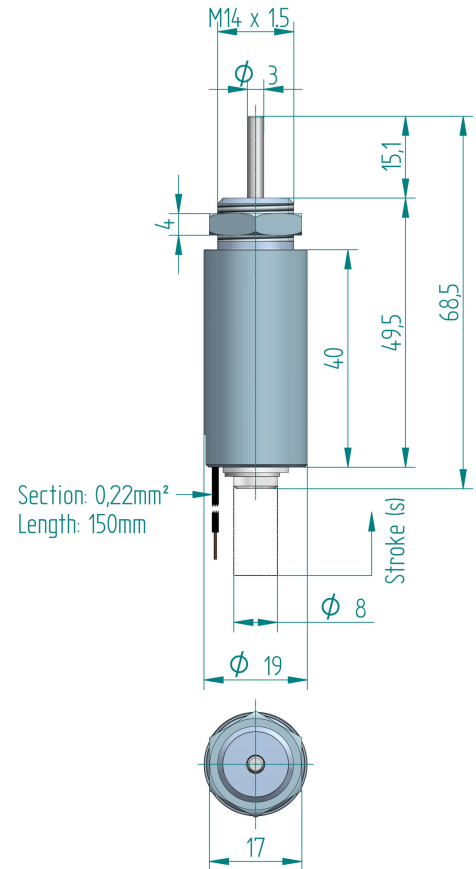
Ordering code: ECM19/E --V ED---% - Spring

Voltage: 24Vdc; Duty cycle: ED100%: With spring:
 ECM19/E 24Vdc ED100% RS

Voltage: 12Vdc; Duty cycle: ED15%: Without spring:
 ECM19/E 12Vdc ED15% RN

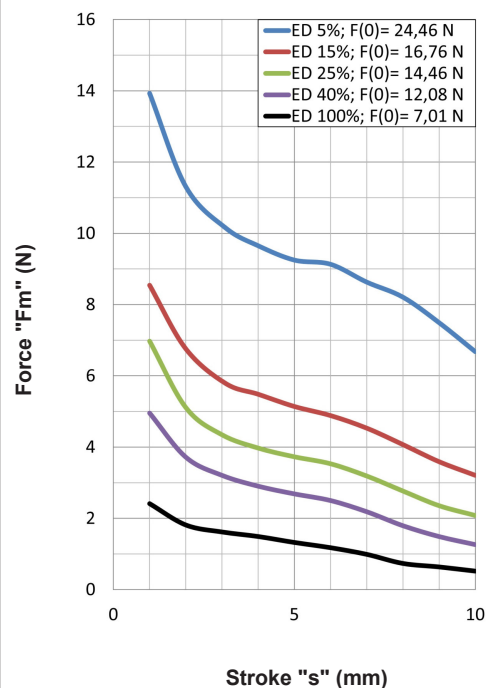
Spring yes: RS ; Spring no: RN

Solenoid under voltage (s=0mm position)



Section: 0,22mm²
 Length: 150mm

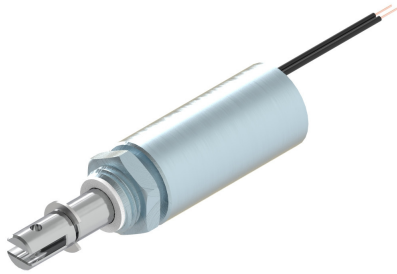
Force-stroke curve



Calculation of the effective force:
 see pages 1 and 59

For fixation and mounting positions: see page 59

• ECM 19/T TYPE



Protection rate: **IP30**
 Insulation class: **B (130°C)**
 Reference cycle: **2 minutes**
 Standard stroke (s): **10 mm**
 Temperature rise " ΔV_{31} ": **70°C**
 Working temperature: **-10 to 45°C**
 Work: **Pull**

Release spring NOT
 incorporated in standard
 product.

(ED) Duty-cycle ED(%)	100	40	25	15	5
(P20) Power at 20°C (W)	7	17	28	45	140
(Fm) Solenoid force (N) 1)	0.5	1.2	2	3.2	6.6
Max time under voltage(s)	Inf	48	30	18	6
Opening time (ms) 2)	44	40	38	37	34
Release time (ms) 3)	39	39	38	38	36
Plunger weight (Kg)	0.020				
Solenoid weight (Kg)	0.080				

1) Fm Solenoid force is given according to VDE0580 without deducting the spring force or the plunger weight if vertical mounting.

2) Time is given on these conditions: Coil supplied under nominal voltage ; Stabilized in it's working temperature ; Load 70% of the solenoid force ; Horizontal assembly ; Standard stroke initial position; 20°C ambient temperature.

3) Time is given on these conditions: without load on shaft ; Horizontal assembly ; Standard stroke initial position.

Duty-cycle ED%	Standard voltages										Under demand			
	VDC								VAC		VDC		VAC	
	6	12	24	48	100	125	205	110	230		Min	Max	Min	Max
100	o	o	o	o	o	o	x	x	x		3	125	x	x
40	o	o	o	o	o	o	o	x	x		3	230	x	x
25	o	o	o	o	o	o	o	x	x		5	250	x	x
15	o	o	o	o	o	o	o	x	x		5	250	x	x
5	x	o	o	o	o	o	o	x	x		9	250	x	x

Layout: o = Available ; x = Unavailable

- Voltage under demand:
 They can be manufactured at voltages between the maximum and minimum voltage values shown in the chart.

- The duty cycles described in the chart are standard, they can be manufactured in any intermediate value.

- If any customization from the original is needed, please ask us.

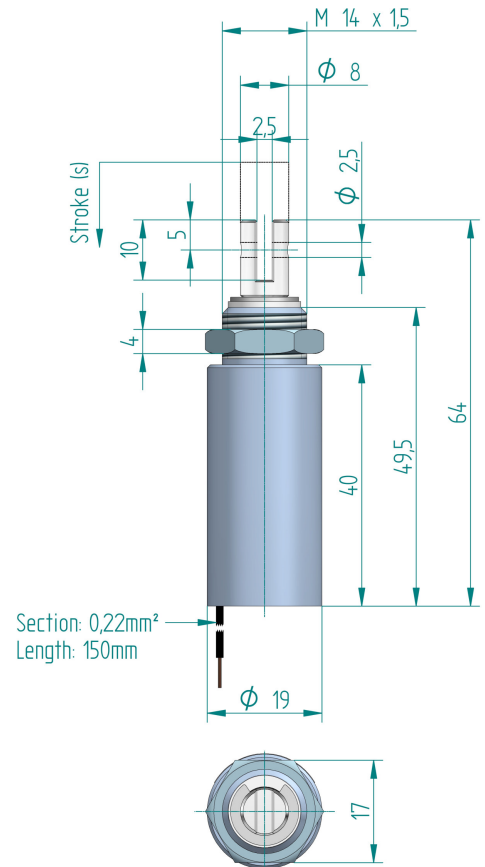
- Earthing is recommended if the metallic parts are accessible.

Ordering code: ECM19/T --V ED---%

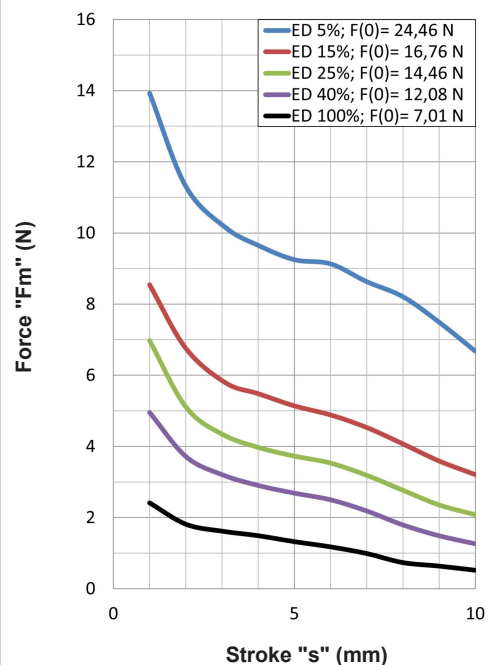
Voltage: 24Vdc; Duty cycle: ED100%
 ECM19/T 24Vdc ED100%

Voltage: 12Vdc; Duty cycle: ED15%
 ECM19/T 12Vdc ED15%

Solenoid under voltage (s=0mm position)



Force-stroke curve



Calculation of the effective force:
 see pages 1 and 59

For fixation and mounting positions: see page 99

• ECM 25/E TYPE



Protection rate: **IP30**
 Insulation class: **B (130°C)**
 Reference cycle: **2 minutes**
 Standard stroke (s): **12 mm**
 Temperature rise " ΔV_{31} ": **70°C**
 Working temperature: **-10 to 45°C**
 Work: **Push**

Release spring NOT
 incorporated in standard
 product. Available under
 demand.

(ED) Duty-cycle ED(%)	100	40	25	15	5
(P20) Power at 20°C (W)	10	25	40	65	200
(Fm) Solenoid force (N) 1)	0.6	1.5	2.3	3.4	8.4
Max time under voltage(s)	Inf	48	30	18	6
Opening time (ms) 2)	67	57	51	47	41
Release time (ms) 3)	65	63	60	58	55
Plunger weight (Kg)	0.050				
Solenoid weight (Kg)	0.190				

1) Fm Solenoid force is given according to VDE0580 without deducting the spring force or the plunger weight if vertical mounting.

2) Time is given on these conditions: Coil supplied under nominal voltage ; Stabilized in its working temperature ; Load 70% of the solenoid force ; Horizontal assembly ; Standard stroke initial position; 20°C ambient temperature

3) Time is given on these conditions: without load on shaft ; Horizontal assembly ; Standard stroke initial position

Duty-cycle ED%	Standard voltages										Under demand			
	VDC								VAC		VDC		VAC	
	6	12	24	48	100	125	205	110	230		Min	Max	Min	Max
100	o	o	o	o	o	o	o	x	x		5	250	x	x
40	o	o	o	o	o	o	o	x	x		6	250	x	x
25	x	o	o	o	o	o	o	x	x		9	250	x	x
15	x	o	o	o	o	o	o	x	x		9	250	x	x
5	x	x	o	o	o	o	o	x	x		16	250	x	x

Layout: o = Available ; x = Unavailable

- Voltage under demand:
 They can be manufactured at voltages between the maximum and minimum voltage values shown in the chart.

- The duty cycles described in the chart are standard, they can be manufactured in any intermediate value.

- If any customization from the original is needed, please ask us.

- Earthing is recommended if the metallic parts are accessible.

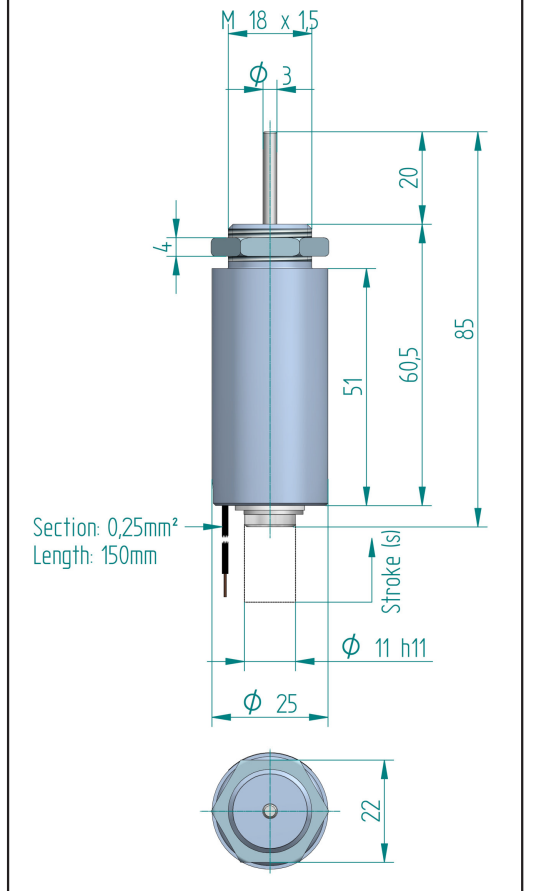
Ordering code: ECM25/E --V ED---% - Spring

Voltage: 24Vdc; Duty cycle: ED100%: With spring
 ECM25/E 24Vdc ED100% RS

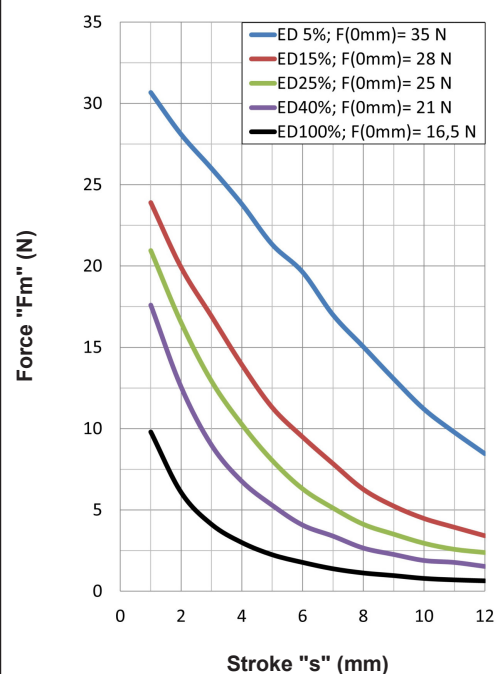
Voltage: 12Vdc; Duty cycle: ED15%: Without spring
 ECM25/E 12Vdc ED15% RN

Spring yes: RS ; Spring no: RN

Solenoid under voltage (s=0mm position)



Force-stroke curve



Calculation of the effective force:
 see pages 1 and 59

For fixation and mounting positions: see page 59

• ECM 25/T TYPE



Protection rate: **IP30**
 Insulation class: **B (130°C)**
 Reference cycle: **2 minutes**
 Standard stroke (s): **12 mm**
 Temperature rise " ΔV_{31} ": **70°C**
 Working temperature: **-10 to 45°C**
 Work: **Pull**

Release spring NOT
 incorporated in standard
 product.

(ED) Duty-cycle ED(%)	100	40	25	15	5
(P20) Power at 20°C (W)	10	25	40	65	200
(Fm) Solenoid force (N) 1)	0.6	1.5	2.3	3.4	8.4
Max time under voltage(s)	Inf	48	30	18	6
Opening time (ms) 2)	67	57	51	47	41
Release time (ms) 3)	65	63	60	58	55
Plunger weight (Kg)	0.050				
Solenoid weight (Kg)	0.190				

1) Fm Solenoid force is given according to VDE0580 without deducting the spring force or the plunger weight if vertical mounting.

2) Time is given on these conditions: Coil supplied under nominal voltage ; Stabilized in it's working temperature ; Load 70% of the solenoid force ; Horizontal assembly ; Standard stroke initial position; 20°C ambient temperature

3) Time is given on these conditions: without load on shaft ; Horizontal assembly ; Standard stroke initial position.

Duty-cycle ED%	Standard voltages										Under demand			
	VDC								VAC		VDC		VAC	
	6	12	24	48	100	125	205	110	230		Min	Max	Min	Max
100	o	o	o	o	o	o	o	x	x		5	250	x	x
40	o	o	o	o	o	o	o	x	x		6	250	x	x
25	x	o	o	o	o	o	o	x	x		9	250	x	x
15	x	o	o	o	o	o	o	x	x		9	250	x	x
5	x	x	o	o	o	o	o	x	x		16	250	x	x

Layout: o = Available ; x = Unavailable

- Voltage under demand:
 They can be manufactured at voltages between the maximum and minimum voltage values shown in the chart.

- The duty cycles described in the chart are standard, they can be manufactured in any intermediate value.

- If any customization from the original is needed, please ask us.

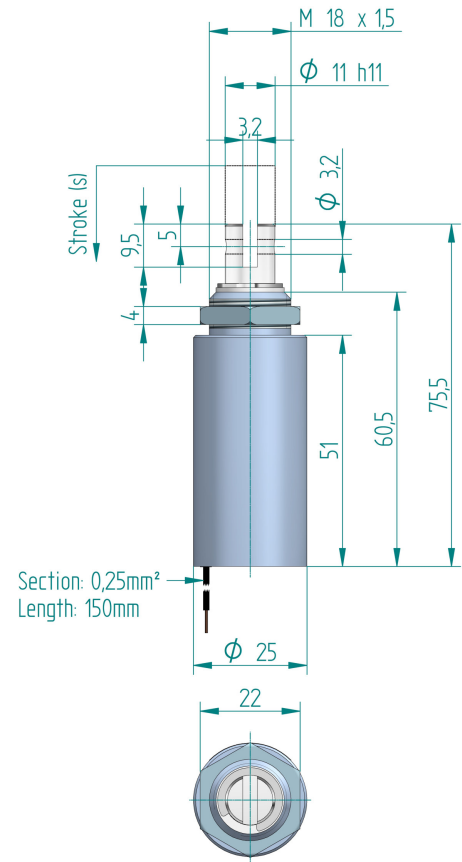
- Earthing is recommended if the metallic parts are accessible.

Ordering code: ECM25/T --V ED---%

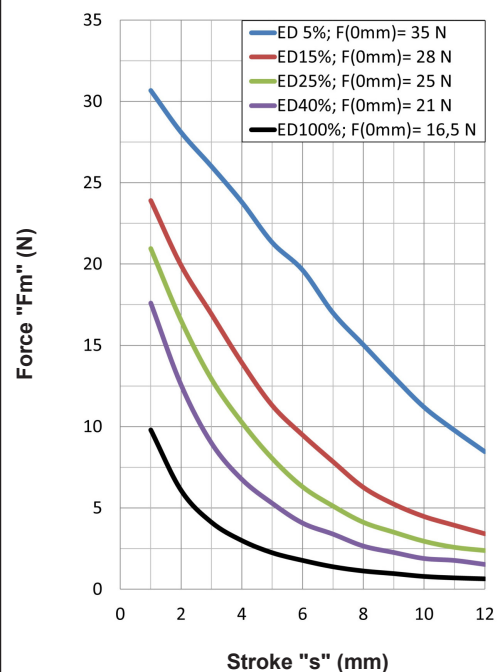
Voltage: 24Vdc; Duty cycle: ED100%:
 ECM25/T 24Vdc ED100%

Voltage: 12Vdc; Duty cycle: ED15%:
 ECM25/T 12Vdc ED15%

Solenoid under voltage (s=0mm position)



Force-stroke curve



Calculation of the effective force:
 see pages 1 and 59

For fixation and mounting positions: see page 99

• ERD 60-05/C TYPE

Simple effect linear solenoids of the ERD series have got a double coil, one of them with low resistive value (pulse coil) and the other one with high resistive value (holding coil). It is used commonly when a 100% duty-cycle and a huge force at the beginning of the stroke are needed.

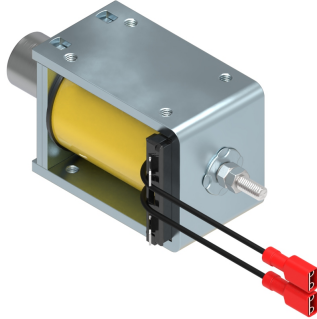


Figure1

Protection rate: **IP00**
 Insulation class: **B(130°C)**
 Standard voltage: **Vdc (24V; 48V; 110V; 125V)**
 Standard voltage: **Vac (110V60Hz; 230V50Hz)**
 Cycle duration: **3minutes**
 Working temperature: **(-10°C a 65°C)**
 Work: **Push / Pull**
 Return spring incorporated: **YES**
 Plunger weight (kg): **0.117**
 Solenoid weight (kg): **0.720**

Working:

Before the performance, when the solenoid is without voltage (see fig.3), the holding coil must be shorted circuit by an external microswitch (fig.2) connecting terminals 3 and 4. The solenoid is fed with its standard voltage U_n (between 1 and 2 terminals) and then only the pulse coil works (as it has got low resistive value, it will demand much power), and the solenoid shaft moves due to the forces indicated in chart 2. When total stroke is completed the solenoid shaft must push the microswitch and quit the short-circuit of the holding coil, so both serie coils start to work together, adding their resistive value and getting little demand of power.

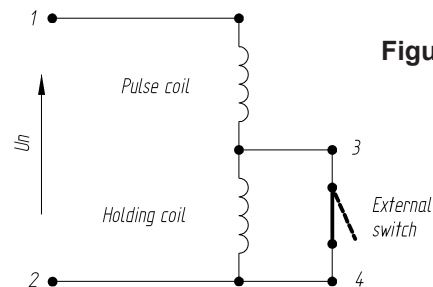


Figure2

Chart 1

Pulse coil	Duty cycle (ED%)				
	20	15	10	5	3
Abs. power at 20°C (W)	68	115	169	337	462
Max time under voltage (s)	36	27	15	8	5

Chart 2: Values of force without springs

Pulse coil:	Duty cycle ED(%)				
Stroke "s" (mm)	20	15	10	5	3
25	6	9	13	24	33
20	8	13	18	33	46
15	11	19	25	44	61
10	18	28	36	64	88
5	36	56	74	137	140
3	63	94	114	162	188
1	196	235	259	263	288
0	378	390	411	436	440

Chart 3

Springs	ERD60/5	ER60/5	ER60/5/B
Force (N) a 25mm	9,7	1,6	5
Force (N) a 0 mm	44	5,3	21
Constant (K)	1,37	0,15	0,65

Solenoid without voltage (s=20mm position)

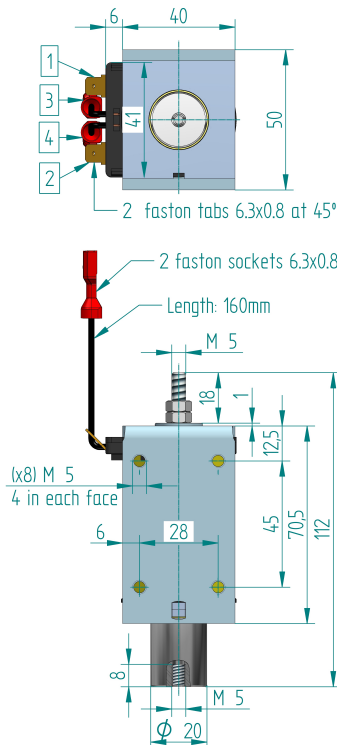


Figure3

*Earthing is recommended if the metallic parts are accessible.

Holding coil:

Power: 4W
 Duty cycle (ED%): 100
 Holding force: 60N

Return spring can be mounted (customer selection), in standard ERD60/5 is mounted

All the solenoids are tested at 20°C. The force will decrease due to the room temperature rising, decreasing a 30% at 65°C. When the temperature is -10°C, standard current will increase a 15%. If any extra data is needed, please contact NAFSA.

• CUSTOMIZATION ECR SERIES

ECR serie electromagnets are linear reversible solenoids, where the stroke is made by the alternative piloting of two coils, each one must be excited alternatively to make the movement as shown in the figure 1. To keep any final stroke position, the coil must remain under voltage.

These solenoids are used in those applications where force must be the same for both movement senses push and pull.

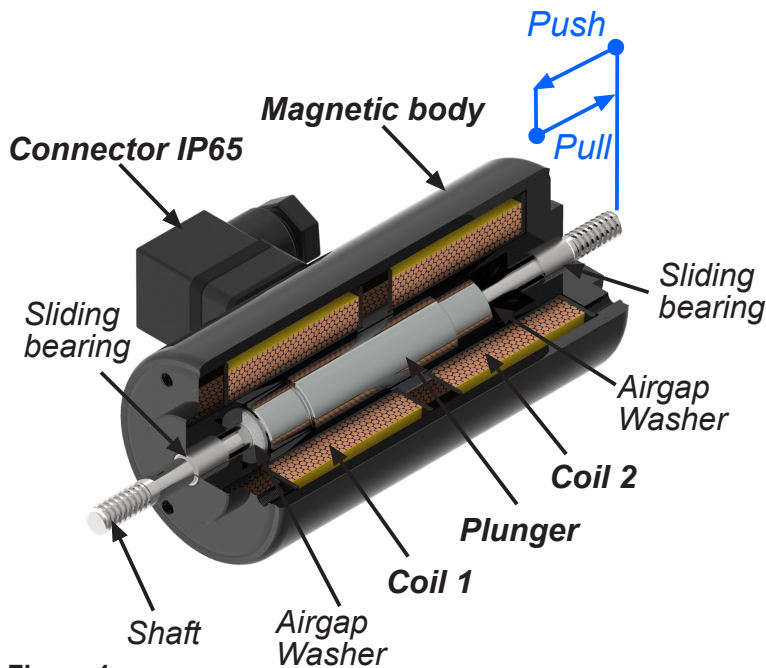


Figure 1.

Structure, basic components

Magnetic body:

The metallic piece containing the coils, and the plunger of the solenoid.

Coils:

They are those that receive the electrical energy to create the magnetic field. The plunger moves towards the coil that is excited.

Plunger:

It moves inside along the coil, and it has a non-magnetic shaft fixed to it. The shaft has got two screwed sides so that they can be used both to push and pull.

Connector (DIN43650):

It is the part where the electrical connection takes place. It has got a stuffing box PG11. For more info see page 73.

• Datasheet rated values conditions (According to DIN VDE 0580):

The values of the magnetic force (F_m) depending on the stroke, are obtained in the following conditions:

Room temperature = 35°C

Coil stabilized at its working temperature.

Rated voltage equal to 90% of the standard one.

Solenoid working in horizontal position.

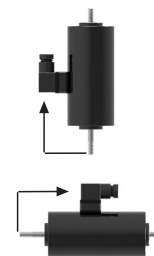
The effective force (F_h) is obtained from magnetic force (F_m) adding or subtracting the weight of the plunger.

1) When the solenoid pushes or pulls upwards or downwards:

$\text{Effective force} = \text{Magnetic force} \pm \text{plunger weight}$

2) When the solenoid pushes or pulls in horizontal position:

$\text{Effective force} = \text{Magnetic force}$

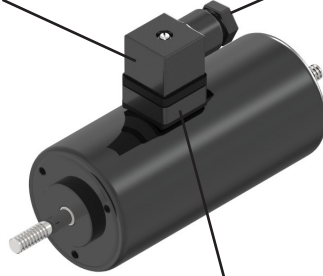
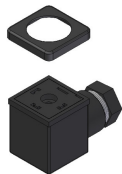
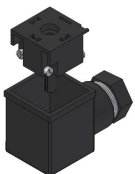
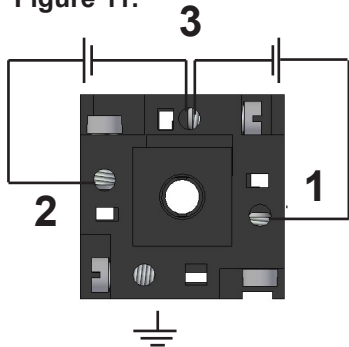
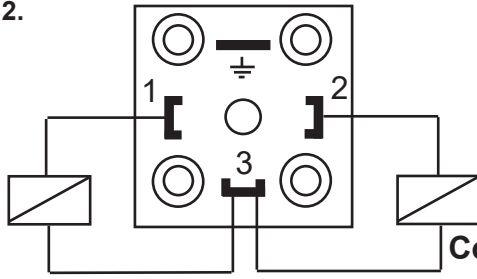


REMARK: The work option 2) increases the abrasion of the slide bearings comparing to mounting option 1).

• 4x90° adjustable connector by the user :



• CUSTOMIZATION ECR SERIES

Connector  Figure 4. Connector base mounted on the solenoid, must not be manipulated		1)The electrical connection will be detailed in the following points.  Figure 5.
2) Take out the screw between the connector and the base.  Figure 6.		
3) Take off the connector pulling it up.  Figure 7.	4) Take off the rubber piece.  Figure 8.	
5) Remove the interior piece, this one has power terminals. To remove it, push the carrier between the terminals 1 and the mass one. Finally take off the stuffing box and connect the supply cables like in figure 11.  Figure 9.  Figure 10.		
Figure 11.  Connection by the user Take out the screws, take in the supply cables in the power terminals and screw them again Figure 12.  Coil1 Coil2 Connection between base connector and coil, realized by the manufacturer		
Coil 1 under voltage  Coil1 Coil2 Figure 13. Coil 2 under voltage  Coil1 Coil2 Figure 14.		

• ECR series: Force-stroke Chart

Type	Stroke (mm)		Duty-cycle				
			100%	40%	25%	15%	5%
ECR40-07	Beginning of stroke $s_1=07$	Magnetic force "Fm" (N)	10	17.9	22	28	46
	End of stroke $s_0=0$		10.4	16	19.6	27	43
ECR50-16	Beginning of stroke $s_1=16$		18.7	30	41	56	92
	End of stroke $s_0=0$		44	84	104	133	193
ECR65-15	Beginning of stroke $s_1=15$		46	73	91	118	177
	End of stroke $s_0=0$		152	199	253	303	385
ECR72-30	Beginning of stroke $s_1=30$		28	42	56	71	146
	End of stroke $s_0=0$		68	112	148	182	269
ECR90-25	Beginning of stroke $s_1=25$		85	126	163	205	341
	End of stroke $s_0=0$		265	379	501	578	837

The values of force-stroke and the return spring are in Newton (N), solenoid in horizontal position and without return spring.

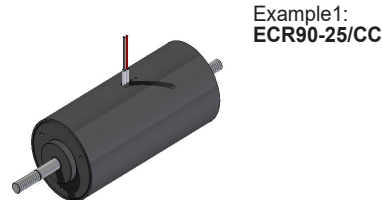
• CUSTOMIZATION ECR SERIES

The models described in the catalogue are standard and minimum manufacturing batches are not required. However, there is the possibility of customizing them to suit better customer's needs. See below some of the most common customizations.

If any modification is needed, please ask NAFSA about the possibility and the minimum manufacturing batch required.

1. ELECTRICAL CUSTOMIZATION

a) DIN43650A connectors replacement by supply cables

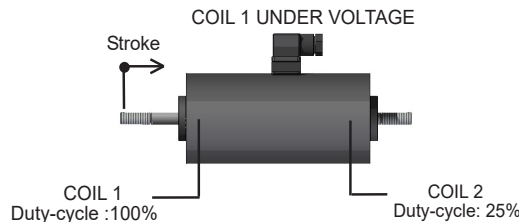


b) Intermediate duty-cycle manufacturing:

NAFSA can manufacture any intermediate duty-cycle from 0 to 100, but the viability depends on the model and the voltage associated with it. For any special requirement, please ask NAFSA.

c) Different duty-cycle manufacturing for each coil:

ECR series electromagnets are linear reversible solenoids, where the stroke is made by the alternative piloting of two coils. In case of different forces need for each stroke direction, there is the option of manufacture each coil with different duty-cycle. For any special requirement, please ask NAFSA.



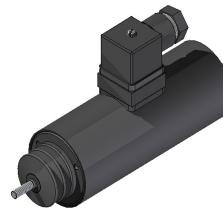
Example 2:
ECR90-25.01R.24.100-25.C

2. INSULATION CLASS CUSTOMIZATION:

Depending on the model, insulation class can be increased until H (180°C), this change is limited to voltages less than 48VDC, this usually involves DIN43650A connectors replacement by cables or another type of connectors. For any special requirement, please ask NAFSA.

3. PROTECTION RATE CUSTOMIZATION IP (EN60529):

Standard models are IP40, but protecting the shaft and its guides IP54 can be obtained.



Example 3:
Bellows have been added in the shaft

4. MECHANICAL CUSTOMIZATION

a) Shaft modifications:



Example 4:
Shaft diameter, length, thread can be modified

b) Stroke modifications:



Example 5:
ECR40-16/RO
Modification of ECR40-07 stroke has been increased from 7mm to 16mm

c) Fastening element added as Fork joint DIN71752



Example 6:
ECR50-16+Fork joint
Modification ECR50-16, DIN71752 fork joint has been added

• ECR 40-07 TYPE



Protection rate: **IP40**
 Insulation class: **B (130°C)**
 Reference cycle: **5 minutes**
 Standard stroke (s): **7 mm**
 Temperature rise " ΔV_{31} ": **70°C**
 Working temperature: **-10 to 45°C**
 Work: **Push / Pull**

Release spring NOT
 incorporated in standard
 product.

(ED) Duty-cycle ED(%)	100	40	25	15	5
(P20) Power at 20°C (W)	13	30	45	75	210
(Fm) Solenoid force (N) 1)	10	15	18	22	37
Max time under voltage(s)	Inf	120	75	45	15
Opening time (ms) 2)	117	95	84	79	77
Release time (ms) 3)	70	57	51	48	46
Plunger weight (Kg)	0.140				
Solenoid weight (Kg)	0.8				

1) Fm Solenoid force is given according to VDE0580 without deducting the spring force or the plunger weight if vertical mounting.

2) Time is given on these conditions: Coil supplied under nominal voltage ; Stabilized in it's working temperature ; Load 70% of the solenoid force ; Horizontal assembly ; Standard stroke initial position; 20°C ambient temperature.

3) Time is given on these conditions: without load on shaft ; Horizontal assembly ; Standard stroke initial position.

Duty-cycle ED%	Standard voltages									Under demand				
	VDC								VAC		VDC		VAC	
	6	12	24	48	100	125	205	110	230	Min	Max	Min	Max	
100	o	o	o	o	o	o	o	x	x	5	250	x	x	
40	o	o	o	o	o	o	o	x	x	6	250	x	x	
25	x	o	o	o	o	o	o	x	x	9	250	x	x	
15	x	o	o	o	o	o	o	x	x	9	250	x	x	
5	x	o	o	o	o	o	o	x	x	12	250	x	x	

Layout: o = Available ; x = Unavailable

- Voltage under demand:
 They can be manufactured at voltages between the maximum and minimum voltage values shown in the chart.

- To feed in alternating current, there has to be an external rectification of the signal.

- The duty cycles described in the chart are standard, they can be manufactured in any intermediate value.

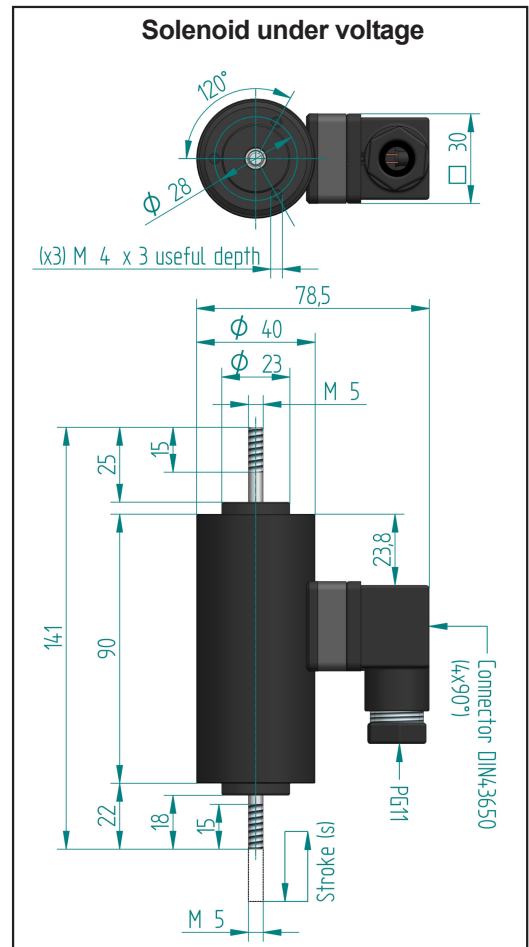
- If any customization from the original is needed, please ask us.

- Earthing is recommended if the metallic parts are accessible.

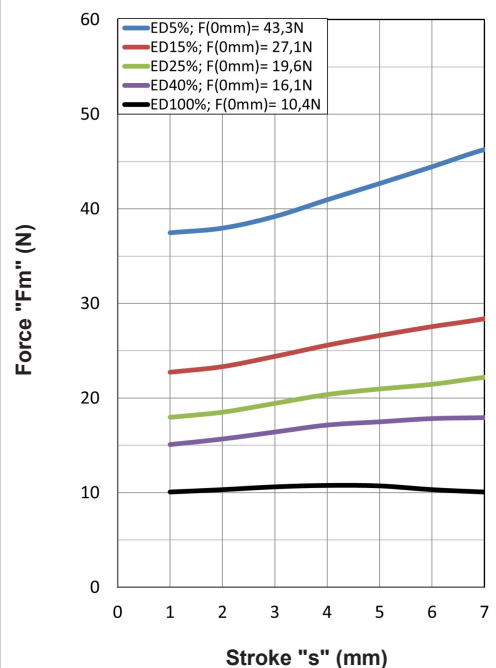
Ordering code: ECR40-07 --V ED---%

Voltage: 24Vdc; Duty cycle: ED100%; ECR40-07 24Vdc ED100%

Voltage: 12Vdc; Duty cycle: ED15%; ECR40-07 12Vdc ED15%



Force-stroke curve



Calculation of the effective force:
 see pages 1 and 72

For fixation of the solenoid: see page 72

• ECR 50-16 TYPE



Protection rate: **IP40**
 Insulation class: **B (130°C)**
 Reference cycle: **5 minutes**
 Standard stroke (s): **16 mm**
 Temperature rise " ΔV_{31} ": **70°C**
 Working temperature: **-10 to 45°C**
 Work: **Push / Pull**

Release spring NOT
 incorporated in standard
 product.

(ED) Duty-cycle ED(%)	100	40	25	15	5
(P20) Power at 20°C (W)	20	45	70	120	320
(Fm) Solenoid force (N) 1)	13	18	26	41	72
Max time under voltage(s)	Inf	120	75	45	15
Opening time (ms) 2)	203	160	137	127	116
Release time (ms) 3)	131	106	92	86	80
Plunger weight (Kg)	0.220				
Solenoid weight (Kg)	1.4				

1) Fm Solenoid force is given according to VDE0580 without deducting the spring force or the plunger weight if vertical mounting.

2) Time is given on these conditions: Coil supplied under nominal voltage ; Stabilized in its working temperature ; Load 70% of the solenoid force ; Horizontal assembly ; Standard stroke initial position; 20°C ambient temperature.

3) Time is given on these conditions: without load on shaft ; Horizontal assembly ; Standard stroke initial position.

Duty-cycle	Standard voltages										Under demand			
ED%	VDC								VAC		VDC		VAC	
	6	12	24	48	100	125	205	110	230	Min	Max	Min	Max	
100	o	o	o	o	o	o	o	x	x	5	250	x	x	
40	x	o	o	o	o	o	o	x	x	9	250	x	x	
25	x	o	o	o	o	o	o	x	x	9	250	x	x	
15	x	o	o	o	o	o	o	x	x	12	250	x	x	
5	x	x	o	o	o	o	o	x	x	24	250	x	x	

Layout: o = Available ; x = Unavailable

- Voltage under demand:
 They can be manufactured at voltages between the maximum and minimum voltage values shown in the chart.

- To feed in alternating current, there has to be an external rectification of the signal.

- The duty cycles described in the chart are standard, they can be manufactured in any intermediate value.

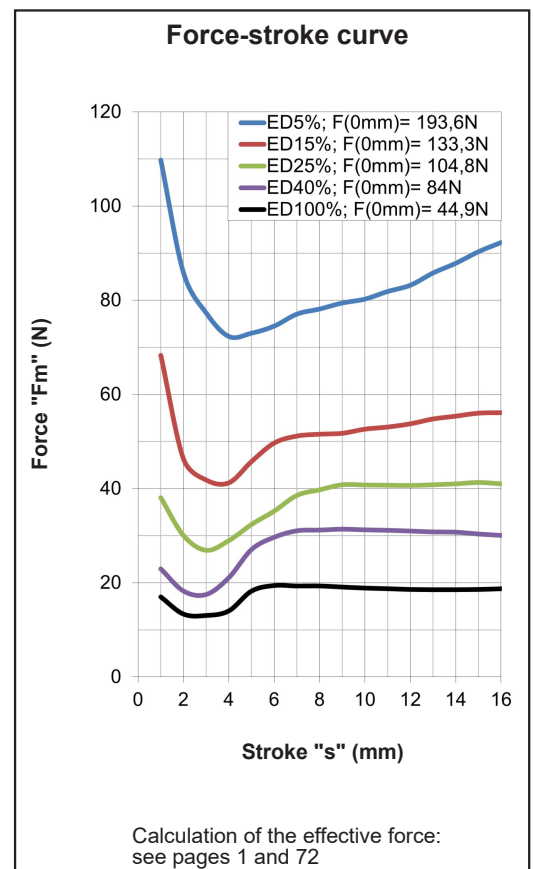
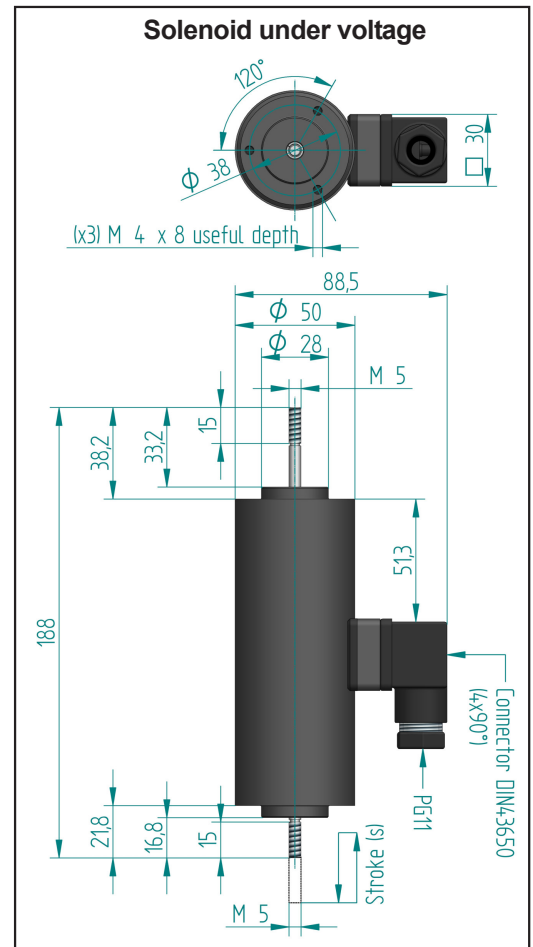
- If any customization from the original is needed, please ask us.

- Earthing is recommended if the metallic parts are accessible.

Ordering code: ECR50-16 --V ED---%

Voltage: 24Vdc; Duty cycle: ED100%; ECR50-16 24Vdc ED100%

Voltage: 12Vdc; Duty cycle: ED15%; ECR50-16 12Vdc ED15%



For fixation of the solenoid: see page 72

• ECR 65-15 TYPE



Protection rate: **IP40**
 Insulation class: **B (130°C)**
 Reference cycle: **5 minutes**
 Standard stroke (s): **15 mm**
 Temperature rise " ΔV_{31} ": **70°C**
 Working temperature: **-10 to 45°C**
 Work: **Push / Pull**

Release spring NOT
 incorporated in standard
 product.

(ED) Duty-cycle ED(%)	100	40	25	15	5
(P20) Power at 20°C (W)	30	75	110	185	545
(Fm) Solenoid force (N) 1)	38	64	80	99	162
Max time under voltage(s)	Inf	120	75	45	15
Opening time (ms) 2)	291	228	198	196	181
Release time (ms) 3)	181	143	125	124	115
Plunger weight (Kg)	0.350				
Solenoid weight (Kg)	2.8				

1) Fm Solenoid force is given according to VDE0580 without deducting the spring force or the plunger weight if vertical mounting.

2) Time is given on these conditions: Coil supplied under nominal voltage ; Stabilized in it's working temperature ; Load 70% of the solenoid force ; Horizontal assembly ; Standard stroke initial position; 20°C ambient temperature.

3) Time is given on these conditions: without load on shaft ; Horizontal assembly ; Standard stroke initial position.

Duty-cycle ED%	Standard voltages										Under demand			
	VDC								VAC		VDC		VAC	
	6	12	24	48	100	125	205	110	230		Min	Max	Min	Max
100	x	o	o	o	o	o	o	x	x		9	250	x	x
40	x	o	o	o	o	o	o	x	x		12	250	x	x
25	x	x	o	o	o	o	o	x	x		24	250	x	x
15	x	x	o	o	o	o	o	x	x		24	250	x	x
5	x	x	o	o	o	o	o	x	x		24	250	x	x

Layout: o = Available ; x = Unavailable

- Voltage under demand:
 They can be manufactured at voltages between the maximum and minimum voltage values shown in the chart.

- To feed in alternating current, there has to be an external rectification of the signal.

- The duty cycles described in the chart are standard, they can be manufactured in any intermediate value.

- If any customization from the original is needed, please ask us.

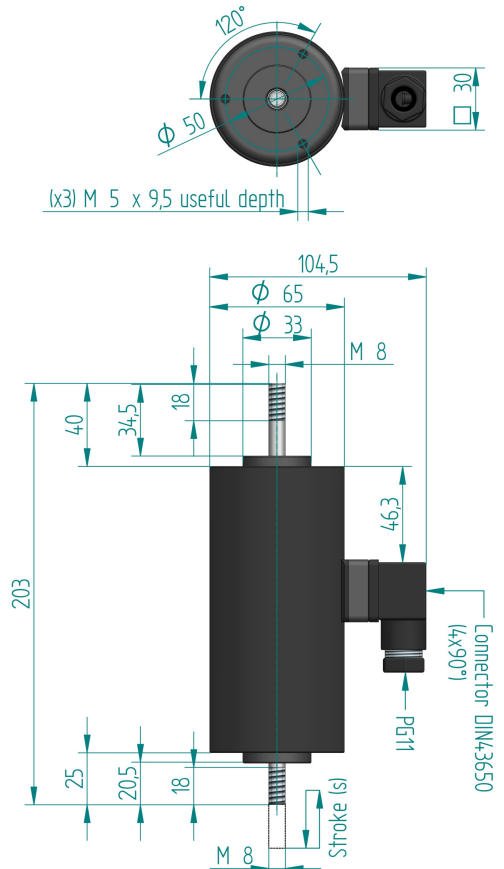
- Earthing is recommended if the metallic parts are accessible.

Ordering code: ECR65-15 --V ED---%

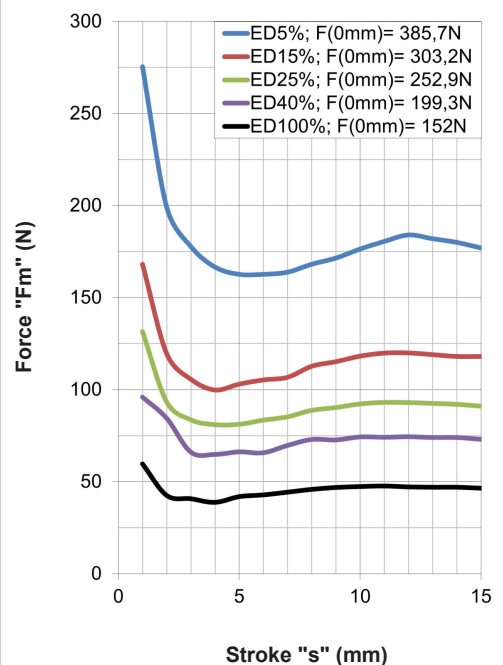
Voltage: 24Vdc; Duty cycle: ED100%; ECR65-15 24Vdc ED100%

Voltage: 48Vdc; Duty cycle: ED15%; ECR65-15 48Vdc ED15%

Solenoid under voltage



Force-stroke curve



Calculation of the effective force:
 see pages 1 and 72

For fixation of the solenoid: see page 72

• ECR 72-30 TYPE



Protection rate: **IP40**
 Insulation class: **B (130°C)**
 Reference cycle: **5 minutes**
 Standard stroke (s): **30 mm**
 Temperature rise " ΔV_{31} ": **70°C**
 Working temperature: **-10 to 45°C**
 Work: **Push / Pull**

Release spring NOT
 incorporated in standard
 product.

(ED) Duty-cycle ED(%)	100	40	25	15	5
(P20) Power at 20°C (W)	34	98	166	195	830
(Fm) Solenoid force (N) 1)	28	42	56	71	146
Max time under voltage(s)	Inf	120	75	45	15
Opening time (ms) 2)	410	352	284	269	241
Release time (ms) 3)	256	222	181	172	156
Plunger weight (Kg)	0.400				
Solenoid weight (Kg)	3.2				

1) Fm Solenoid force is given according to VDE0580 without deducting the spring force or the plunger weight if vertical mounting.

2) Time is given on these conditions: Coil supplied under nominal voltage ; Stabilized in it's working temperature ; Load 70% of the solenoid force ; Horizontal assembly ; Standard stroke initial position; 20°C ambient temperature.

3) Time is given on these conditions: without load on shaft ; Horizontal assembly ; Standard stroke initial position.

Duty-cycle ED%	Standard voltages									Under demand				
	VDC								VAC		VDC		VAC	
	6	12	24	48	100	125	205	110	230	Min	Max	Min	Max	
100	o	o	o	o	o	o	o	x	x	5	250	x	x	
40	x	o	o	o	o	o	o	x	x	9	250	x	x	
25	x	o	o	o	o	o	o	x	x	12	250	x	x	
15	x	o	o	o	o	o	o	x	x	12	250	x	x	
5	x	x	o	o	o	o	o	x	x	24	250	x	x	

Layout: o = Available ; x = Unavailable

- Voltage under demand:
 They can be manufactured at voltages between the maximum and minimum voltage values shown in the chart.

- To feed in alternating current, there has to be an external rectification of the signal.

- The duty cycles described in the chart are standard, they can be manufactured in any intermediate value.

- If any customization from the original is needed, please ask us.

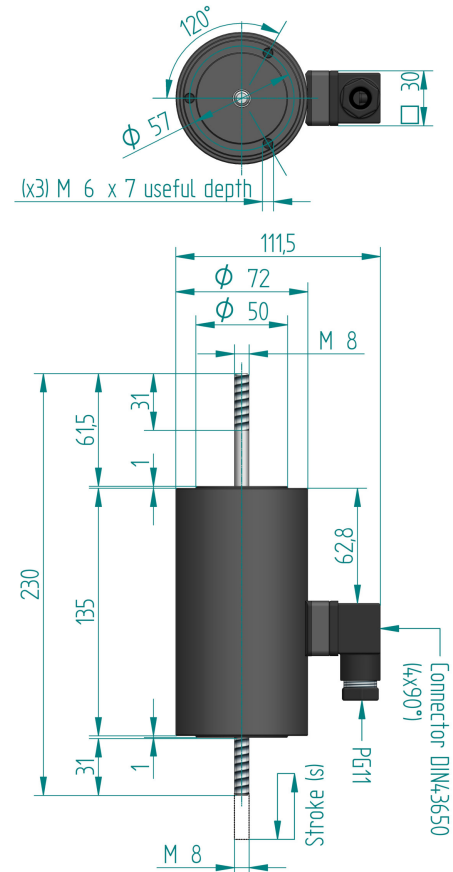
- Earthing is recommended if the metallic parts are accessible.

Ordering code: ECR72-30 --V ED---%

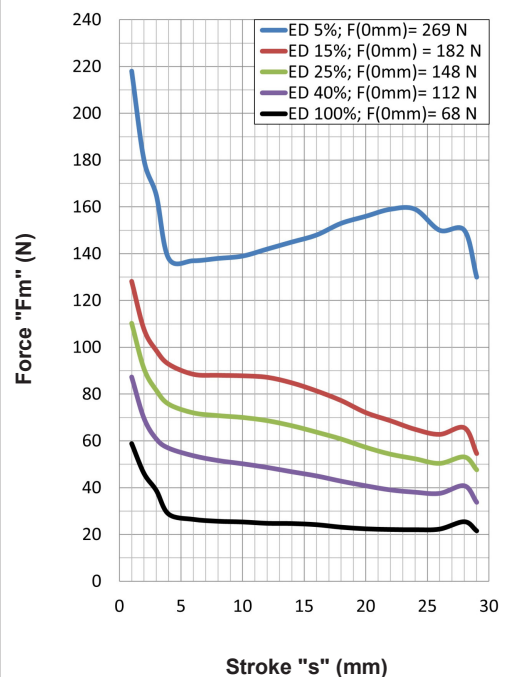
Voltage: 24Vdc; Duty cycle: ED100%; ECR72-30 24Vdc ED100%

Voltage: 12Vdc; Duty cycle: ED15%; ECR72-30 12Vdc ED15%

Solenoid under voltage



Force-stroke curve



Calculation of the effective force:
 see pages 1 and 72

For fixation of the solenoid: see page 72

• ECR 90-25 TYPE



Protection rate: **IP40**
 Insulation class: **B (130°C)**
 Reference cycle: **5 minutes**
 Standard stroke (s): **25 mm**
 Temperature rise " ΔV_{31} ": **70°C**
 Working temperature: **-10 to 45°C**
 Work: **Push / Pull**

Release spring NOT
 incorporated in standard
 product.

(ED) Duty-cycle ED(%)	100	40	25	15	5
(P20) Power at 20°C (W)	55	125	190	300	900
(Fm) Solenoid force (N) 1)	70	111	146	178	305
Max time under voltage(s)	Inf	120	75	45	15
Opening time (ms) 2)	651	488	417	332	307
Release time (ms) 3)	399	301	259	208	193
Plunger weight (Kg)	0.900				
Solenoid weight (Kg)	8.5				

1) Fm Solenoid force is given according to VDE0580 without deducting the spring force or the plunger weight if vertical mounting.

2) Time is given on these conditions: Coil supplied under nominal voltage ; Stabilized in it's working temperature ; Load 70% of the solenoid force ; Horizontal assembly ; Standard stroke initial position; 20°C ambient temperature.

3) Time is given on these conditions: without load on shaft ; Horizontal assembly ; Standard stroke initial position.

Duty-cycle ED%	Standard voltages										Under demand			
	VDC								VAC		VDC		VAC	
	6	12	24	48	100	125	205	110	230	Min	Max	Min	Max	
100	x	x	x	x	x	x	x	x	x	12	250	x	x	
40	x	x	x	x	x	x	x	x	x	24	250	x	x	
25	x	x	x	x	x	x	x	x	x	24	250	x	x	
15	x	x	x	x	x	x	x	x	x	24	250	x	x	
5	x	x	x	x	x	x	x	x	x	24	250	x	x	

Layout: o = Available ; x = Unavailable

- Voltage under demand:
 They can be manufactured at voltages between the maximum and minimum voltage values shown in the chart.

- To feed in alternating current, there has to be an external rectification of the signal.

- The duty cycles described in the chart are standard, they can be manufactured in any intermediate value.

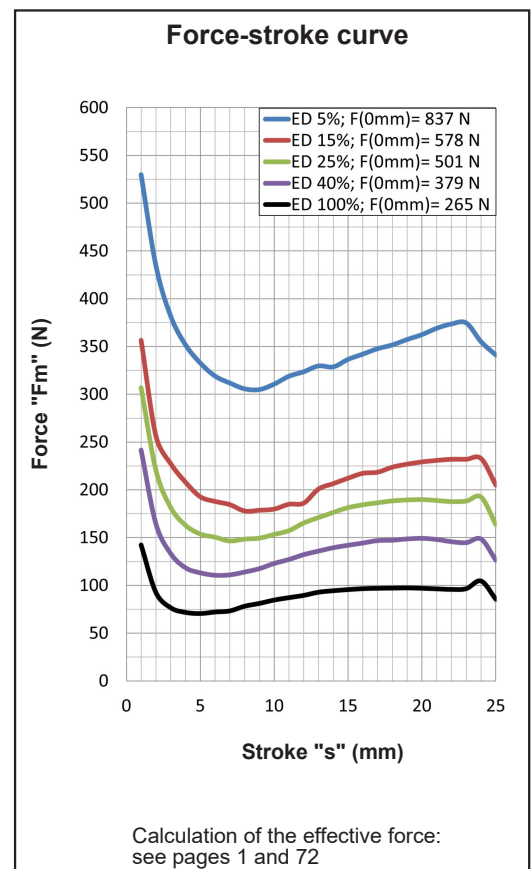
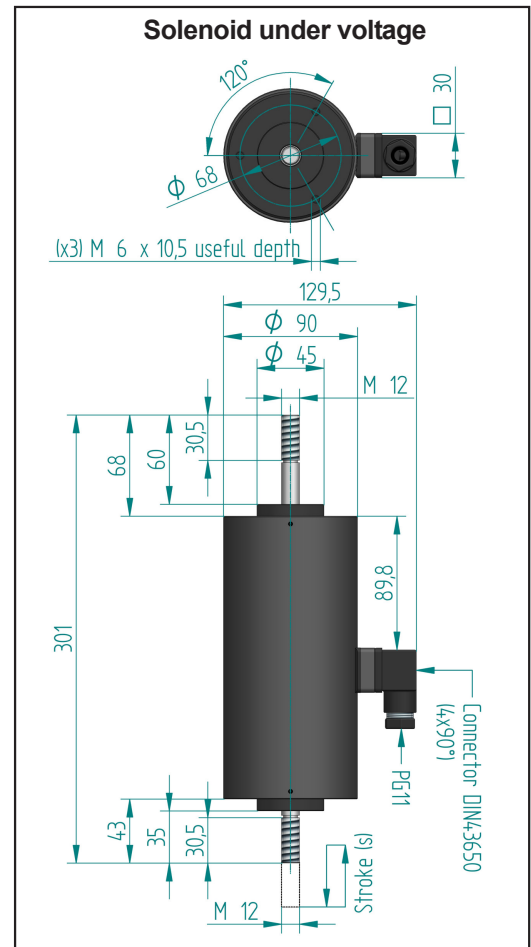
- If any customization from the original is needed, please ask us.

- Earthing is recommended if the metallic parts are accessible.

Ordering code: ECR90-25 --V ED---%

Voltage: 24Vdc; Duty cycle: ED100%; ECR90-25 24Vdc ED100%

Voltage: 48Vdc; Duty cycle: ED15%; ECR90-25 48Vdc ED15%



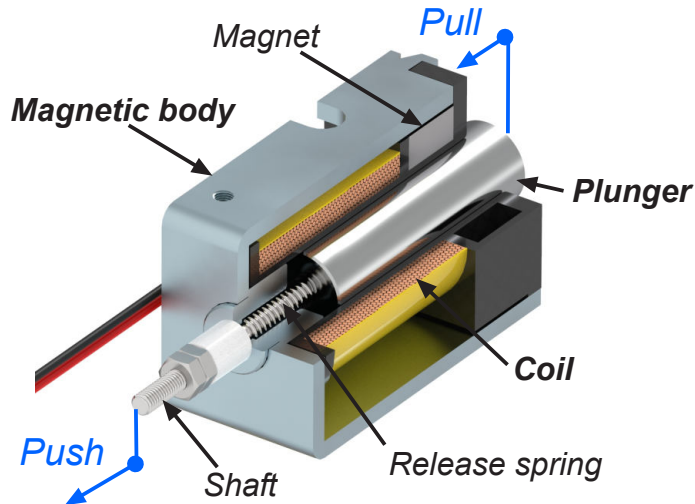
For fixation of the solenoid: see page 72

• ERB SERIES

ERB serie electromagnets are bistable linear solenoids, where the stroke movement from initial (unlocked) to final position (locked) is made by electromagnetic forces, the return to initial position takes place by an inverse polarizing pulse combined with external forces or by an incorporated spring.

When it is off, the bistable solenoids has got two working and maintained positions. One will be held by a permanent magnet system and the other one by a return spring or external forces.

Its specifications makes this solenoid perfect to use when both unlocking and locking position are kept for a long time.



Structure, basic components:

Magnetic body:

It is the metal part containing a coil, the core, a magnet system and the fixation holes.

Coil:

It receives the electrical energy to create a magnetic field.

Plunger:

It moves along and inside the coil, it has got a non-magnetic shaft fixed to the plunger. If pulling is needed, fix the element to activate to the plunger. To push, fix the shaft to the element to activate.

• Datasheet rated values conditions (According to DIN VDE 0580):

The values of the magnetic force (F_m) depending on the stroke, are obtained in the following conditions:

Room temperature = 35°C

Coil stabilized at its working temperature.

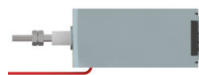
Rated voltage equal to 90% of the standard one.

Solenoid working in horizontal position.

Work depending on the feeding mode:

Locked position

Red cable: +Vdc
Black cable: -Vdc



F-S: Force-stroke

(F-S) Coil+magnet

(F-S) Spring

Unlocked position

Red cable: -Vdc
Black cable: +Vdc



Effective force (F_h) is obtained from magnetic force (F_m), adding and subtracting the plunger weight.

- When the solenoid pulls upwards:

Transition of unlock to lock:

Effective force = Magnetic force - Plunger weight - Spring force

Transition of lock to unlock:

Effective force = Spring force + Plunger weight

- When the solenoid pulls downwards:

Transition of unlock to lock:

Effective force = Magnetic force + Plunger weight - Spring force

Transition of lock to unlock:

Effective force = Spring force - Plunger weight

- When the solenoid pulls in horizontal position

Transition of unlock to lock:

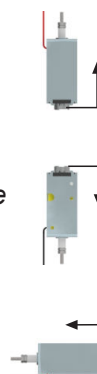
Effective force = Magnetic force - Spring force

Transition of lock to unlock:

Effective force = Spring force

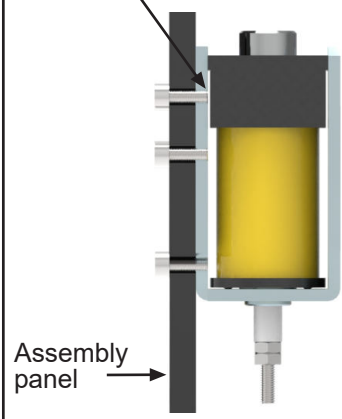
- For the units with incorporated return spring:

Effective force = Magnetic force - Spring force $\pm$ Plunger weight



• Important:

The fixation screws do not have to exceed the wall of the magnetic body not to damage the coil and magnets.



• CUSTOMIZATION ERB SERIES

The models described in the catalogue are standard and minimum manufacturing batches are not required. However, there is the possibility of customizing them to suit better customer's needs. See below some of the most common customizations.

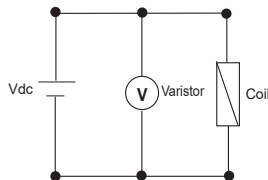
If any modification is needed, please ask NAFSA about the possibility and the minimum manufacturing batch required.

1. ELECTRICAL CUSTOMIZATION

a) Electronics integrated in the coil:

a.1) For peak suppression

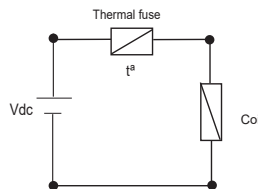
Examples:



a.2) Thermal fuse

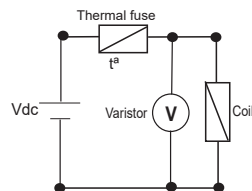
Examples:

*The thermic resettable polyswitches are used in coils with low duty cycles against overheating, caused by long time under voltage and not respected the duty cycle times. It can be used also as timer.



a.3) Thermal fuse and peak suppression

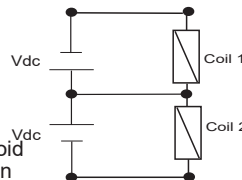
Examples:



a.4) Double coil

Examples:

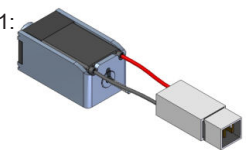
Our standard ERB series has only a coil, that has to be electrically polarized to get the desired movement sense, to avoid this supply polarization inversion we can produce the ERB series with two coils, that will be feeded individually to get the desired movement sense. The two coil version solenoid will have less force than the single one or higher power for the same force as the coil has to be divided in two.



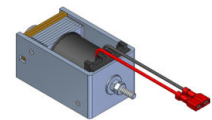
b) Cable length modification and terminal or connector mounted over cables:

All bistable models have supply cables, this length can be modified to customer requirement. Likewise any kind of terminals or connectors can be added to the cables.

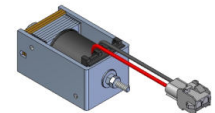
Example 1:



Example 2:



Example 3:



2. INSULATION CLASS CUSTOMIZATION:

Depending on the model, insulation class can be increased until B(130°C).

3. PROTECCIÓN RATE CUSTOMIZATION IP (EN60529): The standard model are IP00, but for the mechanical part IP40 can be obtained and for the electrical part IP65 through coil overmolding..

4. MECHANICAL CUSTOMIZATION

4.1) Shaft modifications:

Length and shape can be modified.



a) Flat



b) Spherical



c) Threaded



d) Transverse hole



e) Grooved



f) Threaded hole

4.2) Plunger modifications:

Length and shape can be modified.



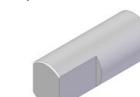
a) Flat



b) Threaded hole



c) Fork joint

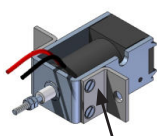


d) Flat faces

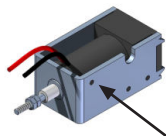


e) Grooved

4.3) Fixing holes modification:



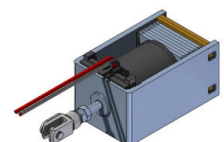
Model customized with extra holes and fixing sheet: ERB35/NS



Standard model: ERB35/N

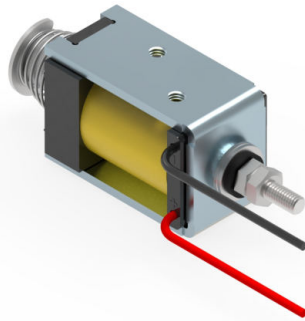
4.4) Fastening element added as Fork joints as DIN71752:

Example:
ERB50/N+Fork joint



NOTE: All this customizations cannot be applied to all models, ask NAFSA for each case.

• ERB 20-15-06/C TYPE

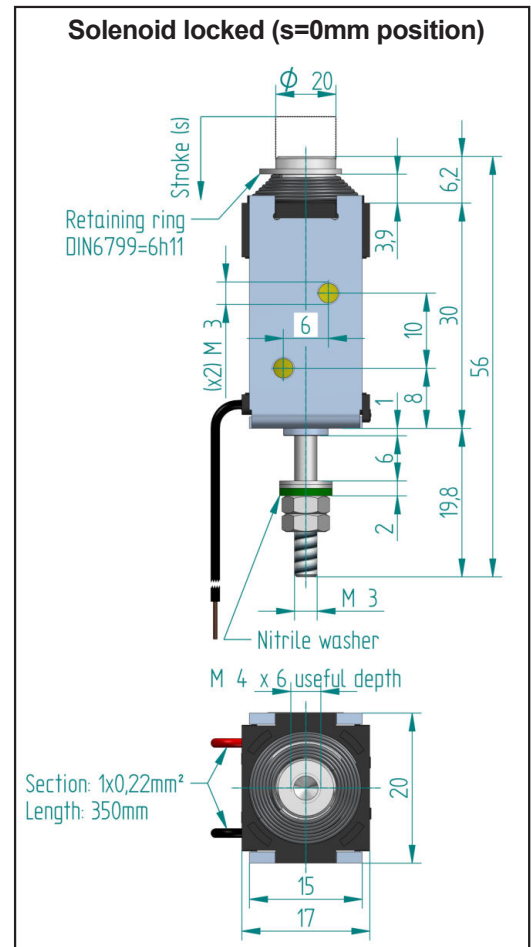


Protection rate: **IP00**
 Insulation class: **Y (90°C)**
 Reference cycle: **3 minutes**
 Standard stroke (s): **8 mm**
 Temperature rise " ΔV_{31} ": **70°C**
 Working temperature: **-10 to 45°C**
 Work: **Push / Pull**

Release spring will be incorporated by defect

Standard spring force:
 $F_s(s=0\text{mm}) = 2.7 \text{ N}$
 $F_s(s=8\text{mm}) = 1.1 \text{ N}$

(Un) Standard voltage (Vdc)	24
(ED) Duty-cycle ED(%)	20
(P20) Power at 20°C (W)	10
Available voltage (Vdc)	from 5 to 24
Available voltage (Vac)	NOT AVAILABLE
Max time under voltage(s)	30
Plunger weight (Kg)	0.011
Solenoid weight (Kg)	0.047



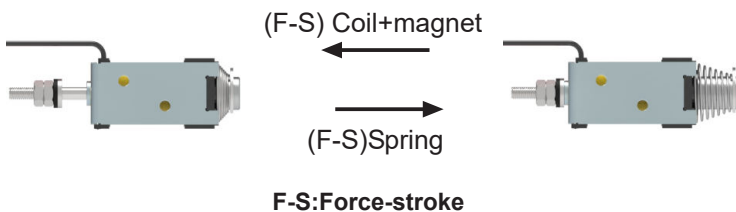
Work depending on feeding mode:

Locked position

Red cable: +Vdc
 Black cable: -Vdc

Unlocked position

Red cable: -Vdc
 Black cable: +Vdc



- Voltage under demand:

They can be manufactured at voltages between the maximum and minimum voltage values shown in the chart.

- If any customization from the original is needed, please ask us.

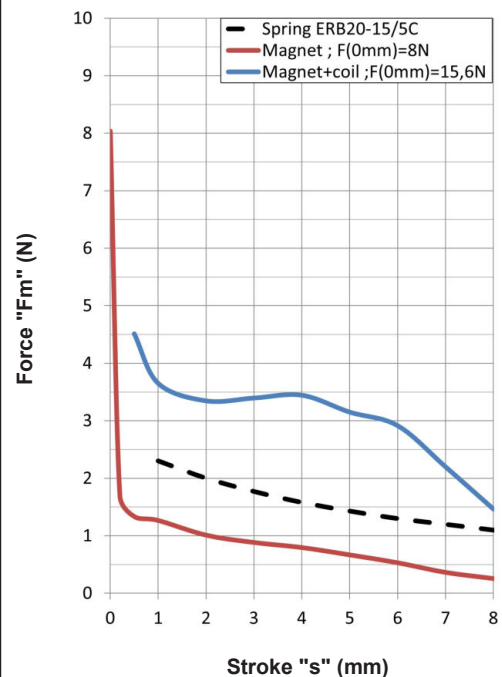
- Earthing is recommended if the metallic parts are accessible.

Ordering code: ERB20-15-06/C --V ED25% - Spring

Voltage: 24Vdc; Duty cycle: ED25%; With spring:
 ERB20-15-06/C 24Vdc ED25% RS

Voltage: 12Vdc; Duty cycle: ED25%; Without spring:
 ERB20-15-06/C 12Vdc ED25% RN

Force-stroke curve

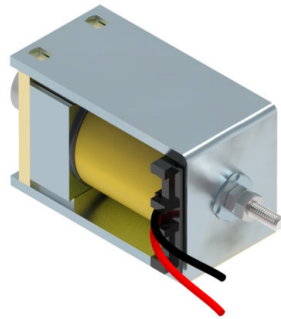


Calculation of the effective force:
 see pages 1 and 81

Spring yes: RS ; Spring no: RN

For fixation and mounting positions: see page 81

• ERB 50/N TYPE



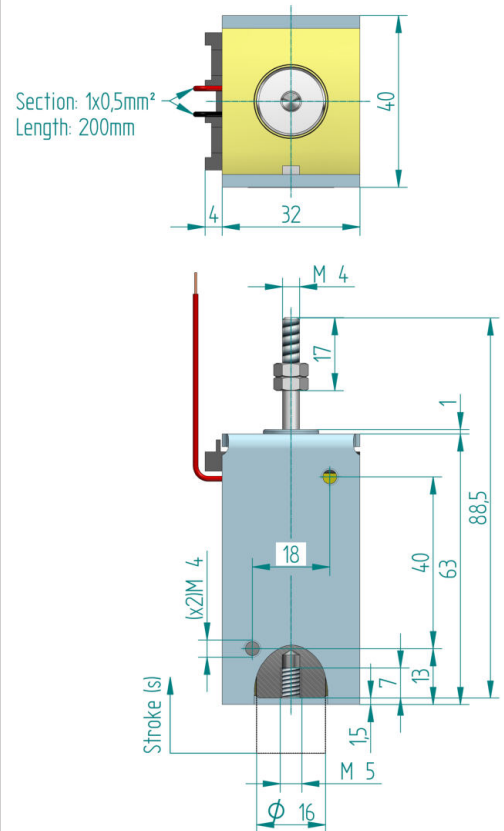
Protection rate: **IP00**
 Insulation class: **Y (90°C)**
 Reference cycle: **3 minutes**
 Standard stroke (s): **10 mm**
 Temperature rise " ΔV_{31} ": **70°C**
 Working temperature: **-10 to 45°C**
 Work: **Push / Pull**

Release spring will be incorporated by defect

Standard spring force:
 $F_s(s=0\text{mm}) = 29.4 \text{ N}$
 $F_s(s=10\text{mm}) = 10 \text{ N}$

(Un) Standard voltage (Vdc)	24
(ED) Duty-cycle ED(%)	20
(P20) Power at 20°C (W)	67
Available voltage (Vdc)	from 12 to 205
Available voltage (Vac)	NOT AVAILABLE
Max time under voltage(s)	30
Plunger weight (Kg)	0.071
Solenoid weight (Kg)	0.365

Solenoid locked (s=0mm position)



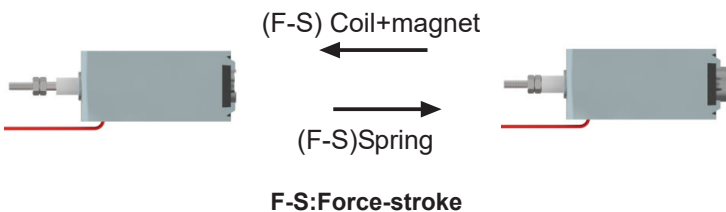
Work depending on feeding mode:

Locked position

Red cable: +Vdc
 Black cable: -Vdc

Unlocked position

Red cable: -Vdc
 Black cable: +Vdc



- Voltage under demand:

They can be manufactured at voltages between the maximum and minimum voltage values shown in the chart.

- If any customization from the original is needed, please ask us.

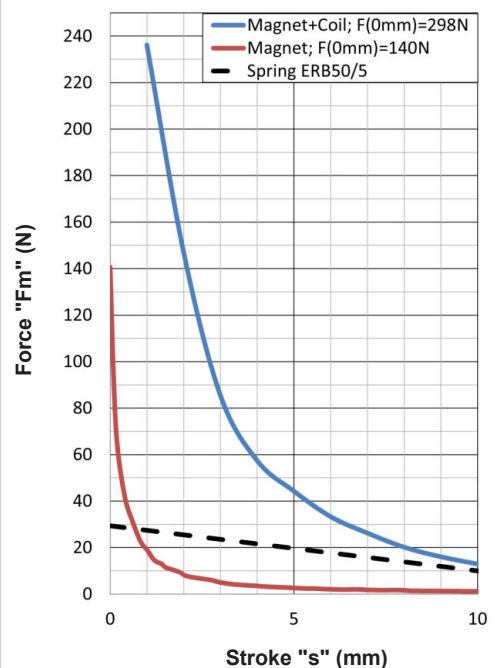
- Earthing is recommended if the metallic parts are accessible.

Ordering code: ERB50/N --V ED20% - Spring

Voltage: 24Vdc; Duty cycle: ED20%; With spring:
 ERB50/N 24Vdc ED20% RS

Voltage: 12Vdc; Duty cycle: ED20%; Without spring:
 ERB50/N 12Vdc ED20% RN

Force-stroke curve



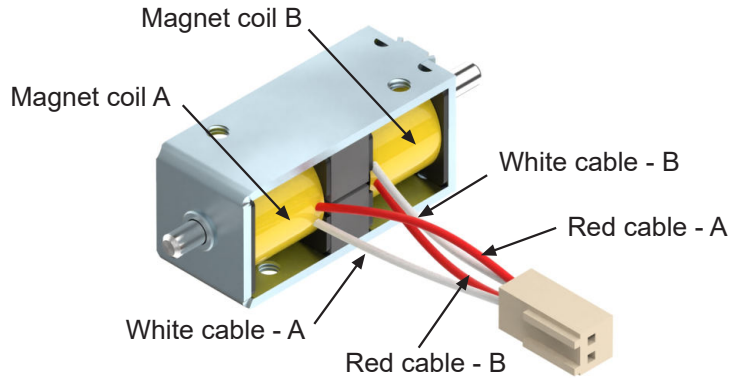
Calculation of the effective force:
 see pages 1 and 81

Spring yes: RS ; Spring no: RN

For fixation and mounting positions: see page 81

• ERDI 15 TYPE

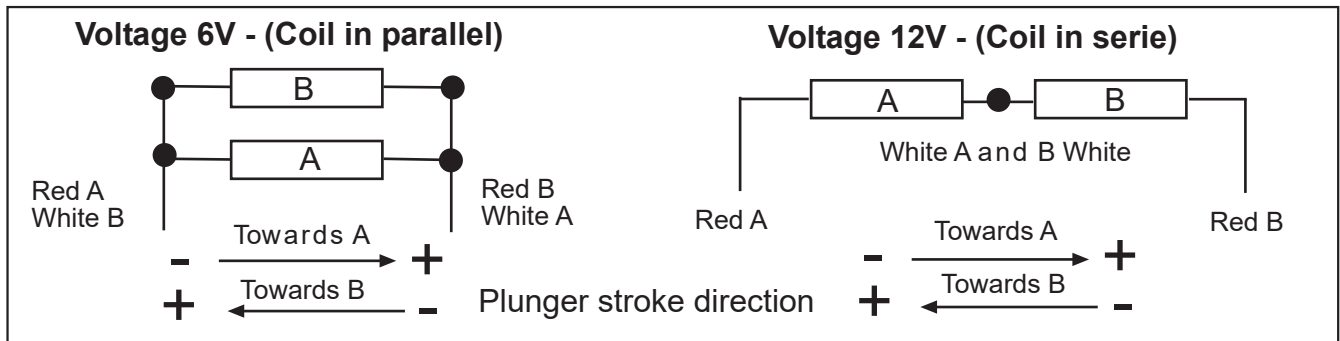
This solenoid has two resting positions, the stroke movement "s" from a position to the other one is made by a polarized electric signal, the plunger is retained in each end of stroke position using permanent magnets.



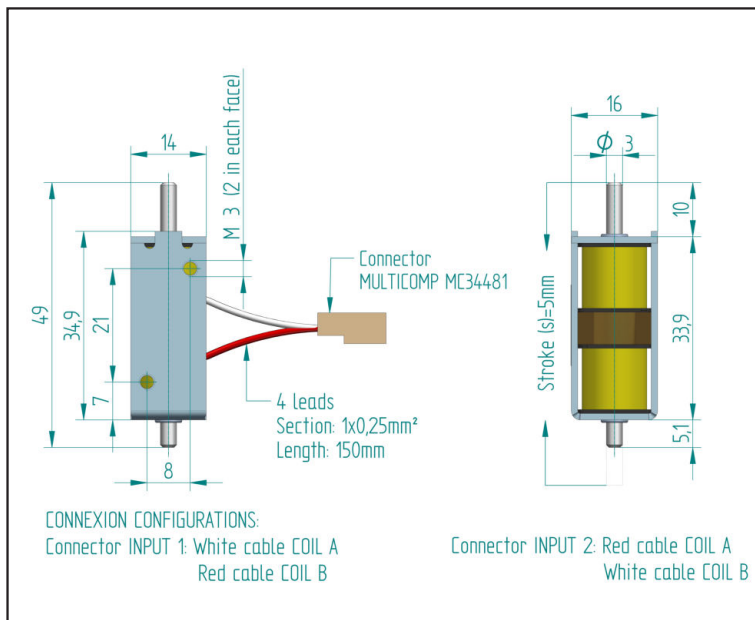
Protection rate: **IP00**
 Insulation class: **E (120°C)**
 Standard voltage: **from 6 to 12 Vdc**
 Under demand voltage: **Ask NAFSA**
 Standard stroke "s": **5mm**
 Duty cycle ED: **33%**
 Coil resistance at 20°C: **8 Ohm**
 Initial force: **1.5 N**
 Holding force: **6N**
 Plunger weight: **0.005 Kg**
 Solenoid weight: **0.040 Kg**

*Compulsory earthing if the metallic parts are accessible.

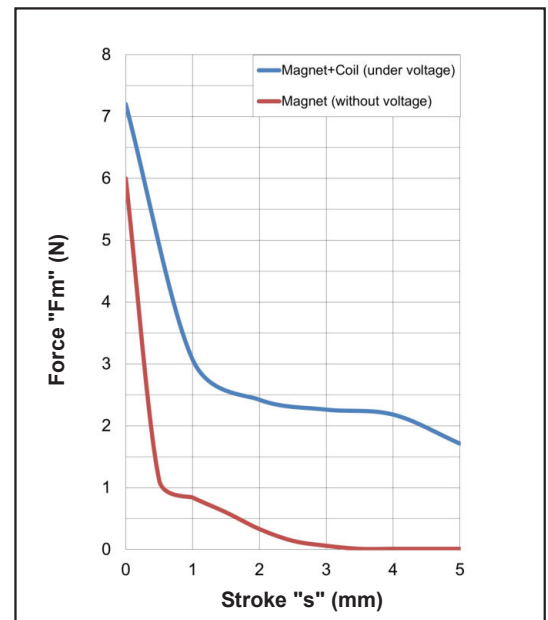
Connection scheme: Coil in parallel will be the standard configuration.



Dimensional drawing:



Force-stroke Curve (F-S)



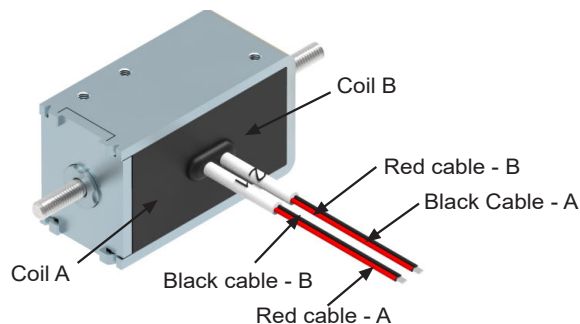
ASSEMBLY: the screw does not have to exceed the wall of the magnetic circuit

Ordering code:

Coil in parallel: **ERDI15 6V 33%, (standard configuration)**
 Coil in serie: **ERDI15 12V 33%, (special configuration)**

• ERDI 35-06/CC TYPE

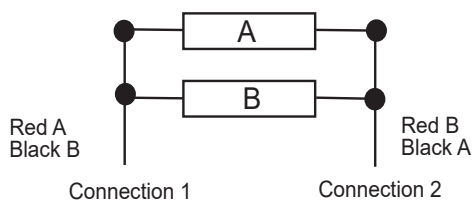
This solenoid has two stable positions, the stroke movement "s" from a position to the other one is made by a polarized electric signal, the plunger is retained in each end of stroke position using permanent magnets.



Protection rate: **IP40 EN60529**
 Insulation class: **Y (90°C)**
 Standard voltage: **24 Vdc**
 Voltages under demand: **from 6VDC to 250Vdc**
 Standard stroke "s": **6mm**
 Duty-cycle ED: **20%**
 Abs. power at 20°C: **28W (14W each coil)**
 Plunger weight: **0.028 Kg**
 Solenoid weight: **0.175 Kg**
 Holding force at stroke 0mm: **20N**

*Obligatory earthing if the metallic parts are accessible.

Connection scheme



Work depending on the feeding mode:



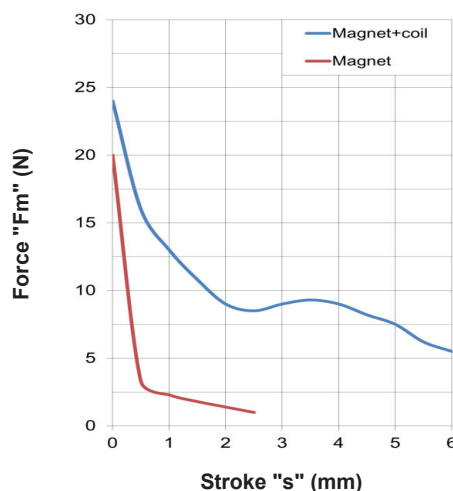
Connection 1:

+VDC and Connection 2: -VDC. The shaft will go to B position

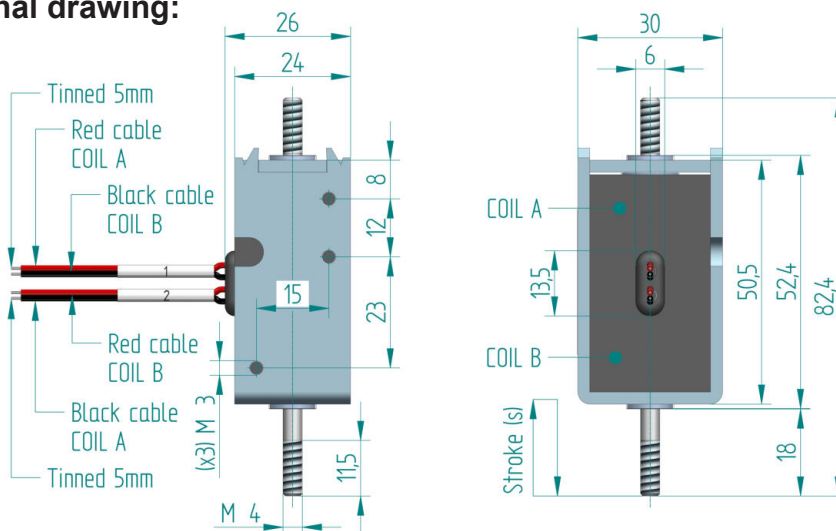
Connection 2:

+VDC and Connection 1: -VDC. The shaft will go to A position

Force-stroke curve



Dimensional drawing:



ASSEMBLY: the screw does not have to exceed the wall of the magnetic circuit

Ordering code: ERDI35-06/CC--V ED20%

Voltage: 6Vdc: ERDI35-06/CC Vdc ED20%

Voltage: 24Vdc: ERDI35-06/CC 24Vdc ED20%

• ECI 35/C TYPE



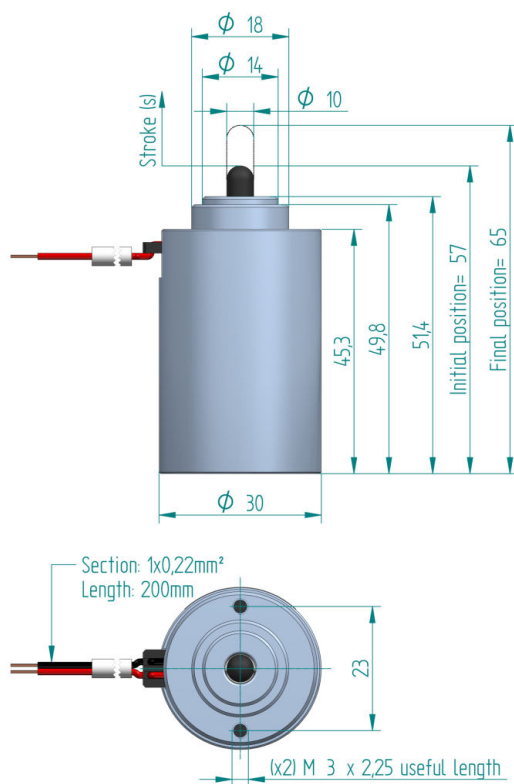
ECI serie electromagnets are bistable linear electromagnet, where the stroke movement from initial to final position is made by a incorporated spring.

When solenoid is in final position after been under voltage (See drawings bellow), the mechanical reset to the initial position has to be made by external forces acting on the mobile core.

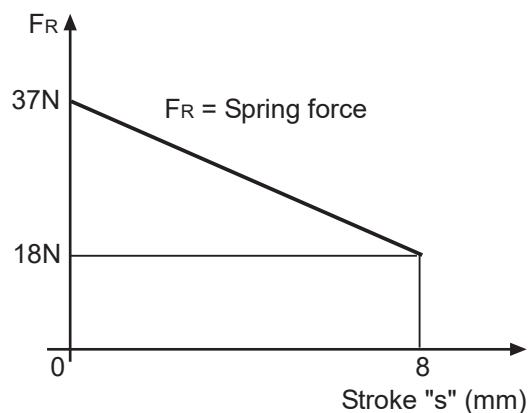
The plunger is retained in the initial position by permanent magnets. To release the plunger is necessary feed the electromagnet with a low power polarized voltage signal.

Solenoid protection rate: **IP40**
 Insulation class: **Y (90°C)**
 Minimum release voltage: **6V**
 Duty-cycle ED: **100%**
 Standard stroke "s": **8 mm**
 Work: **Push**
 Magnetic retention force (F_{rm}): **44N**
 Initial force (F_e): **37N**
 Useful magnetic force ($F_{ru}=F_{rm}-F_e$): **7N**
 Final force (F_a): **18N**
 Mechanical response time: **5ms**
 Minimum energy of release: **30 mJ**
 Minimum duration of the electrical impulse: **20ms**
 Solenoid weight: **0.190 Kg**

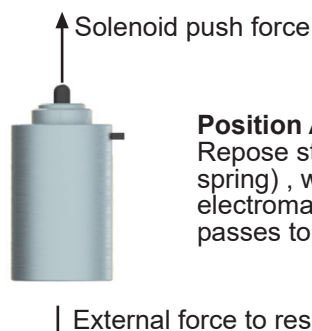
Solenoid with compressed spring



Force-stroke curve



Working



Position A (Initial position):
 Repose status (compressed spring), when the electromagnet is feeded it passes to position B.



Position B (Final position):
 After voltage status (spring free). To return to position A, will be necessary to apply an external force

Ordering code: **ECI35/C 6Vdc ED100%**

• CUSTOMIZATION LOCKING BOLTS

The models described in the catalogue are standard and minimum manufacturing batches are not required. However, there is the possibility of customizing them to suit better customer's needs. See below some of the most common customizations.

If any modification is needed, please ask NAFSA about the possibility and the minimum manufacturing batch required.

1. ELECTRICAL CUSTOMIZATION

NAFSA's locking bolts are standard linear solenoid adapted to work standing radial forces. With this modification, the plunger works as bolt.

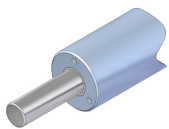
Therefore, all electrical customization that are made in the standard solenoid are also applicable in the locking bolts. For example one ER model which has been adapted to be used as locking bolt, can be modified with any electrical customization described in the ER serie. It will be the same for all other series.

Some of the most common customizations are free wheel diode, varistor, rectifier diodes, PWM electronic (pulse width modulation), thermal protection, etc... integration in the solenoid.

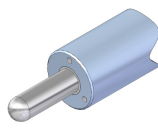
The PWM mounting is particularly interesting in this type of locking bolts since it allows working with more force, so this will allow to mount harder springs if necessary. This can be done keeping the 100% duty-cycle.

2. MECHANICAL CUSTOMIZATION:

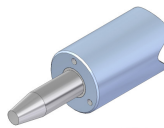
2.1) Bolts plunger lenght and shape:



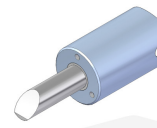
a) Flat



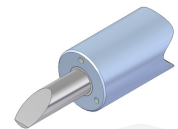
b) Spherical



c) Conical



d) Slip at 30°

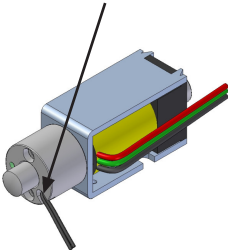


e) Slip at 45°

2.2) Position detection system integration:

a) Magnetic sensor

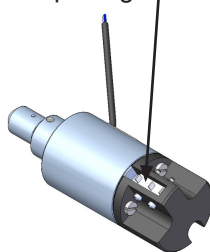
In this example the magnetic sensor is integrated in the guide, and it detects the position transition.



Example:
ERB35-05_NDBCP

b) Microswitch

In this case, the microswitch is integrated in the cover and it detects bolt opening

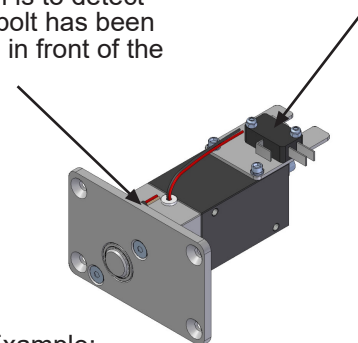


Example:
ECH40-10_BM

b) Combination of magnetic sensor and microswitch:

Magnetic sensor: In this example magnetic sensor is integrated in the support. Its function is to detect when the bolt has been positioned in front of the closure.

Microswitch: In this case it detects when the locking bolt is closing the door.



Example:
CU40_CPD

NOTE: All these customizations cannot be applied to all models, ask NAFSA for each case.

• CU 20/CPXU TYPE

These locking bolts are simple effect linear solenoids, where the shaft has been reinforced to assure the performance in case of radial stress. This model assures the locking with voltage (active security).

It has got frontal fixing.

Its design makes it good to be used as industrial locking bolt.

Protection rate: **IP40**
 Insulation class: **B (130°C)**
 Standard voltage: **24Vdc**
 Available voltages: **6 a 48Vdc**
 Duty-cycle (ED%): **100**
 Abs. power at 20°C: **4.8W**
 Standard stroke "s": **10mm**
 Temperature increase " ΔV_{31} ": **70°C**
 Plunger weight (Kg): **0.017**
 Locking bolt weight (Kg): **0.090**
 Incorporated return spring: **YES**
 Return spring force ED100% (N):
from 0.7 (compressed, under voltage)
to 0.15 (extended, without voltage)
 Pushing force at stroke 10mm (N): **0.35**

- Voltage under demand:
 They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.

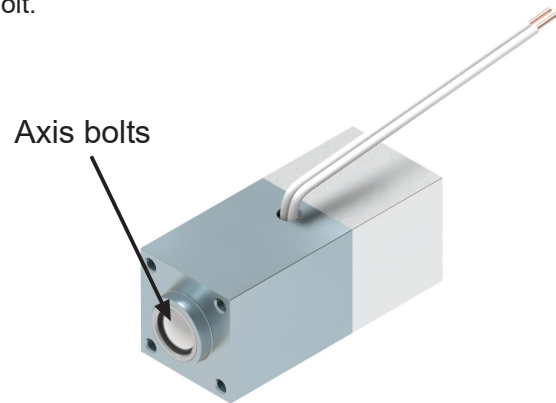
- To feed in alternating current the solenoid will have a rectifier mounted in.

- If any change from the original is needed, please contact us.

Ordering code: CU20/CPXU --V ED--%

Voltage: 24Vdc, Duty cycle 100%:

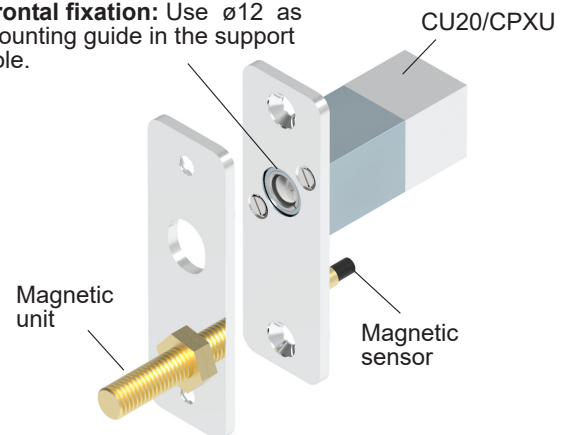
CU20/CP XU24VdcED100%



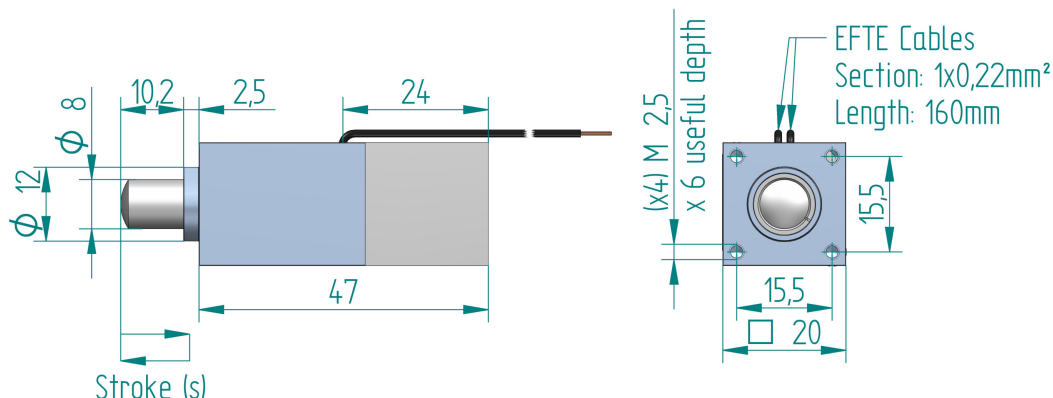
Possibility of supply with detection system integrated in the supports.

Reference: CU20/CPXUM

Frontal fixation: Use $\varnothing 12$ as mounting guide in the support hole.



Solenoid under voltage (s=0mm position)



● ER 30/CCR TYPE

Derivative of ER series, and reinforced with a guide to guarantee the operation of the axis bolt before possible radial efforts. The closing takes place under voltage (active security). This indicated to work in automatism where an intense use is not required. It is possible to be fixed frontally or laterally.

Solenoid protection rate: **IP00**

Insulation class: **B (130°C)**

Standard voltage: **24Vdc**

Duty cycle (ED%): **100**

Absorbed power at 20°C: **8W**

Under demand voltage: **Vdc (de 3V a 205V)**

Under demand voltage: **Vac (de 24V a 230V)**

Standard stroke "s": **from 8 to 10mm**

Temperature rise " ΔV_{31} ": **70°C**

Plunger weight (Kg): **0.060**

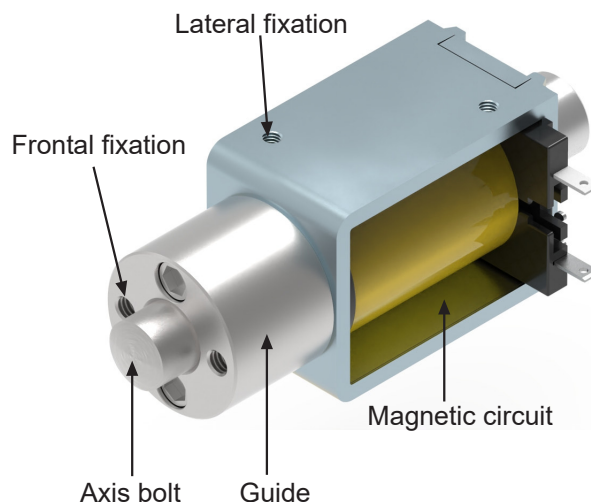
Locking bolt weight (Kg): **0.220**

Return spring incorporated: **YES**

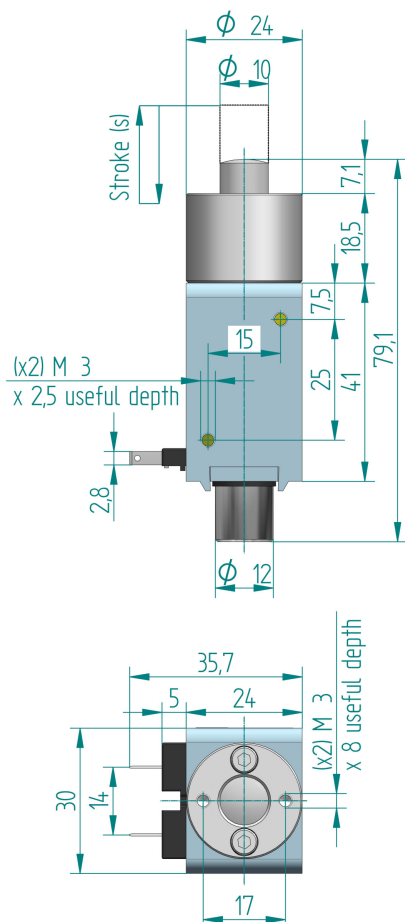
Spring return force (N): **from 1.6 to 0.6**

Maximum radial effort with lateral fixation: **50N**

Maximum radial effort with frontal fixation fixing in the guide diameter: **1000N**



Solenoid without voltage



- Voltage under demand:

They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.

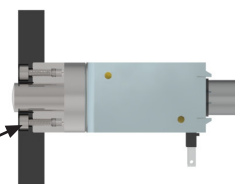
- To feed in alternating current, the solenoid will have a rectifier incorporated. Faston terminals will be changed by flying leads (L=150mm).

- If any changes from the original are needed, please contact.

- Earthing is recommended if the metallic parts are accessible.

Frontal fixation (recommended Assembly):

it is advisable to realize a small bush of the guide thus to secure the optimal efficiency.



Lateral fixation (Only for smaller lateral stress than 20N): The length of the assembly screws does not have to exceed of the thickness of the magnetic circuit



Ordering code:

ER30/CCR --V ED100%

Example:

Voltage: 24Vdc: ER30/CCR 24Vdc ED100%

Voltage: 48Vdc: ER30/CCR 48Vdc ED100%

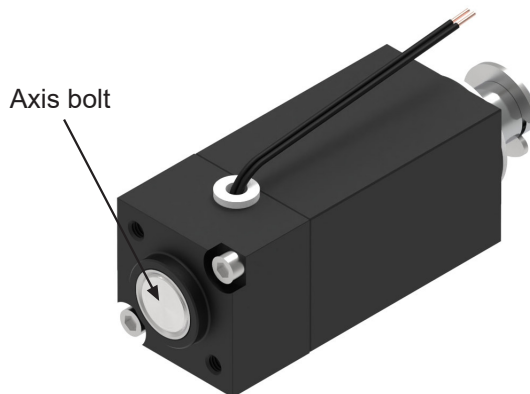
• CU 30/CP TYPE

These locking bolts are simple effect linear solenoids, where the shaft has been reinforced to assure the performance in case of radial stress. This model assures the locking with voltage (active security).

It has got lateral and frontal fixing.

Its design makes it good to be used in robotics where an intensive work is required.

Solenoid protection rate: **IP40**
 Insulation class: **B (130°C)**
 Standard voltage: **24Vdc**
 Duty-cycle (ED%): **100 or 25**
 Absorbed power at 20°C: **7.5W (ED100%); 29W (ED25%)**
 Under demand voltage: **Vdc (from 3V to 205V)**
 Standard stroke "s": **10mm**
 Temperature rising " ΔV_{31} ": **70°C**
 Plunger weight (Kg): **0.060**
 Locking bolt weight (Kg): **0.330**
 Return spring incorporated: **YES**
 Return force ED100%(N): **from 1.5(comprissed spring, with voltage) to 1 (free, without voltage)**
 Return force ED25%(N): **from 2.8 (comprissed spring, with voltage) to 1.8 (free, without voltage)**
 Maximum radial effort (N): **3000N**



Ordering code:

CU30/CP --V ED100% or ER25%

Example:

24Vdc 100%ED: CU30/CP100 24Vdc ED100%

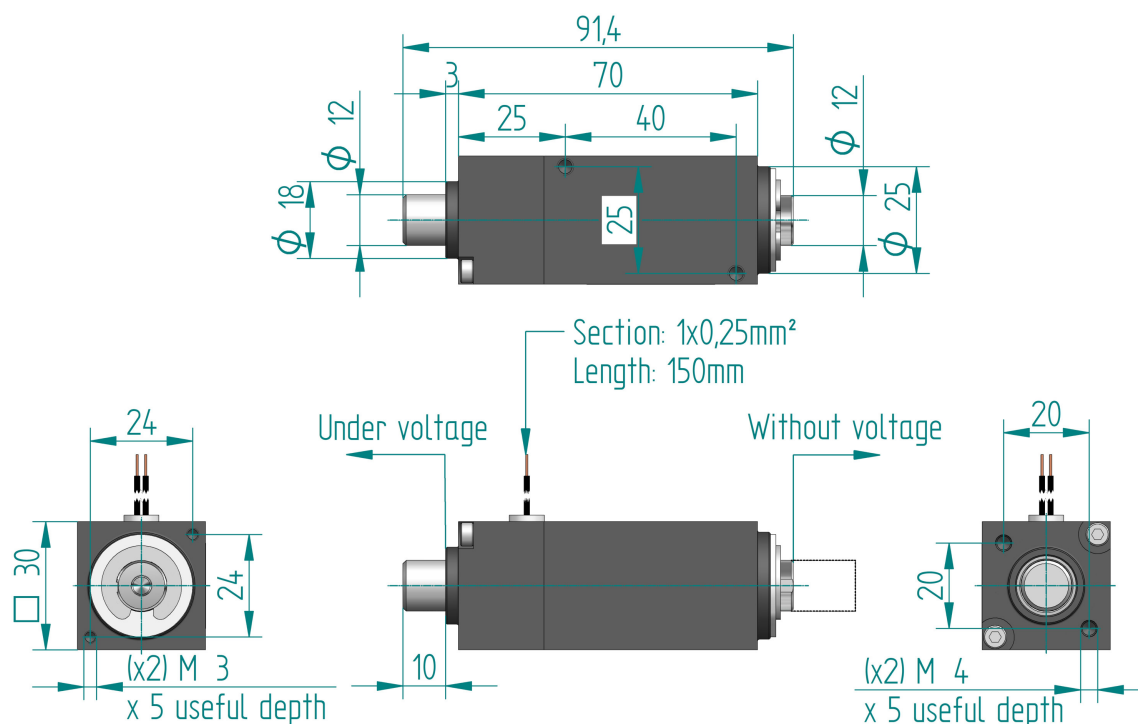
48Vdc 25%ED: CU30/CP25 48Vdc ED25%

- Voltage under demand:
 They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.

- To feed in alternating current the solenoid will have a rectifier mounted in.

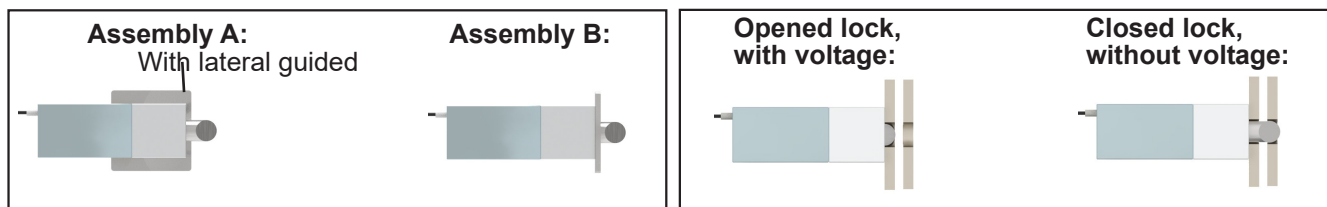
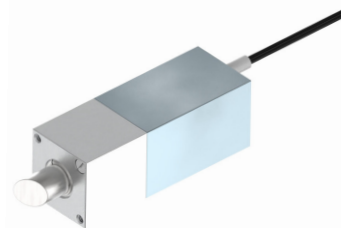
- If any change from the original is needed, please contact us.

Solenoid under voltage (s=0mm position)



• CU 20/CP TYPE

These locking bolts are simple effect linear solenoids, where the shaft has been reinforced to assure the performance in case of radial stress. This model assures the locking without voltage (passive security). It has got frontal and rear fixing. The bolt has a slip with anti-rotation system. Its design makes it good to be used as industrial locking bolt.



Model: CU20CP100

Model: CU20CP25

Protection rate: **IP40**
Insulation class: **B (130°C)**
Standard voltage: **VDC (12V;24V;48V)**
Duty cycle (ED%): **100%**
Absorbed power at 20°C: **4,2W**
Standard stroke "s": **7mm**
Temperature rising " ΔV_{31} ": **70°C**
Mobil plunger weight (Kg): **0.017**
Locking bolt weight (Kg): **0.107**
Return spring incorporated: **1.1 N (Opened lock, with voltage) to 0.2N (Closed lock, without voltage).**
Minimum force at stroke 7mm with incorporated spring (N): **0,3**
Maximum radial stress (N): **2000N (Assembly A)**
Maximum radial stress (N): **750N (Assembly B)**

Protection rate: **IP40**
Insulation class: **B (130°C)**
Standard voltage: **VDC (12V;24V;48V)**
Duty cycle (ED%): **25%**
Absorbed power at 20°C: **17W**
Standard stroke "s": **7mm**
Temperature rising " ΔV_{31} ": **70°C**
Mobil plunger weight (Kg): **0.017**
Locking bolt weight (Kg): **0.107**
Return spring incorporated: **1.5 N (Opened lock, with voltage) to 0.5N (Closed lock, without voltage).**
Minimum force at stroke 7mm with incorporated spring (N): **1,75**
Maximum radial stress (N): **2000N (Assembly A)**
Maximum radial stress (N): **750N (Assembly B)**

- If any change from the original is needed, please contact us.
- The connector can be deleted or replaced.
- To use the solenoid with the electric saver, see page 109 Electric saver.

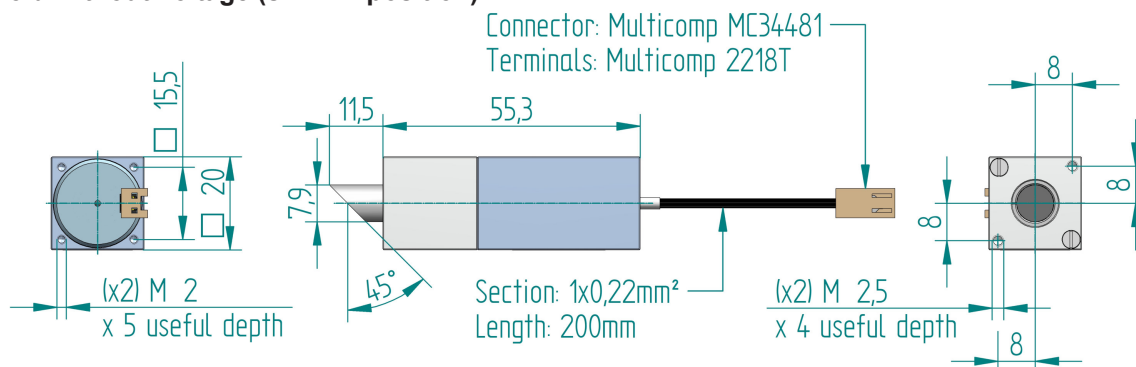
Ordering code:

- CU20CP100 12VDC100%: Features: Vn (12VDC) ; ED (100%) ; Pn (4,2W)
- CU20CP25 12VDC25%: Features: Vn (12VDC) ; ED (25%) ; Pn (17W)
- CU20CP100 24VDC100%: Features: Vn (24VDC) ; ED (100%) ; Pn (4,2W)
- CU20CP25 24VDC25%: Features: Vn (24VDC) ; ED (25%) ; Pn (17W)
- CU20CP100 48VDC100%: Features: Vn (48VDC) ; ED (100%) ; Pn (4,2W)
- CU20CP25 48VDC25%: Features: Vn (48VDC) ; ED (25%) ; Pn (17W)

Lay out:

Vn= Standard voltage ; ED= Duty-cycle ; Pn= Standard power

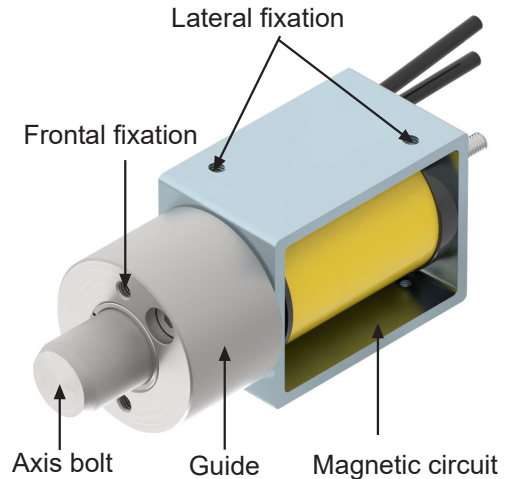
Solenoid without voltage (s=7mm position)



• ERC 30/CP TYPE

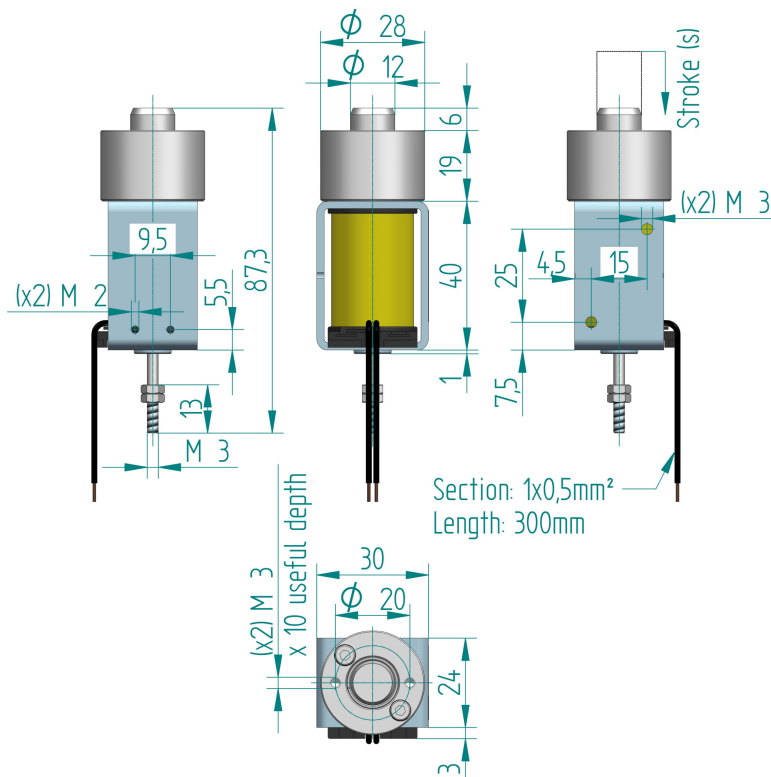
Based on ERC series, it has been reinforced with a guide to guarantee the performance of the plunger as a bolt in case of radial forces. The locking takes place without voltage (passive security). It is indicated to work in automatisms where an intense use is required. It is possible to be fixed frontally or laterally.

Protection rate: **IP00**
 Insulation class: **B (130°C)**
 Standard voltage: **24Vdc**
 Duty-cycle (ED%): **100% or 25%**
 Abs. power at 20°C: **8W (100%ED), 30W (25%ED)**
 Voltages under demand: **Vdc (12,24,48,105,125,205)**
 Voltages under demand: **230Vac**
 Standard stroke "s": **8 mm**
 Temperature increase " ΔV_{31} ": **70°C**
 Plunger weight (Kg): **0.038**
 Locking-bolt weight (Kg): **0.215**
 Spring return force: **YES**
 Return spring force ED100% (N): **from 1.6 (compressed, under voltage) to 0.6 (extended, without voltage)**
 Return spring force ED25% (N): **from 6.7 (compressed, under voltage) to 3.1 (extended, without voltage)**

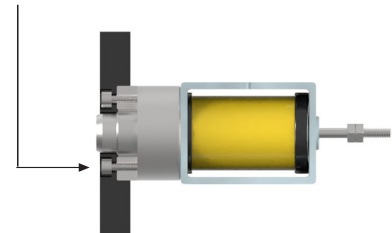


- Voltage under demand: They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.
- If any changes from the original are needed, please contact.
- Earthing is recommended if the metallic parts are accessible.

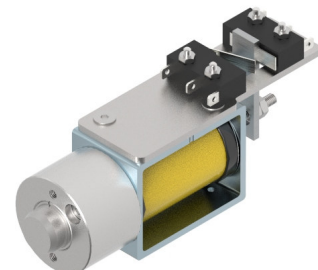
Solenoid under voltage (s=0mm position)



Frontal fixation (recommended Assembly): it is convenient to make a bushing of the guide to obtain the optimal performance.
 Max. radial effort: 2500N



Lateral holes can be used to integrate position detection system, for example, using microswitch:



Ordering code

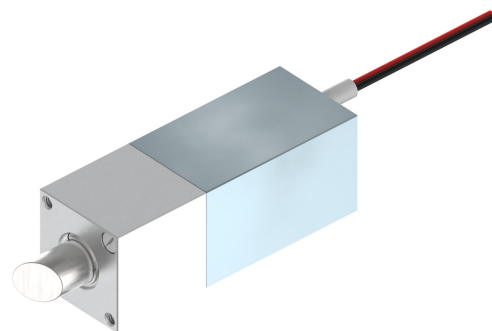
ERC30/CP --V ED100%: Example: Voltage: 24Vdc: **ERC30/CP100 24Vdc**
 ERC30/CP --V ED25%: Example: Voltage: 24Vdc: **ERC30/CP25 24Vdc**

• CU 20/CPB TYPE

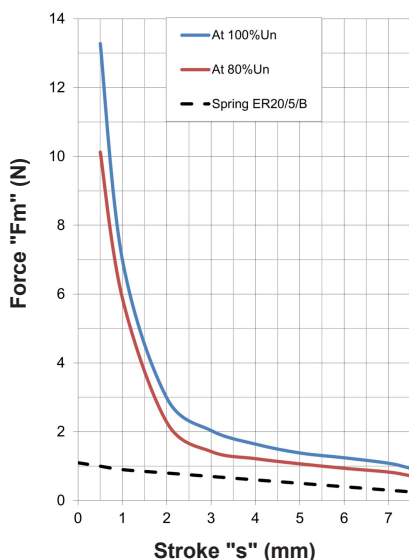
Based on CU20CP model, it is a bistable locking bolt where the movement from initial (unlocked) to final position (locked) is made by electromagnetic forces. The return to initial position takes place by an inverse polarizing pulse combined with external forces or by an incorporated spring.

The bistable solenoid has two working and maintained positions without voltage. One will be held by a permanent magnet system and the other one by a return spring or external forces. The bolt has a slip with anti-rotation system and frontal, rear and lateral fixations, and the guide has been reinforced for a correct performance in case of radial stress.

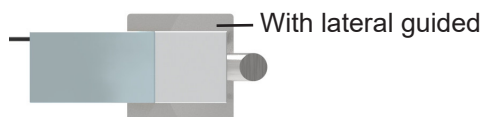
Protection rate: **IP40**
Insulation class: **Y (90°C)**
Voltages under demand: **VDC (3, 3,6; 5; 6; 9;12; 24; 48)**
Duty-cycle (ED%): **25%**
Abs. power at 20°C: **12 W (ED25%)**
Standard stroke "s": **7.5±0.3 mm**
Plunger weight (Kg): **0.019**
Locking bolt weight (Kg): **0.090**
Minimum pulse time: **20ms**
Incorportaed return spring: **YES**
Maximum radial stress (N): **2000N (assemble A)**
Maximum radial stress (N): **750N (assemble B)**



Force-stroke curve



Assembly A:



With lateral guided

Assembly B:



Work depending on the feeding mode:

**Unlocked position
(held by magnet 15N)**

Red cable: +Vdc
Black cable: -Vdc

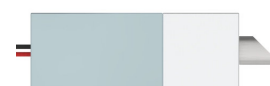


(F-S) Coil+magnet

(F-S) Spring

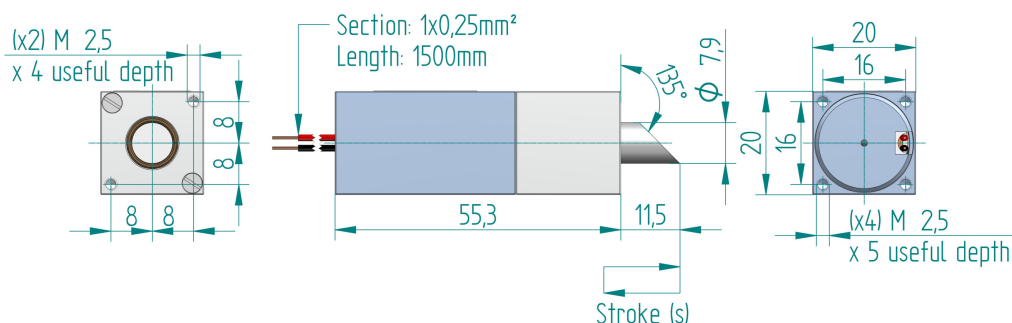
**Locked position
(held by spring 0.25N)**

Red cable: -Vdc
Black cable: +Vdc



F-S: Force-stroke

Solenoid without voltage (s= 7.5mm position)

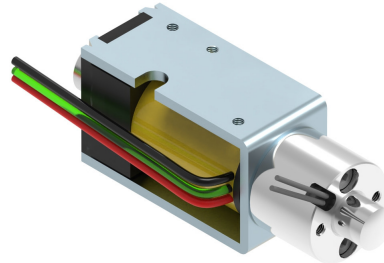


Ordering code: CU20/CPB--V ED25%
Voltage: 24Vdc ED25%: CU20/CPB 24Vdc ED25%
Voltage: 12Vdc ED25%: CU20/CPB 12Vdc ED25%

• ERB 35-05/NDBCP TYPE

This locking bolt is double coil bistable solenoid, where the stroke movement from initial (unlocked) to final position (locked) is made by electromagnetic forces when coil 1 is feeded. The return to initial positions takes place by an inverse polarizing pulse (when coil 2 is feeded) combined with an incorporated spring. It has proximity sensor integrated to detect locked position and free wheel diode to protect the coil against reverse polarity.

Protection rate: **IP00**
 Insulation class: **Y (90°C)**
 Available voltages: **12, 24, 48 Vdc**
 Coil 1 duty-cycle (ED%): **20**
 Coil 2 duty-cycle (ED%): **25**
 Cycle duration: **3 minutes**
 Standard stroke "s": **7 mm**
 Temperature stroke " ΔV_{31} ": **70°C**
 Work: **push/pull**
 Incorporated return spring: **YES**

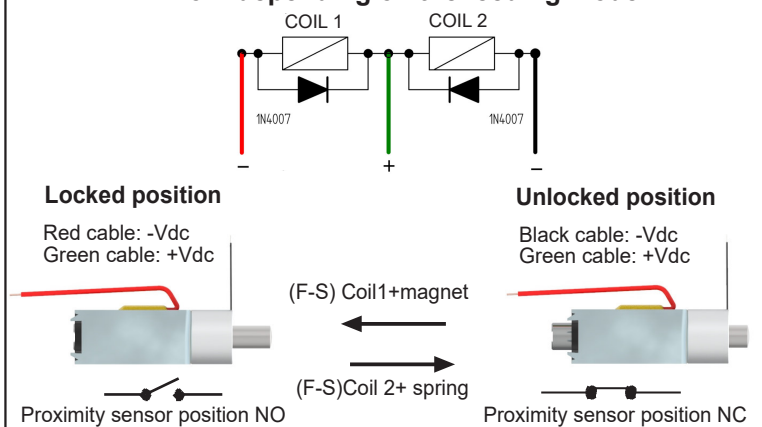


Standard voltage:	24Vdc
Coil 1 duty-cycle ED(%)	20
Coil 1 abs. power at 20°C (W)	24
Coil 2 duty-cycle ED(%)	25
Coil 2 abs. power at 20°C (W)	22
Vac (V) 1) 2)	NP
Plunger weight (kg)	0.046
Solenoid weight (kg)	0.218

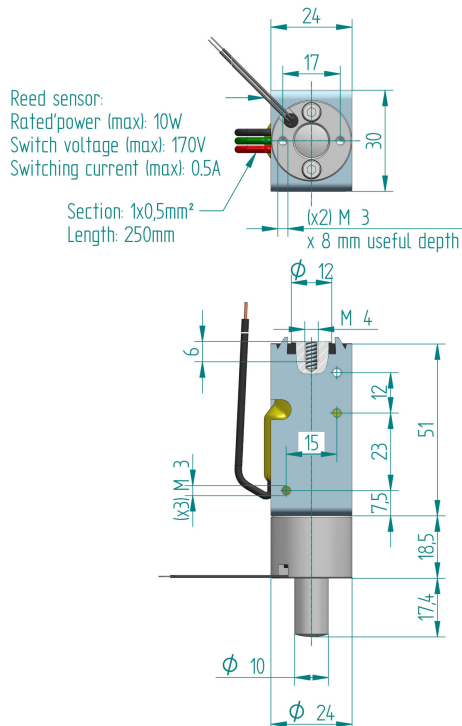
NP= Not available

- They can be manufactured at any voltage between the maximum and the minimum voltage values shown under chart.
- If any variation from the original is needed please contact.
- Earthing is recommended if the metallic are accessible.

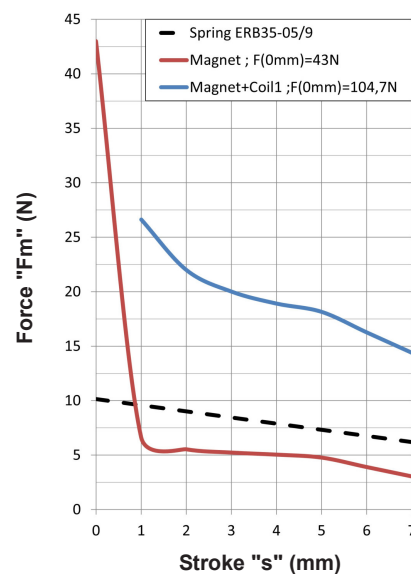
Work depending on the feeding mode:



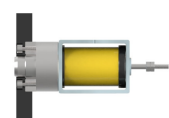
Solenoid locked (s=0mm position)



Force-stroke curve(F-S)



Frontal fixation: it is imperative to realize a small bush of the guide thus to secure the optimal efficiency.



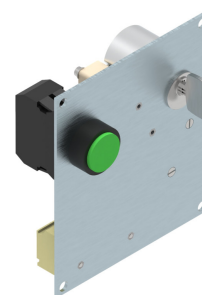
Ordering code: ERB35-05/NDBCP --V ED20%ED25%

Example: Voltage: 24Vdc: ERB35-05/NDBCP 24Vdc ED20%ED25%

ASSEMBLY: the screw does not to have to exceed the wall of the magnetic circuit

• C30 TYPE

Protection rate: **IP00**
 Insulation class: **B (130° C)**
 Standard voltage: **24-48-125Vdc and 230Vac**
 Power at 20°C: **8.5W**
 Duty cycle: **ED 100%**
 Weight: **0.6Kg**



DESCRIPTION

This bolt is locked without voltage, the locking is made by an incorporated spring. With an electrical signal the bolt turns to unlocked.

The key has two positions, in the locked position the key cannot be removed. To remove it, it is necessary to unlock the bolt.

Microswitch number and its operation mode (normally open, closed or combined) depends on the application required.

Applications: it is designed to protect properly from electrical accidents, it is assembled inside the front of the high, medium and low voltage electrical equipment and for all those applications where an electrical signal needs to be sent or turn off by a combined security activation (thumb switch/ key turn).

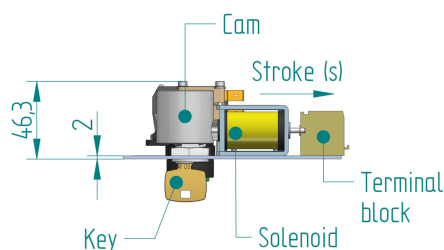
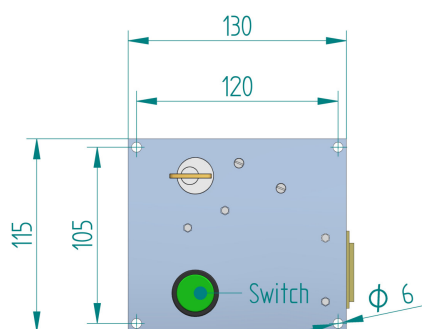
OPERATION MODE

To operate any part of the line and for being sure that the electrical accident does not happen to people, the bolt must be unlocked.

Push the (a1) thumb switch, at the same time turn the key 90° to (A), in this position the microswitches (b1-b2) are working and the line of actuation is cut, stop pushing the thumb switch and extract the key (d), this must be kept out of the electrical equipment, in the unlock position the lamp is switched off, it switches on when locking.

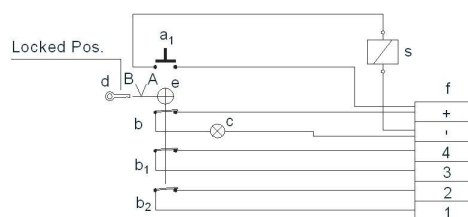
To lock introduce the key and turn 90° to (B).

*Earthing is recommended if the metallic parts are accessible.



Disposition with 3 micros (NC)

ELECTRIC DIAGRAM



LAY OUT

s=Solenoid
 a₁=Switch with lamp
 b=Microswitch (to keep lamp on when actionate the key)
 b₁-b₂=Microswitch available
 c=Lamp
 d=Bolt key to actionate the cam (e)
 e=Cam to actionate accionamiento micros (b-b₁-b₂)
 f=Terminal block

The bolt will be provided with two keys.

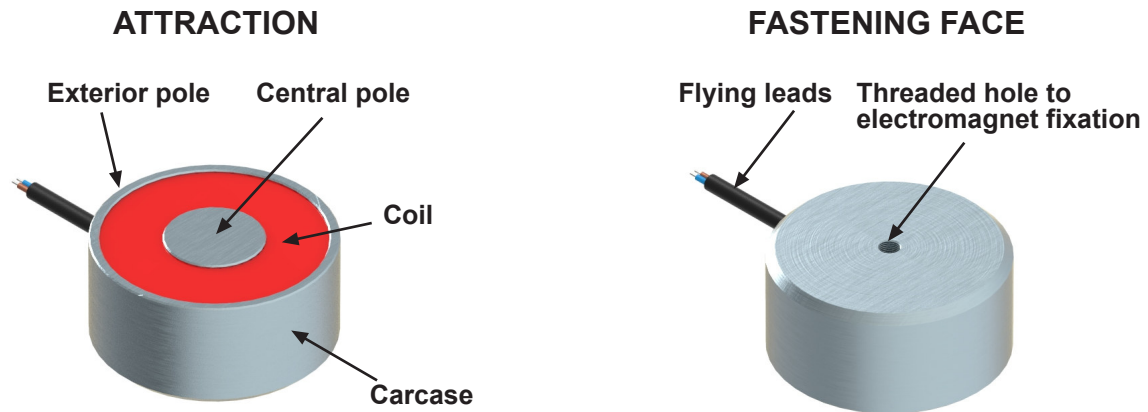
Ordering code: C30--V ED100%

Example: Voltage: 24Vdc: C30 24Vdc ED100%

DESCRIPTION:

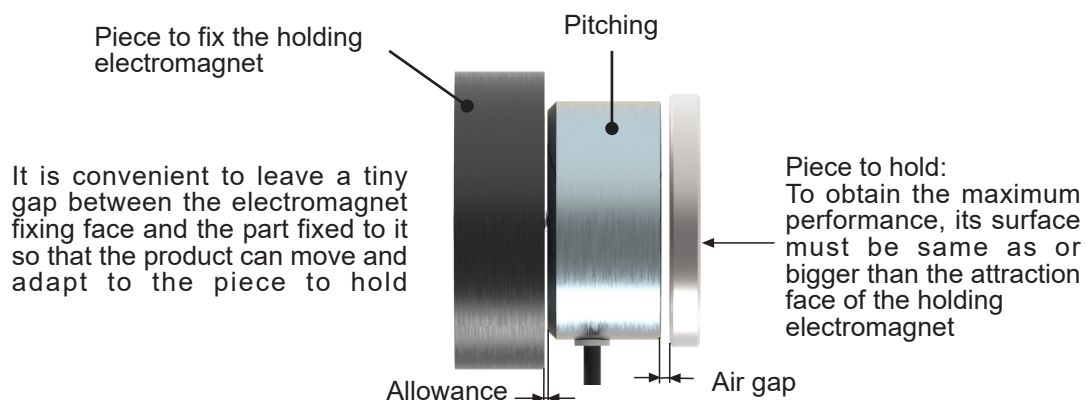
The holding electromagnets (electromagnetic and electropermanent) are used to attract and hold ferromagnetic pieces.

The maximum force efficiency is achieved with the piece to be hold over the attraction's face and in direct contact with both poles (outside pole and inside pole).



It is not recommended to use holding electromagnets in applications that require an air gap $> 0.2\text{mm}$. The retention force will fall down exponentially when the air gap increases (as can be seen in the data sheet of each product).

CONDITIONS FOR A CORRECT INSTALATION, USE AND MAINTENANCE:



In electropermanent holding electromagnets, vibration and temperature higher than the one recommended must be avoided because it could damage the magnet and the product would loose force.

MAINTENANCE:

If the attraction face suffers bumps when working, a reduction of force will occur due to the air gap generated by them, and to recover the initial force, attraction face must be rectified.

• CUSTOMIZATION

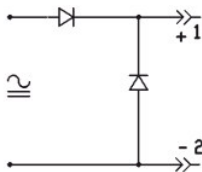
The models described in the catalogue are standard and minimum manufacturing batches are not required. However, there is the possibility of customizing them to suit better customer's needs. See below some of the most common customizations.

If any modification is needed, please ask NAFSA about the possibility and the minimum manufacturing batch required.

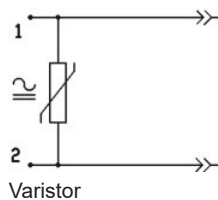
1. ELECTRICAL CUSTOMIZATION

a) Integrated electronics only in versions with DIN43650A connector:

a.1) For peak suppression Examples:

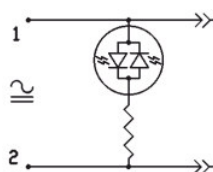


Free wheel diode+second diode to protect the free wheel diode against reverse polarity.

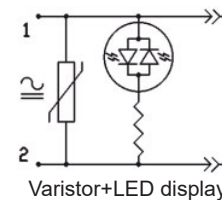


Varistor

a.2) Power display Examples:

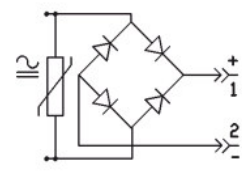


Connector under voltage display by LED

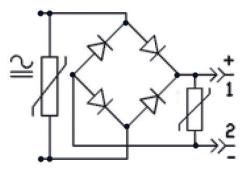


Varistor+LED display

a.3) For rectification Examples:



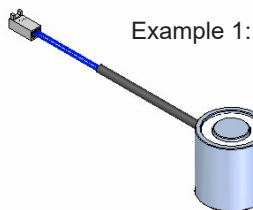
4 diodes with varistor at the input



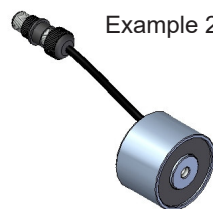
4 diodes with double varistor.

b) Cable length modification and terminal or connector mounted over cables:

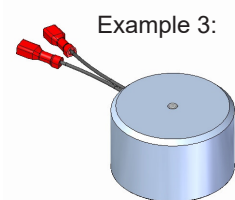
In some holding electromagnet models, cables can be replaced by connector DIN43650 or clamping screw (see each serie datasheet). In the holding electromagnet models which have supply cables, this length can be modified to customer requirement. Likewise any kind of terminals or connectors can be added to the cables.



Example 1:



Example 2:



Example 3:

c) Intermediate duty-cycle manufacturing:

In the VEM and ERM are manufactured by default with duty-cycle is 100%, but NAFSA can manufacture any intermediate duty-cycle from 0 to 100, but the viability depends on the model and the voltage associated with it. For any special requirement, please ask NAFSA.

In the VM and VM/ND series the duty-cycle can not be modified.

2. INSULATION CLASS CUSTOMIZATION:

In the VEM serie, insulation class can be increased until H (180°C).

In the VM and VM/ND, insulation class can be increased until F (155°C).

3. PROTECCIÓN RATE CUSTOMIZATION IP (EN60529):

Standard models are IP65, but it can be decreased until IP40 to cheapen production cost.

NOTE: All this customizations cannot be applied to all models, ask NAFSA for each case.

• CUSTOMIZATION

The models described in the catalogue are standard and minimum manufacturing batches are not required. However, there is the possibility of customizing them to suit better customer's needs. See below some of the most common customizations.

If any modification is needed, please ask NAFSA about the possibility and the minimum manufacturing batch required.

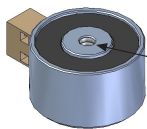
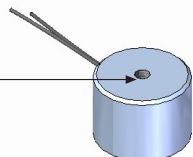
4. MECHANICAL CUSTOMIZATION:

The viability of the modifications depends on the model.

For any special requirement, ask NAFSA.

4.1) Fastening holes modification:

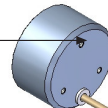
Example: VEM30M6
M4 hole has been modified to M6



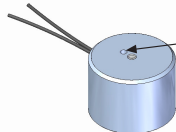
Example: VEM50RB
M5x8 hole has been modified by pass-through M8 hole

4.2) Non-rotating holes integration:

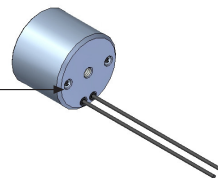
Example: VEM65E
Three M5 holes on $\varnothing 40$ have been made



Example: VEM30G
 $\varnothing 2,5$ hole has been added

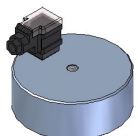
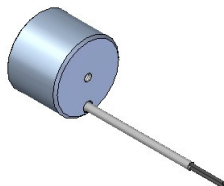


Example:
Two holes have been added



4.3) Cable or connector position modification:

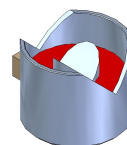
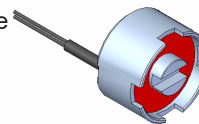
Example: VEM30D
Cables from fastening face



Example: VEM150CCA
Connector from fastening face

4.4) Carcase shape modification:

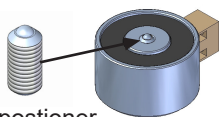
4 milled at 90° on the attraction face



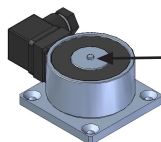
Example: VEM80VC
V-shaped milling

4.5) Antiremanence pins:

Example: VEM50/RB
with M8-ball postioner

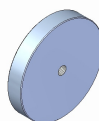


M8-ball postioner

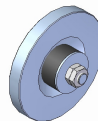


Example: VEM50/CP/1
Customized antiremanence pin

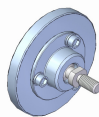
4.6) Holding plate fabrication:



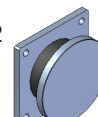
Example: CPL-42x7
Holding plate $\varnothing 42 \times 7$ with M-5 hole



Example: VEM80CP
Holding plate with damping washer



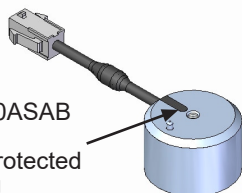
Example: VEM50CP/2
Holding plate with ball joint



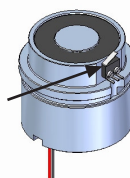
Example: VEM40CP/2
Holding plate with damping washer on support

4.7) Position detection system:

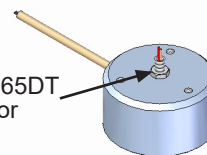
Example: VEM30ASAB
Proximity sensor integrated and protected with overmolding



Example: VM40NDFM
Microruptor screwed in the carcase



Example: VEM65DT
Magnetic sensor



NOTE: All this customizations cannot be applied to all models, ask NAFSA for each case.

• VEM SERIE

The attraction and holding of the magnetic pieces are obtained feeding the winding inside the solenoid. When the power supply stops the electromagnet loses the piece.
When working with loads security norms must be respected.



Protection rate: **IP65**
Insulation class: **B (130°C)**
Standard voltage: **24 VDC**
Standard duty cycle: **ED100%**
Other voltages, ED and sizes: **Consult**

Flying leads for every size.
Supply possibilities under demand:
*With **campling screw** from the VEM25
*With **connector** from the VEM65.
The connector (1) has 4 possibilities of direction (4x90°) and it is possible to be incorporated to the same diodes of rectification for alternating current connection (AC).

Table 1

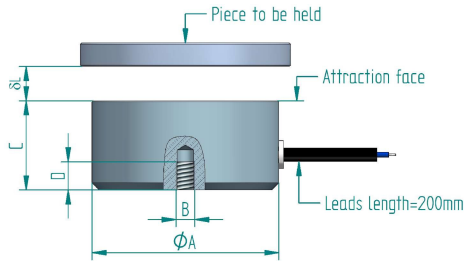
TYPE	øA (-0,3)	B	C±0.1	D	E	F	Weight (Kg)
VEM 20	20	M-3	12	5	---	---	0.02
VEM 25	25	M-4	20	6	---	40	0.06
VEM 30	30	M-4	22	6	---	45	0.10
VEM 40	40	M-5	26	8	---	55	0.20
VEM 50	50	M-5	30	8	---	65	0.30
VEM 65	65	M-8	35	12	112	80	0.80
VEM 80	80	M-8	38	12	127	95	1.30
VEM 100	100	M-10	43	15	147	115	2.10
VEM 150	150	M-16	56	24	197	165	6.40

Table 2

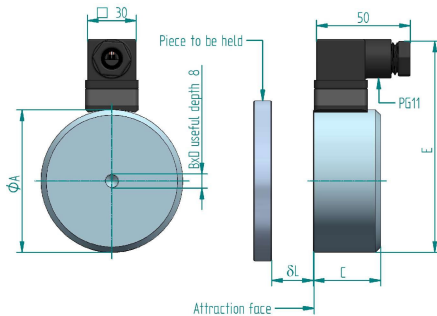
TYPE	P at 20°C (W)	e (mm)	Air gap (mm) δ_L					
			0	0,1	0,2	0,5	1	
VEM20	1.6	1 3	14.5 27	3.8 5.7	1.6 2.6	0.3 0.35		Magnetic Force Fm (N)
VEM25	3.2	1 3 6	27 114 135	19 47 50	12 20 21	3 3.5 3.7		
VEM30	4	1 3 6	37 170 190	24 80 90	18 40 45	6 9.5 12	1.5 1.6 2	
VEM40	5.6	1 3 6	38 300 400	30 203 245	24 133 160	13 27 30	4 4.5 5	
VEM50	6.5	1 3 6	40 320 500	32 235 370	30 185 240	20 65 68	15 16 20	
VEM65	10	1 3 6 10	45 310 830 980	40 290 660 750	35 250 500 560	25 148 164 190	15 40 46 50	
VEM80	15	1 3 6 10	65 430 1150 2000	42 360 970 1350	40 325 830 1000	30 230 375 420	20 90 110 125	
VEM100	20	1 3 6 10	70 530 1400 2600	50 440 1200 2200	45 426 1050 1700	35 335 730 880	25 225 310 330	
VEM150	40	3 6 10 18	700 1810 5800 7104	580 1650 4350 5760	550 1580 3910 4992	480 1400 3000 3840	390 1100 1850 2400	

e (mm): Thickness of the piece to hold

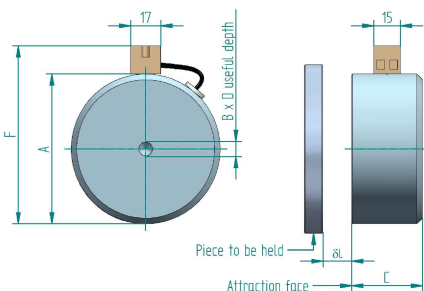
Flying leads: Ref: VEM (type)-V - ED%
Example: VEM 65-24Vdc- ED100%



Connector (C): Ref: VEM (type)/C-V-ED%
Example: VEM65/C-24Vdc ED100%
Connection:
see documentation that is enclosed with the material



Clamping screw (B): Ref: VEM(type)/B-V-ED%
Example: VEM50/B-24Vdc-ED100%



The table 2 gives for each type of holding magnet, the values of the force of maintenance (Fm) based on the air gap, measured in the following conditions:

- Direct current supply.
- Flat piece (3µm rugosity) in A°St37, thickness as shown in the table 2 and dimensions are similar or bigger than the attraction face.
- Room temperature 35°C.
- Coil working on its regime temperature.

At different conditions, the magnetic force (Fm) may decrease. The value of the magnetic remanence after the power supply stops is 5% of the holding force.

*Earthing is recommended if the metallic parts are accessible.

*Technical explanation: see pages 4 & 5.

*Under demand: any size, voltage, duty cycle etc can be manufactured.



When lifting or handling heavy loads a minimum security margin of 3 must be respected, the weight of the load cannot exceed 33% of the magnetic force.

ERM SERIE

The attraction and holding of the magnetic pieces are obtained by feeding the winding inside the solenoid. When the power supply stops, the solenoid looses the piece.

When working with loads, security norms must be respected.

Protection rate: **IP65**
Insulation class: **B (130°C)**
Nominal Voltage: **24VDC**
Standard duty cycle: **ED100%**
Other voltages, ED and sizes: **Consult**



Table 1

TYPE	A	B	C	D	E	F	H	N° of holes	Compression gland	Weight(kg)
ERM100/35	125					10		2		0.9
ERM150/35	175					10		3		1
ERM200/35	225					10		4		1.5
ERM400/35	425	35±0.3	34±0.1	25	50	12	M-6	8	PG-9	2.8
ERM500/35	525					12		10		3.5
ERM600/35	625					12		12		4.5
ERM150/60	180			40	70			2		2.3
ERM200/60	230	60±0.1	49.5±0.2	40	120	12	M-8	2	PG-11	3
ERM500/60	530			70	120			4		7.8

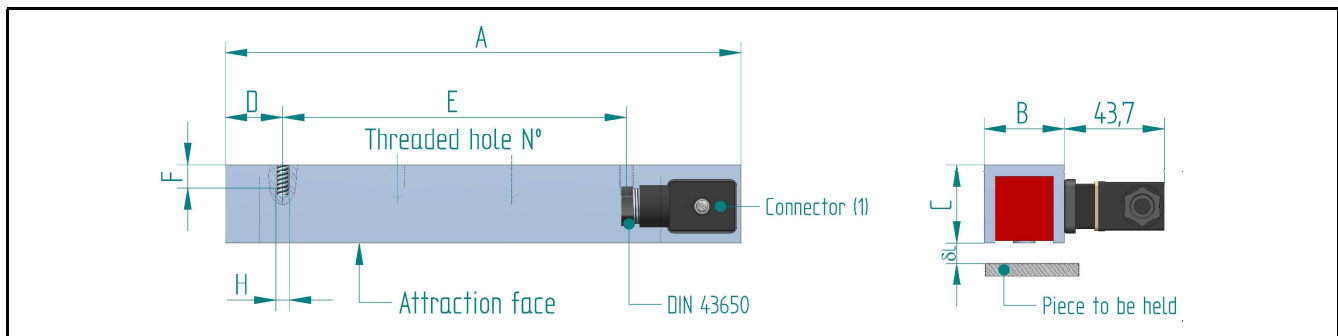


Table 2

TYPE	P at 20°C (W)	e (mm)	Airgap (mm)					Magnetic force Fm (N)
			0	0,1	0,2	0,5	1	
ERM100/35	10	1	32	22	12	8	6	
		3	396	308	120	45	8	
		6	604	320	190	52	12	
		10	752	468	238	60	18	
ERM150/35	14	1	65	50	30	21	14	
		3	769	580	220	82	17	
		6	1090	657	368	90	21	
		10	1450	904	490	116	35	
ERM200/35	18	1	80	60	42	28	14	
		3	928	720	260	94	20	
		6	1400	810	460	121	27	
		10	1758	1108	690	136	46	
ERM400/35	30	1	172	131	91	60	35	
		3	2100	1460	537	210	45	
		6	3060	1722	962	263	60	
		10	3810	2371	1297	304	93	
ERM500/35	45	1	210	150	100	60	36	
		3	2323	1806	674	234	56	
		6	3540	2100	1114	295	70	
		10	4423	2745	1501	330	117	
ERM600/35	53	1	226	173	90	66	40	
		3	2653	2053	706	266	66	
		6	4053	2266	1286	346	80	
		10	5026	3120	1806	400	120	
ERM150/60	25	1	140	112	102	75	50	
		3	780	680	600	445	180	
		6	1800	1490	1100	610	200	
		10	1900	1500	1250	650	210	
ERM200/60	40	1	205	165	155	116	72	
		3	1130	990	890	680	250	
		6	2550	2160	1800	884	280	
		10	2760	2300	1870	900	300	
ERM500/60	75	1	553	440	397	310	190	
		3	3150	2630	2320	1800	780	
		6	7250	5870	4650	2380	850	
		10	7450	5950	4820	2410	910	

e = Thickness of the piece to hold

The table 2 gives for each type of holding magnet, the values of the force of maintenance (Fm) based on the air gap, measured in the following conditions:
-Direct current supply.
-Flat piece (3µm rugosity) in A°St37, thickness as shown in the table 2 and dimensions are similar or bigger than the attraction face.
-Room temperature 35°C.
-Coil working on its regime temperature.
At different conditions, the magnetic force(Fm) may decrease. The value of the magnetic remanence after the power supply stops is 5% of the holding force.

- Alternating current connection (AC):
Only for sizes ERM150/60 to ERM500/60.
- Earthing is recommended if the metallic parts are accessible.
- Mounting, supply possibilities and ordering code: page 104.
- Technical explanations: see pages 4 & 5.
- Under demand: any size, voltage, duty cycle etc can be manufactured.

Ordering code: Size--V ED---%
Voltage: 24Vdc; Duty cycle: ED100%
ERM150/35 24Vdc 100%
For other configurations see page 104

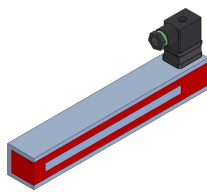
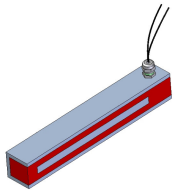
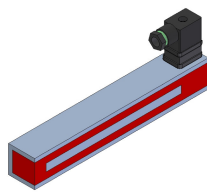
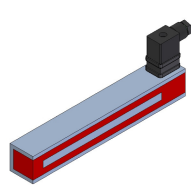


When lifting or handling heavy loads a minimum security margin of 3 must be respected, the weight of the load cannot exceed 33% of the magnetic force.

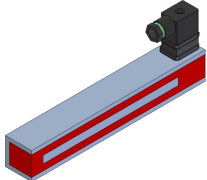
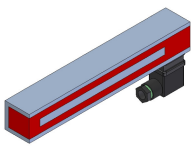
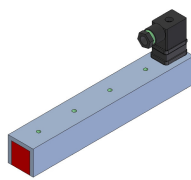
ERM SERIE

Mounting and supply possibilities for rectangular holding electromagnet

ERM --/35

Supply possibilities   A)Connector (Standard) B)Stuffing box (under demand)	2x180° connector   Standard mounting Opcional mounting under demand
---	--

Connector and stuffing box different positions

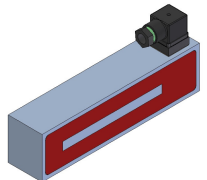
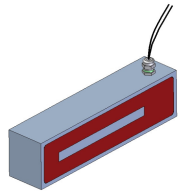
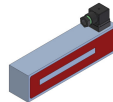
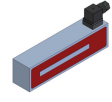
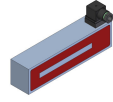
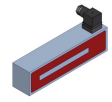




1)Standard mounting

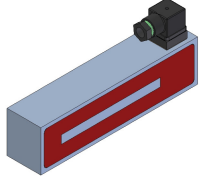
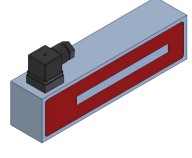
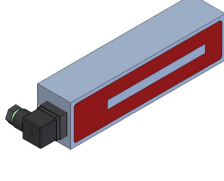
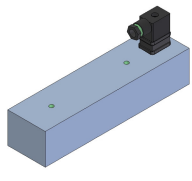
2)Face opposite to standard mounting
(Under demand)

3)Fastening face
(Under demand)

ERM --/60

Supply possibilities   A)Connector (Standard) B)Stuffing box (Under demand)	4x90° connector     Optional mounting under demand
---	---

Connector and stuffing box different positions

1)Standard mounting

2)Face opposite to standard
mounting (Under demand)

3)Longitudinal output
(Under demand)

4)Fastening face
(Under demand)

Ordering code:

Size; Supply possibilities; Positioning; Voltage; Duty-cycle;

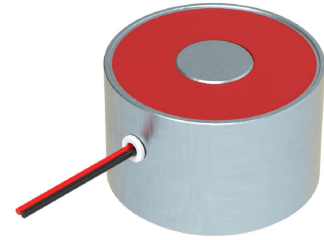
Example: ERM200/35 A2 24Vdc 100% (Connector in the opposite face to standard mounting)
ERM200/60 B4 24Vdc 50% (Stuffing box in the fastening face)

IMPORTANT: Under demand orders can be delayed in the delivery

• VM SERIE

The attraction and holding of magnetic pieces are made by permanent magnets mounted in the electromagnet, with these kind of products we avoid the risk of load falling down due to sudden power supply failure. The power supply on the coil allows to loose the load, when this power supply stops, the product recovers its initial force.

When working with suspended loads, security norms must be respected.



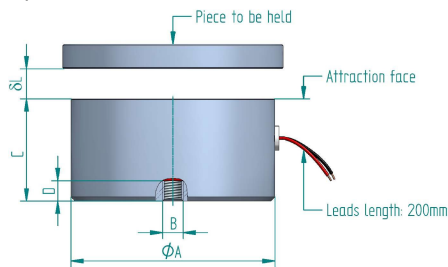
Protection rate: **IP65**
Insulation class: **B (130°C)**
Standard voltage: **24VDC**
Standard duty cycle: **ED100%**
Different voltage, ED or size: **Consult**

Flying leads for every size
Supply possibilities under demand:
.With sampling screw from the VM25
.With connector from the VM65.
The connector (1) has 4 possibilities of direction (4x90°)
and it is possible to be incorporated to the same diodes
of rectification for alternating current connection (AC).

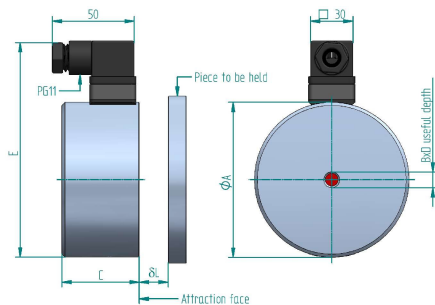
Table 1

TYPE	øA (-0,3)	B	C±0.1	D	E	F	Weight(Kg)
VM 20	20	M-3	25	5	---	---	0.04
VM 25	25	M-4	27	5	---	40	0.06
VM 30	30	M-4	28	5	---	45	0.17
VM 40	40	M-5	30	6	---	55	0.24
VM 50	50	M-5	35	6	---	65	0.44
VM 65	65	M-8	40	8	112	80	0.74
VM 80	80	M-8	45	8	127	95	1.42
VM 100	100	M-10	50	10	147	115	2.20
VM 150	150	M-16	65	15	197	165	6.60

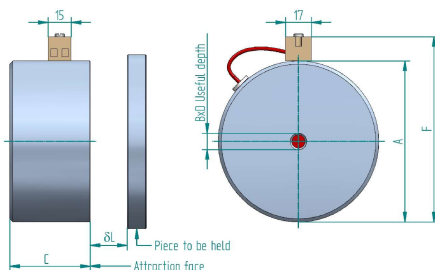
Flying leads: Ref: VM (type)-V - ED%
Example: VM 50-24Vdc- ED100%



Connector (C): Ref: VM (type)/C-V-ED%
Example: VM65/C-24Vdc ED100%
Connection:
see documentation that is enclosed with the material



Clamping screw (B): Ref: VM(type)/B-V-ED%
Example: VM50/B-24Vdc-ED100%



Important: the clamping screw does not have to exceed measure D

TYPE	P at 20°C (W)	Thickness of the piece to hold (mm)	Air gap (mm) δ_L			
			0	0.1	0.2	
VM20	2.6	1	18	5	1	Magnetic Force Fm (N)
		3	18	5	1	
		10	18	5	1	
VM25	4.3	1	20	7	3	
		3	23	7	4	
		10	29	10	7	
VM30	4.5	1	24	10	5	
		3	45	10	6	
		10	52	14	7	
VM40	7	1	39	29	22	
		3	108	57	29	
		10	128	58	37	
VM50	10	1	43	30	28	
		3	129	110	75	
		10	226	125	80	
VM65	14	1	44	35	25	
		3	266	203	140	
		10	374	238	145	
VM80	18	1	44	35	25	
		3	294	267	217	
		10	588	362	256	
VM100	25	1	45	35	25	
		3	299	282	262	
		10	1000	745	519	
VM150	45	1	93	75	60	
		3	415	350	320	
		10	2000	1500	1300	

The table 2 gives for each type of holding magnet, the values of the force of maintenance (Fm) based on the air gap, measured in the following conditions:

- Holding magnet without voltage.
 - Flat piece (3µm rugosity) in A°St37, thickness as shown in the table 2 and dimensions are similar or bigger than the attraction face.
 - Room temperature 35°C.
 - Coil working on its regime temperature.
- At different conditions, the magnetic force(Fm) may decrease. The value of the magnetic remanence after the power supply stops is 5% of the holding force.

.Earthing is recommended if the metallic parts are accessible.
.Technical explanation: see page 4 & 5.

.Under demand: any size, voltage, duty cycle etc can be manufactured.

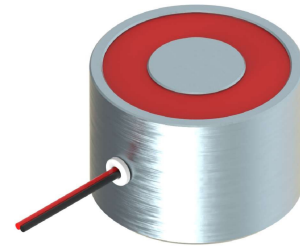


When lifting or handling heavy loads a minimum security margin of 3 must be respected, the weight of the load cannot exceed 33% of the magnetic force.

• VM/ND SERIE

The attraction and holding of the magnetic pieces are made by permanent magnets mounted in the solenoid. With these kind of products, we avoid the risk of load falling due to sudden power supply failure. The power supply on the coil allows to loose the load, when this power supply stops, the product recovers its initial force.

When working with suspended loads, security norms must be respected.

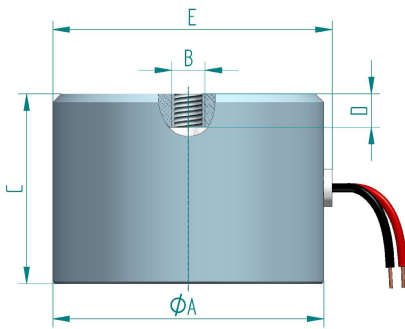


Protection rate: **IP65**
Insulation class: **Y (90°C)**
Standard voltage: **24VDC**
Standard duty cycle: **See chart**
Different voltage, ED or size: **Consult**

Supply possibilities:

Flying leads for every size:
VM20/ND, VM30/ND, VM40/ND: 1x0.25mm2
VM50/ND, VM65/ND, VM100/ND: 1x0.5mm2
VM150/ND: 2x0.75mm2
Under demand: any size, voltage, duty cycle etc can be manufactured

Flying leads



Feeding mode to take off the workpiece:

Voltage: 24Vdc
Polarization:
Red lead +VDC / Black lead -VDC

Important: the clamping screw does not have to exceed measure D

Table 1

TYPE	ØA (-0,3)	B	C(±0,1)	D	E	Weight(Kg)
VM 20/ND	20	M-3	25	5	26	0.04
VM 30/ND	30	M-4	32.5	6	35.2	0.13
VM 40/ND	40	M-5	41.7	6	42.7	0.28
VM 50/ND	50	M-5	42.8	6	52.5	0.45
VM 65/ND	65	M-8	45.5	8	67	0.74
VM 100/ND	100	M-10	67	10	102	3.00
VM 150/ND	150	M-16	65	15	152	7.10

TYPE	P (W)	ED (%)	Minimum pulse (ms)	Resting time (ms)	e (mm)	Air gap (mm) ΔL			Magnetic force Fm (N)
						0	0.2	0.5	
VM20/ND	10	20	24	180	1 3 10	22 39 39	7 7 7	1.7 1.7 1.7	Magnetic force Fm (N)
VM30/ND	25	20	110	825	1 3 10	46 181 181	34 74 74	22 22 22	
VM40/ND	42	15	75	743	1 3 10	51 205 270	36 89 89	23 38 38	
VM50/ND	48	15	120	1188	1 3 10	60 304 607	41 200 225	34 95 110	
VM65/ND	80	15	225	2228	1 3 10	70 374 1220	50 340 750	40 260 400	
VM100/ND	75	25	150	1500	1 3 10	83 421 2205	61 365 1254	49 338 686	
VM150/ND	77	40	285	1070	1 3 10	78 615 2254	46 475 1490	32 401 1100	

e (mm): Thickness of the piece to hold

The table 2 gives for each type of holding magnet, the values of the minimum pulse time and resting time measured in the following conditions:

- With a weight of 5% of the maximum magnetic force made by each model
- Coil working on its regime temperature.

The table 2 gives for each type of holding magnet, the values of the force of maintenance (Fm) based on the air gap, measured in the following conditions:

- Holding magnet without voltage.
- Flat piece (3µm rugosity) in A°St37, thickness as shown in the table 2 and dimensions are similar or bigger than the attraction face.
- Room temperature 35°C.
- Coil working on its regime temperature.

At different conditions, the magnetic force(Fm) may decrease.

The value of the magnetic remanence after the power supply stops is 5% of the holding force.

Earthing is recommended if the metallic parts are accessible.

Technical explanation: see pages 4 & 5.

Under demand: any size, voltage, duty cycle etc can be manufactured.

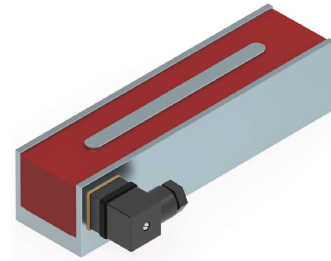
Under demand an internal protection can be added to the coil to protect it of the overheating, generated by the no respecting of the times given by the duty cycles, this overheating can demagnetize the internal magnet or destroy the coil changing the proper working of holding magnet.

⚠ When lifting or handling heavy loads a minimum security margin of 3 must be respected, the weight of the load cannot exceed 33% of the magnetic force.

Ordering code : VM(size)/ND --V ED---%
VM50/ND; Voltage : 24Vdc ; Duty cycle : ED15% ; Ref.: VM50/ND 24Vdc ED15%
VM50/ND with protection ; Voltage : 24Vdc ; Duty cycle : ED15% ; Ref.: VM50/ND_WP 24Vdc ED15%

• ERMI 200-60 TYPE

The attraction and holding of the magnetic pieces are made by permanent magnets mounted in the solenoid.
With these kind of products, we avoid the risk of load falling due to sudden power supply failure. The power supply on the coil allows to loose the load, when this power supply stops, the product recovers its initial force.
When working with suspended loads, security norms must be respected.



Protection rate: **IP65**
Insulation class: **Y (90°C)**
Standard voltage: **24VDC**
Standard power: **250W**
Standard duty-cycle: **ED15%**
Solenoid weight: **4.7 kg**

Supply possibilities:

- Connector standard
- **Alternating current connection (AC):**
The connector offers the possibility of incorporating rectifying diodes
- Under demand: other possibilities of input can be manufactured.

If any changes from the original (see drawing), please contact.

- Electric connection of the connector:
see documentation that is enclosed with the material
- Earthing is recommended if the metallic parts are accessible.
- Technical explanations: see pages 4 & 5.

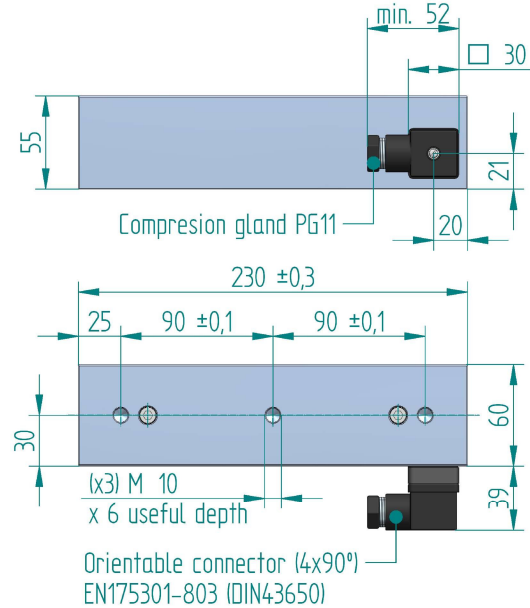


Table 1

Thickness of the piece to hold(mm)	Air gap (mm) δ_L							Magnetic Force Fm (N)
	0	0.1	0.2	0.3	0.4	0.5	1	
1	250	210	190	180	165	160	140	
3	1350	1250	1150	1100	1000	925	570	
6	2350	2000	1750	1400	1200	1100	590	
10	2800	2450	2150	1900	1600	1400	700	
18	3000	2550	2300	2000	1700	1500	800	

For these holding electromagnet correct working the minimum pulse and resting time must be respected:

- **Minimum pulse time: 300ms**
- **Minimum resting time: 5000ms**

The values of the minimum pulse time and resting time measured in the following conditions:

- Coil working on its regime temperature.
- Piece weight: 2 Kg (it is not recommended to use these holding electromagnet for lower weights)

The table 2 gives for each type of holding magnet, the values of the force of maintenance (Fm) based on the air gap, measured in the following conditions:

- Holding electromagnet without voltage.
- Flat piece ($3\mu\text{m}$ rugosity) in A°St37, thickness as shown in the table 2 and dimensions are similar or bigger than the attraction face.
- Room temperature 35°C.
- Coil working on its regime temperature.

At different conditions, the magnetic force(Fm) may decrease.The value of the magnetic remanence after the power supply stops is 5% of the holding force.



When lifting or handling heavy loads a minimum security margin of 3 must be respected, the weight of the load cannot exceed 33% of the magnetic force.

Ordering code:

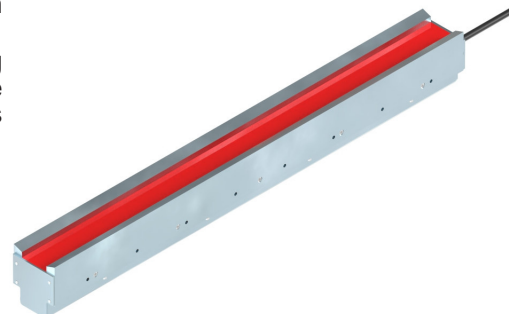
Ref.: *ERMI200/60 24Vdc ED15%*

• BP 1000-10 TYPE

It is a bipolar holding electromagnet with 1000mm of effective surface. The face is made with an angle to work with different pieces between $\varnothing 120$ mm y $\varnothing 250$ mm.

The attraction and holding of the magnetic pieces is obtained by feeding the coil inside the electromagnet. When the power supply stops the electromagnet looses the piece. When working with loads security norms must be respected.

Protection rate: **IP65**
Insulation class: **B (130°C)**
Standard voltage: **24Vdc**
Standard duty cycle ED: **100%**
Abs. power at 20°C: **217 W**
Temperature rise "DV31" **40°C**
Solenoid weight: **47 Kg**



• Maximum keeping force

$\varnothing$ Round bar (mm)	Force N/mm	Force N (for bar $\Rightarrow$ 1000mm)
$\varnothing 120$ - $\varnothing 200$	5.4	5400
$\varnothing 250$	8	8000

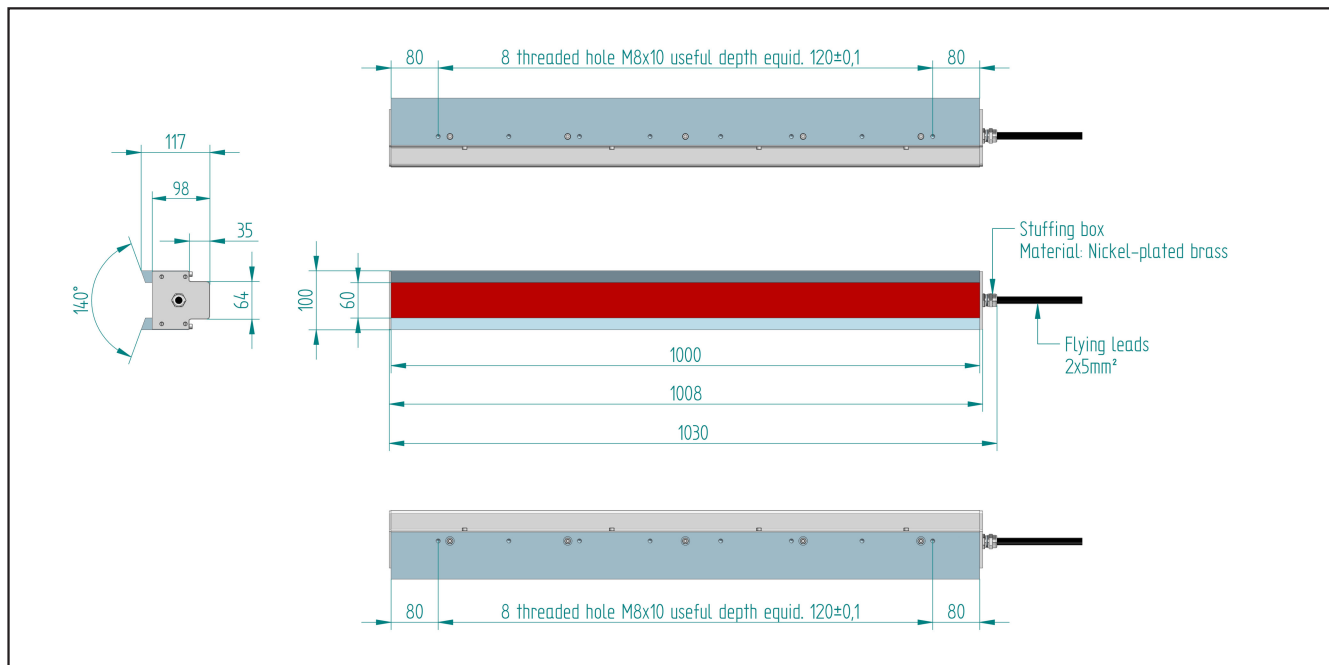
The forces values are obtained with the electromagnet at its working temperature and with the piece to be held in contact with whole attraction surface

1) To feed in alternating current the electromagnet will have an external rectifier.

2) It can be manufactured at any voltage, duty cycle, connection etc. Also other sizes for different applications.

3) Ground connection is recommended if to the metallic parts are accessible.

• General dimensions



When lifting or handling heavy loads a minimum security margin of 3 must be respected, the weight of the load cannot exceed 33% of the magnetic force.

Ordering code: BP1000/100 --V ED---%

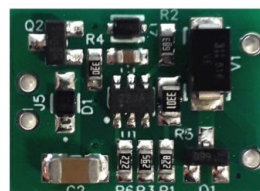
Voltage: 24Vdc; Duty-cycle: ED100%
BP1000/100 24Vdc ED100%

• EES24V3/0.8A TYPE

This electric power saver supplies full power to the solenoid for a pre-defined time then the voltage is lowered to a certain percentage of the input. That value can be 50%Vn, 33%Vn, 25%Vn according to the selected configuration. This value is then maintained throughout the time until the supply voltage is turned off, when the system is reset and the cycle starts again.

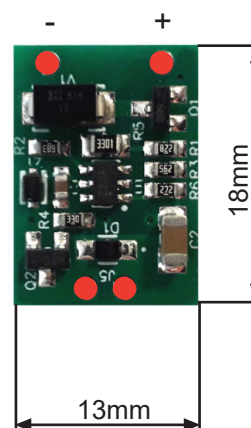
The circuit is used in those applications where the force in the beginning of the stroke of a solenoid of 100% duty cycle is not enough or in applications where less heating of the solenoid is required.

If a 24V supply is applied through the power saver to a 12VDC 100% duty-cycle solenoid, it will have a force equivalent to a duty-cycle of 25% while switching the solenoid.

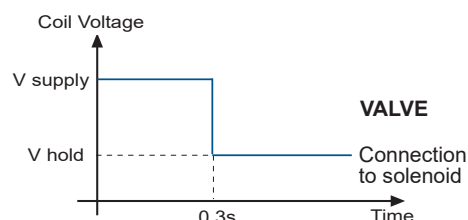


General dimensions

Voltage input: (+) Positive input of 24VDC
(-) Of input feed



Timing diagram



Power supply: 10 to 28VDC
Maximum pull in current: 3A
Maximum hold current: 0.8A
Pull in time: 0.3 seconds
Possible voltage reduction ratio: There are three versions to 50% Vn, 33%Vn or 25%Vn
Operating temperature range: -25°C to 75°C
Protection against reverse feed: -28VDC
Protection against coil discharge through diode.

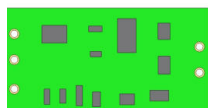
Products that can be applied

ER Serie: ER15/C, ER20/C, ER21/C, ER25/C, ER30/C, ER30/CT, ER35/C, ER40/CT, ER45-05/C, ER45-15/C, ER50-15/C, ER50-15/CT
ERC Serie: ERC30/C, ERC35/C, ERC45-50-15/C, ERC50-15/C
ECH serie: ECH40-10
CU Serie: CU20/C, CU30/C, CU40/C
ECM Serie: ECM13-03/E, ECM13-03/T, ECM13-10/E, ECM13-10/T, ECM19/E, ECM19/T, ECM25/E, ECM25/T
ECR Serie: ECR40-07
Locking bolts: ER30/CCR, CU30/CP, CU20/CP
Holding electromagnets: VEM20, VEM25, VEM30, VEM40, VEM50, VEM65, VEM80, VEM100, VEM150, ERM100/35, ERM150/35, ERM200/35, ERM400/35, ERM200/60

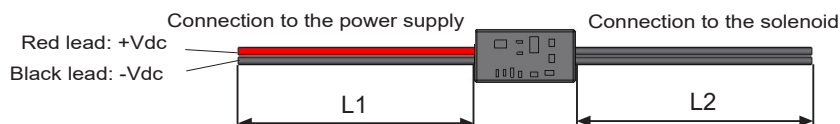
* Before purchasing ask NAFSA technical department, because the coils usually need to be adjusted for the coordinated work between the solenoid and the electronic plate.

Supply options:

Option1 (O1): Electronic plate individually



Option 2 (O2): Board integrated in the in a wiring subset and protected with a plastic overmolding.



Unless other specification it will be supplied with L1 and L2=300mm

NOTE: The supply option 2 (O2) will only be available for orders which require a minimum quantity defined by the commercial department of NAFSA

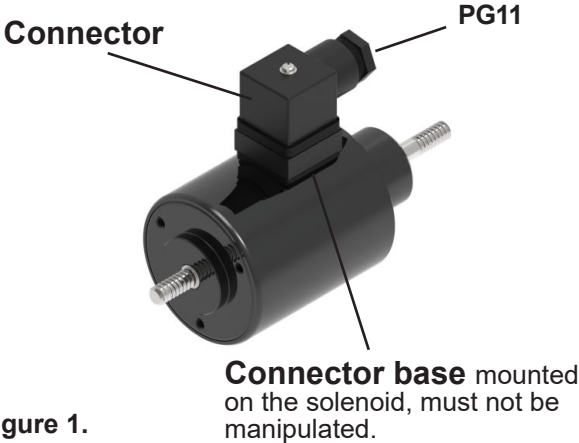
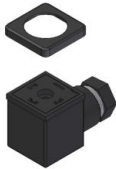
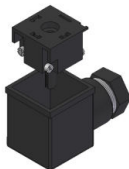
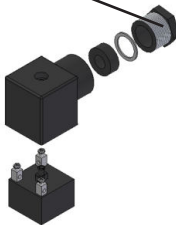
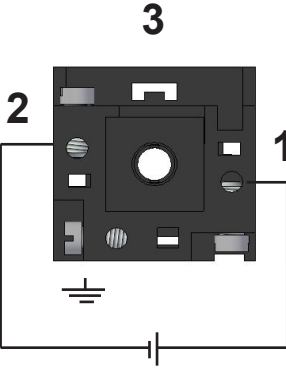
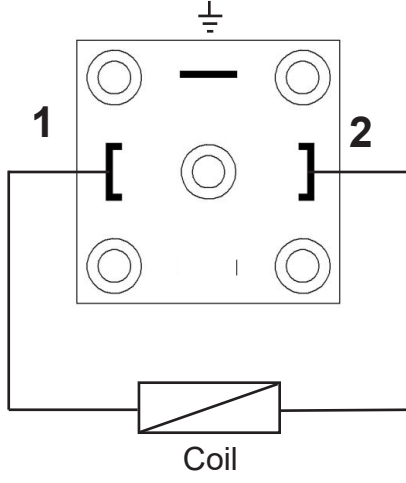
Ordering code examples:

Standard voltage reduced to 25%, supply option 1:
Reference: EES24V3/0.8A25%O1

Standard voltage reduced to 33%, supply option 2 and default lenght of cables:
Reference: EES24V3/0.8A33%O2

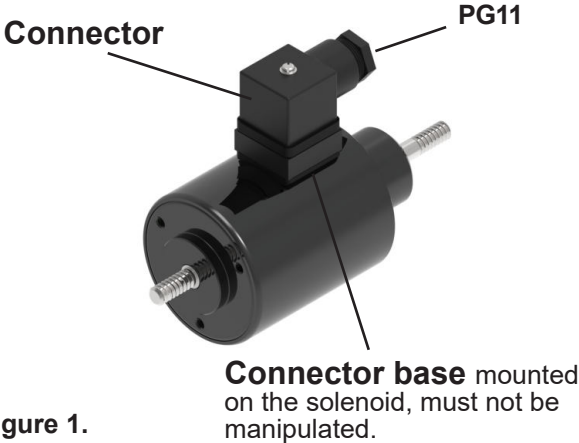
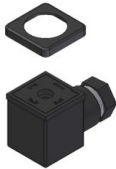
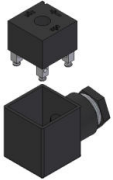
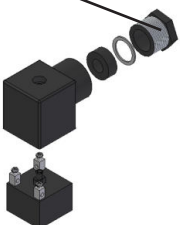
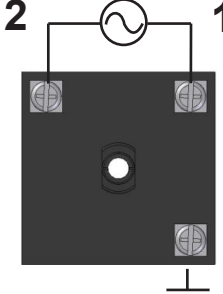
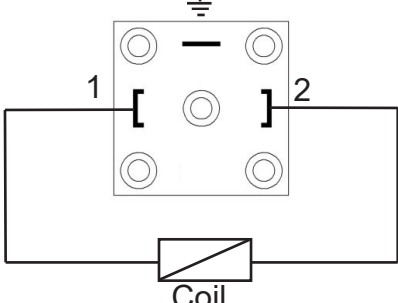
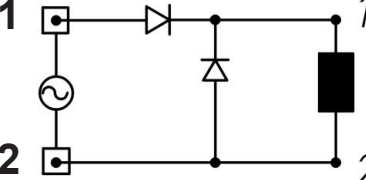
• **2P+T TYPE**

• **Working instructions and electrical connection:**

 Figure 1.	1) The electrical connection will be detailed in the following points.  Figure 2.
3) Take off the connector pulling it up.  Figure 4.	2) Take out the screw between the connector and the base.  Figure 3.
4) Take off the rubber piece.  Figure 5.	5) Remove the inner piece, this one has power terminals. To remove it, push the carrier between the terminals 1 and the mass one. Finally take off the stuffing box and connect the supply cables as shown in figure 8.  Figure 6.  Figure 7.
Take out the screws, take in the supply cables in the power terminals and screw them again.  Figure 8. Wiring diagram between the coil and the connector base  Figure 9.	

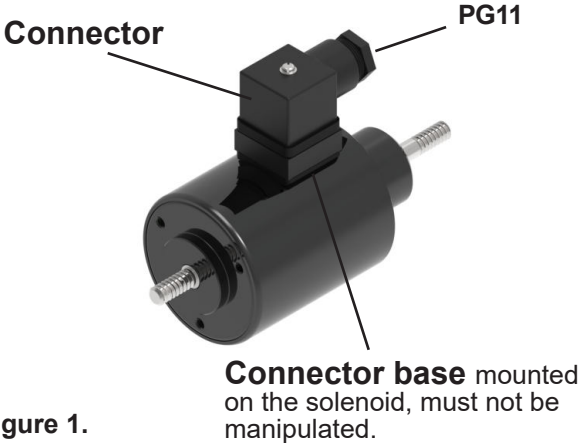
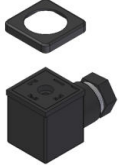
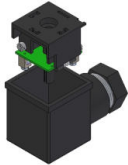
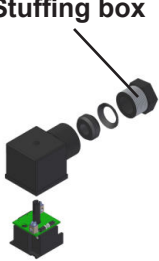
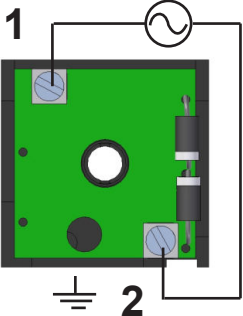
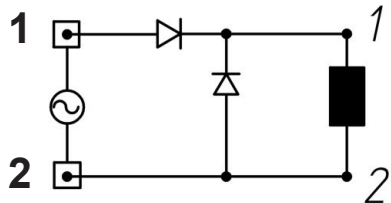
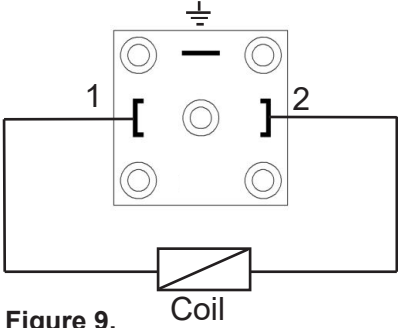
• 2P+T/C/2D TYPE

• Working instructions and electrical connection:

 Connector PG11 Connector base mounted on the solenoid, must not be manipulated. Figure 1.	1) The electrical connection will be detailed in the following points.  Figure 2.
3) Take off the connector pulling it up.  Figure 4.	2) Take out the screw between the connector and the base.  Figure 3.
4) Take off the rubber piece.  Figure 5.	5) Remove the inner piece, this one has power terminals. To remove it, push the carrier between the terminals 1 and the mass one. Finally take off the stuffing box and connect the supply cables as shown in figure 8.  Figure 6.  Stuffing box Figure 7.
 Figure 8. Take out the screws, take in the supply cables in the power terminals and screw them again. Electric diagram  Figure 9.  Wiring diagram between the coil and the connector base.	

• 2P+T/2D

• Working instructions and electrical connection:

 Figure 1.	1) The electrical connection will be detailed in the following points.  Figure 2.
3) Take off the connector pulling it up.  Figure 4.	2) Take out the screw between the connector and the base.  Figure 3.
4) Take off the rubber piece.  Figure 5.	5) Remove the inner piece, this one has power terminals. To remove it, push the carrier between the terminals 1 and the mass one. Finally take off the stuffing box and connect the supply cables as shown in figure 8.  Figure 6.  Figure 7.
 Figure 8. Take out the screws, take in the supply cables in the power terminals and screw them again. Electric diagram   Figure 9. Wiring diagram between the coil and the connector base	

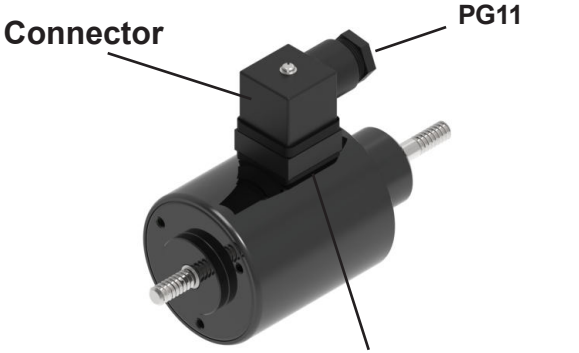
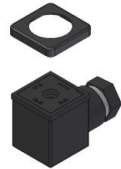
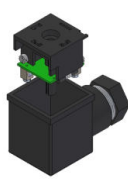
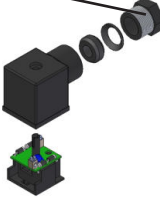
• 2P+T/C/4D TYPE

• Working instructions and electrical connection:

Connector PG11 Connector base mounted on the solenoid, must not be manipulated. Figure 1.	1) The electrical connection will be detailed in the following points. Figure 2.	
3) Take off the connector pulling it up. Figure 4.	4) Take off the rubber piece. Figure 5.	5) Remove the inner piece, this one has power terminals. To remove it, push the carrier between the terminals 1 and the mass one. Finally take off the stuffing box and connect the supply cables as shown in figure 8. Figure 6. Figure 7.
Figure 8. Take out the screws, take in the supply cables in the power terminals and screw them again Figure 9. Coil Electric diagram Wiring diagram between the coil and the connector base		

• **2P+T/4D**

• **Working instructions and electrical connection:**

 Figure 1. Connector base mounted on the solenoid, must not be manipulated.	1) The electrical connection will be detailed in the following points.  Figure 2.
3) Take off the connector pulling it up.  Figure 4.	4) Take off the rubber piece.  Figure 5.
2) Take out the screw between the connector and the base.  Figure 3.	5) Remove the inner piece, this one has power terminals. To remove it, push the carrier between the terminals 1 and the mass one. Finally take off the stuffing box and connect the supply cables as shown in figure 8.  Figure 6.  Figure 7.

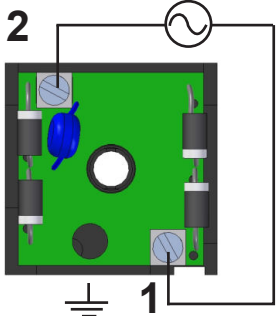


Figure 8.

Take out the screws, take in the supply cables in the power terminals and screw them again.

Electric diagram

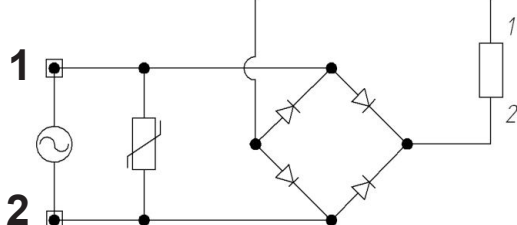
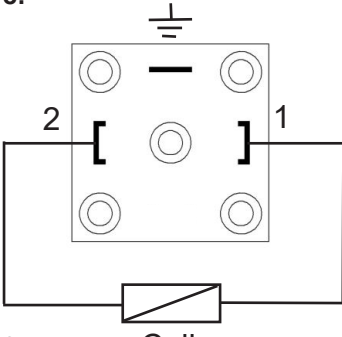


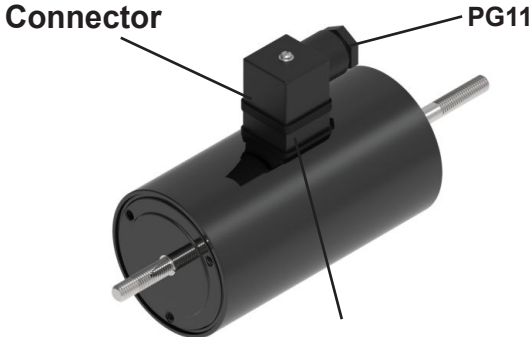
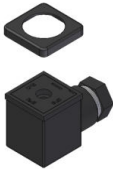
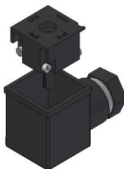
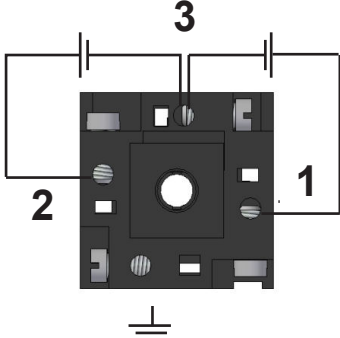
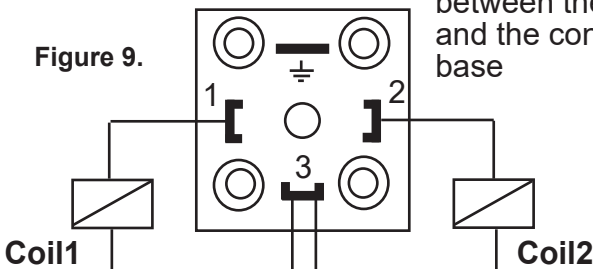
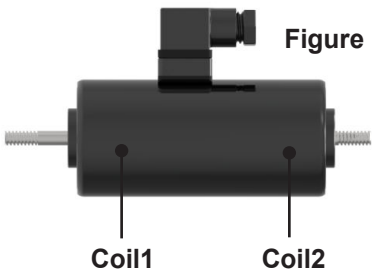
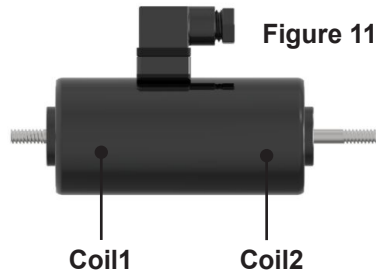
Figure 9.



Coil

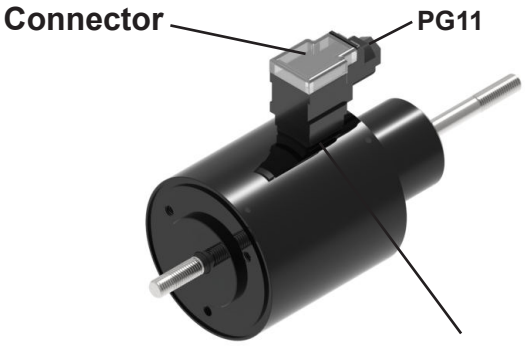
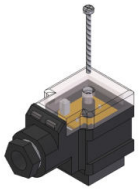
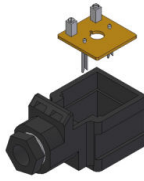
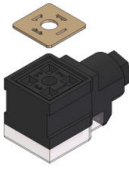
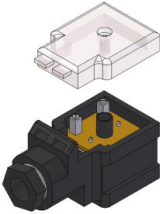
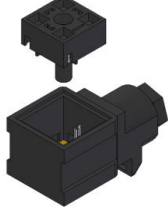
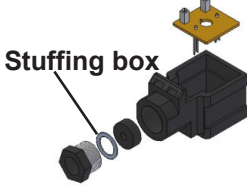
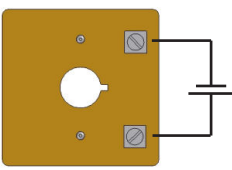
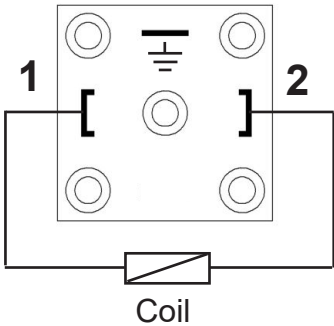
• 3P+T TYPE

• Working instructions and electrical connection:

 Figure 1. Connector base mounted on the solenoid, must not be manipulated	1) The electrical connection will be detailed in the following points.  Figure 2.
3) Take off the connector pulling it up.  Figure 4.	2) Take out the screw between the connector and the base.  Figure 3.
4) Take off the rubber piece.  Figure 5.	5) Remove the inner piece, this one has power terminals. To remove it, push the carrier between the terminals 1 and the mass one. Finally take off the stuffing box and connect the supply cables as shown in figure 8.  Figure 6.  Figure 7.
 Figure 8. Take out the screws, take in the supply cables in the power terminals and screw them again  Figure 9. Wiring diagram between the coil and the connector base Coil 1 under voltage  Figure 10. Coil 2 under voltage  Figure 11.	

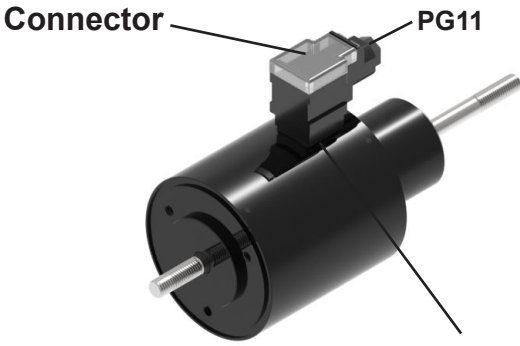
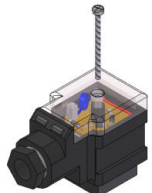
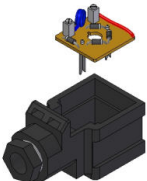
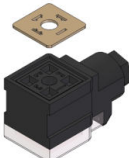
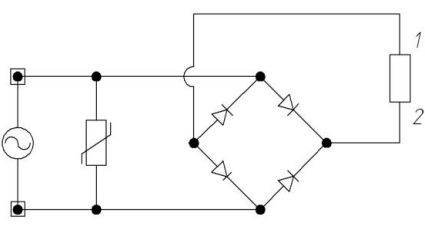
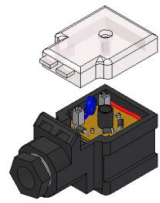
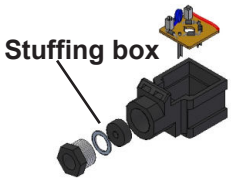
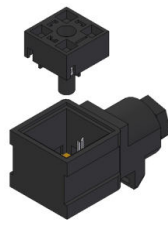
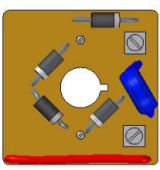
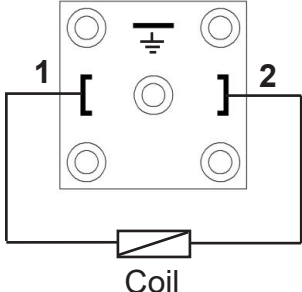
• 2P+T/G TYPE

• Working instructions and electrical connection:

 Figure 1.	1) The electrical connection will be detailed in the following points.  Figure 2.
3) Take off the connector pulling it up.  Figure 4.	2) Take out the screw between the connector and the base.  Figure 3.
7) Remove the electronic  Figure 8.	4) Take off the rubber piece.  Figure 5.
5) Take off the lid.  Figure 6.	6) Remove the interior piece, which has the power terminals.  Figure 7.
8) Take off the stuffing box  Figure 9.	9) Connect the supply cables  Take out the screws, take in the supply cables in the power terminals and screw them again. Figure 10.
 Wiring diagram between the coil and the connector base	

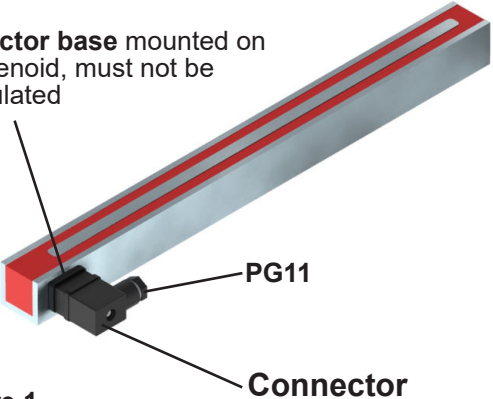
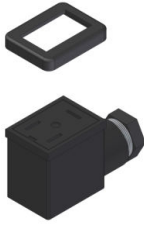
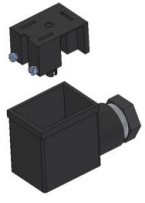
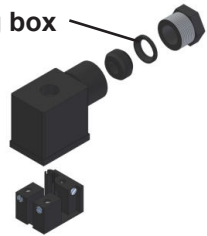
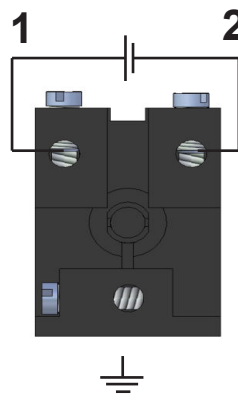
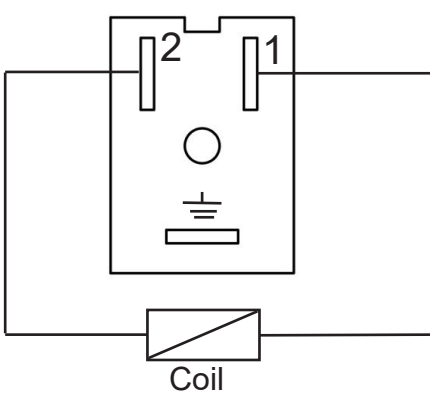
• 2P+T/G/4D TYPE

• Working instructions and electrical connection:

 Figure 1. Connector base mounted on the solenoid, must not be manipulated	1) The electrical connection will be detailed in the following points.  Figure 2.
3) Take off the connector pulling it up.  Figure 4.	2) Take out the screw between the connector and the base.  Figure 3.
7) Remove the electronic  Figure 8.	4) Take off the rubber piece.  Figure 5.
Electric diagram 	5) Take off the lid.  Figure 6.
8) Take off the stuffing box  Figure 9.	6) Remove the interior piece, which has the power terminals.  Figure 7. 9) Connect the supply cables  Figure 10. Take out the screws, take in the supply cables in the power terminals and screw them again. Wiring diagram between the coil and the connector base 

• 2P+T/E TYPE

• Working instructions and electrical connection:

Connector base mounted on the solenoid, must not be manipulated  Figure 1.	1) The electrical connection will be detailed in the following points.  Figure 2.
3) Take off the connector pulling it up.  Figure 4.	4) Take off the rubber piece.  Figure 5.
2) Take out the screw between the connector and the base.  Figure 3.	5) Remove the inner piece, this one has power terminals. To remove it, push the carrier between the terminals 1 and 2. Finally take off the stuffing box and connect the supply cables as shown figure 8.  Figure 6.  Figure 7.
Take out the screws, take in the supply cables in the power terminals and screw them again.  Figure 8.	Wiring diagram between the coil and the connector base  Figure 9.

● PROTECTION FOR THE ELECTROMAGNETIC COMPATIBILITY (to avoid voltage peaks)

Our products don't need to fulfil the Directive of electromagnetic compability 2004/108 CE, according to disposition number 20, and the customer must adapt the electromagnets to fulfil the directive.

Anyway, and if the customer asks for it, the following protections can be included:

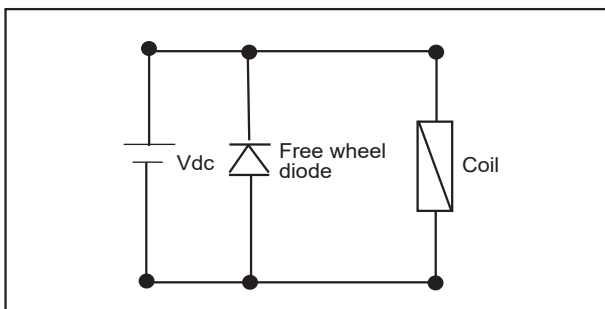
A- Free wheel diode

B- Varistor to avoid voltage peaks.

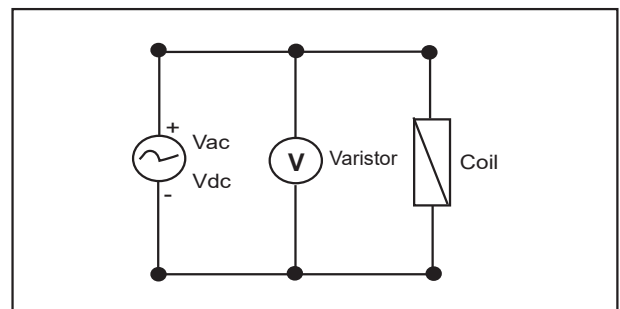
C- Second diode to protect the free wheel diode against reverse polarity.

D- Second diode to protect the free wheel diode against reverse polarity and varistor for the voltage peaks.

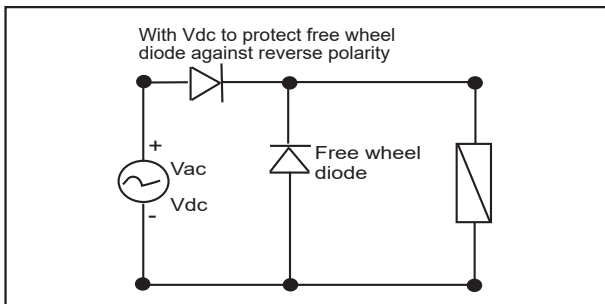
A- Free wheel diode



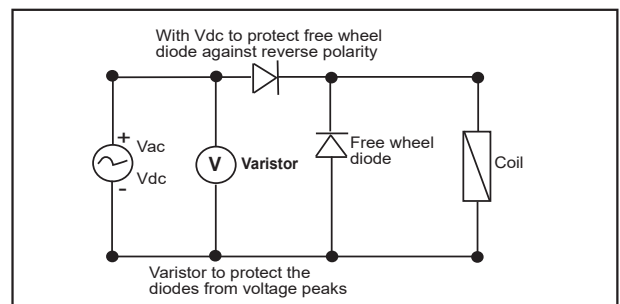
B- Varistor



C- Two diodes



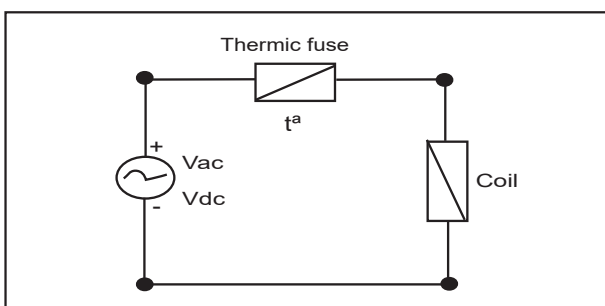
D- Two diodes and varistor



● THERMAL PROTECTION:

The thermic resettable polyswitchs are used in coils with low duty cycles against overheating, caused by long time under voltage and not respect the duty cycle times. It can be used also as timer.

Thermic polyswicht resettable device

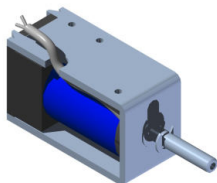


NOTE: All these protections can't be used to all models, consult NAFSA for each case.

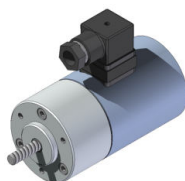
Specially designed electromagnets for customer application and solenoids customized from the ones in catalog to fit the customer's requirements.

Some examples:

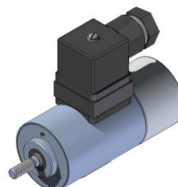
• MODIFICATIONS:



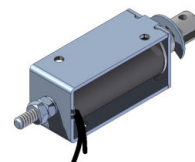
ERB35/E



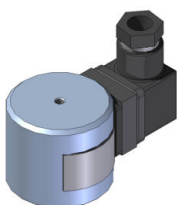
ECH65-12/E



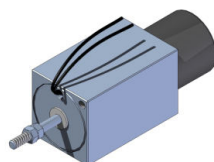
ECH40-10/F



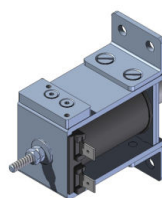
ER15/CT



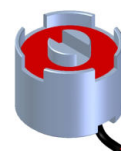
VM50/ND/C



CU40/E

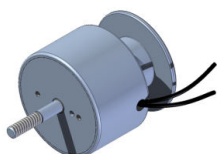


ER50-15/ES

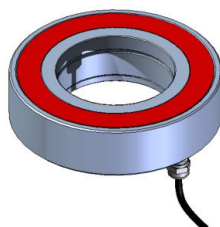


VEM35/E

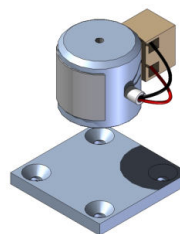
• SPECIALLY DESIGNED FOR CUSTOMER



ECC90-10/E



VM135/E



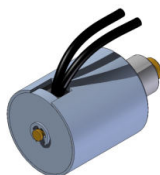
VM30/ECP



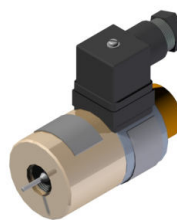
ECM20



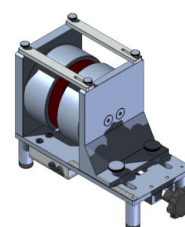
NER200



ECM16



VMG45



LABVEM150

And much more ...