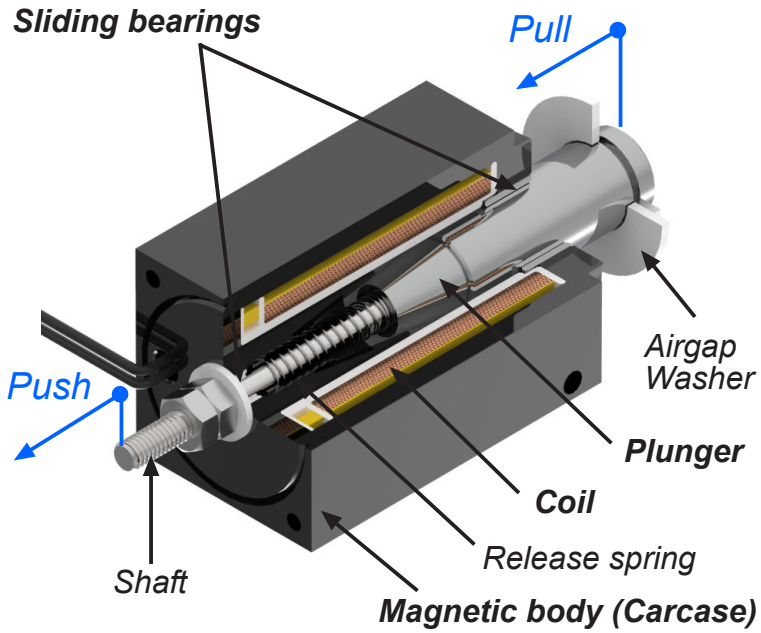
• CU SERIES

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 appropiate 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.

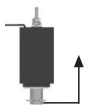
• Datasheet rated values conditions (According to DIN VDE 0580):

The values of the magnetic force (Fm) depending on the stroke, are obtained in the following conditions:
Room temperature = 35ºC
Coil stabilized at its working temperature.
Rated voltage equal to 90% of the standard one.
Solenoid working in horizontal position.

Effective force (Fh) is obtained from magnetic force (Fm).

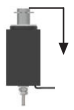
-When the solenoid pulls upwards:

Effective force = Magnetic force - Plunger weight

1) 

-When the solenoid pulls downwards:

Effective force = Magnetic force + Plunger weight

2) 

-When the solenoid pulls in horizontal position:

Effective force = Magnetic force

3) 

-For the units with incorporated return spring:

Effective force = Magnetic force - Spring force ± Plunger weight

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

• CU series: Force-stroke Chart

Type	Stroke (mm)		Duty-cycle 100%	40%	25%	15%	5%	Return Spring force (N)
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 requeriments, 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.

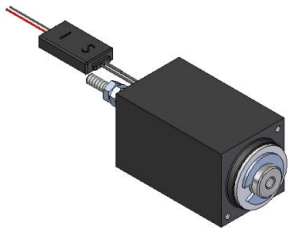
1. ELECTRICAL CUSTOMIZATION

a) Combination of solenoids with PWM electronics:

It consists on feeding the electromagnet through an electronic PWM (Pulse width modulation). This device will iniattially 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 untill 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%.



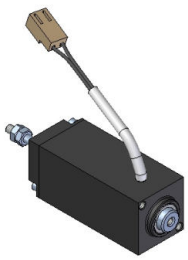
***PWD integrated in the cables**

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

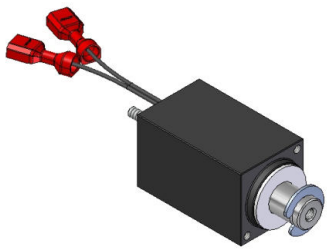
b) Cable length modification and terminal or connector mounted over cables:

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.

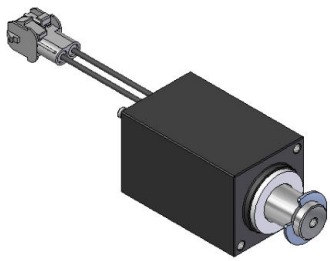
Example 1:



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 requeriment, please ask NAFSA .

2. INSULATION CLASS CUSTOMIZATION:

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

3. PROTECTIÓN RATE CUSTOMIZATION IP (EN60529):

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

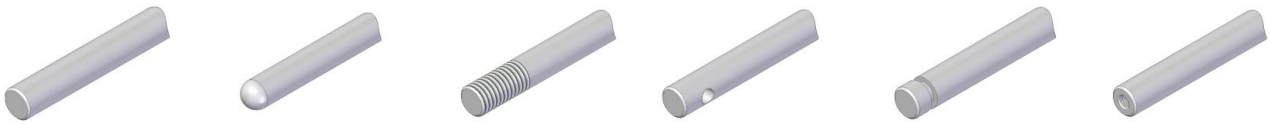
NOTE: All this customizations cannot be applied to all models, ask NAFSA for each case.

• 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.

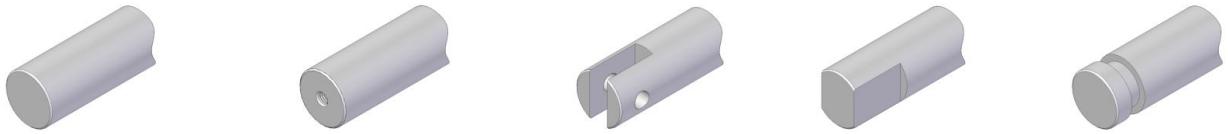
4. MECHANICAL CUSTOMIZATION:

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.



a) Flat | b) Spherical | c) Threaded | d) Transverse hole | e) Grooved | f) Threaded hole

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



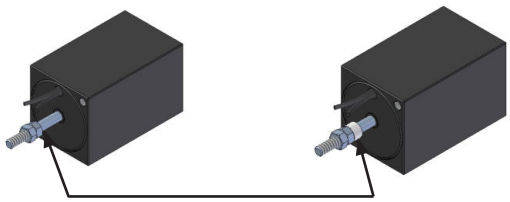
a) Flat | b) Threaded hole | c) Fork joint | d) Flat faces | e) Grooved

4.3) Return spring force modification:
CU 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 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.

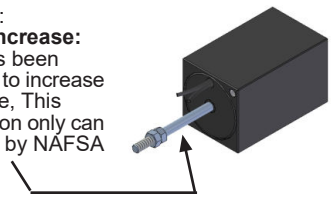
In the cases that spring is not required, solenoid can be ordered without spring or it can be removed manually.

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

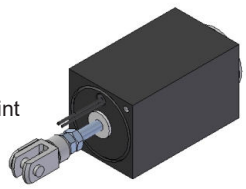


Example:
Stroke increase:
Shaft has been enlarged to increase the stroke, This modifcation only can be made by NAFSA



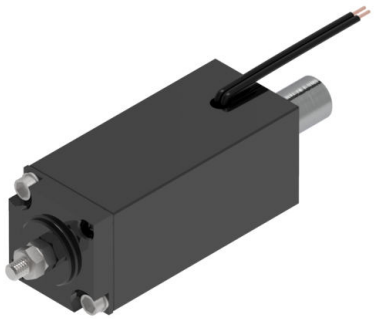
4.5) Fastening element added as Fork joints DIN71752:

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 (130ºC)**
Reference cycle: **3 minutes**
Standard stroke (s): **6 mm**
Temperature rise "ΔV_{31}": **70ºC**
Working temperature: **-10 to 45ºC**
Work: **Push / Pull**

Release spring will be incorporated by defect

Standard spring force:
Fs(s=0mm) = 0.5N
Fs(s=6mm) = 0.2N

(ED) Duty-cycle ED(%)	100	40	25	15	5
(P20) Power at 20ºC (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 acording 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; 20ºC 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 alterning 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.

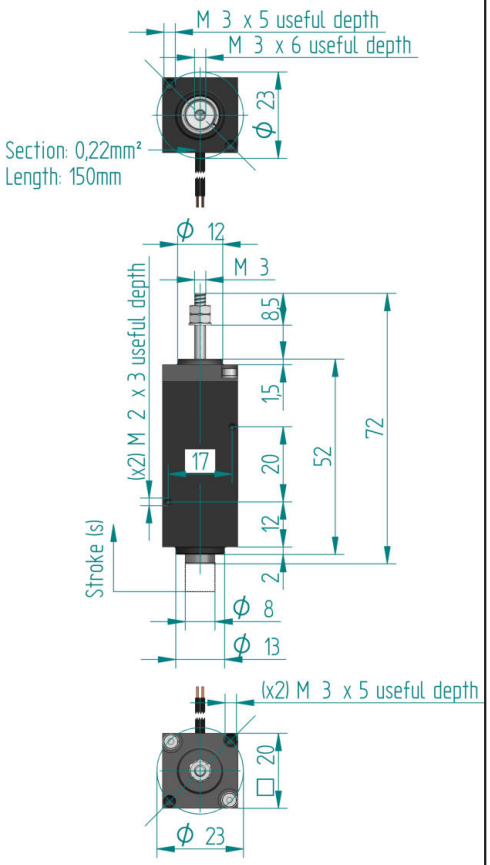
Ordering code: *CU20/C --V ED---%* - Spring

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

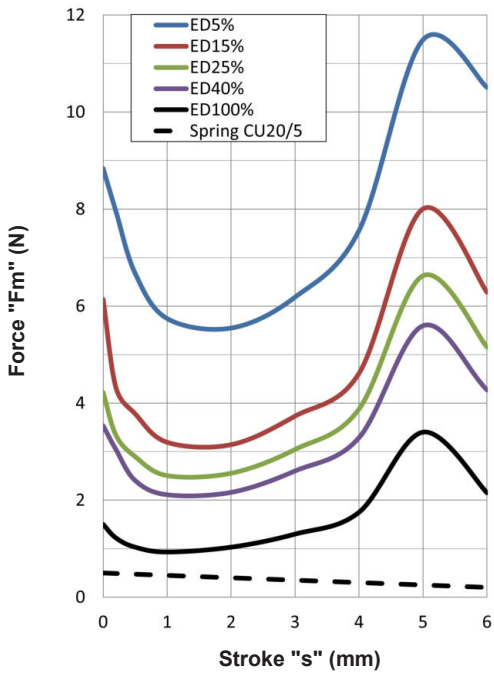
Voltage: 12Vdc; Duty cycle: ED15%; Without spring:
CU20/C 12Vdc ED15% RN

Spring yes: RS ; Spring no: RN

Solenoid under voltage (s=0mm position)



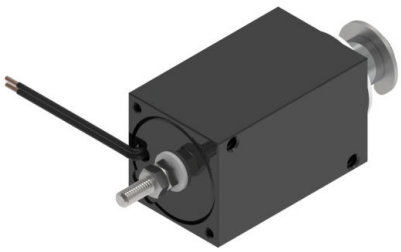
Force-stroke curve



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 (130ºC)**
Reference cycle: **3 minutes**
Standard stroke (s): **10 mm**
Temperature rise "ΔV_{31}": **70ºC**
Working temperature: **-10 to 45ºC**
Work: **Push / Pull**

Release spring will be incorporated by defect

Standard spring force:
Fs(s=0mm) = 1.44N
Fs(s=10mm) = 0.95N

(ED) Duty-cycle ED(%)	100	40	25	15	5
(P20) Power at 20ºC (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 acording 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; 20ºC 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 alterning 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.

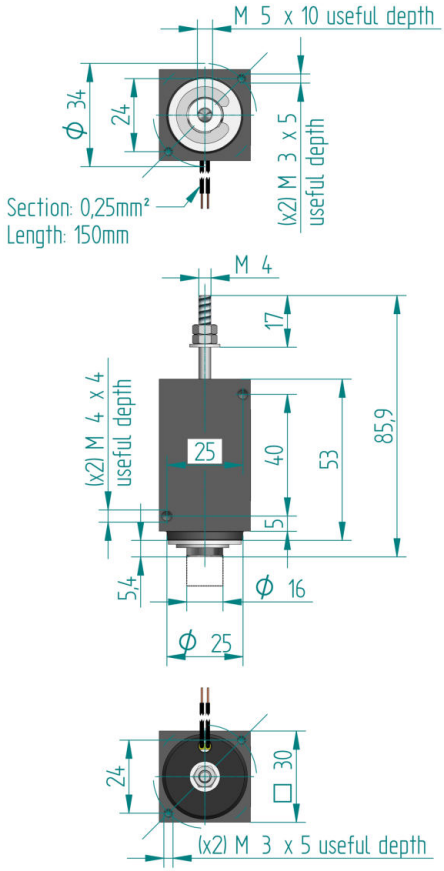
Ordering code: *CU30/C --V ED---%* - Spring

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

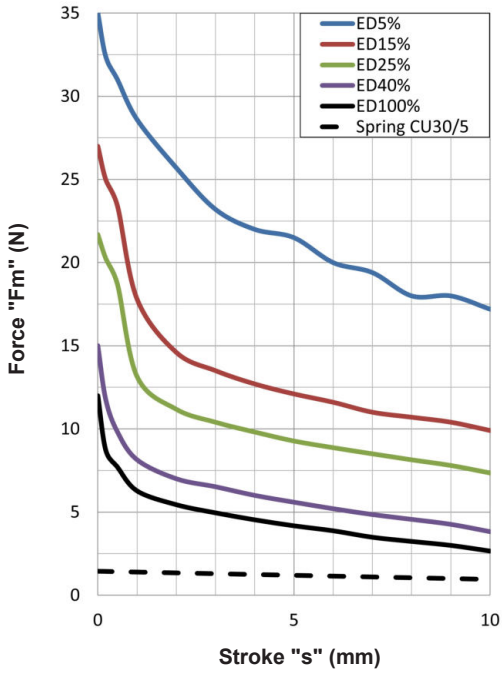
Voltage: 12Vdc; Duty cycle: ED15%; Without spring:
CU30/C 12Vdc ED15% RN

Spring yes: RS ; Spring no: RN

Solenoid under voltage (s=0mm position)



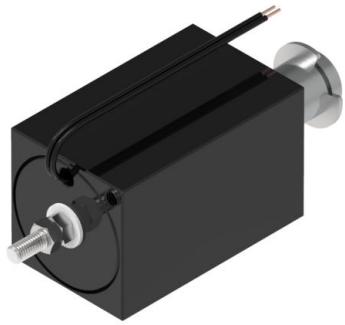
Force-stroke curve



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 (130ºC)**
Reference cycle: **3 minutes**
Standard stroke (s): **15 mm**
Temperature rise "ΔV_{31}": **70ºC**
Working temperature: **-10 to 45ºC**
Work: **Push / Pull**

Release spring will be incorporated by defect

Standard spring force:
Fs(s=0mm) = 3.2N
Fs(s=15mm) = 1.7N

(ED) Duty-cycle ED(%)	100	40	25	15	5
(P20) Power at 20ºC (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 acording 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; 20ºC 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 alterning 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.

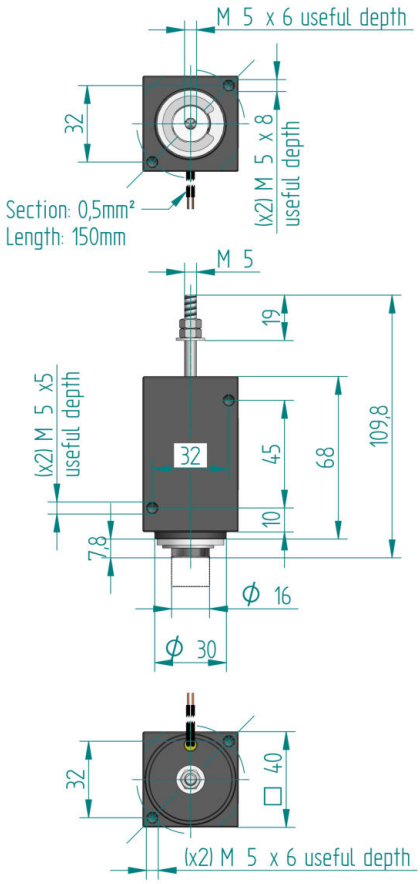
Ordering code: *CU40/C --V ED---%* - Spring

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

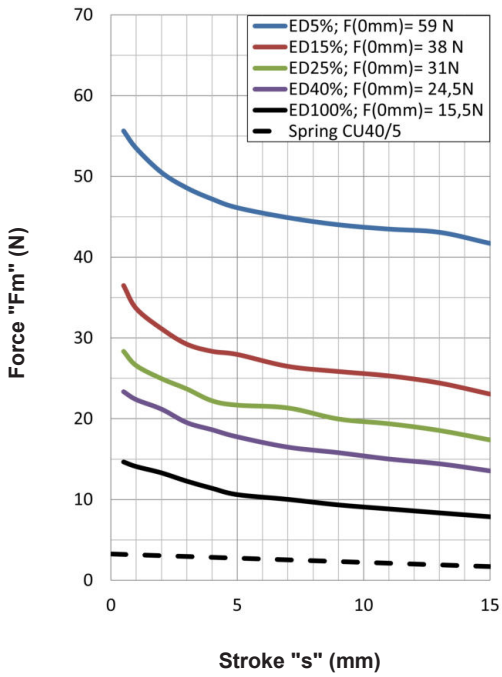
Voltage: 12Vdc; Duty cycle: ED15%; Without spring:
CU40/C 12Vdc ED15% RN

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