About us

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.

Quality

In NAFSA we understand the quality as a basic requirement to guarantee our customer’s expectations. 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-9001 norm granted by Lloyd’s Register Quality.

Commercial

In NAFSA we have a professional and motivated commercial team. Inquires can be send in English, Spanish or French. You can also contact to our official distributors.

- **JS Magnettechnik**  
  (Germany and Austria)  
  www.js-magnettechnik.de

- **Solentec Ltd.**  
  (United Kingdom)  
  www.solenoids.co.uk

- **Binder magnetic**  
  (France, Belgium, Switzerland and Luxemburg)  
  www.binder-magnetic.com

- **Morgado & CA**  
  (Portugal and West Africa)  
  www.morgadocl.pt

- **OEM-Automatic AB**  
  (Finland)  
  www.oem.fi

- **OEM-Motor AB**  
  (Sweden)  
  www.oemmotor.se

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**
Bekoibarra 27. Módulos 5, 6  
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

R + D Technical department

NAFSA has a highly qualified technical department, specialized in developing new products in close collaboration with our customers and the continuous improvement of our products and processes by working together with our quality and production departments.
Simple-effect linear solenoids:

ER series:
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11. ER Force-stroke chart
12/13. ER series customization
14. ER15/C
15. ER20/C
16. ER21/C
17. ER25/C
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25. ER50-15/C
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28. ER60-10/C
29. ER60-10/CT
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35. ERC25-04/CC
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44. ECH series customization
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46. ECH50-16
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54/55. CU series customization
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63. ECM13-03/E
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65. ECM13-10/E
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67. ECM19/E
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70. ECM25/T

ERD series:
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73. ECR Working instruction and electrical connection
74. ECR Force-stroke chart
75. ECR series customization
76. ECR40-07
77. ECR50-16
78. ECR65-15
79. ECR72-30
80. ECR90-25

Bistable solenoids:

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82. Bistable series customization
83. ERB20-15-6/C
84. ERB35-05/NC
85. ERB35/N
86. ERB50/N

Reversible bistable solenoids:

ERDI series:
87. ERDI15
88. ERDI35-06/CC
89. ERDI35

Linear bistable solenoids:

ECI series:
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91. Electrical locking bolt customization
92. CU20/CPXU  (Active security)
93. CU30/CP  (Active security)
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95. ERC30/CP  (Passive security)
96. CU20/CPB (Bistable bolt)
97. ERB35-05/NDBCP (Bistable bolt)
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Holding electromagnets:

99. Holding electromagnets Introduction
100/101. Holding electromagnets customization
102. VEM Serie (electromagnets)
103. ERM Serie (electromagnets)
104. ERM Mounting and supply possibilities
105. VM Serie (electropermanets)
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107. ERM200/60 (electropermanets)
108. BP1000/100 (electromagnets)

Accessories:

109. Programmable timer TP10V36A1
110. Programmable TP20V240A1
111. Electric saver EES24V2/0.5A

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122. Common terminals and connectors under demand
123. Special solenoids
Technical explanation: 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 (Fm):**
It is the force developed by the solenoid measured in the stroke direction.

**Effective Force (Fh):**
It is the magnetic force (Fm) 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 (s1):**
It is the position in which the plunger starts the stroke and where it comes back after return movement.

**Final Position (s0):**
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 (s0) direction.

VOLTAGE, CURRENT AND POWER

**Standard Voltage (Un):**
This is the value supposed for the solenoid correct performance. A variation between +5% and -10% is admitted.

**Standard Current (In):**
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 (Un).

**Standard Absorbed power (Pn):**
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 (Un) and standard current (In).

**Resistance:**
Manufacturing tolerance will be ±10%.

**Maximum performance room temperature:**
55°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.

- **Letters of the code**
  (International protection)
- **First digit**
  Against access to hazardous parts.
  (digits: from 0 to 6)
- **Second digit**
  Against harmful ingress of water
  (digits: from 0 to 8)

**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.
**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 frecuency:* The duty-cycle per hour.

*Duty-cycle (ED%):* It is the result of dividing time connected between the total cycle expressed as a percentage.

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**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.

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

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

**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%.
**Technical explanation: 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 (130ºC). These temperature limit may admit a variation of 5K (K=5ºC). Under demand, we can manufacture our products in class F (155ºC) even class H (180ºC)

**Insulation class chart:**

<table>
<thead>
<tr>
<th>Insulation class</th>
<th>Temperature limit(ºC) V11</th>
<th>Heating limit (K) (Room temperature 35ºC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>90</td>
<td>50</td>
</tr>
<tr>
<td>E</td>
<td>120</td>
<td>65</td>
</tr>
<tr>
<td>B</td>
<td>130</td>
<td>80</td>
</tr>
<tr>
<td>F</td>
<td>155</td>
<td>115</td>
</tr>
<tr>
<td>H</td>
<td>180</td>
<td>140</td>
</tr>
<tr>
<td>C</td>
<td>200</td>
<td>&gt;200</td>
</tr>
</tbody>
</table>

**Reference temperature V11 (ºC):**
It is the constant temperature of the solenoid without voltage. Sometimes it can be different from V13.

**Minimum room temperature V12 (ºC):**
The lowest temperature admitted to the correct working of solenoid.

**Room temperature V13 (ºC):**
The temperature of the place where the solenoid is going to work.

**Maximum room temperature V14 (ºC):**
The highest admitted room temperature for the correct solenoid performance.

**Room temperature range ∆V15 (ºC):**
It is the difference between maximum and minimum admitted room temperature.

**Initial temperature at the beginning of the test V16 (ºC):**
Room temperature at the beginning of the test.

**Temperature limit V21 (ºC):**
The maximum admitted temperature for each solenoid.

**Temperature limit range ∆V22 (ºC):**
Difference between V21 and V12.

**Working temperature V23 (ºC):**
Temperature reached by the solenoid when it is under constant nominal voltage. V23=V13+∆V31

**Temperature rise ∆V31 (ºC):**
It is the temperature difference between initial room temperature and the working temperature

**Final temperature rise ∆V32 (ºC):**
It is the temperature rise on the solenoid above room temperature due to constant voltage on the coil.

**Limit temperature rise ∆V33 (ºC):**
The maximum admitted temperature over the room and coil temperature working at nominal voltage.

**Difference between hotspots ∆V34 (ºC):**
It's the difference between the average and maximum temperatures on the coil.

**Temperature graphic:**
The temperature are shown in Cº and the temperature differences in K (5ºC)

**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 40ºC and its average during 24h cannot be higher than 35ºC. Furthermore, the temperature cannot be lower than -5ºC.

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

**Enviroment conditions:**
NAFSA solenoids must be protected from enviroments containing a huge quantity of dust, dirt, corrosive gases, steam, sea air, etc...

**Relative humidity:**
The humidity in the enviroment must be under 50% at 40ºC. At lower temperature higher relative humidity can be admitted, for example at 20ºC- 90% humidity. Occasional condensation in the enviroment must be avoided.

**Treatment against corrosion:**
The coatings used by NAFSA can range from 25 hours to 400 hours in salt spray chamber. Zinced solenoids (resistance up to 200 hours salt spray chamber) such as ER, ERC, ECM, ERD, ERB, ECI series and Holding electromagnet. Solenoids with Cataphoresis 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.
Technical explanation: 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 ($\Phi$) goes in and out.

Holding force ($F_m$):
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 ($F_L$):
It is the parallel force needed to loose the attracted piece. Depending on the finish of the attracted piece, the force ($F_L$) may vary between 20% and 35% of the holding force ($F_m$).

Air gap ($d_L$):
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($U_n$):
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 $F_m$ depending on the piece (size, roughness, material, etc..)

Polarity inversion:
To cancell 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($P_n$):
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 35ºC.

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

Maximum performance room temperature:
55ºC.

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 ($ED\%$):

$$ED\% = \frac{\text{Time on}}{\text{Time on + Time off}} \times 100 = \frac{\text{Time on}}{\text{A cycle duration}}$$
Technical explanation: Holding Electromagnets.

Magnetic flux $\phi$:
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.

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.

H= magnetic field intensity (AV/cm)  
B= induction (Teslas)

Material:
- Armco Telar 57
- Si60
- Malleable smelting
- Cast steel
- 20MnCr5
- Cast iron

Figure 2
PRECAUTIONS TAKING INTO ACCOUNT IN THE SOLENOID MANIPULATION AND INSTALLATION

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 reponse 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 sensivity 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 affects on the life expectancy.

Electromagnet force slightly greater than the work load:
The magnetic force and the reponse 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 (e.g., 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.

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 TAKING INTO ACCOUNT IN THE SOLENOID MANIPULATION AND INSTALLATION

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, ÉCH, 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.

ENVIRONMENTAL WORKING CONDITIONS:
Adhesion of oil, dust and other strange material 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 35ºC:
The higher the room tempertaure 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 controled.
**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 cooper wire.
This can create short- circuit in the coil.

**Broken leads:**
Avoid pulling from supply leads, terminals...
Working principles

Simple-effect linear solenoids
- ER SERIE:
- ECM SERIE:
- ECH SERIE:

ERD SERIE: Simple effect double coil linear solenoid

ECR SERIE: Reversible linear solenoids

ERB SERIE: Bistable solenoids

ERDI SERIE: Reversible bistable solenoids

ECI SERIE: Linear bistable solenoids

DOOR HOLDING ELECTROMAGNET:
- VEM50/CP and VEM65/CP
- Plate
- Plate, holding electromagnet without voltage

ELECTRICAL LOCKING BOLTS: Active security
- ER30/CCR
- CU30

ELECTRICAL LOCKING BOLTS: Passive security
- CU20CP

HOLDING ELECTROMAGNETS:
- VEM SERIE
- BP1000/100

MAGNETIC HOLDING ELECTROMAGNET:
- ERMI 200/60

Operation:
- Position with voltage
- Hold position by spring without voltage
- Hold position by magnets
- Displacement by inverse polarizing pulse and by spring
- Displacement with voltage by pulse coil
- Work: pull
- Work: push
- Displacement without voltage by external forces or by a spring
- Coil 1 under voltage
- Coil 2 under voltage
- Coil A with voltage
- Coil B with voltage
- Holding electromagnets
- Plate, holding electromagnet without voltage
- Holding electromagnet
- Piece to be held, holding electromagnet without voltage
- Piece to be held, holding electromagnet with voltage
- Piece to be held, holding magnetic holding electromagnet without voltage
- Piece to be held, holding magnetic holding electromagnet without voltage

VEM SERIE

ERMI 200/60
## Linear solenoids operating time

<table>
<thead>
<tr>
<th>Type</th>
<th>Operating time (ms)</th>
<th>Duty-cycle</th>
<th>Type</th>
<th>Operating time (ms)</th>
<th>Duty-cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T opening</td>
<td>100%</td>
<td>ERC61-10/C</td>
<td>T opening</td>
<td>100%</td>
</tr>
<tr>
<td>ER15/C</td>
<td>30</td>
<td>28</td>
<td>ERC61-20/C</td>
<td>32</td>
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<tr>
<td>ER20/C</td>
<td>36</td>
<td>27</td>
<td>ERC20-05/C</td>
<td>28</td>
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<tr>
<td>ER21/C</td>
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<td>31</td>
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<tr>
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<td>109</td>
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<tr>
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<td>87</td>
<td>ECM13-10/T</td>
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<td>45</td>
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<td>45</td>
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<td>127</td>
<td>81</td>
<td>ECM25/E</td>
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<td>68</td>
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<tr>
<td>ER60-05/C</td>
<td>181</td>
<td>120</td>
<td>ECM25/T</td>
<td>67</td>
<td>68</td>
</tr>
<tr>
<td>ER60-10/C</td>
<td>187</td>
<td>126</td>
<td>ECH40-10</td>
<td>117</td>
<td>118</td>
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<tr>
<td>ER60-10/CT</td>
<td>187</td>
<td>126</td>
<td>ECH40-16</td>
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<td>121</td>
<td>ECH45-15</td>
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<td>ERC25-04/CC</td>
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<td>35</td>
<td>ECH45-20</td>
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<td>48</td>
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<tr>
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<td>122</td>
<td>71</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Release time:
- Standard spring for each solenoid type
- Without load on the solenoid shaft
- Horizontal assembly position
- Standard stroke for each solenoid type
- Test temperature 20ºC

### Operating time:
- Solenoid supplied under standard voltage
- Coil stabilized at its working temperature
- Load tested: 70% of the solenoid force
- Horizontal assembly position
- Standard stroke for each type
- Test temperature 20ºC

Any variation on these test conditions can change the operating time.
ER SERIE

 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, basic elements:

**Magnetic body:**
It is the metal piece 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 axis.

Data sheet rated values conditions:

The values of the magnetic force (Fm) 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 (Fh) is obtained from magnetic force (Fm).

- **When the solenoid pulls upwards:**
  \[
  \text{Effective force} = \text{Magnetic force} - \text{Plunger weight}
  \]

- **When the solenoid pulls downwards:**
  \[
  \text{Effective force} = \text{Magnetic force} + \text{Plunger weight}
  \]

- **When the solenoid pulls in horizontal position:**
  \[
  \text{Effective force} = \text{Magnetic force}
  \]

- **For the units with incorporated return spring:**
  \[
  \text{Effective force} = \text{Magnetic force} - \text{Spring force} \pm \text{Plunger weight}
  \]

Terminals placement:

A   B   C   D

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

<table>
<thead>
<tr>
<th>Type</th>
<th>Stroke (mm)</th>
<th>Duty- cycle</th>
<th>Return Spring force (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>100% 40% 25% 15% 5%</td>
<td></td>
</tr>
<tr>
<td>ER15/C</td>
<td>Beginning of stroke s₁=5 End of stroke s₀=0</td>
<td>0.3 0.5 0.8 1 2.5</td>
<td>4.9 7.9 9.8 12.2 16.5</td>
</tr>
<tr>
<td>ER20/C</td>
<td>Beginning of stroke s₁=5 End of stroke s₀=0</td>
<td>0.8 2.1 2.8 4.1 6.8</td>
<td>2.6 4.9 6.2 7.7 11.2</td>
</tr>
<tr>
<td>ER21/C</td>
<td>Beginning of stroke s₁=10 End of stroke s₀=0</td>
<td>1.3 2.3 3.1 4.1 6.2</td>
<td>1.8 2.9 3.8 5 7.4</td>
</tr>
<tr>
<td>ER25/C</td>
<td>Beginning of stroke s₁=5 End of stroke s₀=0</td>
<td>2.5 5.4 7.5 10 17</td>
<td>7.1 17.3 21.3 24.4 31.9</td>
</tr>
<tr>
<td>ER30/C</td>
<td>Beginning of stroke s₁=8 End of stroke s₀=0</td>
<td>2.9 5.6 7.8 11.4 19.7</td>
<td>7.7 12 13.8 21.5 35</td>
</tr>
<tr>
<td>ER30/CT</td>
<td>Beginning of stroke s₁=8 End of stroke s₀=0</td>
<td>2.8 5.5 7.7 11.3 19.6</td>
<td>7.6 11.9 13.7 21.4 34.9</td>
</tr>
<tr>
<td>ER35/C</td>
<td>Beginning of stroke s₁=12 End of stroke s₀=0</td>
<td>1.5 4.3 7.5 10.6 17.3</td>
<td>4.5 10.9 14.7 16.6 31</td>
</tr>
<tr>
<td>ER40/CT</td>
<td>Beginning of stroke s₁=5 End of stroke s₀=0</td>
<td>2.9 6.5 13 16.5 43</td>
<td>26.1 41.5 68.4 74.5 121.8</td>
</tr>
<tr>
<td>ER45-05/C</td>
<td>Beginning of stroke s₁=5 End of stroke s₀=0</td>
<td>0.1 6.3 10.6 14.4 35</td>
<td>59.9 113.3 160.6 192.5 234.5</td>
</tr>
<tr>
<td>ER45-15/C</td>
<td>Beginning of stroke s₁=15 End of stroke s₀=0</td>
<td>3.3 7.3 10 15.5 27</td>
<td>9.3 20.8 31.9 45.3 71.3</td>
</tr>
<tr>
<td>ER48/T</td>
<td>Beginning of stroke s₁=8 End of stroke s₀=0</td>
<td>9.1 19.5 26.7 32.5 45.1</td>
<td>36.2 42.8 48.4 50.4 65.4</td>
</tr>
<tr>
<td>ER50-15/C</td>
<td>Beginning of stroke s₁=15 End of stroke s₀=0</td>
<td>6.7 13 16 23 37</td>
<td>22.5 41 52.7 67.9 99.3</td>
</tr>
<tr>
<td>ER50-15/CT</td>
<td>Beginning of stroke s₁=15 End of stroke s₀=0</td>
<td>6.5 12.8 15.8 22.8 36.8</td>
<td>22.3 40.8 52.5 67.7 99.1</td>
</tr>
<tr>
<td>ER60-05/C</td>
<td>Beginning of stroke s₁=5 End of stroke s₀=0</td>
<td>7 18 28 47 96</td>
<td>155 192 296 346 382</td>
</tr>
<tr>
<td>ER60-10/C</td>
<td>Beginning of stroke s₁=10 End of stroke s₀=0</td>
<td>12 24 32 44 80</td>
<td>55.6 95.5 121.7 152.5 200.8</td>
</tr>
<tr>
<td>ER60-10/CT</td>
<td>Beginning of stroke s₁=10 End of stroke s₀=0</td>
<td>11.6 23.6 31.6 43.6 79.6</td>
<td>55.1 95.1 121.3 152.1 200.4</td>
</tr>
<tr>
<td>ER60-20/C</td>
<td>Beginning of stroke s₁=20 End of stroke s₀=0</td>
<td>9.2 16.7 21.5 28.5 50</td>
<td>27.2 60.5 87.7 103.6 150.2</td>
</tr>
</tbody>
</table>

The magnetic force “Fm” (N) is shown in the rightmost column.
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


   a.2) Thermal protection
   Examples:
   *The thermic resettable polyswitchs 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 initiaitally 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 feded 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 feded 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 (155ºC),

3. PROTECCIÓN 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.

NOTE: All these customizations cannot be applied to all models, ask NAFSA for each case.
CUSTOMIZATION: ER SERIE

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 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.

4.5) 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 activation force. These modifications can be made by customer or NAFSA.

4.6) Position detection system integration:

4.7) Fastening element added as Fork joints DIN71752:

NOTE: All this customizations cannot be applied to all models, ask NAFSA for each case.
**ER15/C TYPE**

Protection rate: IP00
Insulation class: B (130°C)
Cycle-duration: 2minutes
Standard stroke "s": 5mm
Temperature rise "ΔV31": 70°C
Work: pull / push
Incorporated return spring: NO

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abs. Power at 20°C (W)</td>
<td>3</td>
<td>7.5</td>
<td>12</td>
<td>20</td>
<td>60</td>
</tr>
<tr>
<td>Minimum force (N)</td>
<td>0.3</td>
<td>0.5</td>
<td>0.8</td>
<td>1</td>
<td>2.5</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>∞</td>
<td>48</td>
<td>30</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solenoid weight (g)</td>
<td>39</td>
<td></td>
<td></td>
<td></td>
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<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100%</th>
<th>40%</th>
<th>25%</th>
<th>15%</th>
<th>5%</th>
</tr>
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<tbody>
<tr>
<td>Absolute power at 20°C (W)</td>
<td>3</td>
<td>7.5</td>
<td>12</td>
<td>20</td>
<td>60</td>
</tr>
<tr>
<td>Minimum force (N)</td>
<td>0.3</td>
<td>0.5</td>
<td>0.8</td>
<td>1</td>
<td>2.5</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>∞</td>
<td>48</td>
<td>30</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td>11</td>
<td></td>
<td></td>
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<tr>
<td>Solenoid weight (g)</td>
<td>39</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Voltage under demand:
They can be manufactured at any voltage between the maximum and minimum voltage shown in the chart.

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

3) If any variation from the original is needed, please ask us.

4) Earthing is recommended if the metallic parts are accessible.

**Solenoid under voltage**

**Force-stroke curve**

Calculation of the effective force: see pages 1 and 10

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

Example: Standard voltage: 24Vdc Duty-cycle: ED100%: Position when mounted A: ER15/C 24Vdc ED100% A
Standard voltage: 12Vdc Duty-cycle: ED15%: Position when mounted C: ER15/C 12Vdc ED15% C

For fixation and positions (A, B, C, D) of the solenoid: see page 10
**ER20/C TYPE**

Protection rate: IP00  
Insulation class: B (130°C)  
Cycle duration: 2 minutes  
Standard stroke "s": 5mm  
Temperature rise ΔTs: 70°C

- Work: Pull/Push  
- Incorporated return spring: YES

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abs. Power at 20°C (W)</td>
<td>5.5</td>
<td>11</td>
<td>16</td>
<td>24</td>
<td>60</td>
</tr>
<tr>
<td>Minimum force (N)</td>
<td>0.8</td>
<td>2.1</td>
<td>2.8</td>
<td>4.1</td>
<td>6.8</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>∞</td>
<td>48</td>
<td>30</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td></td>
<td>12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solenoid weight (g)</td>
<td></td>
<td>45</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Voltage under demand: They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.  
2) To feed in alternating current the solenoid will have a rectifier incorporated in the coil.  
3) The duty cycles described in the chart are standard, they can be manufactured in any intermediate cycle.  
4) If any variation from the original is needed, please ask us.  
5) Earthing is recommended if the metallic parts are accessible.

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

For fixation and positions (A,B,C,D) of the solenoid: see page 10  
Spring yes: RS; Spring no: RN

**Ordering code:**  
**ER20/C V ED---%** - Position when mounted - Spring

Example: Standard voltage:24Vdc Duty-cycle: ED100%: Position when mounted A: With spring : ER20/C 24Vdc ED100% A RS  
Standard voltage:12Vdc Duty-cycle: ED15%: Position when mounted C: Without spring : ER20/C 12Vdc ED15% C RN
**ER21/C TYPE**

Protection rate: IP00
Insulation class: B (130ºC)
Cycle duration: 2 minutes
Standard stroke "s": 10mm
Temperature rise ΔT: 70ºC
Work: pull/push
Incorporated return spring: YES

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abs. Power at 20ºC (W)</td>
<td>6</td>
<td>14</td>
<td>24</td>
<td>35</td>
<td>100</td>
</tr>
<tr>
<td>Minimum force (N)</td>
<td>1.3</td>
<td>2.3</td>
<td>3.1</td>
<td>4.1</td>
<td>6.2</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>∞</td>
<td>48</td>
<td>30</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td>12</td>
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<tr>
<td>Solenoid weight (g)</td>
<td>62</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**Product with leads:**
Reference: ER21/CC--V ED--%

1) Voltage under demand: They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.
2) To feed in altering current the solenoid will have a rectifier incorporated in the coil.
3) The duty cycles described in the chart are standard, they can be manufactured in any intermediate cycle.
4) If any variation from the original is needed, please ask us.
5) Earthing is recommended if the metallic parts are accessible.

**Duty-cycle ED(%)**

- **VDC**
  - 6
  - 12
  - 24
  - 48
  - 100
  - 125
  - 205
  - 230
- **VAC**
  - Min
  - Max
  - Min
  - Max

<table>
<thead>
<tr>
<th>Duty-cycle ED%</th>
<th>Standard voltages</th>
<th>Under demand voltages</th>
</tr>
</thead>
<tbody>
<tr>
<td>VDC</td>
<td>VAC</td>
<td></td>
</tr>
<tr>
<td>100%</td>
<td>o o o o o x x x x</td>
<td>3 110 x x</td>
</tr>
<tr>
<td>40%</td>
<td>o o o o o x x x x</td>
<td>4 165 x x</td>
</tr>
<tr>
<td>25%</td>
<td>o o o o o x x x x</td>
<td>5 220 x x</td>
</tr>
<tr>
<td>15%</td>
<td>o o o o o x x x x</td>
<td>6 230 x x</td>
</tr>
<tr>
<td>5%</td>
<td>x o o o o o x x x</td>
<td>9 230 x x</td>
</tr>
</tbody>
</table>

**Duty-cycle ED(%)**

- 100%
- 40%
- 25%
- 15%
- 5%

**Abs. Power at 20ºC (W)**

- 6
- 14
- 24
- 35
- 100

**Minimum force (N)**

- 1.3
- 2.3
- 3.1
- 4.1
- 6.2

**Max time under voltage(s)**

- ∞
- 48
- 30
- 18
- 6

**Plunger weight (g)**

- 12

**Solenoid weight (g)**

- 62

**Simple effect linear solenoids**

- **Product with leads:**
  - Reference: ER21/CC--V ED--%

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

Example: Standard voltage: 24Vdc Duty cycle: ED100% Mounting position A; With spring: ER21/C 24Vdc ED100% A RS
        Standard voltage: 12Vdc Duty cycle: ED15%: Mounting position C: Without spring: ER21/C 12Vdc ED15% C RN

**For fixation and positions (A, B, C, D) of the solenoid: see page 10**

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

**Force stroke curve**

Calculation of the effective force: see pages 1 and 10
**ER25/C TYPE**

Protection rate: IP00  
Insulation class: B (130ºC)  
Cycle duration: 2 minutes  
Standard stroke "s": 5mm  
Temperature rise \( \Delta V_{st} \): 70ºC  
Work: pull/push  
Incorporated return spring: YES

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abs. Power at 20ºC (W)</td>
<td>7.5</td>
<td>17</td>
<td>25</td>
<td>38</td>
<td>95</td>
</tr>
<tr>
<td>Minimum force (N)</td>
<td>2.5</td>
<td>5.4</td>
<td>7.5</td>
<td>10</td>
<td>17</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>∞</td>
<td>48</td>
<td>30</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td>15</td>
<td></td>
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<td></td>
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<tr>
<td>Solenoid weight (g)</td>
<td>85</td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

---

1) Voltage under demand: 
They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.
2) To feed in alternating current the solenoid will have a rectifier incorporated in the coil.
3) The duty cycles described in the chart are standard, they can be manufactured in any intermediate cycle.
4) If any variation from the original is needed, please ask us.
5) Earthing is recommended if the metallic parts are accessible.

---

**Duty-cycle**

<table>
<thead>
<tr>
<th>ED%</th>
<th>Standard voltages</th>
<th>Under demand voltages</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VDC</td>
<td>VAC</td>
</tr>
<tr>
<td>100%</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>40%</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>25%</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>15%</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>5%</td>
<td>x</td>
<td>o</td>
</tr>
</tbody>
</table>

**Ordering code:**  
**ER 25/C --V ED--%**  
**Mounting position - Spring**

Example: Standard voltage: 24Vdc Duty cycle: ED100% Mounting position A: With spring: **ER25/C 24Vdc ED100% A RS**  
Standard voltage: 12Vdc Duty cycle: ED15% Mounting position C: Without spring: **ER25/C 12Vdc ED15% C RN**

---

**Solenoid under voltage**

**Force stroke curve**

Calculation of the effective force: see pages 1 and 10

---

For fixation and positions (A,B,C,D) of the solenoid: see page 10  
Spring yes: RS; Spring no: RN
ER30/C TYPE

Protection rate: IP00
Insulation class: B (130°C)
Cycle duration: 2 minutes
Standard stroke "s": 8mm
Temperature rise: "ΔVs": 70°C
Work: pull/push
Incorporated return spring: YES

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abs. Power at 20°C (W)</td>
<td>8</td>
<td>20</td>
<td>30</td>
<td>50</td>
<td>120</td>
</tr>
<tr>
<td>Minimum force (N)</td>
<td>2.9</td>
<td>5.6</td>
<td>7.8</td>
<td>11.4</td>
<td>19.7</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>∞</td>
<td>48</td>
<td>30</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solenoid weight (g)</td>
<td>140</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Voltage under demand:
They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.
2) To feed in alternating current the solenoid will have a rectifier incorporated in the coil.
3) The duty cycles described in the chart are standard, they can be manufactured in any intermediate cycle.
4) If any variation from the original is needed, please ask us.
5) The terminals can be changed by leads.
6) Earthing is recommended if the metallic parts are accessible.

Ordering code: ER30/C --V ED---%
Example: Standard voltage: 24Vdc Duty cycle: ED100% Mounting position A: With spring: ER30/C 24Vdc ED100% A RS
Standard voltage: 12Vdc Duty cycle: ED15% Mounting position C: Without spring: ER30/C 12Vdc ED15% C RN

For fixation and positions (A,B,C,D) of the solenoid: see page 10
Spring yes: RS; Spring no: RN

Calculation of the effective force: see pages 1 and 10

Solenoid under voltage

Force stroke curve

Product with leads:

Reference: ER30/CC--V ED--%
ER30/CT TYPE

Protection rate: IP00
Insulation class: B (130ºC)
Cycle duration: 2 minutes
Standard stroke "s": 8mm
Temperature rise ∆Vs: 70ºC
Work: pull/push
Incorporated return spring: YES

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abs. Power at 20ºC (W)</td>
<td>8</td>
<td>20</td>
<td>30</td>
<td>50</td>
<td>120</td>
</tr>
<tr>
<td>Minimum force (N)</td>
<td>2.8</td>
<td>5.5</td>
<td>7.7</td>
<td>11.3</td>
<td>19.6</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>∞</td>
<td>48</td>
<td>30</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td>32</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Solenoid weight (g)</td>
<td>147</td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Voltage under demand: They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.
2) To feed in alternating current the solenoid will have a rectifier incorporated in the coil.
3) The duty cycles described in the chart are standard, they can be manufactured in any intermediate cycle.
4) If any variation from the original is needed, please ask us.
5) The terminals can be changed by leads.
6) Earthing is recommended if the metallic parts are accessible.

Ordering code: ER30/CT --V ED--% - Mounting position - Spring
Example: Standard voltage: 24Vdc Duty cycle: ED100%; Mounting position A: With spring: ER30/CT 24Vdc ED100% A RS
Standard voltage: 12Vdc Duty cycle: ED15%; Mounting position C: Without spring: ER30/CT 12Vdc ED15% C RN

For fixation and positions (A,B,C,D) of the solenoid: see page 10, Spring yes: RS; Spring no: RN
**ER35/C TYPE**

Protection rate: IP00  
Insulation class: B (130°C)  
Cycle duration: 2 minutes  
Standard stroke "s": 12 mm  
Temperature rise "ΔV": 70°C  
Work: pull/push  
Incorporated return spring: YES

---

**Solenoid under voltage**

--

**Force stroke curve**

---

**Duty-cycle ED(%)** | 100 | 40 | 25 | 15 | 5  
---|---|---|---|---|---
Abs. Power at 20°C (W) | 9 | 20 | 35 | 60 | 150  
Minimum force (N) | 1.5 | 4.3 | 7.5 | 10.6 | 17.3  
Max time under voltage(s) | ∞ | 48 | 30 | 18 | 6  
Plunger weight (g) | 34  
Solenoid weight (g) | 170  

---

1) Voltage under demand:  
They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.  
2) To feed in alternating current the solenoid will have a rectifier incorporated in the coil.  
3) The duty cycles described in the chart are standard, they can be manufactured in any intermediate cycle.  
4) If any variation from the original is needed, please ask us.  
5) The terminals can be changed by leads.  
6) Earthing is recommended if the metallic parts are accessible.

---

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

Example: Standard voltage: 24Vdc Duty cycle: ED100%: Mounting position A: With spring: ER35/C 24Vdc ED100% A RS  
Standard voltage: 12Vdc Duty cycle: ED15%: Mounting position B: Without spring: ER35/C 12Vdc ED15% B RN

For fixation and positions (A,B) of the solenoid: see page 10; Spring yes: RS; Spring no: RN
Simple effect linear solenoids

ER 40/CT TYPE

Protection rate: IP00
Insulation class: B (130°C)
Cycle duration: 3 minutes
Standard stroke "s": 15 mm
Temperature rise "ΔVs": 70°C
Work: pull
Incorporated return spring: NO

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abs. Power at 20°C (W)</td>
<td>13</td>
<td>27</td>
<td>44</td>
<td>76</td>
<td>218</td>
</tr>
<tr>
<td>Minimum force (N)</td>
<td>2.9</td>
<td>6.5</td>
<td>13</td>
<td>16.5</td>
<td>43</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>∞</td>
<td>60</td>
<td>38</td>
<td>23</td>
<td>8</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td>65</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solenoid weight (g)</td>
<td>368</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Voltage under demand: They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.
2) To feed in alternating current the solenoid will have a rectifier incorporated in the coil.
3) The duty cycles described in the chart are standard, they can be manufactured in any intermediate cycle.
4) If any variation from the original is needed, please ask us.
5) Earthing is recommended if the metallic parts are accessible.

Duty-cycle                          Standard voltages                                  Under demand voltages
ED%                             VDC                                    VAC          VDC          VAC

100%                           6       12      24      48      100     125     205     110     230    Min Max Min Max
40%                             x o o o o o o o o  o  8      230    64    230    104    230
25%                             x o o o o o o o o  o  9      230    104    230
15%                             x o o o o o o o o  x  11     230    180    230
5%                              x x o o o o o o  x  x     24     230    x    x

Layout: o = Available ; x = Unavailable

Calculation of the effective force: see pages 1 and 10

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

Example: Standard voltage:24Vdc; Duty cycle: ED100%; ER40/CT 24Vdc ED100%
Standard voltage:48Vdc; Duty cycle: ED15%; ER40/CT 48Vdc ED15%
**ER45-05/C TYPE**

Protection rate: IP00  
Insulation class: B (130°C)  
Cycle duration: 3 minutes  
Standard stroke "s": 5mm  
Temperature rise "ΔV31": 70°C  
Work: pull/push  
Incorporated return spring: YES

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abs. Power at 20°C (W)</td>
<td>12</td>
<td>30</td>
<td>48</td>
<td>80</td>
<td>240</td>
</tr>
<tr>
<td>Minimum force (N)</td>
<td>0.1</td>
<td>6.3</td>
<td>10.6</td>
<td>14.4</td>
<td>35</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>∞</td>
<td>60</td>
<td>38</td>
<td>23</td>
<td>8</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td>59</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Solenoid weight (g)</td>
<td>285</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

1) Voltage under demand:  
They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.  
2) To feed in alternating current the solenoid will have a rectifier incorporated in the coil.  
3) The duty cycles described in the chart are standard, they can be manufactured in any intermediate cycle.  
4) If any variation from the original is needed, please ask us.  
5) The terminals can be changed by leads.  
6) Earthing is recommended if the metallic parts are accessable.

---

**Product with leads:**

Reference: ER45-05/CC--V ED--%

---

**Solenoid under voltage**

**Force stroke curve**

Calculation of the effective force: see pages 1 and 10

---

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

Example: Standard voltage: 24Vdc Duty cycle: ED100% Mounting position A With spring: ER45-05/C 24Vdc ED100% A RS  
Standard voltage: 12Vdc Duty cycle: ED15% Mounting position C Without spring: ER45-05/C 12Vdc ED15% C RN

For fixation and positions (A,B,C,D) of the solenoid: see page 10  
Spring yes: RS; Spring no: RN
ER45-15/C TYPE

Protection rate: IP00
Insulation class: B (130°C)
Cycle duration: 3 minutes
Standard stroke "s": 15mm
Temperature rise "ΔVs": 70°C
Work: pull/push
Incorporated return spring: YES

Duty-cycle ED(%)  100  40  25  15  5
Abs. Power at 20°C (W)  12  30  48  80  240
Minimum force (N)  3.3  7.3  10  15.5  27
Max time under voltage(s)  ∞  60  38  23  8
Plunger weight (g)  59
Solenoid weight (g)  285

1) Voltage under demand:
   They can be manufactured at any voltage
   between the maximum and minimum
   voltage values shown in the chart.
2) To feed in alternating current the solenoid
   will have a rectifier incorporated in the
   coil.
3) The duty cycles described in the chart
   are standard, they can be manufactured
   in any intermediate cycle.
4) If any variation from the original is
   needed, please ask us.
5) The terminals can be changed by
   leads.
6) Earthing is recommended if the metallic
   parts are accessible.

For fixation and positions (A,B,C,D) of the solenoid: see page 10
Spring yes: RS; Spring no: RN
**ER48/T TYPE**

Protection rate: IP00  
Insulation class: B (130ºC)  
Cycle duration: 3 minutes  
Standard stroke "s": 8mm  
Temperature rise "Dv3": 70ºC  
Work: pull  
Incorporated return spring: NO

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abs. Power at 20ºC (W)</td>
<td>15</td>
<td>35</td>
<td>54</td>
<td>89</td>
<td>271</td>
</tr>
<tr>
<td>Minimum force (N)</td>
<td>9.1</td>
<td>19.5</td>
<td>26.7</td>
<td>32.5</td>
<td>45.1</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>∞</td>
<td>60</td>
<td>38</td>
<td>23</td>
<td>8</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td>66</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solenoid weight (g)</td>
<td>292</td>
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<td></td>
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</tr>
</tbody>
</table>

### Duty-cycle ED(%) and Under demand voltages

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100%</th>
<th>40%</th>
<th>25%</th>
<th>15%</th>
<th>5%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard voltages</td>
<td>VDC</td>
<td>VAC</td>
<td>VDC</td>
<td>VAC</td>
<td>VDC</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>12</td>
<td>x</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>x</td>
</tr>
<tr>
<td>24</td>
<td>x</td>
<td>o</td>
<td>o</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>48</td>
<td>x</td>
<td>o</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<tr>
<td>100</td>
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<td>x</td>
<td>x</td>
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<tr>
<td>125</td>
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<td>x</td>
<td>x</td>
</tr>
<tr>
<td>205</td>
<td>x</td>
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<td>x</td>
<td>x</td>
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<td>110</td>
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<tr>
<td>230</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100%</th>
<th>40%</th>
<th>25%</th>
<th>15%</th>
<th>5%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abs. Power at 20ºC (W)</td>
<td>15</td>
<td>35</td>
<td>54</td>
<td>89</td>
<td>271</td>
</tr>
<tr>
<td>Minimum force (N)</td>
<td>9.1</td>
<td>19.5</td>
<td>26.7</td>
<td>32.5</td>
<td>45.1</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>∞</td>
<td>60</td>
<td>38</td>
<td>23</td>
<td>8</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td>66</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Solenoid weight (g)</td>
<td>292</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. **Voltage under demand:** They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.  
2. To feed in alternating current the solenoid will have a rectifier incorporated in the coil.  
3. The duty cycles described in the chart are standard, they can be manufactured in any intermediate cycle.  
4. If any variation from the original is needed, please ask us.  
5. The connector can be changed by leads.  
6. Earthing is recommended if the metallic

---

**Solenoid under voltage**

**Force stroke curve**

![Solenoid under voltage diagram](image1)

![Force stroke curve](image2)

**Ordering code:** ER48/T --V ED---% - Mounting position  
Example: Standard voltage:24Vdc Duty cycle: ED100% Mounting position A: ER48/T 24Vdc ED100% A  
Standard voltage:12Vdc Duty cycle: ED15% Mounting position C: ER48/T 12Vdc ED15% C  
For fixation and positions (A,B,C,D) of the solenoid: see page 10
**ER50-15/C TYPE**

Protection rate: IP00  
Insulation class: B (130ºC)  
Cycle duration: 3 minutes  
Standard stroke "s": 15mm  
Temperature rise "ΔVs": 70ºC  
Work: pull/push  
Incorporated return spring: YES

---

**Duty-cycle ED(%)**

<table>
<thead>
<tr>
<th>ED (%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abs. Power at 20ºC (W)</td>
<td>14</td>
<td>35</td>
<td>56</td>
<td>93</td>
<td>280</td>
</tr>
<tr>
<td>Minimum force (N)</td>
<td>6.7</td>
<td>13</td>
<td>16</td>
<td>23</td>
<td>37</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>∞</td>
<td>60</td>
<td>38</td>
<td>23</td>
<td>8</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td>71</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solenoid weight (g)</td>
<td>365</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

1) Voltage under demand: They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.  
2) To feed in alternating current the solenoid will have a rectifier incorporated in the coil.  
3) The duty cycles described in the chart are standard, they can be manufactured in any intermediate cycle.  
4) If any variation from the original is needed, please ask us.  
5) The terminals can be changed by leads.  
6) Earthing is recommended if the metallic parts are accessible.

---

**Product with leads:**

Reference: ER50-15/C --V ED--%

---

**Ordering code:**  
ER50-15/C --V ED--% - Mounting position - Spring  
Example: Standard voltage: 24Vdc Duty cycle: ED100%; Mounting position A: With spring: ER50-15/C 24Vdc ED100% A RS  

---

For fixation and positions (A,B) of the solenoid: see page 10  
Spring yes: RS; Spring no: RN
**ER50-15/CT TYPE**

Protection rate: IP00  
Insulation class: B (130ºC)  
Cycle duration: 3 minutes  
Standard stroke “s”: 15mm  
Temperature rise “ΔVT*: 70ºC  
Work: pull/push  
Incorporated return spring: YES

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abs. Power at 20ºC (W)</td>
<td>14</td>
<td>35</td>
<td>56</td>
<td>93</td>
<td>280</td>
</tr>
<tr>
<td>Minimum force (N)</td>
<td>6.7</td>
<td>13</td>
<td>16</td>
<td>23</td>
<td>37</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>∞</td>
<td>60</td>
<td>38</td>
<td>23</td>
<td>8</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td>85</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solenoid weight (g)</td>
<td>380</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Voltage under demand:  
They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.  
2) To feed in alternating current the solenoid will have a rectifier incorporated in the coil.  
3) The duty cycles described in the chart are standard, they can be manufactured in any intermediate cycle.  
4) If any variation from the original is needed, please ask us.  
5) The terminals can be changed by leads.  
6) Earthing is recommended if the metallic parts are accessible.

**Product with leads:**

Reference: ER50-15/CT--V ED--%

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

Example: Standard voltage: 24Vdc Duty cycle: ED100% Mounting position A: With spring: ER50-15/CT 24Vdc ED100% A RS  
Standard voltage: 48Vdc Duty cycle: ED15% Mounting position B: Without spring: ER50-15/CT 48Vdc ED15% B RN

For fixation and positions (A, B) of the solenoid: see page 10  
Spring yes: RS; Spring no: RN

---

**Solenoid under voltage**

**Force stroke curve**

Calculation of the effective force: see pages 1 and 10
**Simple effect linear solenoids**

**ER60-05/C TYPE**

Protection rate: IP00  
Insulation class: B (130°C)  
Cycle duration: 5 minutes  
Standard stroke "s": 5mm  
Temperature rise "ΔTs": 70°C  
Work: pull/push  
Incorporated return spring: YES

Duty-cycle ED(%) | 100 | 40 | 25 | 15 | 5
---|---|---|---|---|---
Abs. Power at 20°C (W) | 18 | 45 | 70 | 110 | 280
Minimum force (N) | 7 | 18 | 28 | 47 | 96
Max time under voltage(s) | ∞ | 120 | 75 | 45 | 15
Plunger weight (g) | 117
Solenoid weight (g) | 650

1) Voltage under demand: They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.  
2) To feed in alternating current the solenoid will have a rectifier incorporated in the coil.  
3) The duty cycles described in the chart are standard, they can be manufactured in any intermediate cycle.  
4) If any variation from the original is needed, please ask us.  
5) The terminals can be changed by leads.  
6) Earthing is recommended if the metallic parts are accessible.

**Product with leads:**

Reference: ER60-05/CC--V ED--%  
Ordering code: ER60-05/C --V ED---% - Mounting position - Spring  
Example: Standard voltage: 24Vdc Duty cycle: ED100%; Mounting position A: With spring: ER60-05/C 24Vdc ED100% A RS  
Standard voltage: 48Vdc Duty cycle: ED15%: Mounting position C: Without spring: ER60-05/C 48Vdc ED15% C RN

For fixation and positions (A,B,C,D) of the solenoid: see page 10  
Spring yes: RS; Spring no: RN
**ER60-10/C TYPE**

Protection rate: IP00  
Insulation class: B (130ºC)  
Cycle duration: 5 minutes  
Standard stroke "s": 10mm  
Temperature rise "\Delta T": 70ºC  
Work: pull/push  
Incorporated return spring: YES

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abs. Power at 20ºC (W)</td>
<td>18</td>
<td>45</td>
<td>70</td>
<td>110</td>
<td>280</td>
</tr>
<tr>
<td>Minimum force (N)</td>
<td>12</td>
<td>24</td>
<td>32</td>
<td>44</td>
<td>80</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>∞</td>
<td>120</td>
<td>75</td>
<td>45</td>
<td>15</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td>117</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solenoid weight (g)</td>
<td>650</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Duty-cycle ED(%)  
Abs. Power at 20ºC (W)  
Minimum force (N)  
Max time under voltage(s)  
Plunger weight (g)  
Solenoid weight (g)

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>Standard voltages</th>
<th>Under demand voltages</th>
</tr>
</thead>
<tbody>
<tr>
<td>VDC</td>
<td>VAC</td>
<td>VDC</td>
</tr>
<tr>
<td>100%</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>40%</td>
<td>x</td>
<td>o</td>
</tr>
<tr>
<td>25%</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>15%</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>5%</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

Layout: o = Available ; x = Unavailable

1) Voltage under demand: They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.
2) To feed in alternating current the solenoid will have a rectifier incorporated in the coil.
3) The duty cycles described in the chart are standard, they can be manufactured in any intermediate cycle.
4) If any variation from the original is needed, please ask us.
5) The terminals can be changed by leads.
6) Earthing is recommended if the metallic parts are accessible.

**Ordering code:**  
ER60-10/C --V ED--% - Mounting position - Spring

Example: Standard voltage: 24Vdc  
Duty cycle: ED100%  
Mounting position A: With spring  
ER60-10/C 24Vdc ED100% A RS

Standard voltage: 48Vdc  
Duty cycle: ED15%  
Mounting position C: Without spring  
ER60-10/C 48Vdc ED15% C RN

For fixation and positions (A,B,C,D) of the solenoid: see page 10  
Spring yes: RS; Spring no: RN

**Force stroke curve**

Calculation of the effective force: see pages 1 and 10
Simple effect linear solenoids

ER60-10/CT TYPE

Protection rate: IP00
Insulation class: B (130ºC)
Cycle duration: 5 minutes
Standard stroke "s": 10mm
Temperature rise ∆Vs*: 70ºC
Work: pull/push
Incorporated return spring: YES

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abs. Power at 20ºC (W)</td>
<td>18</td>
<td>45</td>
<td>70</td>
<td>110</td>
<td>280</td>
</tr>
<tr>
<td>Minimum force (N)</td>
<td>11.6</td>
<td>23.6</td>
<td>31.6</td>
<td>43.6</td>
<td>79.6</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>∞</td>
<td>120</td>
<td>75</td>
<td>45</td>
<td>15</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td>148</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solenoid weight (g)</td>
<td>681</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Voltage under demand:
   They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.
2) To feed in alternating current the solenoid will have a rectifier incorporated in the coil.
3) The duty cycles described in the chart are standard, they can be manufactured in any intermediate cycle.
4) If any variation from the original is needed, please ask us.
5) The terminals can be changed by leads.
6) Earthing is recommended if the metallic parts are accessible.

Duty cycle table:

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage values</td>
<td>VDC</td>
<td>VAC</td>
<td>VDC</td>
<td>VAC</td>
<td></td>
</tr>
<tr>
<td>100%</td>
<td>6</td>
<td>12</td>
<td>24</td>
<td>48</td>
<td>100</td>
</tr>
<tr>
<td>40%</td>
<td>7</td>
<td>230</td>
<td>48</td>
<td>230</td>
<td>x</td>
</tr>
<tr>
<td>25%</td>
<td>11</td>
<td>230</td>
<td>125</td>
<td>230</td>
<td>x</td>
</tr>
<tr>
<td>15%</td>
<td>13</td>
<td>230</td>
<td>200</td>
<td>230</td>
<td>x</td>
</tr>
<tr>
<td>5%</td>
<td>16</td>
<td>230</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

Calculation of the effective force: see pages 1 and 10

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

Example: Standard voltage: 24Vdc Duty cycle: ED100%; Mounting position A: With spring: ER60-10/CT 24Vdc ED100% A RS
Standard voltage: 48Vdc Duty cycle: ED15%; Mounting position C: Without spring: ER60-10/CT 48Vdc ED15% C RN

For fixation and positions (A,B,C,D) of the solenoid: see page 10
Spring yes: RS; Spring no: RN
**ER60-20/C TYPE**

Protection rate: IP00  
Insulation class: B (130°C)  
Cycle duration: 5 minutes  
Standard stroke "s": 20mm  
Temperature rise: "D\(V\)": 70°C  
Work: pull/push  
Incorporated return spring: YES

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abs. Power at 20°C (W)</td>
<td>18</td>
<td>45</td>
<td>70</td>
<td>110</td>
<td>280</td>
</tr>
<tr>
<td>Minimum force (N)</td>
<td>9.2</td>
<td>16.7</td>
<td>21.6</td>
<td>28.5</td>
<td>50</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>∞</td>
<td>120</td>
<td>75</td>
<td>45</td>
<td>15</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td>117</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solenoid weight (g)</td>
<td>650</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Voltage under demand: They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.  
2) To feed in alternating current the solenoid will have a rectifier incorporated in the coil.  
3) The duty cycles described in the chart are standard, they can be manufactured in any intermediate cycle.  
4) If any variation from the original is needed, please ask us.  
5) The terminals can be changed by leads.  
6) Earthing is recommended if the metallic parts are accessible.

**Ordering code:** ER60-20/C → V ED---%  
Mounting position - Spring

Example: Standard voltage: 24Vdc Duty cycle: ED100% Mounting position A; With spring: ER60-20/C 24Vdc ED100% A RS  
Standard voltage: 48Vdc Duty cycle: ED15% Mounting position C: Without spring: ER60-20/C 48Vdc ED15% C RN

For fixation and positions (A,B,C,D) of the solenoid: see page 10  
Spring yes: RS; Spring no: RN

---

**Product with leads:**

Reference: ER60-20/CC→ V ED--%
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, basic elements:**

**Magnetic body:**
It is the metal piece containing the coil, the core, the fixing holes of the solenoid and friction bearing.

**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 axis.

**Friction bearing:**
They are the guide of the plunger, and abrasion resistant.

**Data sheet rated values conditions:**

The values of the magnetic force (Fm) 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 (Fh) is obtained from magnetic force (Fm).

1) **When the solenoid pulls upwards:**

\[ \text{Effective force} = \text{Magnetic force} - \text{Plunger weight} \]

2) **When the solenoid pulls downwards:**

\[ \text{Effective force} = \text{Magnetic force} + \text{Plunger weight} \]

3) **When the solenoid pulls in horizontal position:**

\[ \text{Effective force} = \text{Magnetic force} \]

- For the units with incorporated return spring:

\[ \text{Effective force} = \text{Magnetic force} - \text{Spring force} \pm \text{Plunger weight} \]

Under demand, terminals can be replaced by flying leads.
## Chart: force-stroke

<table>
<thead>
<tr>
<th>Type</th>
<th>Stroke (mm)</th>
<th>Duty cycle</th>
<th>Return spring force (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Beginning of stroke $s_1$</td>
<td>100%</td>
<td>40%</td>
</tr>
<tr>
<td>ERC25-04/CC</td>
<td>$s_0 = 0$</td>
<td>4.4</td>
<td>8.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12.4</td>
<td>17.6</td>
</tr>
<tr>
<td>ERC30/C</td>
<td>$s_1 = 8$</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>$s_0 = 0$</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>ERC35/C</td>
<td>$s_1 = 12$</td>
<td>2.6</td>
<td>5.8</td>
</tr>
<tr>
<td></td>
<td>$s_0 = 0$</td>
<td>5.6</td>
<td>9.5</td>
</tr>
<tr>
<td>ERC45-50-15/C</td>
<td>$s_1 = 15$</td>
<td>4.5</td>
<td>9.3</td>
</tr>
<tr>
<td></td>
<td>$s_0 = 0$</td>
<td>16</td>
<td>33</td>
</tr>
<tr>
<td>ERC50-15/C</td>
<td>$s_1 = 15$</td>
<td>6.8</td>
<td>12.8</td>
</tr>
<tr>
<td></td>
<td>$s_0 = 0$</td>
<td>20</td>
<td>34</td>
</tr>
<tr>
<td>ERC60-10/C</td>
<td>$s_1 = 10$</td>
<td>19</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>$s_0 = 0$</td>
<td>81</td>
<td>119</td>
</tr>
<tr>
<td>ERC60-20/C</td>
<td>$s_1 = 20$</td>
<td>11</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>$s_0 = 0$</td>
<td>56</td>
<td>86</td>
</tr>
</tbody>
</table>

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

Examples:

*Free wheel diode

\[ + \quad \text{Vac} \quad \text{Vdc} \quad \text{Coil} \]

With Vdc as protection of free wheel diode against reverse polarity

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

\[ + \quad \text{Vac} \quad \text{Vdc} \quad \text{Coil} \]

b) Thermal protection

Examples:

*The thermic resettable polyswitchs 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.

\[ + \quad \text{Vac} \quad \text{Vdc} \quad \text{Coil} \]

a.2) Thermal protection

Examples:

*Varistor

\[ + \quad \text{Vac} \quad \text{Vdc} \quad \text{Varistor} \]

With Vdc as protection of free wheel diode against reverse polarity

a.3) For rectification

Examples:

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

\[ + \quad \text{Vac} \quad \text{Vdc} \quad \text{Varistor} \]

B) 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 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 feded 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 feded 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:

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 requeriment, please ask NAFSA .

2. INSULATION CLASS CUSTOMIZATION:

In the ER série maximum insulation class can be obtained is F (155ºC),

3. PROTECCIÓN RATE IP (EN600529) CUSTOMIZATION:

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

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

![Shaft modifications]

4.2) Plunger modifications: Length and shape can be modified

![Plunger modifications]

4.3) Fixing holes modification:

![Fixing holes modification]

4.4) Return spring force modification:

ERC 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.

4.5) 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 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.

4.6) 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**

Protection rate: IP00  
Insulation class: B (130ºC)  
Cycle duration: 3 minutes  
Standard stroke "s": 4 mm  
Temperature rise ΔT31: 70ºC  
Work: pull/push  
Incorporated return spring: NO (optional)

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abs power at 20ºC (W)</td>
<td>6.3</td>
<td>15.2</td>
<td>24.7</td>
<td>40.3</td>
<td>123</td>
</tr>
<tr>
<td>Minimum force (N)</td>
<td>4.3</td>
<td>8.2</td>
<td>10.6</td>
<td>14</td>
<td>23</td>
</tr>
<tr>
<td>Max. time under voltage (s)</td>
<td>∞</td>
<td>72</td>
<td>45</td>
<td>27</td>
<td>9</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solenoid weight (g)</td>
<td>110</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Voltage under demand: They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.  
2) To feed in alternating current the solenoid will have a rectifier incorporated in the coil.  
3) The duty cycles described in the chart are standard, they can be manufactured in any intermediate cycle.  
4) If any variation from the original is needed, please ask us.  
5) Earthing is recommended if the metallic parts are accessible.

**Duty cycle chart**

<table>
<thead>
<tr>
<th>Duty cycle</th>
<th>Standard voltages</th>
<th>Under demand voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>ED(%)</td>
<td>VDC</td>
<td>VAC</td>
</tr>
<tr>
<td>100%</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>100%</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>40%</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>25%</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>15%</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>5%</td>
<td>x</td>
<td>o</td>
</tr>
</tbody>
</table>

Layout: o = Available; x = Unavailable

**Ordering code:**  
**ERC 25-04/CC --V ED---%**  
Example: Standard voltage: 24Vdc; Duty-cycle: ED100%; **ERC25-04/CC 24Vdc ED100%**  
Standard voltage: 24Vdc; Duty-cycle: ED100%; With spring: **ERC25-04/CCRS 24Vdc ED100%**

For fixation of the solenoid: see page 31  
Spring yes: RS; Spring no: RN
**ERC 30/C TYPE**

Protection rate: IP00  
Insulation class: B (130ºC)  
Cycle duration: 2 minutes  
Standard stroke "s": 8 mm  
Temperature rise: ΔT ≤ 70ºC  
Work: pull/push  
Incorporated return spring: YES

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abs. Power at 20ºC (W)</td>
<td>8</td>
<td>20</td>
<td>30</td>
<td>50</td>
<td>120</td>
</tr>
<tr>
<td>Minimum force (N)</td>
<td>3</td>
<td>6</td>
<td>9</td>
<td>12</td>
<td>21</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>∞</td>
<td>48</td>
<td>30</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solenoid weight (g)</td>
<td>130</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Duty-cycle ED(%) | Standard voltages | Under demand voltages |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>VDC</td>
<td>VAC</td>
</tr>
<tr>
<td>40%</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>25%</td>
<td>6</td>
<td>230</td>
</tr>
<tr>
<td>15%</td>
<td>6</td>
<td>230</td>
</tr>
<tr>
<td>5%</td>
<td>9</td>
<td>230</td>
</tr>
</tbody>
</table>

Layout: o = Available ; x = Unavailable

1) Voltage under demand:  
They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.  
2) To feed in alternating current the solenoid will have a rectifier incorporated in the coil.  
3) The duty cycles described in the chart are standard, they can be manufactured in any intermediate cycle.  
4) If any variation from the original is needed, please ask us.  
5) The terminals can be changed by leads.  
6) Earthing is recommended if the metallic parts are accessible.

**Ordering code:** ERC30/C --V ED---%  
Example: Standard voltage: 24Vdc; Duty cycle: ED100%; With spring: ERC30/C 24Vdc ED100% RS  
Standard voltage: 12Vdc; Duty cycle: ED15%; Without spring: ERC30/C 12Vdc ED15% RN

For fixation of the solenoid: see page 31  
Spring yes: RS; Spring no: RN

**Force stroke curve**

Calculation of the effective force: see pages 1 and 31
ERC 35/C TYPE

Protection rate: IP00
Insulation class: B (130°C)
Cycle duration: 2 minutes
Standard stroke "s": 12 mm
Temperature rise: ΔT: 70°C
Work: pull/push
Incorporated return spring: YES

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abs. Power at 20°C (W)</td>
<td>9</td>
<td>20</td>
<td>35</td>
<td>60</td>
<td>150</td>
</tr>
<tr>
<td>Minimum force (N)</td>
<td>2.6</td>
<td>5.4</td>
<td>7.3</td>
<td>9.6</td>
<td>17.7</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>∞</td>
<td>48</td>
<td>30</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td></td>
<td></td>
<td></td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>Solenoid weight (g)</td>
<td></td>
<td></td>
<td></td>
<td>150</td>
<td></td>
</tr>
</tbody>
</table>

Duty-cycle ED% Standard voltages Under demand voltages
<table>
<thead>
<tr>
<th>ED%</th>
<th>VDC</th>
<th>VAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>6 12 24 48 100 125 205 110 230</td>
<td>Min 230 Max 36 230</td>
</tr>
<tr>
<td>40%</td>
<td>5</td>
<td>230 75 230</td>
</tr>
<tr>
<td>25%</td>
<td>6</td>
<td>230 105 230</td>
</tr>
<tr>
<td>15%</td>
<td>8</td>
<td>230 180 230</td>
</tr>
<tr>
<td>5%</td>
<td>12</td>
<td>230 x x</td>
</tr>
</tbody>
</table>

1) Voltage under demand: They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.
2) To feed in alternating current the solenoid will have a rectifier incorporated in the coil.
3) The duty cycles described in the chart are standard, they can be manufactured in any intermediate cycle.
4) If any variation from the original is needed, please ask us.
5) The terminals can be changed by leads.
6) Earthing is recommended if the metallic parts are accessible.

For fixation of the solenoid: see page 31
Spring yes: RS; Spring no: RN
ERC 45-50-15/C TYPE

Protection rate: IP00
Insulation class: B (130ºC)
Cycle duration: 3 minutes
Standard stroke “s”: 15 mm
Temperature rise “ΔVst”: 70ºC
Work: Push / pull
Incorporated return spring: YES

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abs. Power at 20ºC (W)</td>
<td>12</td>
<td>29</td>
<td>46</td>
<td>77</td>
<td>228</td>
</tr>
<tr>
<td>Minimum force (N)</td>
<td>4.5</td>
<td>9.3</td>
<td>12</td>
<td>16</td>
<td>32</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>∞</td>
<td>60</td>
<td>38</td>
<td>23</td>
<td>8</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td>52</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solenoid weight (g)</td>
<td>297</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Voltage under demand:
They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.
2) To feed in alternating current the solenoid will have a rectifier incorporated in the coil.
3) The duty cycles described in the chart are standard, they can be manufactured in any intermediate cycle.
4) If any variation from the original is needed, please ask us.
5) Earthing is recommended if the metallic parts are accessible.

Calculation of the effective force: see pages 1 and 31
**ERC 50-15/C TYPE**

Protection rate: IP00  
Insulation class: B (130ºC)  
Cycle duration: 3 minutes  
Standard stroke "s": 15 mm  
Temperature rise "ΔVs": 70ºC  
Work: pull/push  
Incorporated return spring: YES

### Duty-cycle ED(%)  
<table>
<thead>
<tr>
<th></th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abs. Power at 20ºC (W)</td>
<td>14</td>
<td>35</td>
<td>56</td>
<td>93</td>
<td>280</td>
</tr>
<tr>
<td>Minimum force (N)</td>
<td>6.8</td>
<td>12.8</td>
<td>17</td>
<td>23</td>
<td>43</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>∞</td>
<td>60</td>
<td>38</td>
<td>23</td>
<td>8</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td>70</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solenoid weight (g)</td>
<td>335</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Standard voltages  
<table>
<thead>
<tr>
<th>ED%</th>
<th>6</th>
<th>12</th>
<th>24</th>
<th>48</th>
<th>100</th>
<th>125</th>
<th>205</th>
<th>110</th>
<th>230</th>
</tr>
</thead>
<tbody>
<tr>
<td>VDC</td>
<td>16</td>
<td>16</td>
<td>24</td>
<td>31</td>
<td>48</td>
<td>65</td>
<td>100</td>
<td>110</td>
<td>160</td>
</tr>
<tr>
<td>VAC</td>
<td>6</td>
<td>24</td>
<td>48</td>
<td>95</td>
<td>160</td>
<td>230</td>
<td>310</td>
<td>310</td>
<td>410</td>
</tr>
</tbody>
</table>

1) Voltage under demand: They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.  
2) To feed in alternating current the solenoid will have a rectifier incorporated in the coil.  
3) The duty cycles described in the chart are standard, they can be manufactured in any intermediate cycle.  
4) If any variation from the original is needed, please ask us.  
5) The terminals can be changed by leads.  
6) Earthing is recommended if the metallic parts are accessible.

**Solenoid under voltage**  
**Force stroke curve**

### Calculation of the effective force: see pages 1 and 31

**Ordering code:**  
**Example:**  
- Standard voltage: 24Vdc; Duty cycle: ED100%; With spring: ERC50-15/C 24Vdc ED100% RS  
- Standard voltage: 48Vdc; Duty cycle: ED15%; Without spring: ERC50-15/C 48Vdc ED15% RN

For fixation of the solenoid: see page 31  
Spring yes: RS; Spring no: RN
Simple effect linear solenoids

ERC 60-10/C TYPE

Protection rate: IP00
Insulation class: B (130°C)
Cycle duration: 5 minutes
Standard stroke "s": 10 mm
Temperature rise "ΔVs": 70°C
Work: pull/push
Incorporated return spring: YES

Duty-cycle ED(%) | 100 | 40 | 25 | 15 | 5
---|---|---|---|---|---
Abs. Power at 20°C (W) | 18 | 45 | 70 | 110 | 280
Minimum force (N) | 19 | 33 | 43 | 56 | 94
Max time under voltage(s) | ∞ | 120 | 75 | 45 | 15
Plunger weight (g) | 120
Solenoid weight (g) | 660

1) Voltage under demand:
   They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.
2) To feed in alternating current the solenoid will have a rectifier incorporated in the coil.
3) The duty cycles described in the chart are standard, they can be manufactured in any intermediate cycle.
4) If any variation from the original is needed, please ask us.
5) Earthing is recommended if the metallic parts are accessible.

Duty-cycle ED(%)

<table>
<thead>
<tr>
<th>ED%</th>
<th>6</th>
<th>12</th>
<th>24</th>
<th>48</th>
<th>100</th>
<th>125</th>
<th>205</th>
<th>110</th>
<th>230</th>
<th>Min</th>
<th>Max</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>x</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>7</td>
<td>230</td>
<td>48</td>
<td>230</td>
</tr>
<tr>
<td>40%</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>11</td>
<td>230</td>
<td>125</td>
<td>230</td>
</tr>
<tr>
<td>25%</td>
<td>x</td>
<td>x</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>x</td>
<td>x</td>
<td>13</td>
<td>230</td>
<td>200</td>
<td>230</td>
</tr>
<tr>
<td>15%</td>
<td>x</td>
<td>x</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>x</td>
<td>x</td>
<td>16</td>
<td>230</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>5%</td>
<td>x</td>
<td>x</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>x</td>
<td>x</td>
<td>24</td>
<td>230</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

Layout: o = Available; x = Unavailable

Force stroke curve

Calculation of the effective force: see pages 1 and 31

Example:

Standard voltage: 24Vdc; Duty cycle: ED100%; With spring: ERC60-10/C 24Vdc ED100% RS
Standard voltage: 48Vdc; Duty cycle: ED15%; Without spring: ERC60-10/C 48Vdc ED15% RN

Ordering code: ERC60-10/C --V ED---% - Spring
For fixation of the solenoid: see page 31 Spring yes: RS; Spring no: RN
**ERC 60-20/C TYPE**

Protection rate: IP00  
Insulation class: B (130°C)  
Cycle duration: 5 minutes  
Standard stroke "s": 20 mm  
Temperature rise "\(\Delta V_{5s}\)" : 70°C  
Work: pull/push  
Incorporated return spring: YES

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abs. Power at 20°C (W)</td>
<td>18</td>
<td>45</td>
<td>70</td>
<td>110</td>
<td>280</td>
</tr>
<tr>
<td>Minimum force (N)</td>
<td>11</td>
<td>19</td>
<td>24</td>
<td>32</td>
<td>57</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>∞</td>
<td>120</td>
<td>75</td>
<td>45</td>
<td>15</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td>110</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solenoid weight (g)</td>
<td>660</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Duty-cycle ED%**

<table>
<thead>
<tr>
<th>ED%</th>
<th>6</th>
<th>12</th>
<th>24</th>
<th>48</th>
<th>100</th>
<th>125</th>
<th>205</th>
<th>110</th>
<th>230</th>
<th>Min</th>
<th>Max</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>x</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>7</td>
<td>230</td>
<td>48</td>
<td>230</td>
</tr>
<tr>
<td>40%</td>
<td>x</td>
<td>x</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>x</td>
<td>o</td>
<td>11</td>
<td>230</td>
<td>125</td>
<td>230</td>
<td></td>
</tr>
<tr>
<td>25%</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>x</td>
<td>o</td>
<td>13</td>
<td>230</td>
<td>200</td>
<td>230</td>
<td></td>
</tr>
<tr>
<td>15%</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>o</td>
<td>o</td>
<td>x</td>
<td>x</td>
<td>16</td>
<td>230</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>5%</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>o</td>
<td>x</td>
<td>x</td>
<td>24</td>
<td>230</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
</tbody>
</table>

**Solenoid under voltage**

<table>
<thead>
<tr>
<th>Duty-cycle</th>
<th>Standard voltages</th>
<th>Under demand voltages</th>
</tr>
</thead>
<tbody>
<tr>
<td>ED%</td>
<td>VDC</td>
<td>VAC</td>
</tr>
<tr>
<td>100%</td>
<td>240</td>
<td>230</td>
</tr>
<tr>
<td>40%</td>
<td>120</td>
<td>115</td>
</tr>
<tr>
<td>25%</td>
<td>110</td>
<td>105</td>
</tr>
<tr>
<td>15%</td>
<td>110</td>
<td>105</td>
</tr>
<tr>
<td>5%</td>
<td>110</td>
<td>105</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Layout:</th>
<th>o : Available ; x : Unavailable</th>
</tr>
</thead>
</table>

**Force stroke curve**

Calculation of the effective force: see pages 1 and 31

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

Example: Standard voltage:24Vdc; Duty cycle: ED100%; With spring : ERC60-20/C 24Vdc ED100% RS  
Standard voltage:48Vdc; Duty cycle: ED15%; Without spring : ERC60-20/C 48Vdc ED15% RN

For fixation of the solenoid: see page 31  
Spring yes: RS; Spring no: RN

---

1)Voltage under demand:  
They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.  
2)To feed in alternating current the solenoid will have a rectifier incorporated in the coil.  
3)The duty cycles described in the chart are standard, they can be manufactured in any intermediate cycle.  
4)If any variation from the original is needed, please ask us.  
5)Earthing is recommended if the metallic parts are accessible.
ECH SERIE

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).

Datasheet values rated conditions:
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 nominal one.
- Solenoid working in horizontal position.

Effective force (Fh) is obtained from magnetic force (Fm) adding or substracting the plunger weight.

1) When the solenoid pulls upwards:

$$\text{Effective force} = \text{Magnetic force} - \text{Plunger weight}$$

2) When the solenoid pulls downwards:

$$\text{Effective force} = \text{Magnetic force} + \text{Plunger weight}$$

3) When the solenoid pulls in horizontal position:

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

- For the units with return spring incorporated:

$$\text{Effective force} = \text{Magnetic force} - \text{Spring force} \pm \text{Plunger weight}$$

Disposition of the connector every 90º by the user: under demand the connectors can be replaced by flying leads.

Electrical conection: see the documentation enclosed with the material
### Chart: force-stroke

<table>
<thead>
<tr>
<th>Type</th>
<th>Stroke (mm)</th>
<th>Duty-cycle (N)</th>
<th>Return spring force (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>100%</td>
<td>40%</td>
</tr>
<tr>
<td>ECH40-10</td>
<td>Begin of stroke s₁=10</td>
<td>9.5</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>End of stroke s₀=0</td>
<td>10.4</td>
<td>16</td>
</tr>
<tr>
<td>ECH50-16</td>
<td>Begin of stroke s₁=16</td>
<td>18.5</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>End of stroke s₀=0</td>
<td>44</td>
<td>84</td>
</tr>
<tr>
<td>ECH65-15</td>
<td>Begin of stroke s₁=15</td>
<td>46</td>
<td>73</td>
</tr>
<tr>
<td></td>
<td>End of stroke s₀=0</td>
<td>152</td>
<td>199</td>
</tr>
<tr>
<td>ECH75-20</td>
<td>Begin of stroke s₁=20</td>
<td>57</td>
<td>93</td>
</tr>
<tr>
<td></td>
<td>End of stroke s₀=0</td>
<td>159</td>
<td>245</td>
</tr>
<tr>
<td>ECH90-25</td>
<td>Begin of stroke s₁=25</td>
<td>85</td>
<td>126</td>
</tr>
<tr>
<td></td>
<td>End of stroke s₀=0</td>
<td>265</td>
<td>379</td>
</tr>
<tr>
<td>ECH110-45</td>
<td>Begin of stroke s₁=45</td>
<td>75</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td>End of stroke s₀=0</td>
<td>550</td>
<td>730</td>
</tr>
<tr>
<td>ECH150-40</td>
<td>Begin of stroke s₁=40</td>
<td>250</td>
<td>480</td>
</tr>
<tr>
<td></td>
<td>End of stroke s₀=0</td>
<td>1100</td>
<td>1500</td>
</tr>
</tbody>
</table>

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

**Begining of the stroke**

**End of the stroke**

---

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CUSTOMIZATION: ECH SERIE

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:

   a.2) Power display Examples:

   a.3) For rectification Examples:

   b) DIN43650A connectors replacement by supply 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:

   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.

4. MECHANICAL CUSTOMIZATION

   a) Shaft modifications:

   b) Stroke modifications:

   c) Fastening element added as Fork joints DIN71752

   d) Detection system added

   Example 6: ECH75-20E
   Modification of ECH75-20, the shaft has been plucked, from ø12 to ø14, and one of the thread has been removed

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

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

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

Solenoid protection rate: IP40
Connector protection rate: IP65 (EN60529)
Insulation class: B (130°C)
Cycle duration: 3 minutes
Standard stroke “s”: 10 mm
Temperature rise: △Vs1 * 70°C
Work: Pull/Push
Incorporated return spring: YES

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abs. Power at 20°C (W)</td>
<td>13</td>
<td>30</td>
<td>45</td>
<td>75</td>
<td>210</td>
</tr>
<tr>
<td>Minimum force (N)</td>
<td>9</td>
<td>14</td>
<td>17</td>
<td>23</td>
<td>38</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>∞</td>
<td>72</td>
<td>45</td>
<td>27</td>
<td>9</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td>47</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solenoid weight (Kg)</td>
<td>0,416</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duty-cycle ED%</th>
<th>Standard voltages</th>
<th>Under demand voltages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>VDC</td>
<td>VAC</td>
</tr>
<tr>
<td>Voltage</td>
<td>VDC</td>
<td>VAC</td>
</tr>
<tr>
<td>100%</td>
<td>o o o o o o o o</td>
<td>4 250 18 230</td>
</tr>
<tr>
<td>40%</td>
<td>o o o o o o o o</td>
<td>6 250 43 230</td>
</tr>
<tr>
<td>25%</td>
<td>x o o o o o o o</td>
<td>9 250 65 230</td>
</tr>
<tr>
<td>15%</td>
<td>x o o o o o o o</td>
<td>10 250 105 230</td>
</tr>
<tr>
<td>5%</td>
<td>x o o o o o x x</td>
<td>12 250 x x</td>
</tr>
</tbody>
</table>

Layout: o = Available ; x = Unavailable

1) Under demand voltage:
   They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.
2) To feed in alter current the solenoid will have a rectifier incorporated in the connector.
3) The duty-cycles described in the chart are standard, they can be manufactured in any intermediate cycle.
4) If any variation from the original is needed, please ask us.
5) Earthing is recommended if the metallic parts are accessible.

Force-stroke curve

Calculation of the effective force: see pages 1 and 42

Ordering code: ECH40-10/C --V ED---%

Example: Standard Voltage:24Vdc Duty- cycle: ED100%: With spring : ECH40-10/C 24Vdc ED100% RS
Standard Voltage:12Vdc Duty- cycle: ED15%: Without spring : ECH40-10/C 12Vdc ED15% RN

Spring yes: RS; Spring no: RN
### ECH50-16 TYPE

- **Solenoid protection rate:** IP40
- **Connector protection rate:** IP65 (EN60529)
- **Insulation class:** B (130°C)
- **Cycle duration:** 3 minutes
- **Standard stroke “s”:** 16mm
- **Temperature rise:** Δ T31 * 70°C
- **Work:** Pull/Push
- **Incorporated return spring:** YES

#### Duty-cycle ED(%)

<table>
<thead>
<tr>
<th></th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abs. Power at 20°C (W)</td>
<td>19</td>
<td>45</td>
<td>68</td>
<td>120</td>
<td>325</td>
</tr>
<tr>
<td>Minimum force (N)</td>
<td>13</td>
<td>18</td>
<td>26</td>
<td>41</td>
<td>72</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>∞</td>
<td>72</td>
<td>45</td>
<td>27</td>
<td>9</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>120</td>
</tr>
<tr>
<td>Solenoid weight (kg)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.750</td>
</tr>
</tbody>
</table>

#### Duty-cycle

<table>
<thead>
<tr>
<th>ED%</th>
<th>Standard voltages</th>
<th>Under demand voltages</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VDC</td>
<td>VAC</td>
</tr>
<tr>
<td></td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td>100%</td>
<td>6</td>
<td>250</td>
</tr>
<tr>
<td>40%</td>
<td>10</td>
<td>250</td>
</tr>
<tr>
<td>25%</td>
<td>12</td>
<td>250</td>
</tr>
<tr>
<td>15%</td>
<td>16</td>
<td>250</td>
</tr>
<tr>
<td>5%</td>
<td>24</td>
<td>250</td>
</tr>
</tbody>
</table>

**Layout:** o = Available; x = Unavailable

### Force-stroke curve

1) **Under demand voltage:** They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.
2) **To feed in altern current the solenoid will have a rectifier incorporated in the connector.**
3) **The duty-cycles described in the chart are standard,** they can be manufactured in any intermediate cycle.
4) **If any variation from the original is needed, please ask us.**
5) **Earthing is recommended if the metallic parts are accessible.**

#### Ordering code: ECH50-16/C --V ED---%

Example: Standard Voltage:24Vdc Duty- cycle: ED100%; With Spring: ECH50-16/C 24Vdc ED100% RS
Standard Voltage:48Vdc Duty- cycle: ED15%; Without Spring: ECH50-16/C 48Vdc ED15% RN

Spring yes: RS; Spring no: RN
**ECH65-15 TYPE**

Solenoid protection rate: IP40  
Connector protection rate: IP65 (EN60529)  
Insulation class: B (130°C)  
Cycle duration: 3 minutes  
Standard stroke “s”: 15mm  
Temperature rise: ΔV = 70°C  
Work: Pull/Push  
Incorporated return spring: just under demand

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abs. Power at 20°C (W)</td>
<td>30</td>
<td>75</td>
<td>110</td>
<td>185</td>
<td>545</td>
</tr>
<tr>
<td>Minimum force (N)</td>
<td>38</td>
<td>64</td>
<td>80</td>
<td>99</td>
<td>162</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>∞</td>
<td>72</td>
<td>45</td>
<td>27</td>
<td>9</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td>190</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solenoid weight (kg)</td>
<td>1.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Under demand voltage: They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.  
2) To feed in alternating current the solenoid will have a rectifier incorporated in the connector.  
3) The duty-cycles described in the chart are standard, they can be manufactured in any intermediate cycle.  
4) If any variation from the original is needed, please ask us.  
5) Earthing is recommended if the metallic parts are accessible.

**Reference:**  
ECH65-15-V ED-%-RS

---

Solenoid without voltage

**Force-stroke curve**

Calculation of the effective force: see pages 1 and 42

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100%</th>
<th>40%</th>
<th>25%</th>
<th>15%</th>
<th>5%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard voltages</td>
<td>VDC</td>
<td>VAC</td>
<td>VDC</td>
<td>VAC</td>
<td>VDC</td>
</tr>
<tr>
<td>ED%</td>
<td>6</td>
<td>12</td>
<td>24</td>
<td>48</td>
<td>100</td>
</tr>
<tr>
<td>100%</td>
<td>x</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>40%</td>
<td>x</td>
<td>x</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>25%</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>15%</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>o</td>
</tr>
<tr>
<td>5%</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

Layout: o = Available; x = Unavailable

**Ordering code:** ECH65-15/C --V ED-%

Example: Standard Voltage: 24Vdc Duty-cycles: ED100%; With spring: ECH65-15/C 24Vdc ED100% RS  
ECH75-20 TYPE

Solenoid protection rate: IP40
Connector protection rate: IP65 (EN60529)
Insulation class: B (130ºC)
Cycle duration: 5 minutes
Standard stroke "s": 20mm
Temperature rise: "ΔV31" 70ºC
Work: Pull/Push
Incorporated return spring: just under demand

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abs. Power at 20ºC (W)</td>
<td>48</td>
<td>110</td>
<td>165</td>
<td>265</td>
<td>755</td>
</tr>
<tr>
<td>Minimum force (N)</td>
<td>57</td>
<td>93</td>
<td>114</td>
<td>150</td>
<td>258</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>∞</td>
<td>120</td>
<td>75</td>
<td>45</td>
<td>15</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td></td>
<td>375</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solenoid weight (kg)</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Duty-cycle ED%  Standard voltages  Under demand voltages
<table>
<thead>
<tr>
<th>ED%</th>
<th>VDC 6 12 24 48 100 125 205 230</th>
<th>Min</th>
<th>Max</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>x o o o o o o o o o o o o o o</td>
<td>12</td>
<td>250</td>
<td>30</td>
<td>230</td>
</tr>
<tr>
<td>40%</td>
<td>x x o o o o o o o o o o o o</td>
<td>17</td>
<td>250</td>
<td>70</td>
<td>230</td>
</tr>
<tr>
<td>25%</td>
<td>x x o o o o o o o o o o o o</td>
<td>21</td>
<td>250</td>
<td>105</td>
<td>230</td>
</tr>
<tr>
<td>15%</td>
<td>x x o o o o o o o o o o x o</td>
<td>24</td>
<td>250</td>
<td>170</td>
<td>230</td>
</tr>
<tr>
<td>5%</td>
<td>x x x o o o o o o o x x x x</td>
<td>37</td>
<td>250</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

Layout: o = Available ; x = Unavailable

1) Under demand voltage: They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.
2) To feed in altern current the solenoid will have a rectifier incorporated in the connector.
3) The duty-cycles described in the chart are standard, they can be manufactured in any intermediate cycle.
4) If any variation from the original is needed, please ask us.
5) Earthing is recommended if the metallic parts are accessible.

Ordering code: ECH75-20/C --V ED---%
Example: Standard Voltage:24Vdc Duty-cycle: ED100%; With spring: ECH75-20/C 24Vdc ED100% RS
Standard Voltage: 48Vdc Duty-cycle: ED15%; Without spring: ECH75-20/C 48Vdc ED15% RN
**ECH90-25 TYPE**

Solenoid protection rate: IP40  
Connector protection rate: IP65 (EN60529)  
Insulation class: B (130°C)  
Cycle duration: 5 minutes  
Standard stroke “s”: 25mm  
Temperature rise: *ΔV31* 70°C  
Work: Pull/Push  
Incorporated return spring: just under demand

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abs. Power at 20°C (W)</td>
<td>55</td>
<td>125</td>
<td>190</td>
<td>300</td>
<td>900</td>
</tr>
<tr>
<td>Minimum force (N)</td>
<td>72</td>
<td>110</td>
<td>150</td>
<td>190</td>
<td>300</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>∞</td>
<td>120</td>
<td>75</td>
<td>45</td>
<td>15</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td>650</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solenoid weight (kg)</td>
<td>5.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>Standard voltages</th>
<th>Under demand voltages</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VDC</td>
<td>VAC</td>
</tr>
<tr>
<td></td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td>100%</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>40%</td>
<td>x x x</td>
<td>x x x</td>
</tr>
<tr>
<td>25%</td>
<td>x x x</td>
<td>x x x</td>
</tr>
<tr>
<td>15%</td>
<td>x x x</td>
<td>x x x</td>
</tr>
<tr>
<td>5%</td>
<td>x x x</td>
<td>x x x</td>
</tr>
</tbody>
</table>

Layout: o = Available ; x = Unavailable

1) Under demand voltage: They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.  
2) To feed in altern current the solenoid will have a rectifier incorporated in the connector.  
3) The duty-cycles described in the chart are standard, they can be manufactured in any intermediate cycle.  
4) If any variation from the original is needed, please ask us.  
5) Earthing is recommended if the metallic parts are accessible.

**Calculations**

- **Solenoid without voltage**
- **Force-stroke curve**

**Ordering code:** ECH90-25/C --V ED--%

Example: Standard Voltage:24Vdc Duty-cycle: ED100%; With spring: ECH90-25/C 24Vdc ED100% RS  
ECH110-45 TYPE

Solenoid protection rate: IP40
Connector protection rate: IP65 (EN60529)
Insulation class: B (130ºC)
Cycle duration: 5 minutes
Standard stroke "s": 45mm
Temperature rise: "ΔV31 " 70ºC
Work: Pull/Push
Incorporated return spring: NO

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abs. Power at 20°C (W)</td>
<td>76</td>
<td>175</td>
<td>260</td>
<td>420</td>
<td>1260</td>
</tr>
<tr>
<td>Minimum force (N)</td>
<td>75</td>
<td>150</td>
<td>165</td>
<td>240</td>
<td>460</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>∞</td>
<td>120</td>
<td>75</td>
<td>45</td>
<td>15</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td>1100</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solenoid weight (kg)</td>
<td>7.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Duty-cycle ED(%) Standard voltages Under demand voltages

<table>
<thead>
<tr>
<th>ED%</th>
<th>VDC</th>
<th>VAC</th>
<th>VDC</th>
<th>VAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>x o o o o o 12 250 45 230</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40%</td>
<td>x x o o o x o 19 250 105 230</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25%</td>
<td>x x o o x o x o 23 250 155 230</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15%</td>
<td>x x x o o x o x o 29 250 230 230</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5%</td>
<td>x x x x o x x x 48 250 x x</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Layout: o = Available; x = Unavailable

1) Under demand voltage:
   They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.
2) To feed in altern current the solenoid will have a rectifier incorporated in the connector.
3) The duty-cycles described in the chart are standard, they can be manufactured in any intermediate cycle.
4) If any variation from the original is needed, please ask us.
5) Earthing is recommended if the metallic parts are accessible.

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

Example: Standard Voltage: 24Vdc Duty-cycle: ED100%; ECH110-45/C 24Vdc ED100%
Standard Voltage: 48Vdc Duty-cycle: ED15%; ECH110-45/C 48Vdc ED15%
**ECH150-40 TYPE**

- **Solenoid protection rate:** IP40
- **Connector protection rate:** IP65 (EN60529)
- **Insulation class:** B (130°C)
- **Cycle duration:** 5 minutes
- **Standard stroke “s”:** 40mm
- **Temperature rise:** Vmax 70°C
- **Work:** Pull/Push
- **Incorporated return spring:** NO

### Technical Specifications

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Abs. Power at 20°C (W)</strong></td>
<td>120</td>
<td>290</td>
<td>460</td>
<td>750</td>
<td>2200</td>
</tr>
<tr>
<td><strong>Minimum force (N)</strong></td>
<td>250</td>
<td>480</td>
<td>580</td>
<td>780</td>
<td>1300</td>
</tr>
<tr>
<td><strong>Max time under voltage(s)</strong></td>
<td>∞</td>
<td>120</td>
<td>75</td>
<td>45</td>
<td>15</td>
</tr>
<tr>
<td><strong>Plunger weight (kg)</strong></td>
<td>4.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Solenoid weight (kg)</strong></td>
<td>21</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Power Voltage Chart

<table>
<thead>
<tr>
<th>Duty-cycle</th>
<th>ED%</th>
<th>Standard voltages</th>
<th>Under demand voltages</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>VDC</td>
<td>VAC</td>
</tr>
<tr>
<td>100%</td>
<td></td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>40%</td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>25%</td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>15%</td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>5%</td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

**Layout:** o = Available; x = Unavailable

### Additional Information
1) **Under demand voltage:** They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.
2) To feed in altern current the solenoid will have a rectifier incorporated in the connector.
3) The duty-cycles described in the chart are standard, they can be manufactured in any intermediate cycle.
4) If any variation from the original is needed, please ask us.
5) Earthing is recommended if the metallic parts are accessible.

### Force-stroke curve

Calculation of the effective force: see pages 1 and 42

**Ordering code:** ECH150-40/C--V ED---%

Example: Standard Voltage: 24Vdc Duty-cyle: ED100%; ECH150-40/C 24Vdc ED100%
Standard Voltage: 48Vdc Duty-cyle: ED15%; ECH150-40/C 48Vdc ED15%
CU SERIE

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 work for a long time, so applications where the number of cycles is high are appropriate for these solenoids.

Structure, basic elements:

**Magnetic body:**
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.

**Friction bearing:**
They are the guide of the plunger, and abrasion resistant.

**Data sheet rated values condition:**

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 the 90% of the standard one.
- Solenoid working in horizontal position.

The effective force (Fh) is obtained from the magnetic force (Fm) adding or substracting the weight of the plunger.

1) **When the solenoid pulls upwards:**

\[
\text{Effective force} = \text{Magnetic force} - \text{plunger weight}
\]

2) **When the solenoid pulls downwards:**

\[
\text{Effective force} = \text{Magnetic force} + \text{plunger weight}
\]

3) **When the solenoid pulls in horizontal position:**

\[
\text{Effective force} = \text{Magnetic force}
\]

- For the units with incorporated return spring:

\[
\text{Effective force} = \text{Magnetic force} - \text{Spring force} \pm \text{Plunger weight}
\]

NOTE: When mounting position 3) friction bearings abrasion is bigger than mounting positions 1) and 2).
## Chart: force-stroke

<table>
<thead>
<tr>
<th>Type</th>
<th>Stroke (mm)</th>
<th>Duty-cycle</th>
<th>Return Spring force (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>100%</td>
<td>40%</td>
</tr>
<tr>
<td>CU20/C</td>
<td>Beginning of stroke s₁=6</td>
<td>0.9</td>
<td>2.1</td>
</tr>
<tr>
<td></td>
<td>End of the stroke s₀=0</td>
<td>1.5</td>
<td>3.5</td>
</tr>
<tr>
<td>CU30/C</td>
<td>Beginning of stroke s₁=10</td>
<td>2.6</td>
<td>3.8</td>
</tr>
<tr>
<td></td>
<td>End of the stroke s₀=0</td>
<td>12</td>
<td>15</td>
</tr>
<tr>
<td>CU40/C</td>
<td>Beginning of the stroke s₁=15</td>
<td>7.8</td>
<td>13.5</td>
</tr>
<tr>
<td></td>
<td>End of the stroke s₀=0</td>
<td>15.7</td>
<td>24.5</td>
</tr>
</tbody>
</table>

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

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 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 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:

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:

*PWD integrated in the cables

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

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

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. PROTECCIÓN RATE CUSTOMIZATION IP (EN60529):

Standard models are IP40, after overmolding coil, IP65 can be obtained for the coil.
Simple effect linear solenoids

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 increase:** 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.
CU20/C TYPE

Solenoid protection rate: IP40
Insulation class: E (120°C)
Cycle duration: 4 minutes
Standard stroke "s": 6 mm
Temperature rise: "△Vs1" 70°C
Work: pull/push
Incorporated return spring: YES

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abs. Power at 20°C (W)</td>
<td>4</td>
<td>10</td>
<td>16</td>
<td>26</td>
<td>80</td>
</tr>
<tr>
<td>Minimum force (N)</td>
<td>0.9</td>
<td>2.1</td>
<td>2.5</td>
<td>3.1</td>
<td>5.5</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>∞</td>
<td>96</td>
<td>60</td>
<td>36</td>
<td>12</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td>18</td>
<td>18</td>
<td>18</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>Solenoid weight (g)</td>
<td>110</td>
<td>110</td>
<td>110</td>
<td>110</td>
<td>110</td>
</tr>
</tbody>
</table>

1) Under demand voltage:
   They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.

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

3) The duty-cycle described in the chart are standard, they can be manufactured in any intermediate cycle.

4) If any variation from the original is needed, please ask us.

5) Earthing is recommended if the metallic parts are accessible.

Solenoid under voltage

<table>
<thead>
<tr>
<th>Duty-cycle</th>
<th>Standard voltages</th>
<th>Under demand voltages</th>
</tr>
</thead>
<tbody>
<tr>
<td>ED%</td>
<td>VDC</td>
<td>VAC</td>
</tr>
<tr>
<td>100%</td>
<td>6 12 24 48 100 125 205 305</td>
<td>Min</td>
</tr>
<tr>
<td>40%</td>
<td>o o o o o x x x x x x</td>
<td>3 110</td>
</tr>
<tr>
<td>25%</td>
<td>o o o o o o o o o x x</td>
<td>3 175</td>
</tr>
<tr>
<td>15%</td>
<td>o o o o o o o o o o o</td>
<td>3 220</td>
</tr>
<tr>
<td>5%</td>
<td>o o o o o o o o o o</td>
<td>4 250</td>
</tr>
</tbody>
</table>

Layout: o = Available; x = Unavailable

Duty-cycle: CU20/C --V ED---%
Example:
Standard voltage: 24Vdc Duty-cycle: ED100%: with spring:
Ref.: CU20/C 24Vdc ED100% RS
Standard voltage: 12Vdc Duty-cycle: ED15%: without spring:
Ref.: CU20/C 12Vdc ED15% RN

Force-stroke curve

Calculation of the effective force: see pages 1 and 52
**CU30/C TYPE**

Solenoid protection rate: IP40  
Insulation class: E (120ºC)  
Cycle duration: 4 minutes  
Standard stroke “s”: 10 mm  
Temperature rise: "ΔV31" 70ºC  
Work: pull/push  
Incorporated return spring: YES

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abs. Power at 20ºC (W)</td>
<td>7.2</td>
<td>18</td>
<td>30</td>
<td>53</td>
<td>150</td>
</tr>
<tr>
<td>Minimum force (N)</td>
<td>2.6</td>
<td>3.8</td>
<td>7.3</td>
<td>9.9</td>
<td>17.2</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>∞</td>
<td>96</td>
<td>60</td>
<td>36</td>
<td>12</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td></td>
<td></td>
<td></td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td></td>
<td></td>
<td></td>
<td>290</td>
<td></td>
</tr>
</tbody>
</table>

1) Under demand voltage:  
They can be manufactured at any voltage between the maximum and the minimum voltage values shown in the chart.
2) To feed in alternating current the solenoid will have an internal rectifier.
3) The duty-cycles described in the chart are standard, they can be manufactured in any intermediate cycle.
4) If any variation from the original is needed, please ask us.
5) Earthing is recommended if the metallic parts are accessible.

**Solenoid under voltage**

**Force-stroke curve**

Calculation of the effective force: see pages 1 and 52

**Ordering code:** CU30/C -- V ED---%  
Example:  
Standard voltage: 24Vdc Duty-cycle: ED100%: With spring : CU30/C 24Vdc ED100% RS  
Standard voltage: 12Vdc Duty-cycles: ED15%: Without spring : CU30/C 48Vdc ED15% RN
CU40/C TYPE

Solenoid protection rate: IP40
Insulation class: E (120ºC)
Cycle duration: 4 minutes
Standard stroke "s": 15 mm
Temperature rise: \( \Delta T \) 70ºC
Work: pull/push
Incorporated return spring: YES

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abs. Power at 20ºC (W)</td>
<td>13</td>
<td>30</td>
<td>48</td>
<td>82</td>
<td>247</td>
</tr>
<tr>
<td>Minimum force (N)</td>
<td>7.8</td>
<td>13.5</td>
<td>17</td>
<td>23</td>
<td>41</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>∞</td>
<td>96</td>
<td>60</td>
<td>36</td>
<td>12</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td>85</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solenoid weight (g)</td>
<td>665</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Under demand voltage:
They can be manufactured at any voltage between the maximum and the minimum voltage values shown in the chart.
2) To feed in alternating current the solenoid will have an internal rectifier.
3) It is possible to feed at 230V 50Hz with external rectifier.
4) The duty-cycles described in the chart are standard, they can be manufactured in any intermediate cycle.
5) If any variation from the original is needed, please ask us.
6) Earthing is recommended if the metallic parts are accessible.

**Duty-cycle ED(%)**

- **Standard voltages**
  - VDC: 6, 12, 24, 48, 100, 125, 205, 110, 230
  - VAC: 3, 110, 48, 125

**Under demand voltages**

- VDC: 3, 175, 48, 125
- VAC: 3

**Plunger weight (g):** 85
**Solenoid weight (g):** 665

**Calculation of the effective force:** see pages 1 and 52

---

**Force-stroke curve**

- ED5%; F(0mm)= 59 N
- ED15%; F(0mm)= 38 N
- ED25%; F(0mm)= 31 N
- ED40%; F(0mm)= 24.5 N
- ED100%; F(0mm)= 15.5 N

Ordering code: CU40/C --V ED---%  
Example: Standard voltage: 24Vdc Duty-cycle: ED100%; With spring: CU40/C 24Vdc ED100% R  
Standard voltage: 12Vdc Duty-cycles: ED15%; Without spring: CU40/C 48Vdc ED15% NR
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). Its design makes it perfect to be mounted on panels.

**Data sheet values rated conditions:**

Magnetic force values depending on the stroke are obtained in the following conditions:
- Room temperature $= 35^\circ$C
- Coil stabilized at its performance temperature.
- Rated voltage equal to 90% of the standard one.
- Solenoid working in horizontal position.

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

1) **When the solenoid pulls upwards:**
   
   $\text{Effective force} = \text{Magnetic force} - \text{plunger weight}$

2) **When the solenoid pulls downwards:**
   
   $\text{Effective force} = \text{Magnetic force} + \text{plunger weight}$

3) **When the solenoid pulls in horizontal position:**
   
   $\text{Effective force} = \text{Magnetic force}$
   
   - For the units with the return spring incorporated:
     
     $\text{Effective force} = \text{Magnetic force} - \text{spring force} \pm \text{plunger weight}$

COMMENT: When mounting position 3) friction bearings abrasion is bigger than mounting options 1) and 2)
The values of force-stroke and the return spring are in Newton (N) and solenoid in horizontal position.
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) 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 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:

   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.

   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 ECM serie, maximum insulation class can be obtained is B (130ºC).

3. PROTECCIÓN RATE IP (EN60529) CUSTOMIZATION:

   Standard models are IP30, after overmolding the coils, IP65 can be obtained.

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

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.

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 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 useful 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.
**ECM13-03/E TYPE**

Solenoid protection rate: IP30(EN60529)
Insulation class: B (130°C)
Cycle duration: 2 minutes
Standard stroke "s": 3 mm
Temperature rise: "ΔVs" 70°C
Work: push
Incorporated return spring: NO

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abs. Power at 20°C (W)</td>
<td>1</td>
<td>2.5</td>
<td>4</td>
<td>6.6</td>
<td>20</td>
</tr>
<tr>
<td>Minimum force (N)</td>
<td>0.02</td>
<td>0.08</td>
<td>0.12</td>
<td>0.2</td>
<td>0.5</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>∞</td>
<td>48</td>
<td>30</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solenoid weight (g)</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Voltage under demand:
They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.
2) The duty-cycles described in the chart are standard, they can be manufactured in any intermediate cycle.
3) If any variation from the original is needed, please ask us.
4) Earthing is recommended if the metallic parts are accessible.

For fixation of the solenoid: see page 59

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

Example: Standard voltage: 24Vdc, Duty-cycle: ED100%; ECM13-03/E 24Vdc ED100%

Standard voltage: 12Vdc, Duty-cycle: ED15%; ECM13-03/E 12Vdc ED15%
ECM13-03/T TYPE

Solenoid protection rate: IP30(EN60529)
Insulation class: B (130ºC)
Cycle duration: 2 minutes
Standard stroke “s”: 3 mm
Temperature rise: "DVs" 70ºC
Work: pull
Incorporated return spring: NO

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abs. Power at 20ºC (W)</td>
<td>1</td>
<td>2.5</td>
<td>4</td>
<td>6.6</td>
<td>20</td>
</tr>
<tr>
<td>Minimum force (N)</td>
<td>0.02</td>
<td>0.08</td>
<td>0.12</td>
<td>0.2</td>
<td>0.5</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>∞</td>
<td>48</td>
<td>30</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td></td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solenoid weight (g)</td>
<td></td>
<td>25</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Voltage under demand:
They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.
2) The duty-cycles described in the chart are standard, they can be manufactured in any intermediate cycle.
3) If any variation from the original is needed, please ask us.
4) Earthing is recommended if the metallic parts are accessible.

Solenoid under voltage

For fixation of the solenoid: see page 59

Ordering code: ECM13-03/T --V ED---%  
Example: Standard voltage: 24Vdc Duty-cycle: ED100%; ECM13-03/T 24Vdc ED100%
Standard voltage: 12Vdc Duty-cycle: ED15%; ECM13-03/T 12Vdc ED15%
ECM13-10/E TYPE

Solenoid protection rate: IP30(EN60529)
Insulation class: B (130ºC)
Cycle duration: 2 minutes
Standard stroke “s”**: 10 mm
Temperature rise: °AV51 ° 70ºC
Work: push
Incorporated return spring: NO

Ordering code: ECM13-10/E --V ED---%
Example: Standard voltage: 24Vdc Duty-cycle: ED100%: ECM13-10/E 24Vdc ED100%
Standard voltage: 12Vdc Duty-cycle: ED15%: ECM13-10/E 12Vdc ED15%

For fixation of the solenoid: see page 59
**ECM13-10/T TYPE**

Solenoid protection rate: IP30 (EN60529)  
Insulation class: B (130ºC)  
Cycle duration: 2 minutes  
Standard stroke "s": 10 mm  
Temperature rise: "△Vst" 70ºC  
Work: pull  
Incorporated return spring: NO

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abs. Power at 20ºC (W)</td>
<td>3.3</td>
<td>10</td>
<td>16</td>
<td>26</td>
<td>80</td>
</tr>
<tr>
<td>Minimum force (N)</td>
<td>0.15</td>
<td>0.3</td>
<td>0.4</td>
<td>0.7</td>
<td>1.7</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>∞</td>
<td>48</td>
<td>30</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solenoid weight (g)</td>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under demand voltages</td>
<td>VDC</td>
<td>VAC</td>
<td>VDC</td>
<td>VAC</td>
<td>VDC</td>
</tr>
<tr>
<td>ED%</td>
<td>Min</td>
<td>Max</td>
<td>Min</td>
<td>Max</td>
<td>Min</td>
</tr>
<tr>
<td>100%</td>
<td>6</td>
<td>12</td>
<td>24</td>
<td>48</td>
<td>100</td>
</tr>
<tr>
<td>40%</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>25%</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>15%</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5%</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Layout: o = Available; x = Unavailable

1) Under demand voltage:  
They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.  
2) The duty-cycles described in the chart are standard, they can be manufactured in any intermediate cycle.  
3) If any variation from the original is needed, please ask us.  
4) Earthing is recommended if the metallic parts are accessible.

---

**For fixation of the solenoid: see page 59**

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

Example: Standard voltage: 24Vdc Duty-cycle: ED100%: ECM13-10/T 24Vdc ED100%  
Standard voltage: 12Vdc Duty-cycle: ED15%: ECM13-10/T 12Vdc ED15%

---

**Simple effect linear solenoids**
**ECM19/E TYPE**

Solenoid protection rate: IP30(EN60529)
Insulation class: B (130ºC)
Cycle duration: 2 minutes
Standard stroke "s": 10 mm
Temperature rise: *ΔV=70ºC*
Work: push
Incorporated return spring: just under demand

<table>
<thead>
<tr>
<th>Duty cycle ED(%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absorbed power at 20ºC (W)</td>
<td>7</td>
<td>17</td>
<td>28</td>
<td>45</td>
<td>140</td>
</tr>
<tr>
<td>Minimum forces (N)</td>
<td>0.5</td>
<td>1.2</td>
<td>2</td>
<td>3.2</td>
<td>6.6</td>
</tr>
<tr>
<td>Max. time under voltage(s)</td>
<td>∞</td>
<td>48</td>
<td>30</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solenoid weight (g)</td>
<td>80</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duty-cycle ED%</th>
<th>Standard voltages</th>
<th>Under demand voltages</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VDC</td>
<td>VAC</td>
</tr>
<tr>
<td>100%</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>40%</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>25%</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>15%</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>5%</td>
<td>x</td>
<td>o</td>
</tr>
</tbody>
</table>

Layout: o = Available; x = Unavailable

1) Under demand voltage:
They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.
2) The duty-cycles described in the chart are standard, they can be manufactured in any intermediate cycle.
3) If any variation from the original is needed, please ask us.
4) Earthing is recommended if the metallic parts are accessible.

**For fixation of the solenoid:** see page 59

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

Example: Standard voltage: 24Vdc Duty-cycle: ED100%; With spring: ECM19/E 24Vdc ED100% RS
Standard voltage: 12Vdc Duty-cycle: ED15%; Without spring ECM19/E 12Vdc ED15% RN
**ECM19/T TYPE**

Solenoid protection rate: IP30(EN60529)
Insulation class: B (130ºC)
Cycle duration: 2 minutes
Standard stroke "s": 10 mm
Temperature rise: "ΔVs1" 70ºC
Work: pull
Incorporated return spring: NO

<table>
<thead>
<tr>
<th>Duty cycle ED(%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absorbed power at 20ºC (W)</td>
<td>7</td>
<td>17</td>
<td>28</td>
<td>45</td>
<td>140</td>
</tr>
<tr>
<td>Minimum forces (N)</td>
<td>0.5</td>
<td>1.2</td>
<td>2</td>
<td>3.2</td>
<td>6.6</td>
</tr>
<tr>
<td>Max. time under voltage(s)</td>
<td>∞</td>
<td>48</td>
<td>30</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td></td>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solenoid weight (g)</td>
<td></td>
<td>80</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Under demand voltage:
   They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.
2) The duty-cycles described in the chart are standard, they can be manufactured in any intermediate cycle.
3) If any variation from the original is needed, please ask us.
4) Earthing is recommended if the metallic parts are accessible.

**Duty-cycle**

<table>
<thead>
<tr>
<th>ED%</th>
<th>VDC</th>
<th>VAC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>100%</td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td>40%</td>
<td>3</td>
<td>125</td>
</tr>
<tr>
<td>25%</td>
<td>3</td>
<td>230</td>
</tr>
<tr>
<td>15%</td>
<td>5</td>
<td>250</td>
</tr>
<tr>
<td>5%</td>
<td>9</td>
<td>250</td>
</tr>
</tbody>
</table>

**Force-stroke curve**

1) Under demand voltage:
   They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.
2) The duty-cycles described in the chart are standard, they can be manufactured in any intermediate cycle.
3) If any variation from the original is needed, please ask us.
4) Earthing is recommended if the metallic parts are accessible.

**Solenoid under voltage**

**For fixation of the solenoid: see page 59**

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

Example: Standard voltage: 24Vdc Duty-cycle: ED100%: ECM19/T 24Vdc ED100%
Standard voltage: 12Vdc Duty-cycle: ED15%: ECM19/T 12Vdc ED15%
ECM25/E TYPE

Solenoid protection rate: IP30 (EN60529)
Insulation class: B (130°C)
Cycle duration: 2 minutes
Standard stroke “s”: 12 mm
Temperature rise: “△Vst” 70°C
Work: push
Incorporated return spring: just under demand

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abs. Power at 20°C (W)</td>
<td>10</td>
<td>25</td>
<td>40</td>
<td>65</td>
<td>200</td>
</tr>
<tr>
<td>Minimum force (N)</td>
<td>0.6</td>
<td>1.5</td>
<td>2.3</td>
<td>3.4</td>
<td>8.4</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>∞</td>
<td>48</td>
<td>30</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td></td>
<td>50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solenoid weight (g)</td>
<td></td>
<td>190</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Duty-cycles:
- Under demand voltages
  - VDC
  - VAC
- Standard voltages
  - VDC
  - VAC

<table>
<thead>
<tr>
<th>Duty-cycle</th>
<th>Standard voltages</th>
<th>Under demand voltages</th>
</tr>
</thead>
<tbody>
<tr>
<td>ED%</td>
<td>VDC</td>
<td>VAC</td>
</tr>
<tr>
<td>100%</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>40%</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>25%</td>
<td>x</td>
<td>o</td>
</tr>
<tr>
<td>15%</td>
<td>x</td>
<td>o</td>
</tr>
<tr>
<td>5%</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

Layout: o = Available; x = Unavailable

1) Under demand voltage:
   They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.
2) The duty-cycles described in the chart are standard, they can be manufactured in any intermediate cycle.
3) If any variation from the original is needed, please ask us.
4) Earthing is recommended if the metallic parts are accessible.

For fixation of the solenoid: see page 59

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

Example: Standard: 24Vdc Duty-cycle: ED100%; With spring: ECM25/E 24Vdc ED100% RS
Standard: 12Vdc Duty-cycle: ED15% Without spring: ECM25/E 12Vdc ED15% RN
ECM25/T TYPE

Solenoid protection rate: IP30 (EN60529)
Insulation class: B (130ºC)
Cycle duration: 2 minutes
Standard stroke "s": 12 mm
Temperature rise: "ΔV51" 70ºC
Work: pull
Incorporated return spring: NO

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abs. Power at 20ºC (W)</td>
<td>10</td>
<td>25</td>
<td>40</td>
<td>65</td>
<td>200</td>
</tr>
<tr>
<td>Minimum force (N)</td>
<td>0.6</td>
<td>1.5</td>
<td>2.3</td>
<td>3.4</td>
<td>8.4</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>∞</td>
<td>48</td>
<td>30</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solenoid weight (g)</td>
<td>190</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duty-cycle</th>
<th>Standard voltages</th>
<th>Under demand voltages</th>
</tr>
</thead>
<tbody>
<tr>
<td>ED%</td>
<td>VDC</td>
<td>VAC</td>
</tr>
<tr>
<td>100%</td>
<td>o o o o o o o o</td>
<td>x x</td>
</tr>
<tr>
<td>40%</td>
<td>o o o o o o</td>
<td>x x</td>
</tr>
<tr>
<td>25%</td>
<td>x o o o o o</td>
<td>x x</td>
</tr>
<tr>
<td>15%</td>
<td>x o o o o o</td>
<td>x x</td>
</tr>
<tr>
<td>5%</td>
<td>x x o o o o</td>
<td>x x</td>
</tr>
</tbody>
</table>

Layout: o = Available; x = Unavailable

1) Under demand voltage:
   They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.
2) The duty-cycles described in the chart are standard, they can be manufactured in any intermediate cycle.
3) If any variation from the original is needed, please ask us.
4) Earthing is recommended if the metallic parts are accessible.

Solenoid under voltage

For fixation of the solenoid: see page 59

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

Example: Standard voltage: 24Vdc Duty-cycle: ED100%: ECM25/T 24Vdc ED100%
Standard voltage: 12Vdc Duty-cycle: ED15%: ECM25/T 12Vdc ED15%
ERD60-05/C TYPE

Simple effect linear solenoids of the ERD serie 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 begining of the stroke are needed.

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.4) connecting terminals 3 and 4. The solenoid is fed with its standard voltage Un (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.

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: (-10ºC a 65ºC)
Work: pull/push
Return spring incorporated: YES
Plunger weight (g): 117
Solenoid weight (g): 720

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

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.
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 really useful in those applications where force must be the same for both push and return.

**Figure 1.**

**Data sheet rated values conditions:**

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

The effective force (Fh) is obtained from magnetic force (Fm) 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:**

   \[
   \text{Effective force} = \text{Magnetic force}
   \]

   - For the units with incorporated return spring:
     \[
     \text{Effective force} = \text{Magnetic force} - \text{Spring} \pm \text{Plunger weight}
     \]

   COMMENT: The work option 2) increases the abrasion of the friction bearing comparing to mounting option 1).

**4x90º adjustable connector:**

**Structure, basic components**

**Magnetic body:**
- The metalic piece containing the coil, 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. See document 7.1
Working instructions and electrical connection:

1) The electrical connection will be detailed in the following points.

2) Take out the screw between the connector and the base.

3) Take off the connector pulling it up.

4) Take off the rubber piece.

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.

Connection by the user

Take out the screws, take in the supply cables in the power terminals and screw them again.

 Coil 1 under voltage

Coil 1

Coil 2

Figure 11.

Connection between base connector and coil, realized by the manufacturer.
### Chart: force-stroke

<table>
<thead>
<tr>
<th>Type</th>
<th>Stroke (mm)</th>
<th>Duty cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>100%</td>
</tr>
<tr>
<td>ECR40-07</td>
<td>Begining of stroke s₁=7</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>End of stroke s₀=0</td>
<td>10.4</td>
</tr>
<tr>
<td>ECR50-16</td>
<td>Begining of stroke s₁=16</td>
<td>18.7</td>
</tr>
<tr>
<td></td>
<td>End of stroke s₀=0</td>
<td>44</td>
</tr>
<tr>
<td>ECR65-15</td>
<td>Begining of stroke s₁=15</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td>End of stroke s₀=0</td>
<td>152</td>
</tr>
<tr>
<td>ECR72-30</td>
<td>Begining of stroke s₁=30</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>End of stroke s₀=0</td>
<td>68</td>
</tr>
<tr>
<td>ECR90-25</td>
<td>Begining of stroke s₁=25</td>
<td>85</td>
</tr>
<tr>
<td></td>
<td>End of stroke s₀=0</td>
<td>265</td>
</tr>
</tbody>
</table>

The values of force-stroke and the return spring are in Newton (N) and solenoid in horizontal position.
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 serie electromagnets are linear reversible solenoids, where the stroke is made by the alternative piloting of two coils. In case of different forces needed for each stroke direction, there is the option of manufacturing each coil with different duty-cycle. 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 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.

4. MECHANICAL CUSTOMIZATION

a) Shaft modifications:

b) Stroke modifications:

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

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

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

c) Fastening element added as Fork joint DIN71752

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

Example 3:
Bellows have been added in the shaft

Example 1:
ECR90-25/CC

www.nafsa.es
ECR40-07 TYPE

Solenoid protection rate: IP40(EN60529)
Insulation class: B (130ºC)
Cycle duration: 5 minutes
Standard stroke "s": 7 mm
Temperature rise: "\Delta V_31" 70ºC
Work: pull/push
Incorporated return spring: NO

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abs. Power at 20ºC (W)</td>
<td>13</td>
<td>30</td>
<td>45</td>
<td>75</td>
<td>210</td>
</tr>
<tr>
<td>Minimum force (N)</td>
<td>10</td>
<td>15</td>
<td>18</td>
<td>22</td>
<td>37</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>∞</td>
<td>120</td>
<td>75</td>
<td>45</td>
<td>15</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td>140</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solenoid weight (Kg)</td>
<td>0.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Voltage under demand:
   They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.
2) To feed in alternating current, there has to be an external rectification of the signal.
3) The duty-cycles described in the chart are standard, they can be manufactured in any intermediate cycle.
4) If any variation from the original is needed, please ask us.
5) Earthing is recommended if the metallic parts are accessible.

Calculation of the effective force: see pages 1 and 72

Duty-cycle ED(%) | Standard voltages | Under demand voltages |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VDC</td>
<td>VAC</td>
</tr>
<tr>
<td>100%</td>
<td>6 12 24 48 100 205</td>
<td>Min Max Min Max</td>
</tr>
<tr>
<td>40%</td>
<td>x o o o o o x x</td>
<td>5 250 x x</td>
</tr>
<tr>
<td>25%</td>
<td>x o o o o o x x</td>
<td>6 250 x x</td>
</tr>
<tr>
<td>15%</td>
<td>x o o o o o x x</td>
<td>9 250 x x</td>
</tr>
<tr>
<td>5%</td>
<td>x o o o o o x x</td>
<td>12 250 x x</td>
</tr>
</tbody>
</table>

Lay out: o = Available ; x = Unavailable

Ordering code: ECR40-07 --V ED---%  
Example: Standard voltage: 24Vdc Duty-cycle: ED100%: ECR40-07 24Vdc ED100%  
Standard voltage: 12Vdc Duty-cycle: ED15%: ECR40-07 12Vdc ED15%
ECR50-16 TYPE

Solenoid protection rate: IP40 (EN60529)
Insulation class: B (130°C)
Cycle duration: 5 minutes
Standard stroke "s": 16 mm
Temperature rise: \( \Delta V_{11} = 70°C \)
Work: pull/push
Incorporated return spring: NO

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abs. Power at 20°C (W)</td>
<td>20</td>
<td>45</td>
<td>70</td>
<td>120</td>
<td>320</td>
</tr>
<tr>
<td>Minimum force (N)</td>
<td>13</td>
<td>18</td>
<td>26</td>
<td>41</td>
<td>72</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>∞</td>
<td>120</td>
<td>75</td>
<td>45</td>
<td>15</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td>220</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solenoid weight (kg)</td>
<td>1.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Duty-cycle

1) Voltage under demand:
   They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.
2) To feed in alternating current, there has to be an external rectification of the signal.
3) The duty-cycles described in the chart are standard, they can be manufactured in any intermediate cycle.
4) If any variation from the original is needed, please ask us.

Solenoid under voltage

Ordering code: ECR50-16 → V ED—%  
Example: Standard voltage: 24Vdc Duty-cycle: ED100%: ECR50-16 24Vdc ED100%  
Standard voltage: 12Vdc Duty-cycle: ED15%: ECR50-16 12Vdc ED15%
**ECR65-15 TYPE**

Solenoid protection rate: IP40(EN60529)
Insulation class: B (130ºC)
Cycle duration: 5 minutes
Standard stroke "s": 15 mm
Temperature rise: "\( \Delta V_{31} \) 70ºC
Work: pull/push
Incorporated return spring: NO

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abs. Power at 20ºC (W)</td>
<td>30</td>
<td>75</td>
<td>110</td>
<td>185</td>
<td>545</td>
</tr>
<tr>
<td>Minimum force (N)</td>
<td>38</td>
<td>64</td>
<td>80</td>
<td>99</td>
<td>162</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>( \infty )</td>
<td>120</td>
<td>75</td>
<td>45</td>
<td>15</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td>350</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solenoid weight (kg)</td>
<td>2.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Voltage under demand:
   They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.
2) To feed in alternating current, there has to be an external rectification of the signal.
3) The duty-cycles described in the chart are standard, they can be manufactured in any intermediate cycle.
4) If any variation from the original is needed, please ask us.

**Solenoid under voltage**

For fixation of the solenoid: see page 72

**Ordering code:** ECR 65-15 --V ED---%
Example: Standard voltage: 24Vdc Duty-cycle: ED100%: ECR65-15 24Vdc ED100%
Standard voltage: 48Vdc Duty-cycle: ED15%: ECR65-15 48Vdc ED15%
ECR72-30 TYPE

Solenoid protection rate: IP40 (EN60529)
Insulation class: B (130°C)
Cycle duration: 5 minutes
Standard stroke “s”: 30 mm
Temperature rise: ”△Vst“ 70°C
Work: pull/push
Incorporated return spring: NO

<table>
<thead>
<tr>
<th>Duty-cycle ED(%)</th>
<th>100</th>
<th>40</th>
<th>25</th>
<th>15</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abs. Power at 20°C (W)</td>
<td>34</td>
<td>98</td>
<td>166</td>
<td>195</td>
<td>830</td>
</tr>
<tr>
<td>Minimum force (N)</td>
<td>28</td>
<td>42</td>
<td>56</td>
<td>71</td>
<td>146</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>∞</td>
<td>120</td>
<td>75</td>
<td>45</td>
<td>15</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td>400</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solenoid weight (g)</td>
<td>3.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Voltage under demand:
They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.
2) To feed in alternating current, there has to be an external rectification of the signal.
3) The duty-cycles described in the chart are standard, they can be manufactured in any intermediate cycle.
4) If any variation from the original is needed, please ask us.

Solenoid under voltage

Ordering code: ECR72-30- V ED---%

Example: Standard voltage: 24Vdc Duty-cycle: ED100%: ECR72-30  24Vdc ED100%
Standard voltage: 12Vdc Duty-cycle: ED15%: ECR72-30  12Vdc ED15%
ECR90-25 TYPE

Solenoid protection rate: IP40 (EN60529)
Insulation class: B (130ºC)
Cycle duration: 5 minutes
Standard stroke "s": 25 mm
Temperature rise: "△V31" 70ºC
Work: pull/push
Incorporated return spring: NO

Duty-cycle ED(%) | 100 | 40 | 25 | 15 | 5
---|---|---|---|---|---
Abs. Power at 20ºC (W) | 55 | 125 | 190 | 300 | 900
Minimum force (N) | 70 | 111 | 146 | 178 | 305
Max time under voltage(s) | ∞ | 120 | 75 | 45 | 15
Plunger weight (g) | 900
Solenoid weight (Kg) | 8.5

1) Voltage under demand:
   They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.
2) To feed in alternating current, there has to be an external rectification of the signal.
3) The duty-cycles described in the chart are standard, they can be manufactured in any intermediate cycle.
4) If any variation from the original is needed, please ask us.
5) Earthing is recommended if the metallic parts are accessible.

Solenoid under voltage

For fixation of the solenoid: see page 72

Ordering code: ECR90-25 --V ED---%
Example: Standard voltage: 24Vdc Duty-cycle: ED100%: ECR90-25 24Vdc ED100%
           Standard voltage: 48Vdc Duty-cycle: ED15%: ECR90-25 48Vdc ED15%
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.

Data sheet rated values conditions:

Magnetic Force values (Fm) depending on the stroke are obtained in the following conditions:

- Standard 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), adding and substracting the plunger weight.

1) 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

2) 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

3) 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 units with incorporated return spring:
     Effective force = Magnetic force - Spring force ± Plunger weight

COMMENT: The mounting position 3 increases the abrasion of the sliding guides comparing to position 1 and 2.

ASSEMBLY: The screw does not have to exceed the wall of the magnetic circuit.
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:
   Example 4: ERB35/NCIP
   Example 5: ERD135-07/ES

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.
ERB20-15-6/C TYPE

Protection rate: IP00
Insulation class: Y (90°C)
Available voltages: 5, 6, 9, 12, 24 Vdc
Cycle duration: 3 minutos
Standard stroke "s": 6 mm
Maximum stroke "s": 8 mm
Temperature increase "\Delta V_{31}": 70°C
Work: Push/pull

<table>
<thead>
<tr>
<th>Standard voltage:</th>
<th>24Vdc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duty-cycle ED(%)</td>
<td>25</td>
</tr>
<tr>
<td>Abs. power at 20°C (W)</td>
<td>10</td>
</tr>
<tr>
<td>Minimum Vdc (V)</td>
<td>5</td>
</tr>
<tr>
<td>Maximum Vdc (V)</td>
<td>24</td>
</tr>
<tr>
<td>Minimum Vac (V)</td>
<td>NP</td>
</tr>
<tr>
<td>Maximum Vac (V)</td>
<td>NP</td>
</tr>
<tr>
<td>Max. time under voltage.(s)</td>
<td>30</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td>11</td>
</tr>
<tr>
<td>Solenoid weight (g)</td>
<td>47.4</td>
</tr>
</tbody>
</table>

NP= Not available

1) Voltage under demand: They can be manufactured at any voltage between the maximum and the minimum voltage values shown in the chart.
2) To feed in alternating current the solenoid must be fed using a rectifier with standard voltage.
3) If any variation from the original is needed please contact.
4) Earthing is recommended if the metallic parts are accessible.

Work depending on feeding mode:

Locked position
Red cable: +Vdc
Black cable: -Vdc

Unlocked position
Red cable: -Vdc
Black cable: +Vdc

(S) Coil+ magnet
(S) Spring

F-S: Force-stroke

Force-stroke curve (F-S)

Calculation of the effective force: see pages 1 and 81


ASSEMBLY: the screw does not have to exceed the wall of the magnetic circuit
**ERB35-05/NC TYPE**

Protection rate: IP00
Insulation class: Y (90°C)
Available Voltage: 12, 24, 48, 110, 125, 205 Vdc
Cycle duration: 3 minutes
Standard stroke "s": 8 mm
Temperature rise "\Delta V dc": 70°C
Work: pull/push
Return spring incorporated: YES

<table>
<thead>
<tr>
<th>Standard voltage</th>
<th>24Vdc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duty cycle ED(%)</td>
<td>20</td>
</tr>
<tr>
<td>Abs. power at 20°C (W)</td>
<td>35</td>
</tr>
<tr>
<td>Minimum Vdc (V)</td>
<td>6</td>
</tr>
<tr>
<td>Maximum Vdc (V)</td>
<td>205</td>
</tr>
<tr>
<td>Minimum Vac (V)</td>
<td>NP</td>
</tr>
<tr>
<td>Maximum Vac (V)</td>
<td>NP</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>30</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td>40</td>
</tr>
<tr>
<td>Solenoid weight (g)</td>
<td>165</td>
</tr>
</tbody>
</table>

NP: Not available

1) Voltage under demand:
   They can be manufactured at any voltage between the maximum and the minimum voltage values shown in the chart.
2) To feed in alternating current the solenoid must be fed using a rectifier with standard voltage.
3) If any variation from the original is needed please contact.
4) Earthing is recommended if the metallic parts are accessible.

**Work depending on the feeding mode:**

<table>
<thead>
<tr>
<th>Locked position</th>
<th>Unlocked position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red cable: +Vdc</td>
<td>Red cable: -Vdc</td>
</tr>
<tr>
<td>Black cable: -Vdc</td>
<td>Black cable: +Vdc</td>
</tr>
</tbody>
</table>

(F-S) Coil+magnet
(F-S) Spring

**Solenoid locked**

**Force-Stroke curve(F-S)**

Calculation of the effective force: see pages 1 and 81

**Ordering code:** ERB35-05/NC --V ED20% - Spring
Example: Standard voltage: 24Vdc Duty cycle: ED20%; With spring: ERB35-05/NC 24Vdc ED20% RS
Standard voltage: 12Vdc Duty cycle: ED20%; Without spring: ERB35-05/NC 12Vdc ED20% RN

Spring yes: RS; Spring no: RN
ASSEMBLY: the screw does not have to exceed the wall of the magnetic circuit
**ERB35/N TYPE**

Protection rate: IP00
Insulation class: Y (90°C)
Available Voltage: 12, 24, 48, 110, 125, 205 Vdc
Cycle duration: 3 minutes
Standard stroke "s": 5 mm
Temperature rise "ΔVst": 70°C
Work: pull/push
Return spring incorporated: YES

<table>
<thead>
<tr>
<th>Standard voltage</th>
<th>24Vdc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duty cycle ED(%)</td>
<td>20</td>
</tr>
<tr>
<td>Abs. power at 20°C (W)</td>
<td>35</td>
</tr>
<tr>
<td>Minimum Vdc (V) 1)</td>
<td>6</td>
</tr>
<tr>
<td>Maximum Vdc (V) 1)</td>
<td>205</td>
</tr>
<tr>
<td>Minimum Vac (V) 1)</td>
<td>NP</td>
</tr>
<tr>
<td>Maximum Vac (V) 1)</td>
<td>NP</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>30</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td>40</td>
</tr>
<tr>
<td>Solenoid weight (g)</td>
<td>165</td>
</tr>
</tbody>
</table>

NP: Not available

**Work depending on the feeding mode:**

Locked position
Red cable: +Vdc
Black cable: -Vdc

Unlocked position
Red cable: -Vdc
Black cable: +Vdc

(F-S) Coil+mag
(F-S) Spring

**F-S: Force-stroke**

1) Voltage under demand: They can be manufactured at any voltage between the maximum and the minimum voltage values shown in the chart.
2) To feed in alternating current the solenoid must be fed using a rectifier with standard voltage.
3) If any variation from the original is needed please contact.
4) Earthing is recommended if the metallic parts are accessible.

**Solenoid locked**

**Ordering code:**

ERB35/N --V ED20% - Spring

Example: Standard voltage: 24 Vdc Duty cycle: ED20% With spring: ERB35/N 24 Vdc ED20% RS
Standard voltage: 12 Vdc Duty cycle: ED20% Without spring: ERB35/N 12 Vdc ED20% RN

Spring yes: RS; Spring no: RN

ASSEMBLY: the screw does not have to exceed the wall of the magnetic circuit

**Force-Stroke curve (F-S)**

Calculation of the effective force: see pages 1 and 81

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**Notes:**

- Calculation of the effective force: see pages 1 and 81.
**ERB50/N TYPE**

Protection rate: IP00  
Insulation class: Y (90°C)  
Available voltages: 12, 24, 48, 110, 125, 205 Vdc  
Cycle duration: 3 minutes  
Standard stroke "s": 10 mm  
Temperature rise "ΔVSt": 70°C  
Work: pull/push  
Return spring incorporated: YES

<table>
<thead>
<tr>
<th>Standard voltage</th>
<th>24Vdc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duty cycle ED(%)</td>
<td>20</td>
</tr>
<tr>
<td>Abs. power at 20°C (W)</td>
<td>67</td>
</tr>
<tr>
<td>Minimum Vdc (V) 1)</td>
<td>12</td>
</tr>
<tr>
<td>Maximum Vdc (V) 1)</td>
<td>205</td>
</tr>
<tr>
<td>Minimum Vac (V) 1,2)</td>
<td>NP</td>
</tr>
<tr>
<td>Maximum Vac (V) 1,2)</td>
<td>NP</td>
</tr>
<tr>
<td>Max time under voltage(s)</td>
<td>30</td>
</tr>
<tr>
<td>Plunger weight (g)</td>
<td>71</td>
</tr>
<tr>
<td>Solenoid weight (g)</td>
<td>365</td>
</tr>
</tbody>
</table>

NP: Not available

1) Voltage under demand:  
They can be manufactured at any voltage between the maximum and the minimum voltage values shown in the chart.  
2) To feed in alternating current the solenoid must be fed using a rectifier with standard voltage.  
3) If any variation from the original is needed please contact.  
4) Earthing is recommended if the metallic parts are accessible.

**Work depending on the feeding mode:**

Locked position  
Red cable: +Vdc  
Black cable: -Vdc  

Unlocked position  
Red cable: -Vdc  
Black cable: +Vdc

![Locked solenoid](image)

![Force-Stroke Curve](image)

**Ordering code:** ERB50/C --V ED20% - Spring

Example: Standard voltage: 24Vdc Duty cycle: ED20%: With spring: ERB50/C 24Vdc ED20% RS  
Standard voltage: 12Vdc Duty cycle: ED20%: Without spring: ERB50/C 12Vdc ED20% RN

Spring YES: RS, Spring NO: RN  
ASSEMBLY: the screw does not have to exceed the wall of the magnetic circuit
ERDI15 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 EN60529
Insulation class: E (120°C)
Standard voltage: from 6 to 12 Vdc
Under demand voltage: contact
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: 5 gr
Solenoid weight: 40 gr

* Obligatory earthing if the metallic parts are accessible.

Connection scheme: Coil in parallel will be the standard configuration.

Voltage 6V - (Coil in parallel)

Voltage 12V - (Coil in serie)

Dimensional drawing:

Force-stroke Curve (F-S)

Ordering code:
Coil in parallel: ERDI15 6V 33%, (standard configuration)
Coil in serie: ERDI15 12V 33%, (special configuration)
ERDI35-06/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: de 6VDC a 250Vdc
- Standard stroke "s": 6mm
- Duty-cycle ED: 20%
- Abs. power at 20°C: 28W (14W each coil)
- Plunger weight: 28 gr
- Solenoid weight: 175 gr
- Holding force at stroke 0mm: 20N

*Obligatory earthing if the metallic parts are accessible.

**Connection scheme**

**Work depending on the feeding mode:**

<table>
<thead>
<tr>
<th>Connection 1:</th>
<th>Connection 2:</th>
</tr>
</thead>
<tbody>
<tr>
<td>+VDC and Connection 2: -VDC. The shaft will go to B position</td>
<td>+VDC and Connection 1: -VDC. The shaft will go to A position</td>
</tr>
</tbody>
</table>

**Dimensional drawing:**

ASSEMBLY: the screw does not have to exceed the wall of the magnetic circuit

**Ordering code:** ERDI35-06/CC 24V 20%
ECI35/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 retened in the initial positon 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 (90ºC)
Minimum release voltage: 6V
Duty-cycle ED: 100%
Standard stroke "s": 8 mm
Work: Push
Magnetic retention force (Frm): 44N
Initial force (Fe): 37N
Useful magnetic force (Fru=Frm-Fe): 7N
Final force (Fa): 18N
Mechanical response time: 5ms
Minimum energy of release: 30 mJ
Minimum duration of the electrical impulse: 20ms
Solenoid weight: 0.190 Kg

Ordering code: ECI35/C 6Vdc ED100%
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 allows to mount harder springs if necessary. This can be done keeping the 100% duty-cycle.

2. MECHANICAL CUSTOMIZATION:

2.1) Bolts plunger length 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 its detects the position transition.

   b) Microswitch
      In this case, the microswitch is integrated in the cover and its detects bolt opening.

   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: ERB35-05_NDBCP
Example: ECH40-10_BM
Example: CU40_CPD

NOTE: All this customizations cannot be applied to all models, ask NAFSA for each case.
**CU20/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.

It design makes it good to be used as industrial locking bolt.

### Specifications
- **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 "△V31":** 70°C
- **Plunger weight (g):** 17.3
- **Locking bolt weight (g):** 90
- **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

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

2) To feed in alternating current the solenoid will have a rectifier mounted in.

3) If any change from the original is needed, please contact us.

**Ordering code:**

CU2 0/CPXU -V ED--%

Example: 24Vdc 100%ED:

CU20/CP XU24VdcED100%

### Possibility of supply with detection system integrated in the supports

Reference: CU20/CPXUM

**Frontal fixation:** Use ø12 as mounting guide in the support hole.

**Solenoid shown under voltage**

Material: EFTE; s=1x0.22mm²; L=160mm

Supply cables

2.5 x 6 useful depth

Stroke
ER30/CCR TYPE

Derivative of series ER, and reinforced with 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 lateral or.

Solenoid protection rate: IP00
Insulation class: B (130°C)
Standard voltage: 24Vdc
Duty cycle (ED%): 100
Absorbed power at 20°C: 8 W
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 "\(\Delta V31\)": 70°C
Plunger weight (g): 60
Locking bolt weight (g): 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’s diameter: 1000N

1) Voltage under demand: They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.
2) To feed in alterning current, the solenoid will have a rectifier incorporated. Faston terminals will be changed by flying leads (L=150mm).
3) If any changes from the original are needed, please contact.
4) Earthing is recommended if the metallic parts are accessible.

Ordering code:
ER30/CCR --V ED100%
Example:
Standard voltage: 24Vdc: ER30/CCR 24Vdc ED100%
Standard voltage: 48Vdc: ER30/CCR 48Vdc ED100%
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: E (120ºC)
Standard voltage: 24Vdc
Duty-cycle (ED%): 100 or 25
Absorbed power at 20ºC: 7.5 W(ED100%); 29W(ED25%)
Under demand voltage: Vdc (from 3V to 205V)
Standard stroke "s": 10mm
Temperature rising "∆V31": 70ºC
Plunger weight (g): 60
Locking bolt weight (g): 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%
Example: 24Vdc 100%ED: CU30/CP 24Vdc ED100%
48Vdc 25%ED: CU30/CP 48Vdc ED100%

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

2) To feed in alternating current the solenoid will have a rectifier mounted in.

3) If any change from the original is needed, please contact us.
CU20/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.

![Assembly A: With lateral guided](image)

![Assembly B:](image)

![Opened lock, with voltage:](image)

![Closed lock, without voltage:](image)

**Model: CU20CP100**
- **Protection rate:** IP40
- **Insulation class:** E (120°C)
- **Standard voltage:** VDC (12V;24V;48V)
- **Duty cycle (ED%):** 100%
- **Absorbed power at 20°C:** 4.2W
- **Standard stroke "s":** 7mm
- **Temperature rising "\(\Delta V31\):** 70°C
- **Mobil plunger weight (g):** 17
- **Locking bolt weight (g):** 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)

**Model: CU20CP25**
- **Protection rate:** IP40
- **Insulation class:** E (120°C)
- **Standard voltage:** VDC (12V;24V;48V)
- **Duty cycle (ED%):** 25%
- **Absorbed power at 20°C:** 17W
- **Standard stroke "s":** 7mm
- **Temperature rising "\(\Delta V31\):** 70°C
- **Mobil plunger weight (g):** 17
- **Locking bolt weight (g):** 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)

- **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

**Electromagnet without voltage**

![Electromagnet without voltage](image)
**ERC30/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 automatismes 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 o 25%  
- **Abs. power at 20°C:** 8 W (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 "ΔV31":** 70°C  
- **Plunger weight (g):** 38  
- **Locking-bolt weight (g):** 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)  

1) Voltage under demand: They can be manufactured at any voltage between the maximum and minimum voltage values shown in the chart.  
2) If any changes from the original are needed, please contact.  
3) Earthing is recommended if the metallic parts are accessible.

**Solenoid shown under voltage**

**Frontal fixation**

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: Standard voltage: 24Vdc: **ERC30/CP100 24Vdc**  
- **ERC30/CP --V ED25%**: Example: Standard voltage: 24Vdc: **ERC30/CP25 24Vdc**
CU20/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 (g):** 19
- **Locking bolt weight (g):** 90
- **Minimum pulse time:** 20ms
- **Incorporated 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
- **Locked position** (held by spring 0.25N)
  - Red cable: -Vdc
  - Black cable: +Vdc

- (F-S) Coil+magnet
- (F-S) Spring

**Solenoid shown without voltage**
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 (90ºC)
Available voltages: 12, 24, 48 Vdc
Coil 1 duty-cycle (ED%): 20
Coil 2 duty-cycle (ED%): 25
Cycle duration: 3 minutos
Standard stroke "s": 7 mm
Temperature stroke "ΔV31": 70ºC
Work: /push/pull
Incorporated return spring: YES

Standard voltage: 24Vdc
Coil 1 duty-cycle ED(%): 20
Coil 1 abs. power at 20ºC (W): 24
Coil 2 duty-cycle ED(%): 25
Coil 2 abs. power at 20ºC (W): 22
Vac (V): NP
Plunger weight (g): 46
Solenoid weight (g): 218
NP= Not available

1) They can be manufactured at any voltage between the maximum and the minimum voltage values shown under chart.
2) If any variation from the original is needed please contact.
3) Earthing is recommended if the metallic are accesssible.

1) They can be manufactured at any voltage between the maximum and the minimum voltage values shown under chart.
2) If any variation from the original is needed please contact.
3) Earthing is recommended if the metallic are accesssible.

Ordering code: ERB35-05/NDBCP --V ED20%ED25%
Example: Standard voltage:24Vdc : ERB35-05/NDBCP 24Vdc ED20%ED25%
Spring YES: RS; Spring NO: RN
ASSEMBLY: the screw does not to have to exceed the wall of the magnetic circuit
Electrical locking bolts (Contact cutting bolt)
**Holding Electromagnets**

**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 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 installation, use and maintenance:**

It is convenient to leave a tiny gap between the electromagnet fixing face and the part fixed to it so that the product can move and adapt to the piece to hold.

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 lose 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: Holding electromagnets

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 doble 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.

Examples:

- Free wheel diode+second diode
- Varistor
- Connector under voltage display by LED
- Varistor+LED display
- 4 diodes with varistor at the input
- 4 diodes with doble varistor.

b.1) For peak suppression

Examples:

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

b.2) Power display

Examples:

- Connector under voltage display by LED
- Varistor+LED display

b.3) For rectification

Examples:

- 4 diodes with varistor at the input
- 4 diodes with doble varistor.

b.4) 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: Holding electromagnets

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 passant M8 hole

4.2) Non-rotating holes integration:
Example: VEM65E Three M5 holes on ø40 have been made

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 ø42x7 with M-5 hole
Example: VEM80CP Holding plate with damping washer

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.
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 clamping 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**

<table>
<thead>
<tr>
<th>TYPE</th>
<th>øA (-0.3)</th>
<th>B</th>
<th>C±0.1</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>Weight (Kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VEM 20</td>
<td>20</td>
<td>M-3</td>
<td>12</td>
<td>5</td>
<td>--</td>
<td>--</td>
<td>0.02</td>
</tr>
<tr>
<td>VEM 25</td>
<td>25</td>
<td>M-4</td>
<td>20</td>
<td>6</td>
<td>--</td>
<td>40</td>
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<tr>
<td>VEM 30</td>
<td>30</td>
<td>M-4</td>
<td>22</td>
<td>8</td>
<td>--</td>
<td>45</td>
<td>0.10</td>
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<tr>
<td>VEM 40</td>
<td>40</td>
<td>M-5</td>
<td>26</td>
<td>8</td>
<td>--</td>
<td>55</td>
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<tr>
<td>VEM 50</td>
<td>50</td>
<td>M-5</td>
<td>30</td>
<td>8</td>
<td>--</td>
<td>65</td>
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<tr>
<td>VEM 65</td>
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<td>15</td>
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</table>

**Table 2**

<table>
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<tr>
<th>TYPE</th>
<th>P at 20°C (W)</th>
<th>e (mm)</th>
<th>Air gap (mm)</th>
<th>φL</th>
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<tbody>
<tr>
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<td>1</td>
<td>19</td>
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</table>

**Important:**
- the clamping screw does not have to exceed measure D

**Important:**
- the clamping screw does not have to exceed measure D

**Important:**
- the clamping screw does not have to exceed measure D

**Important:**
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.

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 (3 mm roughness) in AºSt37, 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 documents 1.4 & 1.5

Under demand: any size, voltage, duty cycle etc can be manufactured.
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 (130ºC)  
Nominal Voltage: 24VDC  
Standard duty cycle: ED100%  
Other voltages, ED and sizes: Consult

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.

<table>
<thead>
<tr>
<th>TYPE</th>
<th>ERM100/35</th>
<th>ERM150/35</th>
<th>ERM200/35</th>
<th>ERM400/35</th>
<th>ERM500/35</th>
<th>ERM600/35</th>
<th>ERM150/60</th>
<th>ERM200/60</th>
<th>ERM500/60</th>
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<tr>
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<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
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<td>Duty cycle (%)</td>
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<td>100%</td>
<td>100%</td>
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<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
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Table 1

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<th>ERM400/35</th>
<th>ERM500/35</th>
<th>ERM600/35</th>
<th>ERM150/60</th>
<th>ERM200/60</th>
<th>ERM500/60</th>
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<tbody>
<tr>
<td>A (mm)</td>
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<td>175</td>
<td>225</td>
<td>425</td>
<td>525</td>
<td>625</td>
<td>180</td>
<td>230</td>
<td>530</td>
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<tr>
<td>B (mm)</td>
<td>35±0.3</td>
<td>34±0.1</td>
<td>25</td>
<td>50</td>
<td>12</td>
<td>12</td>
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<td>49.5±0.2</td>
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<td>C (mm)</td>
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<td>40</td>
<td>70</td>
<td>120</td>
<td>120</td>
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<td>E (mm)</td>
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<td>12</td>
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<tr>
<td>H (mm)</td>
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<td>M-6</td>
<td>M-6</td>
<td>M-6</td>
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<td>M-6</td>
<td>M-8</td>
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<td>4</td>
<td>8</td>
<td>10</td>
<td>12</td>
<td>2</td>
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<td>2.3</td>
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<td>Weight (kg)</td>
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<td>2.8</td>
<td>3.5</td>
<td>4.5</td>
<td>2.3</td>
<td>3</td>
<td>7.8</td>
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Table 2

<table>
<thead>
<tr>
<th>TYPE</th>
<th>ERM100/35</th>
<th>ERM150/35</th>
<th>ERM200/35</th>
<th>ERM400/35</th>
<th>ERM500/35</th>
<th>ERM600/35</th>
<th>ERM150/60</th>
<th>ERM200/60</th>
<th>ERM500/60</th>
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<tbody>
<tr>
<td>P at 20ºC (W)</td>
<td>10</td>
<td>14</td>
<td>18</td>
<td>30</td>
<td>45</td>
<td>53</td>
<td>45</td>
<td>60</td>
<td>65</td>
</tr>
<tr>
<td>e (mm)</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>0,1</td>
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<td>1</td>
<td>1</td>
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</tr>
</tbody>
</table>

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 AºSt37, thickness as shown in the table 2 and dimensions are similar or bigger than the attraction face.
- Room temperature 35ºC.
- 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: to see 11.3
- Technical explanations: to see documents 1.4 and 1.5
- Under demand: any size, voltage, duty cycle etc can be manufactured.

Ordering code:
Size; Voltage; Duty cycle
Example: Ref.: ERM150/35 24Vdc 100%
To other configurations see document 12.3

<table>
<thead>
<tr>
<th>TYPE</th>
<th>ERM100/35</th>
<th>ERM150/35</th>
<th>ERM200/35</th>
<th>ERM400/35</th>
<th>ERM500/35</th>
<th>ERM600/35</th>
<th>ERM150/60</th>
<th>ERM200/60</th>
<th>ERM500/60</th>
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</thead>
<tbody>
<tr>
<td>e (mm)</td>
<td>Thickness of the piece to hold</td>
<td>503</td>
<td>440</td>
<td>397</td>
<td>310</td>
<td>400</td>
<td>400</td>
<td>310</td>
<td>400</td>
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<td>1</td>
<td>141</td>
<td>112</td>
<td>102</td>
<td>75</td>
<td>50</td>
<td>125</td>
<td>140</td>
<td>112</td>
<td>102</td>
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<tr>
<td>3</td>
<td>278</td>
<td>260</td>
<td>240</td>
<td>180</td>
<td>150</td>
<td>200</td>
<td>240</td>
<td>200</td>
<td>150</td>
</tr>
<tr>
<td>6</td>
<td>557</td>
<td>520</td>
<td>480</td>
<td>360</td>
<td>270</td>
<td>400</td>
<td>557</td>
<td>520</td>
<td>480</td>
</tr>
<tr>
<td>P at 20ºC (W)</td>
<td>10</td>
<td>14</td>
<td>18</td>
<td>30</td>
<td>45</td>
<td>53</td>
<td>45</td>
<td>60</td>
<td>65</td>
</tr>
</tbody>
</table>

Table 2
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 mooring face)

**IMPORTANT:** Under demand orders can be delayed in the delivery
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 lose 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 (130ºC)
Standard voltage: 24VDC
Standard duty cycle: ED100%
Different voltage, ED or size: Consult

<table>
<thead>
<tr>
<th>TYPE</th>
<th>øA (-0,3)</th>
<th>B</th>
<th>C±0.1</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>Weight(Kg)</th>
</tr>
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<tbody>
<tr>
<td>VM20</td>
<td>20</td>
<td>M-3</td>
<td>25</td>
<td>5</td>
<td>---</td>
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<td>0.04</td>
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<tr>
<td>VM25</td>
<td>25</td>
<td>M-4</td>
<td>27</td>
<td>5</td>
<td>---</td>
<td>40</td>
<td>0.06</td>
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<td>VM30</td>
<td>30</td>
<td>M-4</td>
<td>28</td>
<td>5</td>
<td>---</td>
<td>45</td>
<td>0.17</td>
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<td>VM40</td>
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<td>M-5</td>
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<td>---</td>
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<td>0.24</td>
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<td>---</td>
<td>65</td>
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<td>112</td>
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<td>147</td>
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<td>M-16</td>
<td>65</td>
<td>15</td>
<td>197</td>
<td>165</td>
<td>6.60</td>
</tr>
</tbody>
</table>

Flying leads for every size
Supply possibilities under demand:
With campling screw from the VM25
With connector from the VM65.
The connector (1) has 4 possibilities of direction (4x90º) and it is possible to be incorporated to the same diodes of rectification for alternating current connection (AC).

Important: the clamping screw does not have to exceed measure D

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 A²St37, thickness as shown in the table 2 and dimensions are similar or bigger than the attraction face.
- Room temperature 35ºC.
- 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 documents 1.4 & 1.5
- Under demand: any size, voltage, duty cycle etc can be manufactured.

![Image](image_url)

Table 2

<table>
<thead>
<tr>
<th>TYPE</th>
<th>P at 20ºC (W)</th>
<th>Thickness of the piece to hold (mm)</th>
<th>Air gap (mm)</th>
<th>Fm (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VM20</td>
<td>2.6</td>
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<td>5.2</td>
</tr>
<tr>
<td>VM30</td>
<td>4.5</td>
<td>1</td>
<td>0.2</td>
<td>5.5</td>
</tr>
<tr>
<td>VM40</td>
<td>7</td>
<td>1</td>
<td>0.3</td>
<td>6.0</td>
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<tr>
<td>VM50</td>
<td>10</td>
<td>1</td>
<td>0.4</td>
<td>6.5</td>
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<tr>
<td>VM65</td>
<td>14</td>
<td>1</td>
<td>0.5</td>
<td>7.0</td>
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<td>VM80</td>
<td>18</td>
<td>1</td>
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<td>8.0</td>
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<td>VM100</td>
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<td>9.0</td>
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<td>VM150</td>
<td>45</td>
<td>1</td>
<td>0.8</td>
<td>10.0</td>
</tr>
</tbody>
</table>

Important: the clamping screw does not have to exceed measure D
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.

### Table 1

<table>
<thead>
<tr>
<th>TYPE</th>
<th>øA (-0.3)</th>
<th>B</th>
<th>C(±0.1)</th>
<th>D</th>
<th>E</th>
<th>Weight(Kg)</th>
</tr>
</thead>
<tbody>
<tr>
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<td>20</td>
<td>M-3</td>
<td>25</td>
<td>5</td>
<td>26</td>
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<tr>
<td>VM 30/ND</td>
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<td>M-4</td>
<td>32.5</td>
<td>6</td>
<td>35.2</td>
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<td>M-5</td>
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<td>M-5</td>
<td>42.8</td>
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</tr>
<tr>
<td>VM 65/ND</td>
<td>65</td>
<td>M-8</td>
<td>45.5</td>
<td>8</td>
<td>67</td>
<td>0.74</td>
</tr>
<tr>
<td>VM 100/ND</td>
<td>100</td>
<td>M-10</td>
<td>67</td>
<td>10</td>
<td>102</td>
<td>3.00</td>
</tr>
<tr>
<td>VM 150/ND</td>
<td>150</td>
<td>M-16</td>
<td>65</td>
<td>15</td>
<td>152</td>
<td>7.10</td>
</tr>
</tbody>
</table>

### Table 2

<table>
<thead>
<tr>
<th>TYPE</th>
<th>P  (W)</th>
<th>ED  (%)</th>
<th>Minimum pulse time (ms)</th>
<th>Resting time (ms)</th>
<th>e (mm)</th>
<th>Air gap (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VM20/ND</td>
<td>10</td>
<td>20</td>
<td>24</td>
<td>180</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>VM30/ND</td>
<td>25</td>
<td>20</td>
<td>110</td>
<td>825</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>VM40/ND</td>
<td>42</td>
<td>15</td>
<td>75</td>
<td>743</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>VM50/ND</td>
<td>48</td>
<td>15</td>
<td>120</td>
<td>1188</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>VM65/ND</td>
<td>80</td>
<td>15</td>
<td>225</td>
<td>2228</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>VM100/ND</td>
<td>75</td>
<td>25</td>
<td>150</td>
<td>1500</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>VM150/ND</td>
<td>77</td>
<td>40</td>
<td>285</td>
<td>1070</td>
<td>1</td>
<td>10</td>
</tr>
</tbody>
</table>

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 (3. m rugosity) in AºSt37, thickness as shown in the table 2 and dimensions are similar or bigger than the attraction face.
- Room temperature 35ºC.
- 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 documents 1.4 & 1.5

**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

**Protection rate:** IP65
Insulation class: Y (90ºC)
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

**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

**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--/ND --V ED----%
Example 1: VM50/ND : Standard voltage : 24Vdc ; Duty cycle : ED15% ; Ref.: VM50/ND 24Vdc ED15%
Example 2: VM50/ND with protection ; Standard voltage : 24Vdc ; Duty cycle : ED15% ; Ref.: VM50/ND_WP 24Vdc ED15%
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 (90ºC)  
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 documents 1.4 & 1.5

---

**Table 1**

<table>
<thead>
<tr>
<th>Thickness of the piece to hold (mm)</th>
<th>Air gap (mm)</th>
<th>Magnetic Force Fm (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.1</td>
<td>0.2</td>
</tr>
<tr>
<td>1</td>
<td>250</td>
<td>210</td>
</tr>
<tr>
<td>3</td>
<td>1350</td>
<td>1250</td>
</tr>
<tr>
<td>6</td>
<td>2350</td>
<td>2000</td>
</tr>
<tr>
<td>10</td>
<td>2800</td>
<td>2450</td>
</tr>
<tr>
<td>18</td>
<td>3000</td>
<td>2550</td>
</tr>
</tbody>
</table>

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 kilos (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 (3µm rugosity) in AºSt37, thickness as shown in the table 2 and dimensions are similar or bigger than the attraction face.  
- Room temperature 35ºC.  
- 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%**
BP1000/100 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 ø120 mm y ø250 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 loses the piece. When working with loads security norms must be respected.

- Protection rate: IP65
- Insulation class: B (130ºC)
- Standard voltage: 24Vdc
- Standard duty cycle ED: 100%
- Abs. power at 20ºC: 217 W
- Temperature rise "△V31" 40ºC
- Solenoid weight: 47 Kg

**Maximum keeping force**

<table>
<thead>
<tr>
<th>ø Round bar (mm)</th>
<th>Force N/mm</th>
<th>Force N (for bar =&gt; 1000mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ø120-ø200</td>
<td>5.4</td>
<td>5400</td>
</tr>
<tr>
<td>ø250</td>
<td>8</td>
<td>8000</td>
</tr>
</tbody>
</table>

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.

**General dimensions**

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.

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---%

Example: Standard voltage: 24Vdc Duty-cycle: ED100%: BP1000/100 24Vdc ED100%
TP10V36A1 TYPE

These timers control the opening and closing of feeding electromagnet. They have two operation ways:
1) Cyclic: Two possibilities at scheduled time, ON-OFF and OFF-ON.
2) Simple: Two possibilities at scheduled time, ON and OFF.

**Standard voltage:** from 7 to 36VDC  
**Maximum intensity:** 1A  
**Adjustable time:** from 1 sec until 99h59min59sec  
**Work temperature range:** -10ºC to 50ºC  
**Protection rate IP:** IP65 mounted on base of connector DIN43650A

---

**Screen**

First two figures (beginning by the left) represent the hours, next two figures are the minutes and the last two are the seconds.
- **MODE:** Menu setting key.
- **ADD:** increases the time
- **DEC:** decrease the time
- **RESET:** Key for reset and test.
  - If it is pressed when stopping: Reset and starts to work.
  - If it is pressed when working: tests if it works properly.
- **IND:** light on indicate ON and light off indicates OFF.

**Timer Setting:**

1. Feed at standard voltage.
2. Press MODE: the display shows (00.00.00), it's setted on stop mode.
3. Press MODE: display screen shows (CLOSE) 4-Press MODE: set the opening time using ADD and DEC buttons.
4. Press MODE: display screen shows (OPEN) 6- Press MODE: set the opening time using ADD and DEC.
5. Press MODE: We begin setting working mode. Using ADD and DEC buttons we can use four working modes:
   - ON (the electromagnet is under voltage during OPEN time, and then it is disconnected until reset).
   - OFF (the electromagnet is not under voltage during CLOSE time and then it is connected until reset).
   - ON-OFF (the electromagnet works in a ON-OFF cycle until reset).
   - OFF-ON (the electromagnet works in a OFF-ON cycle until reset).
6. Once setted the working mode it must we confirmed by pussing MODE.
7. RESET: Press RESET or stop power voltage supply.

**Voltage feeding face:** 7 to 36VDC (it does not require polarization).

**Warning:** Do not connect the electromagnet to these terminals.

It is possible to be mounted in combination with electrical economizer EEC40-24-50 (See document A.1)

**Ordering code:** TP10V36A1
TP20V240A1 TYPE

This timer is a control for opening and closing of the voltage supply on the electromagnets. It works in a cyclical ON-OFF mode.

OPERATING MODE: When feeding the electromagnet through the timer, it is under voltage the time show in the on key. After this time the voltage on the electromagnet will be cut during the time show in the off key. This cycle will be repeated indefinitely. When the voltage in turned off the cycle begins again.

**Standard voltage:** 24 a 240 VDC/VAC (50-60Hz)
**Maximum intensity:** 1A
**Time ON:** 0.5 to 10 seconds
**Time OFF:** 0.5 to 45 minutes
**Duty cycle ED%:** 100%
**Working temperature:** -10ºC to 50ºC
**Protection rate IP:** IP65 mounted on base of connector DIN43650A

**Warning:** Do not connect the electromagnet to these terminals.

**Voltage entrance face (Polarization no required):**

It is possible to be mounted in combination with economizer EEC40-24-50 (See document A.1)

**Ordering code:** TP20V240A1
TYPE:EES24V3/0.8A

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 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.

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: -25ºC to 75ºC
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, ER100/35, ER150/35, ER200/35, ER400/35, ERM100/35, ERM150/35, ERM200/60

* Before purchasing ask NAFSA’s technical department, because the coils usually need to be adjusted for the coordinated work between the solenoid and the electronic plate.

Supply options:
Option 1 (O1): Electronic plate individually
Option 2 (O2): Board integrated in the in a wiring subset and protected with a plastic overmolding.

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**

**Working instructions and electrical connection:**

1) The electrical connection will be detailed in the following points.

2) Take out the screw between the connector and the base.

3) Take off the connector pulling it up.

4) Take off the rubber piece.

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 1.** Connector base mounted on the solenoid, must not be manipulated.

**Figure 2.**

**Figure 3.**

**Figure 4.**

**Figure 5.**

**Figure 6.**

**Figure 7.**

**Figure 8.**

**Figure 9.**

---

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:

---

Coil

---
1) The electrical connection will be detailed in the following points.

2) Take out the screw between the connector and the base.

3) Take off the connector pulling it up.

4) Take off the rubber piece.

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.

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.
Working instructions and electrical connection:

1) The electrical connection will be detailed in the following points.

2) Take out the screw between the connector and the base.

3) Take off the connector pulling it up.

4) Take off the rubber piece.

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 1. Connector

Figure 2. Connector base mounted on the solenoid, must not be manipulated.

Figure 3.

Figure 4.

Figure 5.

Figure 6.

Figure 7.

Take out the screws, take in the supply cables in the power terminals and screw them again.

Figure 8.

Electric diagram

Wiring diagram between the coil and the connector base

Figure 9.
## 2P+T/C/4D

### Working instructions and electrical connection:

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Connector</strong></td>
<td><strong>Connector base</strong> mounted on the solenoid, must not be manipulated.</td>
<td></td>
</tr>
<tr>
<td>Figure 1.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) The electrical connection will be detailed in the following points.

2) Take out the screw between the connector and the base.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Figure 2.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3) Take off the connector pulling it up.

4) Take off the rubber piece.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Figure 3.</td>
<td>Figure 4.</td>
<td>Figure 5.</td>
</tr>
</tbody>
</table>

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.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Figure 6.</td>
<td>Figure 7.</td>
<td>Figure 8.</td>
</tr>
</tbody>
</table>

Take out the screws, take in the supply cables in the power terminals and screw them again.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Figure 9.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Electric diagram**

Wiring diagram between the coil and the connector base.
**2P+T/4D**

**Working instructions and electrical connection:**

1) The electrical connection will be detailed in the following points.

2) Take out the screw between the connector and the base.

3) Take off the connector pulling it up.

4) Take off the rubber piece.

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.

Take out the screws, take in the supply cables in the power terminals and screw them again.

**Figure 1.**

**Figure 2.**

**Figure 3.**

**Figure 4.**

**Figure 5.**

**Figure 6.**

**Figure 7.**

**Figure 8.**

**Electric diagram**

**Wiring diagram between the coil and the connector base.**

**Figure 9.**
## 3P+T

### Working instructions and electrical connection:

1) The electrical connection will be detailed in the following points.

2) Take out the screw between the connector and the base.

3) Take off the connector pulling it up.

4) Take off the rubber piece.

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 1](image1.png) Connector base mounted on the solenoid, must not be manipulated

![Figure 2](image2.png) Connector

![Figure 3](image3.png) PG11

![Figure 4](image4.png) Take out the screw between the connector and the base.

![Figure 5](image5.png) Take off the connector pulling it up.

![Figure 6](image6.png) Take off the rubber piece.

![Figure 7](image7.png) Remove the inner piece, this one has power terminals.

![Figure 8](image8.png) Take out the screws, take in the supply cables in the power terminals and screw them again.

![Figure 9](image9.png) Wiring diagram between the coil and the connector base

![Figure 10](image10.png) Coil 1 under voltage

![Figure 11](image11.png) Coil 2 under voltage
## 2P+T/G

### Working instructions and electrical connection:

<table>
<thead>
<tr>
<th>Step</th>
<th>Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1)</td>
<td>The electrical connection will be detailed in the following points.</td>
</tr>
<tr>
<td>2)</td>
<td>Take out the screw between the connector and the base.</td>
</tr>
<tr>
<td>3)</td>
<td>Take off the connector pulling it up.</td>
</tr>
<tr>
<td>4)</td>
<td>Take off the rubber piece.</td>
</tr>
<tr>
<td>5)</td>
<td>Take off the lid.</td>
</tr>
<tr>
<td>6)</td>
<td>Remove the interior piece, which has the power terminals.</td>
</tr>
<tr>
<td>7)</td>
<td>Remove the electronic</td>
</tr>
<tr>
<td>8)</td>
<td>Take off the stuffing box</td>
</tr>
<tr>
<td>9)</td>
<td>Connect the supply cables</td>
</tr>
</tbody>
</table>

**Figure 1.** Connector base mounted on the solenoid, must not be manipulated

**Figure 2.**

**Figure 3.**

**Figure 4.**

**Figure 5.**

**Figure 6.**

**Figure 7.**

**Figure 8.**

**Figure 9.**

**Figure 10.**

Wiring diagram between the coil and the connector base.

1. Take out the screws, take in the supply cables in the power terminals and screw them again.
2P+T/G/4D

Working instructions and electrical connection:

1) The electrical connection will be detailed in the following points.

2) Take out the screw between the connector and the base.

3) Take off the connector pulling it up.

4) Take off the rubber piece.

5) Take off the lid.

6) Remove the interior piece, which has the power terminals.

7) Remove the electronic plate.

8) Take off the stuffing box.

9) Connect the supply cables.

Take out the screws, take in the supply cables in the power terminals and screw them again.

Electric diagram

Wiring diagram between the coil and the connector base
2P+T/E

Working instructions and electrical connection:

1) The electrical connection will be detailed in the following points.

2) Take out the screw between the connector and the base.

3) Take off the connector pulling it up.

4) Take off the rubber piece.

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.

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
1- Protection for the electromagnetic compatibility (to avoid voltage peaks)

Our products don’t need to fulfil the Directive of electromagnetic compatibility 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

2- Thermal protection:

The thermic resettable polyswitches 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.
In this document there are some samples of terminals and connectors used very often in NAFSA production when a product has to be customized, if you don’t find on it the terminal you need, we suggest you to contact us and inquiry about the possibility of mounting your desired terminal or connector. We will inform you about the flexibility and the minimum order quantity.

### Quick connection terminals

<table>
<thead>
<tr>
<th>Pre-insulated receptables</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2.8x0.5</td>
</tr>
<tr>
<td></td>
<td>2.8x0.8</td>
</tr>
<tr>
<td></td>
<td>4.8x0.8</td>
</tr>
<tr>
<td></td>
<td>6.3x0.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pre-insulated tabs</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2.8x0.5</td>
</tr>
<tr>
<td></td>
<td>2.8x0.8</td>
</tr>
<tr>
<td></td>
<td>4.8x0.8</td>
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<tr>
<td></td>
<td>6.3x0.8</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Fully insulated receptables</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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### End sleeves

<table>
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<tr>
<th>Preinsulated end sleeves</th>
<th>Dimensions</th>
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<tr>
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<td>Ø1.5</td>
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<tr>
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<td>Ø2.5</td>
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<td>Ø4.0</td>
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<tr>
<td></td>
<td>Ø6.0</td>
</tr>
</tbody>
</table>

### Wire to wire connectors

- Quick connection tab housing
- TE Mate n´lock series
- Molex Microfit series
- M8-M12 connector systems
- Molex Minifit series
- AMP Superseal series

### Wire to board connectors

- JST PH series
- JST VH series
- 2.54 Crimp housing

Possibility of adapt these terminals and connectors to all our products with leads, such as: ER, ERC, CU, ECM, ERB, ECI, ERDI, VEM, VM and VM/ND series. If any other terminal or connector is needed, please ask us.
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 custom:**

- **ECC90-10/E**
- **VM135/E**
- **VM30/ECP**
- **ECM20**
- **NER200**
- **ECM16**
- **VMG45**
- **LABVEM150**

And much more ...
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Tel. +34 944531061
Fax. +34 946250151
E-mail: elec@nafsa.es
http://www.nafsa.es

- MANUFACTURING PLANT:

IMA NAFSA CHINA CO.LTD.
Yinzhou Investment and bussiness Industrial
Ningbo 315104 - China
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Email: elec@nafsa.es

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Email: info@oem.fi
www.oem.fi

(Sweden)
OEM-Motor AB
Tel. +46 (0) 75-242 44 00
Email: info@motor.oem.se
www.oemmotor.se