VALUE-ADDED ASSEMBLIES

EM-PRODUCTS

STANDARD, SPECIALTY AND CUSTOM SOLENOIDS, ELECTROMECHANICAL AND ELECTROMAGNETIC DEVICES, VALUE-ADDED ASSEMBLIES

A leading manufacturer of Electromechanical Devices—Magnet-Schultz of America (MSA) provides advanced engineering, innovative design and high manufacturing capacity for a diverse list of customers and industries.

Through collaborative innovation, every MSA product is available to our customers as a completely unique, custom solution. Performance characteristics and design specifications including size/shape, mounting style, magnetic force and power consumption are all tailored to precisely meet customer requirements.

Our sophisticated Solenoid designs and optional complete sub-assemblies, provide endless variations, tailored solutions that enable us to create our customers' products to outperform their competition.

MSA's experienced design team and skilled support services, coupled with our own in-house manufacturing and assembly operations, provide the flexibility needed to respond to even the most challenging technical and commercial requirements, while meeting customer expectations relative to performance, cost, delivery and quality.

Partnering with MSA Ensures:
- Innovative ideas and cost-effective designs
- Superior, consistent quality and reliability
- Timely projects that are completed to specification
- Globally competitive value

To learn more about our company history, capabilities and custom project offerings, contact Magnet-Schultz of America today.

ELECTROMECHANICAL SOLENOIDS

Full-frame standard Solenoid products include eleven different C-Frame, nineteen different D-Frame and ten different Tubular assemblies, providing a broad range of force and stroke capabilities (see specifications below). To precisely meet the requirements of customers and industries, we have innovatively modified standard designs, including adaptations to the plunger, winding, duty cycle, and/or input power.

C-Frame Solenoids—provide the greatest economic value, while offering at the same time magnetic performance levels.

D-Frame Solenoids—offer moderate design complexity and price point, exchange magnetic efficiency and performance.

Tubular Solenoids—provide the greatest economic efficiency and performance.

Fully Custom Solenoids—MSA custom designs and manufactures fully custom Electromechanical Solenoids, for those applications that require a precise size or performance that cannot be achieved by our standard designs.

Electromagnets

Our collaboration innovation process helps determine whether a standard, modified or completely unique Electromagnetic device is required—depending on the needs of the application. This approach saves money, time and resources while meeting the most demanding challenges.

ELECTROMAGNET STANDARD SIZE SPECIFICATIONS

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Holding Force (N/LB)</th>
<th>Coil Power (W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 / 6</td>
<td>230 / 51.7</td>
<td>4.0</td>
</tr>
<tr>
<td>32 / 1</td>
<td>130 / 29.2</td>
<td>2.0</td>
</tr>
<tr>
<td>30 / 1.5</td>
<td>350 / 76.9</td>
<td>6.0</td>
</tr>
<tr>
<td>30 / 2</td>
<td>450 / 101.9</td>
<td>8.0</td>
</tr>
<tr>
<td>30 / 3</td>
<td>700 / 157.3</td>
<td>12.0</td>
</tr>
<tr>
<td>30 / 4</td>
<td>1,000 / 224.8</td>
<td>17.0</td>
</tr>
<tr>
<td>30 / 5</td>
<td>1,500 / 347.9</td>
<td>23.0</td>
</tr>
</tbody>
</table>

VOICE COILS

MSA provides low-cost, high performance voice coil actuators, capable of latching and unlatching at extremely high speed, precise linear motion and minimal hysteresis. Our EM Products team fully customizes their voice coil designs to achieve desired characteristics:
- Micromotion—voice coil featuring high-impact force, alternating high-low current
- Linear (L) voice coil resistant to high-impact force

VALUE-ADDED ASSEMBLIES

MSA is capable of customizing Electromechanical functionality into more compact assemblies. Based on the needs of the application, this approach saves money, time and resources while meeting the most demanding challenges.

ELECTROMAGNETS

Our collaboration innovation process helps determine whether a standard, modified or completely unique Electromagnetic device is required—depending on the needs of the application. This approach saves money, time and resources while meeting the most demanding challenges.

ELECTROHYDRAULIC applications—Magnet-Schultz of America (MSA) provides advanced engineering, innovative design and high manufacturing capacity for a diverse list of customers and industries.

While collaborative innovation, every MSA product is available to our customers as a completely unique, custom solution. Performance characteristics and design specifications including size/shape, mounting style, magnetic force and power consumption are all tailored to precisely meet customer requirements.

For example, customers and industries, we have innovatively modified standard designs, including adaptations to the plunger, winding, duty cycle, and/or input power.

Fully Custom Solenoids—MSA custom designs and manufactures fully custom Electromechanical Solenoids, for those applications that require a precise size or performance that cannot be achieved by our standard designs.

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MAGNETIC LATCHING (ML) PRODUCTS

For engineering applications—demand magnetic holding (functionally continuous) without continuously applying electrical power. MSA provides low-cost, fully custom magnetic latch products.

For applications requiring a simple, manually controlled on/off switch, magnetic latch products are available as well.

Magnetic Latching Solenoids

MSA Solenoids are capable of latching and unlatching at extremely high speed, precise linear motion and minimal hysteresis. These assemblies help eliminate potentially problematic tasks such as the customer and industries more complex control solutions.

MSA can provide the magnetic design and complete design assistance, as well as manufacture and test the complete assembly.

Learn more about MSAs customizable Electromechanical product families—visit Magnet-SchultzAmerica.com, or contact us directly at 630.789.0600.
EM-PRODUCTS

STANDARD, SPECIALTY AND CUSTOM SOLENOIDS, ELECTROMECHANICAL AND ELECTROMAGNETIC DEVICES, VALUE-ADDED ASSEMBLIES

A leading manufacturer of Electromechanical Devices—ranging Electromechanical and Electromagnetic applications—Magnet-Schultz of America (MSA) provide advanced engineering, innovative design and high manufacturing capabilities for a diverse list of customers and industries.

Through collaborative innovation, every MSA product is available to suit our customers via a completely unique, custom solution. Performance characteristics and design specifications including coil, frame, mounting, ratio, magnetic force and power consumption are all tailored to precisely meet customer requirements.

Our sophisticated Solenoid design and optional complete assemblies, provide: smaller, lighter, higherflow, longerlife solutions that enable our customers and products to outperform their competition.

MSA’s experienced design team and skilled support services, coupled with our lean manufacturing and vertical integration provide the flexibility needed to respond to ever changing technical and commercial requirements, while meeting customer expectations. Relative to performance, cost, delivery and quality.

Partnering with MSA Exceeds:

• Innovative ideas and cost effective designs.
• Superior, consistent quality and reliability.
• Timely projects that are completed to specification.
• Globally competitive value.

To learn more about our company history, capabilities and custom product offerings, visit Magnet-Schultz of America today.

ELECTROMECHANICAL SOLENOIDS

Our three standard solenoid sizes of groups include different C-Frame, square D-Frame and the Tubular variants, providing a broad range of force and stroke capacities (see specifications below). To precisely meet the requirements of customer applications and budgets, our highly skilled in-house design engineers, along with in-house engineering services, are poised to meet the most stringent performance characteristics and/or method of electrical connections. Other voice characteristics are greatly enhanced by changing the coil wrapping, slot width, plate size, and core length.

C-Frame Solenoids—provide the greatest economic value, while operating at the most basic magnetic performance level.

D-Frame Solenoids—offer moderate design complexity, and point price, moderate magnetic efficiency and performance.

Tubular Solenoids—offer complete design flexibility, providing the highest magnetic efficiency and performance.

Fully Custom Solenoids—MSA products designs and manufacturing flexibility, custom Electromechanical Solenoids, for those applications that require a production size or stroke that can’t be tolerated by our standard designs.

VALVE COILS

MSA’s valve coils lend itself to the continuous process of permanent magnets with the intermittent actuation of an electromagnetic coil to achieve high speed, precise linear motion and reliability.

The MSA’s Valve Coils are fully custom, and can be in two design architectures:

• Motion Actuators—dual moving beads, alternating low inertial value.
• Swing Coil—under response beads and high responsiveness.

ELECTROMAGNETS

Our collaborative innovation process helps determine whether a standard, modified or completely custom Electromagnetic coil fits the desired performance and cost efficiencies, typical applications include: Industrial devices for medical imaging equipment, vehicle brakes, door locking and fire door release mechanisms.

ELECTROMAGNET STANDARDS AND SPECIFICATIONS

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Building Coil (W)</th>
<th>Pull Force</th>
<th>Voice Coils</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 / 0.6</td>
<td>1,200 / 157.3</td>
<td>9.8</td>
<td>130 / 2.5</td>
</tr>
<tr>
<td>32 / 1</td>
<td>1,500 / 190.5</td>
<td>12.0</td>
<td>150 / 3.5</td>
</tr>
<tr>
<td>35 / 1.5</td>
<td>1,850 / 269.8</td>
<td>17.0</td>
<td>175 / 4.5</td>
</tr>
</tbody>
</table>

VOICE COILS

These durable low-costs lend the continuous process of permanent magnets for the intermittent actuation of an electromagnetic coil to achieve high speed, precise linear motion and reliability. The MSA’s Voice Coils are fully custom, and can be in two design architectures:

• Motion Actuators—dual moving beads, alternating low inertial value.
• Swing Coil—under response beads and high responsiveness.

VALUE-ADDED ASSEMBLIES

MSA’s capability of incorporating electromagnetics functionality into each unique assembly, based on the needs of the application, this approach can cost anywhere between 5% and functional challenges with the customers and product. These applications identify electromagnetically powered products that suit the customer’s needs more cost-efficiently.

MSA’s product is the magnet design and complete design assistance, as well as manufacturing and test the complete assembly.

Learn more about MSA’s customizable Electromechanical product families—visit Magnet-SchultzAmerica.com, or contact us directly at 630.789.0600.
EM-PRODUCTS

STANDARD, SPECIATLY AND CUSTOM SOLENOIDS, ELECTROMECHANICAL AND ELECTROMAGNETIC DEVICES, VALUE-ADDED ASSEMBLIES

A leading manufacturer of Electromechanical Devices—serving Electromechanical and Electromagentic applications—Magnet-Schultz of America (MSA) provides advanced engineering, innovative design and two-manufacturing capabilities for a diverse list of customers and industries.

Through collaborative innovation, every MSA product is available to suit customers on a completely unique, custom solution. Performance characteristics and design specifications including size/shape, operating speed, magnetic force and power consumption are all tailored to precisely meet customer requirements.

Our sophisticated Solenoid designs and optional complete sub-assemblies, provide an endless variety of combinations that enable our customers’ end products to outperform their competition.

MSA’s experienced design team and skilled support services, coupled with our lean manufacturing and vertical integration provide the flexibility needed to respond to ever-changing technical and commercial requirements while meeting customer expectations relative to performance, cost, delivery and quality.

Partnersing with MSA ensures:

• Innovative ideas and cost-effective designs
• Superior, consistant quality and reliability
• Timely projects that are completed to specification
• Globally competitive value

To learn more about our company history, capabilities and custom product offerings, contact Magnet-Schultz of America today.

ELECTROMECHANICAL SOLENOIDS

MSA’s three standard Solenoid product groups include the following C-frame, moving armature D-frame, and the Tubular series, providing a standard range of force and stroke capabilities (see specifications below). To precisely meet the requirements of customer applications and budgets, we have recently added several standard models, including electromagnetic designs, to fit the growing market’s changing specifications and need of electrical connections. Other design characteristics are greatly enhanced by changing the coil winding, coil shape, end caps and power consumption.

C-frame Solenoids—provide the greatest economic value, while operating at the most basic magnetic performance level.

D-frame Solenoids—offer moderate design complexity and price point, exchange magnetic efficiency and performance.

Tubular Solenoids—provide the highest magnetic efficiency and performance in a very small physical space, and can provide a high impact force with very high operating and actuating forces. MSA’s electromechanical series are available in three manufacturing processes—fully custom, MSA standard designs or custom modified MSA standard designs. To those applications that require a package size or performance level that cannot be satisfied by our standard designs.

FULLY CUSTOM SOLENOIDS

MSA’s custom designs and complete sub-assemblies, fully custom Electromechanical Solenoids, for those applications that require a package size or performance level that cannot be satisfied by our standard designs.

<table>
<thead>
<tr>
<th>SOLENOID TYPE</th>
<th>SIZE RANKER</th>
<th>DIMENSIONS (LxWxH)</th>
<th>MAX SPEED</th>
<th>MAX FORCE PER FORCE</th>
<th>COIL POWER</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-frame (C)</td>
<td>2.75 / 0.69</td>
<td>12 / 7 / 4</td>
<td>10 / 5 / 2.2</td>
<td>12 / 5 / 3.5 / 6</td>
<td></td>
</tr>
<tr>
<td>D-frame (B)</td>
<td>2.75 / 0.69</td>
<td>12 / 7 / 4</td>
<td>10 / 5 / 2.2</td>
<td>12 / 5 / 3.5 / 6</td>
<td></td>
</tr>
<tr>
<td>Tubular</td>
<td>3.5 / 0.8</td>
<td>10 / 5 / 2.2</td>
<td>10 / 5 / 2.2</td>
<td>12 / 5 / 3.5 / 6</td>
<td></td>
</tr>
</tbody>
</table>

VOICE COILS

The DC coil is the basis for the continuous process of permanent magnets with the intermittent activation of an electromagnetic coil to achieve high speed, precision linear motion and extremely long life. MSA’s voice coils are fully custom, and come in two basic design architectures:

• “Moving Armature” voice coil, moving at low current speeds.
• “W raining” coil, with current speeds and high instantaneous currents.

ELECTROMAGNETS

Our collaborative innovation process helps determine whether a standard, modified or completely custom Electromagnet will provide the desired performance and cost efficiencies required. Typical applications include stabilizer devices for medical imaging equipment, clutch/brake mechanisms, door locking and fire door release mechanisms.

LISTED size specifications

<table>
<thead>
<tr>
<th>ELECTROMAGNET STANDARD SIZE SPECIFICATIONS</th>
<th>Nominal Diameter</th>
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<tr>
<td>30 / 0.8</td>
<td>100 / 4</td>
<td>2.0</td>
<td></td>
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<tr>
<td>32 / 0.8</td>
<td>100 / 4</td>
<td>3.0</td>
<td></td>
</tr>
<tr>
<td>38 / 1.3</td>
<td>175 / 5</td>
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<td></td>
</tr>
<tr>
<td>40 / 1.4</td>
<td>175 / 5</td>
<td>8.0</td>
<td></td>
</tr>
<tr>
<td>45 / 1.5</td>
<td>250 / 5</td>
<td>12.0</td>
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VALUE-ADDED ASSEMBLIES

MSA is capable of customizing electromagnetic functionality into more complete assemblies. Based on the results of the application, this approach can cover demanding forms, fit and functional challenges with the standard electromagnet product. These assemblies help eliminate potentially problematic parts in the customer’s end products and therefore decrease component costs. MSA can provide the magnetic design and complete design assistance, as well as manufacture and test the complete assembly.

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