



# Solenoids

## Design Considerations

### BTA® Brushless Torque Actuators

#### Rugged

The BTA design eliminates the axial travel associated with conventional rotary actuators. In so doing, the BTA eliminates loading on associated mechanical linkages, and reduces the number of moving parts and the wear they receive. The BTA is self-contained in an industry standard size which enables easy mounting and interchangeability. The unit is permanently lubricated and requires no adjustment or maintenance over its entire life.

#### Powerful . . . with Less Power

The BTA actuator offers considerably more torque than comparable sized rotary actuator designs.

Even with its high torque output, the BTA requires 40% less power input than competitive units. On high volume applications such as this mail sorter, the BTA conserves as much as 18.9 watts per actuator cycle.

#### Quiet

The BTA can operate virtually noise free. Electronically controlled, the BTA provides soft, shock-free cycling without the noise associated with end-of-stroke mechanical stops.

For machines such as automated, high speed mail sorters which utilize hundreds of BTA actuators per machine, the BTA is used in conjunction with cushioned external stops to minimize noise, and extend the unit's life to that of the precision ball bearings.

#### Rapid Cycling

The BTA actuator requires only milliseconds to rotate through its entire stroke. It can maintain this extremely fast operating speed repetitively without diminishing accuracy or repeatability, or reducing the overall life of the unit.

#### Duty Cycle

Duty cycle is determined by: ON time/(ON + OFF time).

For example: an actuator operated for 30 seconds, then off for 90 seconds.

$$30 \text{ sec ON} / (30 \text{ Sec ON} + 90 \text{ sec OFF}) = 30/120 = 1/4 \text{ or } 25\% \text{ duty cycle}$$

BTA actuators are rated for various duty cycles ranging from continuous to 10% duty.

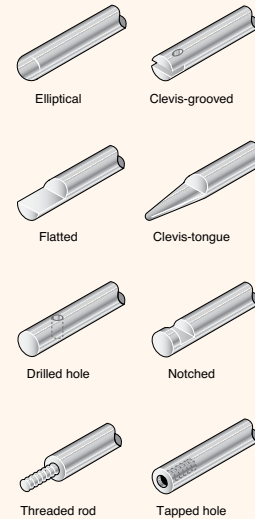
#### Life

When selecting a BTA actuator, as with any other style, it is important to consider the effects of heat on life. When used with a constant voltage supply, an increase in coil temperature reduces the work output and the life of the unit. Standard life is more than 100,000,000 cycles.

#### Power Requirements

Voltage applied to the actuator must be matched to the coil wire size for proper operation. Actuators are cataloged in coil awgs ranging from #23 up to #35 to accommodate your input power. Refer to the individual model specification pages for coil wire awg recommendations. Many other coil awg sizes are available. Please feel free to contact our application engineering department for availability.

#### Typical Examples of Custom Features



#### Options and Modified Designs

Even though our standard BTAs are in stock, our customers often require a product with unique features or performance capabilities. In fact, almost 80% of all products that we make are either modified or custom built to meet our customers' exact application requirements.

So, if you don't find what you're looking for in the catalog, give us a call to discuss your needs with one of our application engineers.



# Solenoids

## Design Considerations

### Ultimag® Rotary Actuators

Ultimag® offers a bidirectional, center return function not found in rotary solenoids. The Ultimag is substantially faster than other solenoids, and can be operated in an on/off mode or proportionally, in both open loop and closed loop systems.

The Ultimag does not offer 360° of rotation which is definitive of motors. With this stroke limitation in mind, Ultimag provides an inexpensive alternative for limited stroke applications, particularly, when total cost of system control is included.

Ultimag actuators offer a 45° stroke. However, the design is capable of a maximum stroke of 160°. Gears, belts, pulley, etc., can be employed to amplify stroke. In all cases, an increase in stroke will cause a reduction in torque.

For shorter strokes, electronic or mechanical stops can be used. By having a unit tooled to perform a specific stroke less than 45°, more torque will be obtained.

When adding the Ultimag to your application, the shaft must be supported to avoid stress fractures to the magnet.

#### Temperature Limitation

The permanent magnet in the Ultimag is NdFeB. For applications running above 130°C, we do not recommend the Ultimag, since the NdFeB magnets irreversibly degrade after reaching a 150°C temperature.

#### Duty Cycle

Duty cycle is determined by: ON time/(ON + OFF time).

For example: an actuator operated for 30 seconds, then off for 90 seconds.

$30 \text{ sec ON} / (30 \text{ Sec ON} + 90 \text{ sec OFF}) = 30/120 = 1/4 \text{ or } 25\% \text{ duty cycle}$

Ultimag actuators are rated for various duty cycles ranging from continuous to 10% duty.

#### Life

When selecting an Ultimag actuator, as with any other style, it is important to consider the effects of heat on life. When used with a constant voltage supply, an increase in coil temperature reduces the work output and the life of the unit. Standard life is more than 100,000,000 cycles.

#### Power Requirements

Voltage applied to the actuator must be matched to the coil wire size for proper operation. Actuators are cataloged in coil awgs ranging from #23 up to #35 to accommodate your input power. Refer to the individual model specification pages for coil wire awg recommendations. Many other coil awg sizes are available. Please feel free to contact our application engineering department for availability.

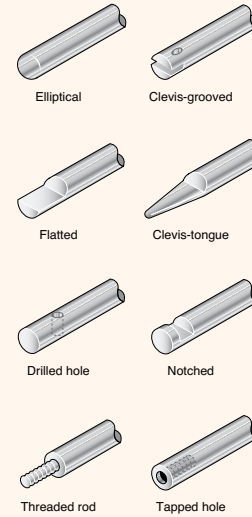
#### Options and Modified Designs

Even though our standard BTAs are in stock, our customers often require a product with unique features or performance capabilities. In fact, almost 80% of all products that we make are either modified or custom built to meet our customers' exact application requirements.

So, if you don't find what you're looking for in the catalog, give us a call to discuss your needs with one of our application engineers.

#### Typical Examples of Custom Features

##### Power Take Off





## Solenoids

### Design Considerations

#### Ledex® Rotary Solenoid Design Considerations

Ledex offers three rotary solenoid coil designs to accommodate most price and performance considerations.

##### Bobbin Wound Coil

Bobbin Coil Style solenoids (Sizes 3B and 5B only) offer good performance, long life and cost less than Precision Standard Coil Style solenoids. However, Bobbin Style solenoids provide somewhat less torque in a slightly taller package. Bobbin Style Solenoids are equipped with either solder lug terminals or lead wires.

- Manufactured by automated high-speed coil winding equipment for good performance and low cost
- Torque output up to 10 lb-in
- One million operations life rating (based on 25% duty cycle at 20°C ambient operating temperature)
- Standard strokes from 25°–110°; custom strokes available, some with one-time tooling charge
- Clockwise and counterclockwise rotation
- Wide variety of configurations to accommodate mounting and environmental considerations
- Many models available from distribution

##### Precision Standard Coil

Precision Standard Coil Style solenoids (Sizes 5S through 7S) are designed with precision wound coils to provide excellent performance and long life. Precision Standard solenoids are equipped with 10" PVC insulated lead wires.

- Precision wound coil for excellent torque to size ratio
- Available in standard or long life versions
- Torque output up to 47 lb-in
- One million operations life rating for standard versions; 50 million operations or 100 million operation if lubricated every 10 million operations for long life versions (life ratings based on 25% duty cycle at 20°C ambient operating temperature)
- Three sizes from 1-7/8" to 2-3/4" diameters
- Standard strokes from 25°–110°; custom strokes available, some with one-time tooling charge
- Clockwise or counterclockwise rotation
- Wide variety of configurations to accommodate mounting and environmental considerations
- Hundreds of models available from distribution

##### Precision Elongated Coil

Precision Elongated Coil Style solenoids (sizes 1E through 4E) also have precision-wound coils like our standard models, except the coil has 30% more copper. The larger coil enables Elongated styles to operate with additional torque at most power levels to provide an additional safety factor when compared to standard S style torque ratings. Consequently, Precision Elongated Coil Solenoids are generally recommended for applications which have relatively long duty cycle ON times. Precision elongated coils, in comparison to standard coils, weigh 20–25% more, have the same diameter and mounting configurations and are equipped with 10" PVC insulated lead wires.

- Built with 30% more coil copper than precision standard coil solenoids for lower power consumption
- Precision wound coil for excellent torque to size ratio

- Available in standard or long life versions
- Torque output up to 52 lb-in
- One million operations life rating for standard versions; 50 million operations or 100 million operations if lubricated every 10 million operations for long life versions (life ratings based on 25% duty cycle at 20°C ambient operating temperature)
- Four sizes from 1" to 1-9/16" diameters
- Standard strokes from 25°–110°; custom strokes available, some with one-time tooling charge
- Clockwise or counterclockwise rotation
- Wide variety of configurations to accommodate mounting and environmental considerations
- Many models available from distribution



# Solenoids

## Design Considerations

### Ledex® Rotary Solenoid Design Considerations (cont.)

#### Rotary Stroke Considerations

Determine whether clockwise or counterclockwise rotation (as viewed from the armature side, opposite the mounting studs) is required.

Match the stroke of the solenoid selected to the rotary stroke required for the application. For example: do not use a 45° stroke solenoid when only 35° of stroke is needed.

The complete rotary stroke of the solenoid should be utilized. It is the contour of the ball race that determines the torque output, but if the armature is not allowed to completely energize or de-energize, the starting torque and ending torque will deviate from the designed torque output.

In some applications, however, users of standard Ledex solenoids have achieved good results with certain

methods of restricting the rotary stroke. If some mechanical means is used to prevent the balls from reaching the deepest part of the races, increased life expectancy and quieter operation can be achieved. However, if the stroke is restricted, it is often necessary that some additional bearing method be employed to keep the balls in phase. Our application engineers will be glad to assist you with any unusual requirements.

When strokes other than those shown in this catalog are needed in production quantities, it is usually best to consider tooling to produce the exact stroke needed.

#### Starting Torque

When determining an application's torque requirement, apply a 1.5 safety factor. For example: a load requiring 4.5 lb-in of torque should utilize a solenoid providing 4.5 x 1.5 or 6.75 lb-in of torque.

#### Snap-Acting Engagement

Rotary solenoids have fast acting engagement. If a controlled speed is required in a rotary stroke application, consider Ledex BTA rotary actuators.

#### Unobstructed Axial Stroke

Axial stroke is the linear distance that the armature travels to the center of the coil as the solenoid is energized and the three bearing balls travel to the lower ends of the races.

The application should allow clearance for axial stroke, which is rarely a problem due to the relatively small magnitude of travel. Axial stroke is listed for each solenoid size and rotary stroke on the appropriate specification pages.

Solenoids without axial stroke, such as our BTA, can be tailored to your application if longitudinal movement must be avoided.

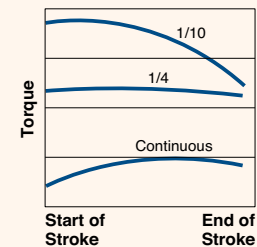
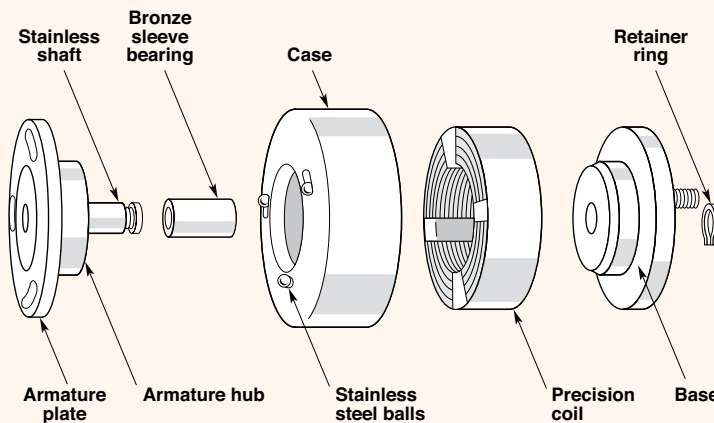
#### Preloaded Axial Stroke

A rotary solenoid's armature produces smoother action if it is preloaded axially. It is important that the three bearing balls be kept in phase throughout the entire stroke. If they are allowed to move freely in the raceway, operation may become erratic.

#### Torque and Duty Cycle

Ledex rotary solenoids are engineered to deliver a relatively flat output curve at 25% duty.

Under highly intermittent usage such as 10% or 5% duty, power and magnetic saturation are increased. This results in a higher starting torque, but a faster reduction of torque as the armature progresses through the rotary stroke. Since most loads have some inertia, the effect of less torque toward the end of the stroke is usually negligible. At continuous duty, magnetic saturation is lower and the torque output typically increases slightly toward the end of stroke.





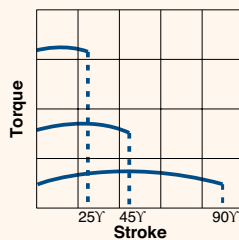
# Solenoids

## Design Considerations

### Ledex® Rotary Solenoid Design Considerations (cont.)

#### Torque and Stroke

Torque is inversely proportional to the total length of the rotary stroke. If, for example, a rotary solenoid with a 90° stroke produces a gross starting torque of 0.7 lb-in, it will have approximately 1.5 lb-in of torque if it has a 45° stroke, and 3.0 lb-in with a 25° stroke.

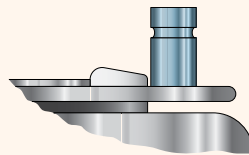


#### Temperature Considerations

Rotary solenoids are designed for operation in ambient temperatures ranging from -55°C to 80°C, provided the coil temperature does not exceed 120°C. Note that standard and elongated solenoids have PVC lead wires which have a maximum rating of 105°C. Special order Teflon leads are available (with maximum temperature rating of 200°C to allow for a 175°C coil temperature.)

#### Armature Drive Pin

Armature pins are commonly used as the main power take-off to perform secondary drive operations. They also provide a convenient adaptor for levers or bars which can convert the rotary stroke into linear motion. With appropriately designed linkages, a limited rotary stroke can produce several inches of linear travel.



#### Life Ratings

Rotary solenoids are laboratory tested under spring load conditions at 25% duty cycle at 20° C ambient temperature to determine life ratings. Bobbin, Precision Standard, and Precision Elongated coil solenoids are rated for 1 million actuations.

Actual life, however, is greatly affected by the application and environment factors such as exposure to extreme temperatures, dirt, dust, etc. Depending on these factors, Precision Standard and Precision Elongated coil solenoids can provide up to 20 million actuations.

#### Duty Cycle

Duty cycle is determined by solenoid ON time/(ON + OFF time).

For example: a solenoid is actuated for 30 seconds, then off for 90 seconds.

$$30 \text{ sec ON} / (30 \text{ Sec ON} + 90 \text{ sec OFF}) = 30/120 = 1/4 \text{ or } 25\% \text{ duty cycle}$$

Ledex rates rotary solenoids for various duty cycles ranging from 100% to 5% duty.

If you cannot find an appropriate Style B Bobbin Coil solenoid which provides satisfactory torque and power, consider S Style Precision Standard Coil, or E Style Precision Elongated Coil models.

#### Maximum ON Time and Duty Cycle

**Note:** Maximum ON time for a particular application can be a factor which overrides duty cycle rating

For example, the maximum ON time for a given rotary solenoid when pulsed continuously at 25% duty cycle at given wattage is 36 seconds. If, however, the solenoid is given a single pulse at the same wattage with the unit at ambient temperature (20°C), then the maximum ON time is extended somewhat to 44 seconds. Maximum ON time ratings are charted by duty cycle.

#### Power Requirement

Standard solenoids are available in coil awgs ranging, in most instances, from #23 up to #33 to accommodate your input power. Refer to selection charts on the following pages. The coil awg number will determine the power rating of the coil. The coil awg number must be specified when ordering a unit. Many other awg coil sizes are available; please contact an application engineer to discuss your requirements.

#### Consider an In-Stock Model for Preliminary Evaluation

Many rotary solenoids are available from distribution inventory. If you're not sure of your exact requirement, you may consider using a stock model prototype as a quick and very inexpensive means to determine your exact requirements.



# Solenoids

## Design Considerations

### Ledex® Rotary Solenoid Design Considerations (cont.)

#### Configuration Options

Ledex custom fabricated solenoids are designed, built, tested, packaged, and shipped to your exact specifications. Whether it's as simple as adding a special connector or mounting bracket, or fabricating a complete assembly, we can build the right product to meet both your design and budget objectives.

Even though we offer thousands of standard rotary solenoid models, almost 80% of the product we build is specifically tailored to our customers' needs. So if you don't find exactly what you're looking for, please call us to discuss your requirements. Here are a few simple design options which we frequently encounter for rotary solenoid applications:

- Special shafts
- Mounting studs threaded to customer specification
- Slots, flats, or holes in shafts for machine linkage
- Double return springs for critical safety redundancy
- Armature covers

For modifications including heavy duty return springs, drive pins, etc., please contact our application engineers for assistance, as these standard modifications require a custom part number.

#### Return Springs

Return springs are employed to return the solenoid armature to its de-energized position, and can also serve to return light loads.

To meet exacting application requirements, rotary solenoids can be equipped with lesser or higher torsion return springs. Contact our application engineers for your specific requirements.

#### Long Life Versions

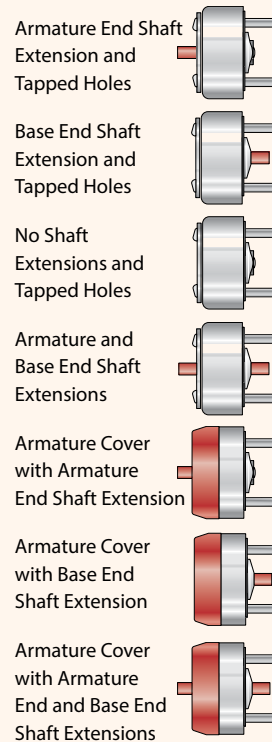
Precision Standard and Precision Elongated coil solenoids are also available in long life versions which provide 50 million actuations (or 100 million actuations if lubricated every 10 million actuations).

Long life models incorporate precision needle bearings and special materials to reduce wear and extend life. The needle bearing is particularly helpful in overcoming side load and starting torque problems.

Long life models provide approximately 90% of the charted torque listed in the performance charts. Long life models are slightly more expensive, but can cost less in terms of machine down time and replacement time.

Long life versions are available in strokes up to 45°. Please consult the factory for longer strokes.

#### Standard Configuration Options



Rotary solenoids are available in seven standard configurations for most sizes: All configurations include a return spring.

Armature covers are available on all models, sizes and styles. They keep adjacent components or wires from interfering with the rotary and axial motion of the solenoid armature.

They are also recommended for dirty or dusty environments.

Armature cover models with armature end shaft extensions are equipped with a felt washer to act as a seal against the entry of dust around the shaft.

Models without an armature cover are equipped with three tapped holes in the armature face for load attachment purposes.



# Solenoids

## Design Considerations

### STA® Tubular Linear Solenoids

#### Starting Force

When determining an application's force requirement, apply a 1.5 safety factor. For example: a load requiring 4.5 lb of force should utilize a solenoid providing 4.5 x 1.5 or 6.75 lb of force.

#### Duty Cycle

Duty cycle is determined by: ON time/(ON + OFF time).

For example: a solenoid is actuated for 30 seconds, then off for 90 seconds.  
 $30 \text{ sec ON} / (30 \text{ Sec ON} + 90 \text{ sec OFF}) = 30/120 = 1/4$  or 25% duty cycle.

Ledex tubular solenoids are rated for various duty cycles ranging from continuous to 10% duty.

#### Life

When selecting a tubular solenoid, as with any other solenoid style, it is important to consider the effects of heat on life. When used with a constant voltage supply, an increase in coil temperature reduces the work output and the life of the unit. Standard life is 25,000,000 actuations for STA designs.

#### Power Requirements

Voltage applied to the solenoid must be matched to the coil wire size for proper operation. Solenoids are cataloged in coil awgs ranging from #23 up to #37 to accommodate your input power. Many other coil awg sizes are available. Please feel free to contact our application engineering department for availability.

#### Plunger Configurations

##### Flat Face



For strokes typically less than 0.060", the flat face plunger is recommended with a pull or push force three to five times greater than 60° plungers.

##### 60° Angle

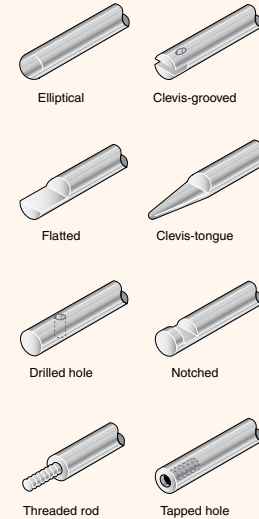


For longer strokes up to 0.80" (20.3 mm), the 60° plunger offers the greatest advantage over the flat face plunger.

#### Options and Modified Designs

Even though many tubular models are in stock, our customers often require a product with unique features or performance capabilities. In fact, almost 80% of all solenoids that we make are either modified or custom built to meet our customers' exact

#### Typical Examples of Custom Features



application requirements. Please give us a call to discuss your needs with one of our application engineers.

### NEW! STA Quiet Tubular Models

#### D2 Series

- Utilize New Dampened Floating Base Technology
- Energizing impact noise reduces approximately 20 dBA
- Virtually no reduction in high holding force compared to comparable standard model

#### Q Series

- Utilize Quiet Technology
- Energizing impact noise reduced to approximately 45 dBA
- Reduces holding force to low level





# Solenoids

## Design Considerations

### Soft Shift® Linear Solenoids

#### Starting Force

When determining an application's force requirement, apply a 1.5 safety factor. For example: a load requiring 4.5 lb of force should utilize a solenoid providing 4.5 x 1.5 or 6.75 lb of force.

#### Duty Cycle

Duty cycle is determined by: ON time/(ON + OFF time).

For example: a solenoid is actuated for 30 seconds, then off for 90 seconds.  
 $30 \text{ sec ON} / (30 \text{ Sec ON} + 90 \text{ sec OFF}) = 30/120 = 1/4$  or 25% duty cycle.

Soft Shift solenoids are rated for various duty cycles ranging from continuous to 10% duty.

Note that maximum ON time for a particular application can be a factor which overrides the duty cycle rating.

#### Life

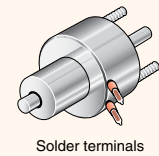
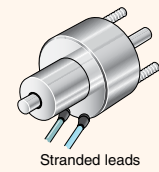
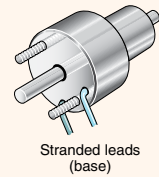
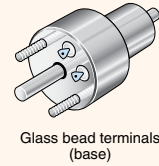
When selecting a Soft Shift solenoid, as with any other solenoid style, it is important to consider the effects of heat on life. When used with a constant voltage supply, an increase in coil temperature reduces the work output and the life of the unit. Standard life is 10 million operations.

#### Power Requirements

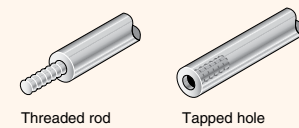
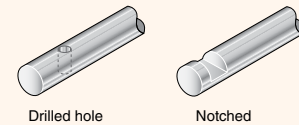
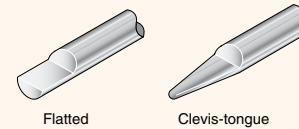
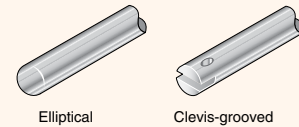
Voltage applied to the solenoid must be matched to the coil wire size for proper operation. Solenoids are cataloged in coil awgs ranging from #23 up to #35 to accommodate your input power. Many other coil awg sizes are available. Please feel free to contact our application engineering department for availability.

### Typical Examples of Custom Features

#### Termination



#### Power Take Off



### Options and Modified Designs

Even though many Soft Shift models are in stock, our customers often require a product with unique features or performance capabilities. In fact, almost 80% of all solenoids that we

make are either modified or custom built to meet our customers' exact application requirements. Please give us a call to discuss your needs with one of our application engineers.





# Solenoids

## Design Considerations

### Ledex® Low Profile Linear Solenoids

#### Starting Force

When determining an application's force requirement, apply a 1.5 safety factor. For example: a load requiring 4.5 lb of force should utilize a solenoid providing  $4.5 \times 1.5$  or 6.75 lb of force.

#### Duty Cycle

Duty cycle is determined by: ON time / (ON + OFF time).

For example: a solenoid is actuated for 30 seconds, then off for 90 seconds.  
 $30 \text{ sec ON} / (30 \text{ Sec ON} + 90 \text{ sec OFF}) = 30/120 = 1/4$  or 25% duty cycle.

Low Profile solenoids are rated for various duty cycles ranging from continuous to 10% duty. Note that maximum ON time for a particular application can be a factor which overrides the duty cycle rating.

#### Life

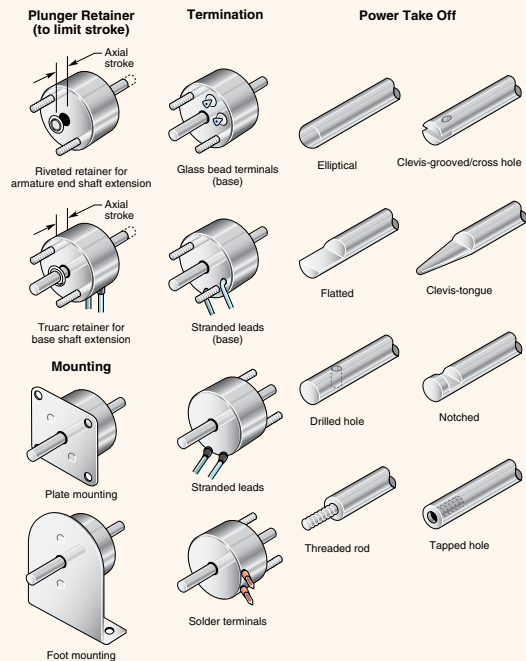
When selecting a Low Profile solenoid, as with any other solenoid style, it is important to consider factors that will affect the life of the unit. Heat, side-loading, stroke and operating environment all play an important role in determining the life you can expect in your application.

#### Power Requirements

Voltage applied to the solenoid must be matched to the coil wire size for proper operation. Solenoids are cataloged in coil awgs ranging from #23 up to #38 to accommodate your input power. Many other coil awg sizes are available. Please feel free to contact our application engineering department for availability.

#### Typical Examples of Custom Features

Even though many low profile models are in stock, our customers often require a product with unique features or performance capabilities. Please call to discuss your needs with one of our application engineers.





# Solenoids

## Design Considerations

### Ledex® Open Frame Linear Solenoids

#### Starting Force

When determining an application's force requirement, apply a 1.3 to 1.5 safety factor. For example: when a 4.5 lb pull force is required, select a model with a safety factor of 1.3 to 1.5 times (5.8 to 6.7 lb).

#### Duty Cycle

Duty cycle is determined by solenoid ON time/(ON + OFF time).

For example: a solenoid is actuated for 30 seconds, then off for 90 seconds.  
 $30 \text{ sec ON} / (30 \text{ Sec ON} + 90 \text{ sec OFF}) = 30/120 = 1/4$   
or 25% duty cycle.

#### Life

When selecting an open frame solenoid, as with any other solenoid style, it is important to consider the effects of heat, since an increase in coil temperature reduces the work output and the life of the unit. Life ratings extend to 5 million cycles depending on the product size and application. Consult the factory for longer life of 500,000 or more cycles, and other special requirements.

#### Frame Design Styles

DC actuated units are available in box frame and C frame design styles in a variety of models and sizes. Models are available for continuous use and intermittent duty. For low duty cycle applications, consider a magnetic latching open frame.

#### Box Frame

This solenoid has a 4-sided closed box frame and solid plunger and is, therefore, more electrically efficient than the C Frame solenoid. The closed, box frame also provides improved mechanical strength.



#### C Frame

C Frame solenoids consist of a formed C-shaped steel frame and solid plunger. Therefore, these solenoids are less efficient and less costly than their Box Frame counterparts.





# Solenoids

## Design Considerations

### Looking for a Specialized Solution?

#### Emerging Trends in Solenoid Actuation

Ledex® Solenoid Products are most often created to address the specific critical performance requirements set by today's design engineers.

With our diverse range of linear and rotary solenoids, and our commitment to innovative technology developments, our products are aligned to meet the most challenging new product design objectives.

Following are highlights of primary design trends that focus on our customers' leading edge commercial and industrial applications.

#### Long Life

Many Ledex solenoid platforms offer extended operational life that reduce down time and service costs. Our newest long life platform includes an order of magnitude improvement (1 to 5 million cycles) for select DC Open Frame solenoids.

#### Life (millions of cycles)

Rotary	BTA	100
	Ultimag	100
	Rotary Solenoids	1
	Long Life Rotary Solenoids	50
Linear	STA Tubular	25
	Soft Shift	10
	Low Profile	1
	Open Frame	0.1 – 0.5

#### Energy Efficiency

Green design initiatives require energy savings at an increasing rate. Ledex magnetic latching linear solenoids can be used for low duty cycle applications in which the solenoid's "on" position is held indefinitely with no power consumption.

While continuous duty, on/off solenoids tend to develop heat, magnetic latching solenoids do not since no power is consumed in the energized state.

Since magnetic latching solenoids are typically used in low duty cycle applications, they are also perfect candidates for battery operation with as little as 3 to 6 volts.

Typical applications for magnetic latching solenoids include door closers, locks, latches and security devices. Almost any solenoid type can be developed as a magnetic latching version. We offer tubular and open frame magnetic latching solenoids platforms as standard. Custom designs are developed on a regular basis for specific application requirements.



#### Battery Operation

Remote operation of actuation devices is easily accomplished with battery operated solenoids. We offer many choices of battery operated Ledex® solenoids that provide a full range of specific design benefits.

Our application engineers can help you determine which battery is right for your design needs using our proprietary battery calculator software. Please contact us to discuss your application requirements.

#### High Speed Actuation

Automation applications demand increasing rates of operation for improved throughput and cost competitiveness. Solenoids are inherently high speed actuation devices and our product development initiatives continue to push the envelope on this important design parameter.

#### Speed (msec) – Typical

Rotary	BTA	10
	Ultimag	3
	Rotary Solenoids	7
Linear	STA Tubular	10
	Soft Shift	8
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#### Quiet Operation

The need for increasingly quiet performance is a major focus in today's products. The Ledex Brand of Johnson Electric has developed a new family of rotary and linear actuation devices that offer significant sound reduction advantages over conventional solenoid products.

For example, our standard STA tubular solenoid performs in the 80-98 dBA range. While this is perfectly acceptable for most applications, a dampened sound or a quiet technology may be required where noise reduction is beneficial. To address this need, we have launched two new STA platforms.

Our new STA-D quiet tubular solenoids employ innovative technology that reduces the traditional impact at the end of the stroke, while maintaining high hold force. As a result, the STA-D provides a 20 dBA sound reduction.

For applications requiring even quieter performance, our new STA-Q quiet solenoids offer the ultimate in sound reduction through the elimination of the traditional end-of-travel hard stops. When energized, the STA-Q provides a 40 dBA noise reduction. The STA-Q has a reduced holding force that is ideal for applications where impacting forces are considered a negative characteristic, and where the application load will maintain its own position.

Our Soft Shift products are inherently quiet as well and can provide velocity controlled

#### Open Design Engineered Products

Ledex® has a number of open design, adaptive product platforms that are readily tailored to our customers' specific needs. In an increasingly competitive global market that demands leading edge technology and rapid deployment to market, our open design products are often the perfect solution.

See page 34  
for details



	MagShift	PMA	CamBolt
Quiet Actuation	■	■	■
Long Stroke		■	
Magnetic Latching		■	
Mechanical Latching			■
Shock Resistance			■
Bidirectional Actuation		■	■
Medium to High Force	■	■	



# Solenoids

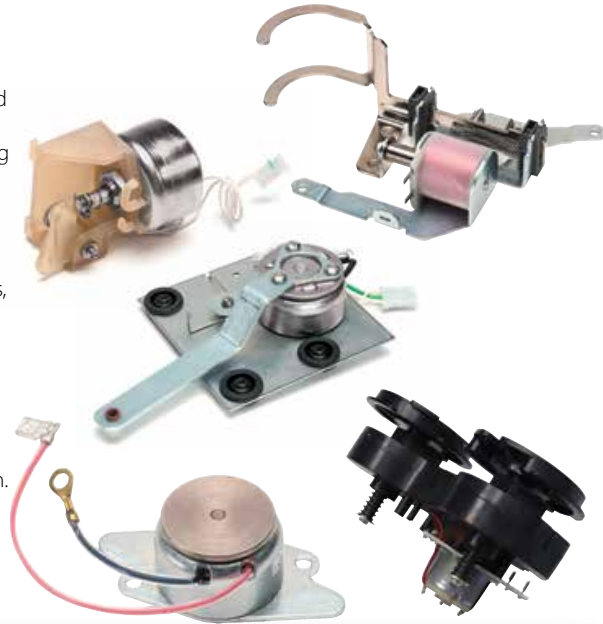
## Design Considerations

**The Simple Way to Make your Solenoid-Actuated Product Better and your Job Easier:**

### Solenoid Subassemblies

Ledex® custom fabricated solenoids are designed, built, tested, packaged, and shipped to your exact specifications. Whether it's as simple as adding a special connector or mounting bracket, or fabricating a complete assembly, testing to confirm performance, and participating in your dock-to-stock inventory and delivery program, Ledex offers much more than "just solenoids".

Custom solenoid assemblies eliminate your added cost and trouble to maintain multiple vendors, added manufacturing resources and additional inventory. Typical modifications include: load interfaces, electrical connections and terminations, mounting adaptations, custom plungers, high temperature coils, shaft extensions, and specialized insulation such as UL approved systems or higher dielectric strength insulation.



We specialize in the design, engineering and production of custom subassemblies including solenoids, enclosures, mounting hardware, mechanical linkages, drive electronics and feedback sensors. The following example is typical of what we do to add value for our customers every day:

### Customer Request:

Our customer had a demanding application for a complete solenoid subsystem including drive electronics, surge suppression, and a feedback sensor.

### Our Solution:

We designed a complete system solution for the customer from concept to completion in a matter of weeks. Materials for this assembly include an STA tubular solenoid plus... bracket, adaptor, spring, hex nut, optical sensor, connector and cable, PCB, PC cable, actuator arm, stand-offs, trans. voltage suppression and housing. Completed units are tested, packaged, and shipped to the customer ready for immediate, easy installation.

