



Smart solutions for comfort and safety

Basics Solenoids

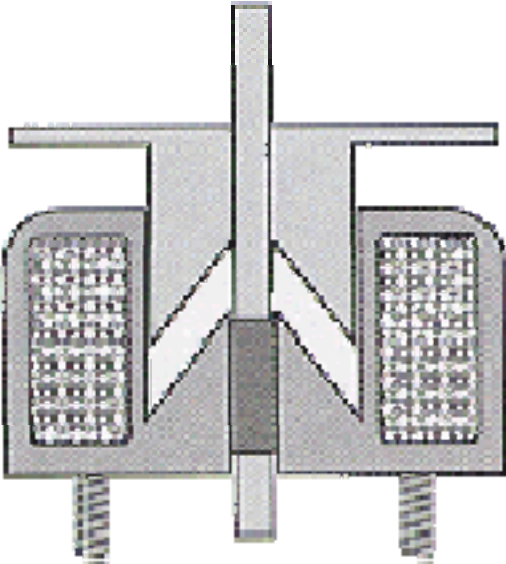


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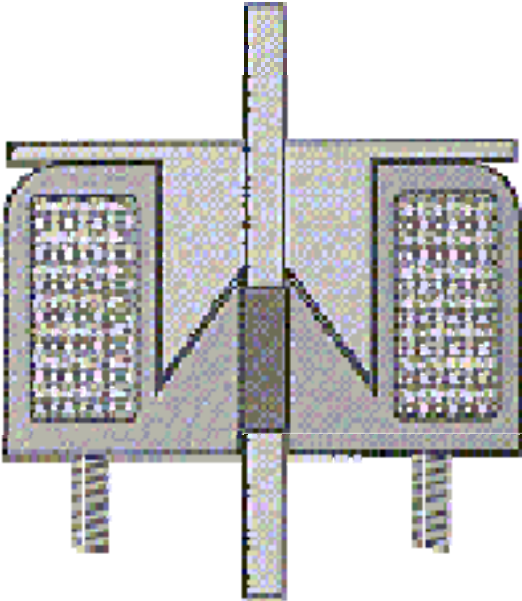
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Linear solenoid operation

De-energized



Energized





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Design Considerations

- **Force (Linear) or Torque (Rotary)**
 - **Type of Motion Required (Push, Pull, Latching,)**
 - **Stroke**
 - **Duty Cycle**
 - **Electrical Power – AC, DC, Current, Watts**
 - **Life**
 - **Environmental Conditions**
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Stroke

“When applying solenoids, keep the stroke as **short as possible.”**

Observing this principle will keep the size and power consumption to a minimum.





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Force or torque

- Force Applies to Linear
- Torque Applies to Rotary
- Catalog Provides Individual Specifications-ambient of +20° C
- Typically Starting Force or Torque Is Most Critical
- **Safety Factor of 1.5 Is Recommended.** “An application requiring 13N of force should specify a product that provides at least 20N”

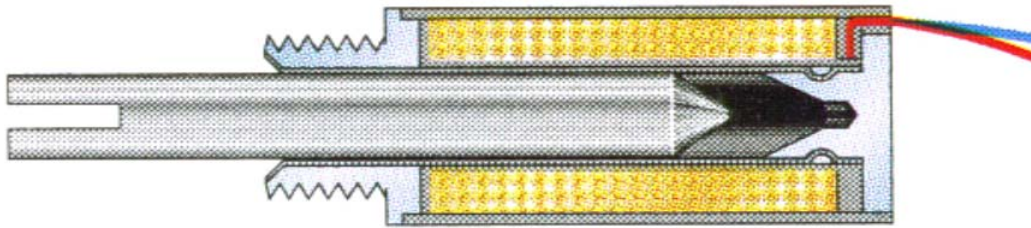




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Typical pull type tubular solenoid

De-energized



Energized

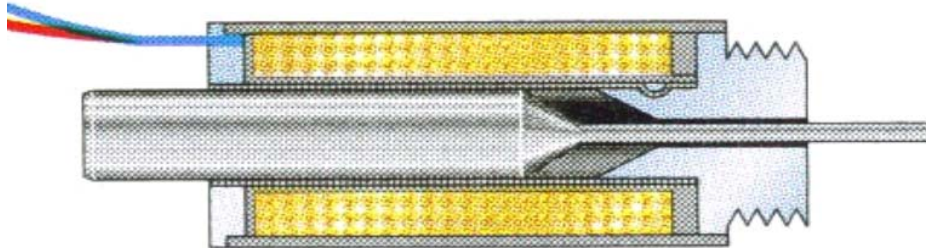




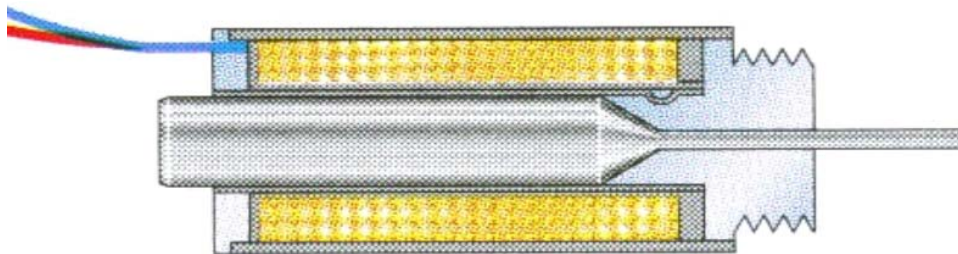
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Typical push type tubular solenoid

De-energized



Energized





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STA Series Pull 13 x 27 (Catalog page 164)

Ordering Reference

Type 195222-(0) Plunger (XX) Coil Data awg (wire diameter)

- Plunger Configurations and anti-rotation flat on mounting
- 1 Flat face plunger without anti-rotation flat
 - 2 60° plunger without anti-rotation flat
 - 5 Flat face plunger with anti-rotation flat
 - 6 60° plunger with anti-rotation flat

Performance		100%	50%	25%	10%		
Maximum ON Time (sec) when pulsed continuously ¹		∞	50	5	2		
Force@Nominal Stroke (N)		0.6–	1.1–	2.0–	3.6–		
		0.8	1.4	2.5	4.5		
Watts (@20°C)		4	8	16	40		
Ampere Turns (@20°C)		497	704	994	1573		
Coil Data	awg	Resistance (@20°C)	# Turns ³	VDC (Nom)	VDC (Nom)	VDC (Nom)	VDC (Nom)
	(XX)						
	27	1.43	306	2.4	3.4	4.8	7.6
	28	1.95	342	2.8	3.9	5.6	8.8
	29	3.84	508	3.9	5.5	7.8	12.4
	30	5.29	572	4.6	6.5	9.2	14.5
	31	9.56	795	6.2	8.8	12.4	19.6
	32	16.54	1068	8.1	11.5	16.3	25.7
	33	22.60	1194	9.5	13.4	19.0	30.0
	34	37.41	1547	12.2	17.3	24.0	39.0
	35	60.71	1976	15.6	22.0	31.0	49.0
	36	96.19	2475	19.6	28.0	39.0	62.0
	37	149.93	3060	24.5	35.0	49.0	77.0

¹ Continuously pulsed at stated watts and duty cycle

² Other coil awg (wire diameter) sizes available — please enquire

³ Reference number of turns

All data is at 20°C coil temperature. Force outputs degrade with elevated temperatures.



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Duty cycle

Usually Expressed As a Percentage or a Fraction (i.e. 100%, 50%, 25%, 10%)

All Intermittent Duty Coils Have a Maximum Allowable “On” Time

“On” Time Must Not Exceed the Power Dissipation Limits of the Coil

Proper Heat Sinking And/or Additional Cooling Improves Heat Dissipation Which Allows a Broader Duty Cycle Range





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Duty cycle

**Duty Cycle = Ratio of “On” Time Over
Total Time for One Complete Cycle**

$$\text{Duty cycle} = \frac{\text{on time}}{\text{on + off time}}$$



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Product range

Solenoids



Rotary solenoids - overview

Ultimag Series



Type **EM**

BTA Series



Type **EVM**

Rotary Series



Type **E. B. S**

Dimensions (mm)	∅ 41 x 26 – ∅ 59 x 41	∅ 30 x 18 – ∅ 59 x 41	∅ 25 x 16 – ∅ 70 x 45
Duty cycle	continuous or intermittent 100% 50% 25% 10%	continuous or intermittent 100% 50% 25% 10%	continuous or intermittent 50% 20% 10%
Life	over 100 million cycles	over 100 million cycles	1 million cycles; 50 million cycles on extended life types
Power (W)	14.5–320	13–320	10–100
Supply (V)	3.2–313 VDC	3.2–113 VDC	2.6–123 VDC
Housing	completely enclosed design	completely enclosed design	compact design with a variety of enclosures
Characteristics	<ul style="list-style-type: none"> ■ quiet, shock-free operation ■ fast energising time ■ high speed cycle rates ■ on/off or proportional mode operation 	<ul style="list-style-type: none"> ■ quiet, shock-free operation ■ high speed cycle rate ■ closed loop velocity ■ position control 	<ul style="list-style-type: none"> ■ “snap” acting engagement ■ maximum versatility ■ on/off operation



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Rotary solenoids - range analysis

Type	Made	Approv.	Comments
Ultimag	Vandalia		bidirectional
BTA	Vandalia		all made for 45°
Rotary	Vandalia		Spring return

Summary

- Ultimag is a very special product due to permanent magnet inside
 - BTA is not sold by a lot of competitors (known: Magnet Schulz)
 - rotaries are the most common rotation solenoids in the market
 - Technology + cost increase is going: Rotary – BTA - Ultimag
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Rotary solenoids - typical applications

Type

Ultimag	Medical Ventilation , High Speed Video Inspection Equipment, Laser Etching Equipment
BTA	Postal sortings, paper processing
Rotary	Locking and Latching applications , medical laser shutters, material handling



Linear solenoids - overview

Soft Shift



Type **EP**

Tubular



Type **STA**

Low Profile



Type **EC, EF, SF**

Open Frame



Type **B, C**

Type	EP	STA	EC, EF, SF	B, C
Dimensions (mm)	∅ 29 x 25 – ∅ 57 x 56	∅ 13 x 27 – ∅ 38 x 63	∅ 19 x 13 – ∅ 57 x 34	up to 51 x 44 x 77 mm
Duty cycle	continuous or intermittent	continuous or intermittent	continuous or intermittent	continuous or intermittent
Stroke	up to 10.7 mm	up to 63.5 mm	up to 10.1 mm	up to 25.4 mm
Force	up to 131 N	up to 43 N	up to 356 N	up to 48.9 N
Life	10 million cycles	25+ million cycles	1 to 5 million cycles	50.000 to 100.000 cycles
Power (W)	7–320	4–200	4.5–320	1.4–190
Supply (V)	2.2–394 VDC	2.4–534 VDC	1.6–394 VDC	6–388 VDC/240 VAC
Housing	completely enclosed design	shock and vibration integrity	completely enclosed design	compact box frame and C frame designs
Characteristics	<ul style="list-style-type: none"> ■ quiet operation with 3-5 time the starting force of standard solenoids ■ slow, smooth motion ■ snap action ■ closed loop velocity and position control 	<ul style="list-style-type: none"> ■ push/pull engagement: well-suited to lock/latch operations ■ multiple plunger designs ■ on/off operation 	<ul style="list-style-type: none"> ■ push/pull engagement: well-suited to lock/latch operations ■ high force ■ short stroke applications ■ on/off operation 	<ul style="list-style-type: none"> ■ pull-in engagement (push types available): well-suited to lock/latch operations ■ AC or DC activated ■ continuous or intermittent ■ on/off operation



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Linear solenoids Range analysis

Type	Made	Approv.	Comments
Soft shift	Vandalia		Very flat force curve
Tubular	Vandalia		Standard: push/pull
Low profile	Vandalia		Compact design
Open frame	Vandalia		Versions: C and D frames

Summary

- soft shifts can be used if nearly constant force line is required
 - Tubulars have greatest life time of linear solenoids
 - Low profiles for high forces with small strokes
 - open frames most cheapest, but also most competition
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Linear solenoids Typical applications / Competition

Type

Soft shift	Cancellation of mail driver, fluid analysing
Tubulars	Card reader locker, dispenser in agricultural equipment
Low profiles	Medical pinch valve, data storage and retrieval
Open frames	Vending machines, locking and latching application, circuit breakers

