Electric Wrap Spring Clutch Technical Datasheet

How it works

As electric current is passed through the stationary coil, lines of magnetic flux are generated and used to attract the control ring to the shoulder. This control ring is attached to the spring, which wraps down onto a hub as the input is turned. Torque is transferred from the input, through the spring, to the output. After electric current is removed, the magnetic attraction is lost, causing the clutch to disengage as the spring unwraps.

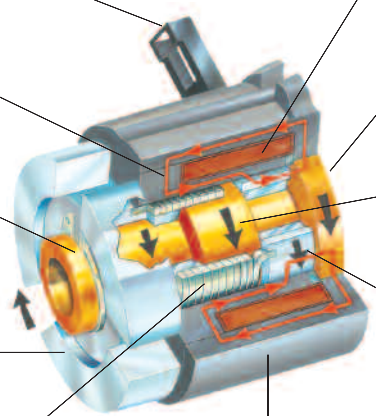
Radial Electric Wrap Spring Clutch Concept

Connector:
Energizes clutch from outside source

Magnetic Flux:
Lines of magnetic flux cause the ring to engage

Shaft:
Used as input or output as dictated by application. Driven by cross pin slot on opposite end

Three Dog Hub:
Used as input or output as dictated by application



Stationary Coil:
Generates magnetic flux when energized

Shoulder:
Pressed on shaft for control ring attraction

Wrap Hub:
Pressed on shaft for spring torque transfer

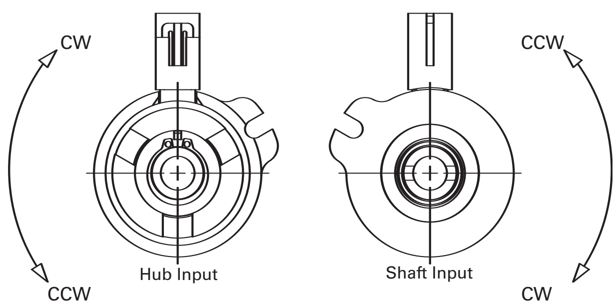
Floating Control Ring:
Attracted to shoulder when magnetized

Spring:
Fixed on three dog hub. During engagement spring wraps down on wrap hub to transfer torque

Stationary Case:
Encloses clutch components, protecting them from contamination

How to Determine the Direction of Rotation

Direction of rotation viewed from the input end of the clutch.

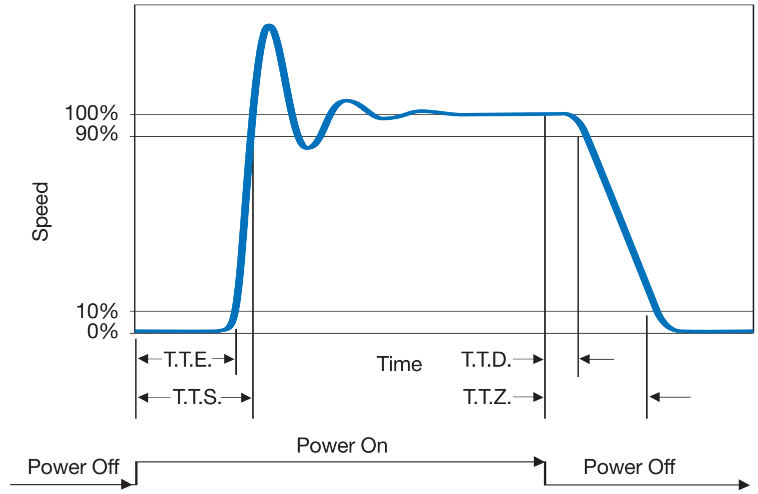


Electric Wrap Spring Clutch Performance Information

Speed to Time Curve

T.T.E. — Time-to-Engage: Time for magnetic flux buildup in clutch to activate the control ring and wrap spring.

T.T.S. — Time-to-Speed: T.T.E. + the time for the system to accelerate.



T.T.D. — Time-to-Disengage: Time for magnetic flux to decay and the spring to unwrap.

T.T.Z. — Time-to-Zero: T.T.D. + deceleration time of the system.

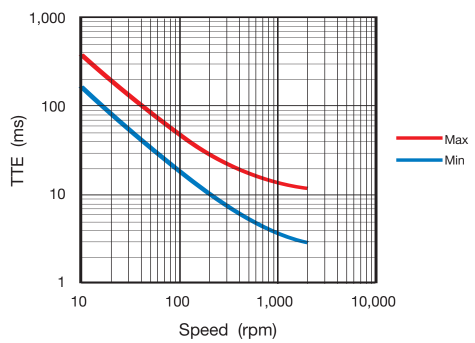
Torque is applied to output at T.T.E.

Torque is removed from output at T.T.D.

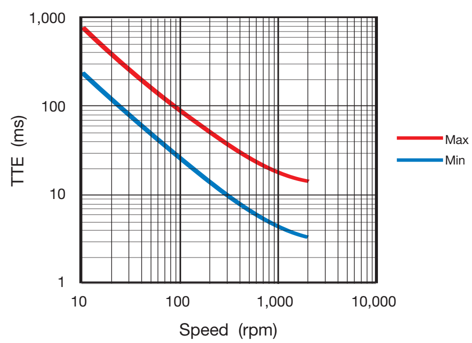
Time-to-Engage (T.T.E.)

Time-to-Engage is directly related to the input speed. The higher the input speed, the quicker the clutch will engage.

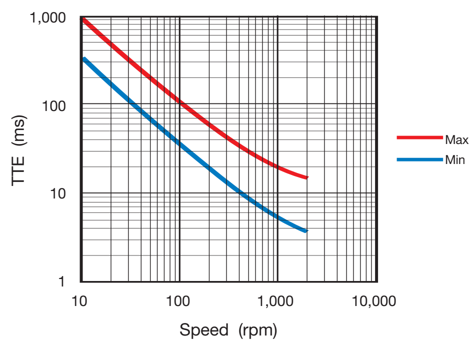
EC5
Time to Engage vs. Speed



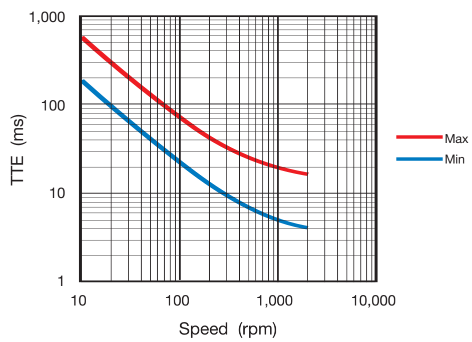
EC20, EC20CBLL, EC25, EC25LL
Time to Engage vs. Speed



EC15, EC30, EC30LL
Time to Engage vs. Speed

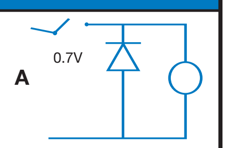
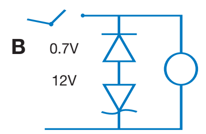


EC75, EC75LL
Time to Engage vs. Speed



Time-to-Disengage Characteristics

(all Reell electric clutches)

T.T.D.	Maximum voltage transient (24 v coil)	Arc Suppression Circuit
30 ms max (all clutches) ± 5ms cycle-to-cycle	≈ 24.7	 diode
12 ms max (all clutches) ± 2ms cycle-to-cycle	≈ 36.7	 diode & 12 v zener

The arc suppression circuit used with the clutch affects disengagement time. As with any magnetic coil, high voltage transients will occur when power is removed. Circuit A shows a simple, economical arc suppression circuit that results in very low transients and fast, consistent disengagement. Circuit B gives even faster and more consistent disengagement but with higher transients.

Reell Wrap Spring Clutch Total Load Worksheet

The worksheet below is a step-by-step procedure to determine the load exerted on your clutch. The total load on your clutch is the sum of the load caused by friction and the load due to inertia of the driven system. **DO NOT IGNORE THE EFFECTS OF INERTIA!** Inertia is the tendency of an object to resist a change in rotation. The rotation of an object with a large inertia will be harder to change than the rotation of an object with less inertia. The weight of an object is not the only variable affecting inertia. The geometric shape is also important.

Reell wrap spring clutches have a quick and positive engagement. Loads will be accelerated from zero to full speed in less than 3 milliseconds. This quick acceleration is the reason inertia effects are important.

The inertia about the axis of a cylinder is given by the formula:
$I = \pi/32 \times D^4 \times L \times \rho$

- I=Inertia lb-in^2 (kg-m^2)
- D=Diameter in (m)
- L=Length in (m)
- ρ=Density lb/in^3 (kg/m^3)

Approximate values for ρ:

Steel	0.284 (7860)
Aluminum	0.098 (2700)
Plastic	0.047 (1300)
Rubber	0.047 (1300)

Example: two steel cylinders
#1. D= 4 inches
L=1 inch
#2. D=2.3 inches
L=3.02 inches
Each has a volume of 12.55 cubic inches but the inertia of each is different. (Cylinder #1 has an inertia value of 7.13 lb-in^2. Cylinder #2 has an inertia value of 2.35 lb-in^2.)

Step 1.
Determine the torque due to friction acting on clutch

The torque due to friction acts on the clutch output. The value for friction torque may be obtained through direct measurement or approximation. In many systems, measurements may be made with a torque wrench.

Friction torque ___________
If friction torque >75 lb-in (8.5 N-m), see Note 1.

Step 2.
Calculate the system inertia

Calculate the inertia of your system. Reasonable approximations can be made by breaking your system into cylinders and adding up the inertia values from each. If system components operate at different speeds, subtotal inertia for each speed.

Inertia of cylinder #1 _______________
Inertia of cylinder #2 _______________
Inertia of cylinder #3 _______________
Total INERTIA _______________

Step 3.
Determine inertia torque

Accelerating the system components exerts a torque load due to the inertia. To determine this torque, use the inertia values calculated in step 2, the system component speed, and the **Estimated Torque to Accelerate Inertia Graphs**. If system components operate at different speeds, determine the inertia torque for each speed. Add these results to determine the total inertia torque.

Inertia torque ______
If inertia torque >75 lb-in (8.5 N-m), see Note 1.

Step 4.
Determine total load

Add results from steps 1 and 3 together to determine total load.

Total load ____________
If total load >75 lb-in (8.5 N-m), see Note 1.

Use the "Estimated Electric Clutch Actuation Life Matrix" to determine which clutch best suits your needs.

Example: The inertia of a 6-inch long, 1.2-inch diameter rubber roller is:
(Reference the graphs on the back page.)

$1 = 3.1416/32 \times 1.2^4 \times 6 \times 0.047 = 0.057$ lb-in^2 (1)

At 500 rpm (2) the inertia load is 10 lb-in (3)

Total Load =
3.0 + 10 (from graph for EC25) = 13 lb-in

From the life table, we find that the model EC25 is suitable if the application life requirement is 10 million cycles. The EC15 can be used if a life of 1 million cycles is acceptable.

NOTE 1: If total load or any of its components exceeds 75 lb-in (8.5 N-m) for one million cycles life requirement. For more information, please see the online calculators at www.reell.com/calculator.htm or contact Reell at 651-484-2447.

Estimated Electric Wrap Spring Clutch Actuation Life Matrix

Reell's electric wrap spring clutches are designed to meet the types of requirements typically found in paper feed systems of office equipment. The versatility of its design lends itself to use in a wide variety of applications where high torque, small package size, and consistent engagement is required.

The following conditions may reduce the life of the clutch:

- Speeds over 800 rpm
- Temperature above 140ºF (40ºC) and/or below 32ºF (0ºC)
- Idle or constantly engaged conditions for more than 1,000 hours
- Poor installation (end or side loading)

If your application has life requirements greater than those listed, consult with your Reell sales representative to discuss the application condition in detail.

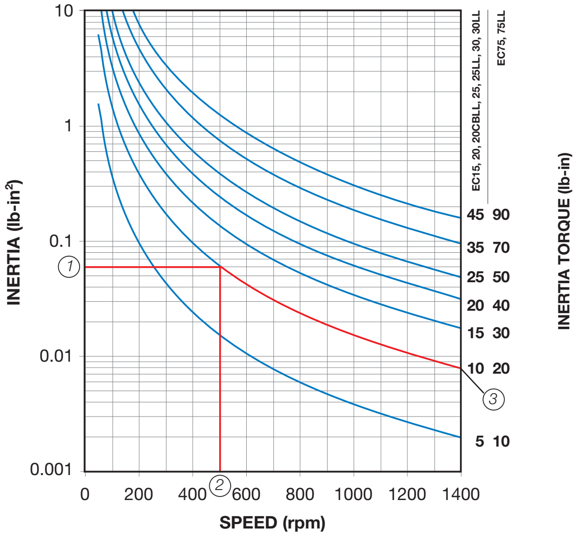
Maximum Allowable Torque Load lb-in (N-m)					
Life Requirement	Model EC15	Model EC20/ EC20 CBLL	Model EC25/ EC25LL	Model EC30/ EC30LL	Model EC75/ EC75LL
1 Million Cycles	15 (1.7)	20 (2.3)	25 (2.8)	30 (3.4)	75 (8.5)
3 Million Cycles	12 (1.4)	16 (1.8)	20 (2.3)	24 (2.7)	60 (6.8)
10 Million Cycles	9 (1.0)	12 (1.4)	15 (1.7)	18 (2.0)	45 (5.1)

Maximum Allowable Torque Load lb-in (N-m)	
Life Requirement	Model EC5
0.5 Million Cycles	6 (0.68)
1 Million Cycles	5 (0.57)
2 Million Cycles	4 (0.45)

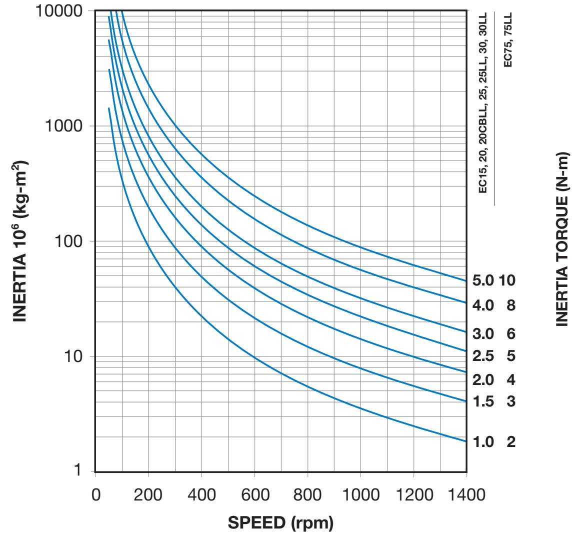
Slip Devices and Flexible Couplers could be added to extend life and quiet application noise.

Estimated Torque to Accelerate Inertia

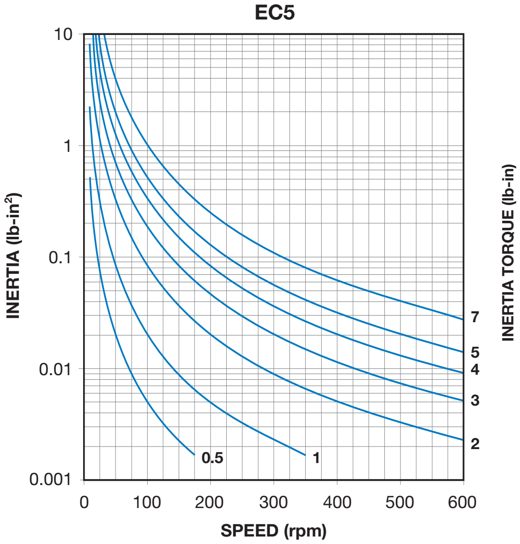
ENGLISH UNITS
EC15, 20, 20CBLL, 25, 25LL, 30, 30LL, 75, 75LL



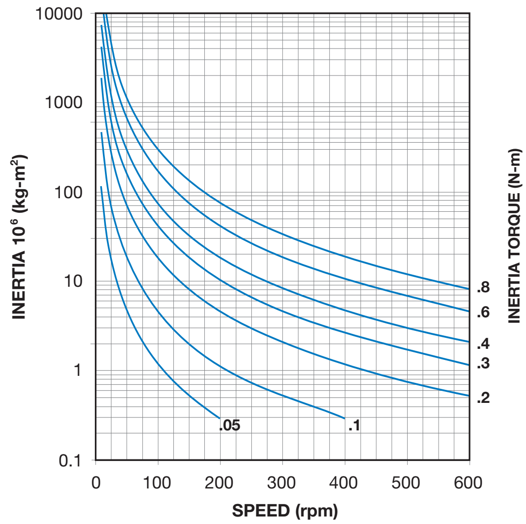
METRIC UNITS
EC15, 20, 20CBLL, 25, 25LL, 30, 30LL, 75, 75LL



ENGLISH UNITS
EC5



METRIC UNITS
EC5



Conversion Factors:

	Multiply	By	To Find
INERTIA	$kg\text{-}m^2$ $lb\text{-}in^2$	3417 0.000293	$lb\text{-}in^2$ $kg\text{-}m^2$
LENGTH	m in	39.4 0.0254	in m
TORQUE	N-m lb-in	8.851 0.1130	lb-in N-m

For more information contact Reell or visit www.reell.com

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