What's the difference between stopping dynamically and holding a load with power off brakes? How do I correctly size a power off brake?

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Last month we ended with the formula used to estimate the torque required to dynamically stop the load in an interval of time. Once the torque value is determined multiply the result by 1.25 (25%) to obtain a minimum static torque. The deceleration time plus the brake engage time must be less than (or equal to) the desired stopping time.

Energy absorption (Energy Dissipation)

Next verify that the brake can dissipate the kinetic energy that it absorbs per cycle for as long as it takes to perform the entire operation. Repeated cycling builds up heat, which the brake must be able to withstand continuously.

Total Energy dissipation is typically expressed in Ft-lb (units). It is defined as the sum of

Kinetic Ek and slip Es energy dissipated.

Kinetic energy dissipation Ek is:

$$Ek = 4.6 \times 10^{-4} \times I \times \omega^2$$

Where: I = total system inertia (lb-in-sec²)
ω = RPM

Slip energy dissipation Es is:

$$Es = 43.6 \times 10^{-4} \times \omega \times D \times Ts$$

Where: I = total system inertia (lb-in-sec²)
ω = RPM
Ts = Total slip time in seconds
D = Load drag torque in the system (lb-in)

Compare the calculated values of energy per cycle and energy per minute with the values given in the manufacturer's product data sheets. The values should be equal to or less than the catalog ratings to ensure that the brakes survive over a long lifetime.

It is important to note that all power off spring set brakes are designed primarily for use in static-holding systems, and the wear factors for friction materials are more critical when the brakes are used in the dynamic stopping mode. If the application calls for repeated dynamic stopping, it may be necessary to utilize different friction material better suited to handle high heat and wear situations.