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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Over the previous two columns we focused our attention on dynamic stopping applications. This month we will turn the attention to static holding applications.

Torque can informally be thought of as "rotational force" or "angular force" that causes a change in rotational motion. In static holding applications, the torque required for a brake to hold the load is the result of linear force multiplied by a radius.

There are several applications that may require different calculations, but following are a few examples and some guidelines for properly sizing a brake for static holding.

1. If the application has a motor, gearbox and drive the specified brake should always be at the high-speed end. The brake should also be mounted at the motor, which allows a smaller brake to be used.

   To calculate the torque required to hold the load, work backwards from the load. As an example, if the gearbox output torque is 250 lb-in and that is what is required to drive the load, then the holding torque would be:

   T / gear ratio X 1.5

   (the service factor should be 1.5 to 3 depending on environment and other application data)

   250/10 = 25 X 1.5 = 37.5 lb-inches

2. In applications where a motor is driving the load through a ball screw or lead screw the required holding torque demanded of the brake will vary depending on the type of ball or lead screw, and determining the right size brake to use may involve several other mechanical engineering calculations that take into consideration the efficiencies of the screw. Then multiply by a service factor of 1.5.

3. In applications where the brake needs to be mounted on an arm to keep a load from falling when power is removed, simply calculate the torque required to hold the weight of the arm plus the load (force x distance). Again, then multiply by a service factor of 1.5.

4. In applications where you know the motor's horsepower but do not know what the loads or holding torque are, a general formula you can use to get in the right ballpark of brake selection is:

$T = 1.25 \times 63000 \times (HP \times K) / \omega$

1.25 – adds factor for holding the load, in addition to stopping.
HP = Horse Power
ω = RPM
K = service factor (can be 1.5 to 3)

Light to Medium Duty Applications (K = 1.5)