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Common Specification Mistakes

for Clutches & Brakes

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Common Specification Mistakes

for Clutches & Brakes

by Joel Hable
Sr. Application Engineer, Warner Electric

Most common mistakes when specifying clutches and brakes:

Perhaps the first potential common mistake is not specifying a clutch and/or brake when necessary. When clutches and/or brakes should be specified depends on the application details but certainly as cycle rates exceed 10/minute they should be considered. Even when cycle rates operate below 10/minute brakes may be appropriate to provide controlled deceleration where large loads are present. In applications where consistent and accurate positioning is required clutches and brakes can provide significant value.

With regard to traditional electromagnetic clutches and brakes, a common mistake is in sizing these devices in applications below 100 rpm. This is most evident at the extreme of low speed, and static engagements; in these cases electromagnetic friction devices will not maintain rated torque. Friction clutches and brakes are designed to dissipate the heat generated by friction surface engagement. At low speeds, these design features are ineffective and a loss of co-efficient of friction can occur. Conversely, spring set, electrically released brakes, ideal for zero-speed-engagement holding applications will see dramatically reduced life in continuous dynamic stopping applications.

Wrap spring clutches and brakes are a simple and effective means of providing accurate, non-accumulative error indexing and positioning. However, they operate in a relatively narrow band of application parameters. Problems related to too much or too little speed and inertia are common.

Closely related to clutches and brakes are the controls used to power them. While controls are a critical part of the clutch/brake system, they are often not given proper consideration at the time the system is designed. Customers often call at the time the clutch and/or brake is being installed, realizing they need something to control it. There is a wide array of control choices and it is important to consider the type of clutch/brake engagement desired (full-on, soft-engage, etc.) as well as the best type of switching for the application at hand. Further, it is wise to ensure that the type of switching used is appropriate to the application.

Problems that occur choosing the wrong (or no) clutch or brake:

Overheating and premature failure of motors are often the result of cycling a motor alone too fast. Low through-put, poor quality and high scrap can often result without the fast and accurate starting and stopping of a clutch and brake. Variable Frequency Drives (VFDs) alone are also limited in cycle rate and the quickness and accuracy of stopping and holding. In addition, constant starting and stopping of the load using the motor alone will use more energy than using a clutch and brake to control the load.

Engaging a traditional electromagnetic device continuously below 100 rpm will not maintain rated torque and can result in inconsistent stopping and compromised load moving and holding. Starting a very large inertia or friction load without a low or no load starting clutch unnecessarily stresses the motor and puts an extreme load on the electric service.

Operating a wrap spring clutch with too much speed and inertia will result in breaking a spring. Operating with too little speed and inertia does not allow the clutch and brake springs to fully wrap and unwrap, causing inconsistency in positioning and premature wear of the springs.

A fixed output power supply may not fully release the armature of a permanent magnet, electrically released brake, causing armature drag, excessive heat, premature wear and failure. Permanent magnet, electrically released brakes require a close balance between permanent magnet magnetism and electrically created magnetism. Having a control that allows for adjustment of electrically created magnetism ensures this balance can be achieved.

Advice for picking the best clutch or brake, avoiding pitfalls, improving results:

For high cycle rate applications it is simply necessary to do a complete and accurate application analysis, being

careful to take into account all load inertias and speeds and potential sources of friction to maximize cycle rates and maintain repeatability. Warner Electric technical support is available to assist you with any questions you may have and we encourage you to take advantage of this no-cost service (800-825-9050). A wide range of clutches and brakes are made, and use of the manufacturer's Applications Assistance service can ensure that the unit selected best fits the goals of the application.

In spite of VFDs growing popularity, they are limited in controlling motion and providing controlled stops and holding. Even compared to servo motors, clutch/brakes can shine. Due to the extremely high torque to internal inertia ratio of a typical electromagnetic-clutch/brake-combination, clutch/brakes can match or exceed a servo's accuracy particularly on a cost/value basis. There is no substitute for brut force. If you have a modest cycle rate, say 10 cycles/min, your cycling motor application may be enhanced by a high performance dynamic-cycling-permanent-magnet-motor-brake module (a Warner EM-20-MBFB or FBB). It takes half the heat out of the motor and drive, dissipating it in the brake and provides long life dynamic stopping and no-power holding.

Avoiding other specific pitfalls, in low speed/no speed engagement applications, pre-burnishing (pre-running the clutch or brake under certain conditions) helps, but is not always permanent. Over-sizing is effective if spacing and proper funding is available. This is a common situation on the output side of a speed reducer when applications require the decoupling of the load so it can be moved independent of the drive. The most elegant solution is an electromagnetic tooth clutch. The caution here is tooth clutches can only be engaged at zero speed. For zero-speed-engagement brake applications a simple spring set brake is a cost effective solution. But many applications require a combination of low/zero speed and higher speed (>100 rpm) engagements. For these applications it may again be a good idea to get Warner Electric technical support involved.

In starting a large load, a fluid coupling (Mesur-Fil) or centrifugal clutch (NLS) is effective in reducing the starting load on the motor and electrical supply.

Wrap spring clutch and brake applications are another place where accurate system analysis is crucial in achieving the desired performance and maximizing life.

Regarding controls, there are numerous options on the market today, making this another good opportunity to take advantage of Warner Electric's technical support for assistance with your application. Some specific features of clutch/brake controls that can help avoid problems and improve results are adjustable outputs, internal transistor switching and over-excitation (OEX). An adjustable output control is required for all permanent magnet electrically released brakes to achieve a clean release of the armature. There are a number of mounting and switching options to accommodate most application requirements. To avoid maintenance issues with electromechanical relays, there are controls available with internal transistor switching, giving millions of cycles of maintenance free service. When ultimate repeatability is required, an OEX control shortens the coil current build time, reducing variation in engagement times and variation in position control. Conversely, when clutch or brake engagements are too abrupt, disrupting material flow, unnecessarily stressing power transmission components and supporting structures, or causing noise and vibrations unacceptable to personnel, an adjustable control can soften the engagements to acceptable acceleration rates.

About Altra Industrial Motion

Altra Industrial Motion (NASDAQ:AMIC) is a leading multi-national designer, producer and marketer of a wide range of electromechanical power transmission products. The company brings together strong brands covering over 40 product lines with production facilities in nine countries.

Altra's leading brands include Boston Gear, Warner Electric, TB Wood's, Formsprag Clutch, Wichita Clutch, Industrial Clutch, Ameridrives Couplings, Kilian Manufacturing, Marland Clutch, Nuttall Gear, Stieber Clutch, Twiflex Limited, Bibby Transmissions, Matrix International, Inertia Dynamics, Huco Dynatork, Ameridrives Power Transmission, Delroyd Worm Gear and Warner Linear. For information on any of these technology leaders, visit www.AltraMotion.com or call 815-389-3771.

Warner® Electric

An Altra Industrial Motion Company

US (Application Assistance)
800-825-9050
www.warnerelectric.com

Europe
+33 (0) 2 41 21 24 76

Asia Pacific
For a list of our AP sales offices:
www.AltraMotion.com/ContactUs

P-1892-WE 9/09 Printed in USA