Make It Last

Maximizing the Service Life Of Industrial Air and Spring Actuated Friction Clutches and Brakes

INTRODUCTION

When speaking of friction clutches and brakes used in industrial machinery, the answer to the question, “How long will it last?” can be complex to answer. Expected service life depends on a number of factors starting with the details of the application. Cycle rates, revolutions per minute and the air pressure that will be required to produce the torque to drive or stop the load are just a few of the application considerations. In our experience, we’ve seen severe applications where clutches and brakes require replacement wear parts after only weeks of use and other applications where they last decades with no maintenance at all.

For the majority of applications, clutch or brake service life will be measurable in years as long as the unit is properly sized and the manufacturer’s recommendations for installation, operation and routine maintenance are followed. This eBook contains Mach III Clutch, Inc.’s recommendations for maximizing service life gleaned from more than 45 years of designing, manufacturing and supporting friction clutches and brakes.

PROPER SELECTION

The most important factor in assuring maximum service life of a clutch or brake is choosing the right unit for the job. The best resource for assistance with selection is the manufacturer. An applications engineer can review your requirements and offer suggestions. Below are the things to consider when selecting an air or spring actuated friction clutch or brake.

Service (Safety) Factor

When selecting a clutch or brake for an application, a torque service factor must be taken into consideration. A service or safety factor will assure the clutch or brake will have the required torque when *new* to drive or stop as anticipated. A service factor of 1.5 to 2 (50% to 100% more torque than required) is recommended by most clutch and brake manufacturers.

Heat Damaged Drive Disc of an Undersized Clutch

Example:

Clutch torque required to drive the load = 500 pound inches

1.5 Service Factor = 500 x 1.5 = 750 pound inches
2.0 Service Factor = 500 x 2.0 = 1,000 pound inches

The clutch selected for the application should have a torque capacity of between 750 and 1,000 pound inches.

Increased service factors are advised for systems including any of the following:

- Gas or Diesel engine drives
- High Inertia loads
- Rough driven loads
- High cycle rates

PROPER SELECTION (Continued)

Revolutions Per Minute (RPM)

Manufacturers of friction clutches and brakes typically list the maximum RPM rating for each of their products. Be sure to note the RPM rating. Larger clutches may require precision balancing for high-speed applications.

High RPM when combined with high cycling can significantly reduce the life of the bearings and/or linings.

AIR SUPPLY

Use Only Filtered Air

Particulate contamination will cause wear to the o-ring, u-cup or diaphragm seals and can hinder proper cycling of the cylinder/piston assembly.

Regulate Air Pressure

Use an air pressure regulator and only use the air pressure required for the job. If the clutch or brake performs its' task at 50 PSI, there is no need to operate it at 80 PSI. Using the lowest possible pressure will maximize bearing life. Also, if the clutch is transmitting more torque than necessary, the unit may overdrive the system further down the drive train and may lead to breakage or wear of other machine components. It is recommended that the air pressure be re-adjusted periodically during the wear-in of a new clutch or brake.

Air Pressure Regulator and Filter

Lubrication

Mach III does not recommend lubricated air for the clutches and brakes it manufacturers. Consult the manufacturer if using another product.

PROPER MOUNTING

Following installation instructions is a critical factor in assuring maximum wear life. Below are some specific considerations.

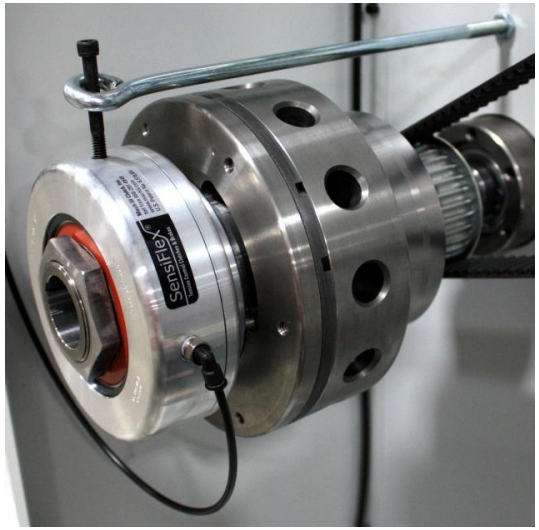
Orientation

The majority of standard catalog model friction clutches and brakes are designed for horizontal mounting. If vertical mounting is required, consult the manufacturer to see if any special modifications are required.

Anti-Rotation Restraint

Some clutches require the installation of an anti-rotation arm to secure the stationary housing. If the restraint applies any axial force to the clutch, bearings and friction linings may be compromised. Additionally, the unit may not engage and disengage properly.

To view Mach III's anti-rotation arm installation guide click on the following or paste the URL into your internet browser:
http://www.machiii.com/pdf/ReactionArmInstallation.pdf



Clutch with Properly Installed Anti-Rotation Arm

Shaft-To-Shaft Mounting

Great care must be taken when installing clutches in shaft-to-shaft mounting configurations to guarantee proper alignment of the shafts. Misalignment of the shafts can impair function and cause premature wear. If both angular and offset alignment of the shafts cannot be assured, a flexible coupling model is recommended.

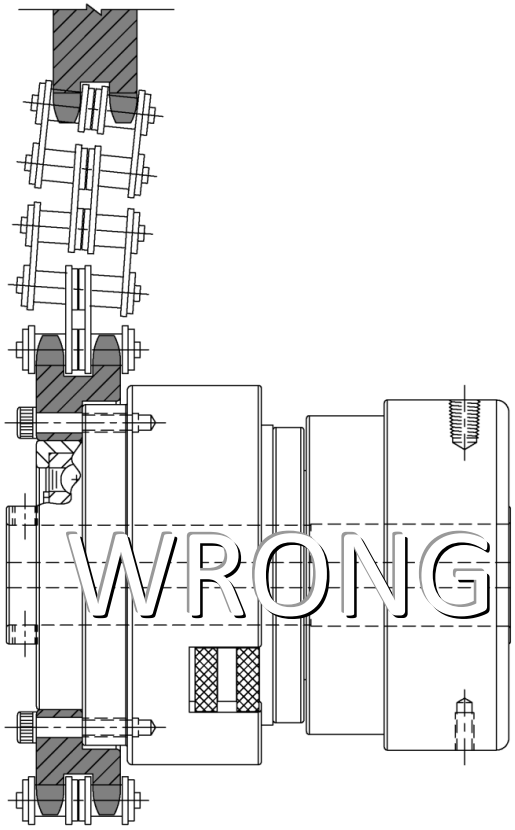
Rigid Coupling Clutch Mechanism

Flexible Coupling Clutch

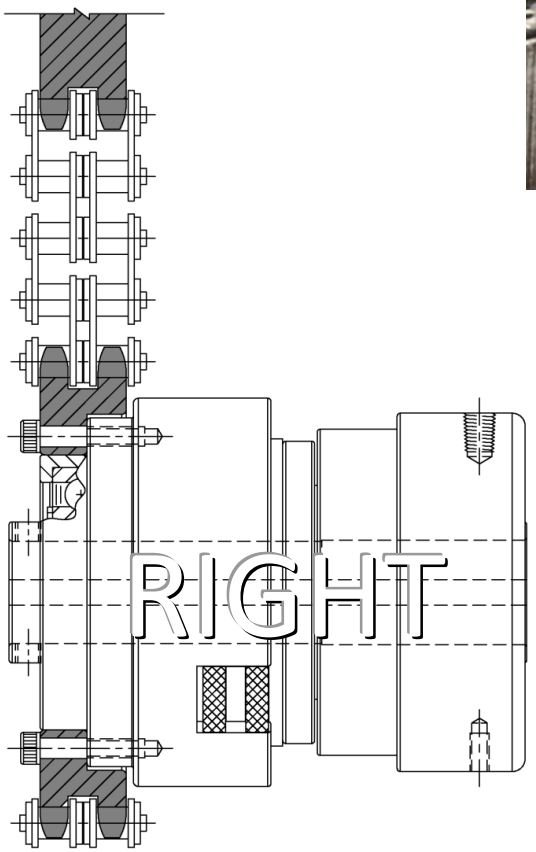
CHAIN AND BELT ALIGNMENT

Misalignment as shown below will produce premature wear of the bearing or bushing in the pilot of the clutch or clutch-brake. This type of misalignment can also cause axial movement of the clutch, potentially causing it to walk off the shaft. Additionally, the teeth of an improperly aligned sprocket will also wear prematurely as seen in the photo on the right.

Sprocket Worn from Misalignment



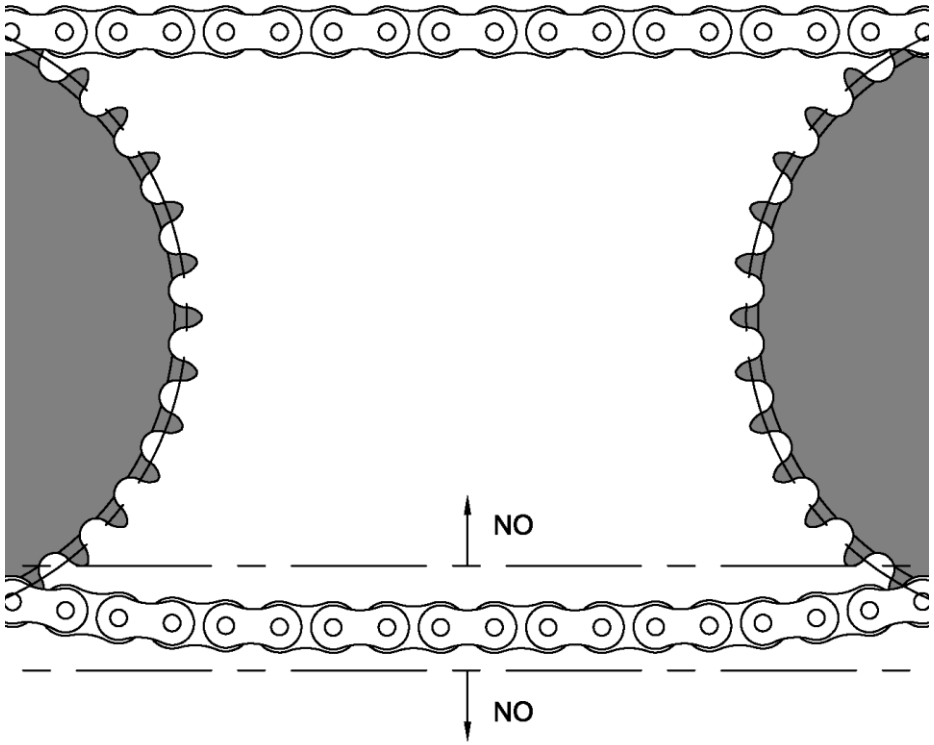
Misaligned Sprockets



Aligned Sprockets

EXCESSIVE CHAIN AND BELT TENSION

When using a clutch or combination clutch-brake with a pilot mounted sprocket, timing or v-belt pulley, the bushing or bearings in the pilot will wear prematurely if the chain or belt tension is excessive. Excessive tension can also cause clutches to continue driving when disengaged. The illustration below shows an example of a properly tensioned roller chain.



Proper Chain Tension

Roller chain and belting manufacturers are the best resource for guidelines on proper tensioning and chain length adjustment procedures.

ENVIRONMENTAL CONSIDERATIONS

Oil/Lubricant Contamination

Lubricants and/or “brake cleaners” should not be used. The example at the right shows a friction disc which is contaminated with brake cleaner. The solution adhered to the surface and led to a loss of torque in the unit.

Friction Disc Contaminated With Brake Cleaner

Particulate Contamination

Solid contaminants on the drive surfaces may prevent the unit from full engagement and will cause uneven wear which can lead to inconsistent torque output. Additionally, particulate contamination can work its way into the cylinder/piston area taking up clearance and preventing proper engagement. Bearing damage may also occur.

Moisture Contamination

Drive components of the unit are susceptible to corrosion from moisture. The example at the right shows corroded drive discs and release spring. Corrosion can adversely affect the ability of the unit to properly engage and disengage.

Drive Discs & Wave Spring Corroded By Moisture

Contact the manufacturer for advice on units that must run in particulate or moisture rich environments. Covered and sealed units that will shield against these contaminants are often available.

ROUTINE MAINTENANCE

All clutches, brakes and combination clutch-brakes should be inspected periodically for wear. The frequency at which the friction linings will require replacement depends upon the application. Operating a unit with heavily worn friction discs (linings) may lead to air leakage or the unit not engaging fully resulting in loss of torque. Repair kits are generally available and commonly contain replacement friction linings along with other typical wear parts such as springs and seals.

Typical Friction Clutch and Brake Repair Kit Contents

SUMMARY

The service life of any friction clutch, brake or combination clutch-brake is dependent first on the application. Cycle Rate, RPM and Operating Pressure are the key factors in determining how quickly components will wear. Following the guidelines contained in this document regarding mounting, chain and belt tension and alignment, environment and maintenance will help the user achieve the best possible service life.

When rapid wear is experienced, consultation with the manufacturer is recommended for assistance in troubleshooting.