

THE MOTION AND CONTROL MAGAZINE

Power Transmission Design

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Technology update:
MECHANICAL COMPONENTS

Shaft-joining systems

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MOTOR BASES

FOR TOP BELT-DRIVE SERVICE, GET DOWN TO MOTOR BASES

In any belt-driven system, two major troubles can be belt slippage and excessive tension. Improper belt tension causes both. The motor mounting base usually sets how well you can control tension. Choose it wisely.

EDWARD J. BEES, Vice President,
Overly Hautz Motor Base Co., Lebanon, Ohio

When you assure correct belt tension, the rewards are substantial: better drive efficiency, less downtime, and fewer maintenance requirements. And you extend the service life of the belt, motor bearings, and other system components.

Ideal belt tension is “just enough” to drive the maximum anticipated load without slippage. Some people call it “proper tension” — the level at which you get maximum drive efficiency while imposing lowest possible stresses on the belt, bearings, and components of the driven member. Too much tension needlessly stresses these same components, leading to premature failure. Too little causes belt slippage, heat, loss of available power, and needless wear on belts and pulleys.

Motor bases to set belt tension come in two broad categories:

- Fixed-position adjustable bases allow adjustment by manually altering the center distance between driver and driven pulleys (or “sheaves,” for V-belt drives).
- Tension-controlling bases have internal or external devices

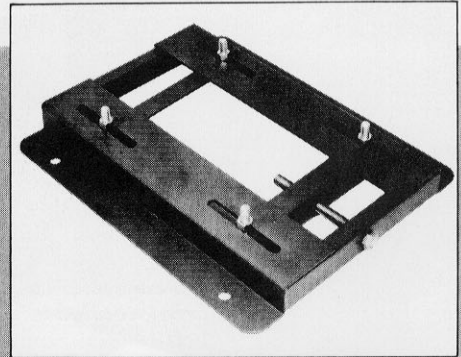
to change pulley center distance automatically as the machine runs and as load conditions require.

What frequently happens in industry is that different parties become involved in design, fabrication, and installation of equipment. Someone, somewhere down the line, is faced with procuring a motor mounting base — often with little or no thought for the important implications of belt tension adjustment and control. So, that person orders a fixed-position base to fit the motor’s mounting dimensions. And where the system application really calls for a tension-controlling base, you can predict trouble.

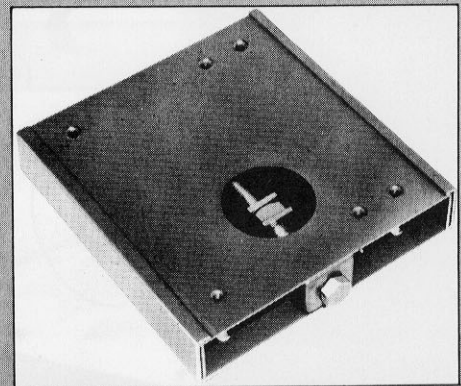
Let’s see what the different types of motor mounting bases will or won’t do in providing greater system efficiency, lower maintenance, and longer system life.

Fixed-position adjustable motor bases

A fixed-position adjustable base lets the motor be pushed or pulled into position, so the belt can be installed and adjusted. After the belt is pulled over the pulley and before the mounting



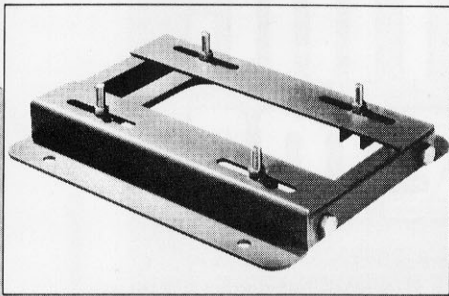
Fixed-position, single-screw adjustable base used for motors in the 10 to 100-hp range.



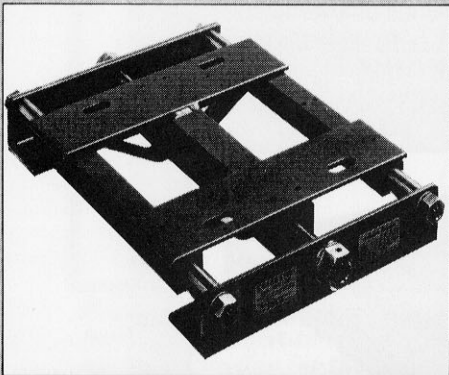
Fixed-position, single-screw adjustable base includes movable plate to carry the motor, and tapped holes for hold-down bolts. Eliminates need to loosen mounting bolts during tension adjustment, permits adjustment as system runs.

bolts are tightened, one or more adjusting screws force the motor away from the driven pulley until the desired tension is reached.

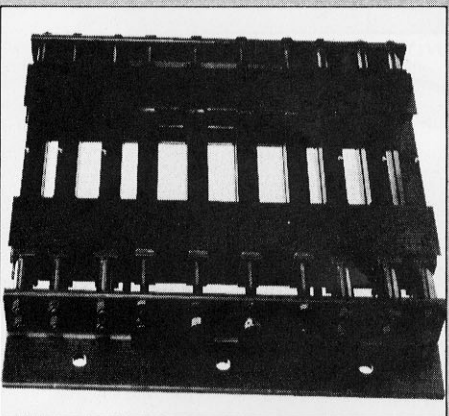
Base construction varies, from a one-piece formed plate to beefed-up versions that include



Fixed-position, dual-screw adjustable base styles offer greater alignment flexibility.



Spring-loaded tension-controlling base has single spring that compresses and expands to compensate for load variation.



Heavy duty spring-loaded tension-controlling base serves 500-hp, 1,200-rpm motor for rock-crushing application.

Z-bars and continuous welding for greater strength. Sizes and styles are available to fit motors from fractional horsepower to over 200 hp and to mate with NEMA mounting dimensions.

The single adjustable base has

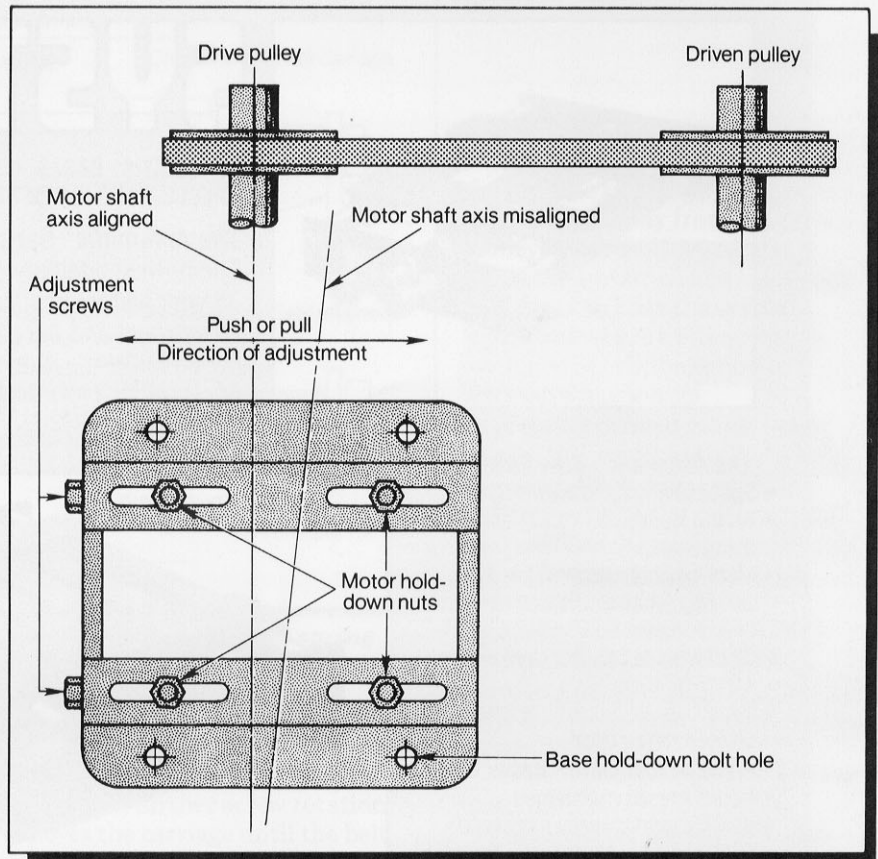


Figure 1 — Dual-screw fixed-position adjustable base has two parallel adjustment screws. Dashed line shows condition of improper motor alignment, which is more likely with a single-screw base. You can run up the dual screws alternately to hold alignment and set tension concurrently.

a central screw for tension positioning. As you turn the screw you move the motor (and its pulley's center) toward or away from the driven pulley's center. Because of this style's simplicity and economy, it offers a cost-effective solution for many applications. In general, single-screw styles can serve on motors from fhp to 150 hp.

A dual positioning base such as the one in Figure 1 has two adjusting screws located directly under the motor feet. This style comes in configurations identical to single-adjustable bases, as well as in reinforced construction to extend the application range to about 200 hp. The major difference in the two styles is that dual screws provide a simple and positive way to hold alignment.

As belt tension is applied, the

motor drive end is pulled away from the driven unit. The mounting nuts are not tightened until tension adjustment is complete. The misaligned condition shown in Figure 1 should not occur if the screws are adjusted correctly. By alternating turns between the two screws, alignment is maintained at the same time tension is adjusted. With the single screw, you must pry and hold the motor in an aligned plane as the mounting bolts are tightened. Depending on motor size, the alignment tool can be as simple as a screwdriver or pry bar. To hold a larger motor in place you may need a hoist or Come-Along.

Many standard fixed-position bases have mounting studs that protrude from slots. You must lift the motor over the studs during

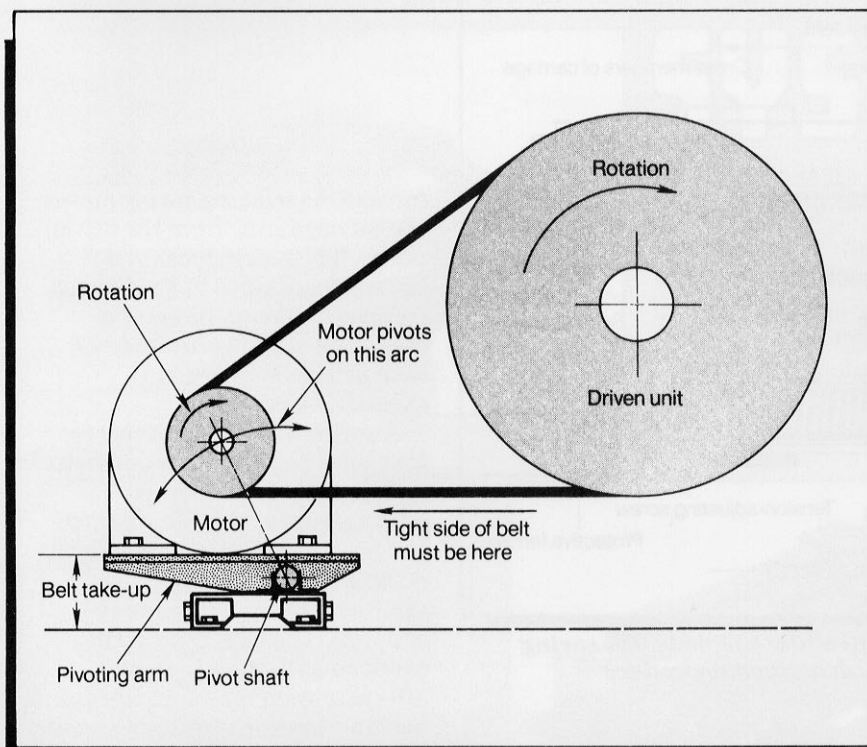


Figure 2 — On pivoting tension-controlling base, load increase causes reaction torque. Resultant force pushes down on pivoted arm, making motor pulley centerline swing down with respect to pivoting-arm axis, increasing pulley center distance, thus raising belt tension to meet higher load.

installation and loosen the nuts to make tension adjustments. A caution: Never loosen the mounting nuts more than absolutely necessary to let the motor be moved during tension adjustment. If they are too loose, the motor can pivot and lift toward the driven pulley during belt tightening. Then, when the nuts are tightened, belt tension will be higher than required and you may overstress the mounting studs.

A special fixed-position adjustable base (see photo) offers several advantages over standard models. It includes a mounting plate that moves as the adjustment screws are turned, to simplify installation, alignment, and tension adjustment. The movable plate not only makes it unnecessary to loosen and tighten bolts during adjustment, but also permits belt adjustment as the system runs.

Fixed-position adjustable bases

have applications from appliances and shop tools to industrial machines powered by motors weighing over 5,000 lb. In numbers, they are by far the most common type. The big advantage is low initial cost; another, availability in standard styles for NEMA mounting dimensions. One manufacturer, for example, stocks over 225 styles and sizes.

Selection considerations.

Before settling on a fixed-position base, consider these major limitations:

- Unless the design includes a movable mounting plate, adjustments must be made while the system is at rest. In most situations, this involves some guesswork. When you can make adjustments at dynamic operating conditions, you are in better position to apply the minimum tension needed to drive the maximum load efficiently.

- Once you adjust the belt and fasten the motor in place, the

center distance between pulleys is fixed. Ideally, belt tension should be sufficient to drive the maximum load without slippage. In making that adjustment, you inadvertently create an adverse condition: When the driven load is less than maximum, belt tension is greater than necessary. This additional stress over time contributes to wear on system components.

- With a fixed-center drive, the system cannot cope with load variations, shock, or vibration. As an extreme example, if you want to drive a rock crusher and you decide on a fixed-position base because of low initial cost, maintenance and replacement costs will eventually exceed the cost of several tension-controlling bases.

Tension-controlling bases

With the fixed adjustable base the chief limitation is that there is no way to adjust belt tension as load varies. The alternative is a base that can automatically adjust the center distance between pulleys as load requirements demand, while the system runs.

Pivoting bases, Figure 2, use the motor's weight as well as its direction of rotation to apply and control tension. The motor mounts on pivoting arms. By locating the motor farther from the pivoting shaft, you increase belt tension; locating it closer, you decrease tension.

Support arms, with bolt holes and slots sized to motor frames, let the motor be positioned and secured. During start-up, motor reaction torque moves the pivoted arm downward, thus increasing the pulley center distance and building up tension. As the operating load increases, the arms swing up, thus decreasing the

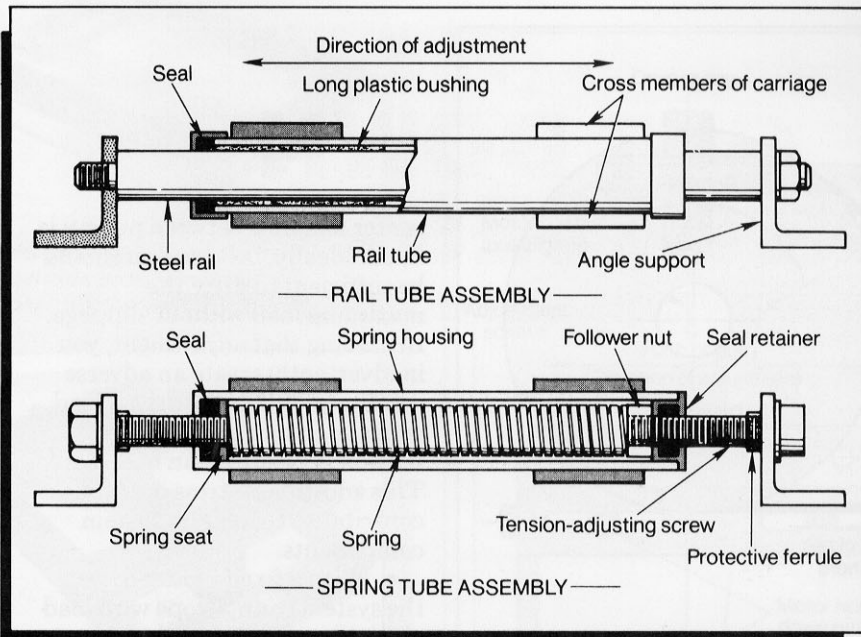


Figure 3 — Spring-loaded tension-controlling base balances spring force against belt-tension forces at any drive load to produce optimum tension for that load.

center distance.

Functionally, the pivoting base offers distinct advantages over fixed-position bases. However, because the motor must be positioned and adjusted to produce enough tension to drive full load, at less than full load this tension can be more than necessary. The pivot base principle also imposes restrictions. For example, the tight side of the belt must be between motor shaft and base pivot shaft; if not, reaction torque causes the base to rise and throw the belts off the pulleys. Usage is restricted to single-direction rotation and mounting is generally limited to horizontal positions.

Spring-loaded bases, Figure 3, use a built-in spring or series of springs to control belt tension. The motor rides on cross members attached to tubes, making up a carriage that automatically moves toward or away from the driven member as load increases or decreases.

The motor bolts to the carriage, which is free to move. Turning the adjustment screw clockwise causes the follower nut, spring, and carriage to move away from

the driven pulley. After the belt is installed, further screw rotation moves the carriage until the belt is snug. Continued clockwise rotation causes the follower nut to compress the spring. The spring, in turn, exerts a force on the carriage, which results in tension being applied to the belt. The force exerted by the spring equals the total tension in the belt; both forces act upon the carriage in opposite directions, and the carriage is free to move to a neutral position where all forces balance — the free body is in equilibrium.

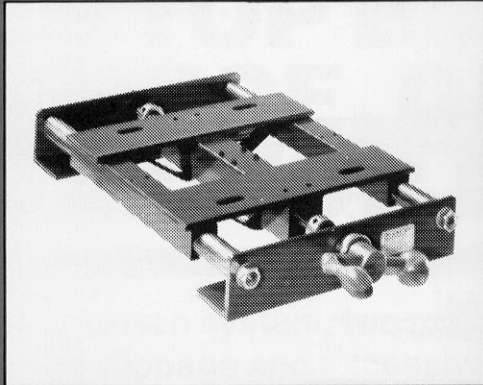
Springs for spring-loaded bases are sized by the manufacturer. Adjustments are made on site as the motor runs at the prevailing load. As load increases, belt tension increases until it exceeds the spring force. The spring then compresses and the carriage moves toward the driven pulley. As this happens, the increased spring force becomes equal to the increased belt tension. Whatever distance the carriage travels equals the additional distance the spring is compressed. Conversely, when belt tension decreases because the load lightens, the

force of the relaxing spring moves the carriage away from the driven pulley. The result: tension is always maintained at a value just sufficient to keep the system operating at peak efficiency — with neither slippage nor excessive tension.

A spring-loaded motor base makes for simple motor and belt installation: you make adjustments as the system runs; you need no calculations; and you do no guesswork in applying minimum tension to prevent slippage. The base can handle overload and shock without affecting system performance, and belt and bearing stresses are never excessively high.

The emphasis in this article has been on belt tension control, because that is the key to higher system efficiency, lower maintenance, and longer life. In general, a fixed-position adjustable motor base can do that, though a more costly tension-controlling base might do better. Other aspects to consider include equipment location, environmental conditions, and unusual or special mounting requirements. Any of these could tilt the decision in favor of a tension-controlling base. A tension-controlling base means fewer trips to a remote or nearly inaccessible site, less time devoted to adjusting belts that stretch more because of high temperature, and the freedom to mount the motor vertically or horizontally on walls or ceilings. **PTD**

MOTOR MOUNTING SYSTEMS



**AUTOMATIC® BASES • RAILS • BASES • SCOOPS
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The Automatic® Spring Loaded Motor Base

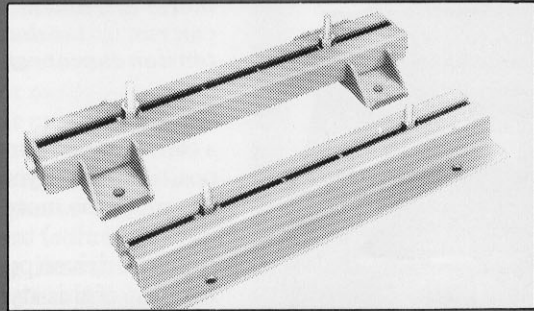
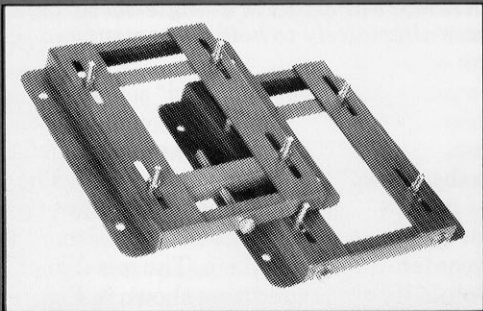
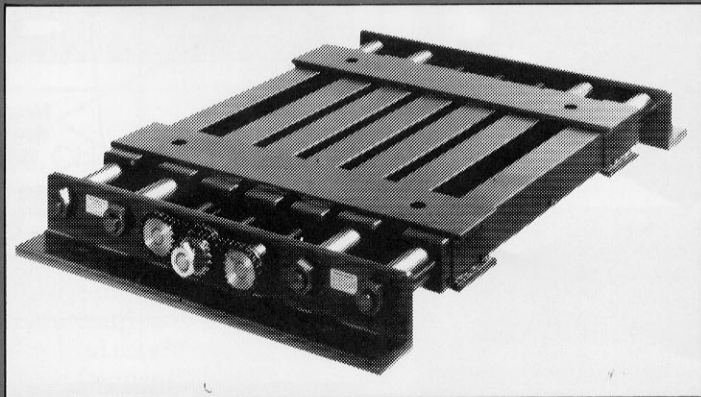
The newest addition to the Overly Hantz line has a 35 year history of success in the industry. Simple adjustment and the convenience of low maintenance make the *Automatic®* base ideal for most applications including remote sites.

The Automatic® Base Features:

- Spacesaving pancake design
- Spring loaded to virtually eliminate maintenance
- Multi-position mounting — floor, sidewall (shaft vertical or horizontal) or overhead
- Clockwise or counter clockwise motor rotation
- Price competitive with less-versatile pivoted motor base

With the Automatic® Base:

- Rated speeds maintained
- Belt-life substantially increased
- Belt tension automatically adjusted while operating under load
- Belt and bearing overload reduced



Adjustable Motor Bases

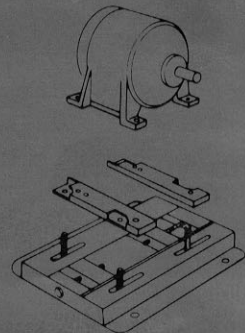
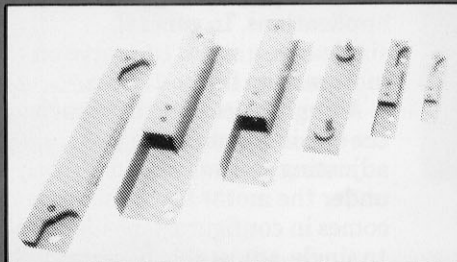
- Stock bases for fractional to several hundred horsepower motors
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Adjustable Motor Rails

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