

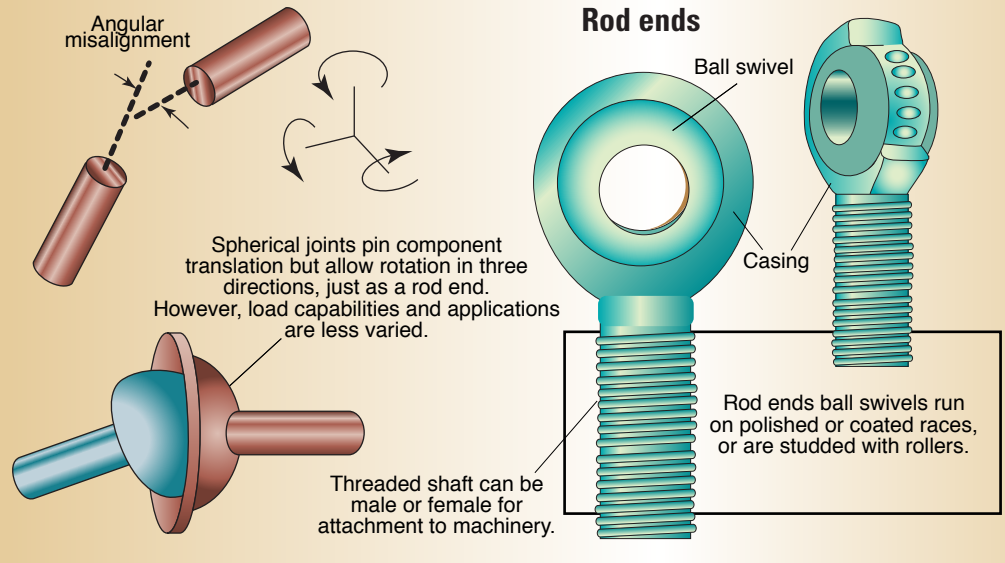
Moving rod ends

Similar to ball-and-socket joints, rod ends integrate a spherical bearing with a threaded shaft to make a support structure for other pivoting or moving parts. They prevent translation while permitting rotation of the components they support (to serve the same purpose as clevis and knuckle joints) but allow for

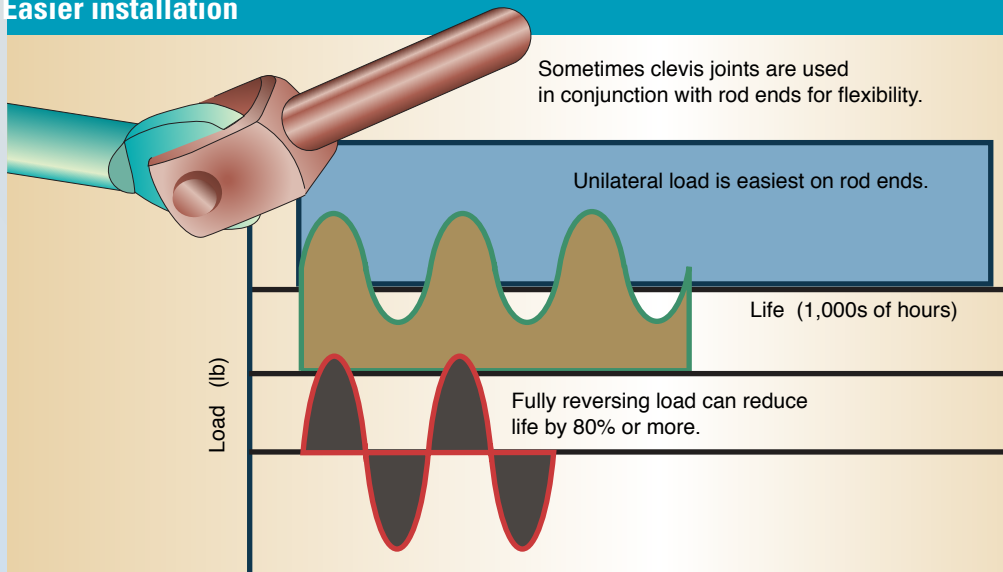
more dynamic loading and precision. Also called *Heim* or *rose* joints, rod ends are best known for their use in slower or nearly static aircraft and automotive applications. That said, more sophisticated units are also applied in these applications as well — and in dynamic off-highway and industrial machinery.

Articulating joints

An inner concave casing race and a convex ball swivel that moves inside are mated with precision to match that of the application.



Easier installation



Rod ends allow mounting of other components with basic pin fasteners. Oscillation and full load reversals reduce life.

Q&A

What options are there for the inner working surfaces?

The surfaces of two parts come into contact and generate friction in every rod end: the inner rounded-out concave casing race of the stationary portion, and the convex ball swivel that moves inside it. These two parts are mated with precision to match that of the application for which they're used. In maintenance-free units for low-speed applications — which are sometimes heavily loaded as well — the convex ball swivel is a simple rounded piece of engineered steel.

Otherwise, sometimes for extended life or higher speed, it is steel coated with a slippery polymer or mated with a casing race lined in brass or thermoplastics. In fact, these particular units exhibit the lowest friction coefficients, down to 0.10 or better.

For faster applications, the surface of the ball swivel is sometimes studded with rollers, to resemble a regular spherical roller bearing. These components are fitted on the side with a port through which lubrication can be applied. Or for the fastest of applications — often in industrial plant machinery and off-highway specialty parts — the outer surface of the ball swivel is studded with two rows of rollers.

How precise are they?

Besides lowering friction, brass and thermoplastic casing-race linings and materials can also serve to tighten dimension ranges to the micron range. In its function to accommodate error, a rod end's geometry determines just how much alignment it can oblige. Many rod ends can accommodate

misalignment to 10° or 20° or better, though limits should be respected to protect linings and any roller cages from damage. The rod end's ball-swivel diameter, casing width, and depth determine how far the joint can swing before it reaches a point of interference or damage.

What dynamics can rod ends withstand?

As with any support, static load capacity depends on the rod end material strength. Dynamic load capacity is reduced by two thirds or more when unilateral force begins to oscillate, and is reduced 80% or more if the reciprocation frequency

is faster than a couple strokes per second. Sliding is another concern; the ball swivel and casing race can create heating friction very quickly. Cooling is one solution — usually through basic conduction or oil lubrication. Another approach if the rest of the application remains below 130° F or so is the use of all-plastic rod-end bearings. Here, rotary motion of mounted shafts takes place in the spherical portion, and not between the race and swivel as in metal varieties.

For more information, visit machinedesign.com and type "rod ends" into the Search field.