# ROD END INSPECTION

*A race car's suspension can easily feature a few dozen rod ends, and these joints allow nearly unhindered motion. Over time, however, each one can become a ticking time bomb. Rod ends don't last forever, but knowing how to inspect them can keep a car on track and off the hook. John McCrory is with Aurora Bearing Company, one of the largest rod end suppliers in the free world, and he has some simple advice for racers and crewmembers.*

Refurbishing an older race car really requires you to question and evaluate every component. Are parts worn, and how can you tell? Even if various parts do appear to be good, should they be replaced by newer, better-performing parts anyway? Rod ends are one of the many items that can cause headaches for the race car refurbisher.

**Evaluation:** When evaluating the rod ends on a race car's suspension, the first step is to eliminate joints that don't belong on a racing suspension in the first place.

Joints with brass, bronze, or plastic races should be eliminated right away. Races made of these materials have relatively low compressive strengths and a low tolerance for shock or vibratory loads—they tend to loosen up quite drastically under hard use. These races are sometimes acceptable for secondary linkage applications, but they really aren't up to the demands of a race car suspension.

Two other items to remove immediately: rod ends with grease fittings and rod ends with hollow shanks. While both features allow the rod end to be relubricated, strength is compromised.

**Condition:** Once you determine that a rod end can be reused, its condition must be examined. Start with the overall condition of the joint.

Is the body bent? Are there signs of stretching on either the shank or the head? Are there marks that indicate the part has ground against something else (maybe the track)? Does the outer face of the race have dents that indicate over-misalignment? Is the race loose in the body or partially pushed out of the body? These are some indications that the joint has been abused, possibly in an accident, and should be replaced. If the joint shows none of these signs of abuse, magnetic particle inspection—like Magnaflux testing—should be done to ensure that the piece is truly free of cracks.

The next thing to do is evaluate the amount of wear on the bearing portion of the joint. Any play in these joints will be more noticeable when the car is together, so shake each corner of the car and try to note any play relative to a joint and its mounting bolt. Touching a finger to both the joint and an adjacent surface should help you detect any relative movement.

Wear can still be evaluated with the parts off the car. On a unit lined with a nonstick material like Teflon (DuPont's brand name for PTFE), low breakaway torque (the force required to move the ball) is not necessarily a sign of a worn-out joint, although it can be. This contradictory statement is rooted in the fact that different bearings manufacturers use different PTFE liner designs. These designs each have different performance characteristics.

One brand of bearing may start out with a very tight fit, then gradually loosen up until it reaches a zero-torque fit and wears out. Others may start out tight, fall off quickly, then maintain a light fit for a long period of time. In either case, the important thing to look for is an absence of play either axially (side to side) or radially (along the direction of the shank).

Judging the wear on a metal-on-metal joint is a little more difficult, as all metal-on-metal joints start life with a small amount of clearance. Comparing your used joints to a new one is a good place to start. An unscientific method is to hold the rod end's shank and give it a good shake. If it rattles, it's worn out.

Looking at it from another perspective, if you car's suspension has metal-on-metal joints, why not replace them with PTFE-lined joints? Remember, lined joints are more precise because of their zero-clearance fit. They're also maintenance free.

**One Last Inspection:** Before reinstalling an old joint, there's one last factor to consider: the fatigue life of the rod end.

The body of a rod end usually fails for one of two reasons. The first is severe overload. Make a hard enough impact with a curb, wall or another car, and you can overstress a joint to the point of breaking. During your inspection, you may find a joint that's been stressed to, or close to, the breaking point.

The second reason for failure is fatigue. Like any other metal component, rod ends are subject to wear. Unfortunately, there's no way to tell if one is too fatigued to pass inspection.

Rod ends can be loaded in many different ways, and each use affects the fatigue life of the joint. They can be loaded in straight tension or compression along the direction of the shank, as on a suspension pull rod or push rod. They can have a straight-line reversing load, as on a tie rod or radius rod. They can also have bending loads applied to the shank, as when a rod end is used as a ball joint. Or there can be a combination of loads in various directions.

So what do you do? The safest thing is to automatically replace any old joints with appropriate new joints. The most realistic strategy is to evaluate the physical condition of each joint, consider the stress it endures in its particular application, and figure out what your budget will allow. That should help you draw up a plan of attack.

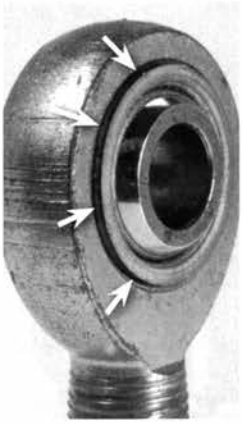
## Common Rod End Failure Modes

photos courtesy aurora bearing

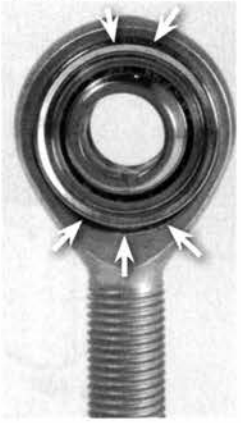
Broken

Misalignment

Misalignment



Pushout



Stretched

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LEFT: During a wintertime work session, we found that most of our car's suspension joints were rod ends of various ages and conditions. We junked them all and ordered replacements. RIGHT: While our suspension was disassembled, we repainted the trailing links and control arms.

per schroeder photos

ABOVE: We replaced our old rod ends with brand-new hardware sourced from Aurora. BELOW: The LeGrand also uses a pair of rod ends to support the steering rack. In this case, we used lightweight aluminum pieces from Aurora. We also took a look at our gauges—or, rather, we tried to take a look at them, but they were too hard to read. A new Stack ST 1800 display unit was the solution. It's a customizable setup, and we specced our tachometer with a 15,000 rpm rev range. Our old muffler was too loud, so we swapped it with a new two-stage unit from Burns. This should keep us from raising the ire of the sound police.

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**From: http://grassrootsmotorsports.com/project-cars/1976-legrand-mk-18/**
**LeGrand Mk 18: Replacing Rod Ends Oct 27, 2010**

After we had to replace a rod end at the Solo National Championships, we took a good long look at all of the rod ends in our LeGrand's suspension. We decided to replace every single one; that was the only way we could ensure we'd have a solid foundation going into our 2011 racing season.

We chose an old favorite of ours, Aurora Bearing Company's alloy-steel PTFE-lined rod ends, for most of the suspension joints. The car is mainly held together by the 3/8-inch versions, but ther are several larger and smaller sizes. We counted 22 joints in the rear suspension alone.

One we have the car back together, we'll need to do a full alignment and "squaring" of the car.

The old rod ends wer worn, and we could feel that several had some play in them. Not good for a suspension!