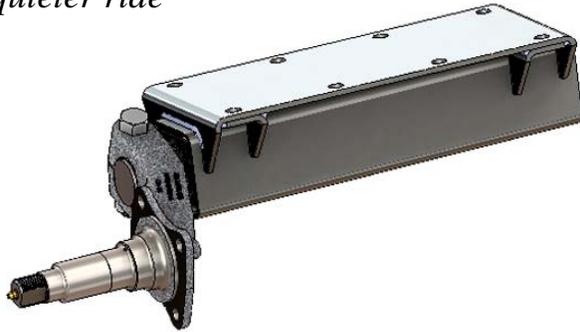


TRAILER BREAKTHROUGH

Torsion axles provide a suspension system that promises to make life easier through better handling and a smoother, quieter ride



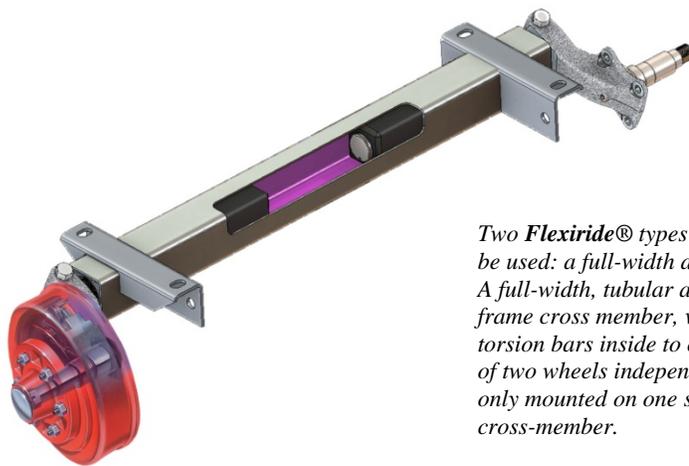
The Flexiride® system is also available as separate, side-to-side units that do not require a beam axle.

The days of the typical boat trailer with leaf springs and solid axles may be numbered after word gets around about the benefits of torsion-axle suspension systems. While not yet commonly available on boat trailers, torsion systems have been used for decades on travel and utility trailers. They offer many benefits over conventional leaf-spring systems and are gaining in popularity, especially with up-scale boat-trailer builders.

The differences between leaf-spring systems and torsion-axle systems are significant.

Leaf springs consist of curved plates bundled together to resist compression as the wheels move up and down. The springs are connected to the trailer frame with hangers and shackles. A rigid axle is bolted to the spring system. Wheels are mounted directly to the axles.

Torsion axles, on the other hand, resist wheel movement with torsion, or twisting, forces. A steel bar inside a tube, or housing, is connected to a short trailing arm. The axle housing is mounted directly to the trailer frame, while the wheel is mounted on a hub at the end of the trailing arm. As the wheel moves the arm up and down, the arm twists the steel bar. The bar resists and exerts force against the movement. Rubber cords are often compressed and inserted between the flat sides of the steel bar and the housing; this further restricts unwanted movement.



Two Flexiride® types of torsion axles can be used: a full-width axle or two stub axles. A full-width, tubular axle can serve as a frame cross member, with two separate torsion bars inside to control the movement of two wheels independently. A stub axle is only mounted on one side of the frame or cross-member.

Trailing arms are the most common pivot arms used with torsion axles. The pivot arm is mounted facing rearward, behind, or trailing, the axle. Most trailing arms allow height adjustment of up to six inches for clearance variations. To function properly, trailers using most torsion axles should be towed at a level angle.

So, what are the benefits of torsion axles over leaf-spring systems?

On leaf springs with rigid axles, suspension movement on one side affects the other side. However, on torsion axle systems, each wheel rides independently over bumps without affecting another wheel, even if on the same axle.

Furthermore, unlike leaf-spring systems, which hang below the frame several inches due to their curvature and hanger hardware, torsion systems mount directly to the trailer frame—they don't clog or become inactivated by mud, snow or ice. Also, most torsion systems use tubular axles that can be made into structural, frame cross members, since no allowance need be made for upward suspension travel required on axles that are suspended with leaf springs. While this practice also reduces weight and frame cost, the potentially lower overall trailer height with a lower center of gravity means improved handling—especially better cornering ability and rough-road stability. Sway allowed by a typical leaf-spring hanger setup is virtually eliminated. On unequalized tandem trailers with torsion axles, you can run the rear wheels off the end of a ramp and they'll only drop about 1½ inches instead of the 4 inches typical with a solid axle having leaf springs. This gives another three feet or so of effective ramp length without getting into trouble. And, if you have a flat tire, the reduced drop will keep from destroying the tire or wheel while making it easier to change a flat. In fact, on many tandem torsion units, it's possible in emergency situations to drive with one wheel removed, although it is not a recommended practice.

Other benefits include reduced maintenance, better durability, virtually no noise and easier installation for trailer manufacturers. Unlike typical leaf springs, which often begin to rust after their first immersion, torsion units are either unaffected by water immersion or protected from its effects; the rubber used is providing a water tight seal for the housing.



*The **Flexiride**® rubber torsion axle consists of three primary components: a rubber cartridge, support bushing and spindle arm. The cartridge is comprised of strong proprietary formula rubber bonded to a steel shaft.*

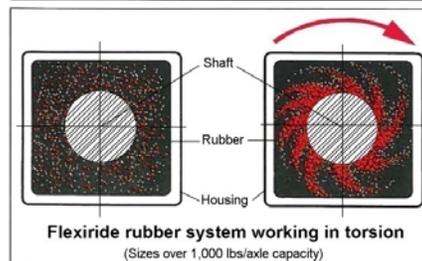
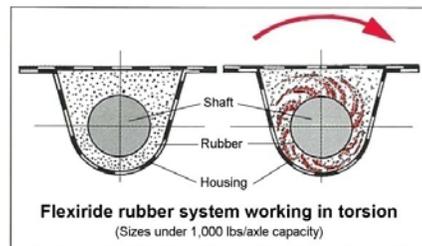
Because metal-to-metal contact is eliminated within the suspension system - either by inherent design or by rubber components - noise is eliminated, along with the need for any lubrication in most systems. There's no maintenance, since there's nothing to wear out. However, brakes, backing plates, hubs and other wheel components are the same as with leaf-spring systems, and require the same maintenance as before.

Installation for trailer builders takes less time and manpower, mainly because of fewer components and assembly procedures. There are no hangers to position and weld, no bushings to install and no extra linkage to bolt in place.

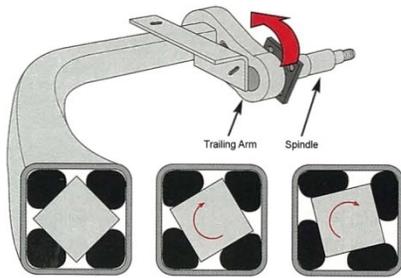
Convenience of repair in the event of damage, however, varies with the type of unit. In the case of some torsion suspensions, like the Flexiride®, which uses stub-axle or cartridge components, these are easily unbolted and replaced. Parts for such units can usually be shipped via UPS because of their smaller size and reduced weight, which may not be the case with heavier, bulkier leaf springs.

*The **Flexiride**® system operates in shear rather than compression providing more angular compliance, a better damping effect and a smoother ride.*

The nylon support bushing maintains camber and contributes additional damping control.



However, in other cases, torsion axles can't be disassembled for repair - the entire axle must be replaced if damaged, which is much the same in the case of a conventional beam axle. But the cost of a torsion axle will be greater because the component is not as simple as an ordinary steel bar or tube used in conventional axles.

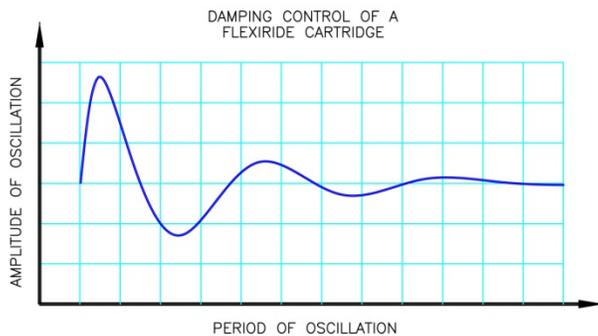
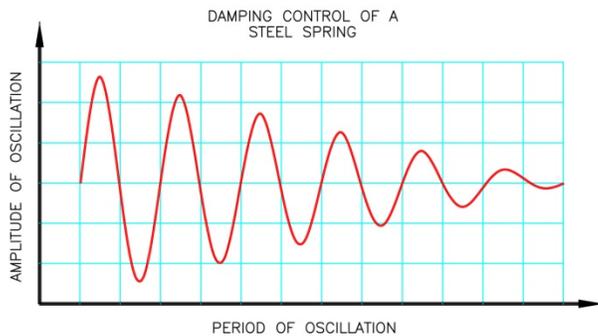


The **Torflex**® system uses a torsion bar mounted in a square tube fitted with rubber cords that compress. The spindle, trailing arm and torsion bar are welded, the whole axle cannot be disassembled.

Boat designers know that trailering a boat may be the most abuse a hull receives. That's why we find torsion systems appealing. For example, when a trailer with leaf springs passes over a railroad crossing or hits a pothole, the trailer rebounds on both sides and tends to bounce around for a while after.

This oscillation is transferred to the boat's supports – bunks or rollers – causing potential hull fatigue, deformation and damage.

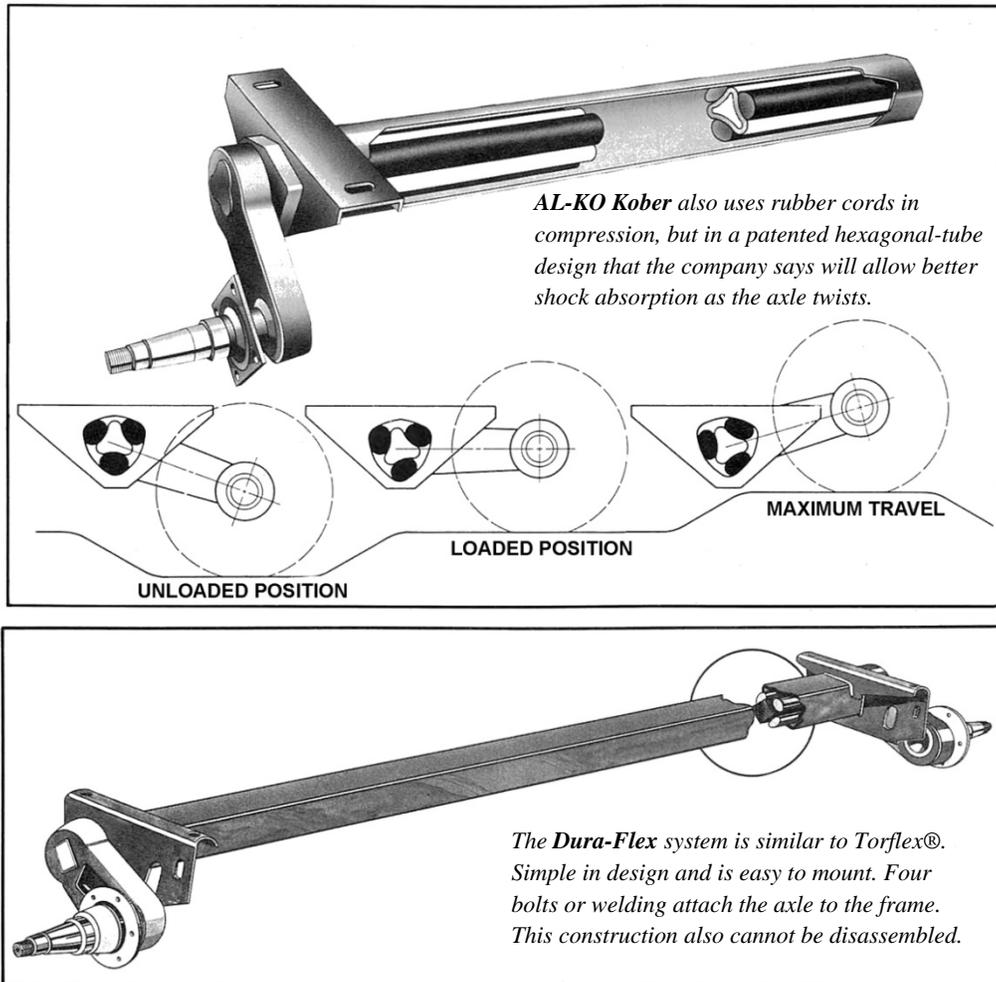
However, with typical torsion-axle systems, each wheel is truly independent and has greater energy absorption due to the rubber springing mechanism offering more compliance and a plusher ride. The boat and trailer suffer much less, since road shocks are taken one wheel at a time and are more completely absorbed.



This energy absorption also minimizes frame fatigue, especially on aluminum trailers that use a material inherently weaker than steel, thus requiring more sophisticated design and construction. The rubber incorporated into most torsion systems insulates the trailer frame and boat from road shocks and vibrations, while the self-damping effect eliminates the need for shock absorbers.

Furthermore, it's potentially easier to match trailered load with torsion units. With leaf springs, load increments between spring sizes may be as much as 1000 pounds. And, when a conventional boat trailer is not loaded to near its spring rating, the ride may be too stiff and hard on the boat.

However, most torsion systems allow trailer builders to make capacity adjustments in smaller steps so that the ride need be neither too hard nor too soft. Then, too, a good ride is still possible without a full load; many systems have what's called a "progressive torque action," which actually increases carrying capacity as load is applied.



Torsion suspension systems trace their roots to Europe, where the first system was patented in Germany in 1941. In fact, their use is widespread in Europe for all types of trailers. Why, then, haven't such systems seen more use on boat trailers in North America?

According to suspension-system firms and boat-trailer manufacturers, there are several reasons.

First, the public simply doesn't know that these units exist, thus there has not been much demand. However, those now building boat trailers with torsion axles believe that customers with more trailering experience (good and bad) want better trailers to protect their boats, which are becoming ever more costly investments.

Second, torsion systems cost more than conventional systems - from 20% to 50% more, depending on capacity rating-a major factor in a very competitive business where low price is often the most important factor influencing purchase. However, as more torsion-system units are used, prices become more favorable, according to industry sources. One trailer builder noted that his company would switch over totally if torsion axles were cheap enough, even on low cost, steel-frame units.

Third, boat-trailer builders often want suppliers to provide a complete package of undercarriage components - wheels, tires, brakes, axles, springs, etc. - from one source. Often, torsion-axle suppliers have not been well-positioned to deliver such packages, although this is improving.

Fourth, as is often the case with new advancements, there has been resistance to change. If the public doesn't demand these units, why should trailer builders offer them while increasing prices at the same time? And, in

the case of some larger boat-trailer builders who actually build their own leaf-spring undercarriage assemblies, the logistical problems would also increase with a change to proprietary torsion-axle systems.

Finally, conventional leaf-spring systems are readily available in generic form without special sourcing, are easily repaired and replaced at a nominal cost, and are familiar to all who are involved with boat trailers. Torsion systems, however, are not interchangeable nor yet as readily available, and some systems have not stood the test of time in marine use, even if they promise to be superior.

WHAT'S AVAILABLE IN TORSION SUSPENSION SYSTEMS

FLEXIRIDE

This system is available as full beam axles and separate side-to-side units that do not require a beam axle or in-cartridge-form units. The trailer builder can install them into his square-steel tube axle. Each unit contains a round bar attached to the trailing arm within a housing that serves as a mounting plate. The space between the bar and housing is filled with elastomeric rubber strongly bonded to the bar, much like a rubber engine mount.

Unlike other units, as the trailing arm moves, this rubber resists the rotational motion in shear rather than in compression. The manufacturer states that it is the lightest in weight of all torsion systems. Also, because the unit is fully bonded with no air within, it is said that immersion in water can't damage the unit. Components are compact enough for parcel-post shipment.

Units are available from 425 to 7,000-pound capacities.

Flexiride®, The Universal Group Corp., 1025 Busch Memorial Hwy., Pennsauken, NJ 08110.

FLOAT-ON

Float-On builds aluminum-frame boat trailers, and claims to have built the first aluminum boat trailer in the U. S. more than 40 years ago. Float-On builds its own proprietary torsion-bar suspension systems and has never used leaf springs. According to the firm's president, theirs is a "true torsion-bar unit without rubber," and not available elsewhere.

The tubular axles are hot-dipped galvanized inside and out, making them immune to corrosion. The company claims no problems over the years with its suspension system.

Float-On Trailers, Dept. TBM, 3001 Industrial Ave, #3, Ft. Pierce, FL 33450

TORFLEX, DURA-FLEX, AL-KO

These three torsion axles are similar in concept, but may vary in design detail. Basically, they consist of steel torsion bars connected to trailing arms. The bars twist within tubular-steel axles fitted with rubber cords that are compressed against the tubes as the bars twist. All offer a five-year limited warranty.

Torflex and DURA-FLEX axles (the latter claiming to have pioneered the rubber torsion axle in 1955) use square torsion bars within square tubes and four rubber cords. AL-KO uses a patented, hexagonal-tube design with a three-sided torsion bar and three rubber cords. AL-KO claims this design allows the rubber elements to roll, providing more shock absorption, and that its unique assembly method ensures exacting toe and camber tolerances.

Torflex (units from 1,000- to 15,000-pound capacities), Dept. TBM, Dexter Axle Division, Philips Industries Inc., 222 Collins Rd., P.O. Box 250, Elkhart, IN 46515.

DURA-FLEX (units from 500-to 10,000-pound capacities), Henschen Industrial, Dept. TBM, 522 N. Main St., Jackson Center, OH 45334.

AL-KO (units from 500- to 7,000-pound capacities), AL-KO Kober Corp., Dept. TBM, 25784 Borg Rd., Elkhart, IN 46514.