Understanding the Different Types of CV Joints

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Constant velocity (CV) joints transfer torque from the drivetrain to the wheels while accommodating the changing angles caused by steering and suspension movement. Different designs exist to meet the specific demands of different axle positions, vehicle platforms, and operating conditions, and selecting the correct joint type matters. This bulletin outlines the most common CV joint designs found in today's vehicles, their operating characteristics, and typical applications.

1. Standard Tripod Plunging Joint

The standard tripod joint is suitable for the inboard joint of a constant velocity side shaft to most vehicles. It has a maximum articulation angle of 23 degrees and has a plunge length of around 50mm. It is ideal for medium working angles and its low plunge resistance aids good NVH (Noise, Vibration & Harshness) characteristics.

2. AAR (ARTICULATING ANGULAR ROLLER)

In addition to the properties of the standard tripod joint, the low plunging resistance and low axial forces of the AAR joint delivers additional NVH refinement, making it appropriate for high working angles. It (usually) has a maximum articulation angle of 26 degrees and a 50mm plunge length.

Popular AAR Applications:

- Many popular CUVs (compact utility vehicles) like the Honda CR-V and Mazda CX-5 are perfect example of vehicles utilizing an AAR CV axle design. The Honda CR-V is built on the same platform as the Civic and shares the same engine and transmission options.
- The chassis, engine, and transmission all must be raised to increase ground clearance. This drastically increases the operating angle of the CV joints to accommodate this.
- Conventional outboard joints are capable of approximately a 45° operating angle, so this is not a concern. However conventional tripod inboard joints are typically limited to a 23° angle without interference.
- To allow for the increased ride height of CUVs, manufacturers had to adopt inboard joints capable of more angle. So, the AAR joint was adopted by OEM axle manufacturers.

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3. RZEPPA Joint

The Rzeppa joint is the most common outboard joint on FWD, AWD, and RWD independent suspension vehicles. Because the outboard joint connects directly to the drive wheel, it must handle wide steering and suspension articulation angles. It consists of a spherical inner shell with 6 grooves in it and a similar enveloping outer shell. Each groove guides one ball. The input shaft fits in the center of a large, steel, star-shaped "gear" that nests inside a circular cage. The cage is spherical but with ends open, and it typically has six openings around the perimeter. This cage and gear fit into a grooved cup that has a splined and threaded shaft attached to it. Six large steel balls sit inside the cup grooves and fit into the cage openings, nestled in the grooves of the star gear. The output shaft on the cup then runs through the wheel bearing and is secured by the axle nut.

4.VL Joint

The VL ball plunging joint is the most common inboard joint for rear-wheel drive axles. With a maximum of 22 degrees articulation and a plunge of 50mm it is ideal for high working angles with low axial forces.

6 Ball vs. 8 Ball Joints

6-BALL JOINTS are a type of constant-velocity joint based on the Rzeppa joint, but with the six balls confined using elliptical tracks rather than a cage. They have improved efficiency and are widely used in modern cars for the outboard driveshaft joints.

8-BALL JOINTS improve efficiency by using eight ball bearings (as the name implies) instead of six. Using more bearings results in a lower load per ball, in turn enabling each ball to be smaller in diameter - thus reducing the diameter of the packaging with no detriment to the torque capacity of the joint. This type of joint is ideal for lifted and heavy-duty/severe applications.

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