



California Clutch & Gear presents

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Inter-Axle Differentials Explained



Ask any truck driver or mechanic which axle drives a vehicle when the power divider isn't locked in, and you'll get

one of three answers:

- A: The back axle
- B: The front axle
- C: Both axles

Many people are surprised to find the correct answer is C: Both axles. This mostly has to do with a misunderstanding about how the inter-axle differential, or power divider, works.

Introduction

To understand the function of an inter-axle differential, you first need to understand the wheel differential.

Tear apart nearly any (non-posi) differential, be it in a car or truck, and you'll find a wheel differential assembly, also known as a nest assembly.

A nest assembly consists of:

- Two splined side gears, which connect with the axle shafts
- Two or four pinion gears
- And a cross or pin, on which the pinion gears turn.

A nest assembly is a compensator. It allows for differences in rotation between the two wheels, which occur mostly during turns.

If you have a car or pickup with an open differential, you may know what happens when

one tire loses traction entirely: one wheel spins while the other remains still – this is a result of the nest assembly as well.

It's called a spinout. Just as the nest assembly compensates for slight differences in rotations during turns, it also "compensates" when one wheel loses traction.

Some single drive axle trucks are equipped with a driver-controlled wheel differential lock. When the lock is activated, one of the axle shafts is locked to the nest assembly (via the nest housing) with a sliding clutch.

This effectively locks the nest assembly so that the two wheels will move in unity, so even when one wheel has no traction, the vehicle can still move, as the other wheel will now turn.



The Power Divider

The front differential has an assembly bolted to it, called a power divider. Within the power divider is a second nest assembly.

The power divider nest assembly is a compensator for the front and rear axles, just as the wheel differential is a compensator for the left and right wheels.

continued

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When the truck is operating in an environment with good traction (like a road), both the front and rear axles are contributing power to move the vehicle.

The power divider splits the power between the two axles and compensates for any differences in rotation between the axles – in much the same way the wheel nest assembly does for the left and right wheels.

Power Divider Care

Now that you know what a power divider does, here are some tips to make it last a long time.

- **Keep Tire Sizes and Tire Wear the Same on Each Axle.** Probably the leading cause of premature power divider wear is a mismatch in tires sizes between the front and rear axles. This also includes wear.
We often see trucks with brand new tires on the rear axle and worn tires on the front. This is the equivalent of having two different ratio differentials installed – it's constantly wearing the power divider nest as it tries to compensate for the difference in tire circumference.
- **Stop Before You Lock.** When in a spinout (ie, one wheel is spinning while the others remain still) don't engage the inter-axle differential lock!
Wait until all four wheels stop moving before you engage the diff lock.
Engaging the lock during a spinout puts tremendous strain on the power divider parts, and it's likely something is going to give way and break.

- **When in a Spinout, STOP!** Because the power divider nest spins at drive shaft speeds, it is spinning very fast during a spinout. Sometimes, it can spin so fast it will burn up, even with proper lubricant levels.
- **Don't Forget to Turn Off the Differential Lock.** Even with brand new tires all the same size, tiny differences do make the power divider nest assembly work constantly. Driving with the inter-axle differential lock engaged puts pressure on both axles.
The better the traction, the worse it is on the axles. Eventually, something is going to give way and break.



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