



by Prashant Kulkarni,
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While different versions of the internal combustion engine were being used more than 200 years ago, commercial vehicle use began in the mid 19th century when the widespread production of petroleum began. Countless engineering advances have occurred since. Yet one constant has never changed:

VIBRATION.

"All of these engines create different firing pulses in order to operate and it is those pulses that cause oscillations and subsequent vibration," explains Prashant Kulkarni, engineering manager – clutch division, Eaton Corporation. "That same vibration then travels through the entire driveline, through the clutch, the transmission, down the driveshaft, and to the axles.

"When the vibration gets to be too excessive, it can break components like synchronizer pins, gears in the transmission and universal joints. It could even be gears down in the axle, or any other component that is directly in the torque path of the driveline."

Kulkarni goes on to note that the clutch is, in fact, the only component along the driveline that can affect vibration. That's because it is the only soft component and the only component with 'air.' Everything else on the driveline is metal-to-metal – or a match-up that does not dampen vibration, but simply passes it along to the next component.

Meanwhile, today's high-torque, low-speed engines are compounding the problem. As engine speed goes down, the amount of vibration that needs to be dampened increases.

"The engines of today are churning out vibrations that can damage high-value driveline components," he notes.

Thankfully solutions do exist, and damper technology is the key.

"The damper in the clutch has to be precisely designed," believes Kulkarni. "The damper is the most critical part of a clutch. If you design the stiffness of the damper appropriately, it will positively impact the entire driveline."

In explaining the role of a damper, Kulkarni likes to use the analogy of a broomstick and a Slinky®.

"If I'm holding a broomstick on one end and someone else is holding it on to the other end and I shake my end, the other person will feel every oscillation," he adds. "Conversely if we do the same with a Slinky®, the other person will not feel a thing because of the soft spring.

"But a clutch damper cannot be as soft as a Slinky®. It has to have enough travel designed into it to soften or dampen torsional vibration yet be strong enough to absorb the torque required to power the driveline."

No One Clutch Fits All Engines

Several factors come into play in order to reach that precise cushioning balance, says Kulkarni, including:

- The amount of torque from the engine that the driveline needs to support.
- The appropriate stiffness/softness of the damper to isolate vibration energy coming from the engine.
- Determining the correct size of the damper to accommodate the number of springs needed.
- The amount of friction material needed to maximize wear life.

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