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SUBJECT: LOCKING DIFFERENTIALS

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## IMPORTANT INFORMATION ON LOCKING DIFFERENTIALS

### LOCKING DIFFERENTIALS

In contract to the traditional differential gear, modern limited slip and locking differentials contain spring-pressurized clutch packs. In low-traction situations, these axles deliver at least as much torque to the non-slipping wheel as is required to overcome the pressure of the spring and clutch system. This allows the driver to use one wheel at reduced torque, rather than having all available torque being sent to a slipping wheel. However, this arrangement can cause noise, vibration, harshness (NVH) and in extreme cases can cause excessive wear to the clutch packs themselves. The most common NVH is associated with high turn-ratios and cold fluid at lower travelling speeds; however this can occur under other conditions as well.

In gear oils without correct friction modification, clutch packs remain stuck in a high friction state until enough energy is built up for the plates to slide across one another. Once the excess energy is released, the clutches become stuck against each other again due to static friction. This is similar to what happens when plates are squeezed together at a fault line – causing earthquakes when they slip against one another.

### FRICION MODIFIERS

To overcome the NVH that is associated with stick-slip in locking differentials, some gear oils contain a friction modifier additive, or an aftermarket additive can be purchased such as Champion® Limited-Slip Axle Additive.

These additives reduce NVH by reducing the friction in clutch plates at low speeds or when the plates are static. As the plates begin to move faster relative to one another, the friction modifier becomes less effective, allowing the plates to correctly lock in a high-torque, high-slip driving condition, such as when a wheel is slipping on mud or ice.

The relationship between speed and friction is important for the characterization of these additives. For good performance of locking differentials, friction modified gear oil should have a higher coefficient of friction as speed increases.

Low-quality additives can produce this relationship initially, but can quickly degrade and cause NVH for the driver. High-quality friction modifiers, like Champion® Limited-Slip Axle Additive will maintain this performance over a much longer period of time.

