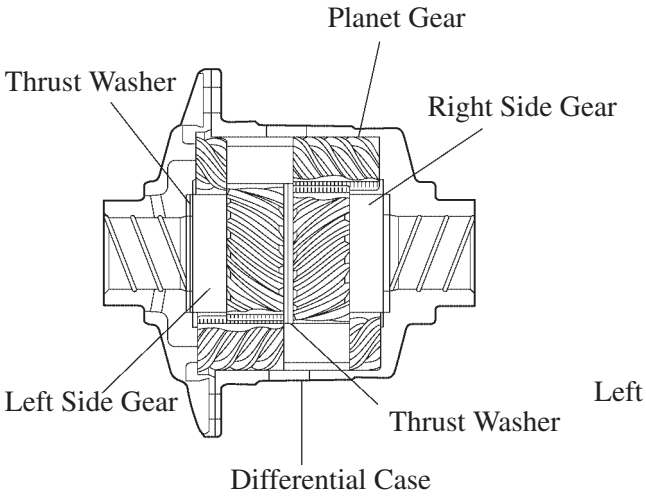
■ HELICAL GEAR TYPE TORSEN LSD

1. Characteristics

- Good traction of high bias ratio design is obtained through the utilization of two types of friction: One is the friction that is generated between the planet gear's tooth tips and the differential case's inner wall. The other is the friction that is generated between the side gear end face and the thrust washer.
- Quick response and minimum time lag until differential limiting force is generated.
- The bias ratio sustains minimal changes due to aging and maintains a stable performance.
- A simple, compact, and lightweight differential configuration has been achieved through the use of the helical gear.
- Ordinary differential oil must be used; do not use special LSD oil.

2. Construction

The helical gear type TORSEN LSD consists of a differential case, 8 planet gears, 2 side gears and 4 thrust washers.
Planet gears mesh with one another as a pair, and each gear of the pair meshes with the side gear on its right or left side.
The planet gears are supported by the hole that is provided in the differential case. They are constructed so that they revolve while rotating over the side gear.



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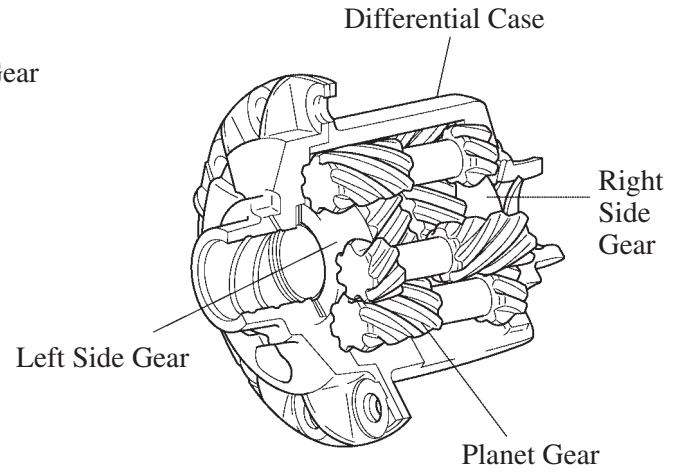

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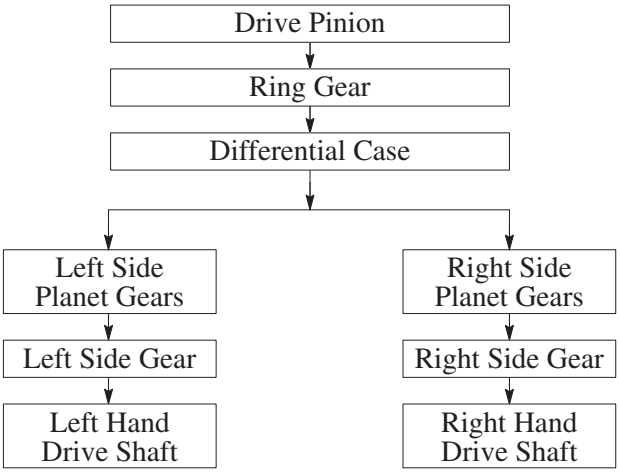
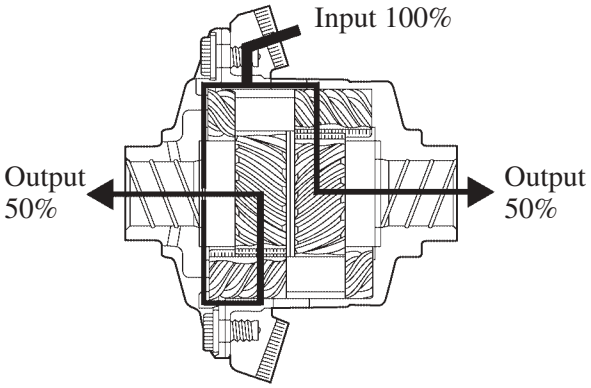
3. Operation

Straight-Ahead Operation

Since side gears (left and right) and planet gears are rotating together with the differential case as a unit when the vehicle is running straight-forward, the driving force is transmitted from the ring gear to the differential case, planet gears and side gears.





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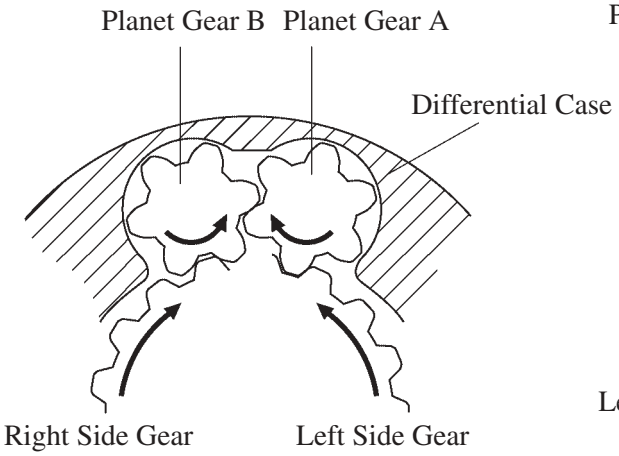
Cornering

Supposing that the differential case is not moving, rotating the left side gear counterclockwise causes planet gear A (which meshes with the left side gear) to rotate clockwise.
Furthermore, planet gear B, which is paired with planet gear A, rotates counterclockwise, causing the right side gear (which meshes with planet gear B) to rotate clockwise.
Therefore the left and right side gears rotate in the opposite direction each other, thus accomplishing a motion differential.



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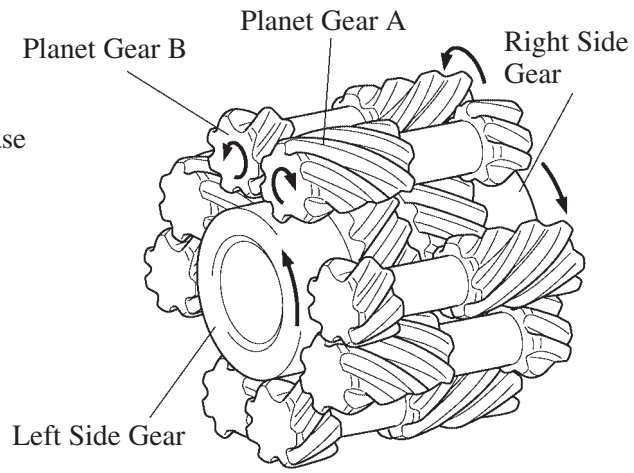

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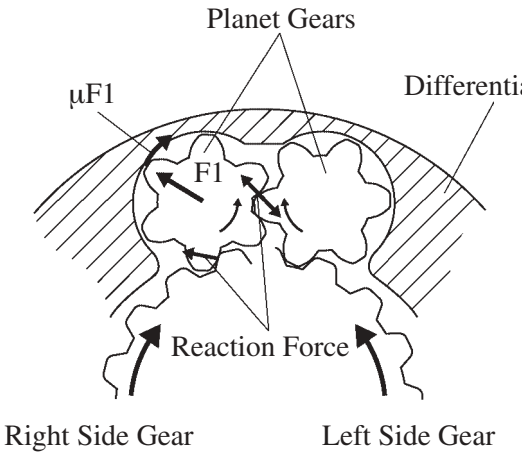
Limited Slip Differential Operation

Limited slip is accomplished primarily by the friction that is generated between the planet gear's tooth tips and the differential case's inner wall, and the friction that is generated between the side gear end face and the thrust washer.
The principle of limited slip enables the resultant reaction force F1 (which is created by the meshing reaction of the planet gear and the side gear and the meshing reaction of the planet gears themselves) to push the planet gear in the direction of the differential case in proportion to the input torque.
Due to the reaction force F1, the friction force μF1 (which is generated between the tooth tip of the planet gear and the inner wall of the differential case) acts in the direction to stop the planet gear's rotation.
At the same time, because of the helical angle that is provided in the differential gear, thrust force F2 is generated towards the axle shaft. Accordingly, friction force μF2 (which is generated between the side gear end face and the thrust washer) applies a force to cancel out the rotational difference between the side gears themselves as well as well as between the side gear and the differential case.



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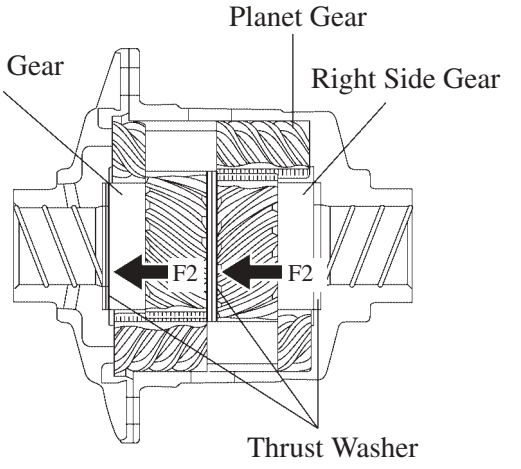

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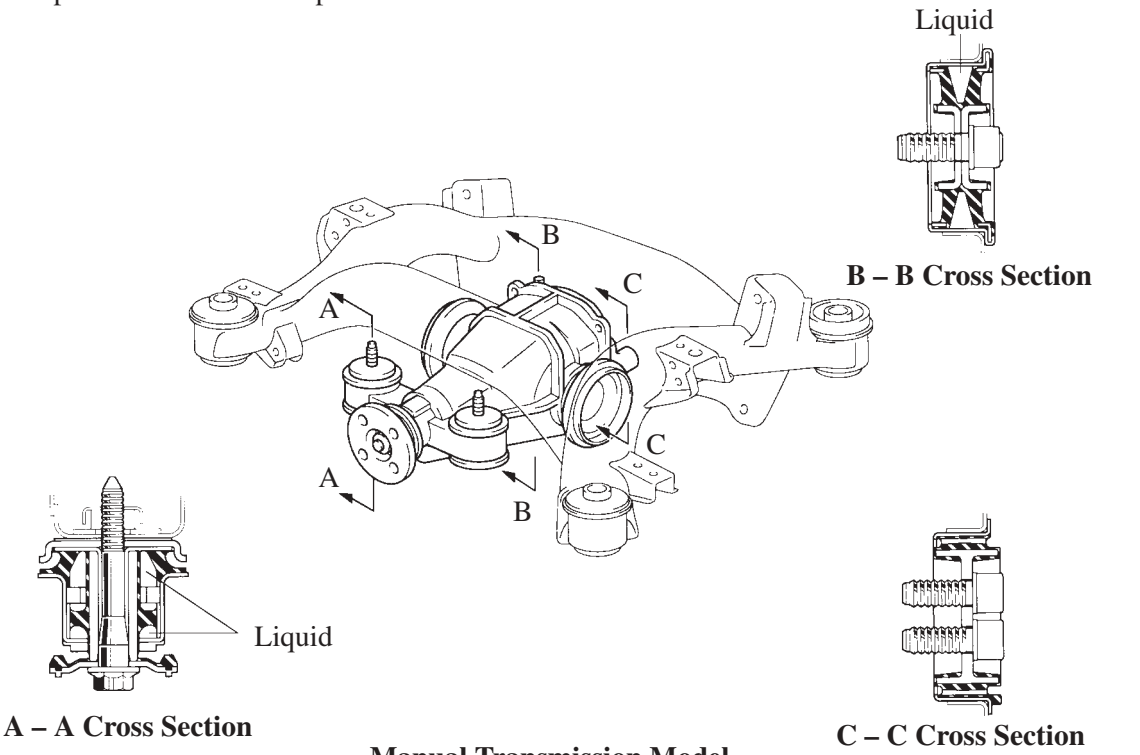
■ DIFFERENTIAL SUPPORT

- The differential of the manual transmission model is supported at 4 points: 2 front and 2 rear. The differential of the automatic transmission model is supported at 3 points: 2 front and 1 rear.
- The front mounts of all models and the rear right mount of the manual transmission model are the liquid-filled compound mounts that help realize low vibration and noise.



B – B Cross Section

A – A Cross Section

C – C Cross Section

Manual Transmission Model

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