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DIFFERENTIALS

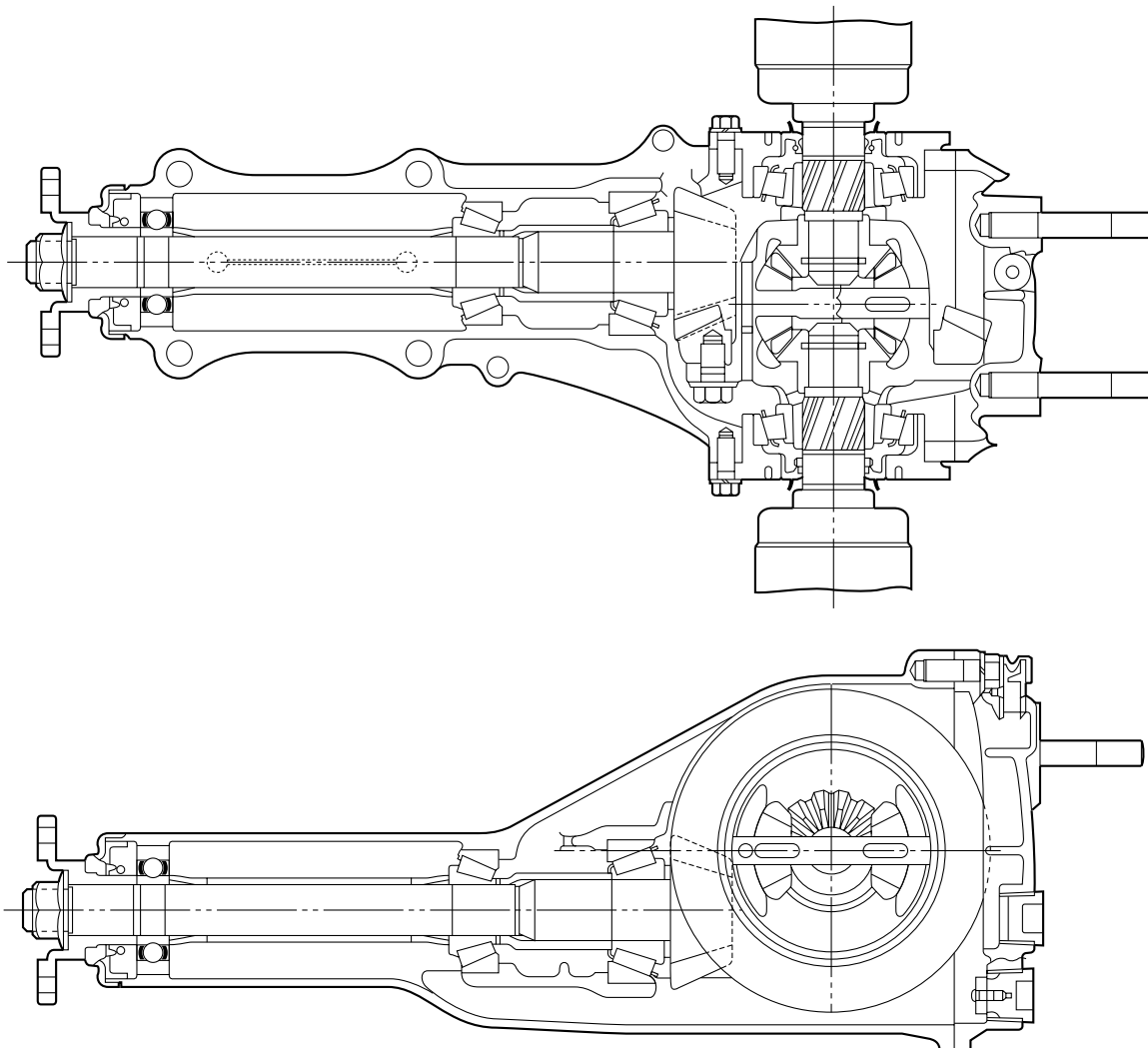
REAR DIFFERENTIAL

DIFFERENTIALS

1. Rear Differential

A: EXCEPT STi MODELS

The drive gear is a hypoid gear with nominal diameter of 160 mm (6.30 in). The drive pinion shaft is supported by three bearings. The bearing preload is adjusted by selecting a spacer and washer combination of a proper thickness. The drive pinion height is adjusted by properly selecting the thickness of the washers located at the drive pinion neck using a dummy shaft and gauge.



DI-00231

DI-2

REAR DIFFERENTIAL

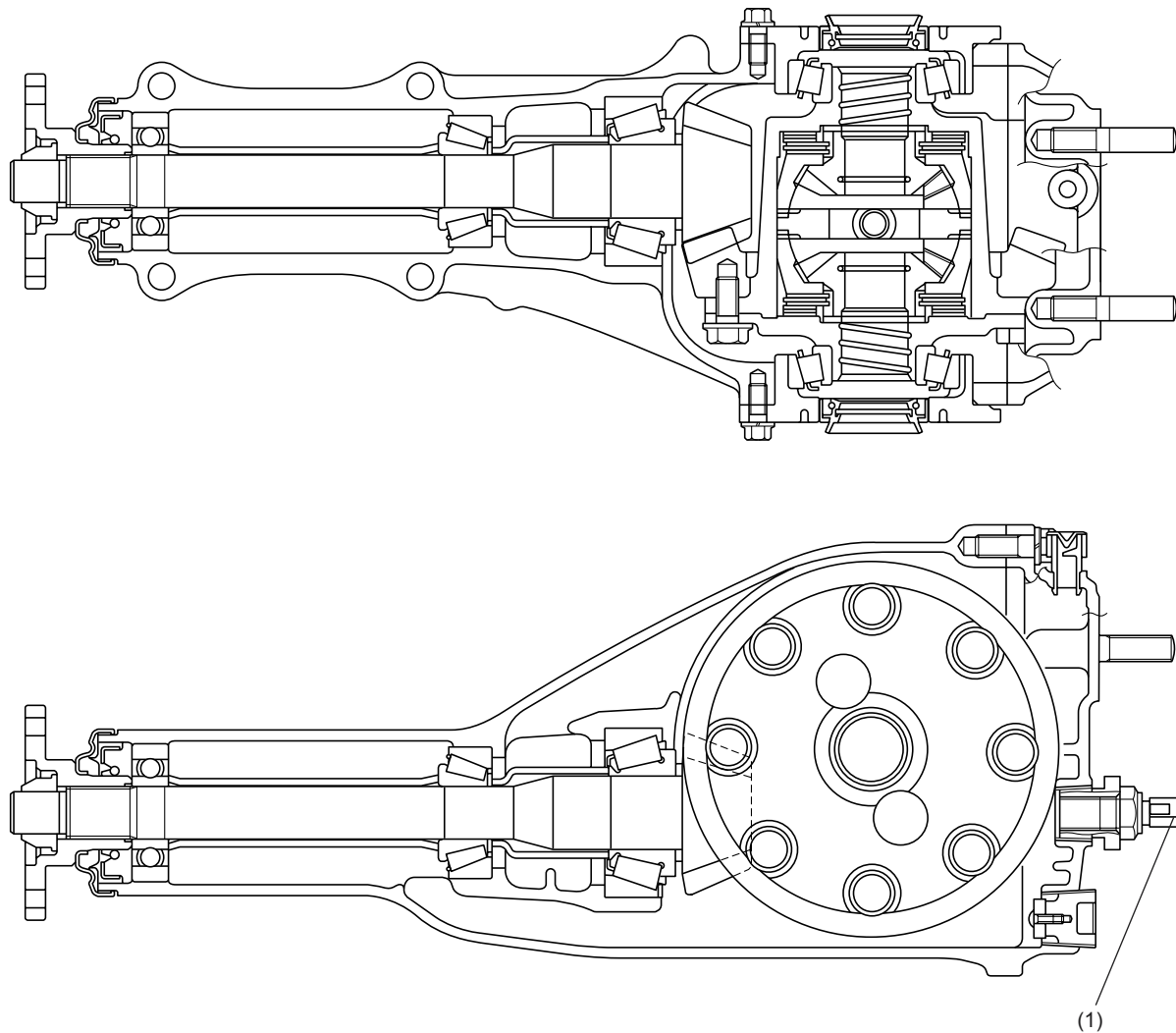
DIFFERENTIALS

B: STi MODELS

The drive gear is a hypoid gear with nominal diameter of 180 mm (7.09 in). The drive pinion shaft is supported by three bearings. The bearing preload is adjusted by selecting a spacer and washer combination of a proper thickness. The drive pinion height is adjusted by properly selecting the thickness of the washers located at the drive pinion neck based on the value stamped on the drive pinion shaft rear end.

To deal with the enhanced engine power, the diameter of the companion flange (joint to the propeller shaft) is increased for additional rigidity.

Moreover, the rear differential oil temperature switch opens when the rear differential oil temperature exceeds 150°C (302°F) causing the rear differential oil temperature warning light in the combination meter to turn on and switch the center differential in the transmission toward differential lock operation.



DI-00330

(1) Rear differential oil temperature switch

DI-3

LIMITED SLIP DIFFERENTIAL (LSD) (VISCOUS COUPLING TYPE)

DIFFERENTIALS

2. Limited Slip Differential (LSD) (Viscous Coupling Type)

A: GENERAL

The limited slip differential (LSD) automatically limits the differential action and distributes torque to the left and right wheels adequately to enhance driving stability when the left and right wheels are rotating at speeds different from each other during driving on a slippery road (muddy, snow-covered or slushy road) or cornering.

DI-4

LIMITED SLIP DIFFERENTIAL (LSD) (VISCOUS COUPLING TYPE)

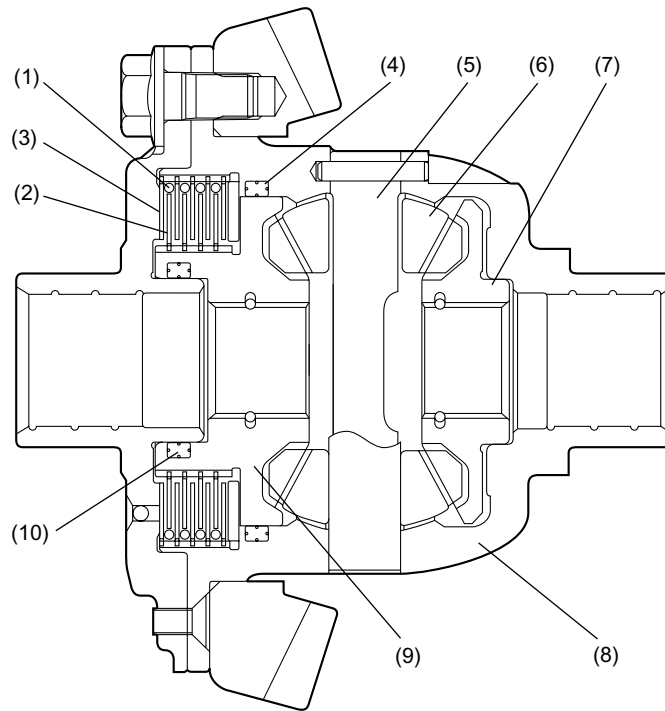
DIFFERENTIALS

B: CONSTRUCTION

The V/C (viscous coupling) type LSD has outer plates and inner plates arranged alternately. Each outer plate is splined to the inside of the differential case at its outer periphery and each inner plate is splined to the outer circumference of the left side gear at its inner periphery.

The outer plates are held in position by spacer rings while the inner plates can slide in the axial direction along the spline teeth.

The space between the differential case and the left side gear is filled with a mixture of high viscosity silicone oil and air and hermetically sealed with X-rings.



DI-00295

- | | |
|------------------|-----------------------|
| (1) Spacer ring | (6) Pinion gear |
| (2) Inner plate | (7) Side gear (right) |
| (3) Outer plate | (8) Differential case |
| (4) X-ring | (9) Side gear (left) |
| (5) Pinion shaft | (10) X-ring |

DI-5

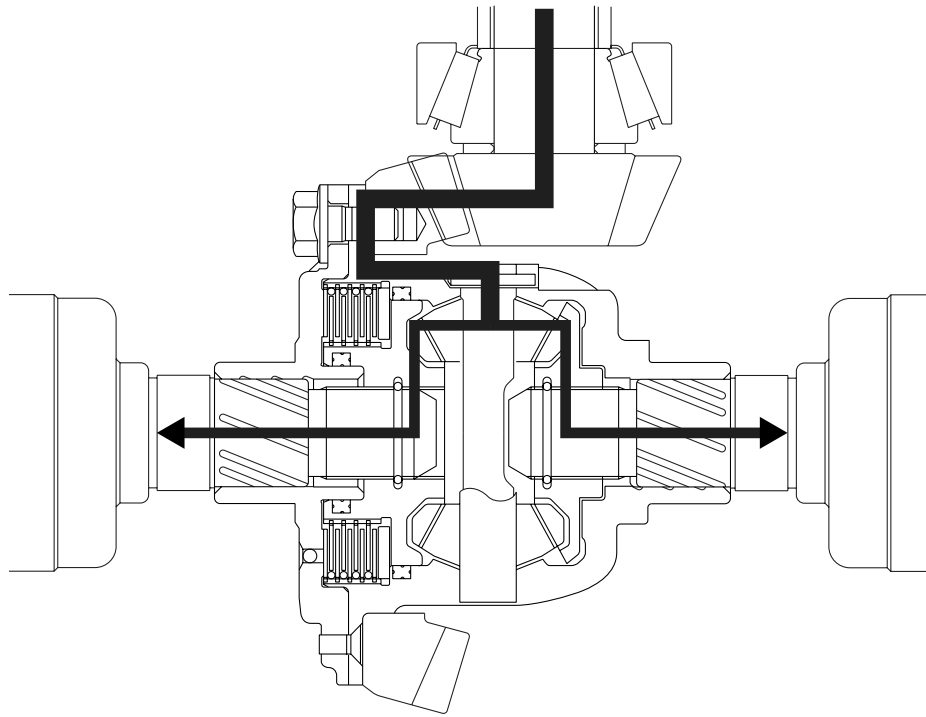
LIMITED SLIP DIFFERENTIAL (LSD) (VISCOUS COUPLING TYPE)

DIFFERENTIALS

C: OPERATION

1. WHEN RIGHT AND LEFT WHEELS ROTATE AT THE SAME SPEED

During normal straight-ahead driving where the right and left wheels rotate at the same speed, the differential case and side gears rotate together, just as in conventional differentials. As a result, driving torque is distributed equally to the right and left side gears.



DI-00296

DI-6

LIMITED SLIP DIFFERENTIAL (LSD) (VISCOUS COUPLING TYPE)

DIFFERENTIALS

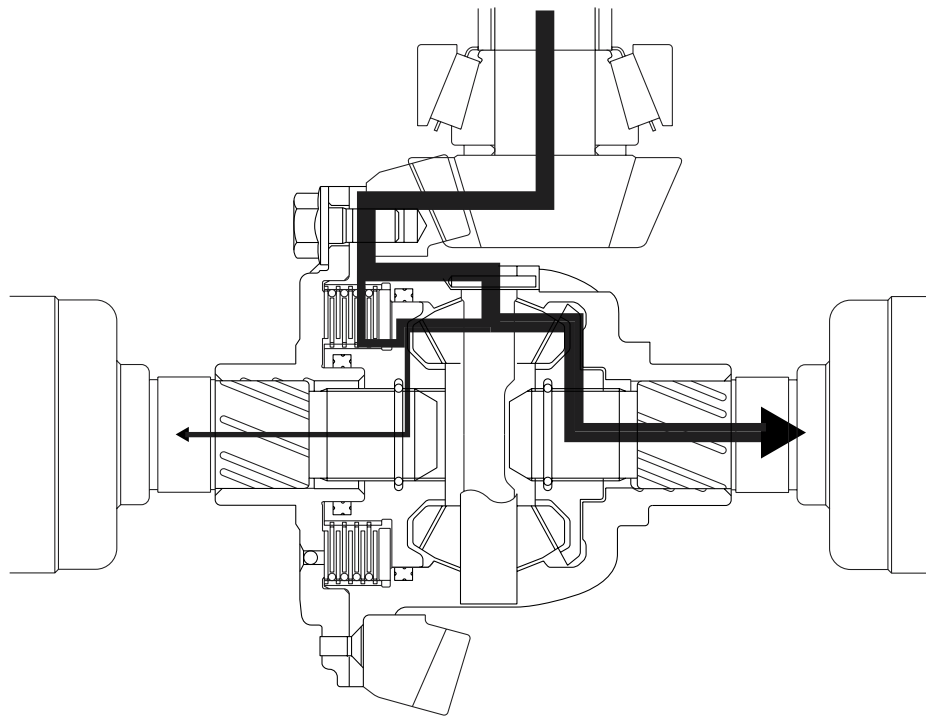
2. WHEN RIGHT AND LEFT WHEELS ROTATE AT DIFFERENT SPEEDS

When a speed difference occurs between the right and left wheels, the differential case and the left side gear do not rotate at the same speed any more. The speed difference between them corresponds to that between both the wheels. Because of the shear force caused in the silicone oil, a differential torque is then generated, which limits differential action.

For example, if the left wheel spins due to small road resistance, a speed difference occurs between the right and left wheels. Since there is the V/C between the differential case and left side gear, a differential torque corresponding to the speed difference is generated in the V/C. This differential torque is transferred from the left wheel to the right wheel. As a result, a greater driving torque is distributed to the right wheel which is rotating at a lower speed.

When the right wheel spins, the differential torque is transferred from the right wheel to the left wheel. Also in this case, a torque greater by the differential torque than the torque to the spinning wheel is transmitted to the wheel rotating at the lower speed.

When left wheel spins



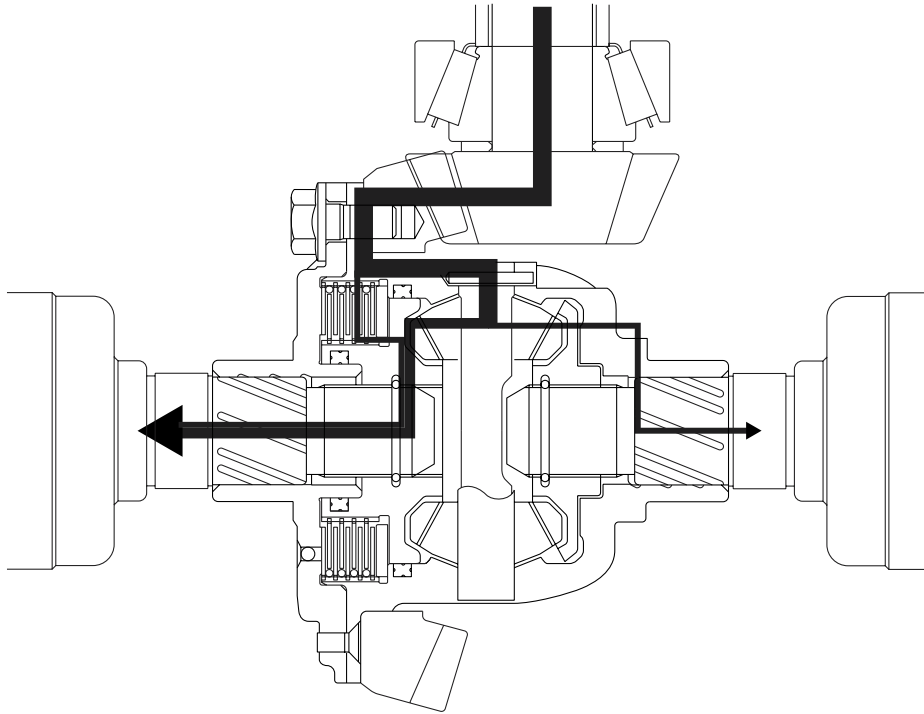
DI-00297

DI-7

LIMITED SLIP DIFFERENTIAL (LSD) (VISCOUS COUPLING TYPE)

DIFFERENTIALS

When right wheel spins



DI-00298

D: SERVICE PROCEDURES FOR LSD

It is not recommended to disassemble the LSD assembly as component parts of LSD assembly are not available individually.

DI-8

LIMITED SLIP DIFFERENTIAL (LSD) (MECHANICAL TYPE)

DIFFERENTIALS

3. Limited Slip Differential (LSD) (Mechanical Type)

A: GENERAL

When controlling the differential action between left and right wheels during cornering or when either of the wheels spins due to slip or bumping, cams will expand the pressure rings to press the friction plates together, thus enabling the driving torque be transmitted to the non-spinning wheel too for more stable driving.

This differential is suitable for high powered and high output torque vehicles also because it responds to the acceleration pedal operation quickly.

DI-9

LIMITED SLIP DIFFERENTIAL (LSD) (MECHANICAL TYPE)

DIFFERENTIALS

B: CONSTRUCTION

Pressure rings with V-grooves are assembled in the case of the mechanical differential. The four lugs (protrusions) on the periphery of the pressure rings fit in the grooves provided inside the differential case when the pressure rings are assembled, and the pressure rings can slide in axial directions.

The tips of the pinion shaft are chamfered to assemble the pinion shaft into the V-grooves of the pressure rings, forming V-shaped cams. Similar to the pressure rings, the friction plates and spring plates also have four lugs (protrusions) on the periphery and these lugs fit in the grooves provided inside the differential case when the plates are assembled.

On the internal circumference of the friction disks and spring plates there are 4 or 6 lugs (protrusions) which fit in the grooves provided on the outer circumference of the side gears, and the friction disks and spring plates can slide in axial directions.

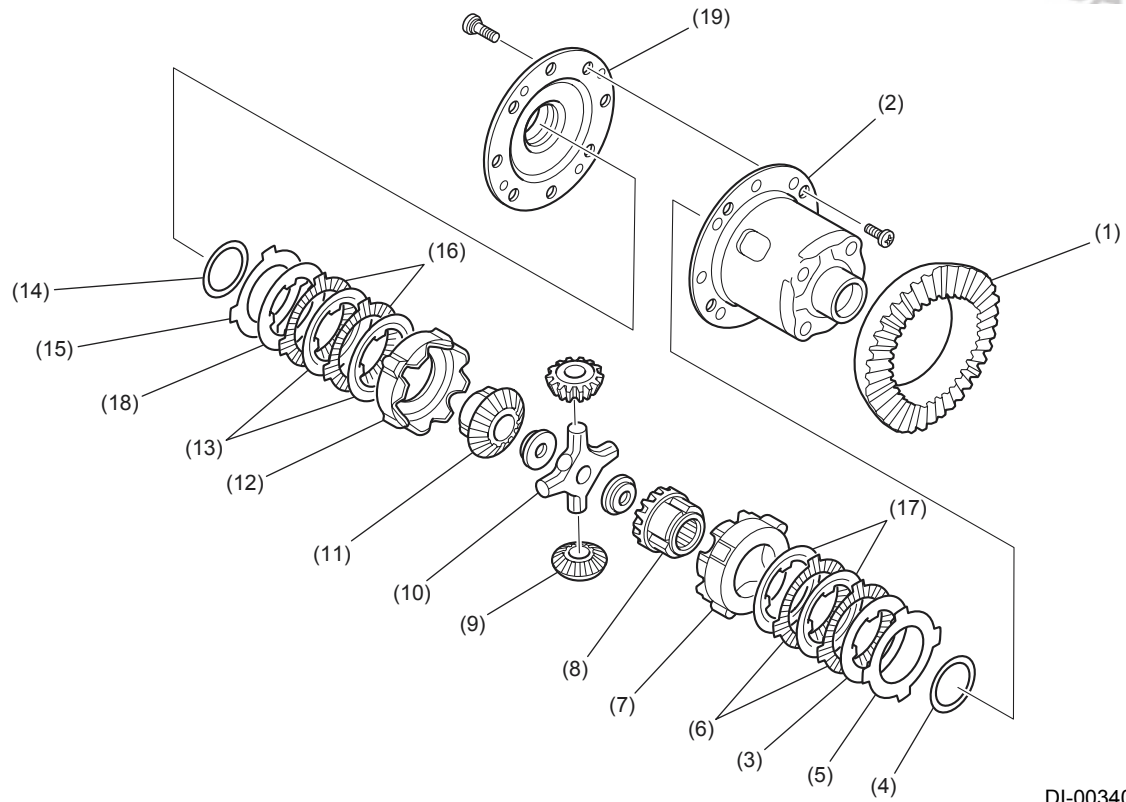
These friction plates, friction disks, spring plates, spring disks are alternately arranged and form a clutch as a whole.

The spring plates and spring disks act as Belleville springs and provide initial torque. Moreover, thrust washers are inserted between the side gears and differential case halves to adjust clearance in the axial direction and prevent thrust from the side gears to work against the pressure rings.

DI-10

LIMITED SLIP DIFFERENTIAL (LSD) (MECHANICAL TYPE)

DIFFERENTIALS



- | | | |
|--------------------------|---------------------|---------------------------|
| (1) Ring gear | (8) Side gear | (15) Spring plate |
| (2) Differential case RH | (9) Pinion | (16) Friction disc |
| (3) Spring disk | (10) Pinion shaft | (17) Friction disc |
| (4) Thrust washer | (11) Side gear | (18) Spring disk |
| (5) Spring plate | (12) Pressure ring | (19) Differential case LH |
| (6) Friction plate | (13) Friction plate | |
| (7) Pressure ring | (14) Thrust washer | |

DI-11

LIMITED SLIP DIFFERENTIAL (LSD) (MECHANICAL TYPE)

DIFFERENTIALS

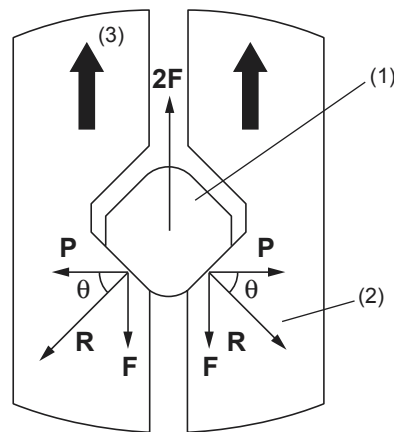
C: OPERATION

The torque transmitted from the crown gear to the differential case is then transmitted to the pressure rings via their four lugs (protrusions) causing the pressure rings and the differential to rotate as a unit.

The torque is further transmitted from the pressure rings to the V-shaped cams of the pinion shaft causing reaction force F opposing the rotational direction and load $P = F \cot \theta$ in the axial directions to be applied on the cam faces.

The reaction force F opposing the rotational direction is transmitted through the pinion gears to the side gears in the same way as a conventional differential. The force P in axial directions push open the pressure rings and act as engaging load for the multi-plate clutches.

This load is needed as a force to cause friction between the friction plates and friction disks to let them work as clutches.



DI-00341

(1) Pinion shaft

(2) Pressure ring

(3) Rotational direction

F: Reaction force that occur when the pressure rings cause the pinion shaft to rotate in driving direction.

P: Reaction force which the pressure rings receive from the pinion shaft in axial direction and this reaction force becomes the clutch engaging load.

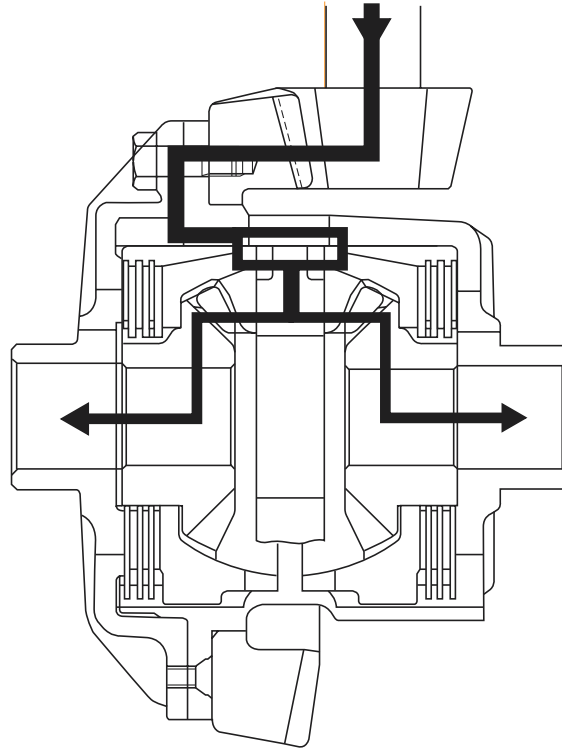
DI-12

LIMITED SLIP DIFFERENTIAL (LSD) (MECHANICAL TYPE)

DIFFERENTIALS

1. WHEN RIGHT AND LEFT WHEELS ROTATE AT THE SAME SPEED

During normal straight-ahead driving where the right and left wheels rotate at the same speed, the differential case and side gears rotate together, just as in conventional differentials. As a result, driving torque is distributed equally to the right and left side gears.



DI-00342

DI-13

LIMITED SLIP DIFFERENTIAL (LSD) (MECHANICAL TYPE)

DIFFERENTIALS

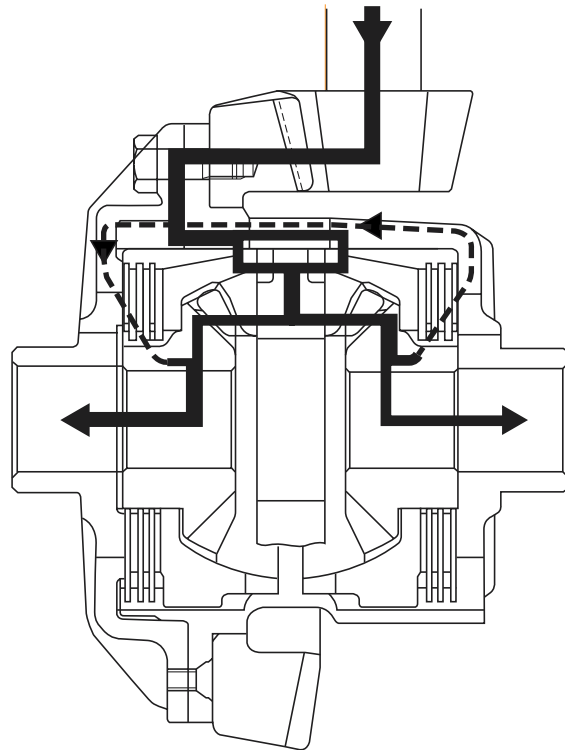
2. WHEN RIGHT AND LEFT WHEELS ROTATE AT DIFFERENT SPEEDS

The right differential bevel gear tries to turn faster than the differential case, however, since the right differential bevel gear is braked by the clutch, a part of the torque is transferred from the right differential bevel gear via the clutch to the differential case as shown by the broken line.

While the left wheel is not spinning and the differential bevel gear is turning at a low speed, the differential case is turning at a high speed, and in contrast with the right side, torque is transferred from the differential case via the clutch to the differential bevel gear.

As a result, the left side differential bevel gear receives a torque which is transferred from the right side differential bevel gear through the clutch, differential case, left side clutch and left side differential bevel gear, in addition to the torque transferred from the differential bevel pinion via the differential bevel gear.

When right wheel spins



DI-00343

D: SERVICE PROCEDURES FOR LSD

It is not recommended to disassemble the LSD assembly as component parts of LSD assembly are not available individually.

DI-14