■ SEAT BELT

1. General

- An adjustable shoulder belt anchor is provided for the front seat and the outer seat of No.1 rear seat.
- The center seat of the No.1 rear seat is provided with a 3-point ELR (Emergency Locking Retractor) seat belt.
- The mechanical sensing type seat belt pretensioner or the electrically sensing type seat belt pretensioner and force limiter are provided for the front seat belt of the new Land Cruiser as described on the chart below.

●: Standard ○: Option

Destination / Type	Europe	Australia	G.C.C. Countries	General Countries
Mechanical Sensing Type Seat Belt Pretensioner		●*1		●*3
Electrically Sensing Type Sear Belt Pretensioner and Force Limiter	●	●*2, ○*1	●*2, ○*1	●*2, ○*1

*1: STD and GX Grade Model
*2: VX Grade Model
*3: Models for South Africa

2. Center Seat Belt of No.1 Rear Seat

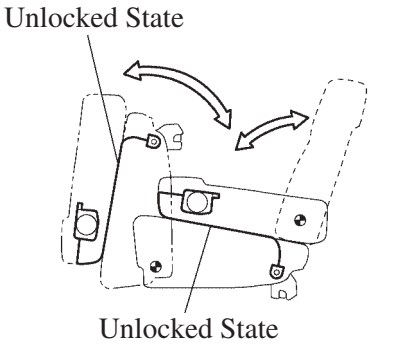
General

- A 3-point ELR seat belt with its retractor enclosed in the seat back is provided as the center seat belt.
- Along with its enclosure in the seat back, the retractor has adopted a mechanism in which the deceleration sensor for activating the ELR unlocks mechanically when the seat belt is fully retracted.
- A reclining detection function has been adopted to constantly maintain the deceleration speed in which the center seat belt ELR activates when the seat back is reclined.

Construction and Operation

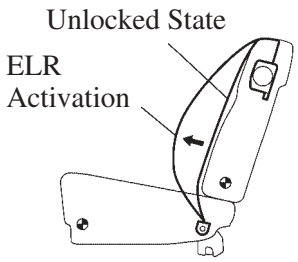
1) ELR Mechanism

The ELR of the center seat belt has adopted a mechanism in which the deceleration sensor for activating the ELR unlocks mechanically when the seat belt is fully retracted. As a result, the ease of tilting forward or folding the seat back has been improved.
When a prescribed amount of the seat belt is pulled out, the deceleration sensor is released from its unlocked state and the ELR assumes the normal ELR operation.



155BO33

Seat Back in the Tilted Forward or Folded State



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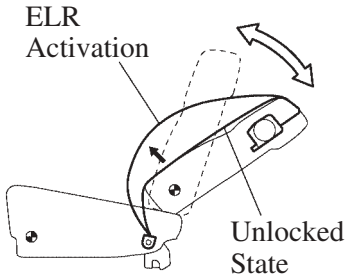
Normal State



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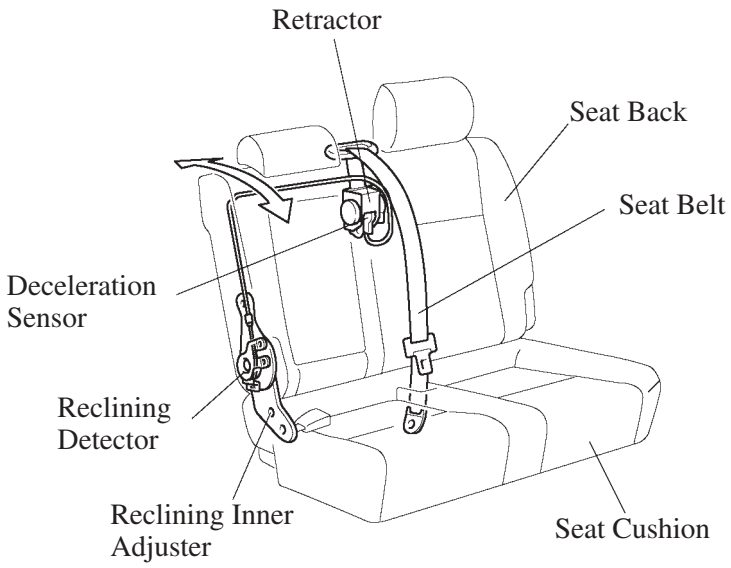
Reclined State

2) Reclining Detection Mechanism

a. Construction

The reclining detection mechanism consists of a retractor, a deceleration sensor for activating the ELR, a reclining detector, and a control cable that connects the deceleration sensor with the reclining detection area. The reclining detector, which is installed on the reclining inner adjuster, detects the difference in the angles of the seat back and the seat cushion.



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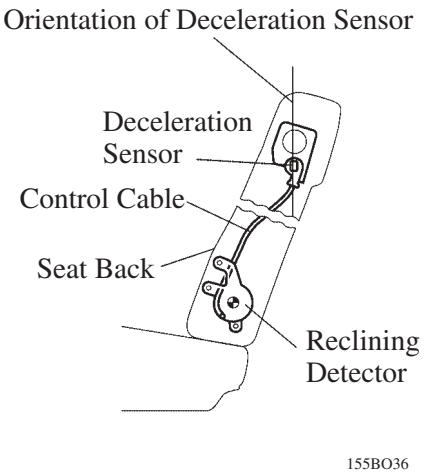
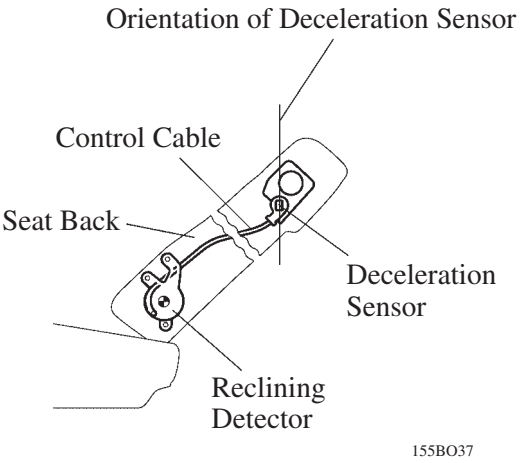
b. Operation

When the seat back is reclined, the retractor moves along with the seat back movement. At the same time, the point on which the control cable is attached to the reclining detector rotates together with the movement of the seat back.
Accordingly, the deceleration sensor that is connected to the control cable rotates, without changing the orientation of the sensor regardless of the reclining angle. Thus, the ELR activates at a prescribed deceleration rate regardless of the reclining angle of the seat back.



Normal State



Reclined State

3. Mechanical Sensing Type Seat Belt Pretensioner

General

In a collision, the pretensioner sensor detects the shock and if the front-to-rear shock is greater than a specified value, the seat belt pretensioner is activated instantaneously to pull in a predetermined length of the seat belt.

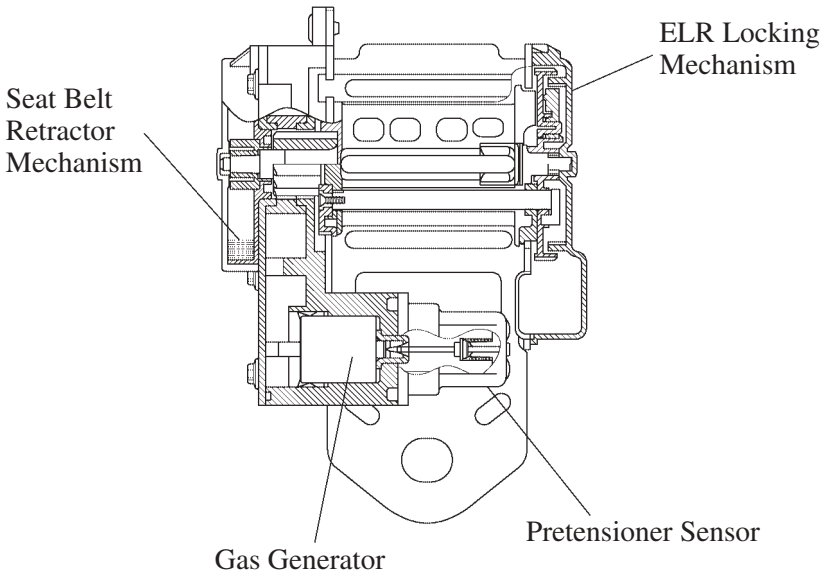
– REFERENCE –

The mechanical sensing type seat belt pretensioner is equipped with an independent pretensioner sensor. For this reason, depending on the circumstances of the collision, there is a case that either right or left seat belt pretensioner alone operates.

Construction and Operation

1) General

The seat belt retractor with pretensioner consists of the pretensioner mechanism, retractor mechanism, and ELR locking mechanism. The pretensioner mechanism consists of a pretensioner sensor, gas generator, rotor, gear clutch, key clutch, etc.. When the pretensioner is activated, the key clutch engages the rotor to the gear clutch. Since the rotor and gear clutch are not normally engaged, the gear clutch and the shaft can rotate freely, thus permitting normal seat belt operation.



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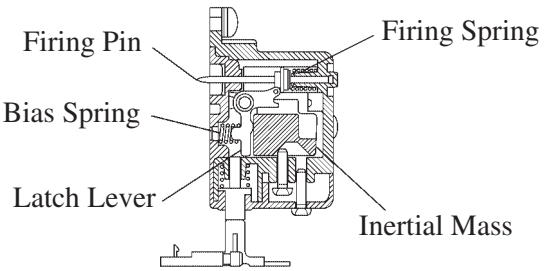
2) Pretensioner Sensor

The pretensioner sensor consists of an inertial mass, latch lever, sub-lever, firing pin, firing spring, etc. The latch lever, sub-lever and firing pin are normally engaged with each other so that the firing pin is not ejected. In addition, any unnecessary inertial mass movement is suppressed by the bias spring force so that the seat belt pretensioner is not activated by mistake.
If a severe frontal collision occurs, the vehicle decelerates instantaneously. The inertial mass begins to move despite the bias spring force. If rapid deceleration continues, the spring force of the firing spring disengages the firing pin from the latch lever, ejects the firing pin, and ignites the primer. The flame spreads instantaneously to the gas generator, and a large amount of gas is generated from the gas generator.

▶ Non-Deployed State ◀



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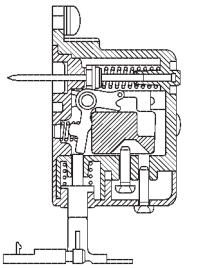
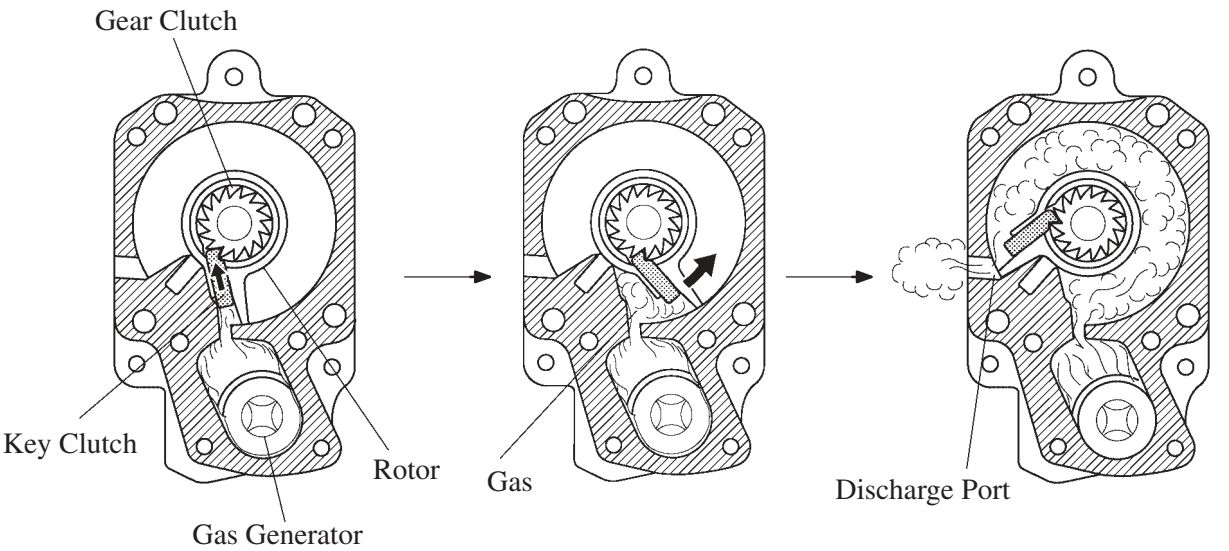
▶ Deployed State ◀



147BO03

3) Pretensioner Mechanism

The large amount of gas generated by the gas generator flows from the accumulator in the housing to the cylinder. The pressure of the gas introduced into the cylinder pushes the key clutch, which in turn meshes with the teeth of the gear clutch, and causes the rotor and gear clutch to engage. After the internal pressure of the cylinder increases further, the rotor and the gear clutch rotate together. Accordingly, the shaft that is meshed to the teeth of the gear clutch also rotates. According to the rotation of the rotor, the shaft rotates approximately a full turn in the wind-up direction of the seat belt and pulls in a predetermined length of the belt to restrain the occupant. After the rotation of the rotor has been completed, the gas that caused the rotation is discharged from the discharge port, and the internal pressure in the cylinder decreases. After the internal pressure in the cylinder decreases, the key clutch is kept engaged with the teeth of the gear clutch. As a results, the shaft will not be albe to rotate any further, so the seat belt is not pulled out.

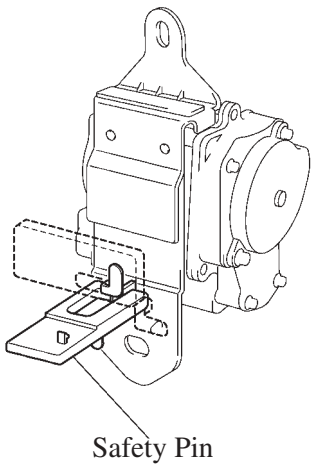


147BO04 147BO05 147BO06

4) Safety Device

In order to prevent unintended deployment when removing the seat belt or when handling the seat belt pretensioner by itself, the seat belt pretensioner is equipped with a safety device that stops the operation of the sensor.
To activate the safety device, pull up the safety pin and the safety pin must be pushed, which causes the safety lever to turn 90° clockwise. Accordingly, the stopper that is attached to the tip of the safety lever moves to the position to restrain the movement of the latch lever. Therefore, even if a large deceleration is applied to the inertial mass, the latch lever will not move and the pretensioner sensor will not activate.

▶ Safety Device Activation ◀



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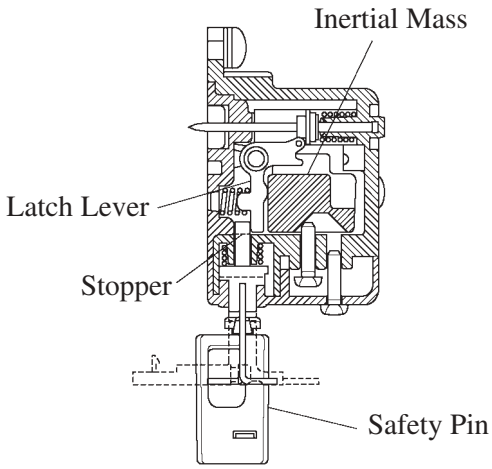

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4. Electrically Sensing Type Seat Belt Pretensioner and Force Limiter

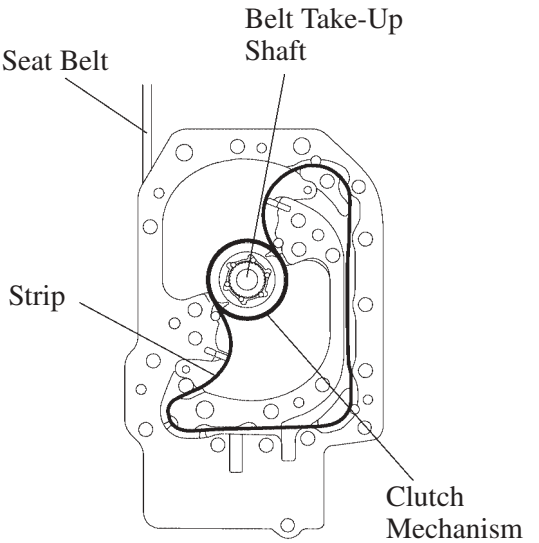
General

- In the beginning of a collision, the seat belt pretensioner instantly takes up the seat belt, thus realizing the excellent belt's effectiveness in restraining the occupant.
  When the impact of a collision causes the tension of the seat belt that is applied to the occupant to reach a predetermined level, the force limiter restrains the tension, thus reducing the force that is applied to the occupant's chest area.
- In accordance with the ignition signal received from the airbag sensor assembly, the seat belt pretensioner activates simultaneously with the deployment of the SRS airbag for the driver and front passenger.

Seat Belt Pretensioner

1) Construction

The seat belt pretensioner consists of the pretensioner mechanism, retracting mechanism, and locking mechanism. The pretensioner mechanism consists of a gas generator, strip, clutch mechanism and etc.



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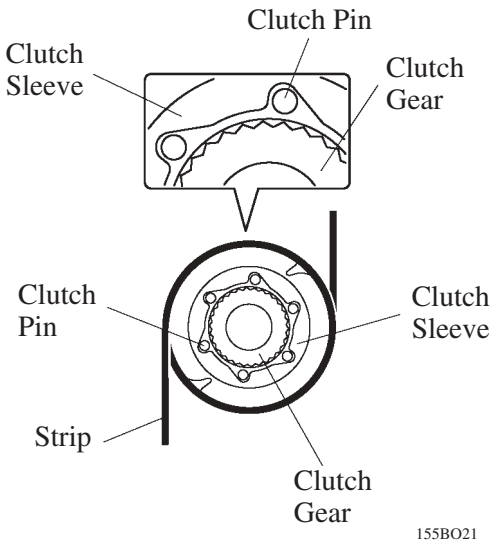
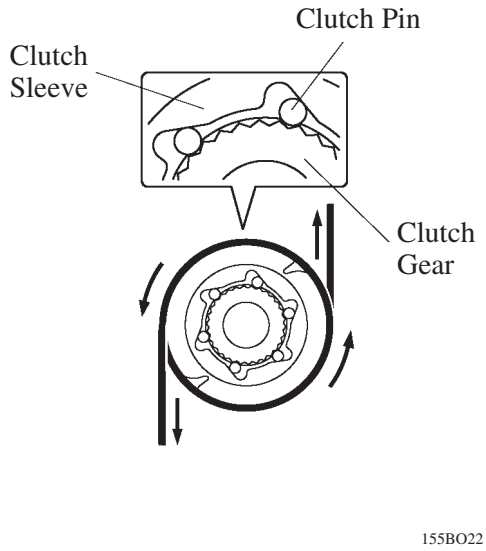
a. Clutch Mechanism

The clutch mechanism consists of a clutch sleeve, clutch pin, base, and clutch gear. The clutch gear is integrated with the belt take-up shaft. The clutch sleeve has a strap wrapped around it.
Normally, the clutch pin is engaged with the base so that the rotation of the clutch gear is not obstructed. The movement of the strap, which is prompted by the gas that is generated by the gas generator, causes the clutch sleeve to rotate. Then, the clutch sleeve causes the clutch pin to shear off from the base, causing the clutch sleeve and clutch gear to engage. As a result, the clutch gear and shaft rotate together.



Before Activation



During Activation

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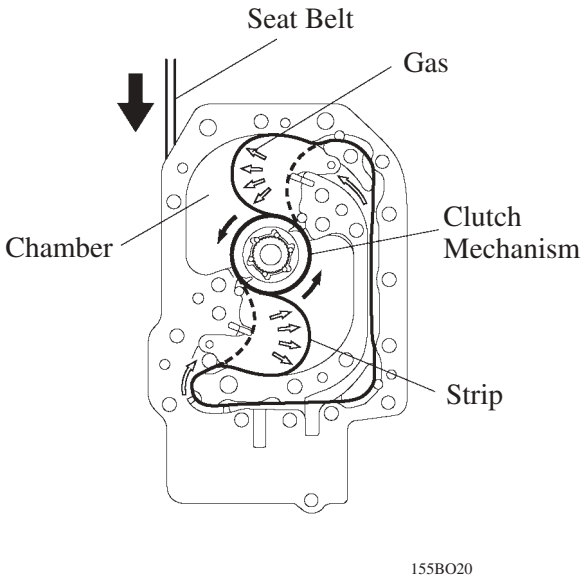
2) Operation

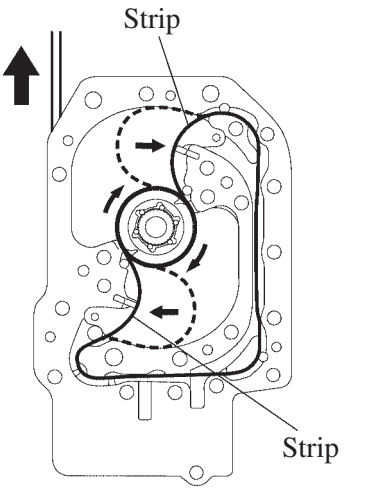
a. During Activation

According to the igniter signal received from the airbag sensor, the gas generator generates a large volume of high-pressure gas in the chamber.
Then, the strip that is wrapped around the clutch sleeve expands, causing the clutch sleeve to rotate.
Then, the movement of the clutch mechanism causes the clutch gear and shaft to rotate, thus taking up the seat belt.



b. After Completing Activation

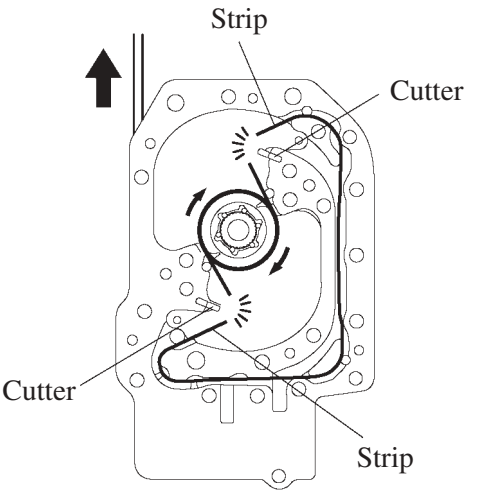
When the activation of the seat belt pretensioner is completed and the seat belt is pulled out by the movement of the occupant, the locking mechanism activates to lock the movement of the belt.
Thereafter, if the force limiter activates, the seat belt is pulled out again, and the rotation of the shaft causes the strip to be taken up by the clutch sleeve.



155BO23

c. If the Activation Amount of the Force Limiter is Large

If the amount of seat belt that is pulled out by the activation of the force limiter is greater than the amount of seat belt that is taken up by the activation of the pretensioner, it would prevent the strap from applying resistance to the rotation of the shaft. Therefore, the cutter cuts the strip.
Accordingly, the force limiter can be activated, so that the seat belt's force to restrain the occupant does not become excessive.



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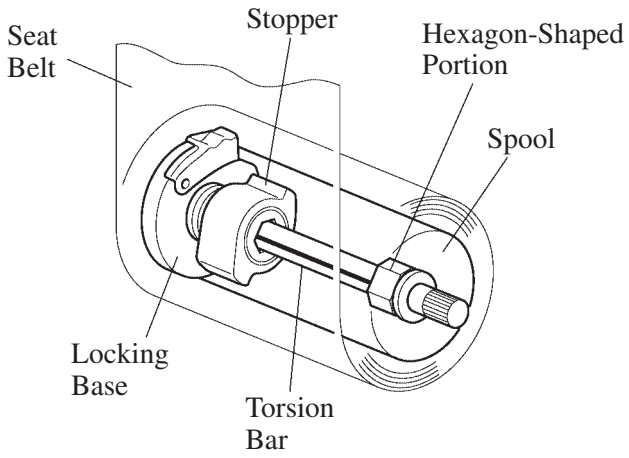
Seat Belt Force Limiter

1) Construction

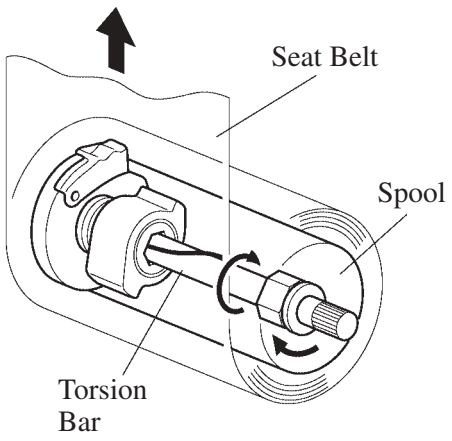
The seat belt force limiter consists of a spool, torsion bar, locking gear, and stopper. One end of the torsion bar is secured to the locking base and the other end is integrated with the hexagon-shaped portion of the spool. The stopper is coupled to the threaded portion of the locking base and rotates in unison with the rotation of the spool.



155BO25

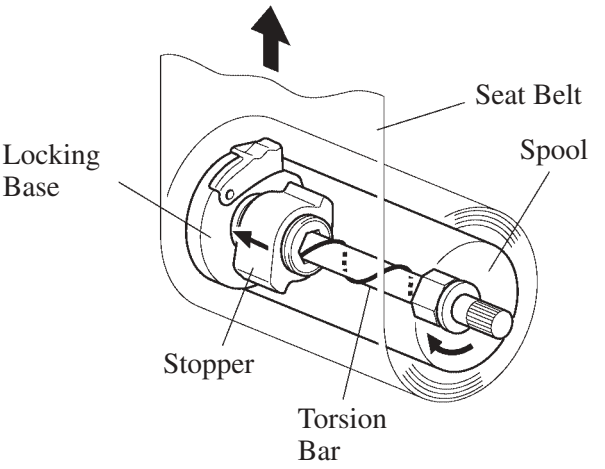
2) Operation

- When the ELR mechanism is activated, if a force that exceeds a predetermined load is applied to the seat belt, the torsion bar becomes twisted, causing the spool to rotate and the belt to be released.



155BO26

- Along with the movement of the spool, the stopper moves while rotating on the threaded portion of the locking base. The twisting force that is generated in the torsion bar along with the rotation of the spool acts as a resistance against the pulling of the belt.



- When the stopper comes in contact with the top of the locking base, the stopper will not be able to rotate any further. As a result, the spool will not rotate, thus stopping the pulling of the belt.