Avensis

Chassis

TOYOTA

Today
Tomorrow
Toyota

Contents

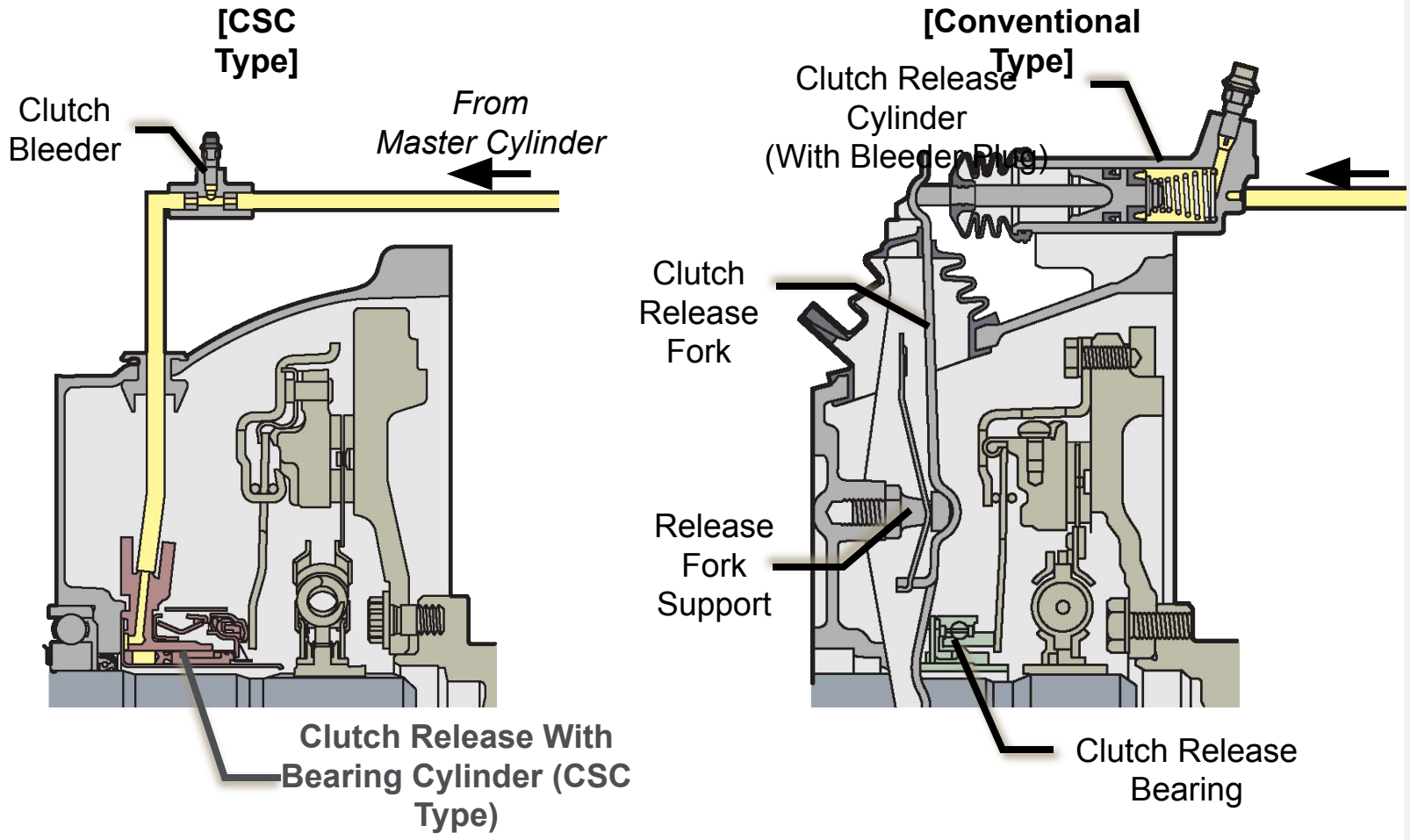
Clutch

Subtitle

Clutch

CSC (Concentric Sleeve Cylinder) [EB60 and EC60]

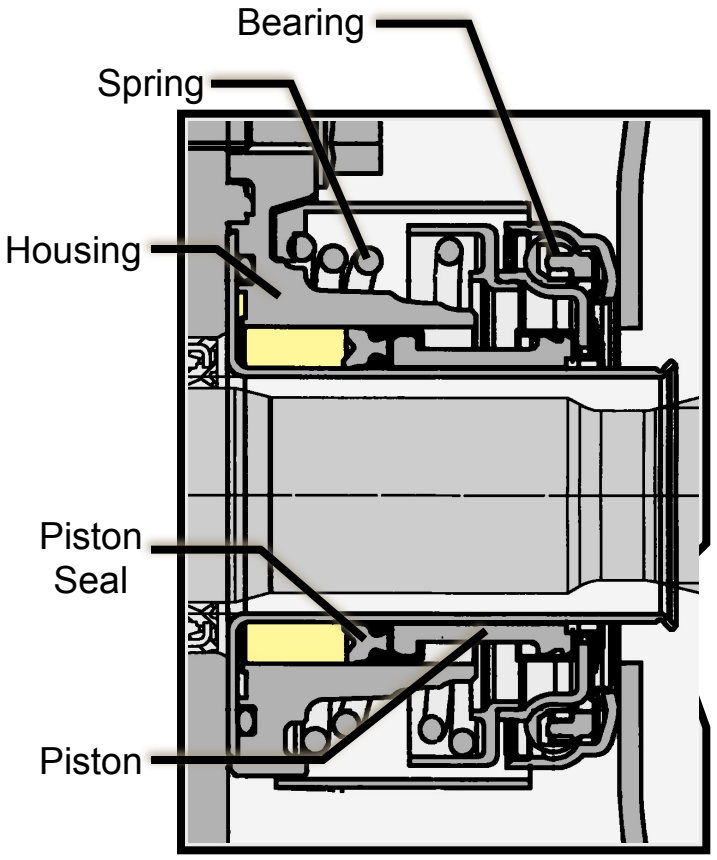
– CSC has combined the functions of clutch release cylinder and clutch release bearing for excellent clutch feeling



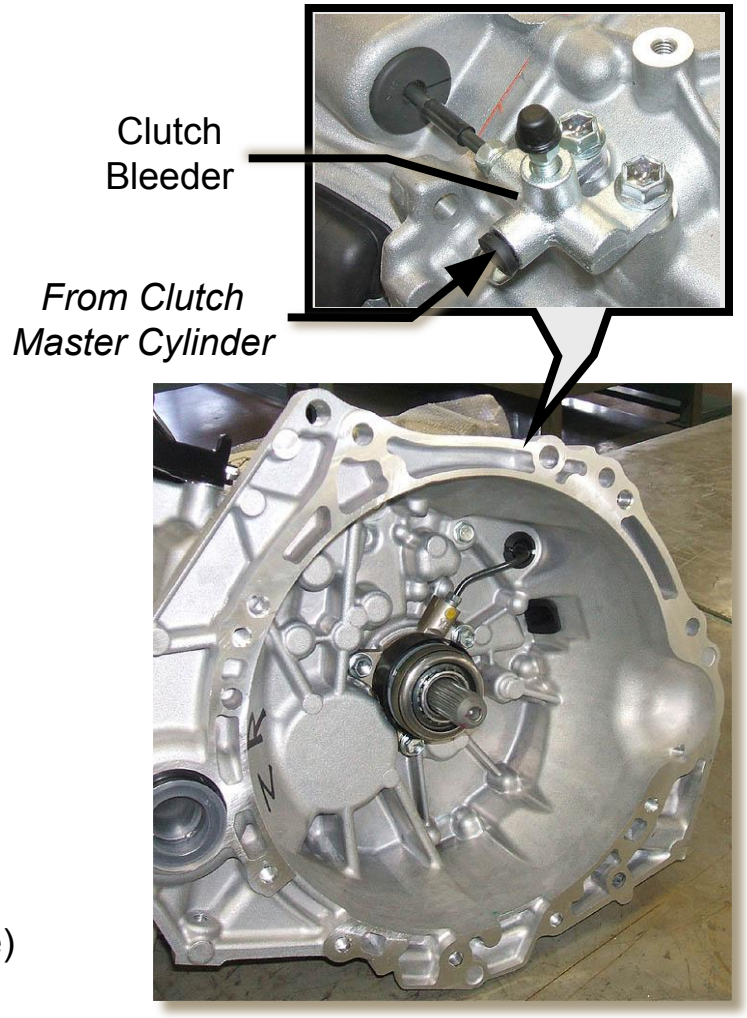
Clutch

CSC (Concentric Sleeve Cylinder) [EB60 and EC60]

– Construction



Clutch Release With Bearing Cylinder (CSC Type)



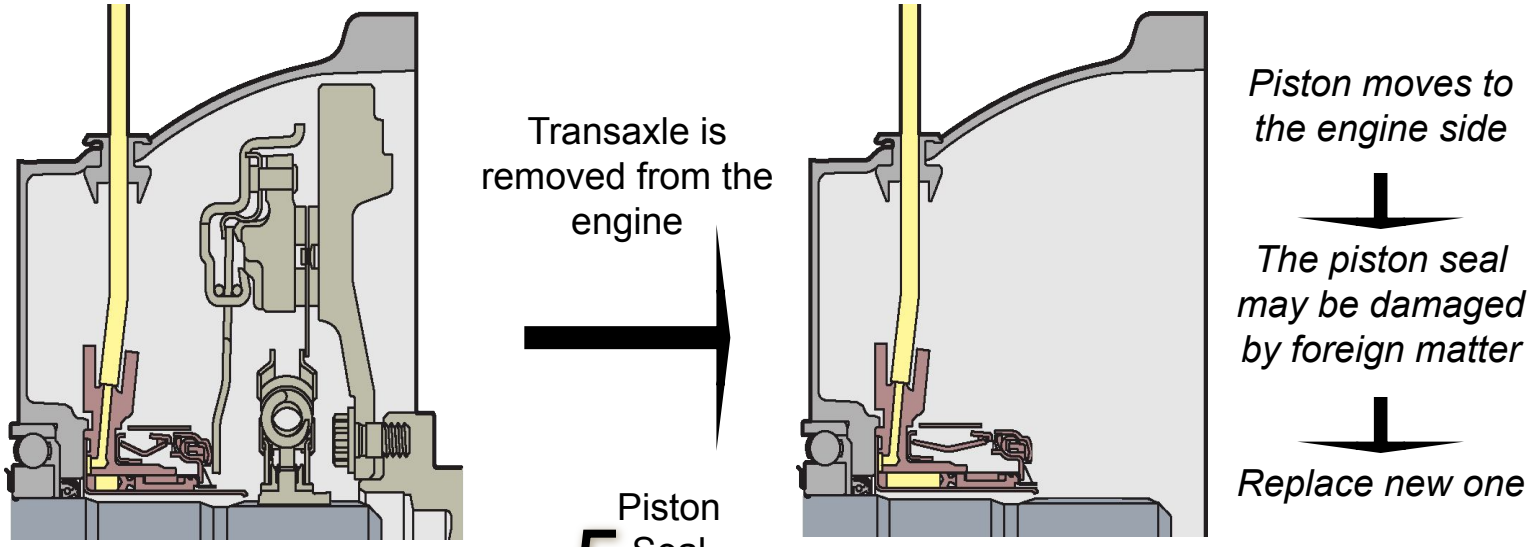
The clutch release with bearing cylinder cannot be disassembled

Service Point (Clutch)

CSC (Concentric Sleeve Cylinder) [EB60 and EC60]

– Service Precaution

— When the transaxle is removed from the engine, replace the clutch release with bearing cylinder assembly with a new one

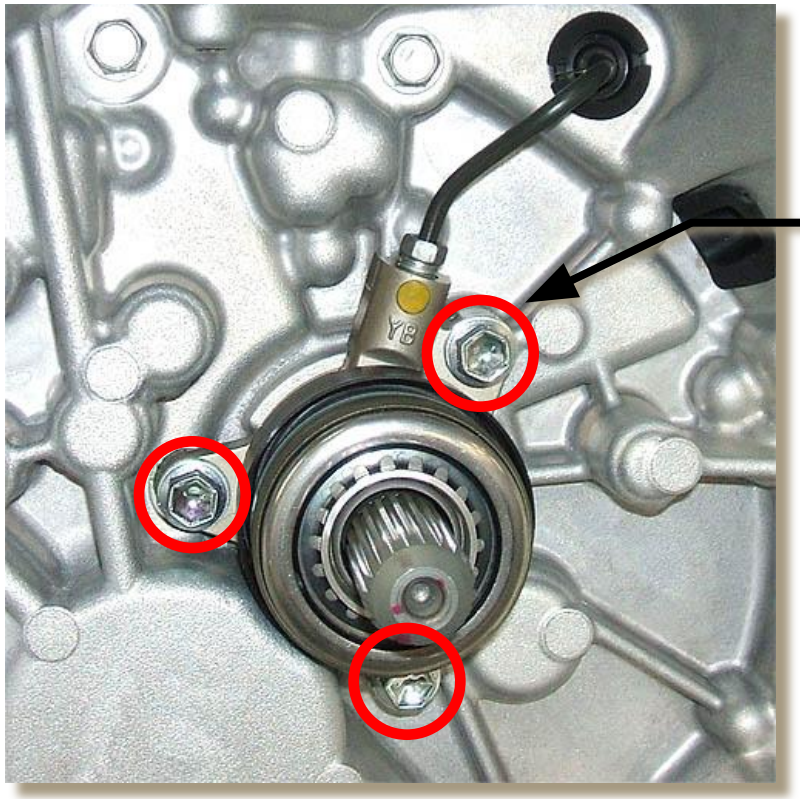


Service Point (Clutch)

CSC (Concentric Sleeve Cylinder) [EB60 and EC60]

– Service Precaution

— When the seal bolts are removed, replace them with new ones



3 Seal Bolts

(*Non-reusable*

Service Point (Clutch)

CSC (Concentric Sleeve Cylinder) [EB60 and EC60]

– Service Precaution

— The clutch fluid should be replaced according to the Maintenance Schedule

[Maintenance Schedule]

Release Cylinder Type		CSC Type	Conventional Type
Transaxle Type		EB60 and EC60	EA6# (Reference)
Clutch Fluid	Inspect	–	Every 30000 km (18000 miles) or 24 months
	Replace	Every 30000 km (18000 miles) or 24 months	–

EA6# Manual Transaxle

Subtitle

EA6# Manual Transaxle

Specifications

Model		New AVENSIS			Previous AVENSIS	
Transaxle Type		EA62	EA63	EA65	EA60	EA61
Engine Type		2AD-FHV	2AD-FTV	1AD-FTV	2AD-FHV	1AD-FTV, 2AD-FTV
Drive Type		FF	FF	FF	FF	FF
Gear Ratio	1st	3.538	←	3.818	3.538	←
	2nd	1.913	←	←	←	←
	3rd	1.218	←	←	←	←
	4th	0.880	←	0.860	←	←
	5th	0.809	←	0.790	←	←
	6th	0.638	0.673	←	0.638	0.673
	Reverse	3.831	←	4.139	3.831	←
Differential Gear Ratio		4.058*1 / 3.450*2	3.777*1 / 3.238 *2	←	←	←
Oil Capacity [Liters (US qts, Imp. qts)]		2.3 (2.4, 2.0)	←	←	←	←
Oil Viscosity		SAE 75W	←	←	←	←
Oil Grade		API GL-4	←	←	←	←
Weight (Reference)*3 [kg (lb)]		62.7 (137.9)	←	←	65.0 (143.3)	←
Gear Shift Indicator		With	←	←	Without	←

*1: For 1st to 4th *2: For 5th, 6th, Reverse *3: With the oil fully filled

EB60 / EC60 Manual Transaxle

Subtitle

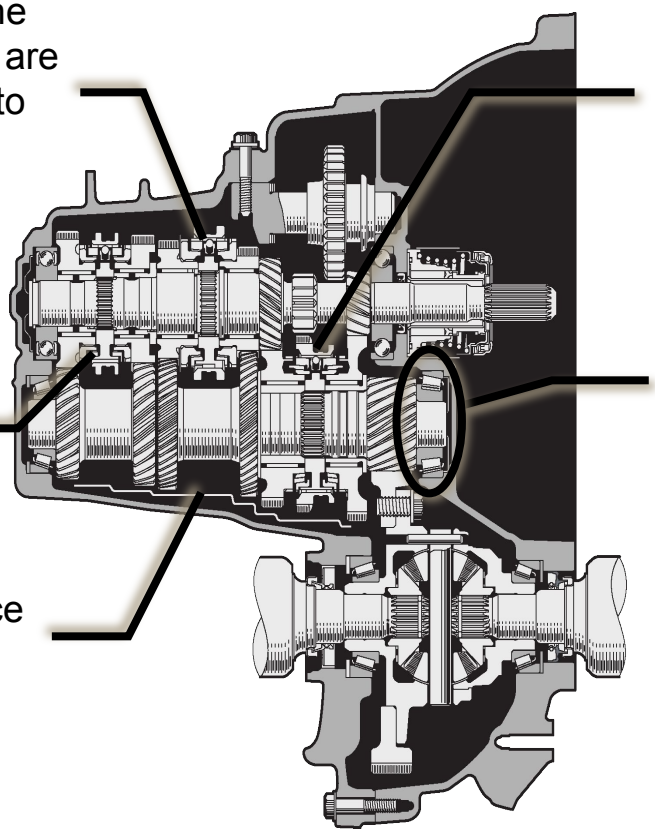
EB60 / EC60 Manual Transaxle

Overall

– EB60 / EC60 6-speed manual transaxle is newly developed

The ball and spring in the synchromesh shifting key are combined into one unit to improve shift feeling

Plastic pad for the shift fork reduces the sliding resistance (Same as EA6#)



Pre-synchronizing system prevents gear noise

Low friction bearings improve torque transmission efficiency

Oil separators reduce energy loss

- Select cable length adjustment mechanism (Same as EA6#)
- Pull collar type shift lever (Same as EA6#)

EB60 / EC60 Manual Transaxle

Specifications

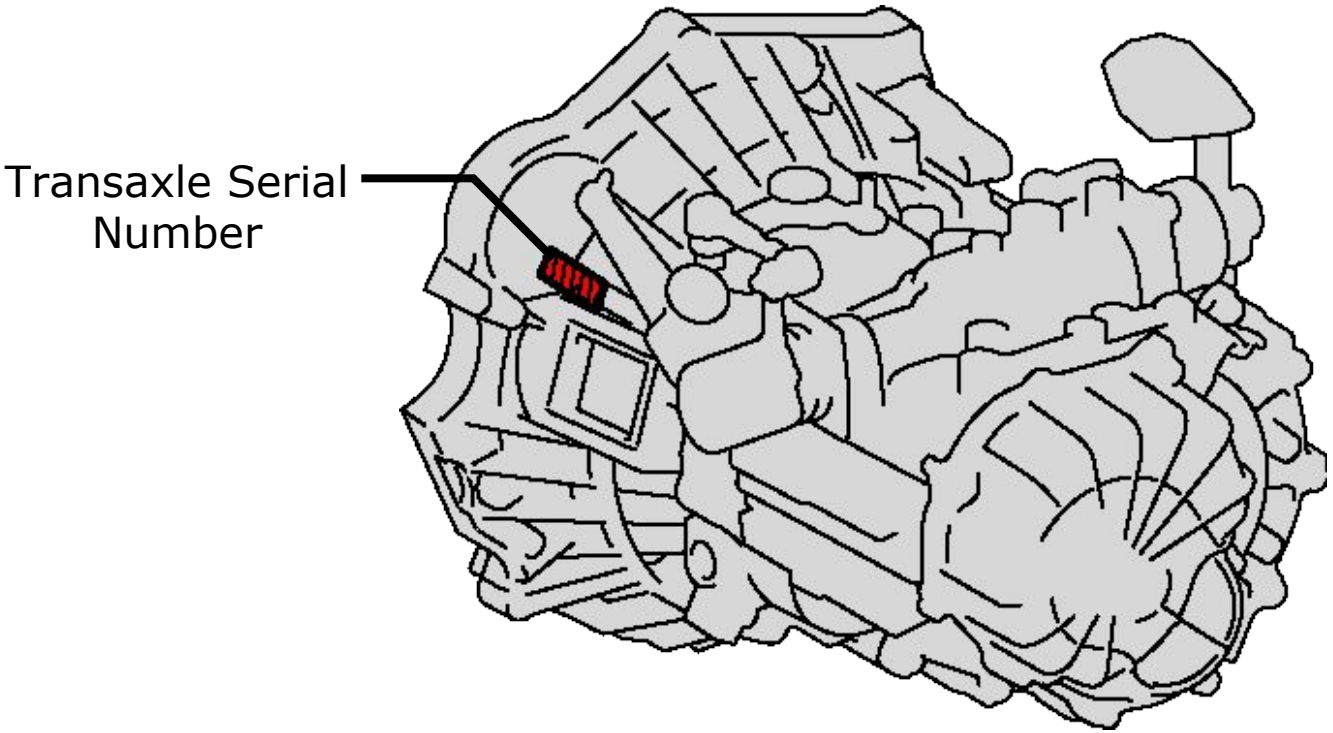
Model		New AVENSIS		
Transaxle Type		EB60	EC60	EA62 (Ref.)
Engine Type		3ZR-FAE, 3ZR-FE	1ZR-FAE, 2ZR-FAE	2AD-FHV
Drive Type		FF	FF	FF
Gear Ratio	1st	3.538	←	←
	2nd	2.047	1.913	←
	3rd	1.375	1.310	1.218
	4th	1.025	0.971	0.880
	5th	0.875	0.818	0.809
	6th	0.733	0.700	0.638
	Reverse	3.545	3.333	3.831
Differential Gear Ratio		4.058	4.562*1 / 4.294*2	4.058*3 / 3.450*4
Oil Capacity [Liters (US qts, Imp. qts)]		2.4 (2.5, 2.1)	←	2.3 (2.4, 2.0)
Oil Viscosity		SAE 75W	←	←
Oil Grade		API GL-4	←	←
Weight (Reference)*5 [kg (lb)]		47.5 (104.5)	42.4 (93.3)*1 42.3 (93.1)*2	62.7 (137.9)
Gear Shift Indicator		With	←	←

*1: 1ZR-FAE
*2: 2ZR-FAE
*3: For 1st to 4th
*4: For 5th, 6th, Reverse
*5: With the oil fully filled

EB60 / EC60 Manual Transaxle

Identification Information

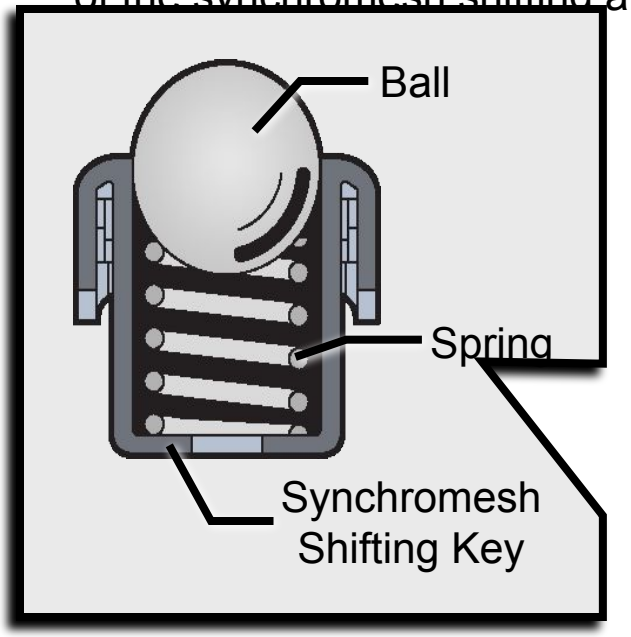
– The transaxle serial number is stamped on the case as shown in the illustration

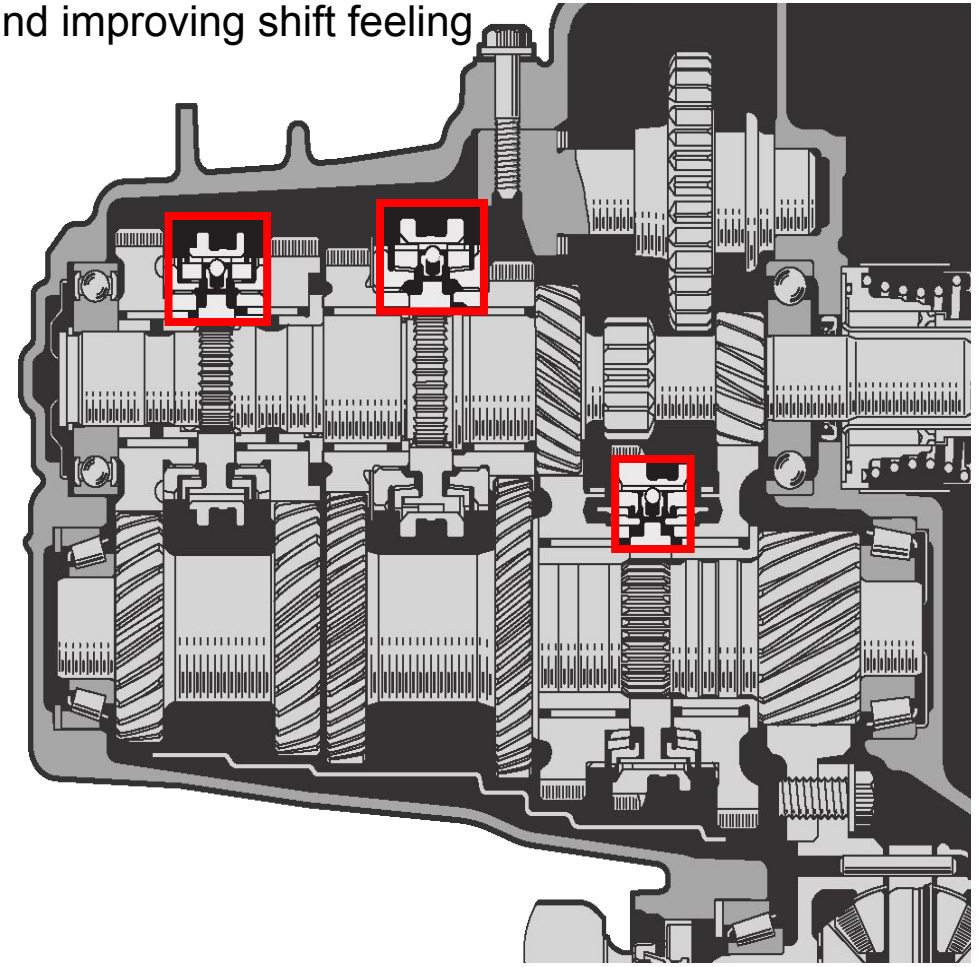


EB60 / EC60 Manual Transaxle

Synchromesh Shifting Key

– The ball and spring are combined into one unit, thus ensuring the stable position
of the synchromesh shifting and improving shift feeling

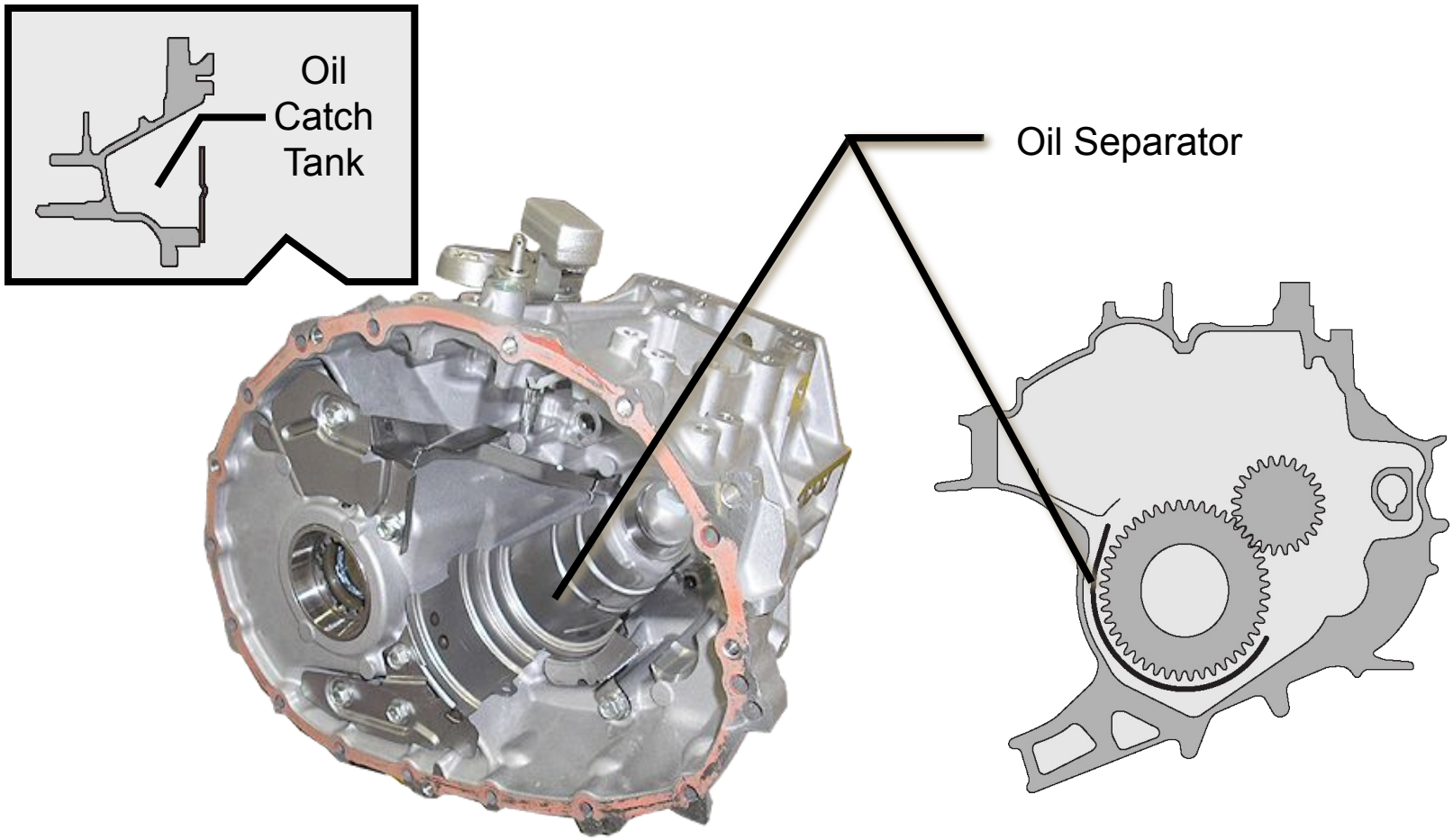




EB60 / EC60 Manual Transaxle

Oil Separator

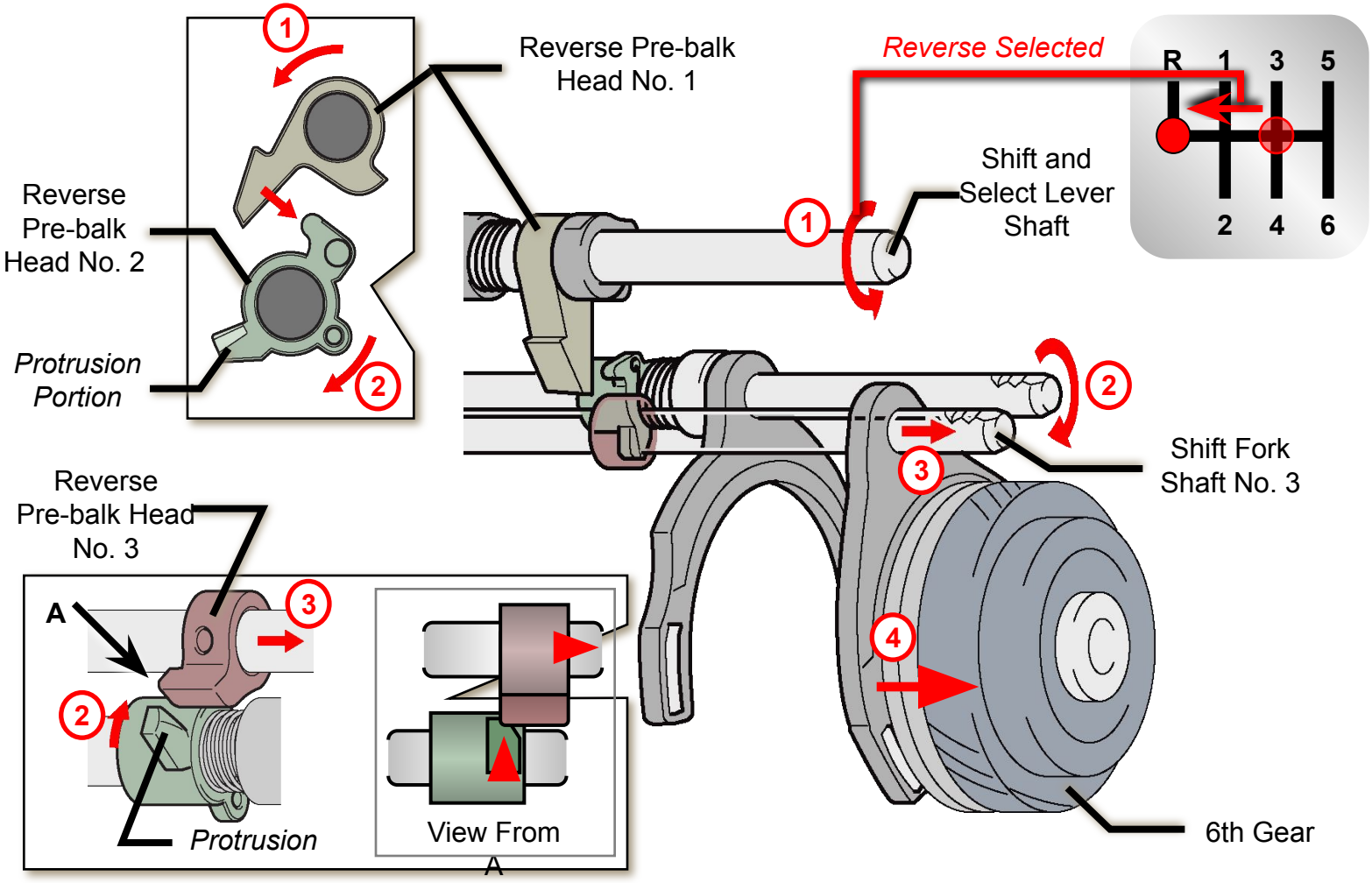
– The oil separator prevents the oil from being directly mixed by the gears, thereby reducing agitation resistance



EB60 / EC60 Manual Transaxle

Pre-synchronizing System

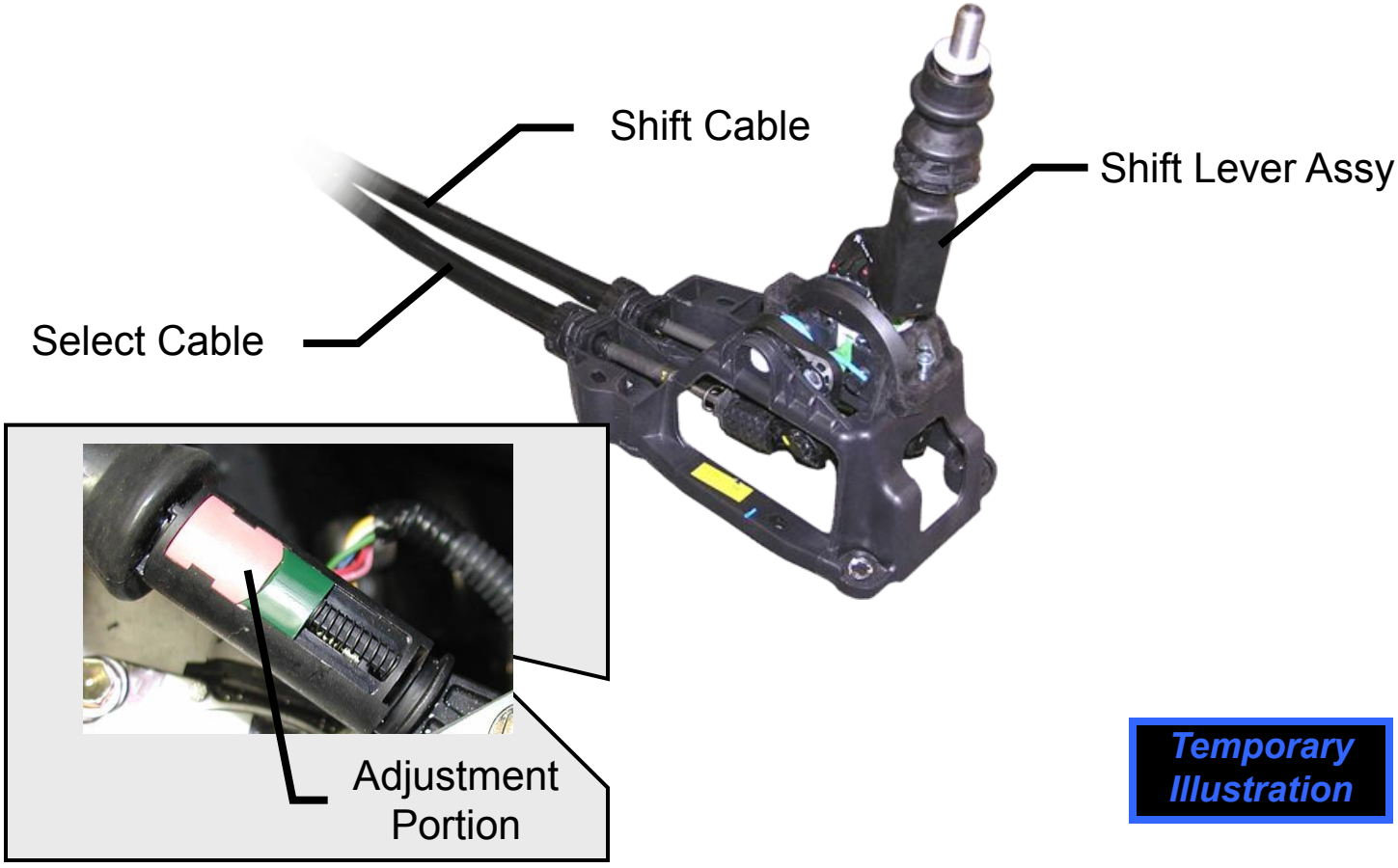
– While reverse is selected, synchromesh mechanism of 6th gear is activated to reduce gear noise



EB60 / EC60 Manual Transaxle

Transmission Control Select Cable

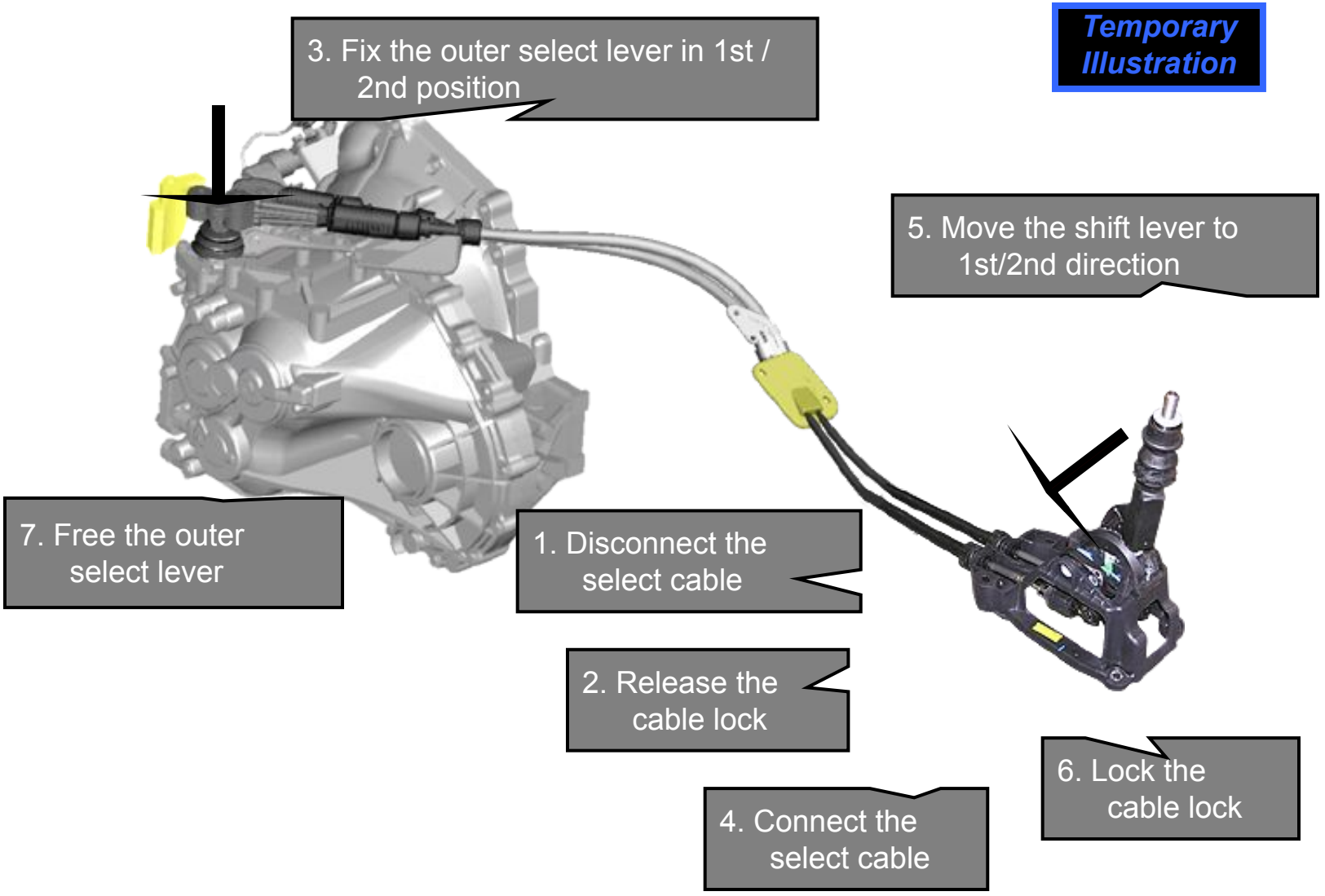
– Select cable with cable length adjustment mechanism is used to improve serviceability



Service Point (EB60 / EC60 Manual Transaxle)

Adjustment for Transmission Control Select Cable

– Outline of adjustment procedure



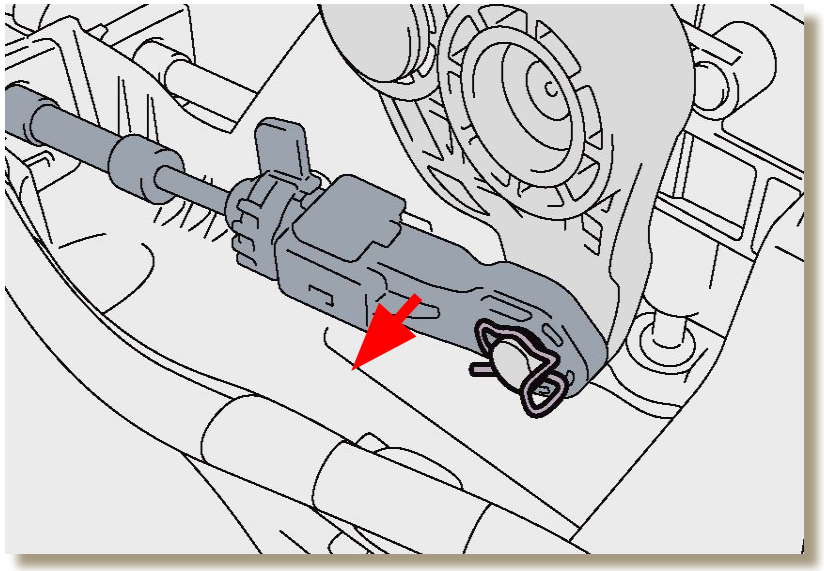
TOYOTA

Today
Tomorrow
Toyota

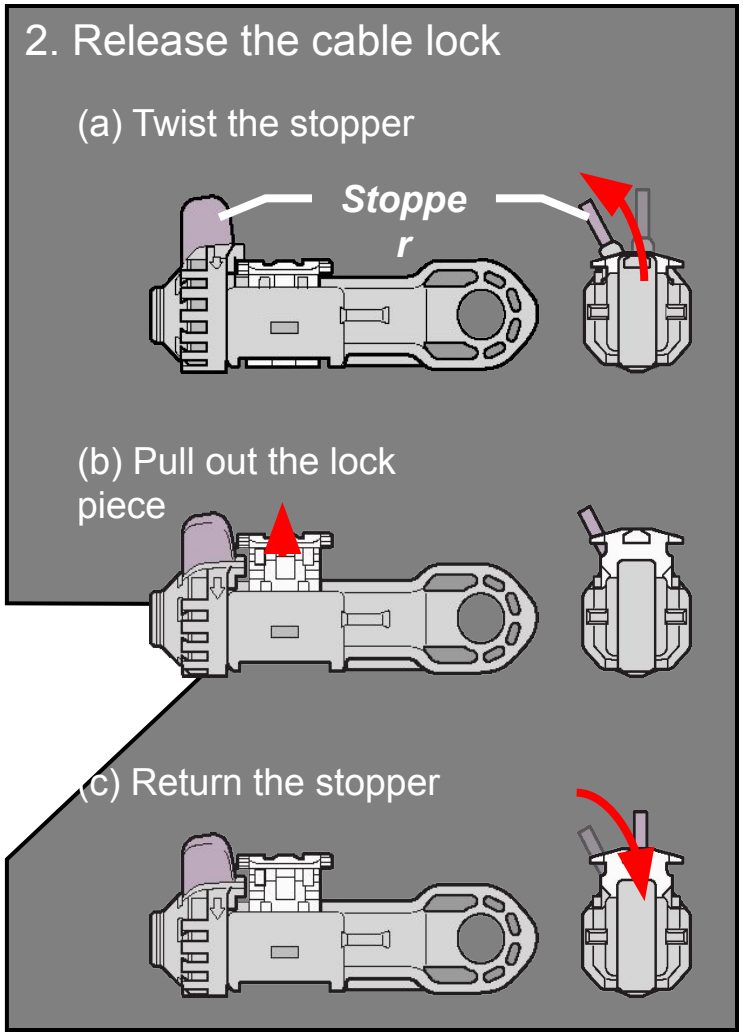
Service Point (EB60 / EC60 Manual Transaxle)

Adjustment for Transmission Control Select Cable

1. Disconnect the select cable
2. Release the cable lock



1. Remove the clip and disconnect the select cable



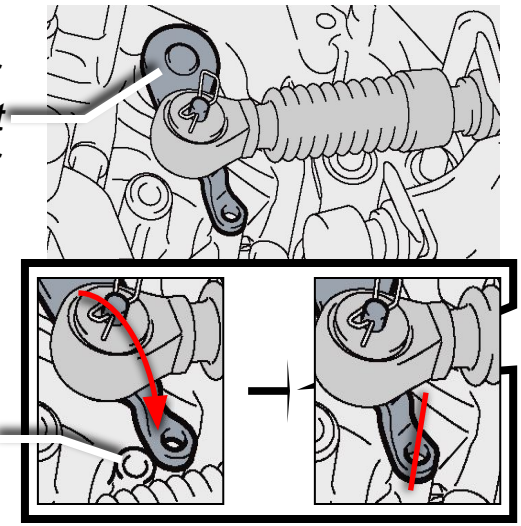
Service Point (EB60 / EC60 Manual Transaxle)

Adjustment for Transmission Control Select Cable

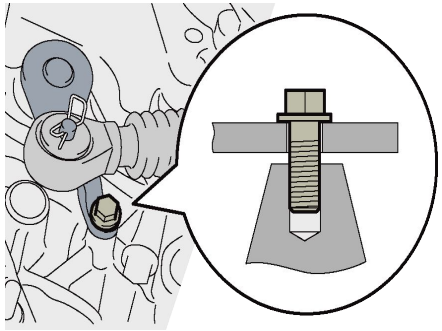
3. Fix the outer select lever in 1st / 2nd position

EB6

(a) Align the hole **0**

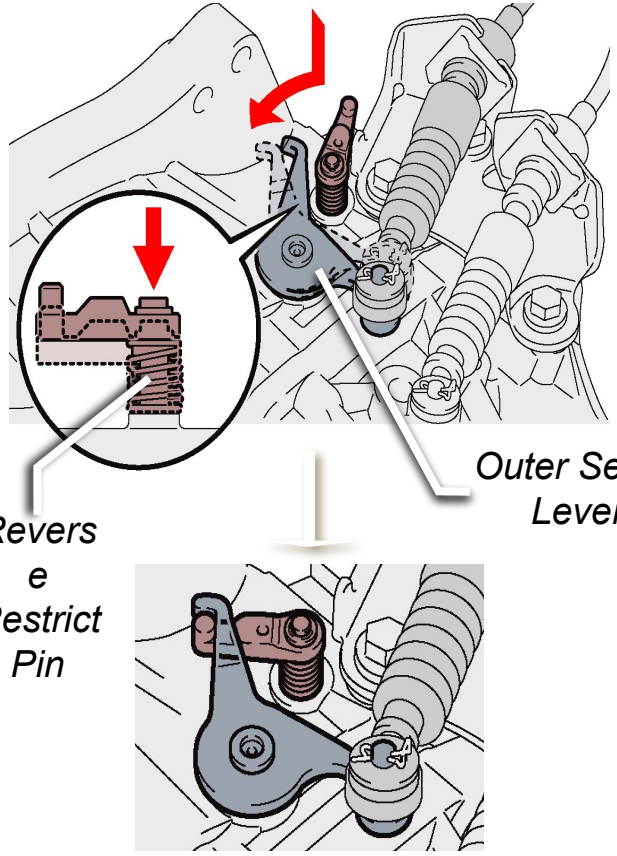


(b) Insert a bolt into the aligned holes



EC6

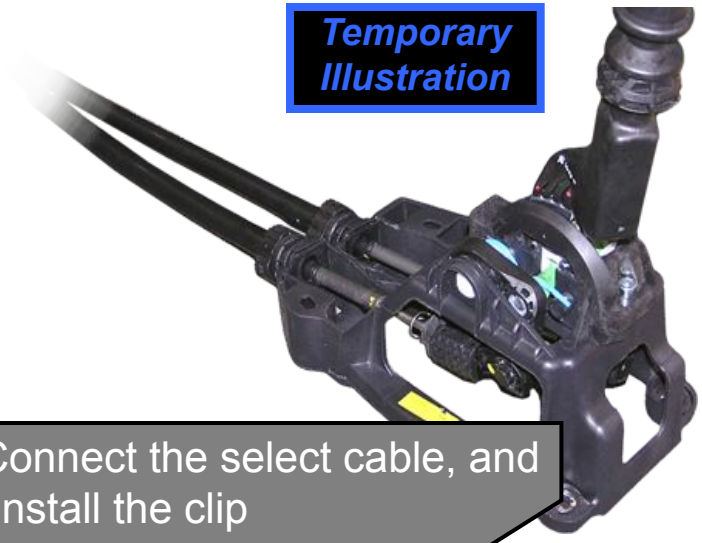
(a) Hook the outer select lever **0** to the reverse restrict pin



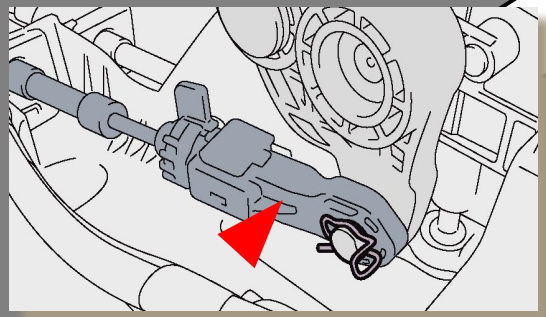
Service Point (EB60 / EC60 Manual Transaxle)

Adjustment for Transmission Control Select Cable

4. Connect the select cable
5. Move the shift lever to 1st/2nd direction



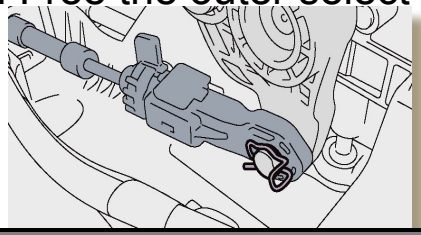
4. Connect the select cable, and install the clip



Service Point (EB60 / EC60 Manual Transaxle)

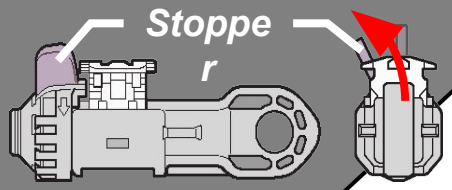
Adjustment for Transmission Control Select Cable

6. Lock the cable lock
7. Free the outer select lever

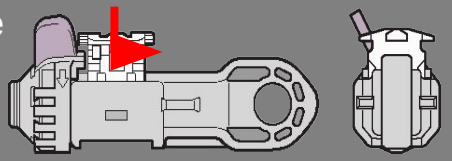


6. Lock the cable lock

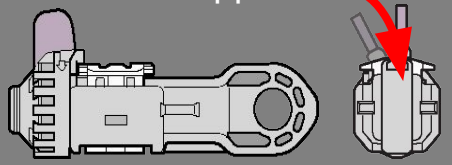
(a) Twist the stopper



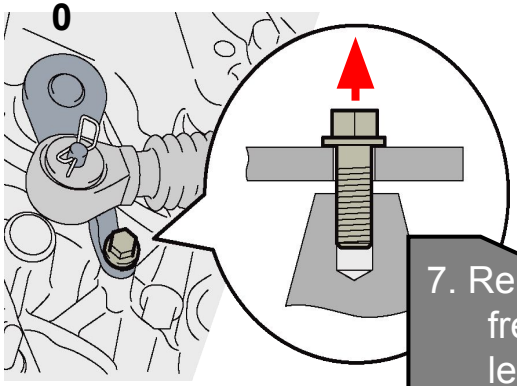
(b) Push the lock piece into the case



(c) Return the stopper

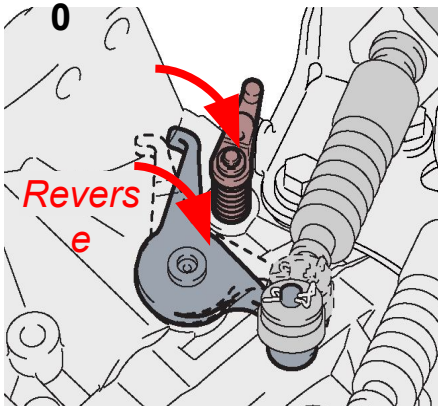


EB6
0



7. Remove the bolt to free the select outer lever

EC6
0



7. Move the shift lever to R, and free the outer select lever

TOYOTA

Today
Tomorrow
Toyota

Gear Shift Indicator System

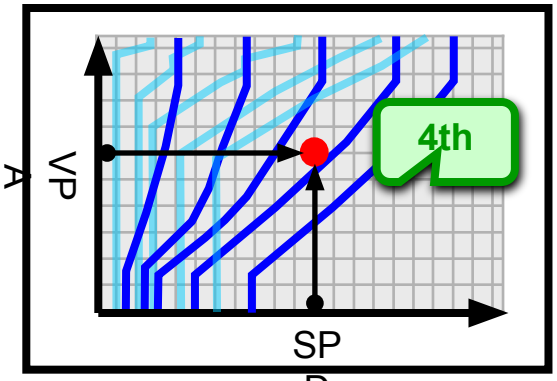
Subtitle

Gear Shift Indicator System

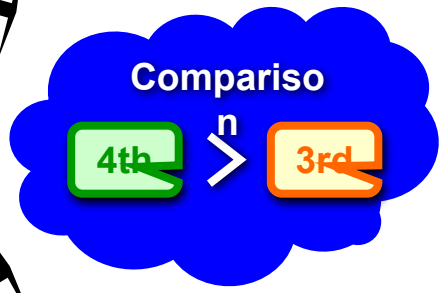
Outline

– This system shows a guideline to help the driver achieve good environmental performance driving

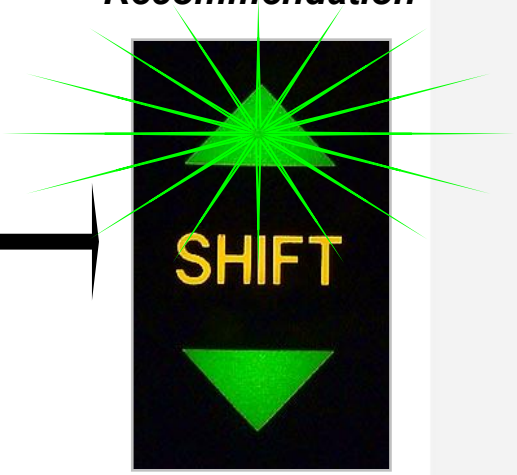
Actual Gear Position



"Recommended Gear Position" (Good Environmental Performance Gear Position)



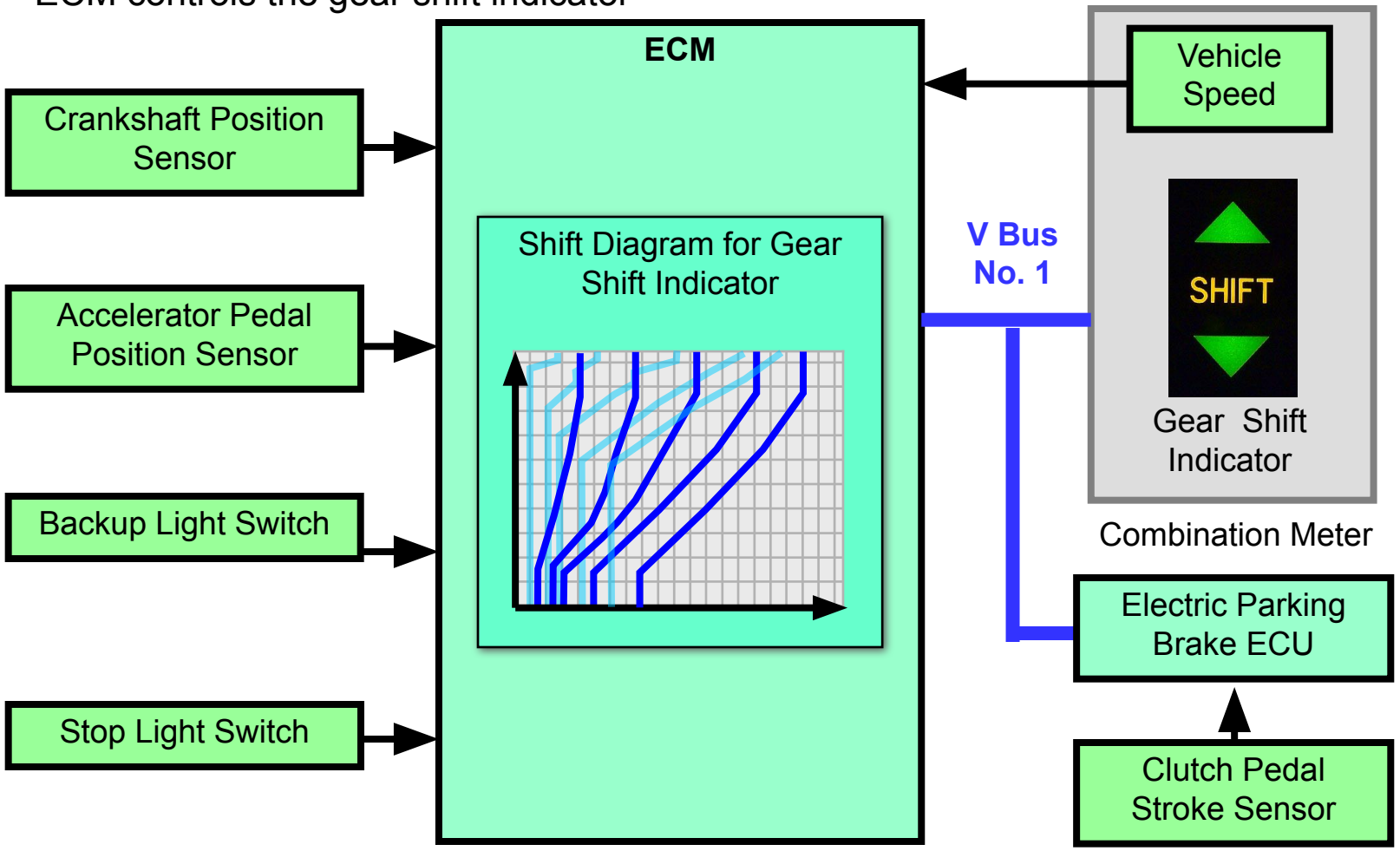
Upshift Recommendation



Gear Shift Indicator System

System Diagram

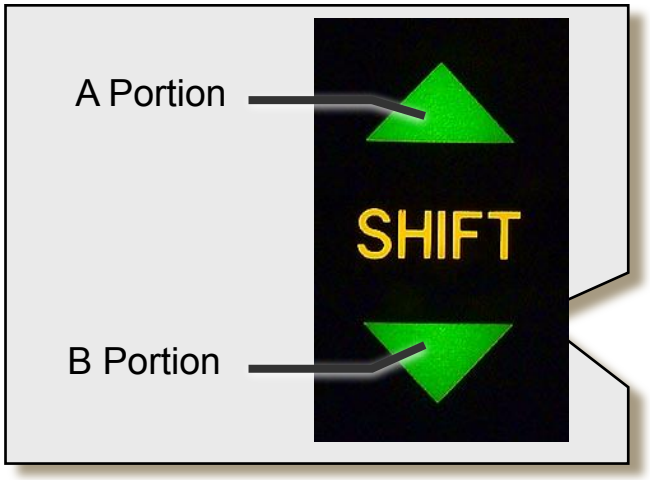
– ECM controls the gear shift indicator



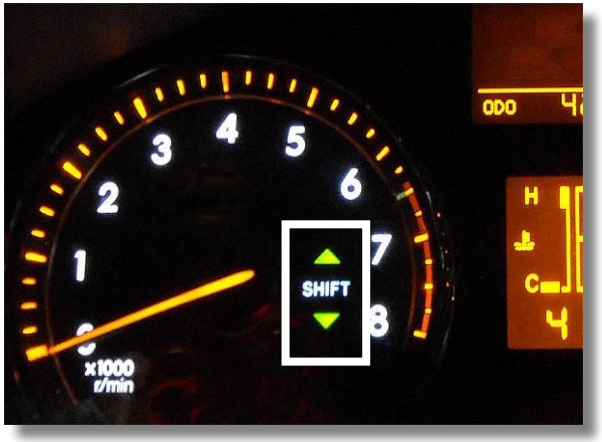
Gear Shift Indicator System

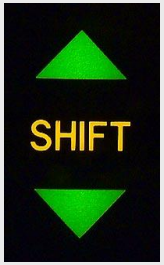
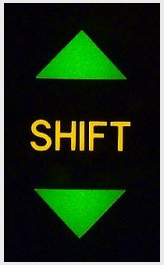
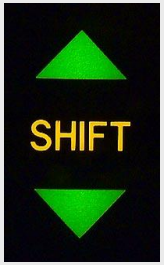
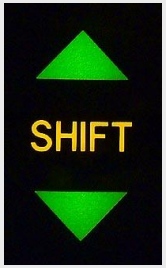
Gear Shift Indicator

– The display shows following condition



Combination Meter

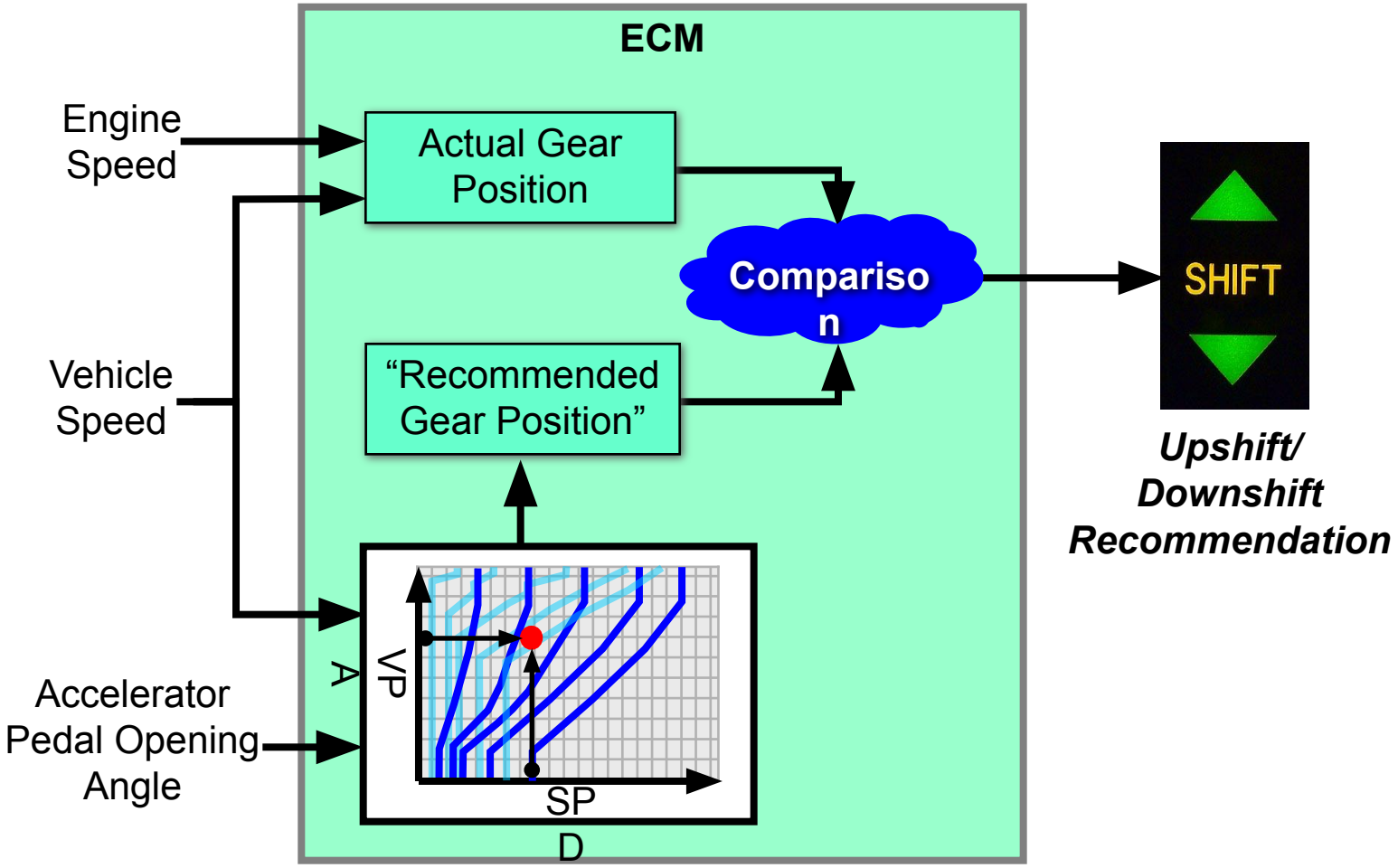


			
Upshift Recommendation	**Downshift Recommendation**	**Good gear position is used**	**Bulb Check (From IG ON to Engine Start)**

Gear Shift Indicator System

System Operation (Basic Operation)

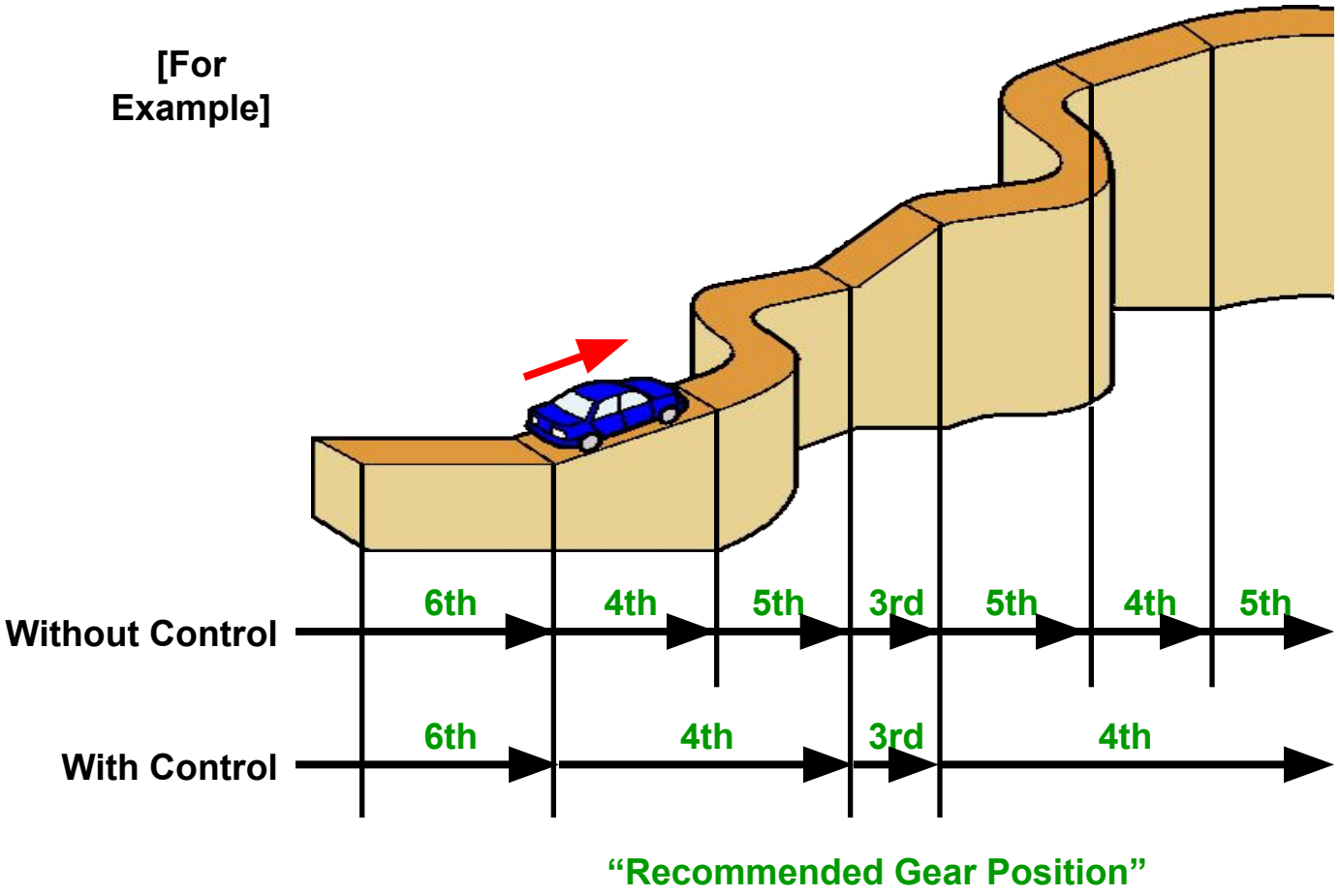
– ECM compares the actual gear position with the “recommended gear position”



Gear Shift Indicator System

System Operation (Control in Uphill Traveling)

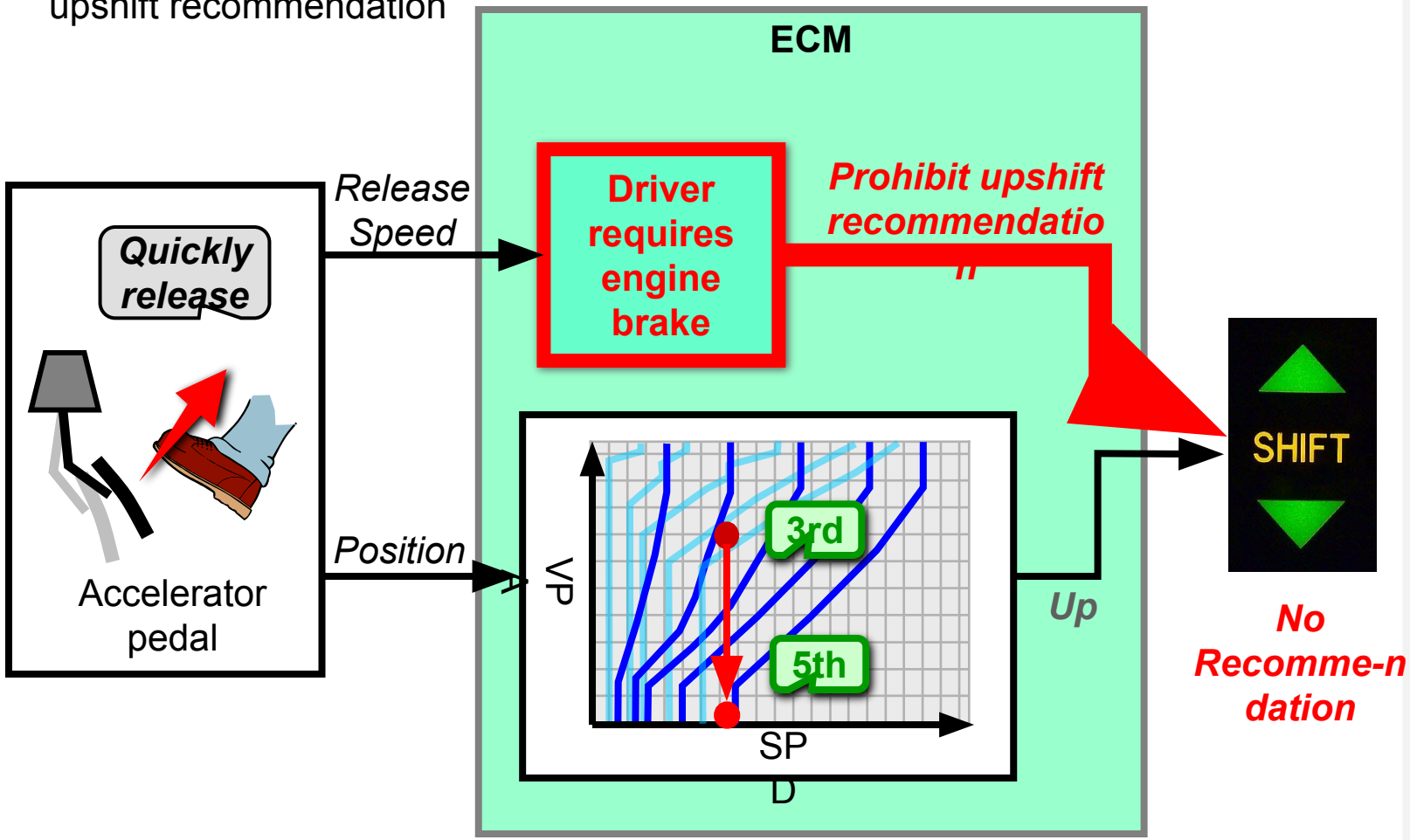
– At uphill traveling, this control reduces the upshift recommendation in order to ensure a comfortable drivability



Gear Shift Indicator System

System Operation (ΔTA Control)

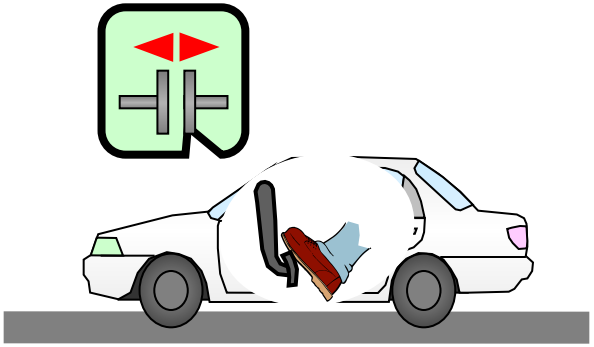
– When the accelerator pedal is quickly released, this system does not show the upshift recommendation



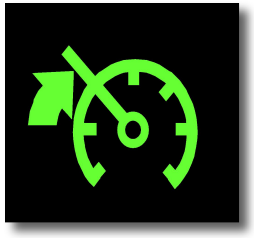
Gear Shift Indicator System

Operation Condition

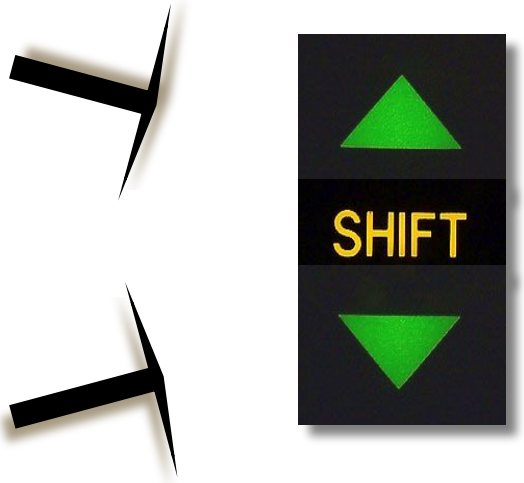
– When the vehicle is following condition, this system does not operate



Clutch is disengaged



Speed Limiter Function (Cruise Control System) is operating



K111 CVT (Continuously Variable Transaxle)

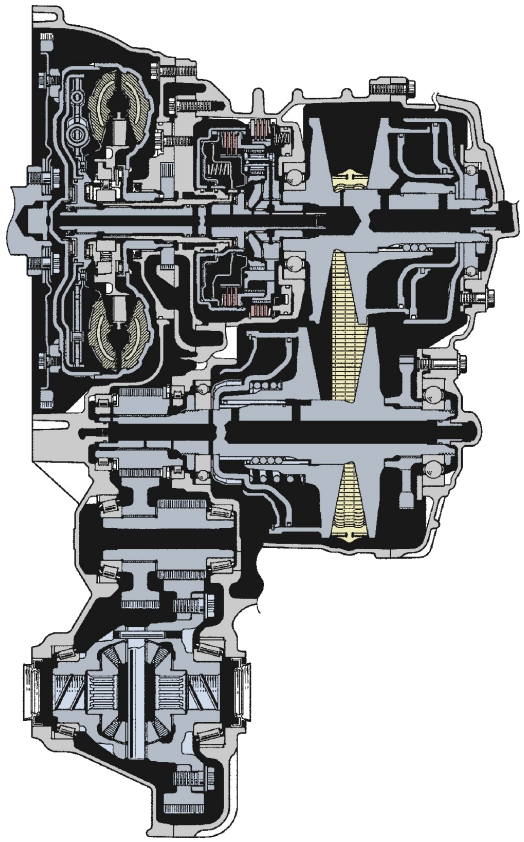
Subtitle

K111 CVT (Continuously Variable Transaxle)

Overall

– A metal belt type continuously variable transaxle with electronic hydraulic control

Transaxle Type		K111
Engine Type		3ZR-FAE (2.0 L)
Shift Mechanism Type		Pulley and Steel Belt
Forward/Reverse Switching Mechanism		Single Pinion Type Planetary Gear
Gear Ratio	Forward	2.396 to 0.428
	Reverse*1	1.668
Differential Gear Ratio*2		5. 182
Shift Lever Position		P – R – N – D – M
Fluid Type		CVT Fluid TC
Fluid Capacity [Liter (US qts, Imp. qts)]		8.6 (9.09, 7.57)
Weight (Reference)		???

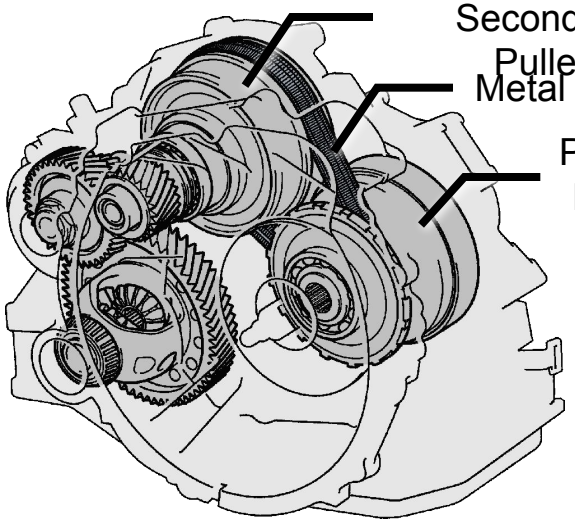


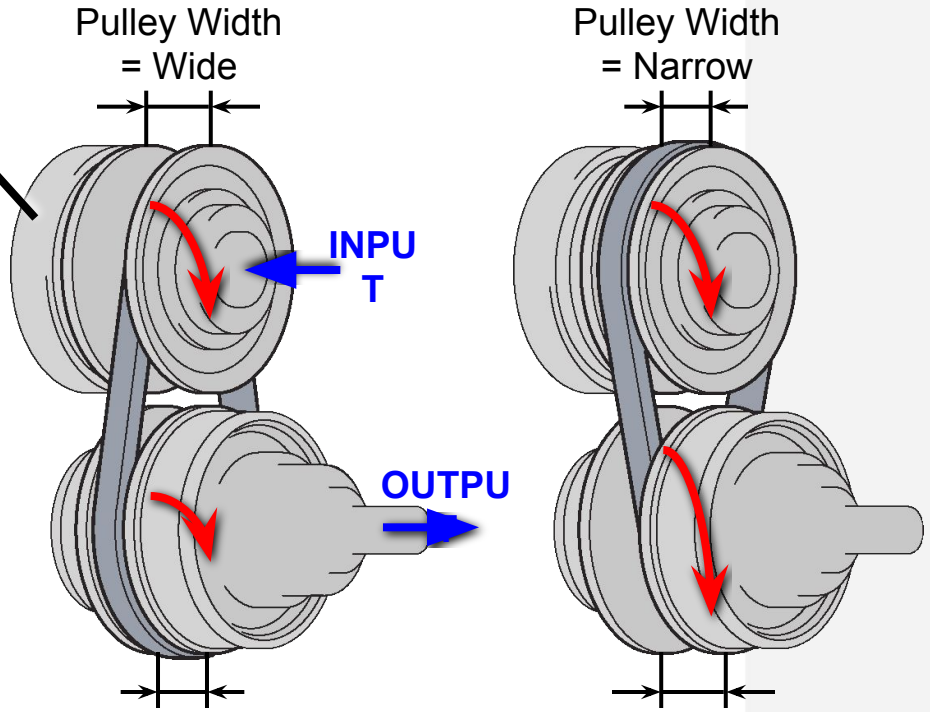
*1: Planetary Gear Ratio Included
*2: Reduction Gear Ratio Included

K111 CVT

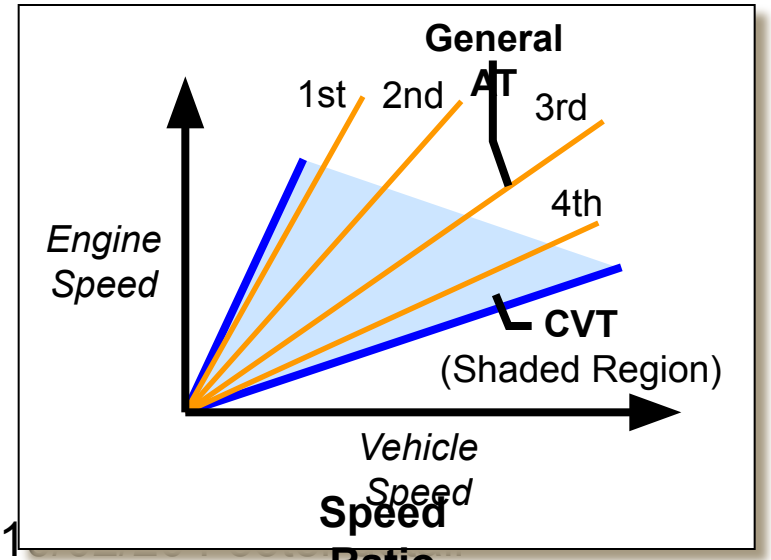
Features of CVT

– CVT perform speed ratio control using a pair of pulleys





Operation of CVT

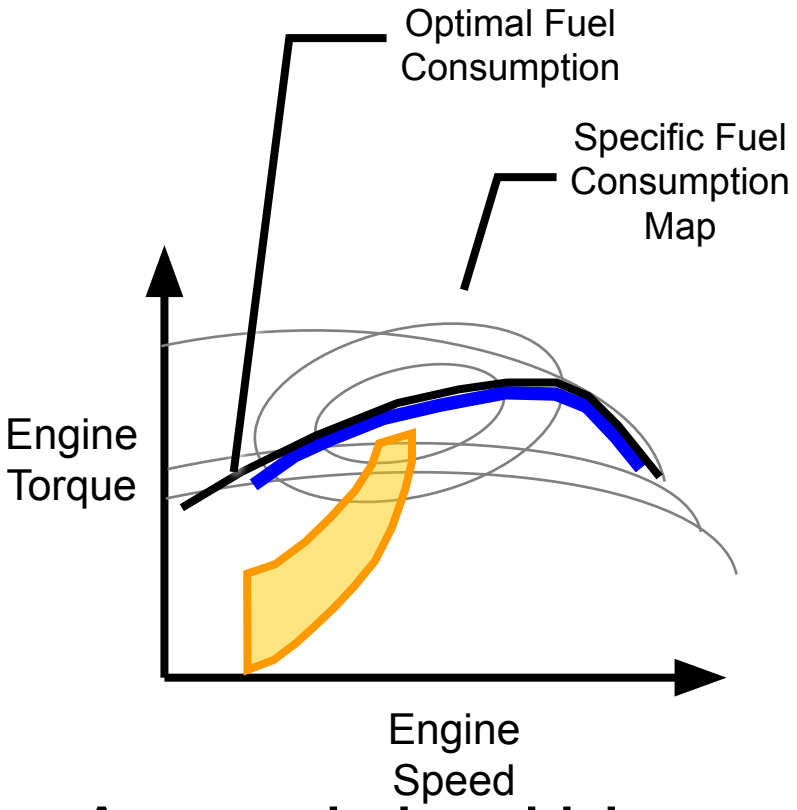


Today
Tomorrow
Toyota

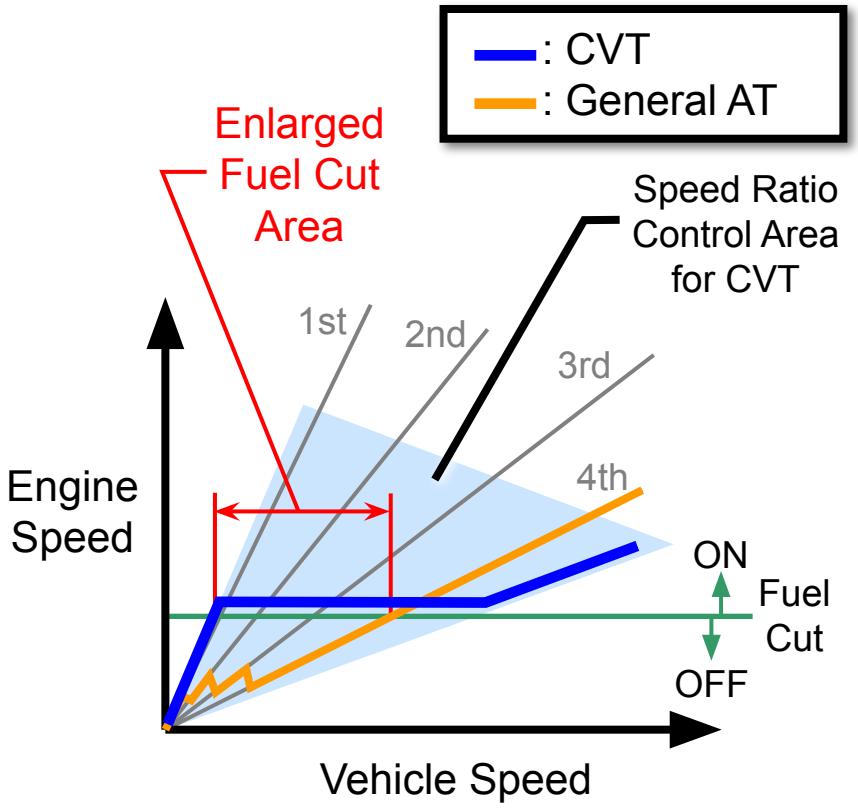
K111 CVT

Features of CVT

– Driving near optimal fuel consumption is allowed



Area used when driving

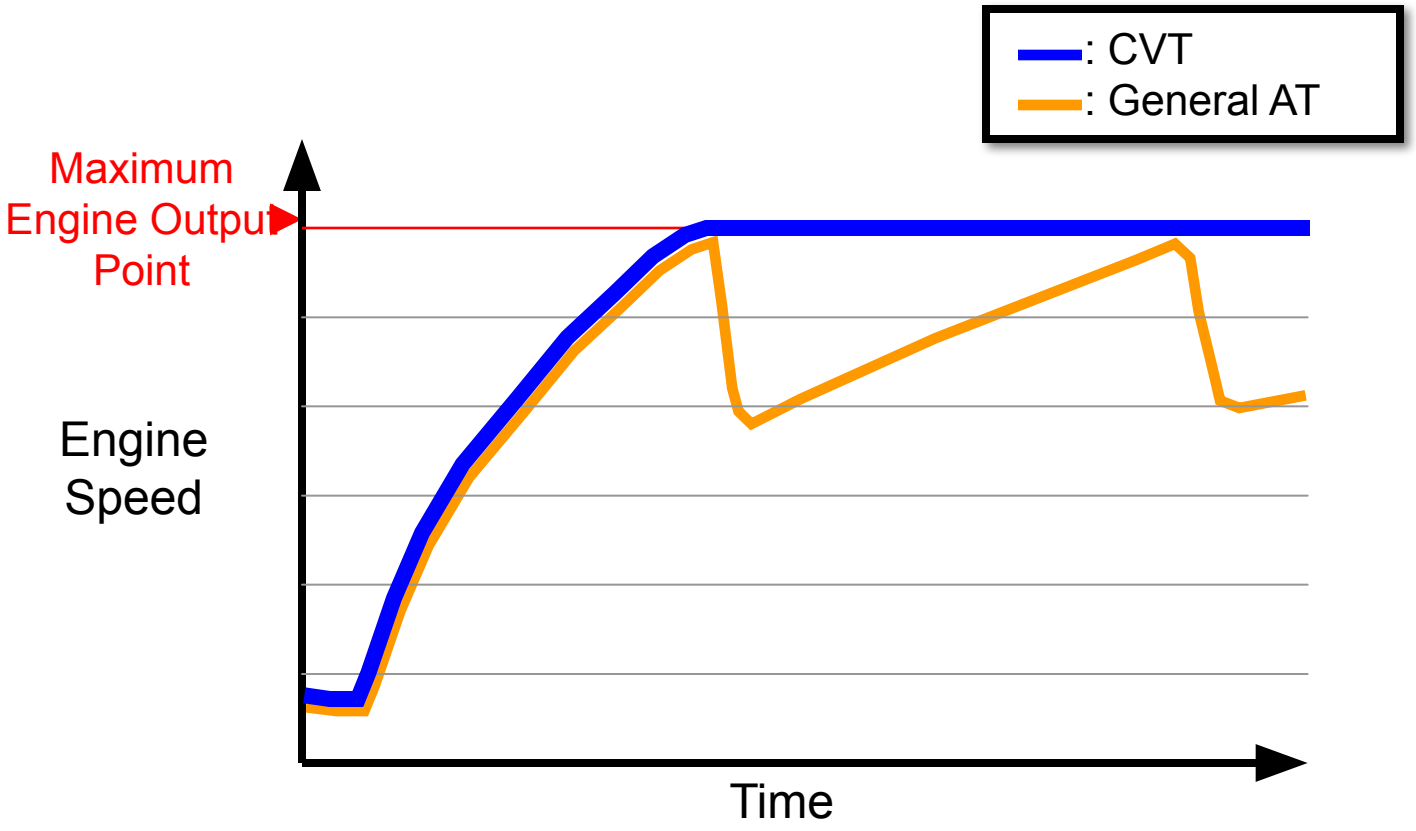


Enlargement of fuel cut area when deceleration

K111 CVT

Features of CVT

– Engine speed in a high output range can be maintained



Engine Speed During Full Throttle Acceleration

K111 CVT

Features of CVT

– Smooth driving force characteristics

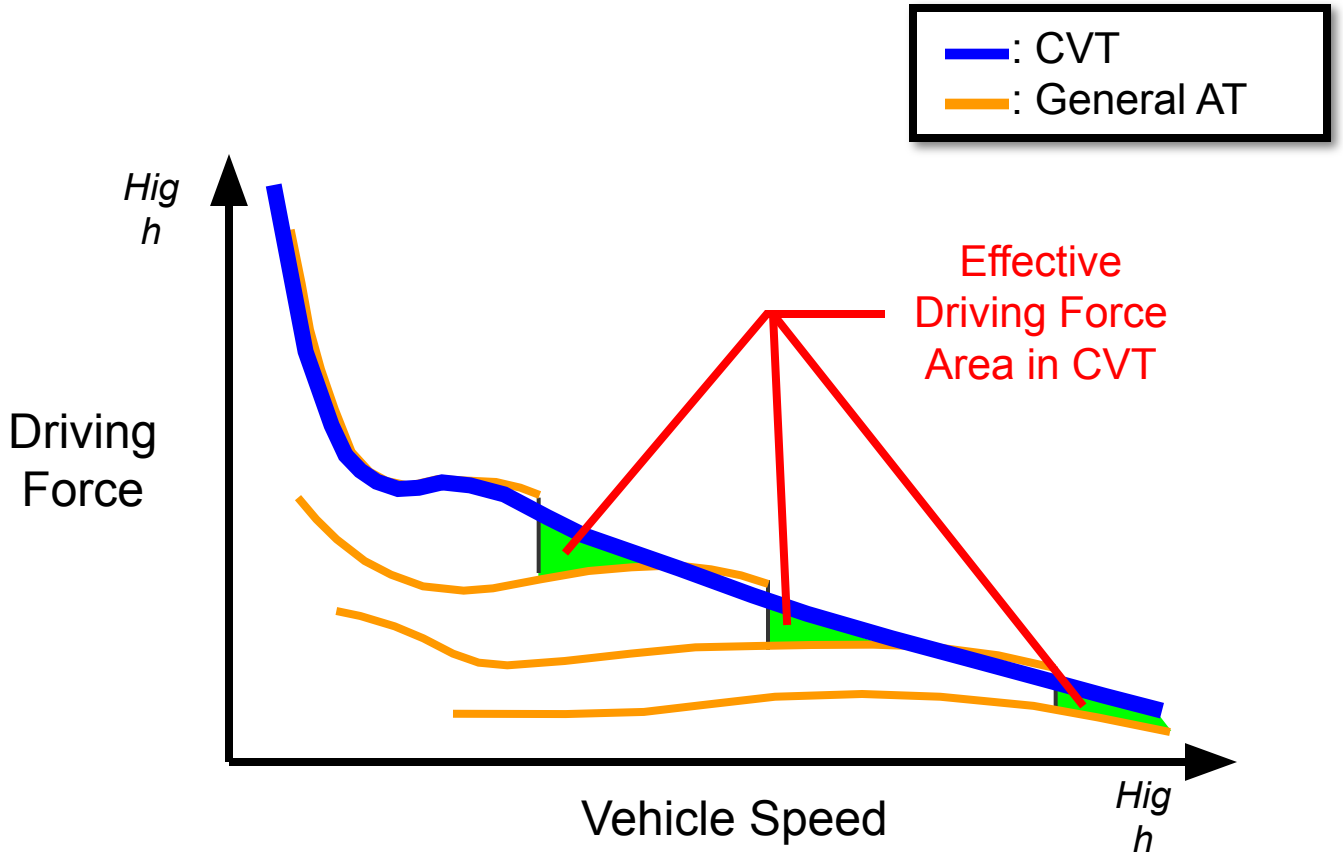
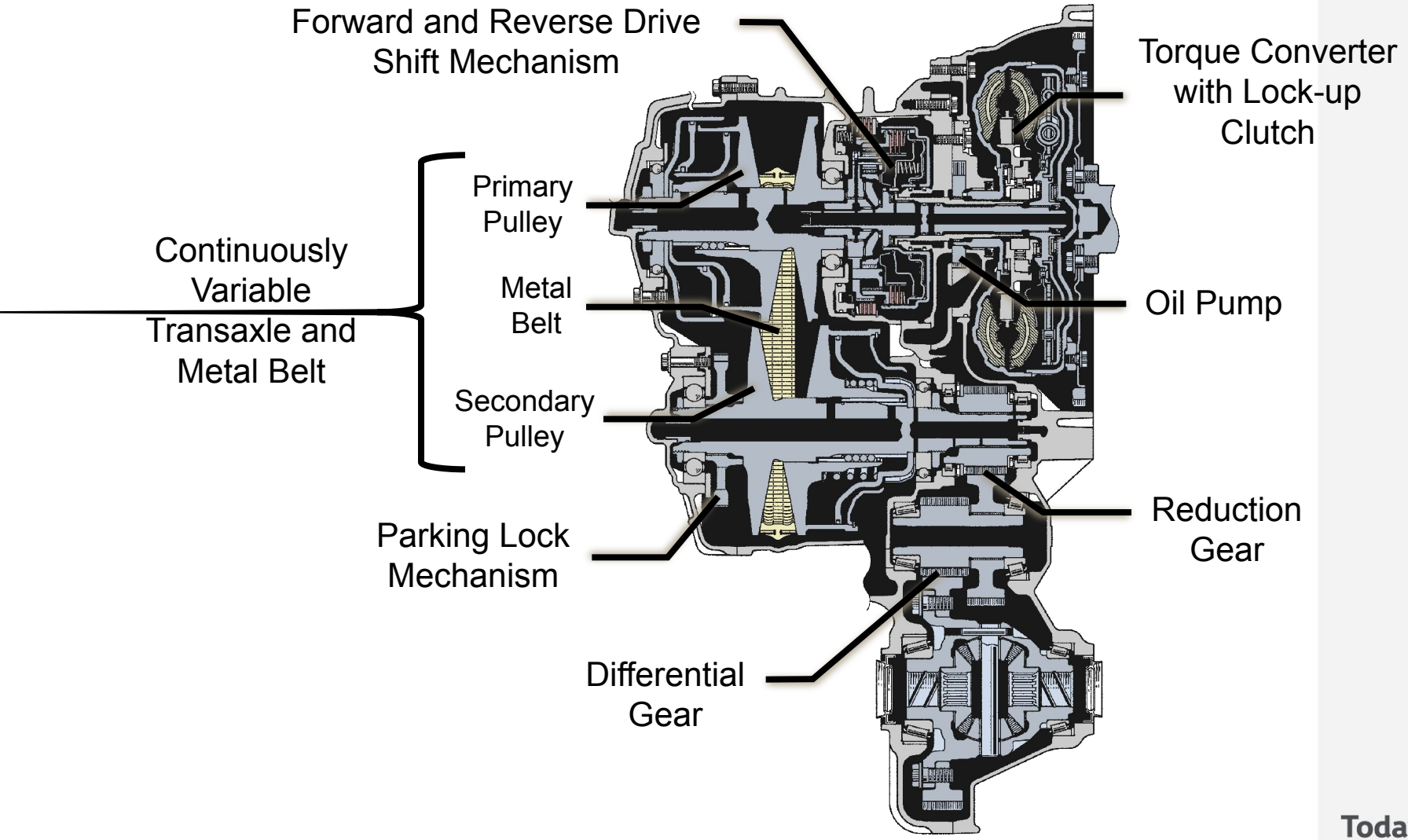


Chart of Driving Force Characteristics

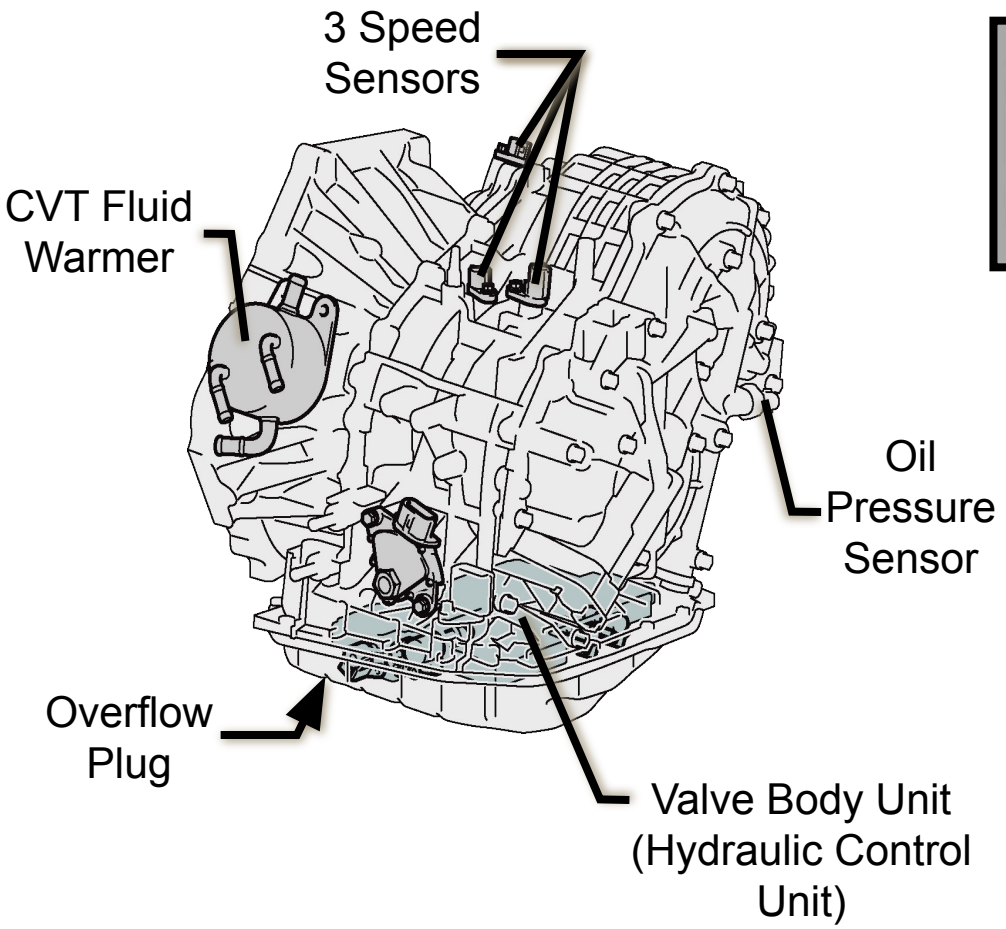
K111 CVT

Components

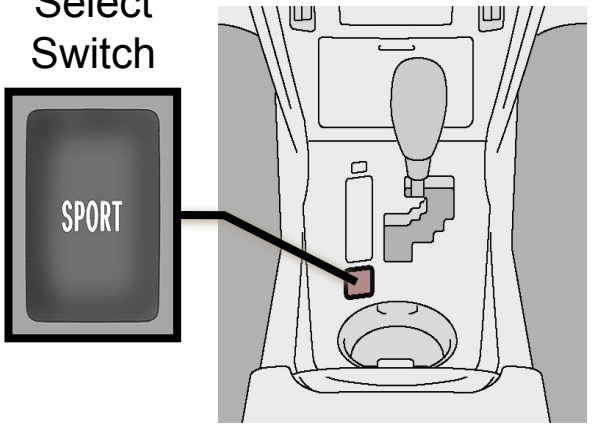


K111 CVT

Components



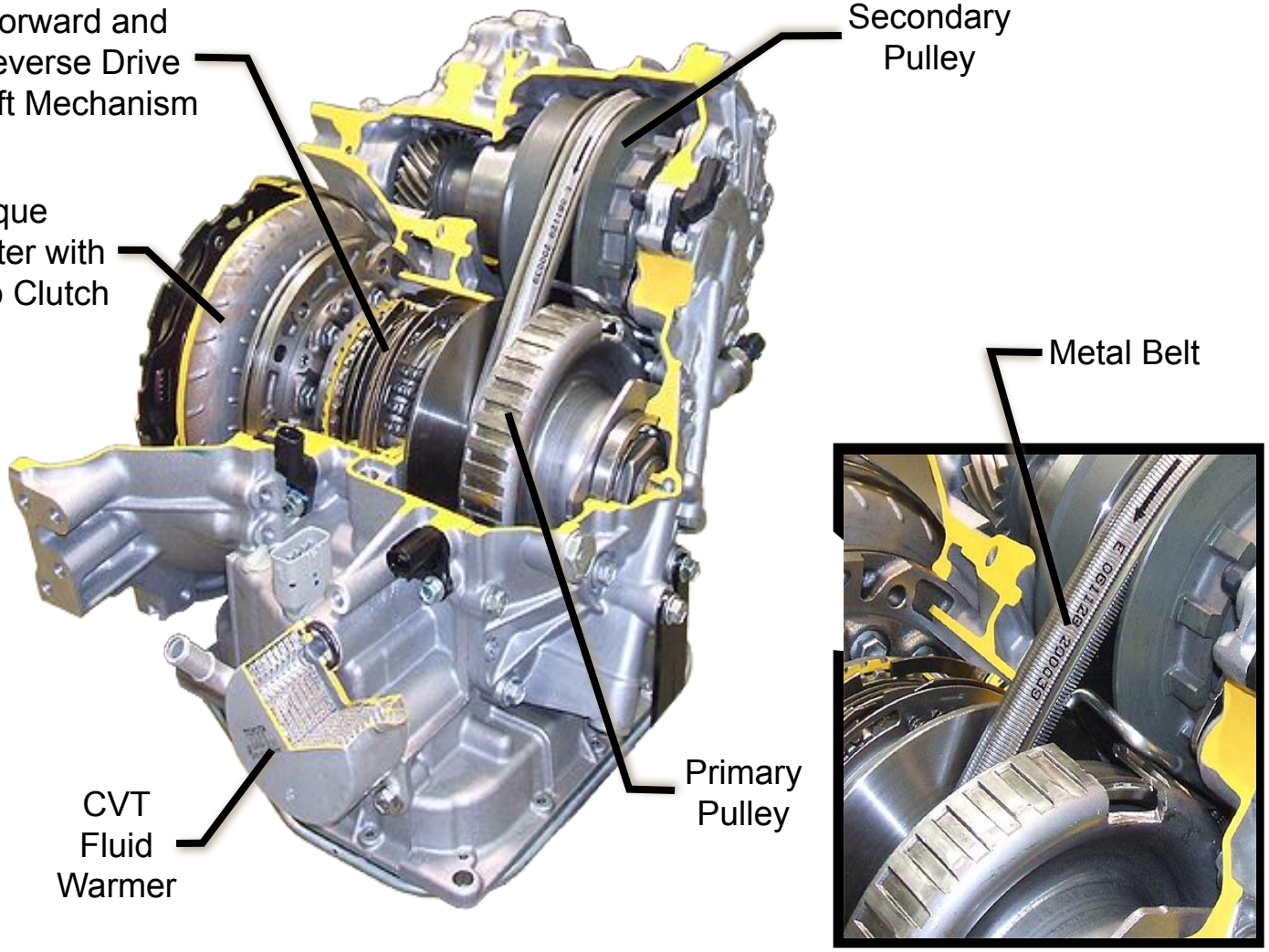
Pattern Select Switch



Shift Position Indicator (Combination Meter)

Reference (K111 CVT)

Components (K210 CVT)



K210 CVT

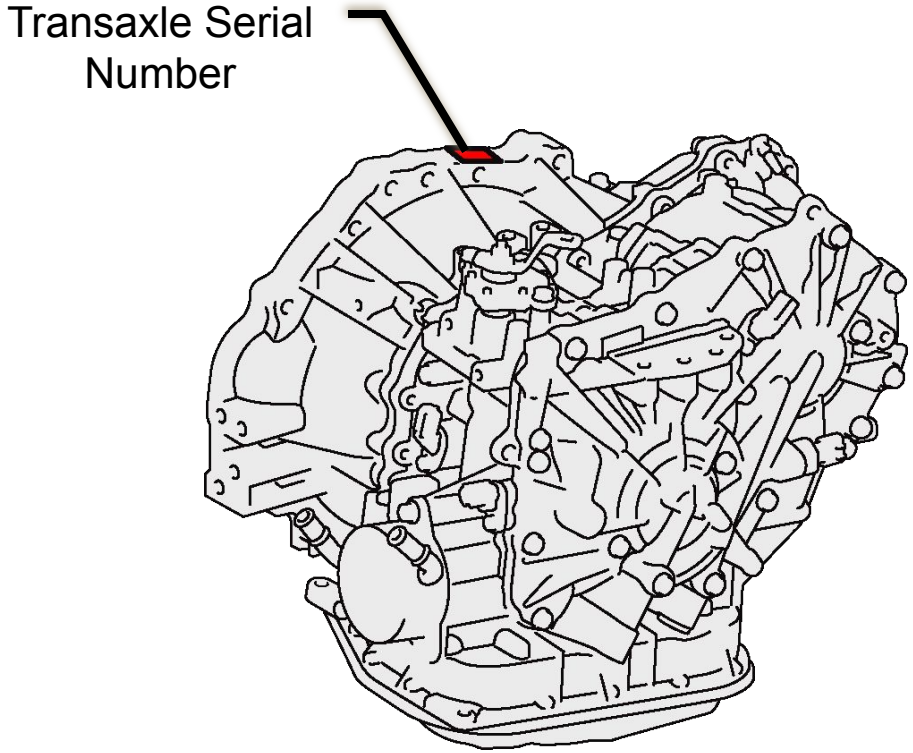
TOYOTA

Today Tomorrow Toyota

K111 CVT

Identification Information

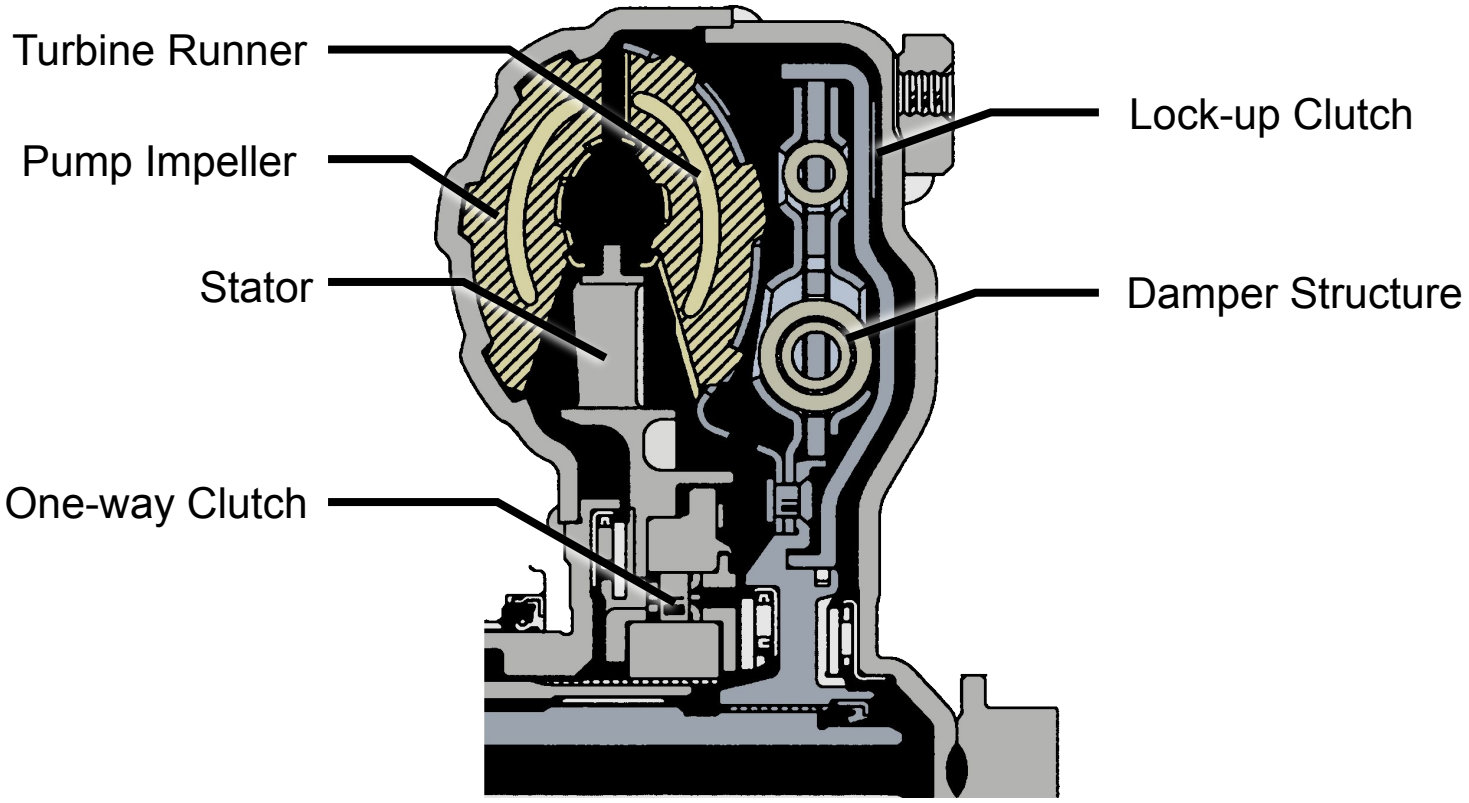
– The transaxle serial number is stamped on the case as shown in the illustration



K111 CVT

Torque Converter with Lock-up Clutch

– Damper structure allowing lock-up from low speed range



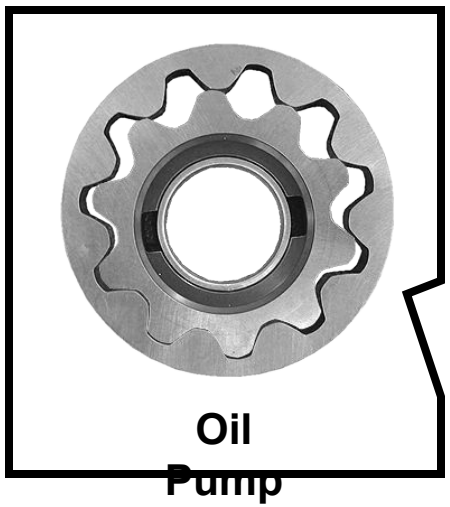
TOYOTA

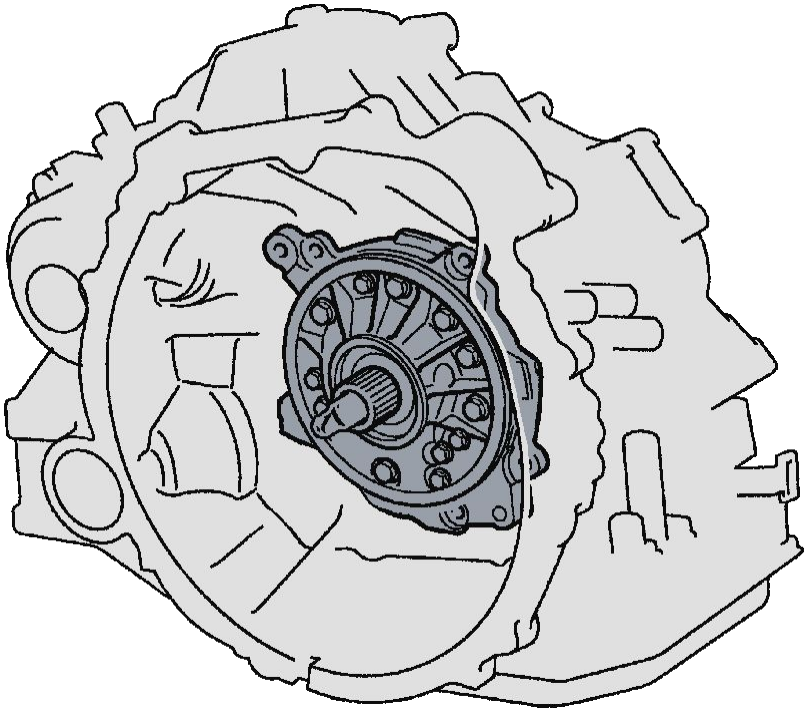
Today
Tomorrow
Toyota

K111 CVT

Oil Pump

– The oil pump is combined with the torque converter, lubricates the parts and supplies operating pressure to the hydraulic control

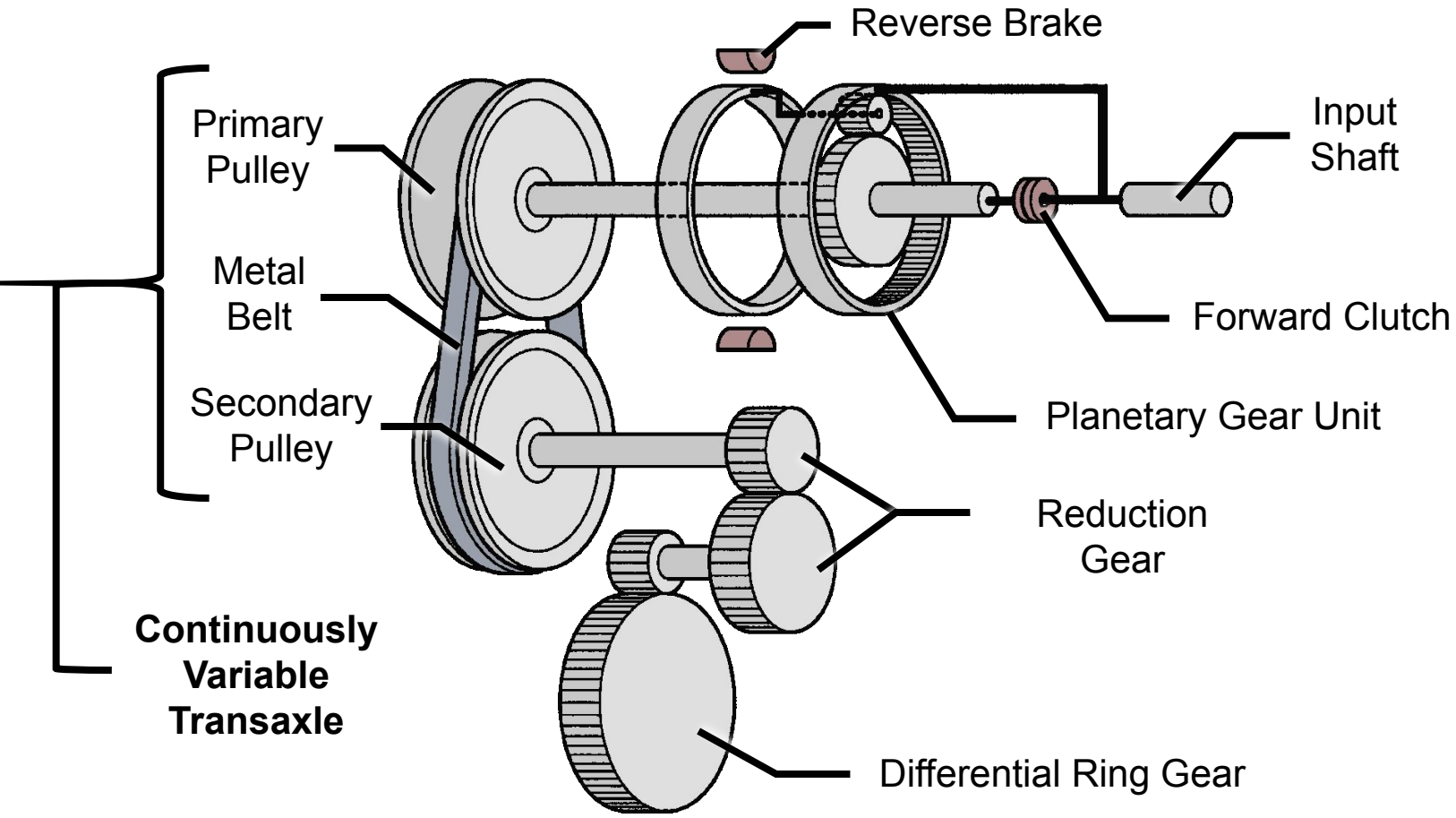




K111 CVT

Gear Train

– Consists of a planetary gear, continuously variable transaxle, reduction gear and differential gear

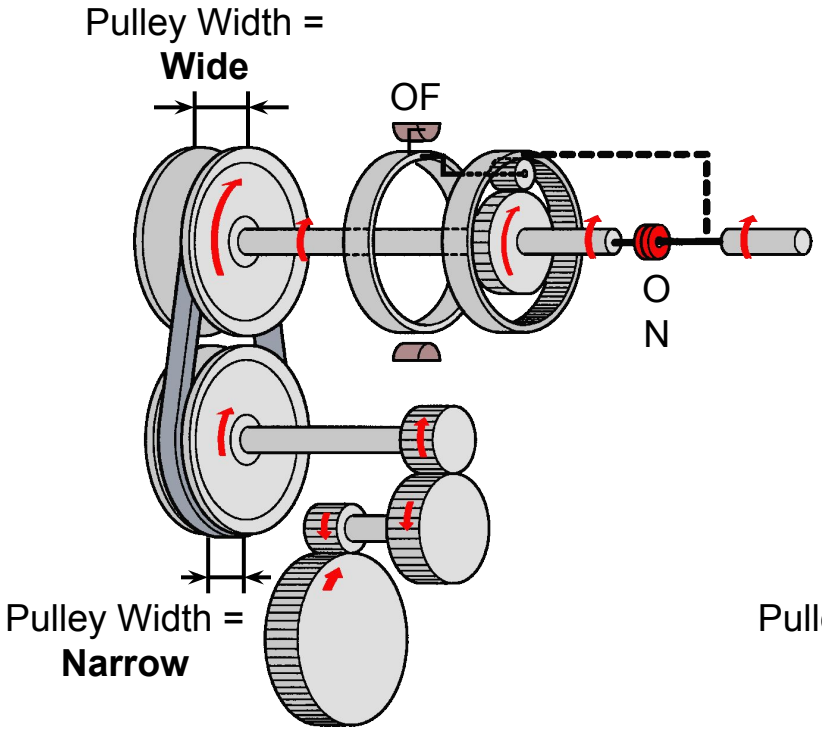


K111 CVT

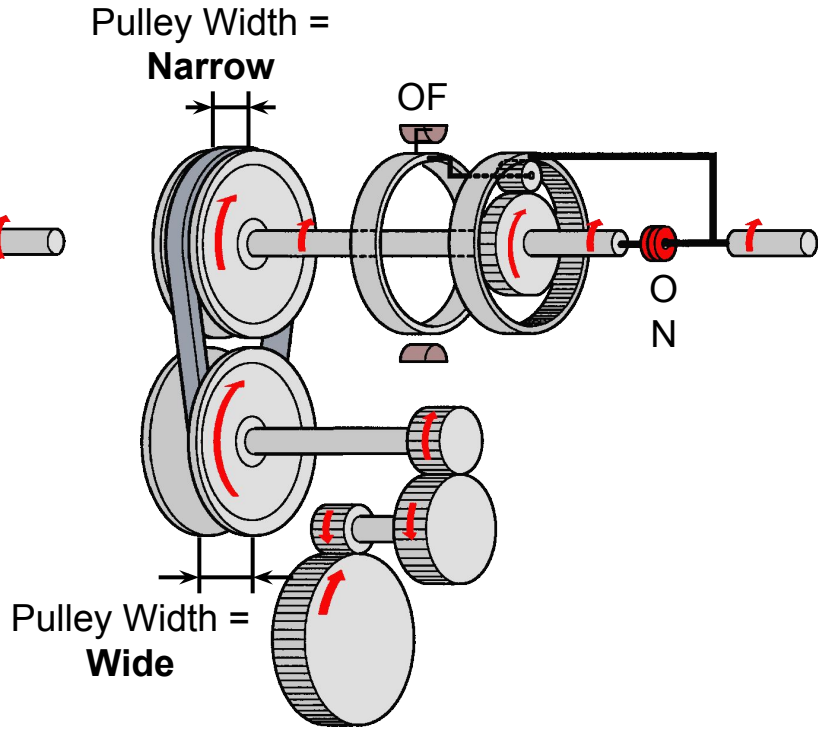
Gear Train

– Operation (D Position)

D position
(Lowest Ratio)



D position
(Highest Ratio)

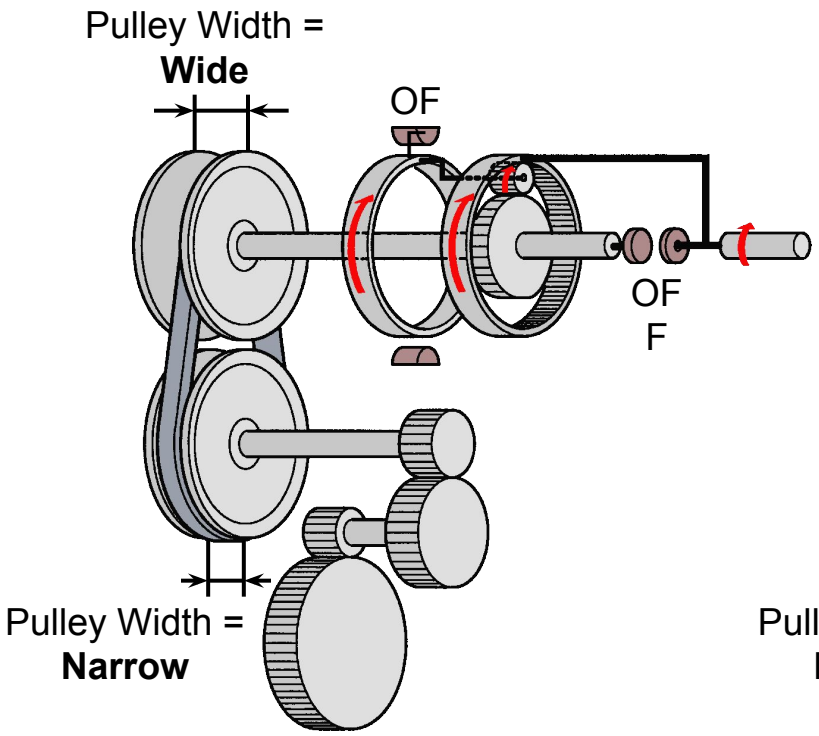


K111 CVT

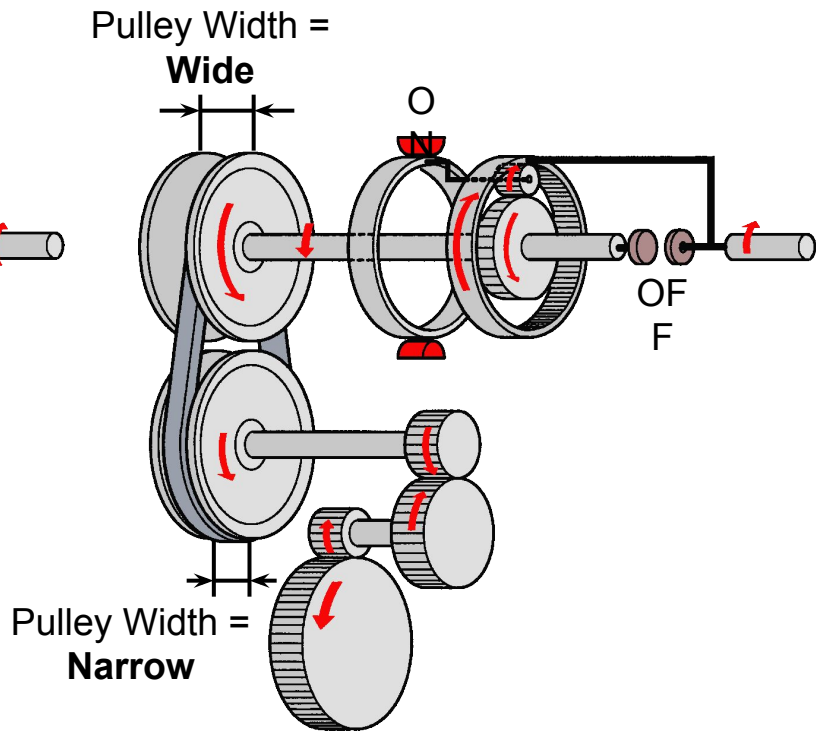
Gear Train

– Operation (N and R Position)

N position



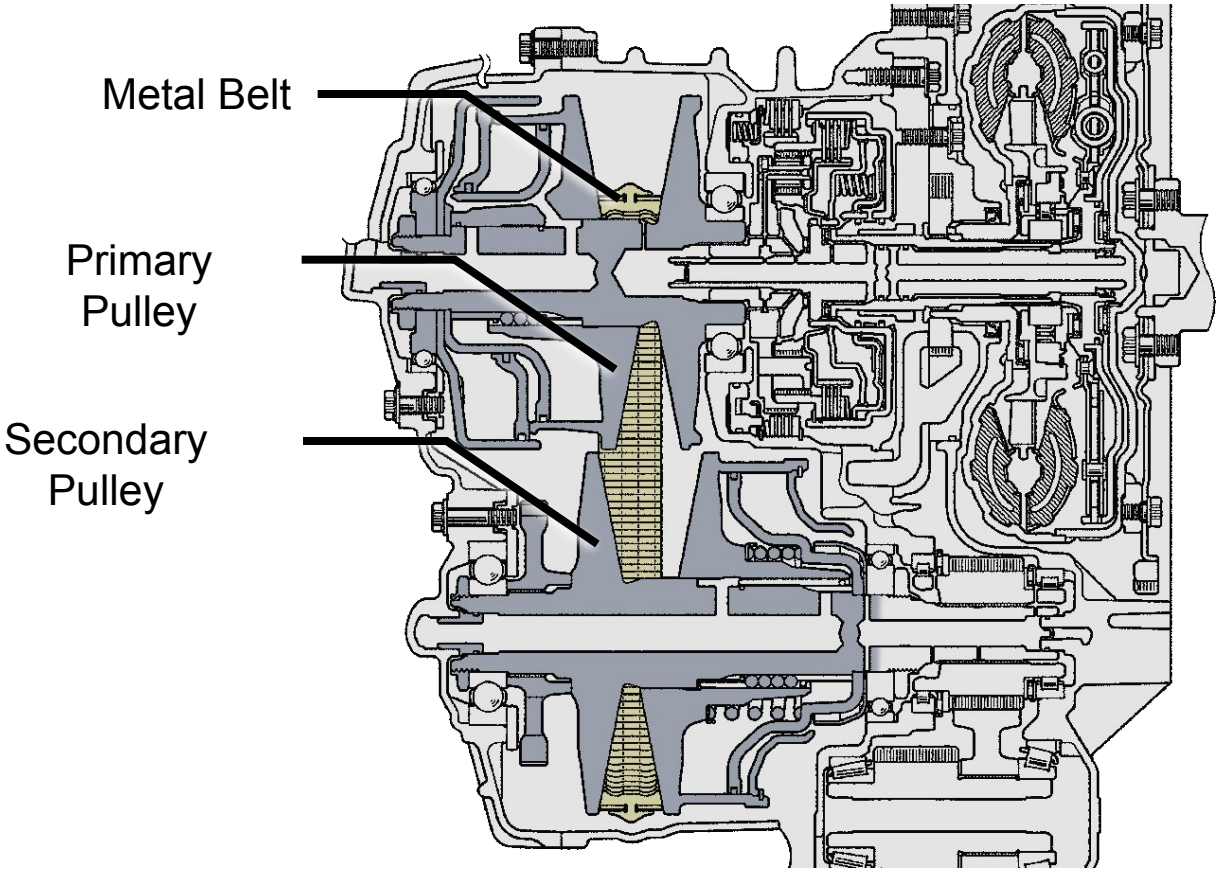
R position



K111 CVT

Continuously Variable Transaxle and Metal Belt

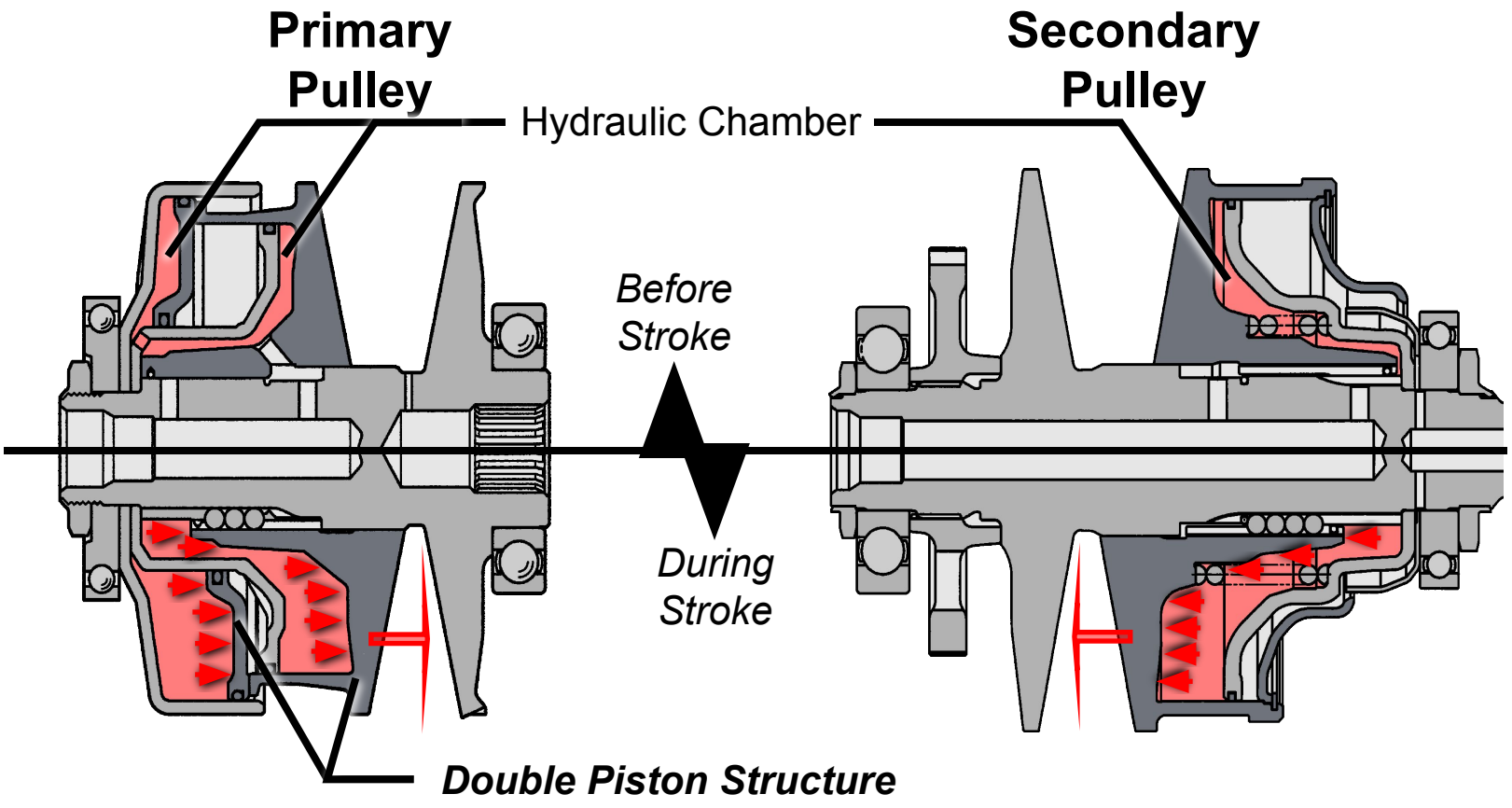
– Performs speed ratio control by varying the pulley width with piston operation of the primary and secondary pulleys



K111 CVT

Continuously Variable Transaxle and Metal Belt

– The primary pulley uses double piston construction to reduce the diameter of hydraulic chamber



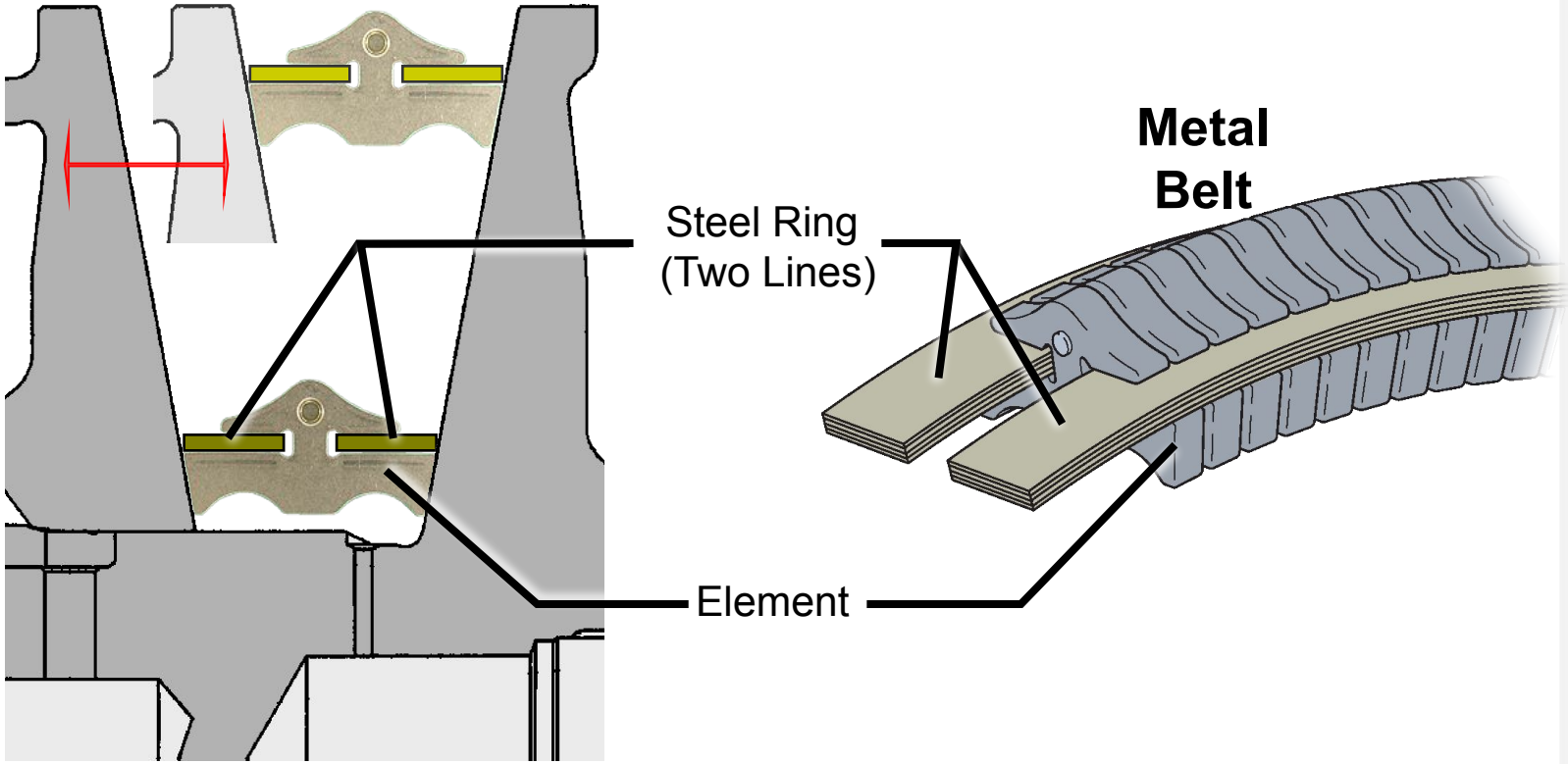
TOYOTA

Today Tomorrow Toyota

K111 CVT

Continuously Variable Transaxle and Metal Belt

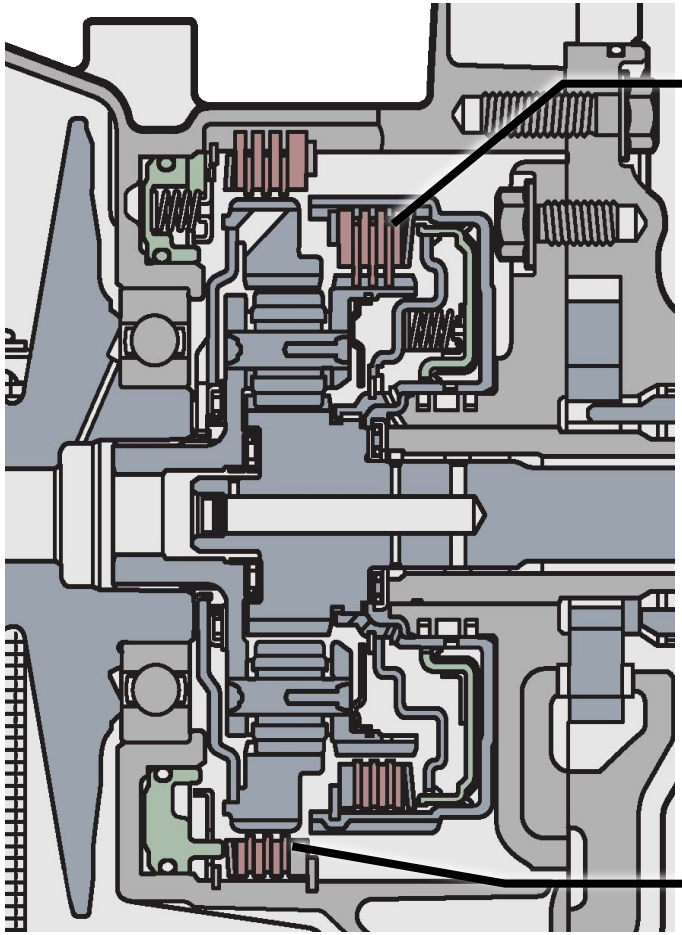
– The metal belt allows power transmission with the compressive effect of element (element extrusion)

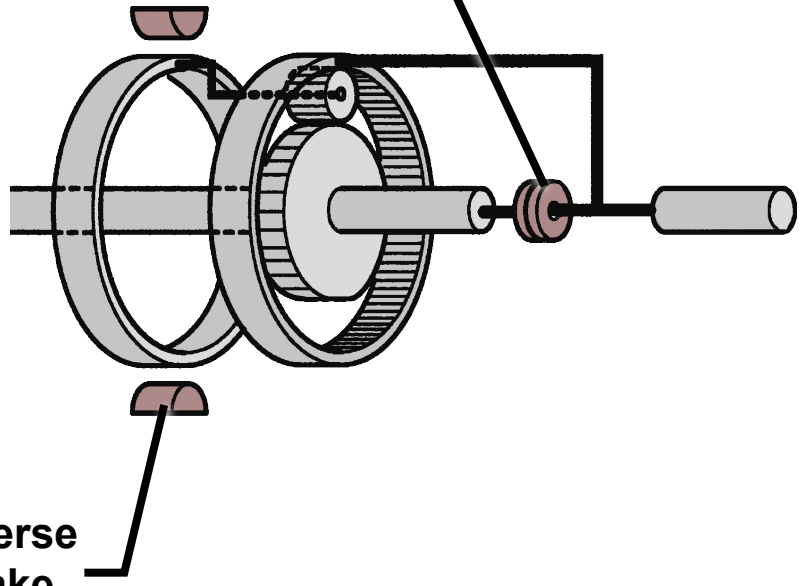


K111 CVT

Forward and Reverse Drive Shift Mechanism

– A single pinion type planetary gear is used



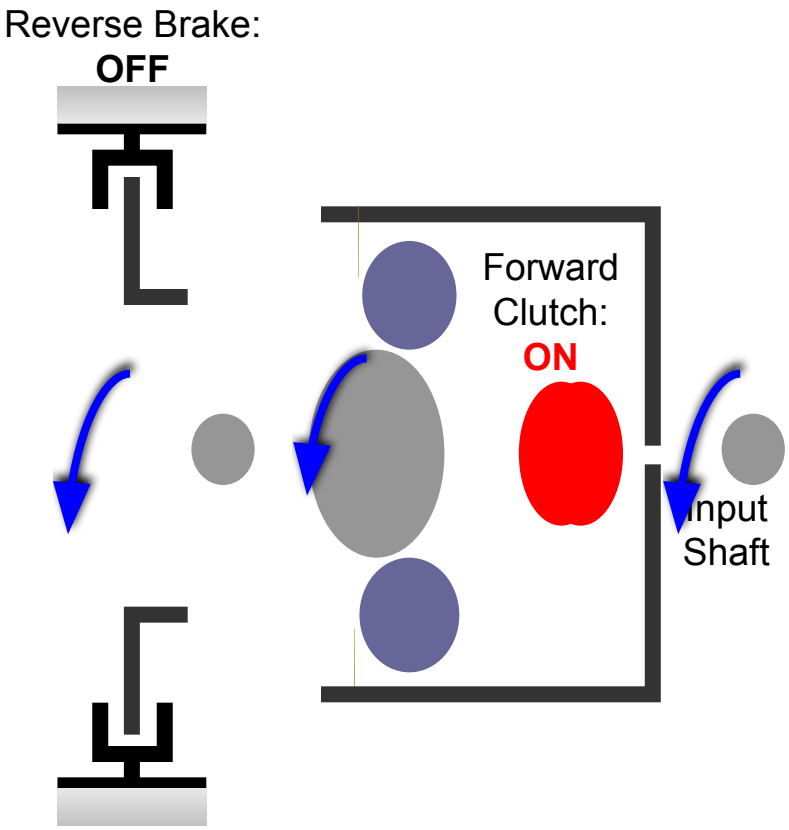


K111 CVT

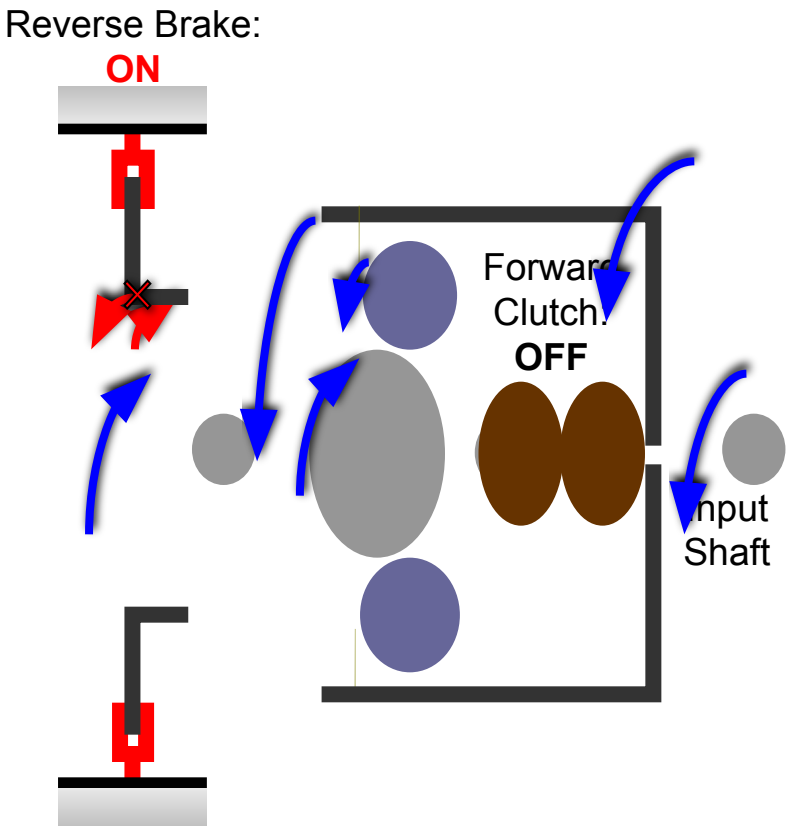
Forward and Reverse Drive Shift Mechanism

– Operation

[During Forward Driving]



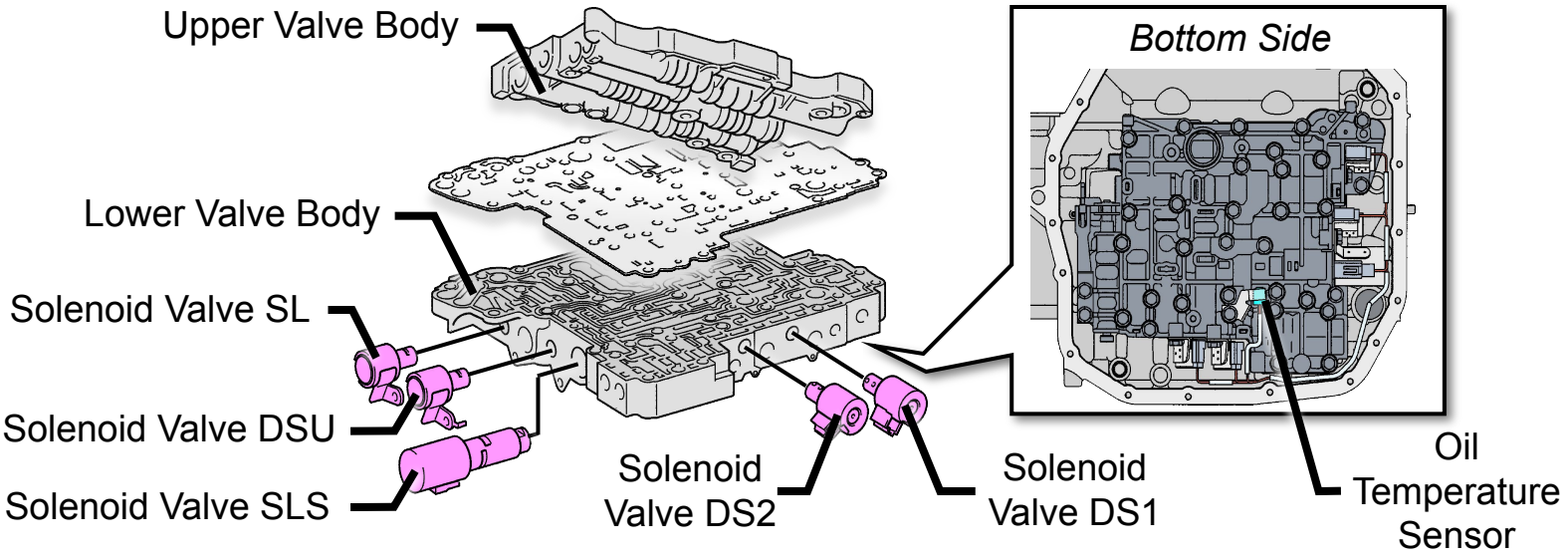
[During Reverse Driving]



K111 CVT

Valve Body Unit

– Consists of the upper and lower valve bodies, 5 solenoid valves and oil temperature sensor

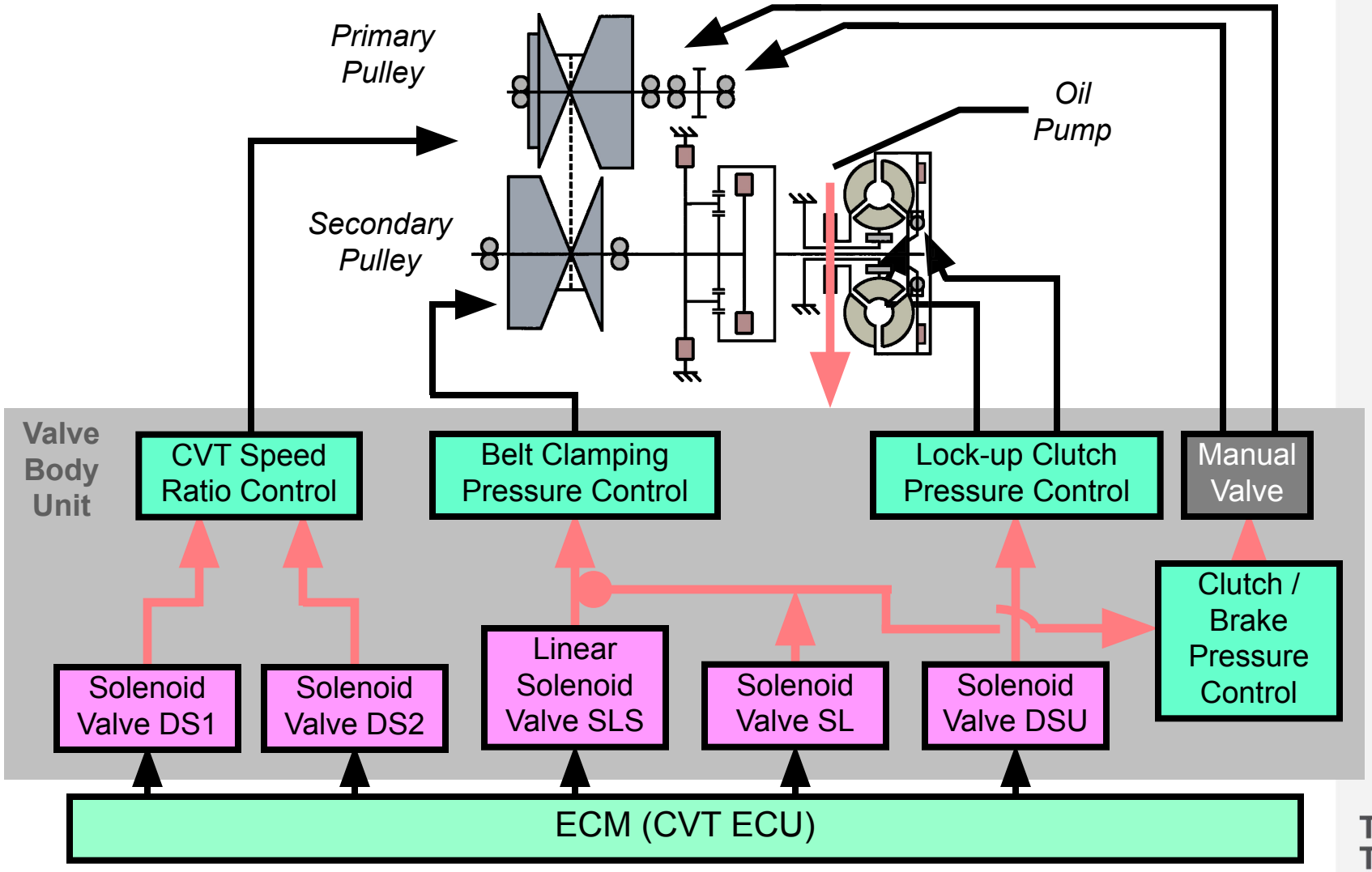


Solenoid Valve	Type	Function
DS1	**Duty**	**Controls the amount of fluid flowing into the primary pulley (shift up control)**
DS2		**Controls the amount of fluid flowing from the primary pulley (shift down control)**
SL	**ON / OFF**	**Switches the function of SLS solenoid**
DSU	**Duty**	**Controls the lock-up clutch hydraulic pressure**
SLS	**Liner**	**•Controls the secondary pulley pressure •Controls the clutch / brake pressure**

Reference (K111 CVT)

Valve Body Unit

– Hydraulic control block diagram

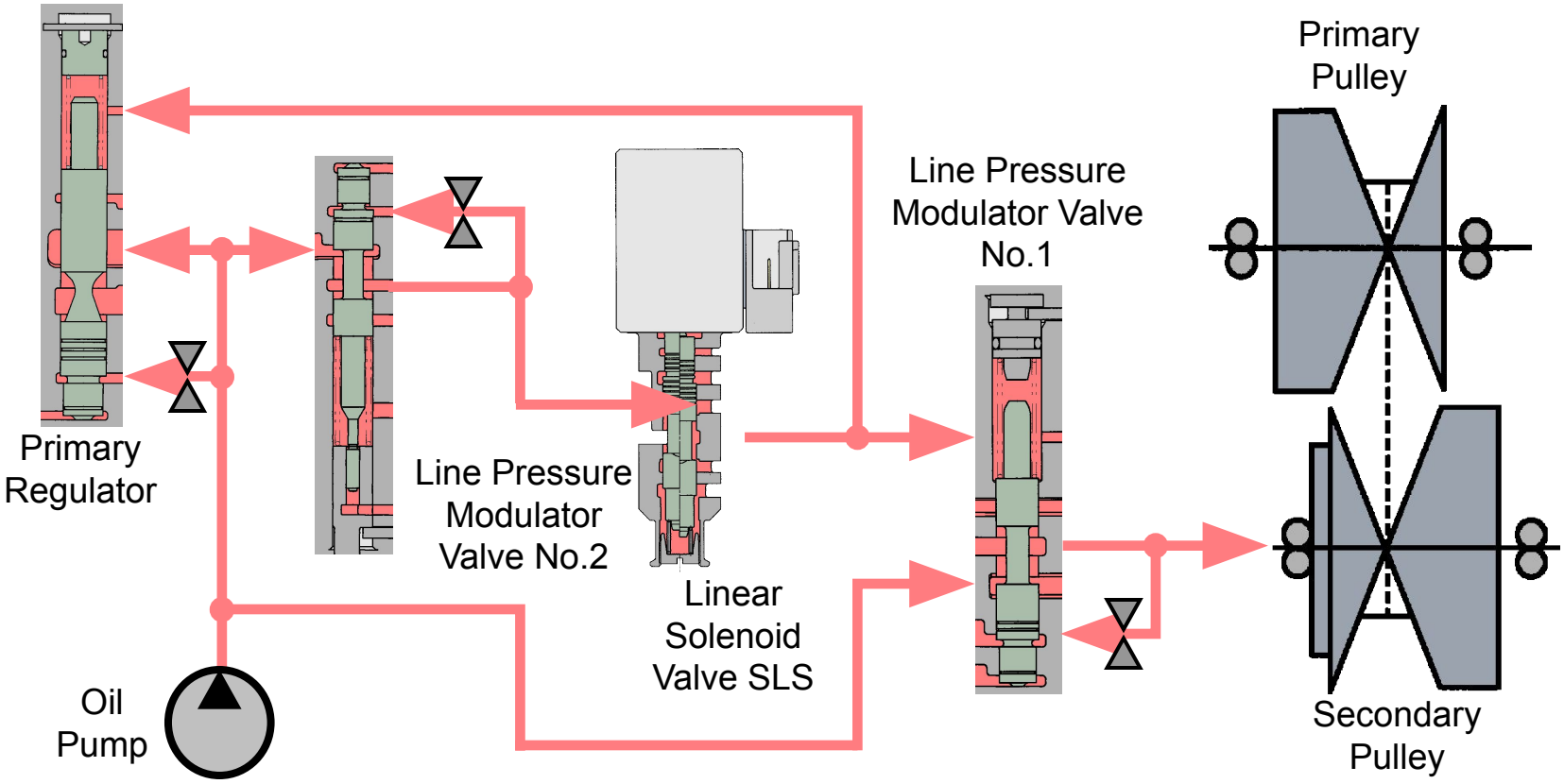


K111 CVT

Valve Body Unit

– Belt Clamping Pressure Control Mechanism

— Belt clamping pressure is controlled by regulating the secondary pulley pressure

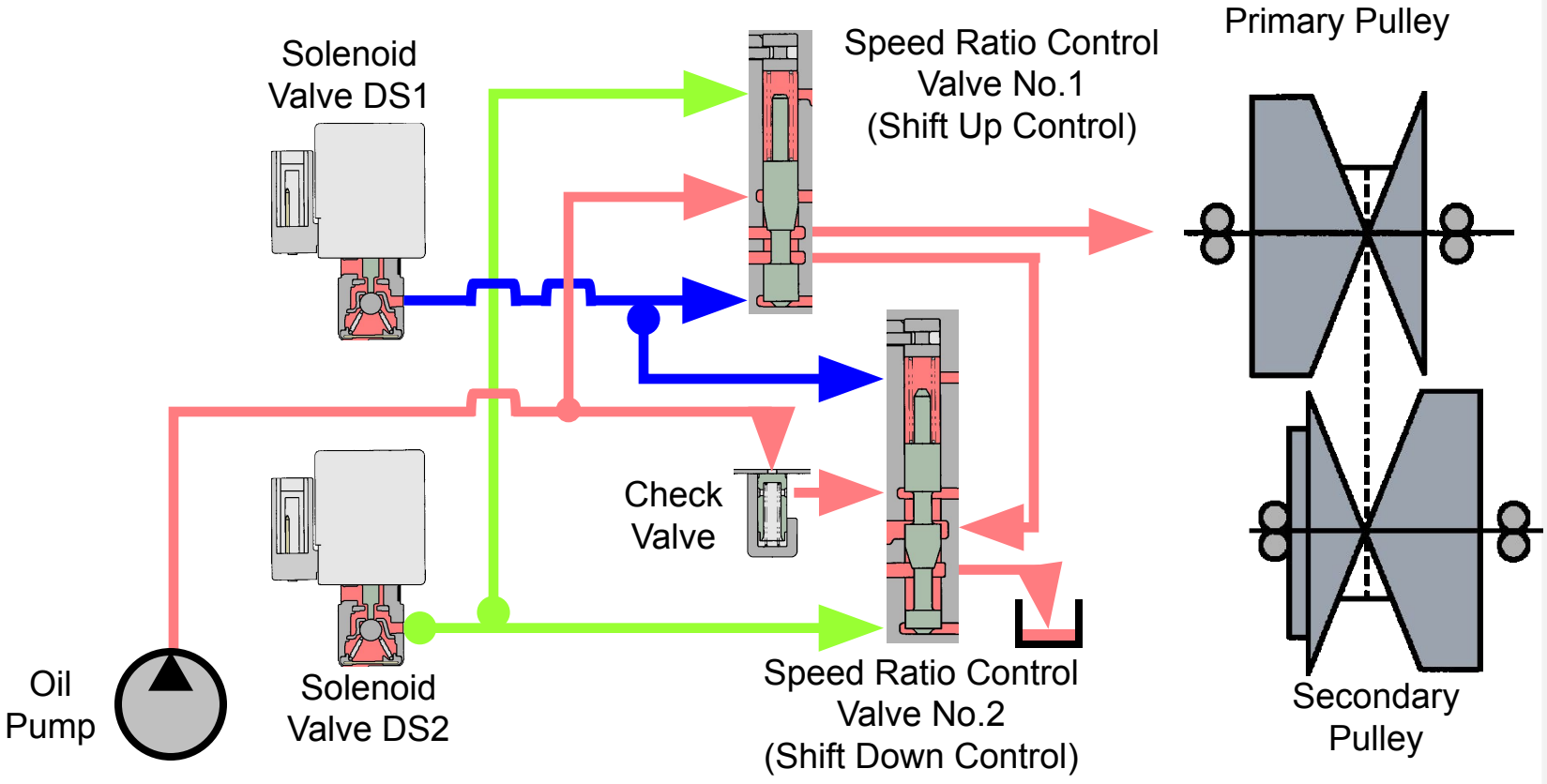


K111 CVT

Valve Body Unit

– Speed Ratio Control Mechanism

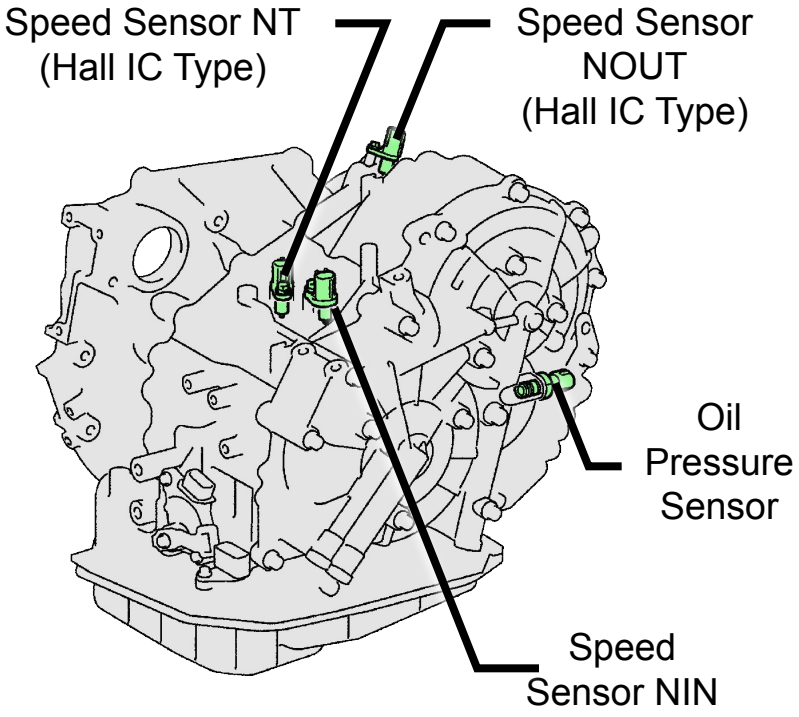
— Speed ratio control is performed by controlling fluid flowing into and from the primary pulley

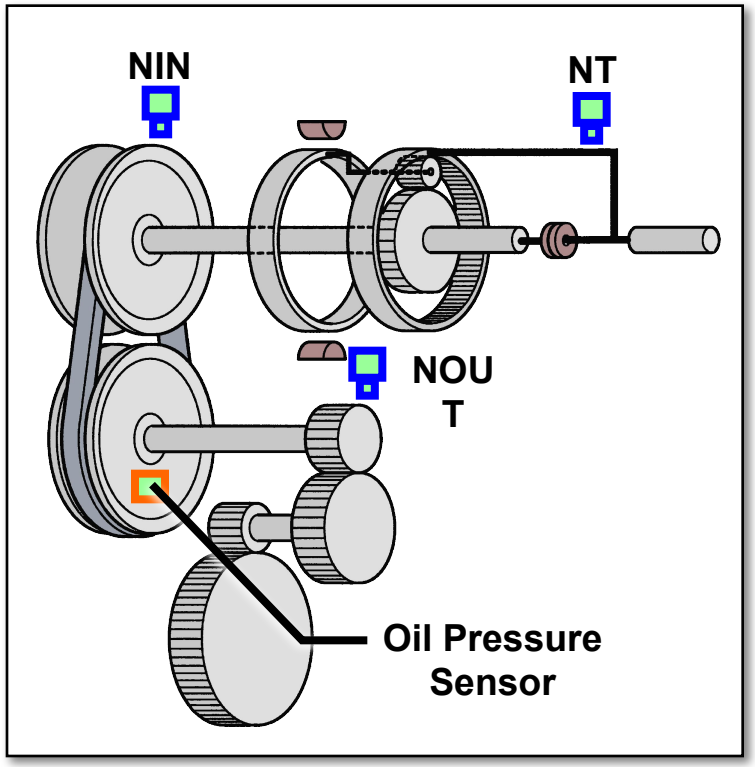


K111 CVT

Speed Sensor and Pressure Sensor

– 3 speed sensors and 1 pressure sensor are used

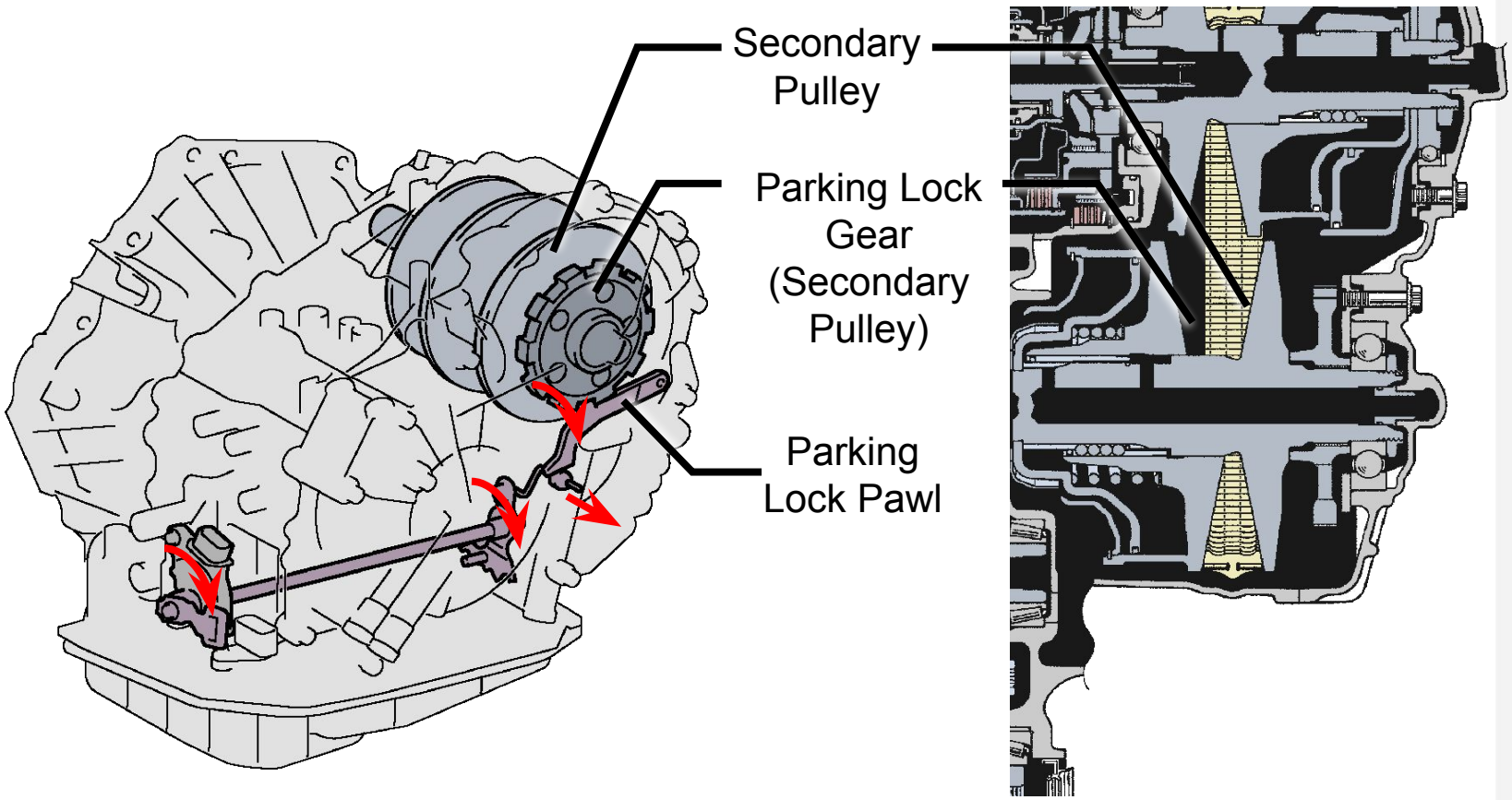




K111 CVT

Parking Lock Mechanism

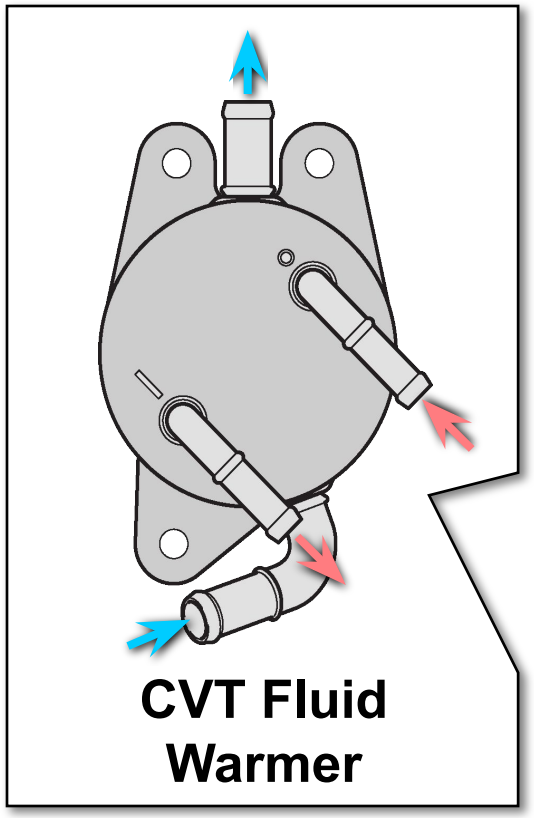
– The parking lock mechanism locks the rotation of the secondary pulley

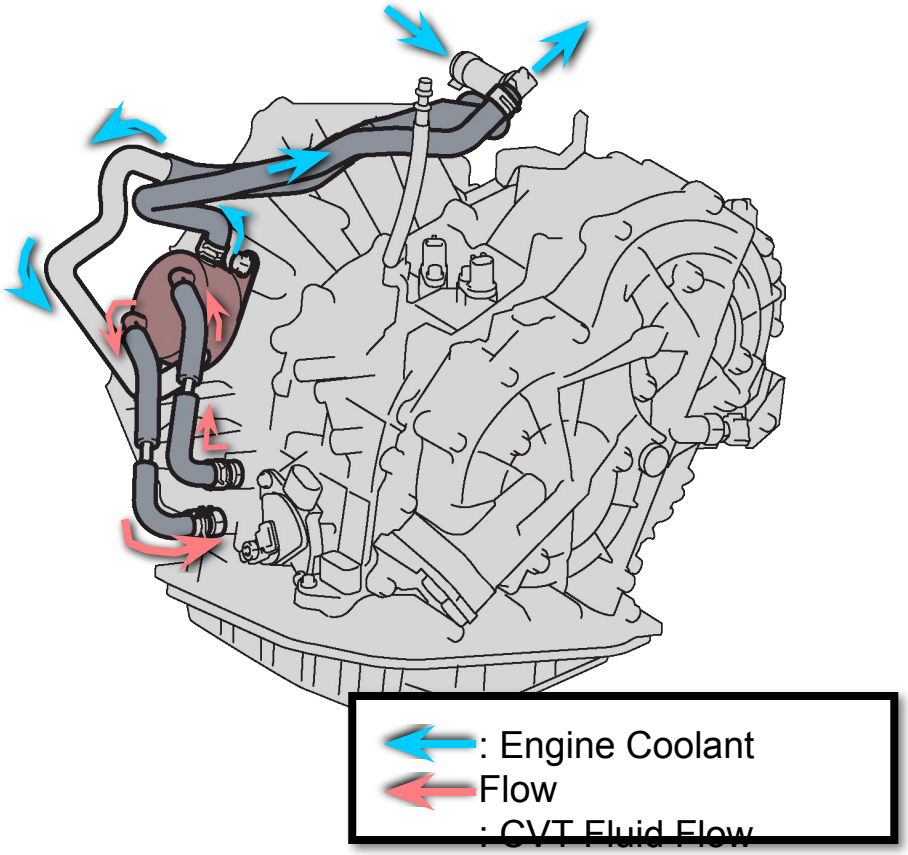


K111 CVT

CVT Fluid Warmer

– Function as fluid warmer after engine start
– Function as fluid cooler during driving



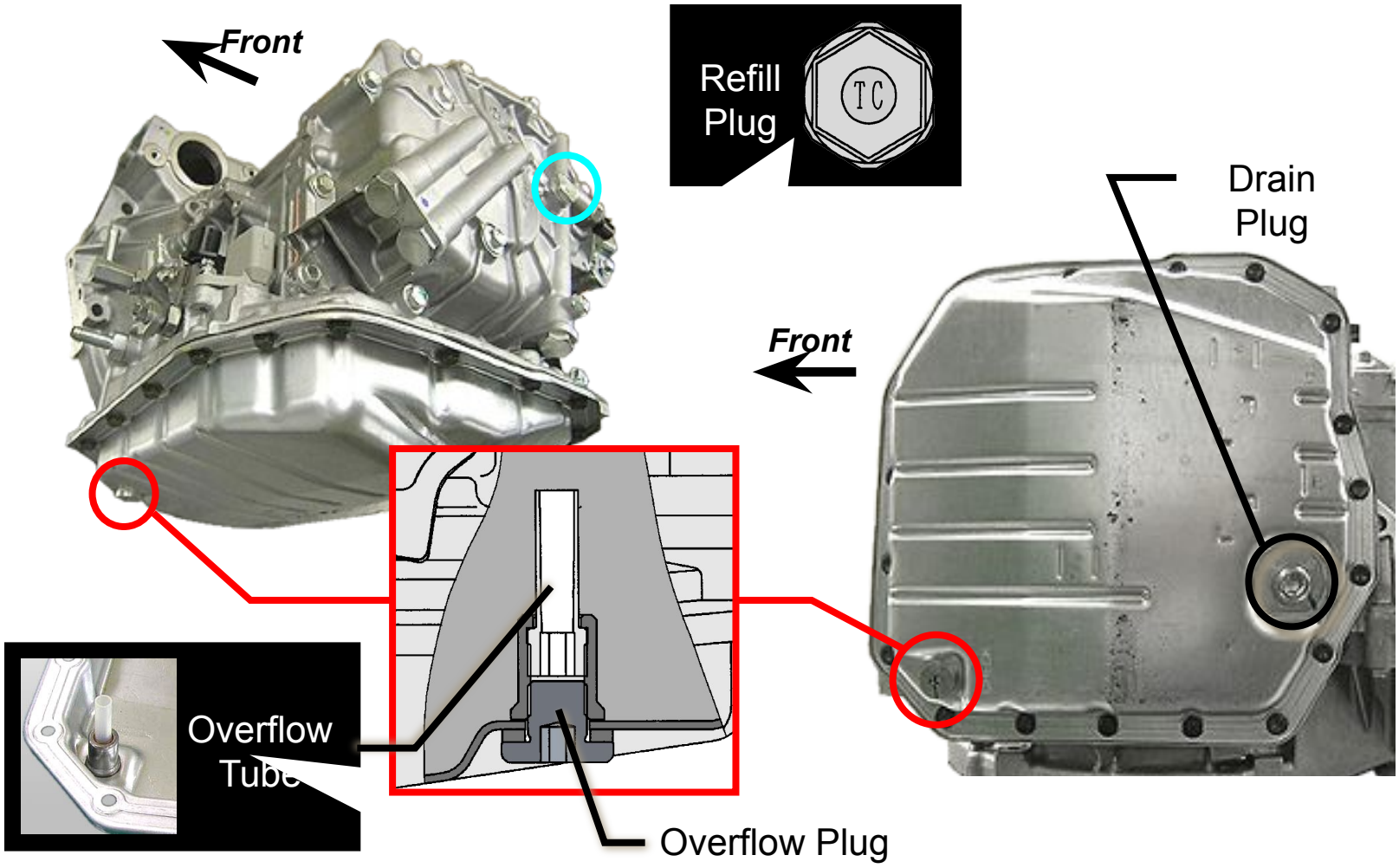


K111 CVT

CVT Fluid

– Use the Toyota Genuine CVT fluid TC

– Overflow type fluid level detection mechanism is used



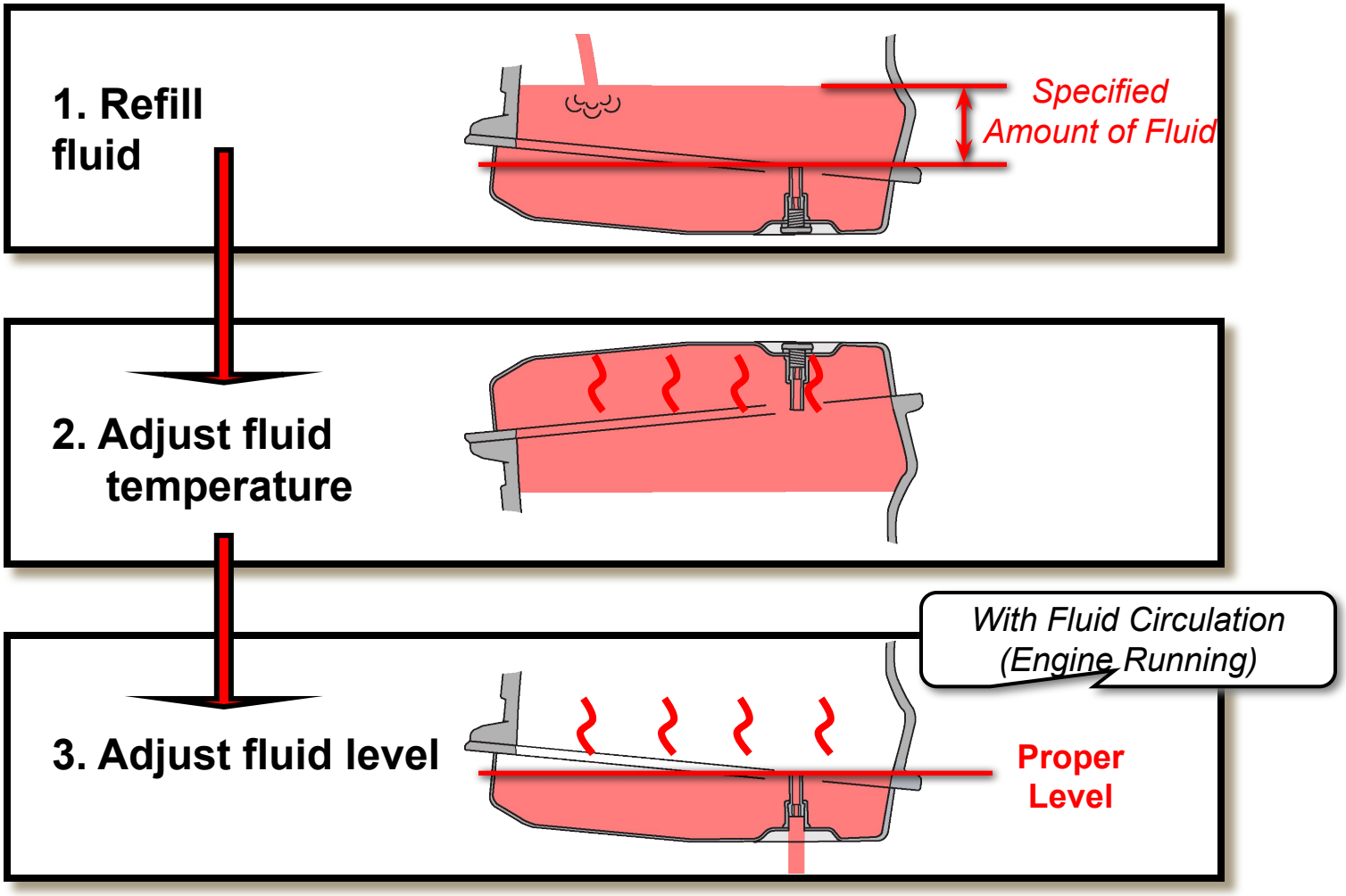
TOYOTA

Today Tomorrow Toyota

Service Point (K111 CVT)

CVT Fluid Adjustment

– Outline of fluid adjustment procedure

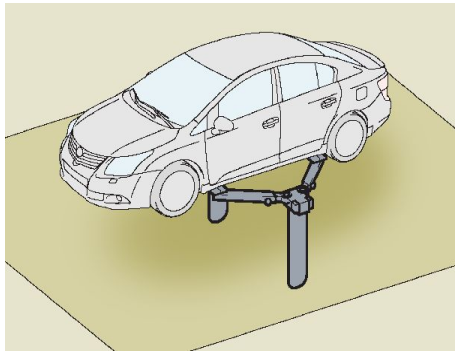


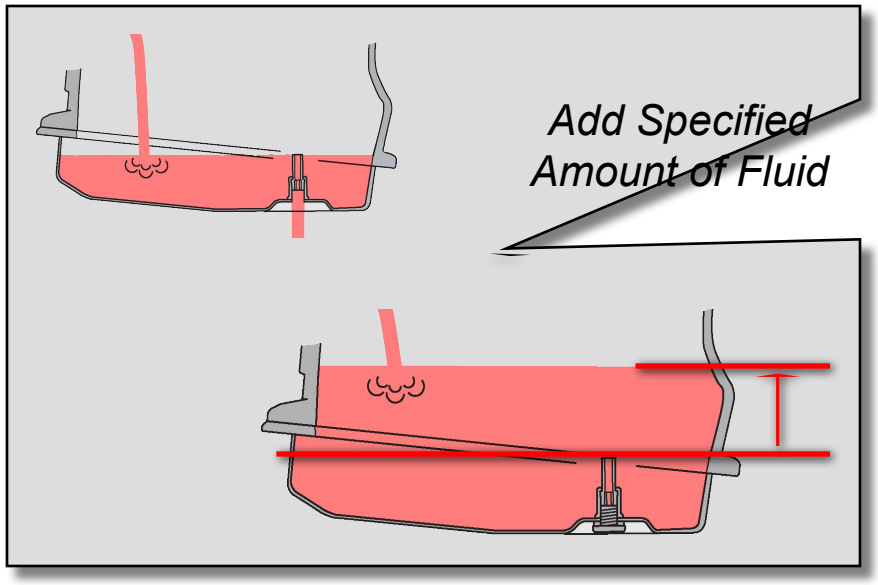
Service Point (K111 CVT)

CVT Fluid Adjustment Procedure

1. Refill fluid

1. Lift the vehicle
2. Remove the refill plug and the overflow plug
3. Tighten the overflow tube to the specified torque
4. Fill up fluid from the refill hole until overflowing from the overflow tube
5. Install the overflow plug
6. Add specified amount* of fluid from the refill hole
7. Install the refill plug
8. Lower the vehicle





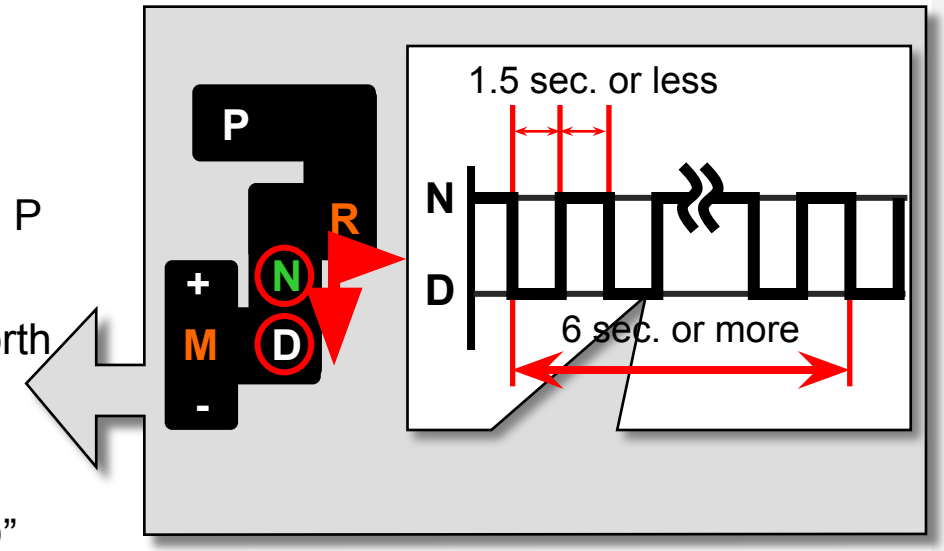
*: Refill amount differs depending on the operation that was performed

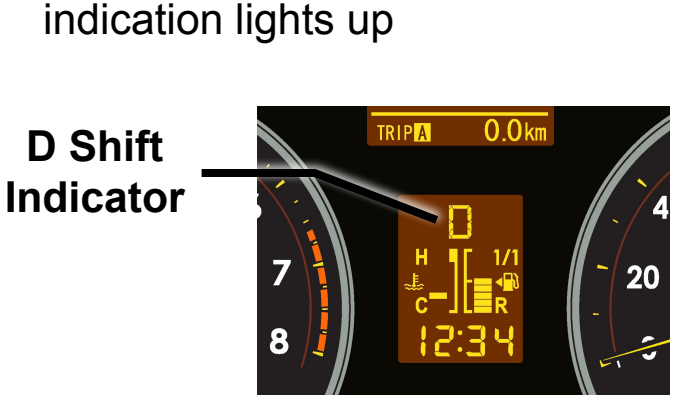
Service Point (K111 CVT)

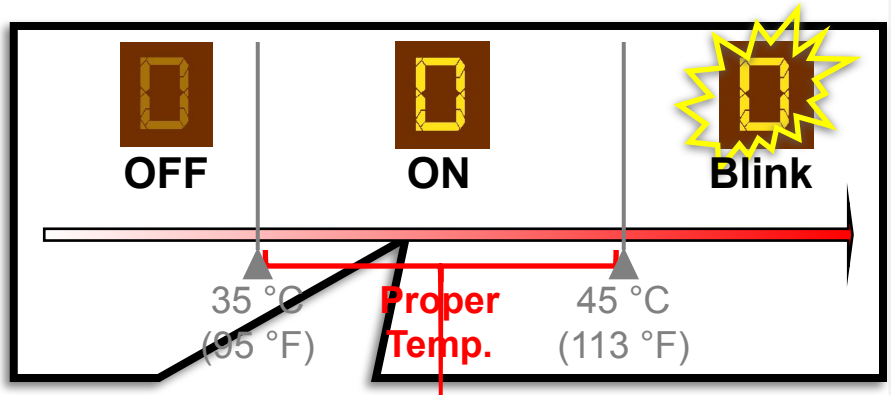
CVT Fluid Adjustment Procedure

2. Adjust fluid temperature

1. Connect TC and CG of DLC3
2. Start the engine
3. Slowly move the shift lever from P to D, and then back to P
4. Move the shift lever back and forth between N and D quickly
5. Shift to P and remove the SST
6. Warm-up the engine until the “D” indication lights up





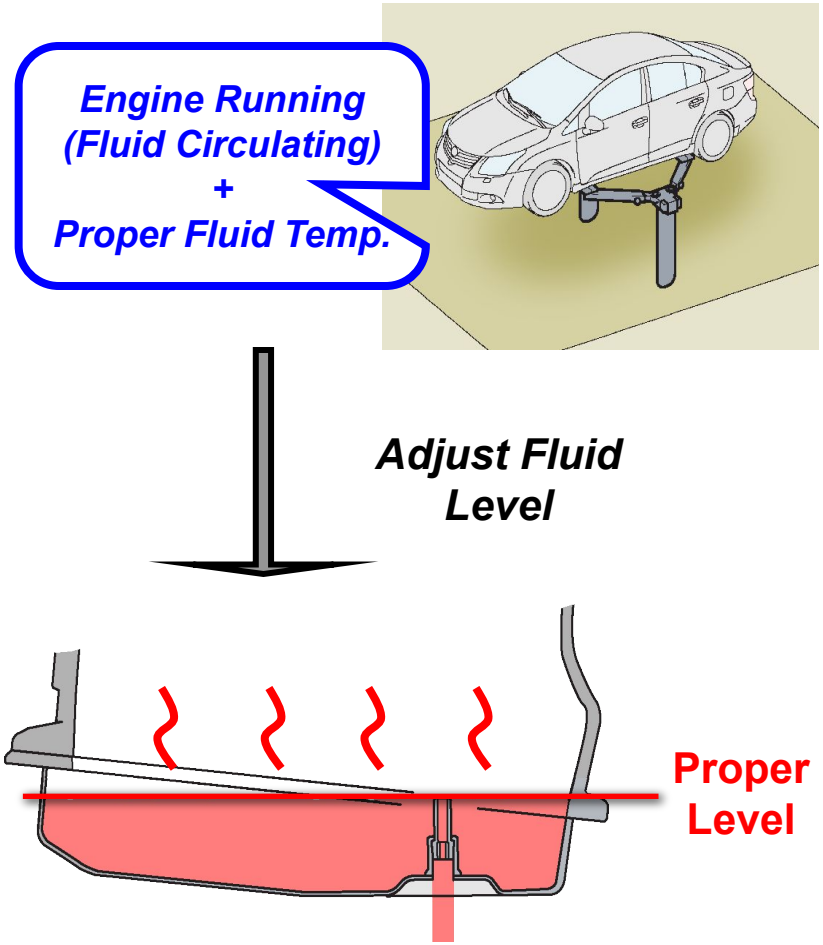


Service Point (K111 CVT)

CVT Fluid Adjustment Procedure

3. Adjust fluid level

1. Lift the vehicle with engine running
2. Remove the overflow plug
   - If fluid overflows, proceed to next step
   - If no fluid overflow, add fluid until it overflows from the overflow plug hole
3. Check that the fluid flow has slowed and only drips come out
4. Install the overflow plug
5. Install the refill plug
6. Lower the vehicle

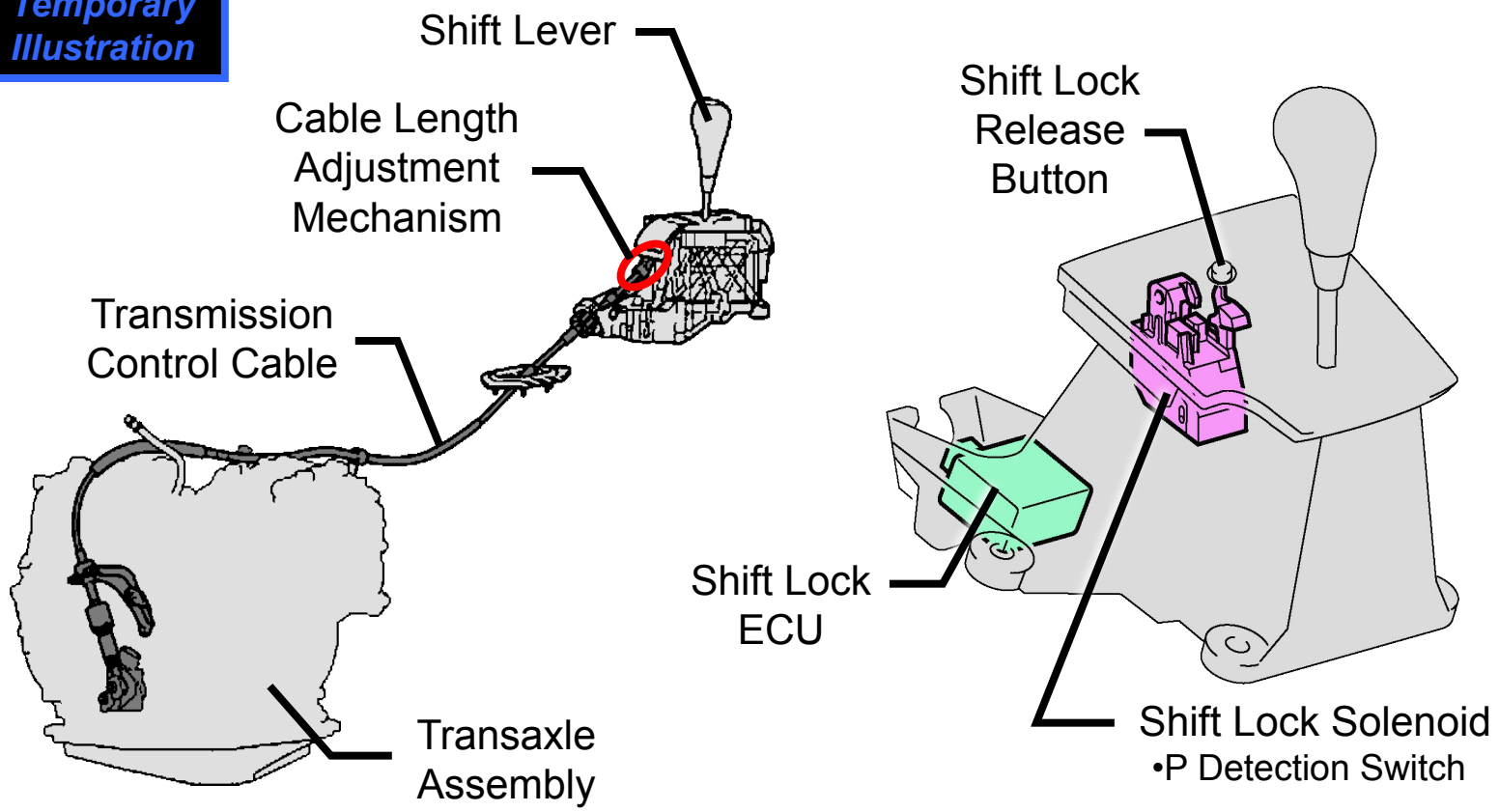


K111 CVT

Shift Lever

– Cable length adjustment mechanism
– Electrical type shift lock system

Temporary Illustration

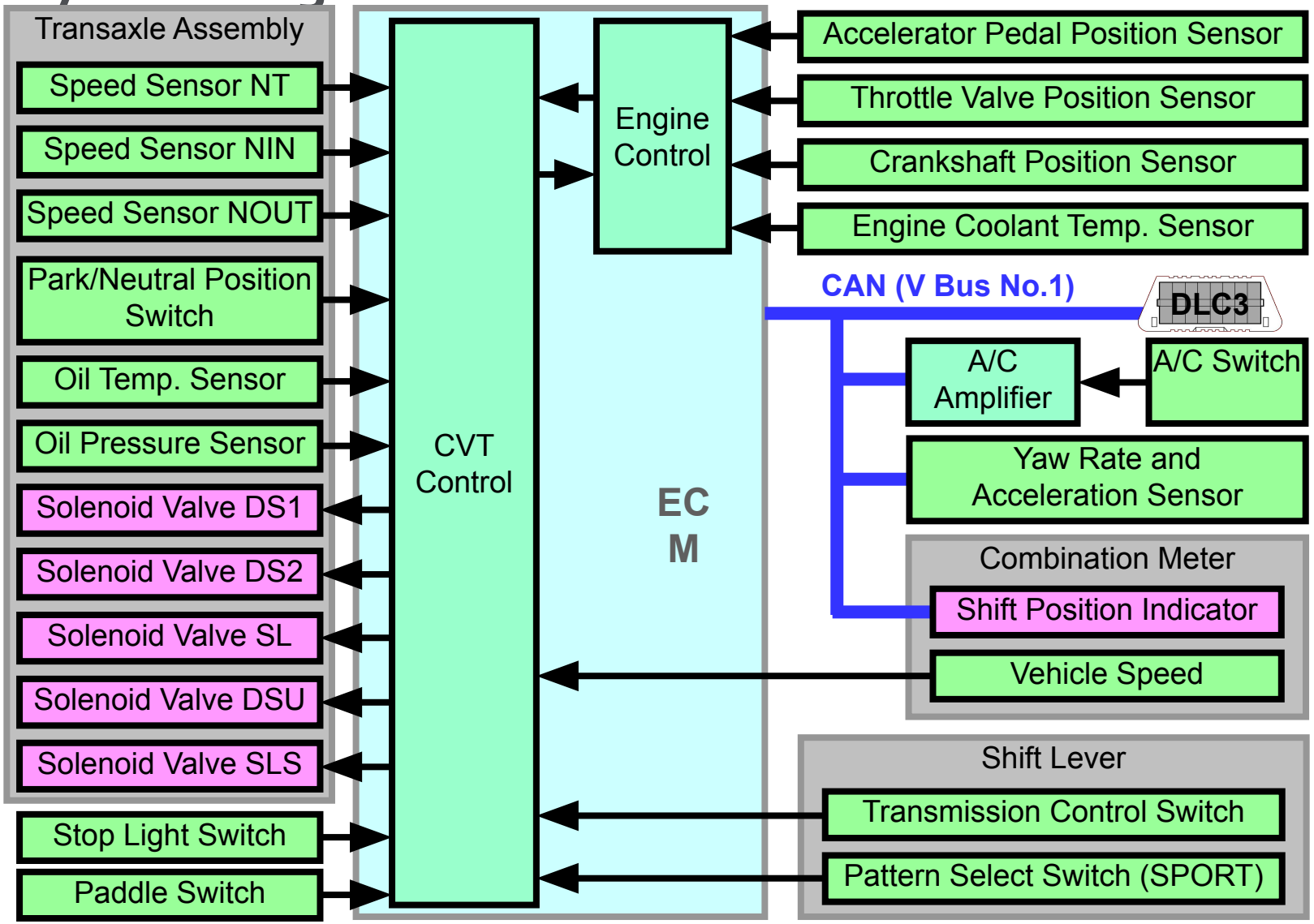


TOYOTA

Today Tomorrow Toyota

K111 CVT

System Diagram



K111 CVT

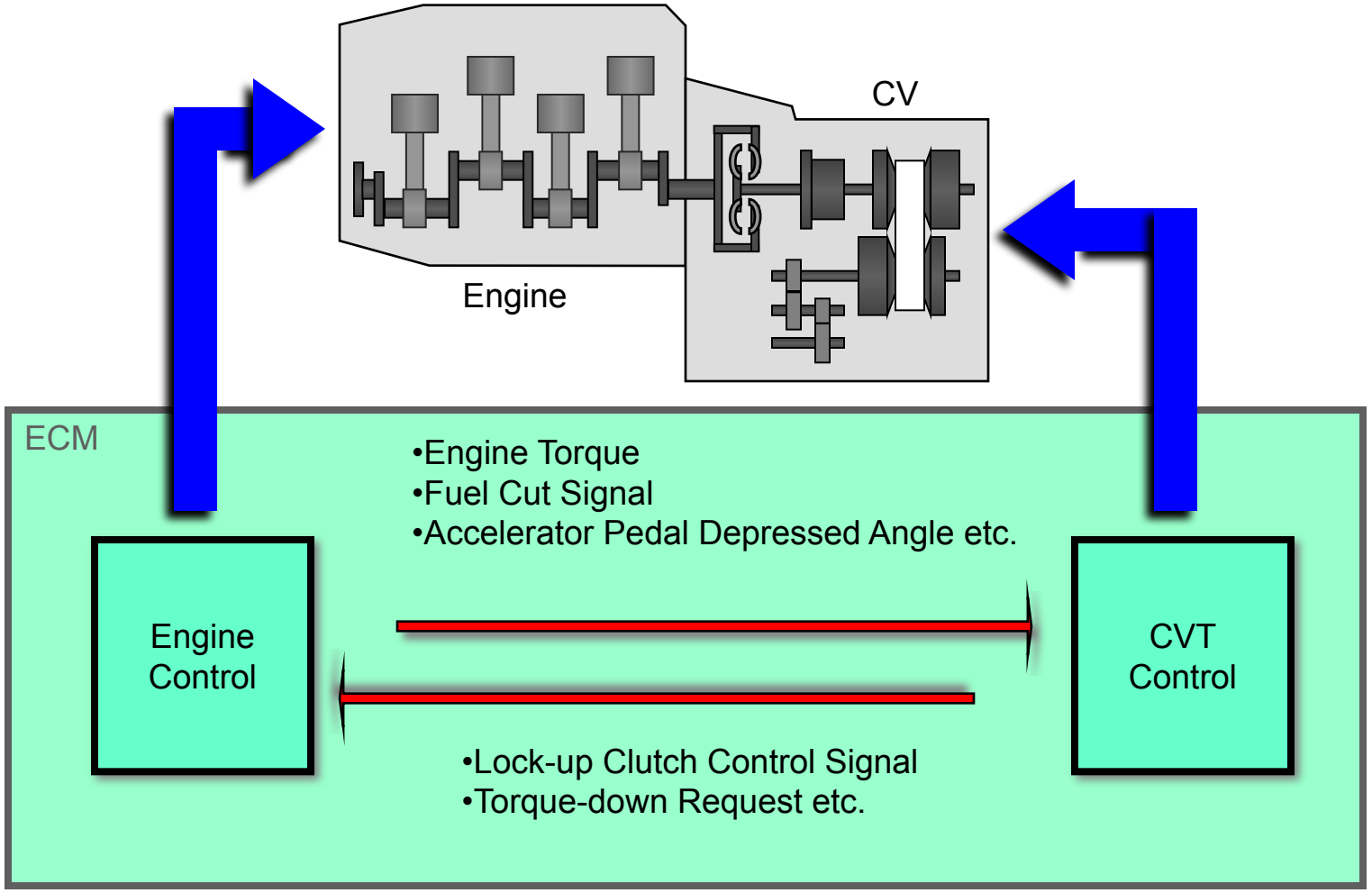
Electronic Control System

Engine-CVT Integrated Control
Neutral Control
Acceleration Improvement Control
(Linear Feeling Improvement Control)
Shifting Control in Uphill/Downhill Traveling
Speed Ratio Control
7-speed Sport Sequential Shiftmatic
Lock-up Clutch Control

K111 CVT

Engine-CVT Integrated Control

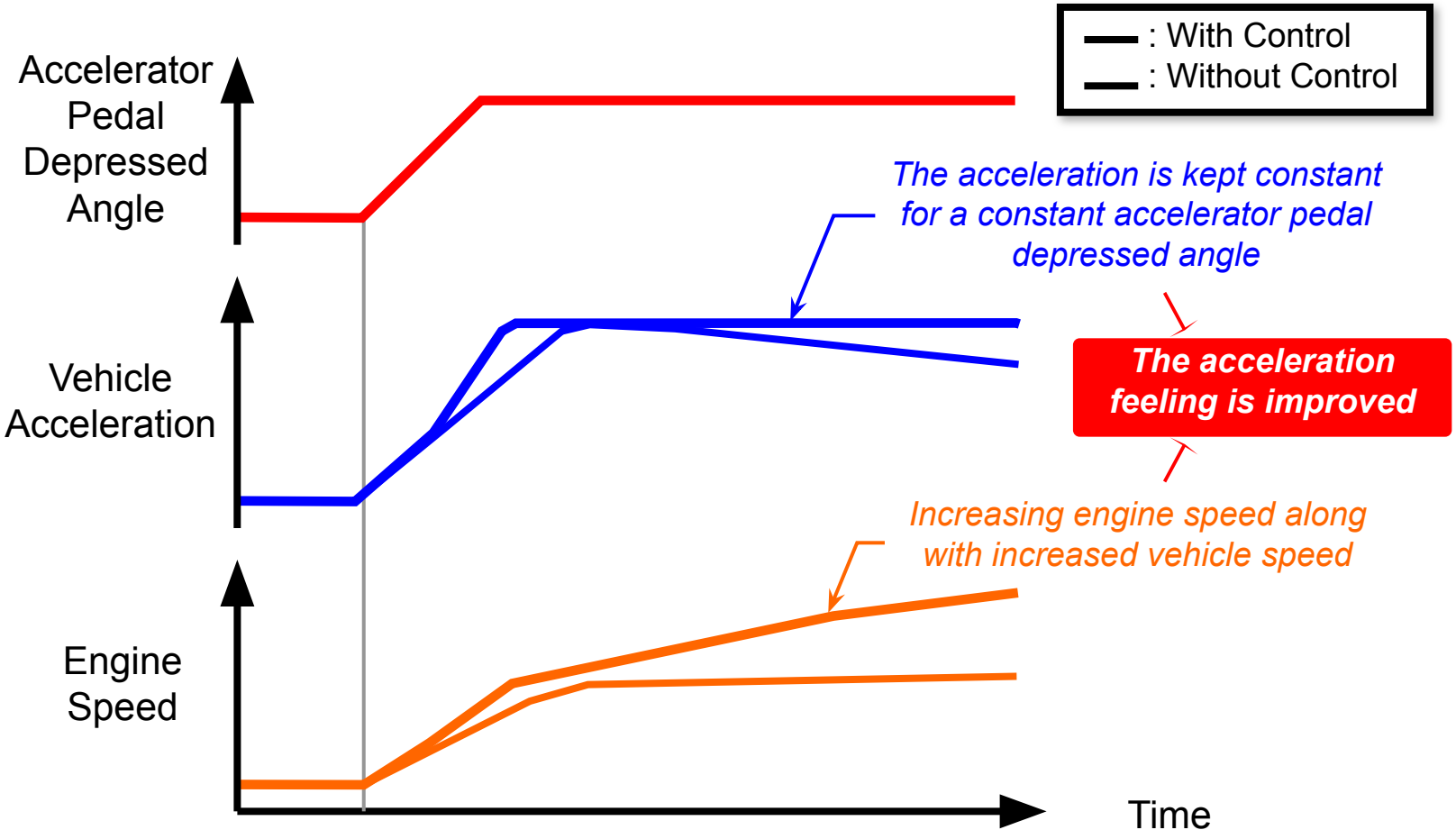
– By communicating various signals, this control realizes smooth, powerful driving and excellent fuel economy



K111 CVT

Acceleration Improvement Control (Linear Feeling Improvement Control)

– This control improves the acceleration feeling for the operation of the accelerator pedal



K111 CVT

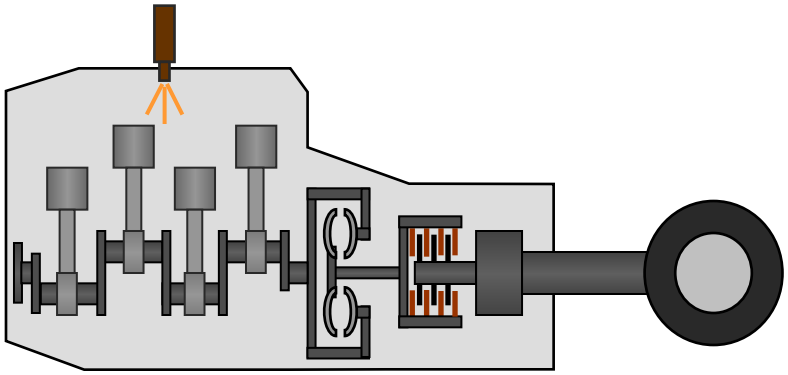
Neutral Control

– When the vehicle is stopped at D position, the clutch is semi-disengaged to reduce engine load

With Control

Injection Volume: **Low**

→ ***Improve fuel economy***

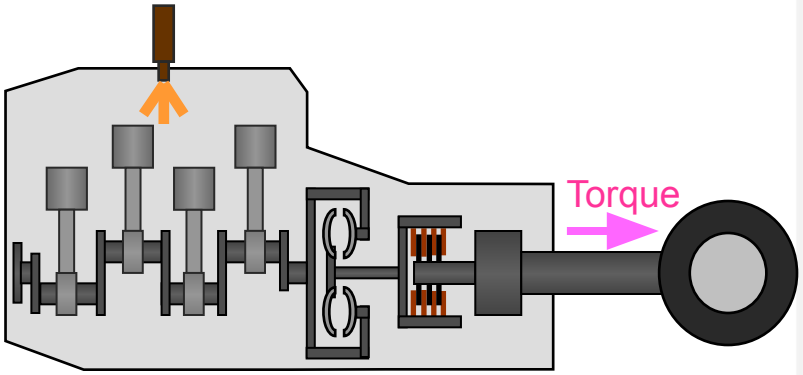


Engine Load: Low

Clutch: **Semi-disengaged**

Without Control

Injection Volume: High



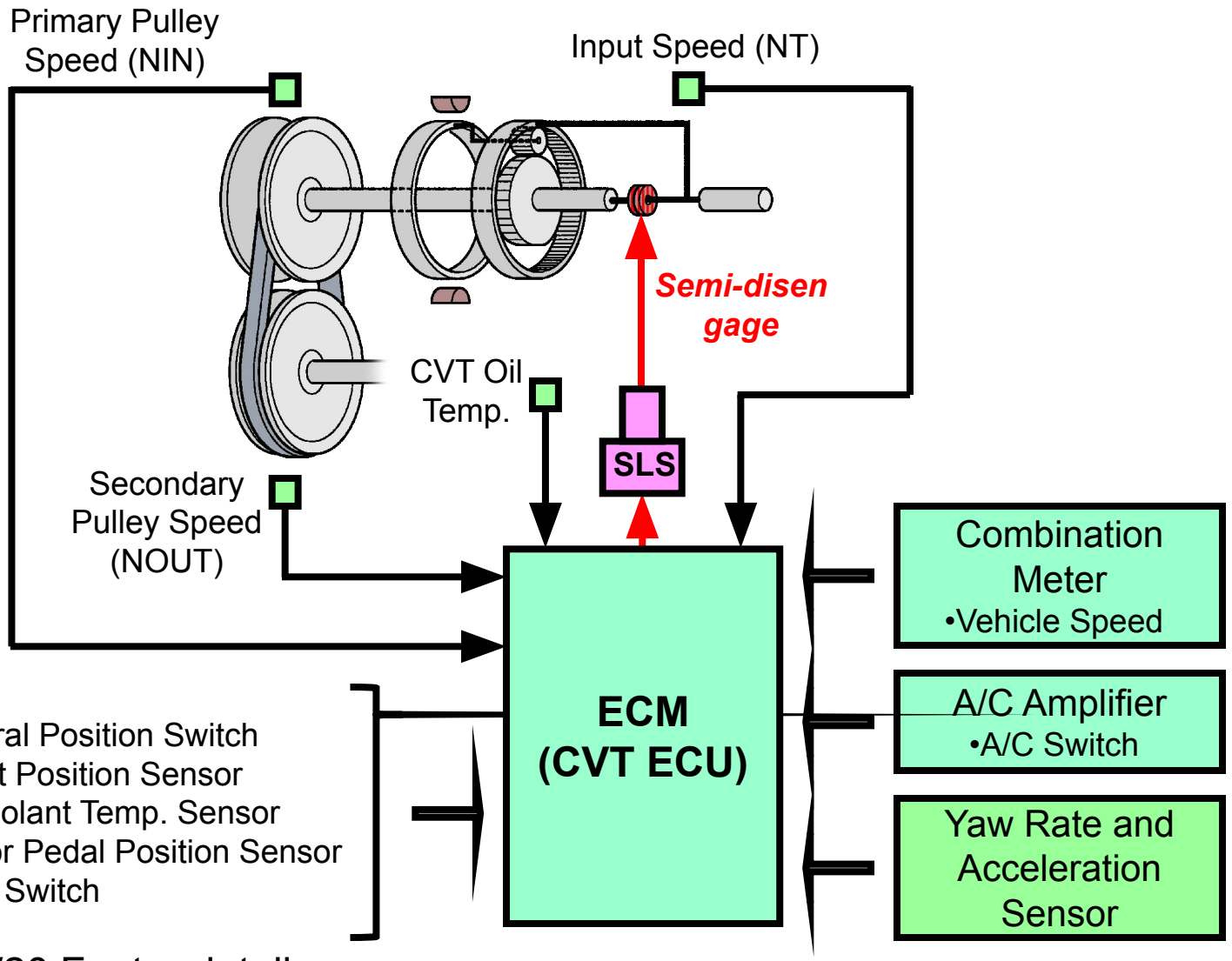
Engine Load: High

Clutch: Engaged

K111 CVT

Neutral Control

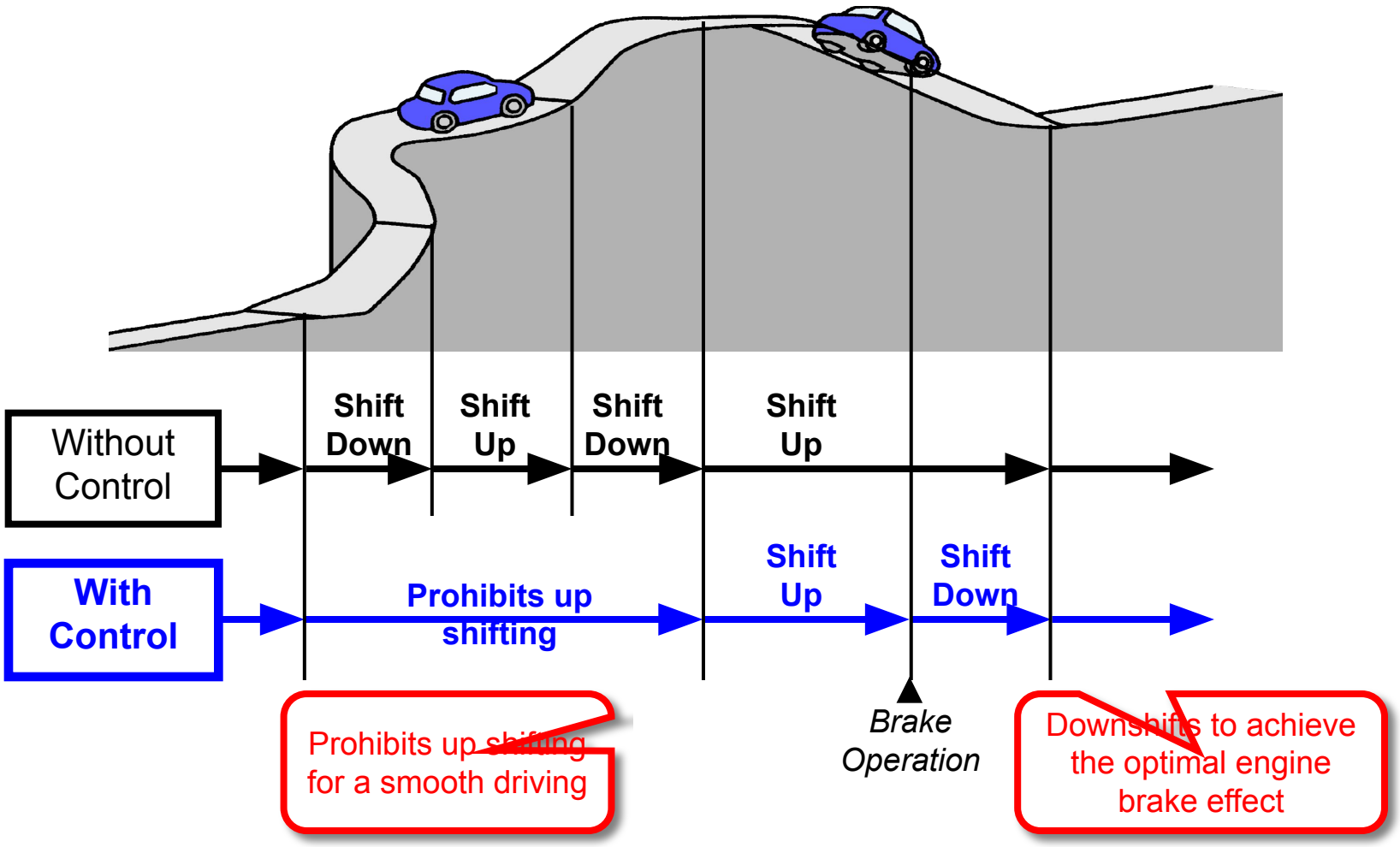
– Control diagram



K111 CVT

Shifting Control in Uphill/Downhill Traveling

– For a smooth driving



TOYOTA

Today Tomorrow Toyota

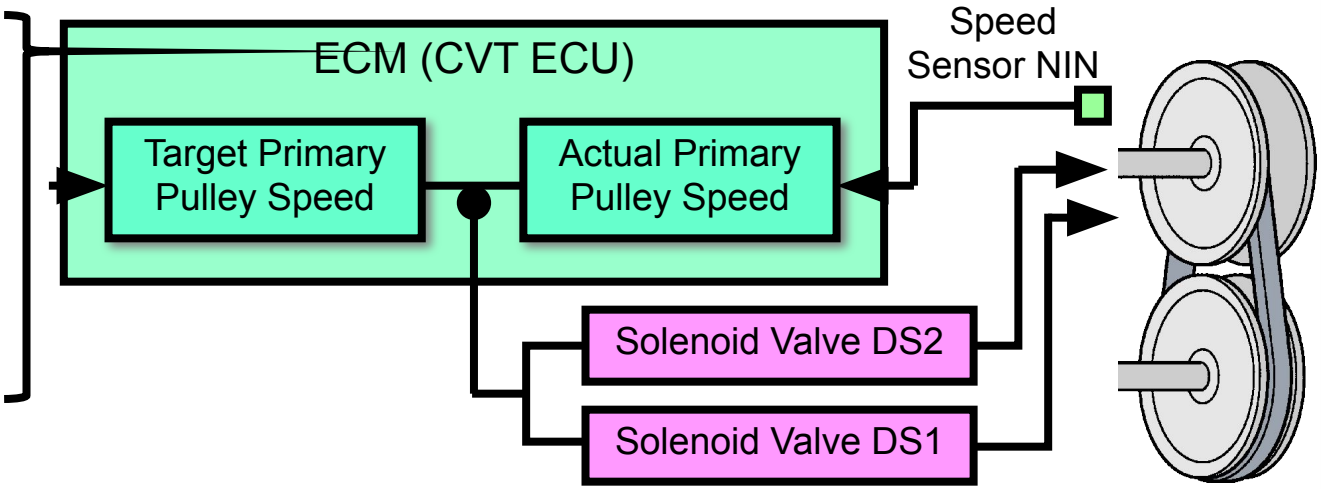
K111 CVT

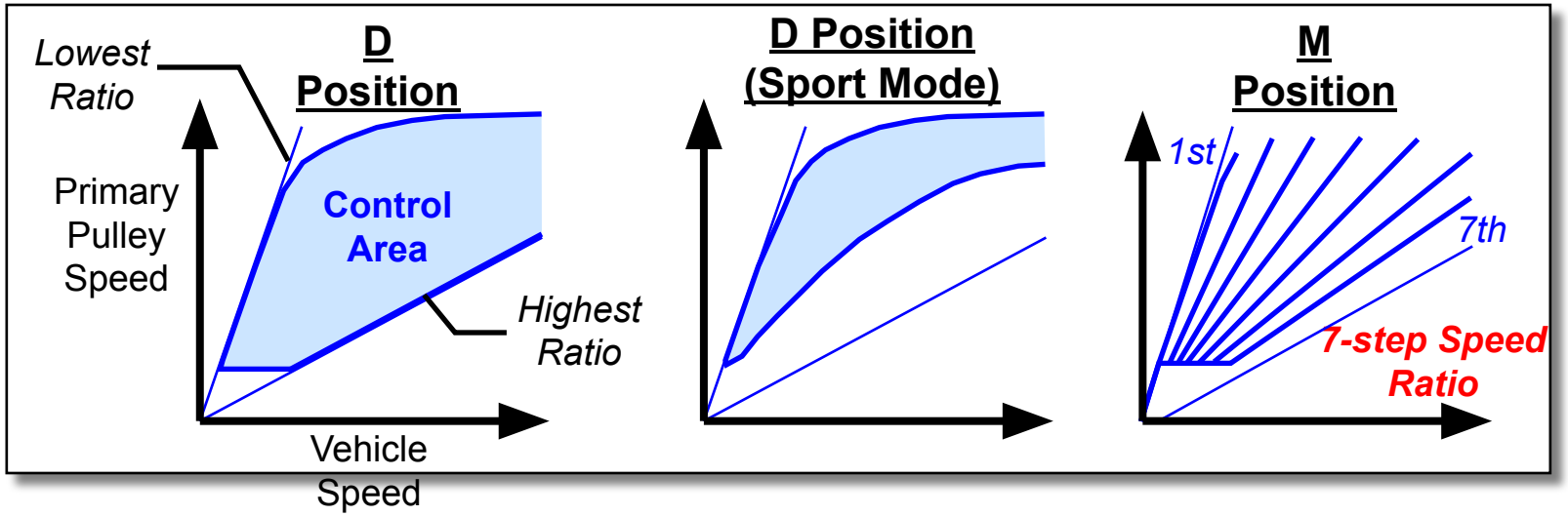
Speed Ratio Control

– The target primary pulley speed is set to obtain the optimum speed ratio to achieve comfortable driving

- Park/Neutral Position Switch
- Transmission Control Switch
- Vehicle Speed
- Stop Light Signal

etc.

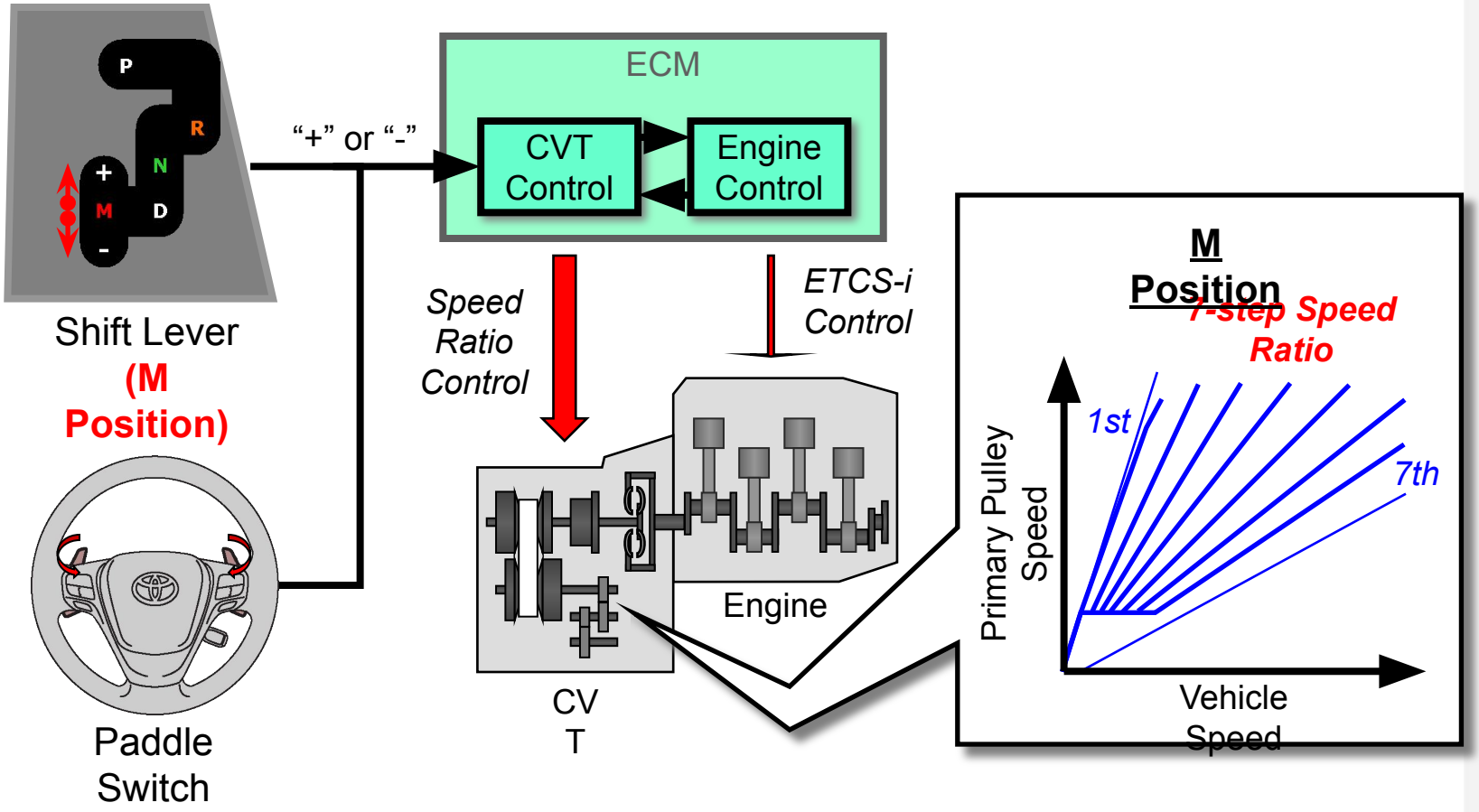




K111 CVT

7-speed Sport Sequential Shiftmatic

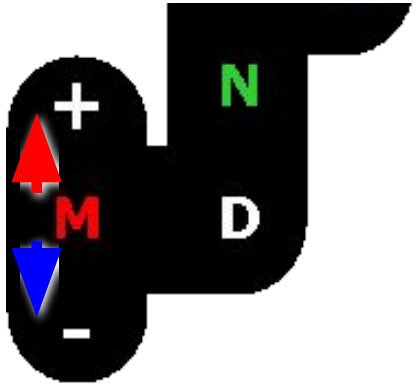
– In the M position, the driver can select the speed ratio from 7-step speed ratio

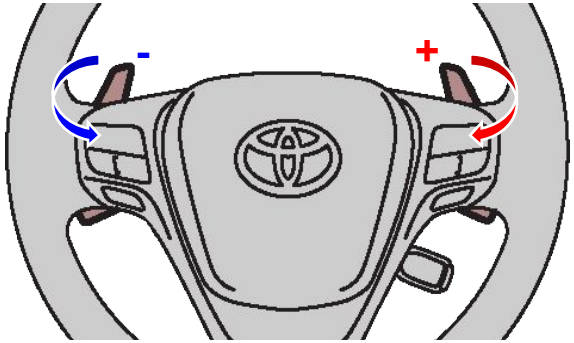


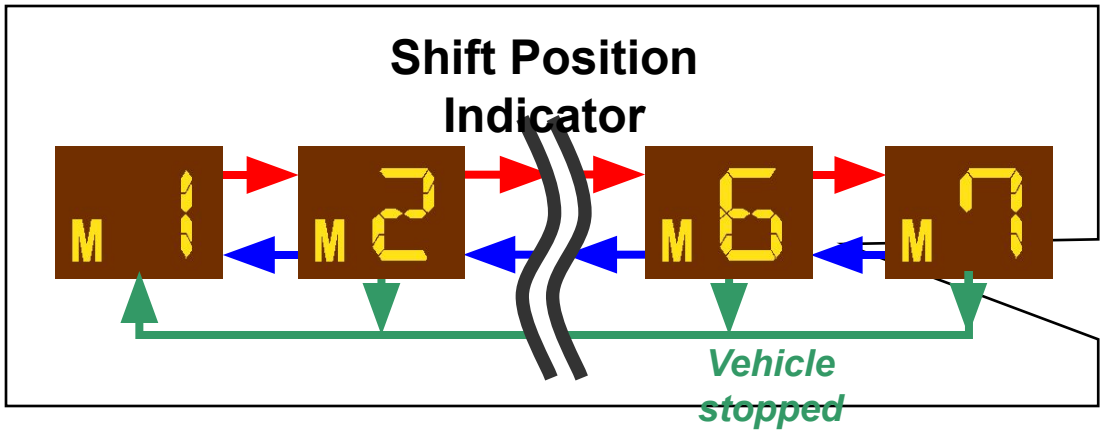
K111 CVT

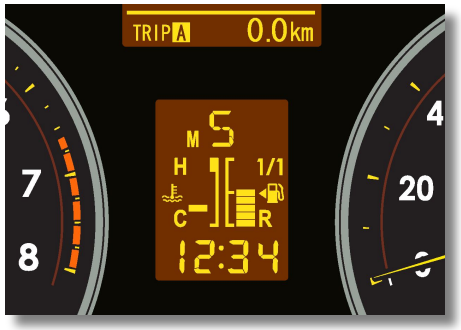
7-speed Sport Sequential Shiftmatic

– Speed ratio is changed by moving the shift lever to "+" or "-" position or pulling the paddle switch





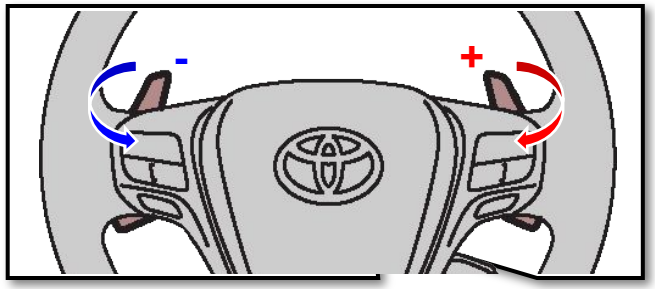




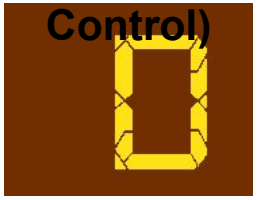
K111 CVT

7-speed Sport Sequential Shiftmatic

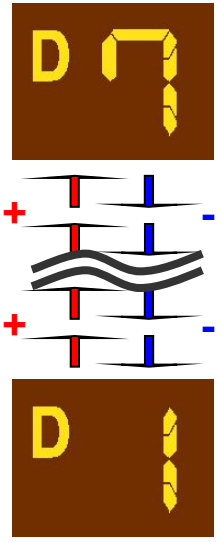
– During D position, it can temporary drive with the stepped speed ratio by pulling the paddle switch



D Position
(Normal Control)



D Position
(Temporary "M" Position Control)



- Accelerator pedal is depressed longer than the specified time in the same speed ratio
- Pull and hold the paddle switch "+" for the specified time
- Vehicle is stopped

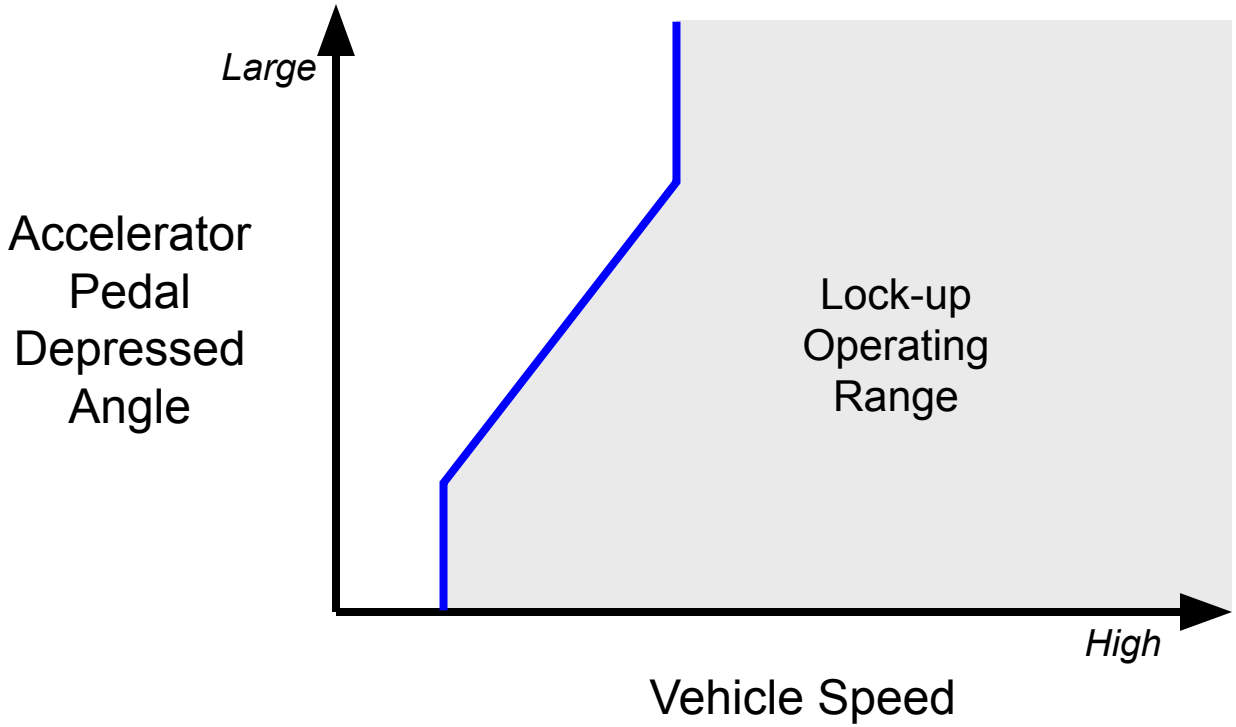
TOYOTA

Today Tomorrow Toyota

K111 CVT

Lock-up Clutch Control

– Wider lock-up area to improve fuel economy



K111 CVT

Fail-safe [1/2]

– This function minimizes the loss of operation when any abnormality occurs in the following parts

Malfunction Part	Fail-safe Function	CVT Operation
Speed Sensor NIN	**Calculate primary pulley speed (NIN) from turbine speed (NT)**	**Normal**
Speed Sensor NOUT	**Calculate secondary pulley speed (NOUT) from wheel speed (vehicle speed sensor)**	**Normal**
Speed Sensor NT	**Calculate turbine speed (NT) from primary pulley speed (NIN)**	**Normal**
Solenoid Valve DS1	**Current to the solenoid valve DS1 is cut off**	**Speed ratio is lower than the normal**
Solenoid Valve DS2	**Current to the solenoid valve DS2 is cut off**	**Speed ratio is higher than the normal**

K111 CVT

Fail-safe [2/2]

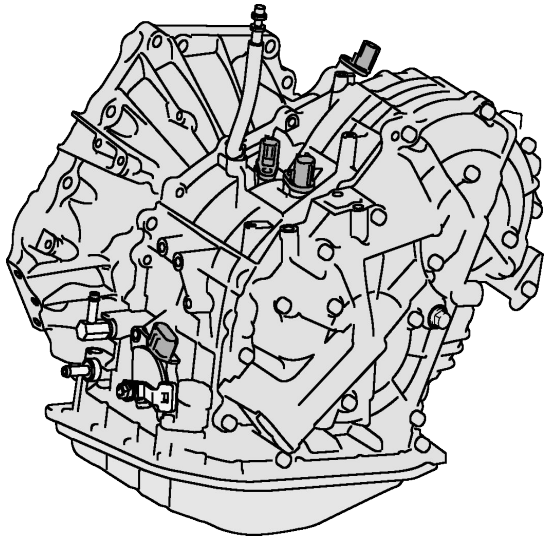
– This function minimizes the loss of operation when any abnormality occurs in the following parts

Malfunction Part	Fail-safe Function	CVT Operation
Solenoid Valve DSU	Current to the solenoid valve DSU is cut off	Lock-up clutch is released
Solenoid Valve SL	Current to the solenoid valve SL is cut off	•Lock-up clutch is released •The forward clutch and reverse brake pressure control by shift solenoid valve SLS is stopped
Solenoid Valve SLS	Current to the solenoid valve SLS is cut off	•Belt clamping pressure is maximized •Speed ratio is fixed to specified ratio •The forward clutch and reverse brake pressure control by shift solenoid valve SLS is stopped
Oil Temperature Sensor	Fix the temperature	Normal
Yaw rate & Acceleration Sensor	-	Neutral control is canceled

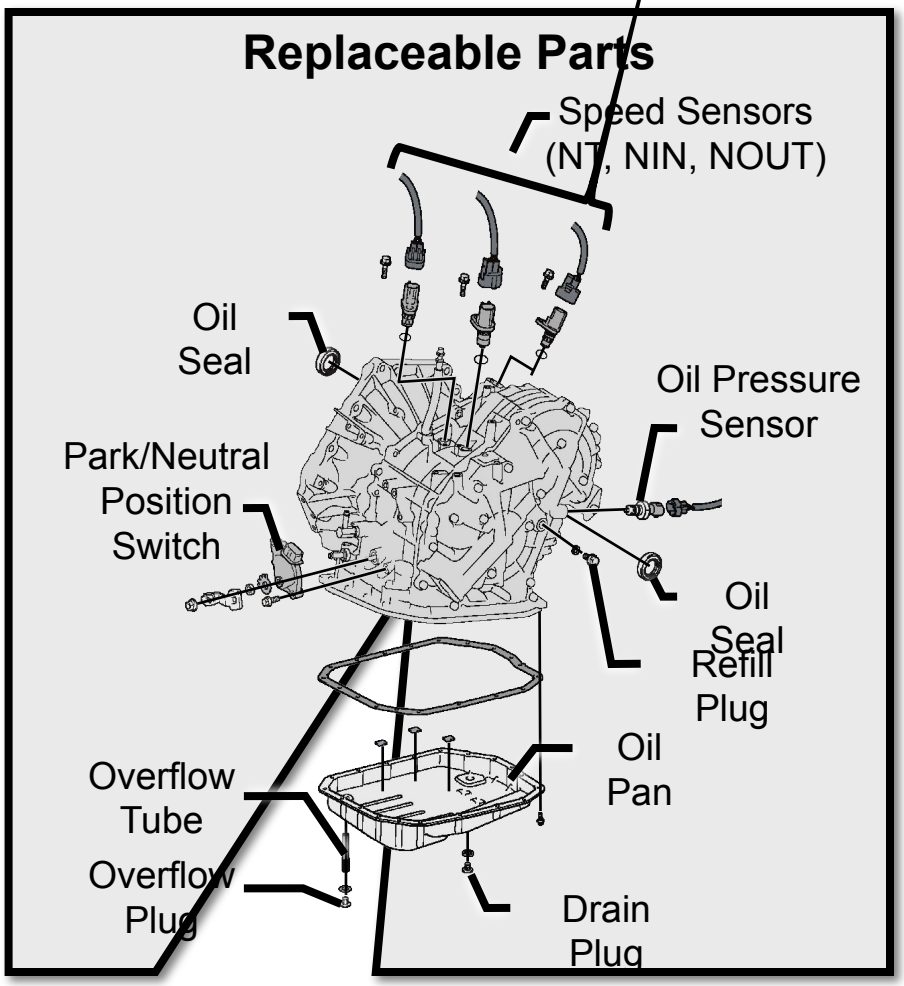
Service Point (K111 CVT)

Replacement

– Transaxle assembly is an assembly replacement parts
(Do not disassembly the transaxle assembly)



Transaxle Assembly
(Assembly Replacement)

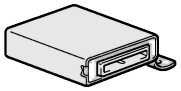


Service Point (K111 CVT)

Initialization and Calibration

– After replacing the following parts, perform the initialization and calibration

Replacement


ECM


Oil Pressure Sensor


Transaxle Assembly


Yaw Rate and Acceleration Sensor

Initialization

CVT Calibrated Value Initialization

Calibration

Yaw Rate and Acceleration Sensor Zero Point Calibration

CVT Oil Pressure Calibration

Service Point (K111 CVT)

Initialization and Calibration

– Initialization and calibration procedure

		Procedure	
Vehicle Condition		• Ignition switch OFF • Shift lever P position	• Parking brake applied • On a level surface
1	CVT Calibrated Value Initialization	1. Connect the intelligent tester 2. Turn the ignition switch ON 3. Perform “Powertrain / Engine and ECT / Utility / Reset Memory”	
2	Yaw Rate and Acceleration Sensor Zero Point Calibration	1. Turn the ignition switch OFF 2. Turn the ignition switch ON and wait for 2 sec. or more 3. Perform “Powertrain / Engine and ECT / Utility / Deceleration Sensor 0 Point Calibration” NOTE: Keep the vehicle stationary and do not vibrate, tilt, move, or shake it (Do not start the engine)	
3	CVT Oil Pressure Calibration	1. Turn the ignition switch OFF and wait for 30 sec. or more 2. Turn the ignition switch ON and wait for 2 sec. or more 3. Start the engine and wait for 5 sec. or more 4. Perform “Powertrain / Engine and ECT / Utility / CVT Oil Pressure Calibration” NOTE: During calibration, the idling speed rises	

Service Point (K111 CVT)

DTC (32 DTCs)

DTC	Detection Item
P0705	Transmission Range Sensor Circuit Malfunction (PRNDL Input)
P0711	Transmission Fluid Temperature Sensor "A" Performance
P0712	Transmission Fluid Temperature Sensor "A" Circuit Low Input
P0713	Transmission Fluid Temperature Sensor "A" Circuit High Input
P0715	Input / Turbine Speed Sensor "A" Circuit (Speed Sensor NT)
P0717	Input / Turbine Speed Sensor "A" Circuit No Signal (Speed Sensor NT)
P0720	Output Speed Sensor Circuit (Speed Sensor NOUT)
P0722	Output Speed Sensor Circuit No Signal (Speed Sensor NOUT)
P0741	Torque Converter Clutch Solenoid Performance (Shift Solenoid Valve SL)
P0746	Pressure Control Solenoid "A" Performance (Shift Solenoid Valve DS1)
P0776	Pressure Control Solenoid “B" Performance (Shift Solenoid Valve DS2)
P0840	Transmission Fluid Pressure Sensor/Switch "A" Circuit
P0841	Transmission Fluid Pressure Sensor/Switch "A" Circuit Range/Performance
P0842	Transmission Fluid Pressure Sensor/Switch "A" Circuit Low
P0843	Transmission Fluid Pressure Sensor/Switch "A" Circuit High
P0962	Pressure Control Solenoid "A" Control Circuit Low (Shift Solenoid Valve DS1)
P0963	Pressure Control Solenoid "A" Control Circuit High (Shift Solenoid Valve DS1)

Service Point (K111 CVT)

DTC (32 DTCs)

DTC	Detection Item
P0966	Pressure Control Solenoid "B" Control Circuit Low (Shift Solenoid Valve DS2)
P0967	Pressure Control Solenoid "B" Control Circuit High (Shift Solenoid Valve DS2)
P1585	Acceleration Sensor Circuit
P1586	Acceleration Sensor Malfunction
P1589	Acceleration Sensor Learning Value
P1750	Brake ECU Malfunction
P2757	Torque Converter Clutch Pressure Control Solenoid Control Circuit Performance (Shift Solenoid Valve DSU)
P2763	Torque Converter Clutch Pressure Control Solenoid Control Circuit High (Shift Solenoid Valve DSU)
P2764	Torque Converter Clutch Pressure Control Solenoid Control Circuit Low (Shift Solenoid Valve DSU)
P2767	Input/Turbine Speed Sensor "B" Circuit No Signal (Speed Sensor NIN)
P2769	Short in Torque Converter Clutch Solenoid Circuit (Solenoid Valve SL)
P2770	Open in Torque Converter Clutch Solenoid Circuit (Solenoid Valve SL)
P2829	Pressure Control Solenoid "K“ Performance (Shift Solenoid Valve SLS)
P282B	Pressure Control Solenoid "K" Electrical (Shift Solenoid SLS)
U0129	Lost Communication with Brake System Control Module

Service Point (K111 CVT)

DATA LIST (The table below is only major item)

Item	Measurement Item	Range
Pattern Switch (PWR/M)	Pattern select switch (SPORT) status	ON or OFF
Sports Shift Up SW	Sport shift up switch (paddle switch and shift lever) status	ON or OFF
Sports Shift Down SW	Sport shift down switch (paddle switch and shift lever) status	ON or OFF
A/T Oil Pressure	Secondary pulley oil pressure value	-0.625 to 9.575 MPa
Solenoid (DS1)	Solenoid DS1 status	ON or OFF
Solenoid (DS2)	Solenoid DS2 status	ON or OFF
Solenoid (SLS)	Solenoid SLS status	ON or OFF
NOUT Sensor Voltage	Secondary pulley speed (NOUT) sensor output voltage	0 to 5 V
SPD (NIN)	Primary pulley speed	0 to 12750 rpm
SPD (NOUT)	Secondary pulley speed	0 to 12750 rpm
CVT Oil Press Calibration	CVT fluid pressure calibration status	Incomplete or Complete
G Sensor Calibration	Yaw rate and acceleration sensor zero point calibration status	Incomplete or Complete
G Sensor Learning Value	Yaw rate and acceleration sensor zero point calibration value	0 to 5 V

Service Point (K111 CVT)

ACTIVE TEST

Item	Test Part	Control Range	Vehicle Condition
Connect the TC and TE1	Turn on and off TC and TE1 connection	ON or OFF	-
Activate the Lock Up	Set the CVT to the lock-up condition	ON or OFF	Vehicle speed: 60 km/h (37 mph) or more
Activate the Solenoid (SL)	Operate the solenoid SL	ON or OFF	•Engine stopped •Shift lever P or N
Control the Shift Position	Set to specific speed ratio	1st (2.4) / 2nd (1.5) / 3rd (1.0) / 4th (0.7) / 5th (0.43) [() = Speed Ratio]	Vehicle speed: 50 km/h (30 mph) or less
Activate the Solenoid (DSU)	Operate the solenoid DSU	ON or OFF	•Engine stopped •Shift lever P or N
Activate the Solenoid (DS1)	Operate the solenoid DS1	ON or OFF	•Engine stopped •Shift lever P or N
Activate the Solenoid (DS2)	Operate the solenoid DS2	ON or OFF	•Engine stopped •Shift lever P or N
Control the SLS Pressure	Operate the belt clamping pressure linear solenoid SLS	High or Low	•Vehicle Stopped •Engine idling
Activate the Solenoid (SLS)	Control the current to the solenoid SLS	MIN or MAX	•Engine idling •Shift lever P or N

K311 CVT (Continuously Variable Transaxle)

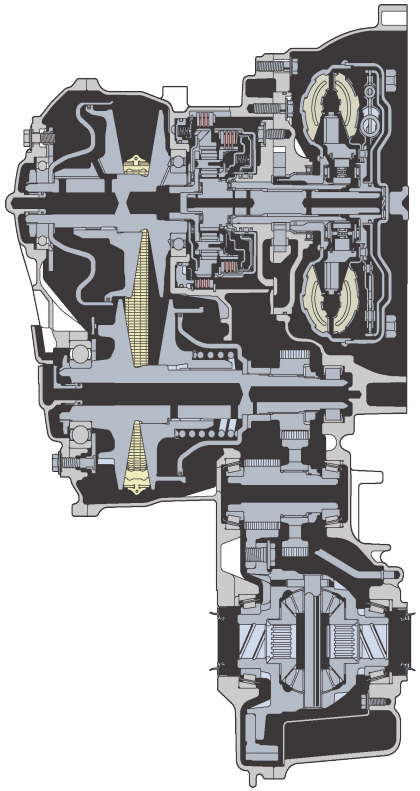
Subtitle

K311 CVT (Continuously Variable Transaxle)

Overall

– A metal belt type continuously variable transaxle with electronic hydraulic control

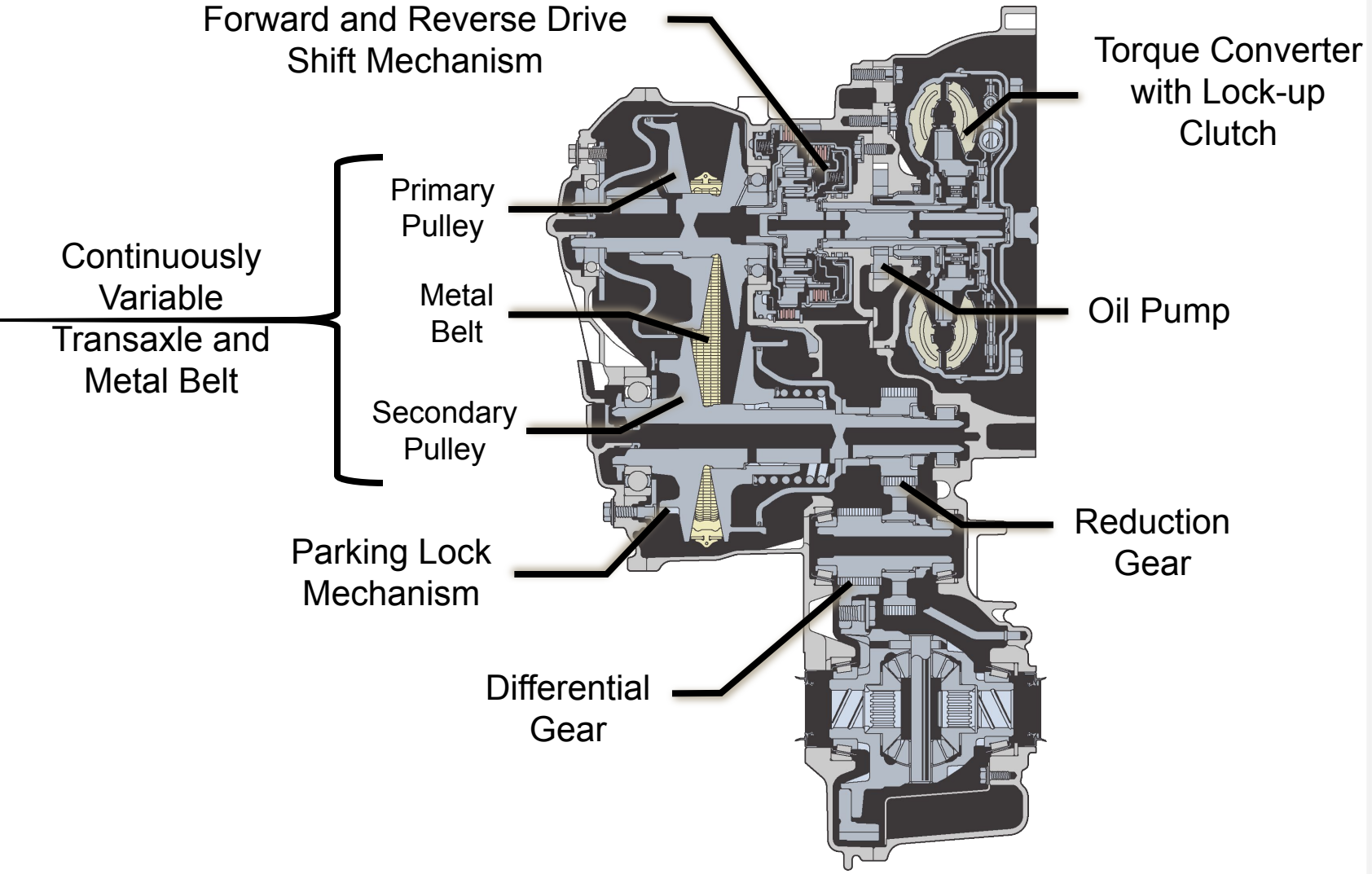
Transaxle Type		K311	K111 (Ref.)
Engine Type		2ZR-FAE (1.8 L)	3ZR-FAE (2.0 L)
Shift Mechanism Type		Pulley and Steel Belt	←
Forward/Reverse Switching Mechanism		Double Pinion Type Planetary Gear	Single Pinion Type Planetary Gear
Gear Ratio	Forward	2.386 to 0.411	2.396 to 0.428
	Reverse*1	2.505	1.668
Differential Gear Ratio*2		5.698	5. 182
Shift Lever Position		P – R – N – D – M	←
Fluid Type		CVT Fluid TC	←
Fluid Capacity [Liter (US qts, Imp. qts)]		8.6 (9.09, 7.57)	←
Weight (Reference)		???	???



*1: Planetary Gear Ratio Included
*2: Reduction Gear Ratio Included

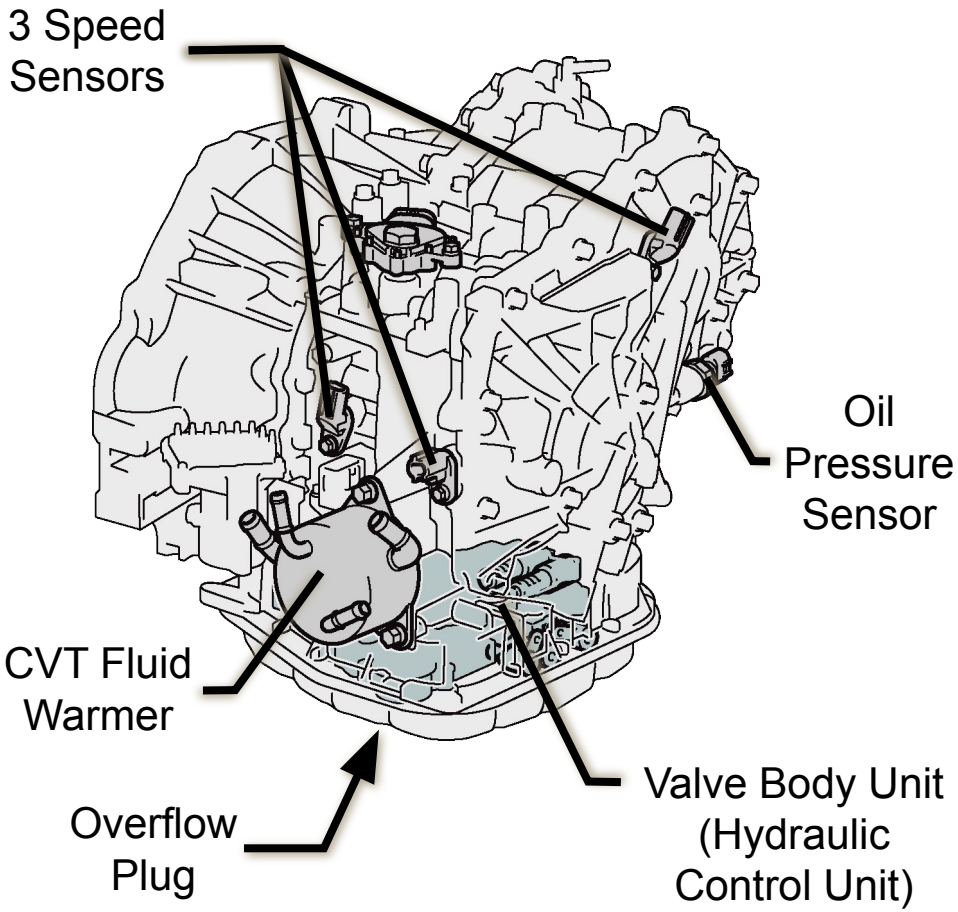
K311 CVT

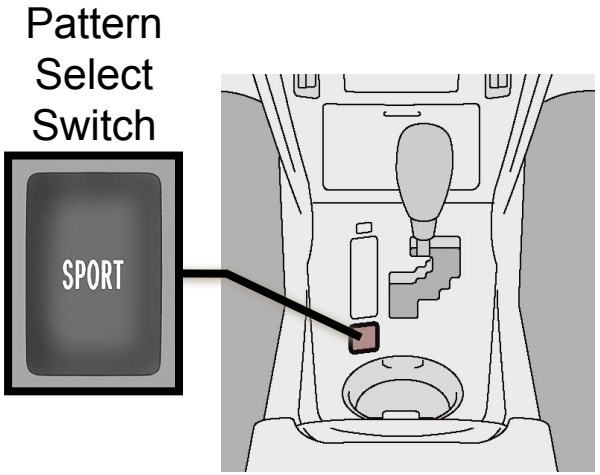
Components

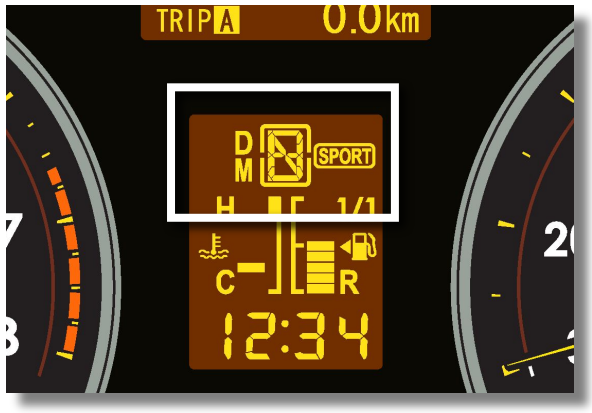


K311 CVT

Components







Shift Position Indicator (Combination Meter)

K311 CVT

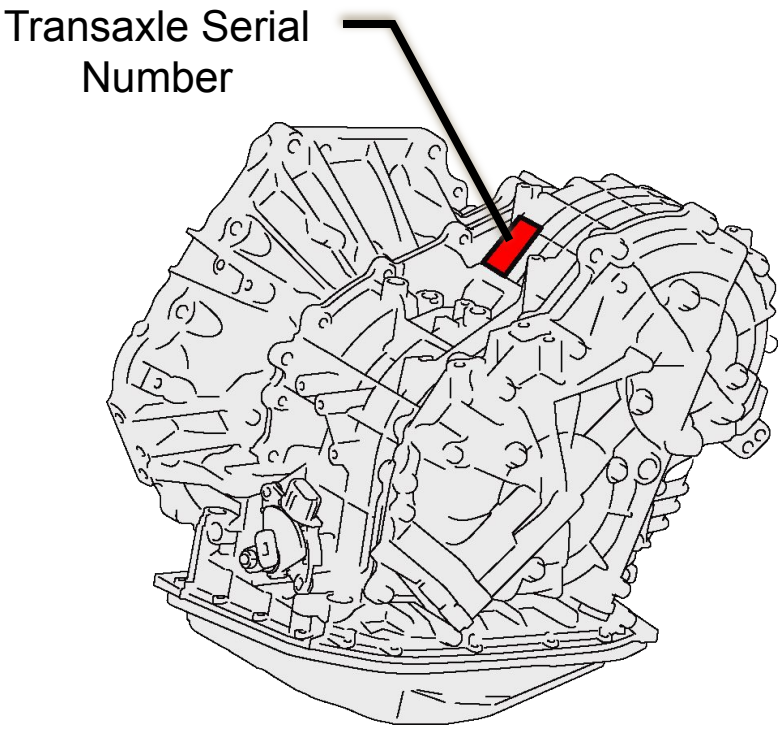
Major Difference Between K111 and K311

Type	K311	K111
Planetary Gear Unit	Double Pinion Type Planetary Gear	Single Pinion Type Planetary Gear
Solenoid Valve	5 Solenoid Valves •DS1 (Duty) •DS2 (Duty) •DSU (Duty) •SLS (Linear) **•SLT (Linear)**	5 Solenoid Valves •DS1 (Duty) •DS2 (Duty) •DSU (Duty) •SLS (Linear) **•SL (ON/OFF)**
Primary Pulley	Single Piston Construction	Double Piston Construction
Reduction Drive Gear	Without Bearing	With Bearings
Paddle Switch	Without	With

K311 CVT

Identification Information

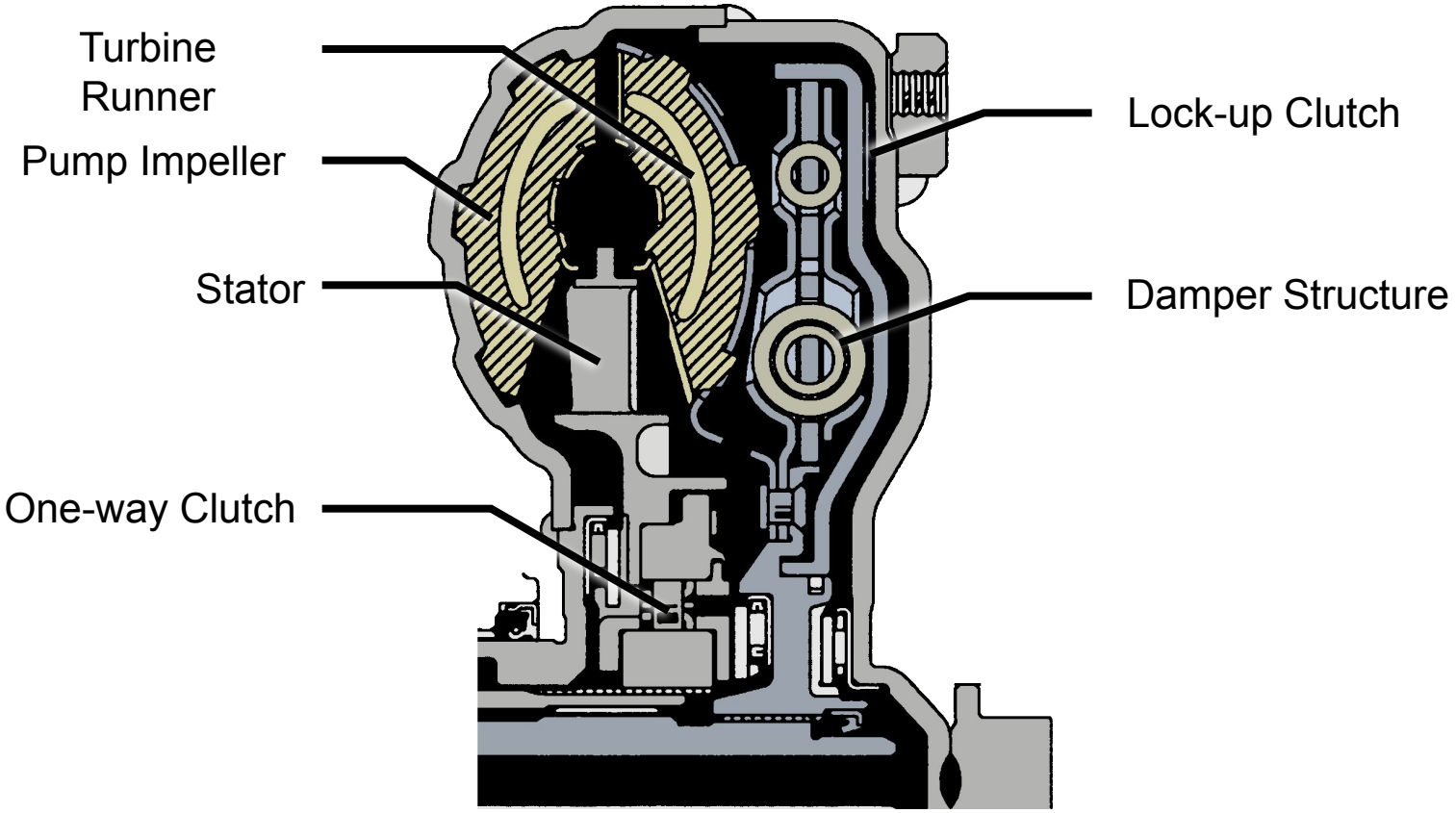
– The transaxle serial number is stamped on the case as shown in the illustration



K311 CVT

Torque Converter with Lock-up Clutch

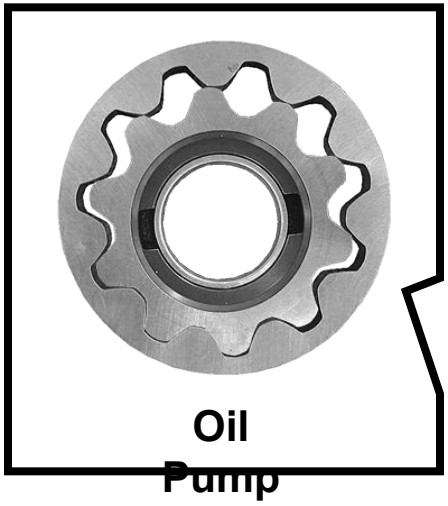
– Damper structure allowing lock-up from low speed range

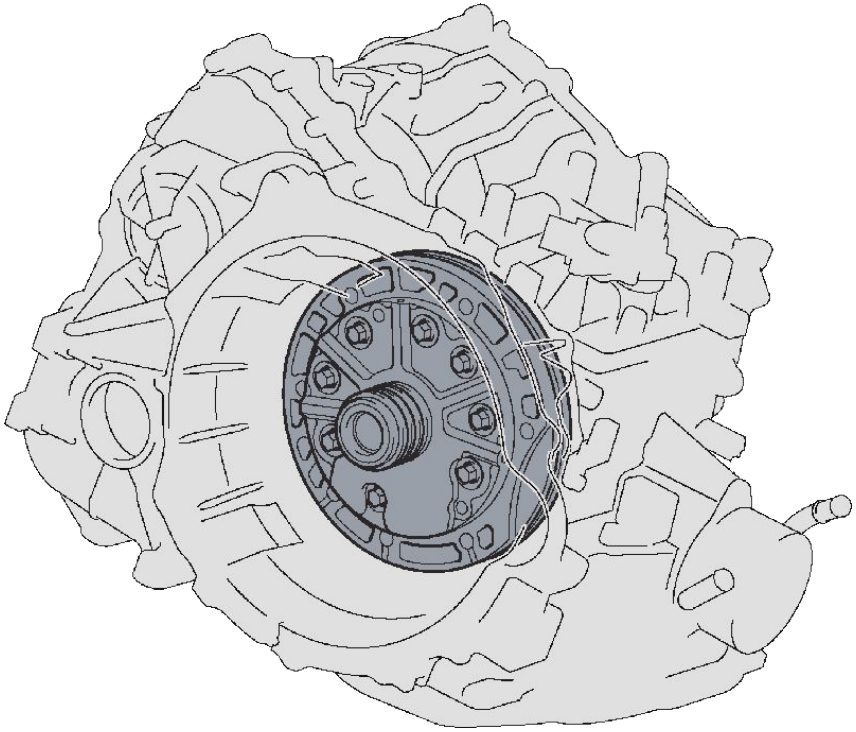


K311 CVT

Oil Pump

– The oil pump is combined with the torque converter, lubricates the parts and supplies operating pressure to the hydraulic control

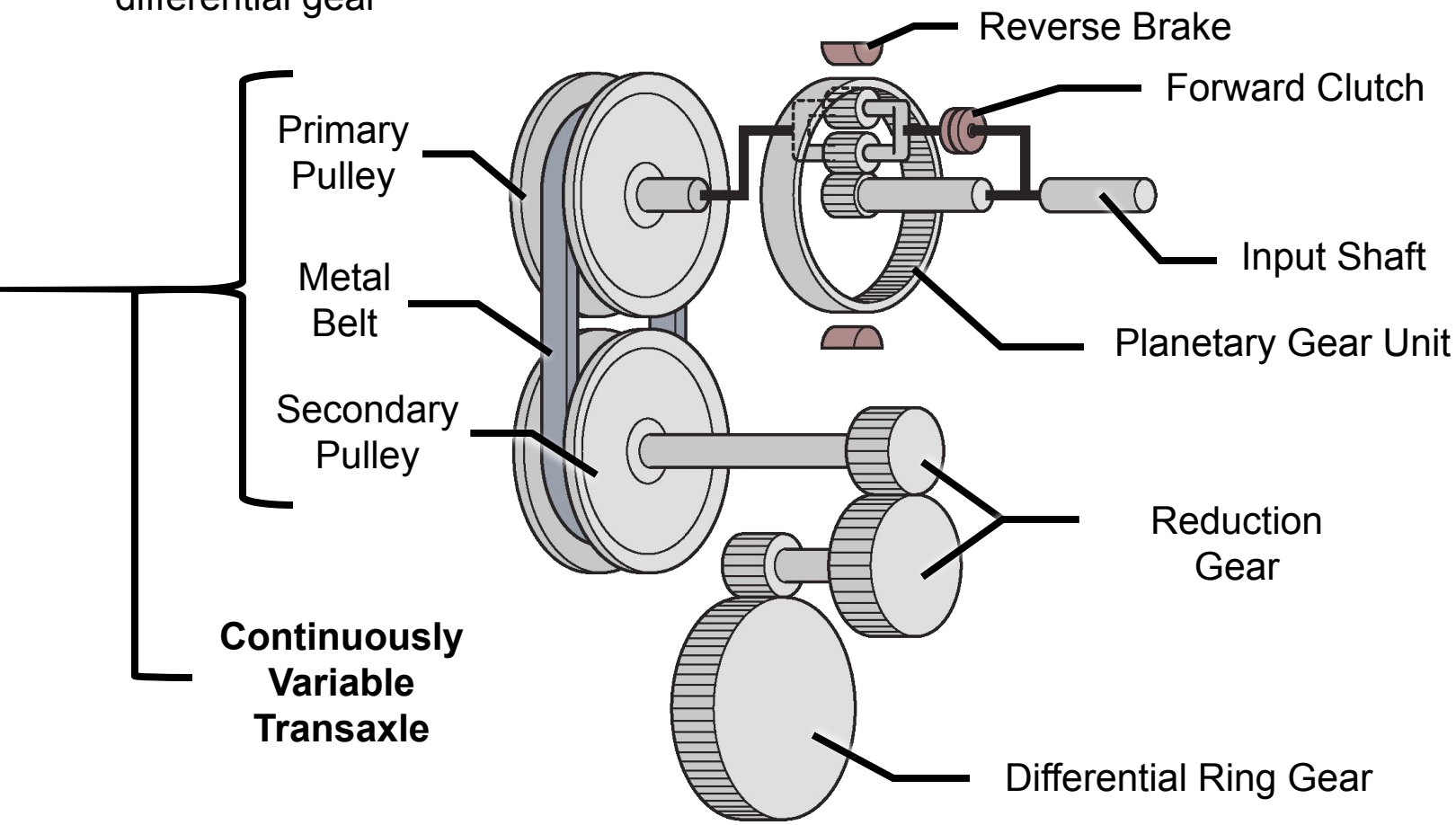




K311 CVT

Gear Train

– Consists of a planetary gear, continuously variable transaxle, reduction gear and
differential gear

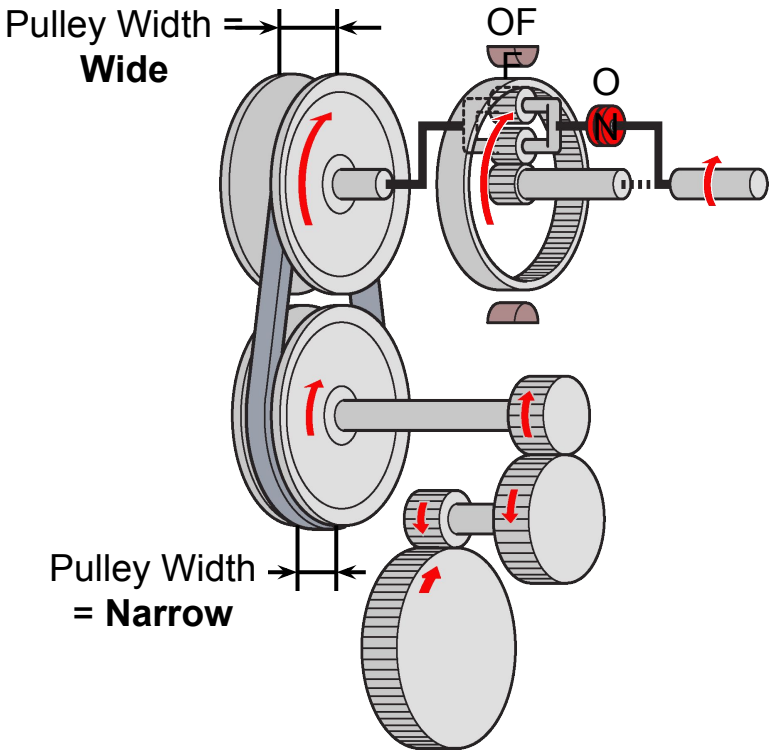


K311 CVT

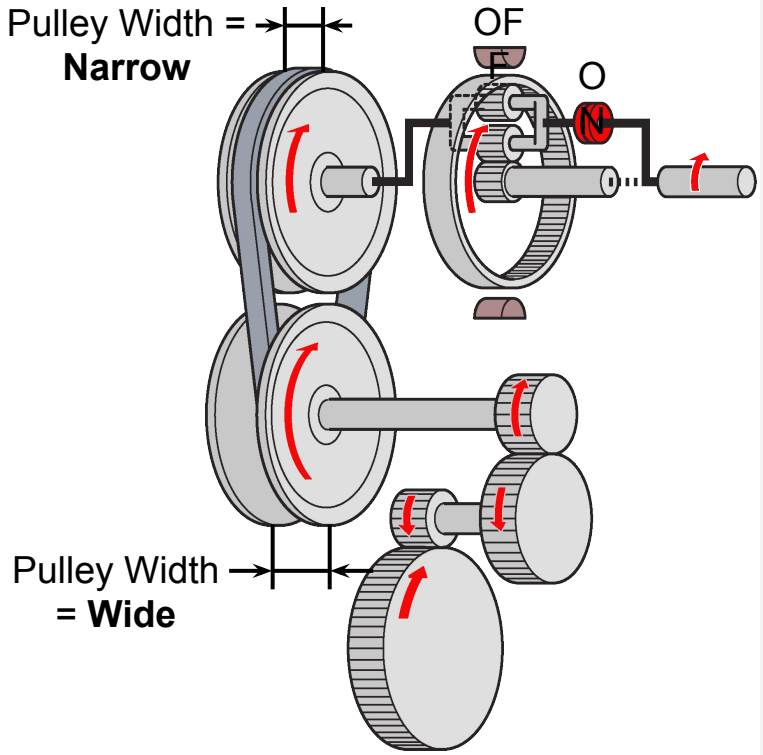
Gear Train

– Operation (D Position)

D position
(Lowest Ratio)



D position
(Highest Ratio)



TOYOTA

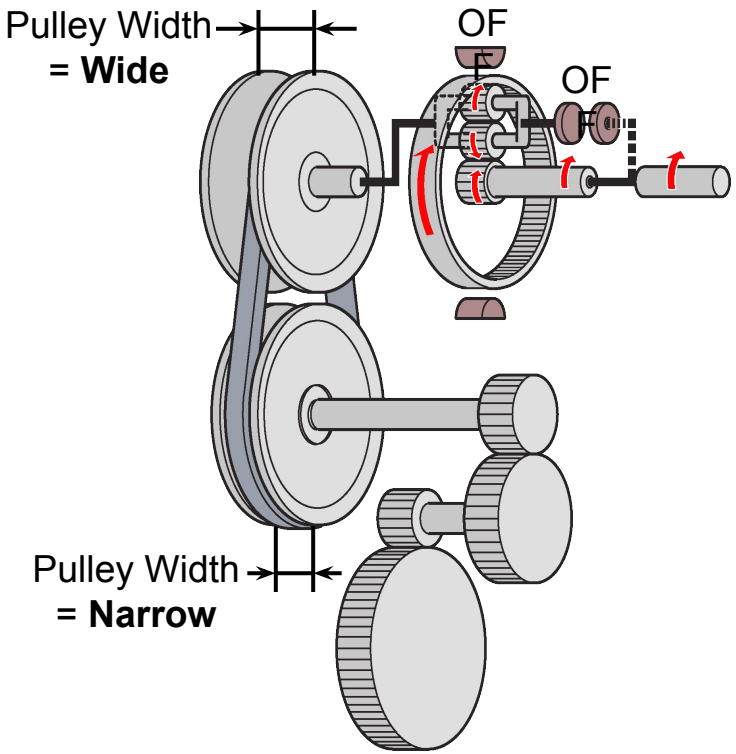
Today
Tomorrow
Toyota

K311 CVT

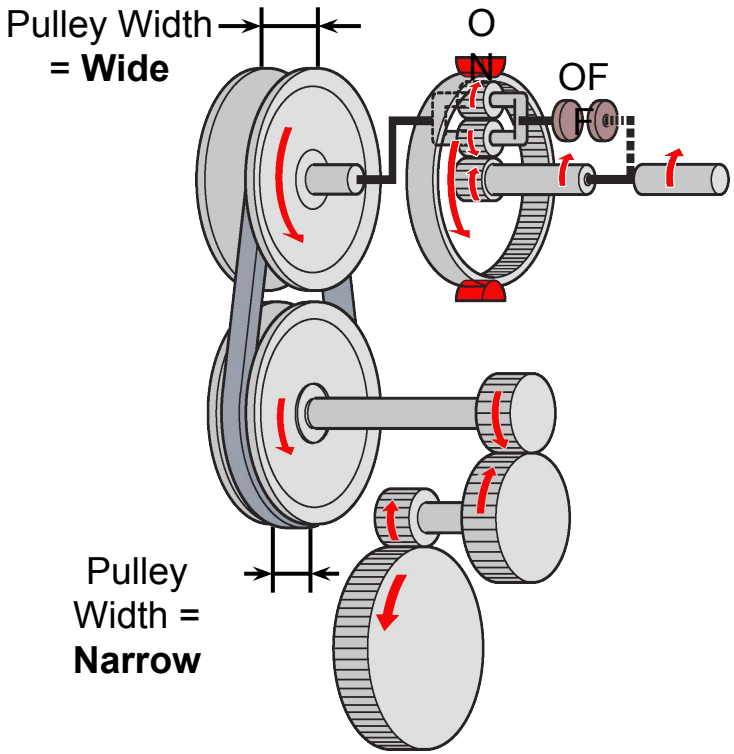
Gear Train

– Operation (N and R Position)

N position



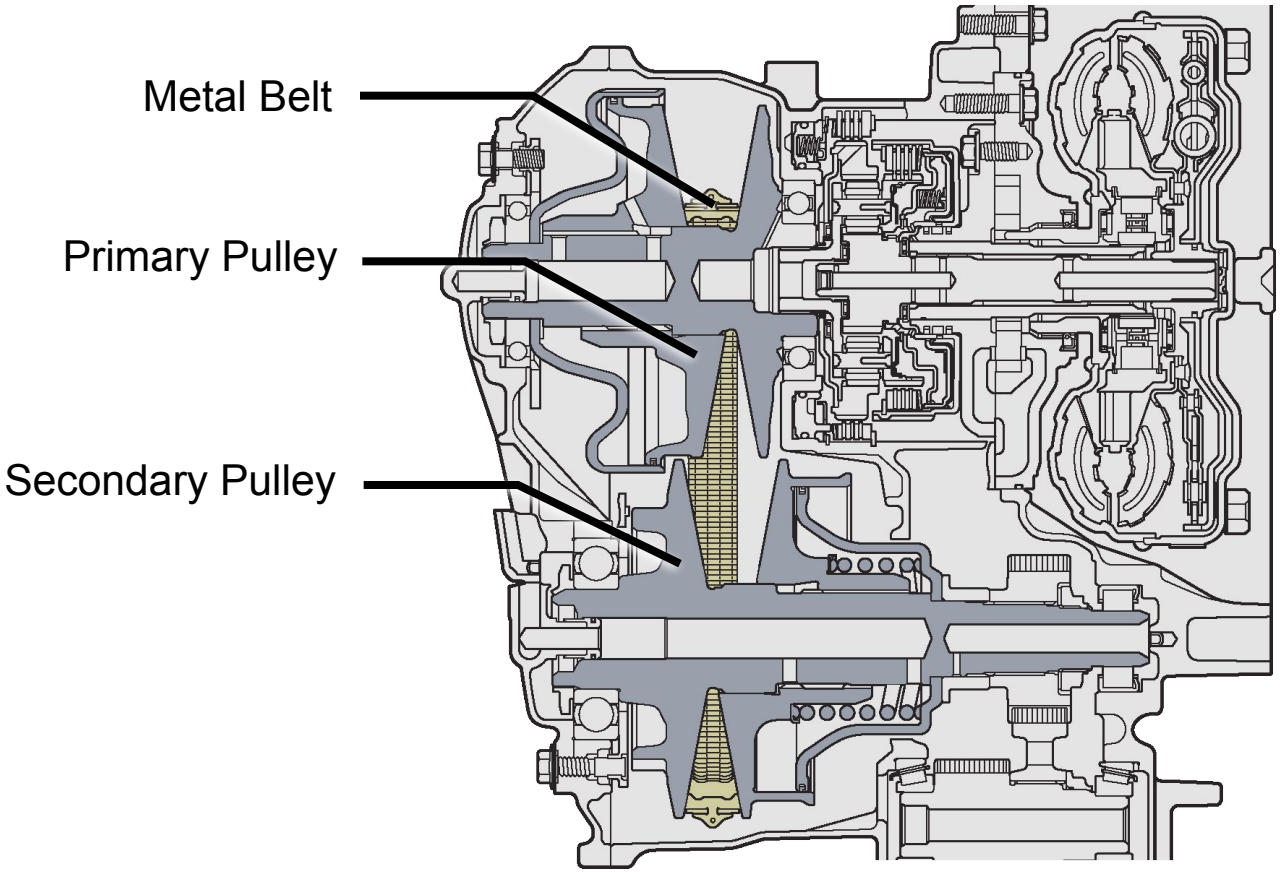
R position



K311 CVT

Continuously Variable Transaxle and Metal Belt

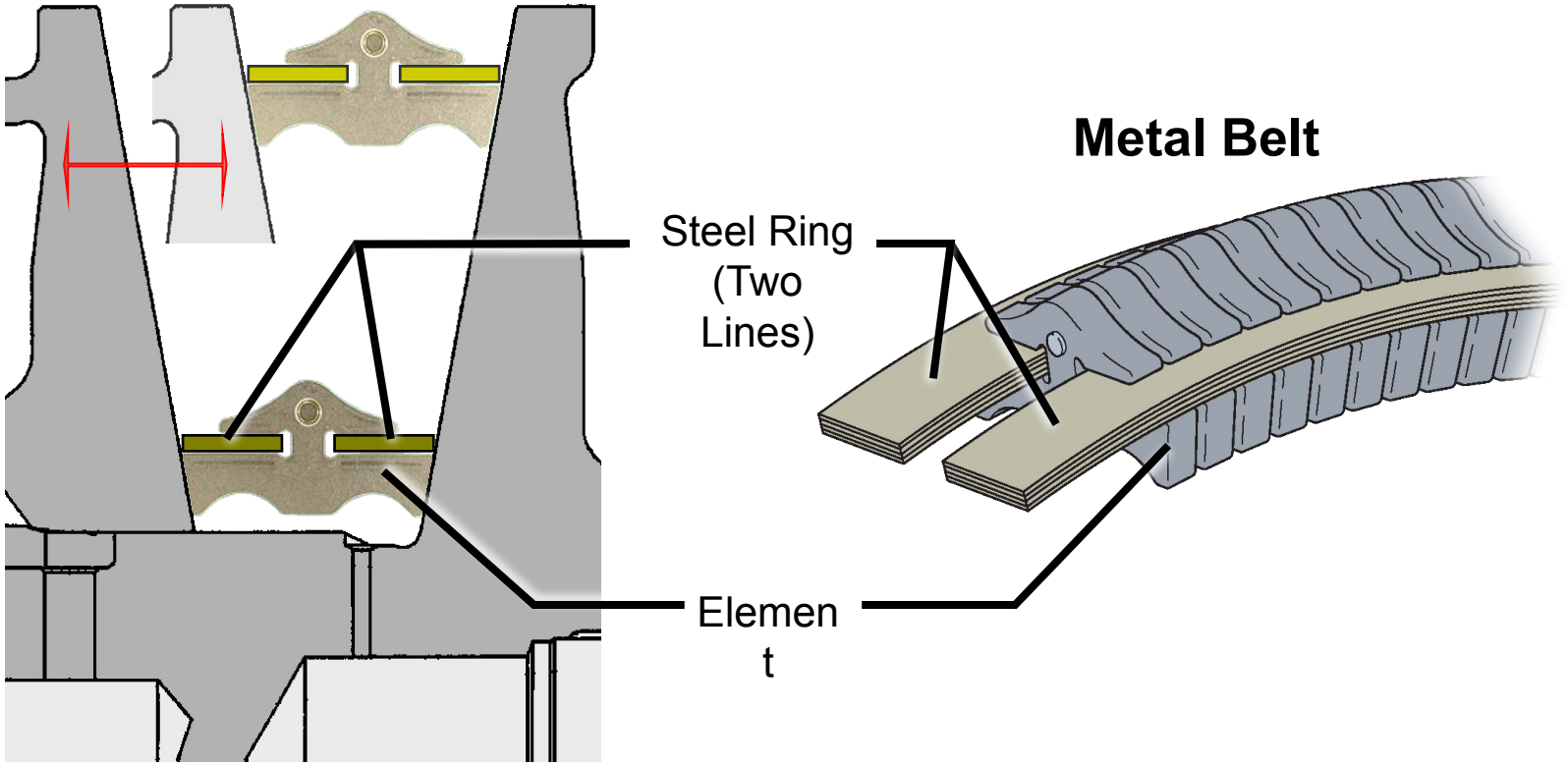
– Performs speed ratio control by varying the pulley width with piston operation of the primary and secondary pulleys



K311 CVT

Continuously Variable Transaxle and Metal Belt

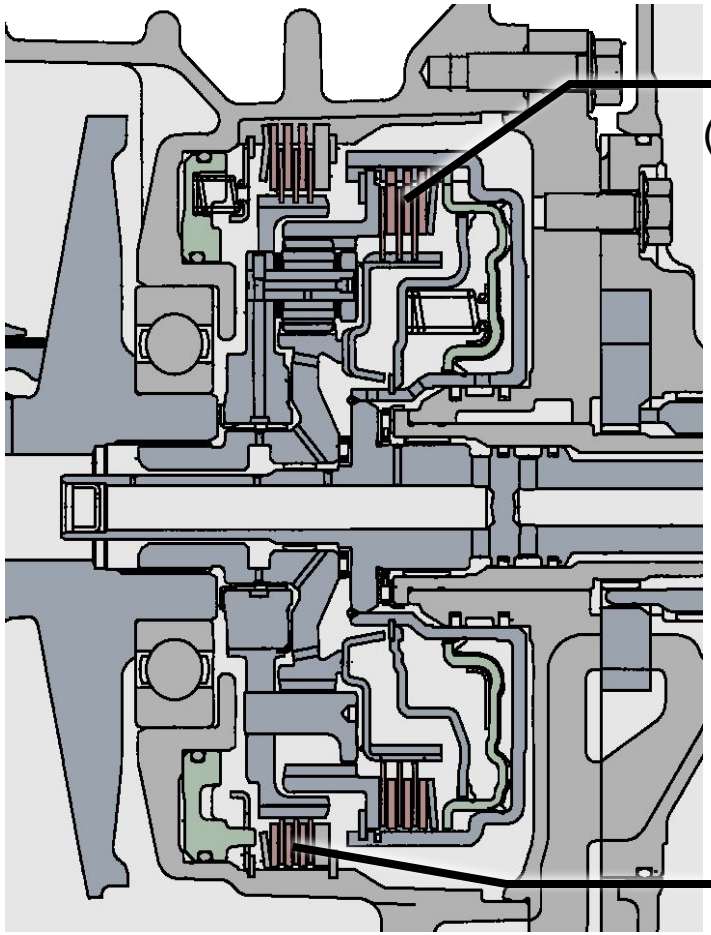
– The metal belt allows power transmission with the compressive effect of element
(element extrusion)

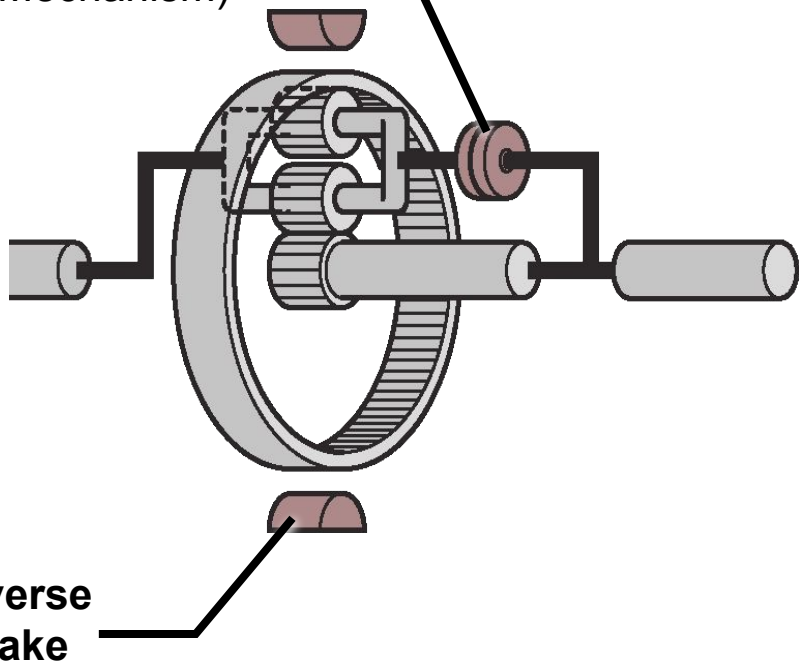


K311 CVT

Forward and Reverse Drive Shift Mechanism

– A double pinion type planetary gear is used



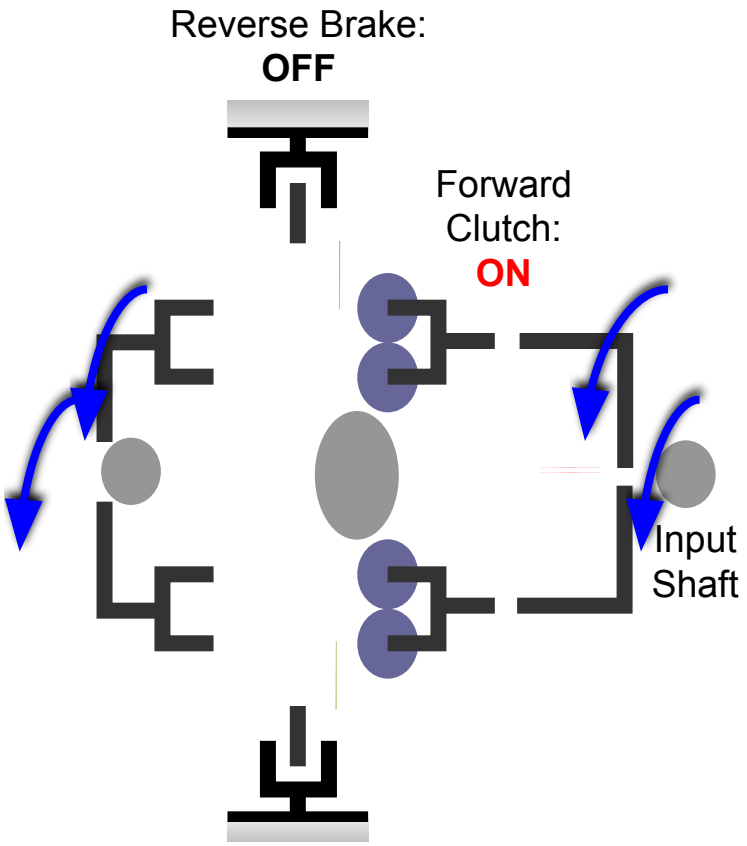


K311 CVT

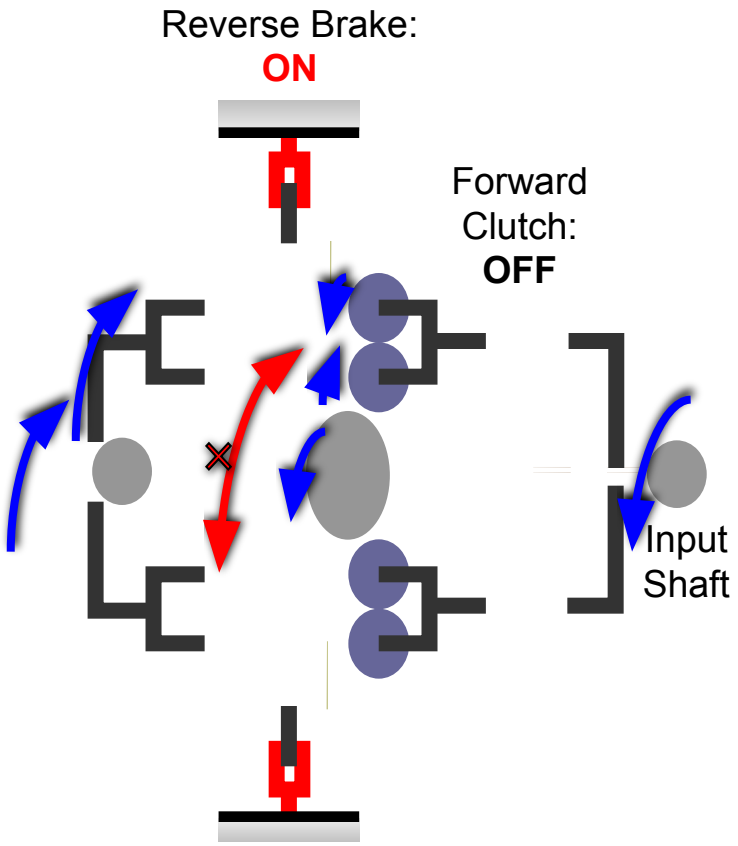
Forward and Reverse Drive Shift Mechanism

– Operation

[During Forward Driving]



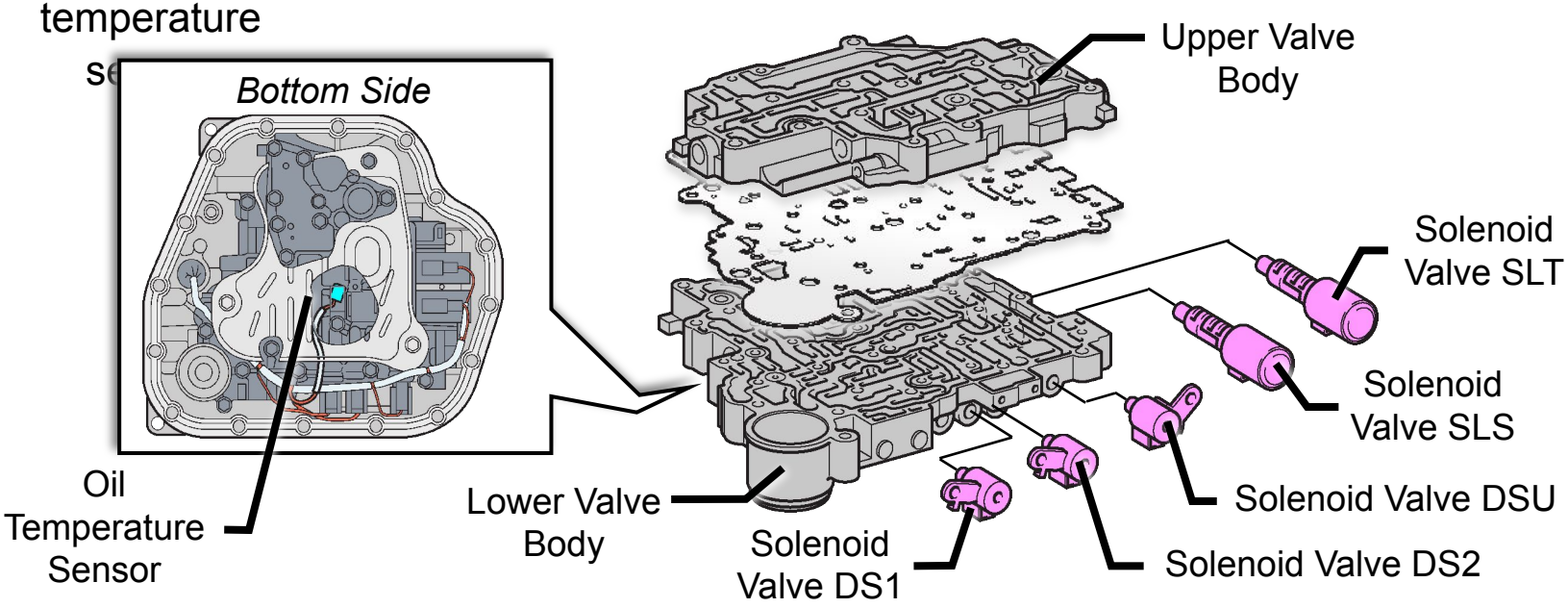
[During Reverse Driving]



K311 CVT

Valve Body Unit

– Consists of the upper and lower valve bodies, 5 solenoid valves and oil temperature

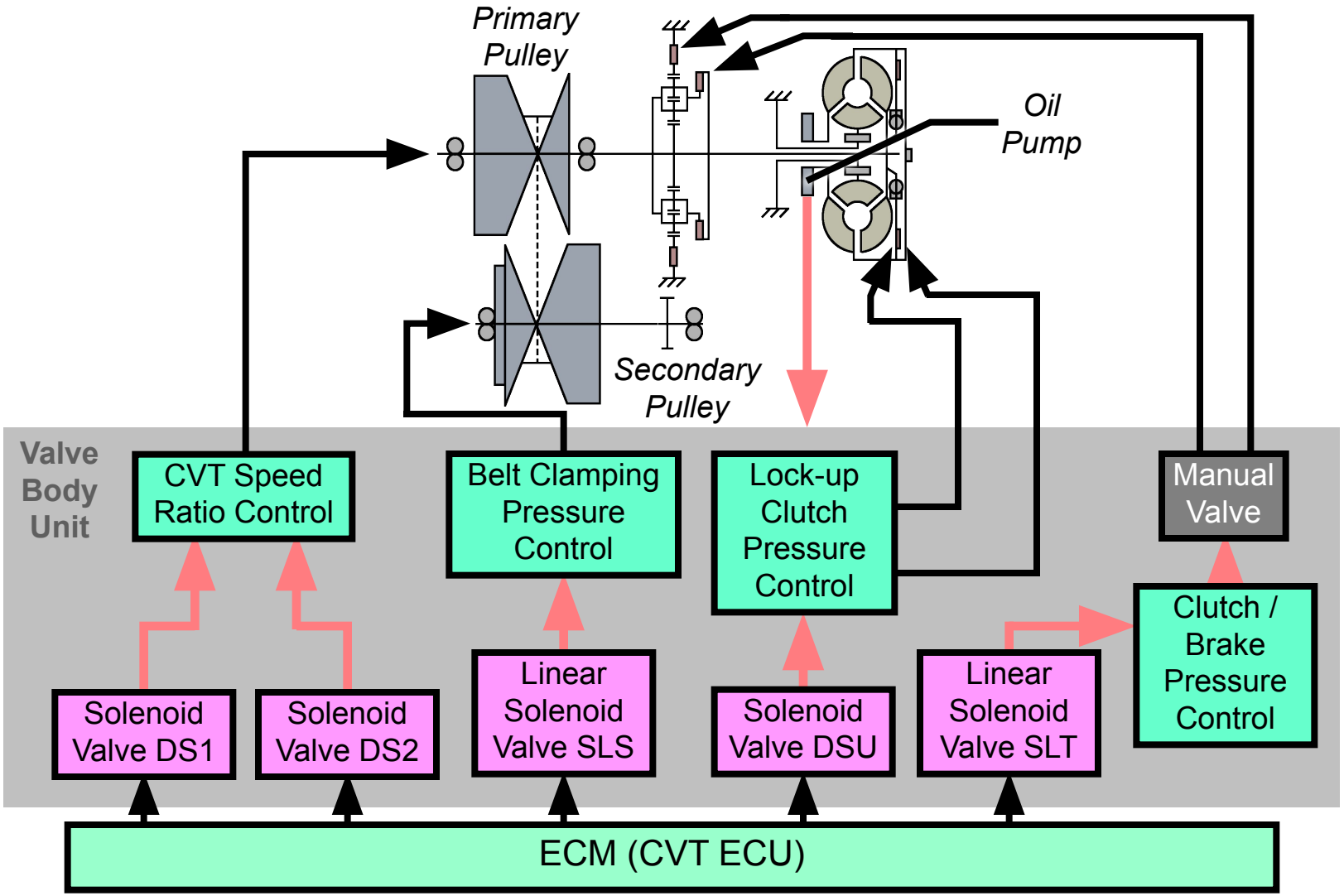


Solenoid Valve	Type	Function
DS1	**Duty**	**Controls the amount of fluid flowing into the primary pulley (shift up control)**
DS2		**Controls the amount of fluid flowing from the primary pulley (shift down control)**
SLT	**Liner**	**Controls the line pressure**
DSU	**Duty**	**Controls the lock-up clutch pressure**
SLS	**Liner**	**Controls the secondary pulley pressure**

Reference (K311 CVT)

Valve Body Unit

– Hydraulic control block diagram

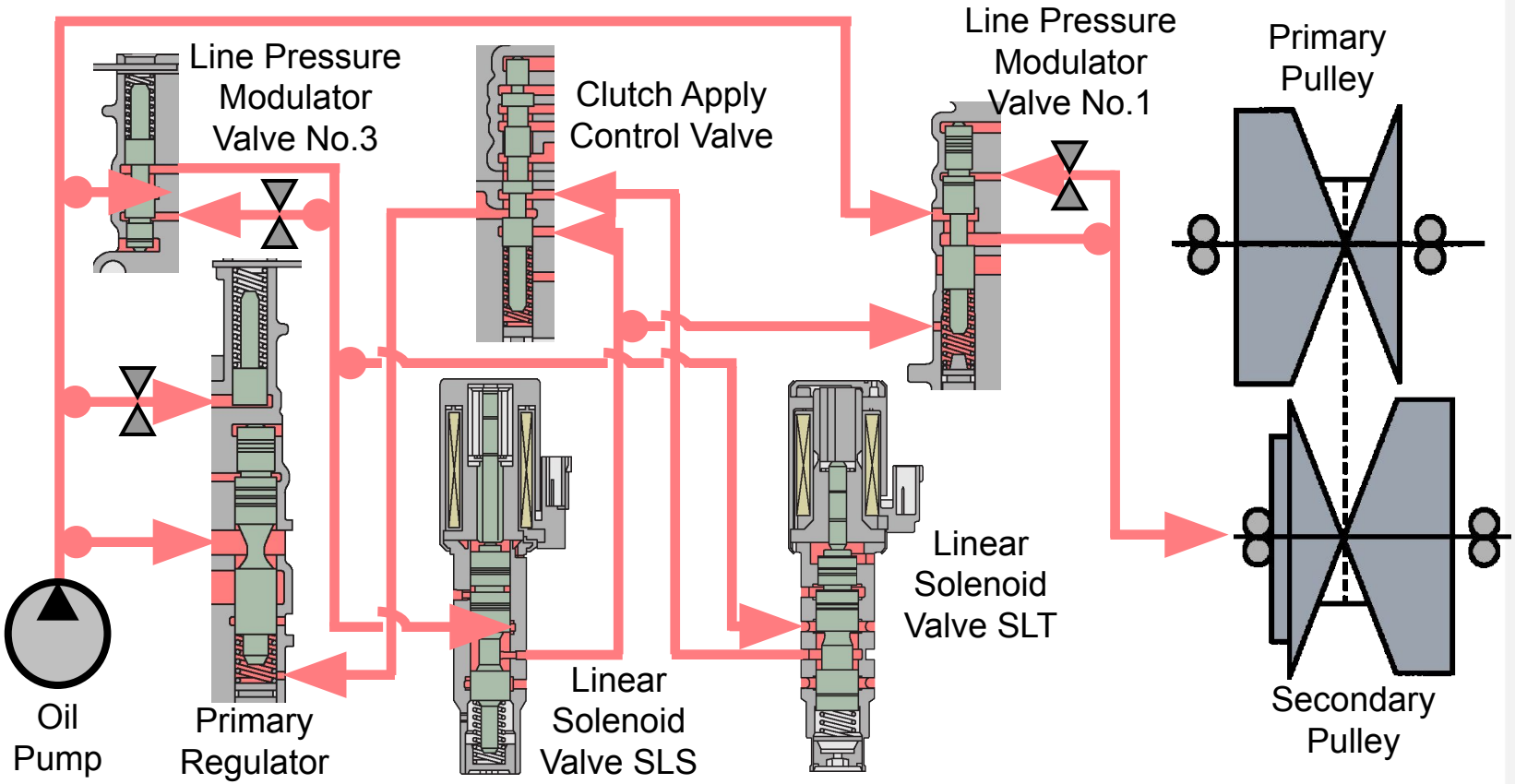


K311 CVT

Valve Body Unit

– Belt Clamping Pressure Control Mechanism

— Belt clamping pressure is controlled by regulating the secondary pulley pressure

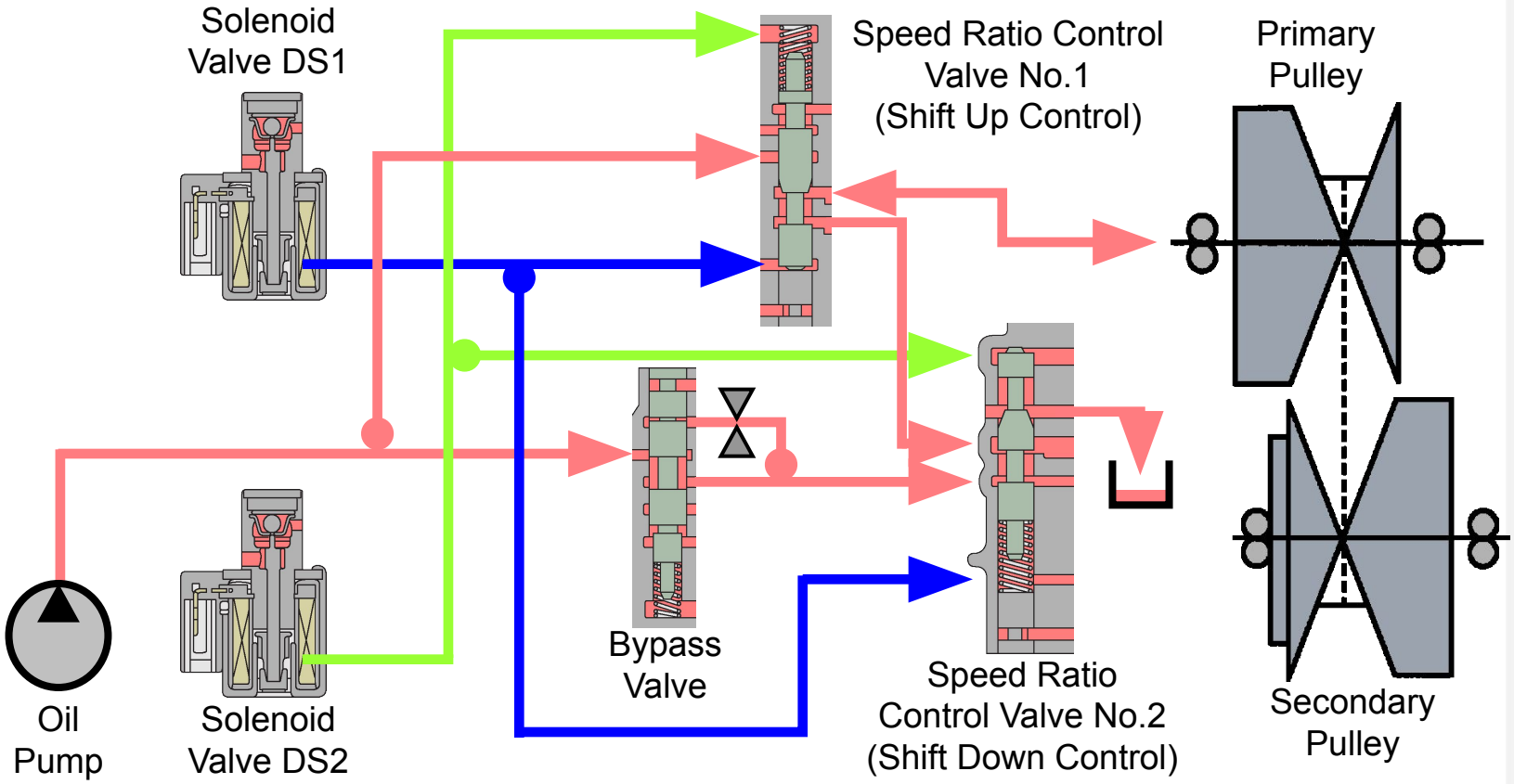


K311 CVT

Valve Body Unit

– Speed Ratio Control Mechanism

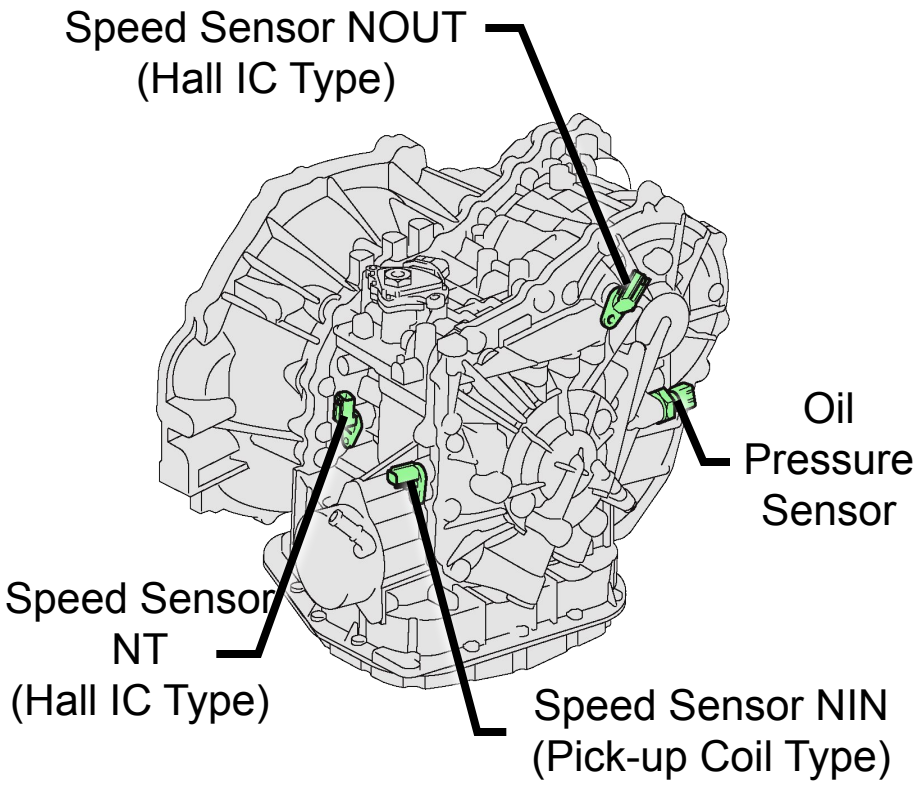
— Speed ratio control is performed by controlling fluid flowing into and from the primary pulley

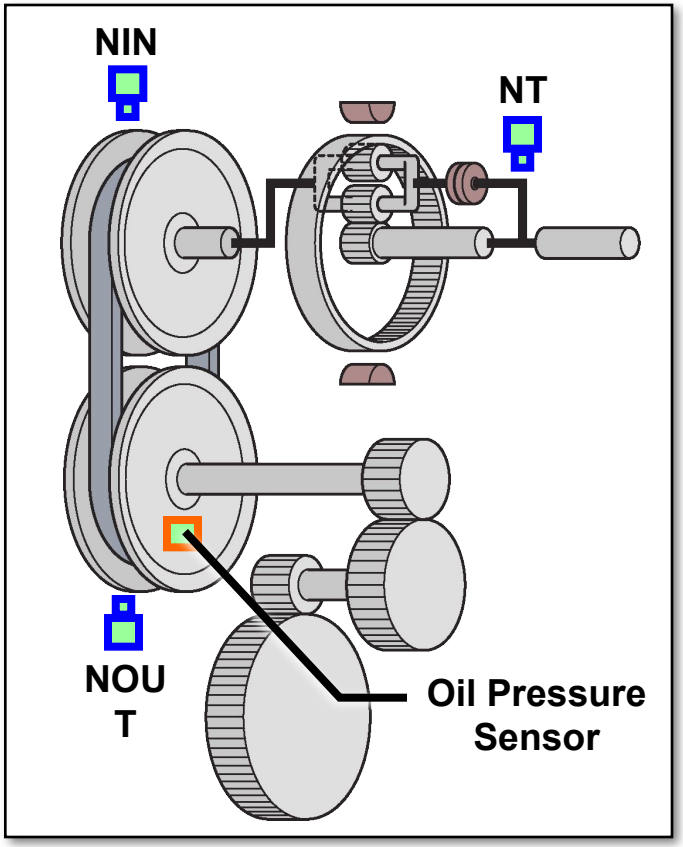


K311 CVT

Speed Sensor and Pressure Sensor

– 3 speed sensors and 1 pressure sensor are used

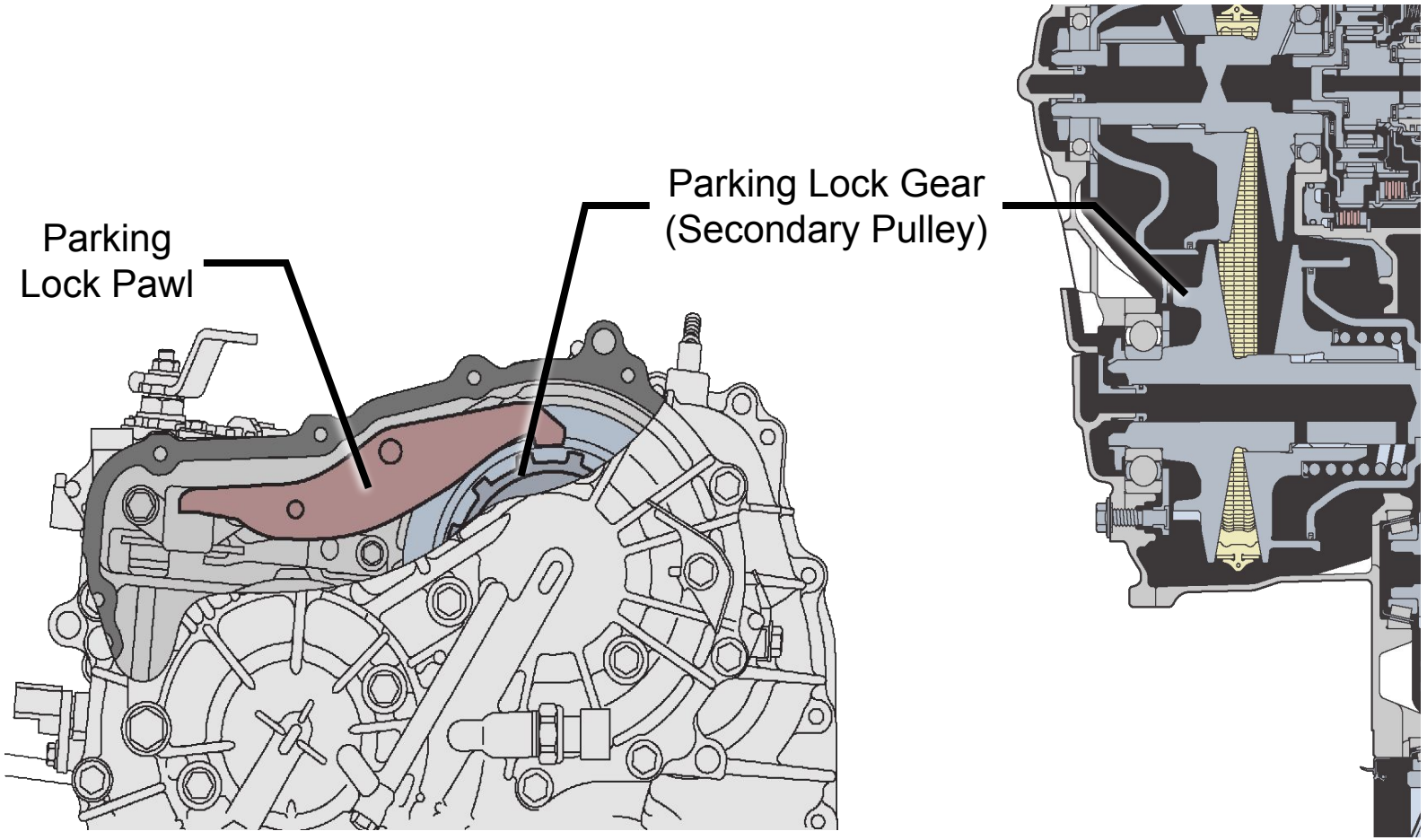




K311 CVT

Parking Lock Mechanism

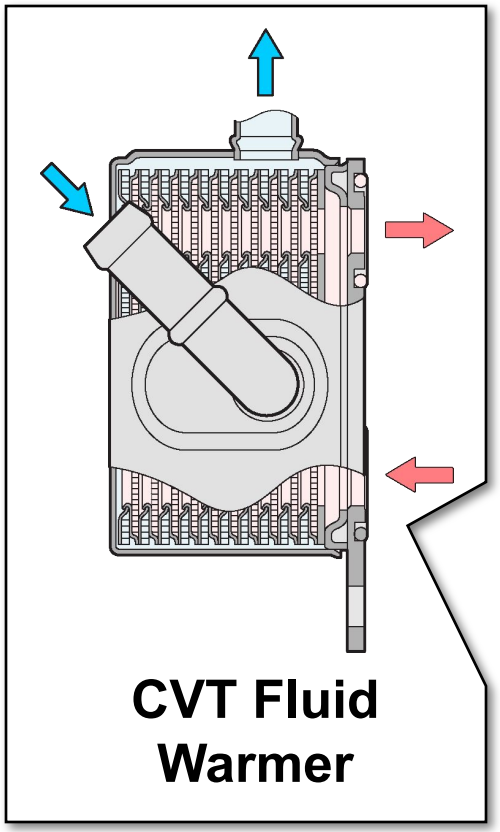
– The parking lock mechanism locks the rotation of the secondary pulley

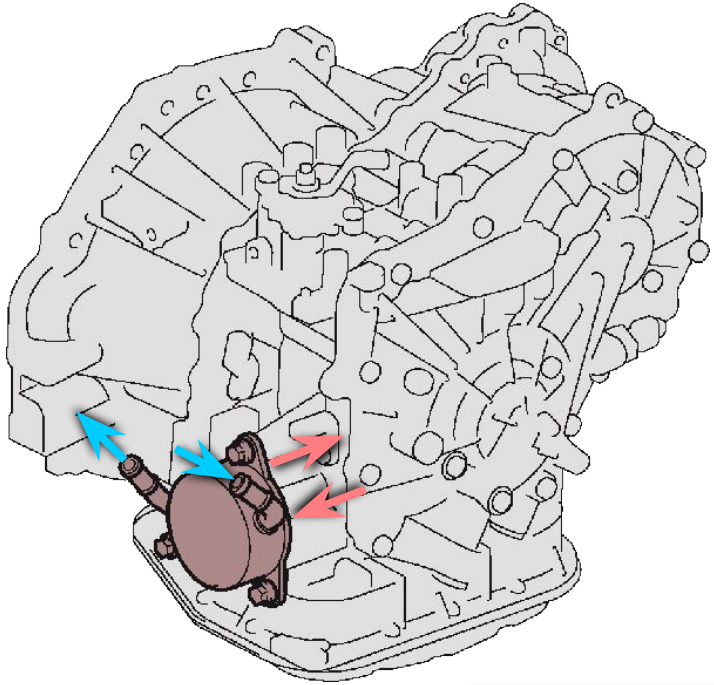


K311 CVT

CVT Fluid Warmer

– Function as fluid warmer after engine start
– Function as fluid cooler during driving





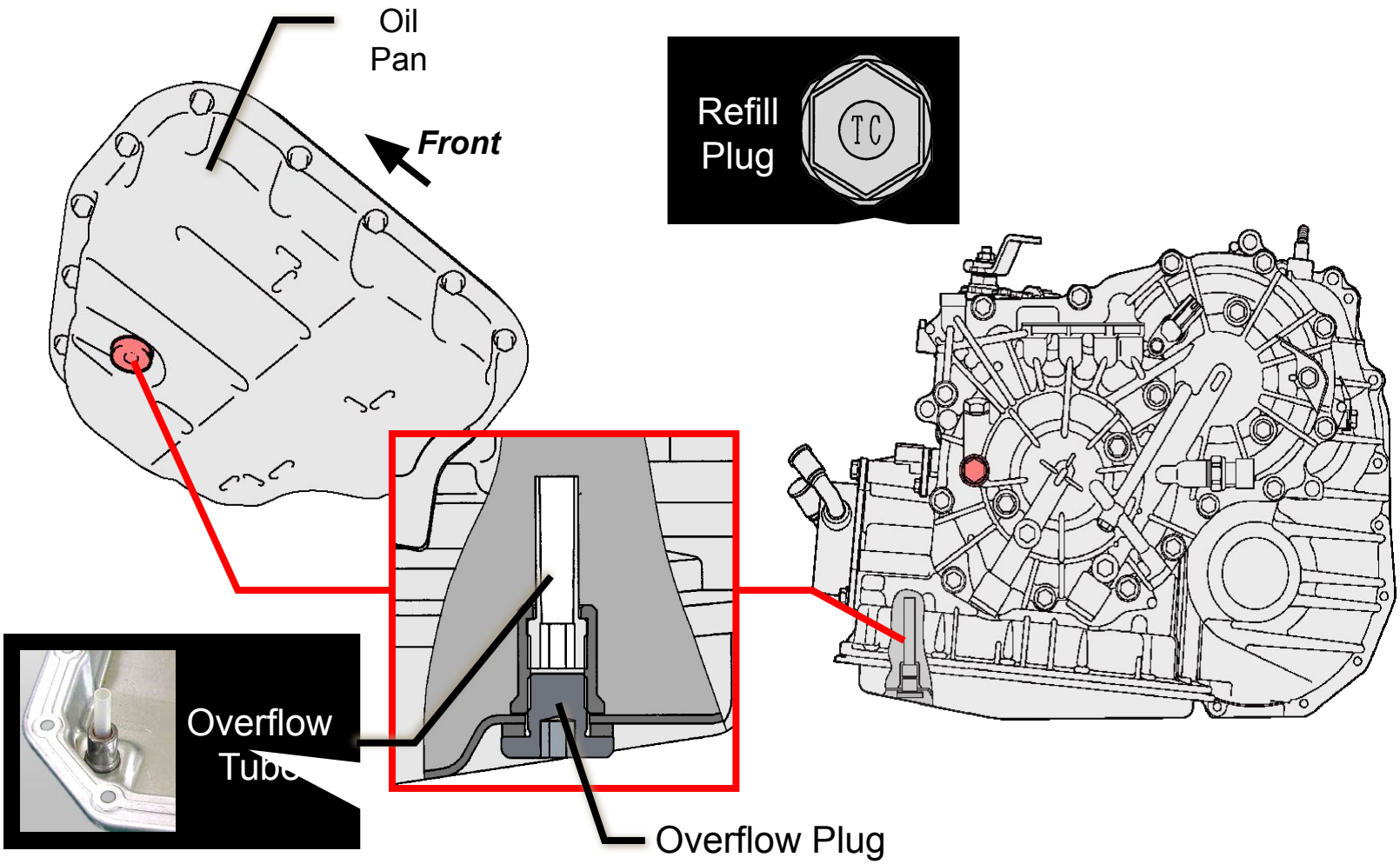
: Engine Coolant Flow
: CVT Fluid Flow

K311 CVT

CVT Fluid

– Use the Toyota Genuine CVT fluid TC

– Overflow type fluid level detection mechanism is used



TOYOTA

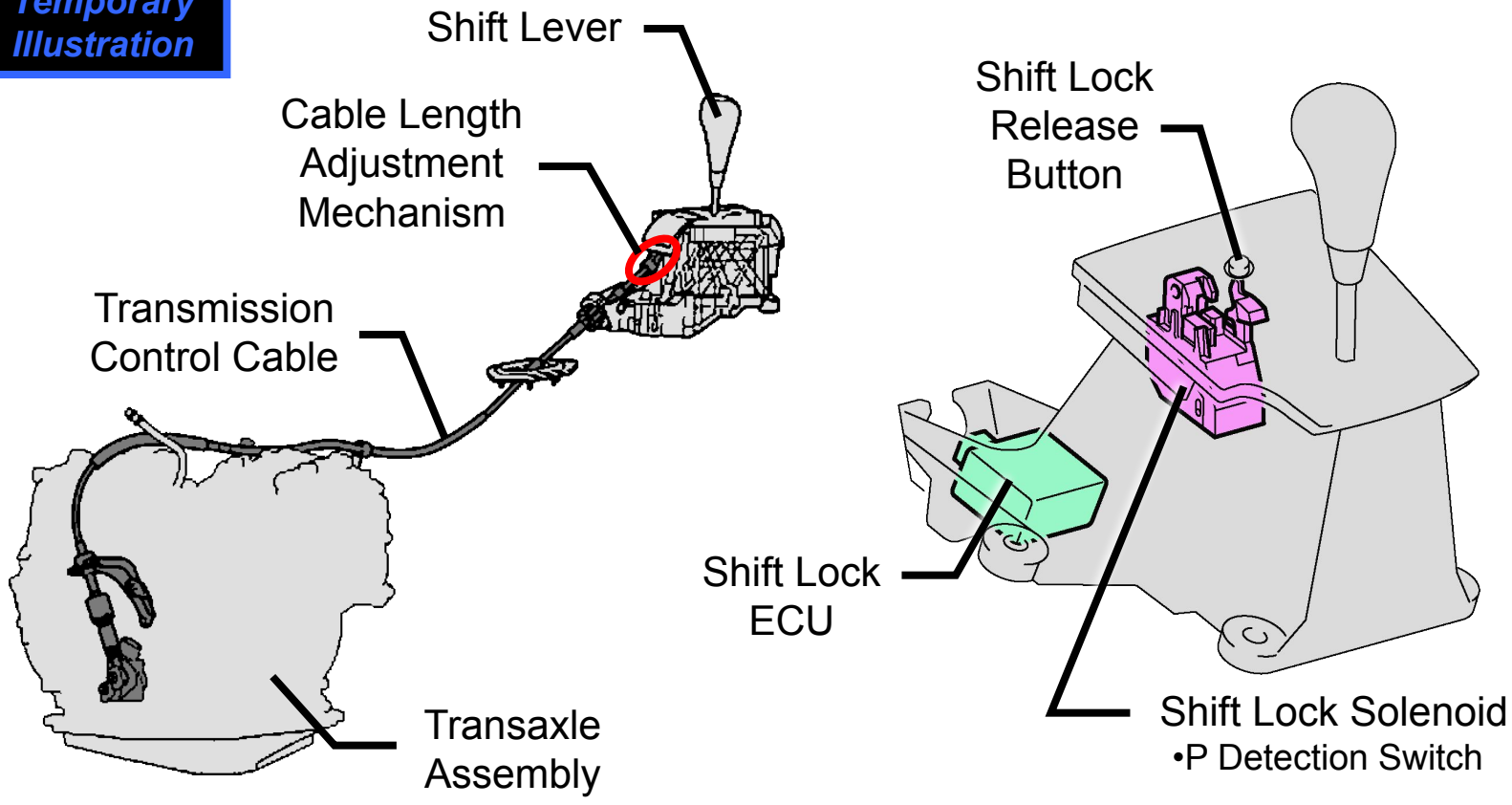
Today
Tomorrow
Toyota

K311 CVT

Shift Lever

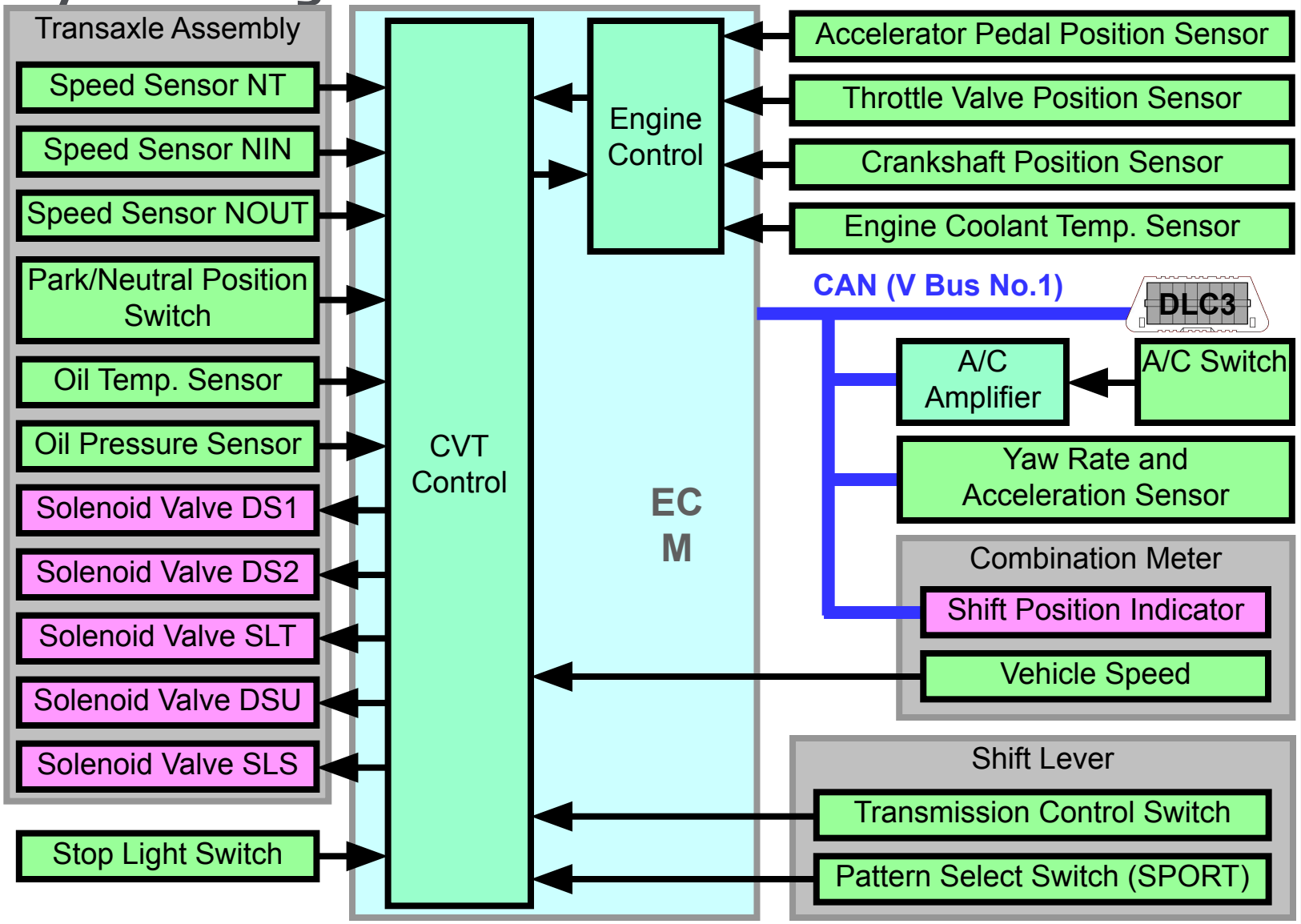
– Cable length adjustment mechanism
– Electrical type shift lock system

Temporary Illustration



K311 CVT

System Diagram



K311 CVT

Electronic Control System

– These controls are basically the same as K111

Engine-CVT Integrated Control
Neutral Control
Acceleration Improvement Control
(Linear Feeling Improvement Control)
Shifting Control in Uphill/Downhill Traveling
Speed Ratio Control
7-speed Sport Sequential Shiftmatic
Lock-up Clutch Control

K311 CVT

Fail-safe [1/2]

– This function minimizes the loss of operation when any abnormality occurs in the following parts

Malfunction Part	Fail-safe Function	CVT Operation
Speed Sensor NIN	**Calculate primary pulley speed (NIN) from turbine speed (NT)**	**Normal**
Speed Sensor NOUT	**Calculate secondary pulley speed (NOUT) from wheel speed (vehicle speed sensor)**	**Normal**
Speed Sensor NT	**Calculate turbine speed (NT) from primary pulley speed (NIN)**	**Normal**
Solenoid Valve DS1	**Current to the solenoid valve DS1 is cut off**	**Speed ratio is lower than the normal**
Solenoid Valve DS2	**Current to the solenoid valve DS2 is cut off**	**Speed ratio is higher than the normal**

K311 CVT

Fail-safe [2/2]

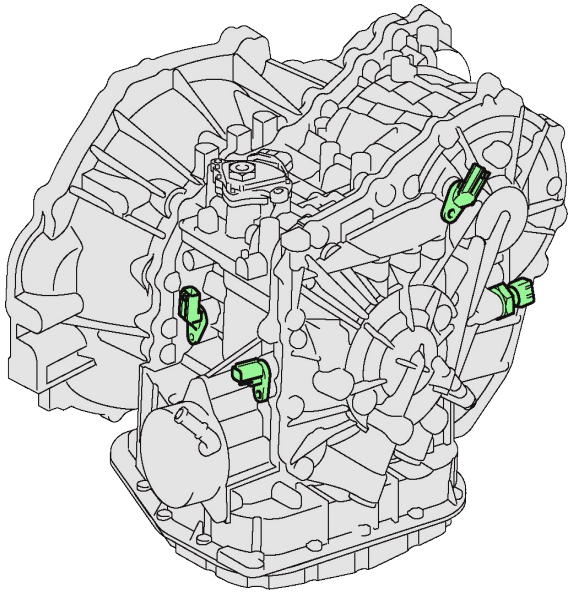
– This function minimizes the loss of operation when any abnormality occurs in the following parts

Malfunction Part	Fail-safe Function	CVT Operation
Solenoid Valve DSU	**Current to the solenoid valve DSU is cut off**	**Lock-up clutch control is released**
Solenoid Valve SLT	**Current to the solenoid valve SLT is cut off**	**The line pressure becomes equal to the maximum oil pressure**
Solenoid Valve SLS	**Current to the solenoid valve SLS is cut off**	**•The belt clamping pressure is maintained by the line pressure •Speed ratio is fixed to specified ratio**
Oil Temperature Sensor	**Fix the temperature**	**Normal**
Yaw rate & Acceleration Sensor	**-**	**Neutral control is canceled**

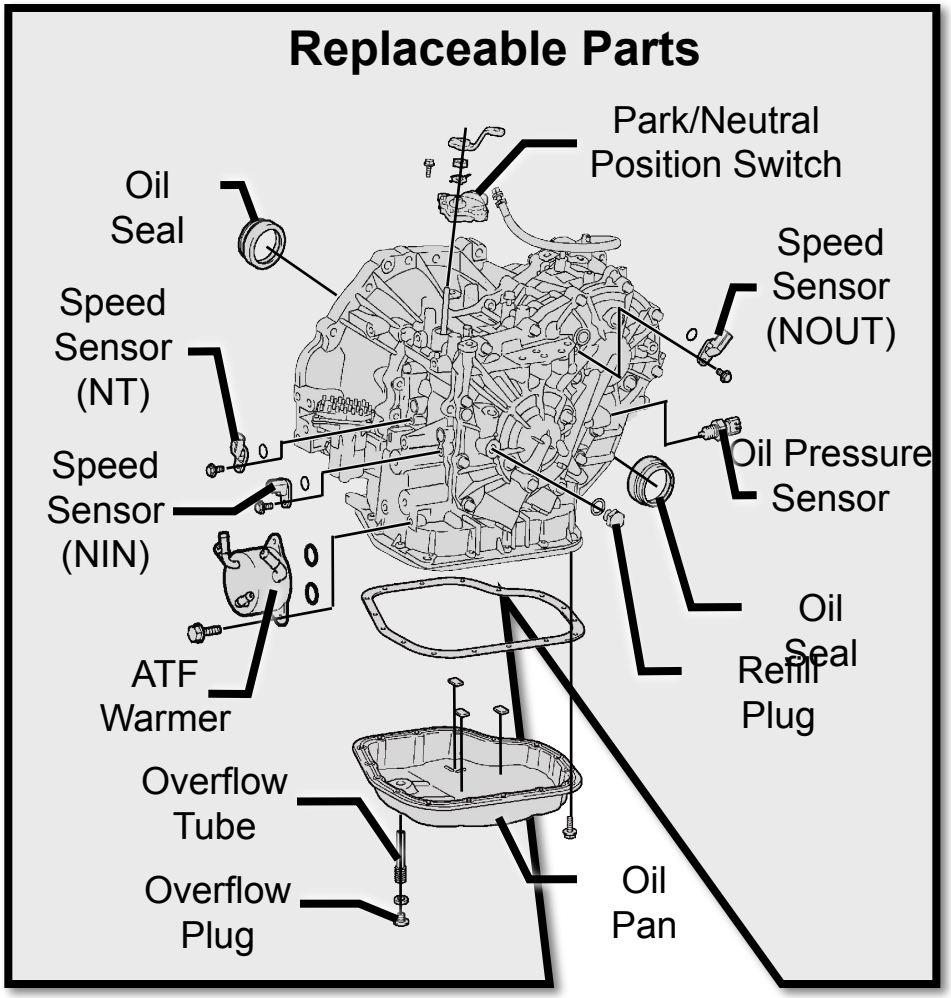
Service Point (K311 CVT)

Replacement

– Transaxle assembly is an assembly replacement parts
(Do not disassembly the transaxle assembly)



Transaxle Assembly (Assembly Replacement)

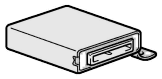


Service Point (K311 CVT)

Initialization and Calibration

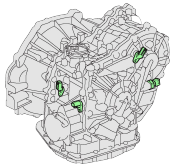
– After replacing the following parts, perform the initialization and calibration

Replacement



ECM

Oil Pressure Sensor



Transaxle Assembly

Yaw Rate and Acceleration Sensor

Initialization

CVT Calibrated Value Initialization

Calibration

Yaw Rate and Acceleration Sensor Zero Point Calibration

CVT Oil Pressure Calibration

Brake

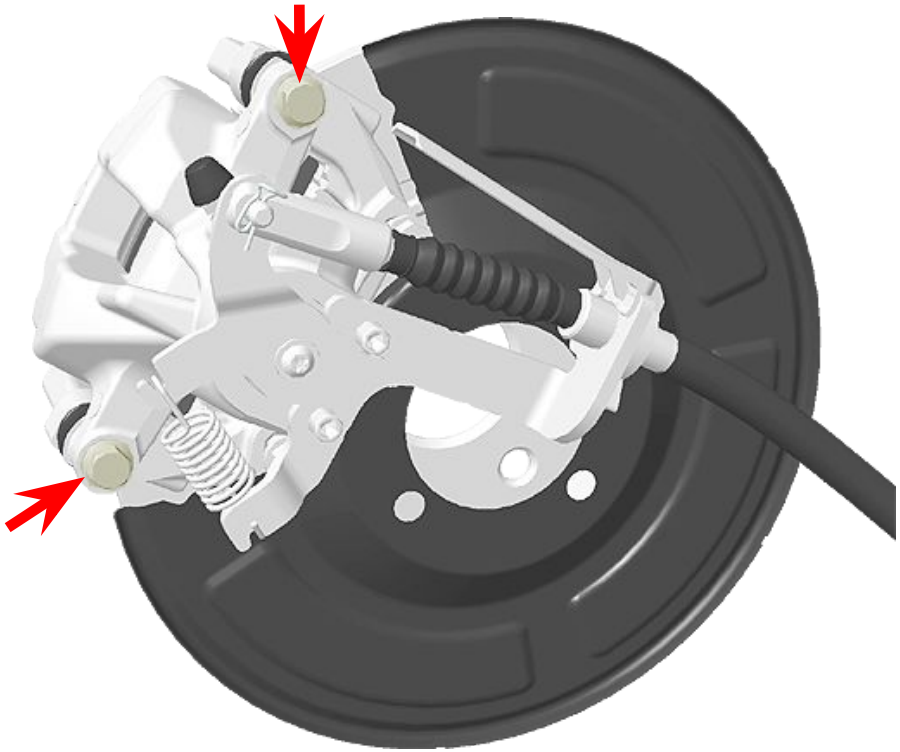
Subtitle

Brake

Rear Brake

– Use the socket wrench (13 mm) to remove or install the 2 bolts for the disc brake cylinder assembly

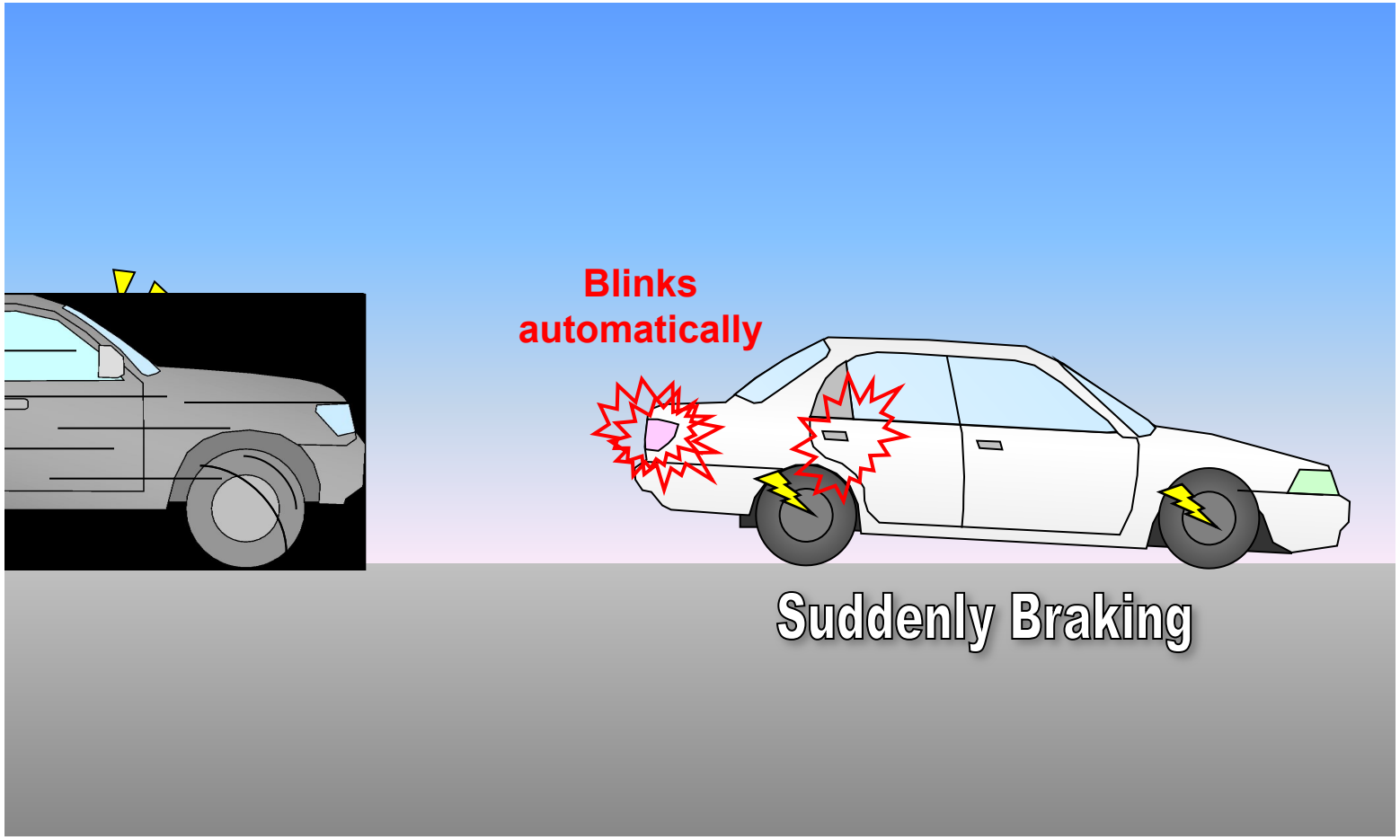
[Recommended Tool]
09011-1C540:
Socket Wrench (13 mm)



Brake

Emergency Brake Signal

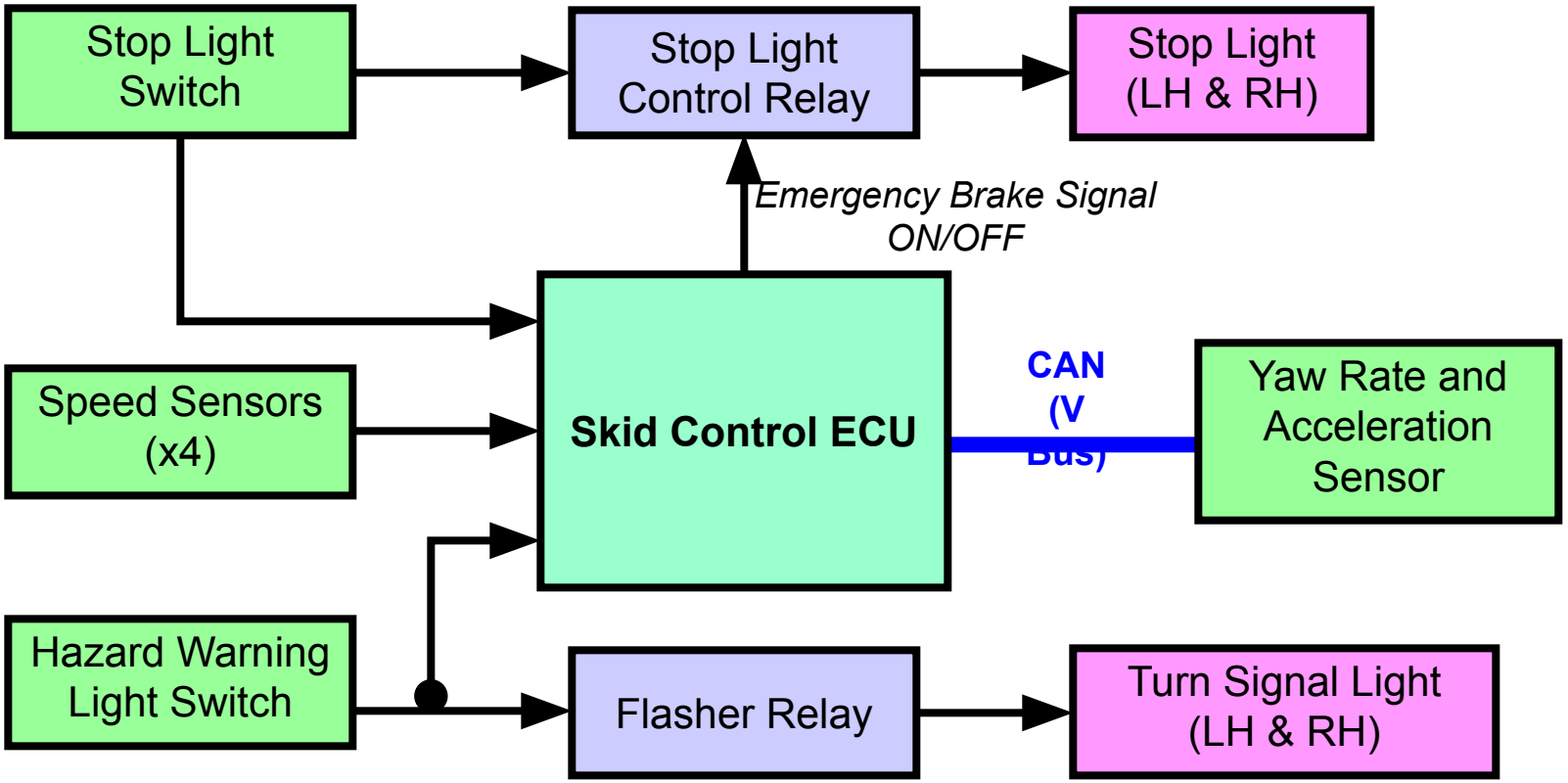
– This function blinks the stop light at sudden braking to reduce the risk of rear-end collision



Brake

Emergency Brake Signal

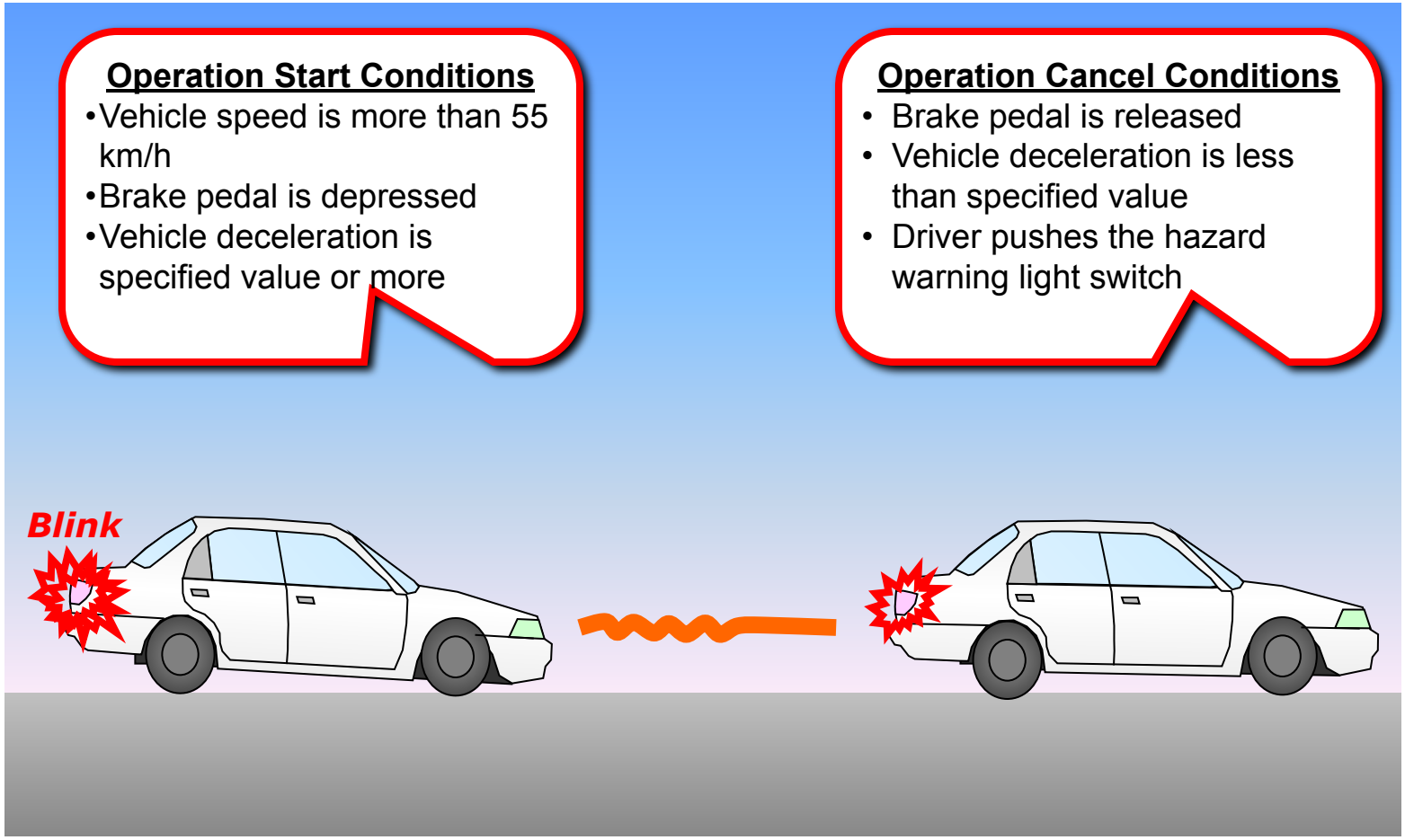
– System Diagram



Brake

Emergency Brake Signal

– Operation Condition



Brake Control System

Subtitle

Brake Control System

Spiral Cable with Steering Angle Sensor

– Absolute angle type steering angle sensor is used

Sensor Type		Absolute Angle Type	Relative Angle Type (Conventional Models)
Rotation Angle Sensor		MREs	←
Neutral Position		Position constantly memorized	Position when battery terminal is connected
After battery terminal is reconnected	—	No need initialization	Required initialization
	Remove steering wheel, etc.	No need initialization / Required initialization*	Required initialization
Supply Part		with Spiral Cable	Steering angle sensor only

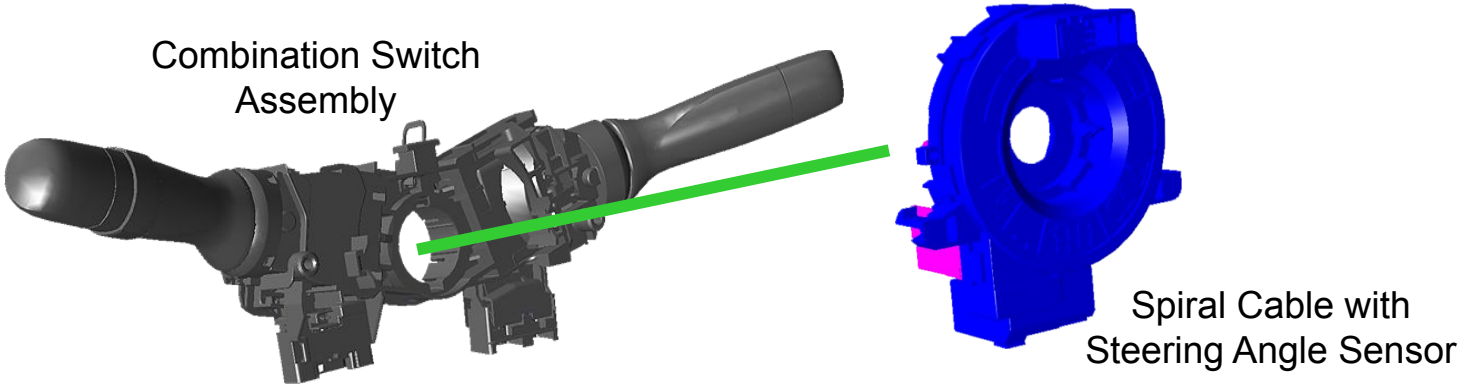
*: When the gap more than specified value arises between memorized steering position and the steering position after the battery reconnected.

Service Point (Brake Control System)

Spiral Cable with Steering Angle Sensor

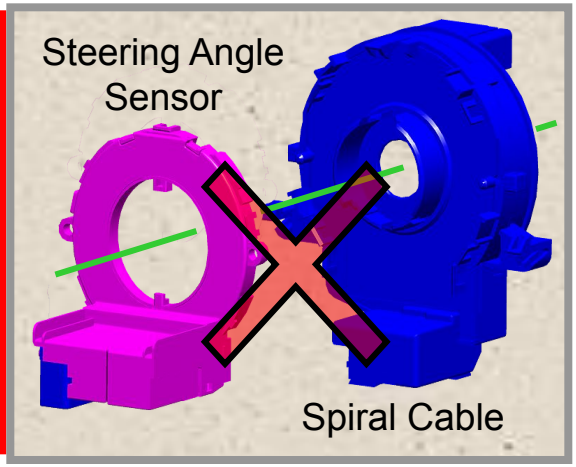
– Notice for steering angle sensor

— Do not remove steering sensor from spiral cable



Notice:

- Do not replace the spiral cable with the battery connected and the engine switch ON
- Do not rotate the spiral cable with the battery connected and the engine switch ON
- Ensure that the steering wheel is installed and aligned straight when inspecting the steering sensor
- Do not remove the steering sensor from the spiral cable
- If disassembly, replace new one



NOTE: Steering sensor is supplied with spiral cable.

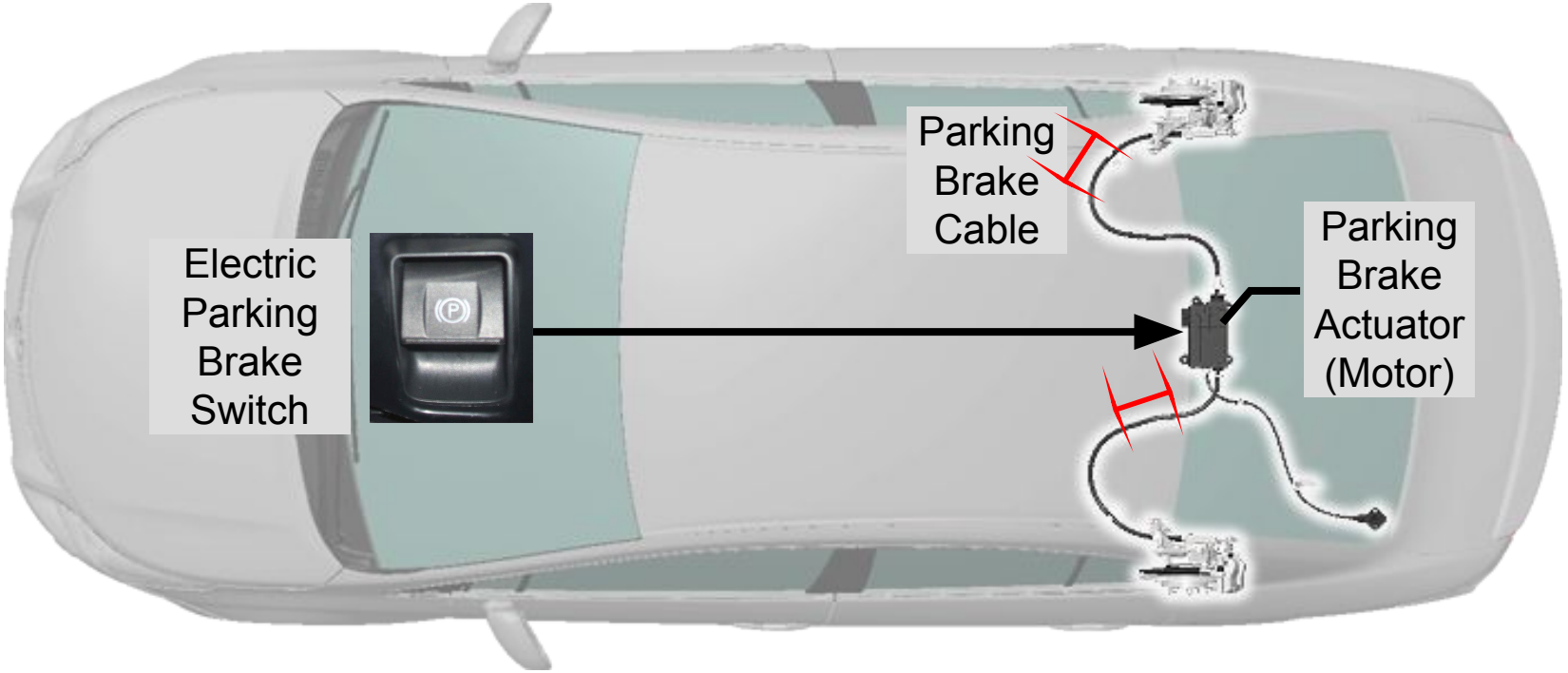
Electric Parking Brake

Subtitle

Electric Parking Brake

General

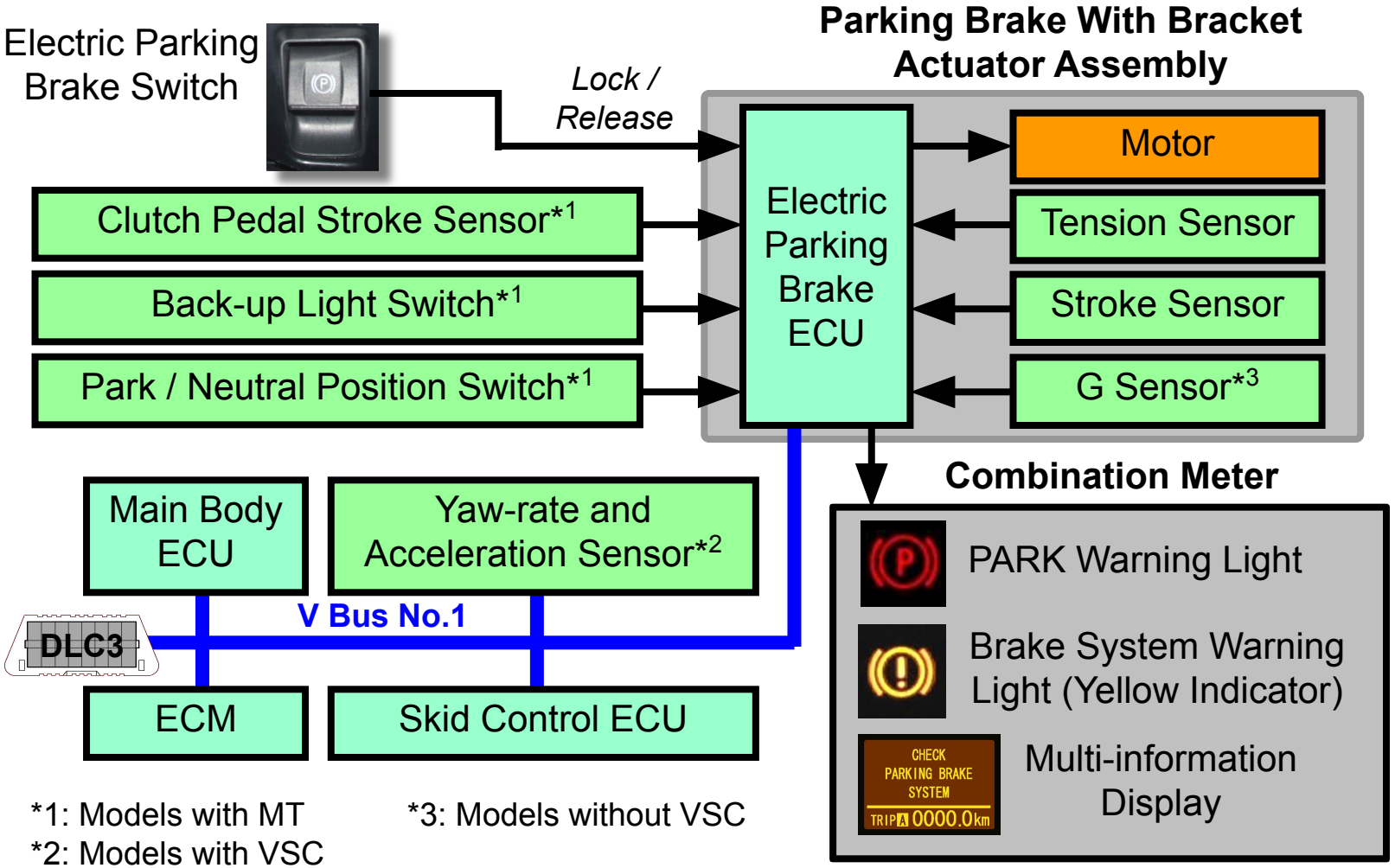
– This system controls the parking brake cable by electrically loosening and locking
the cable with the actuator to minimizes the driver's effort



Electric Parking Brake

System Diagram

– Electric parking brake ECU in the parking brake with bracket actuator assembly controls this system

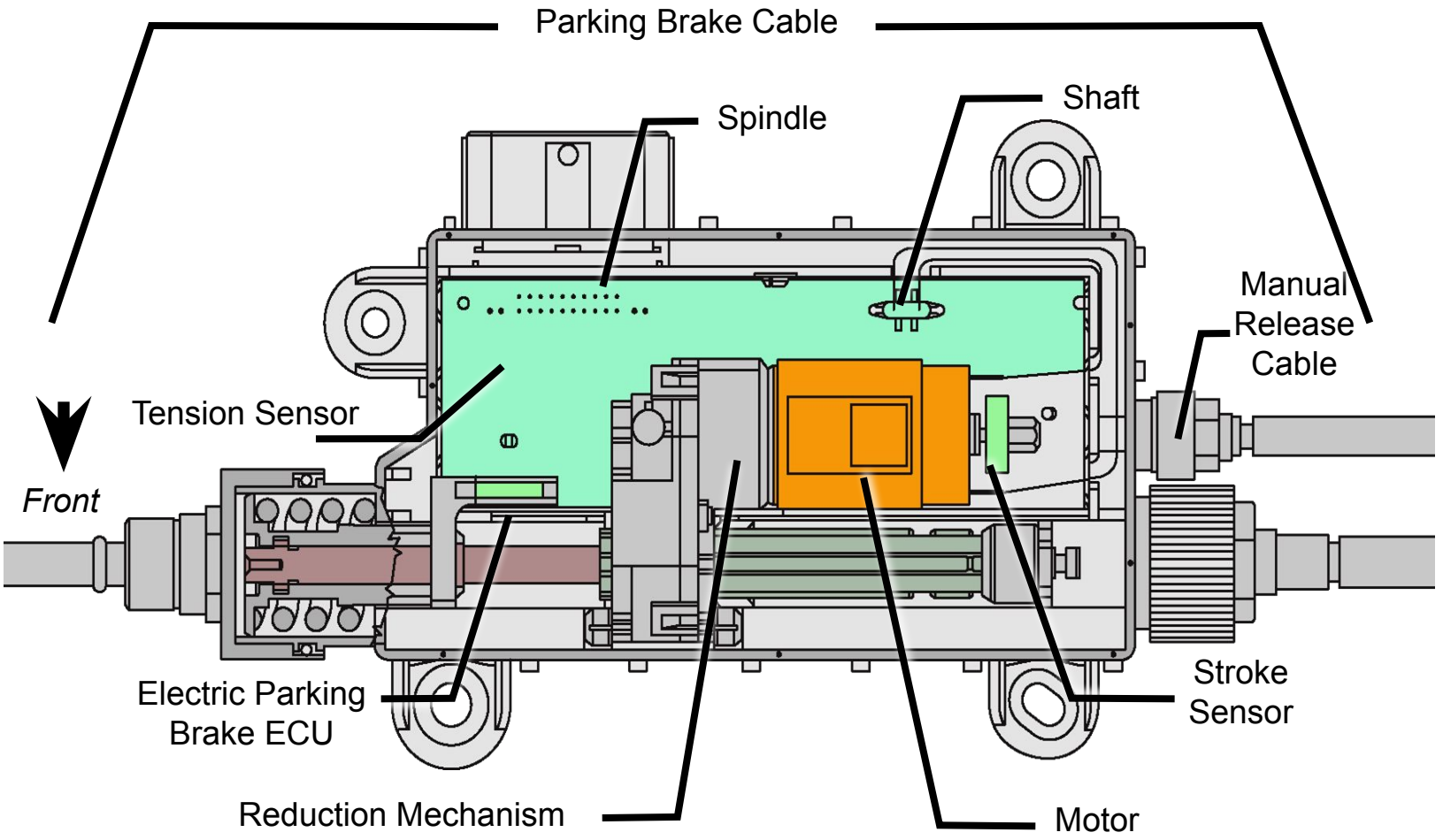


*1: Models with MT
*2: Models with VSC
*3: Models without VSC

Electric Parking Brake

Parking Brake With Bracket Actuator Assembly

– Electric parking brake ECU is included in the actuator assembly



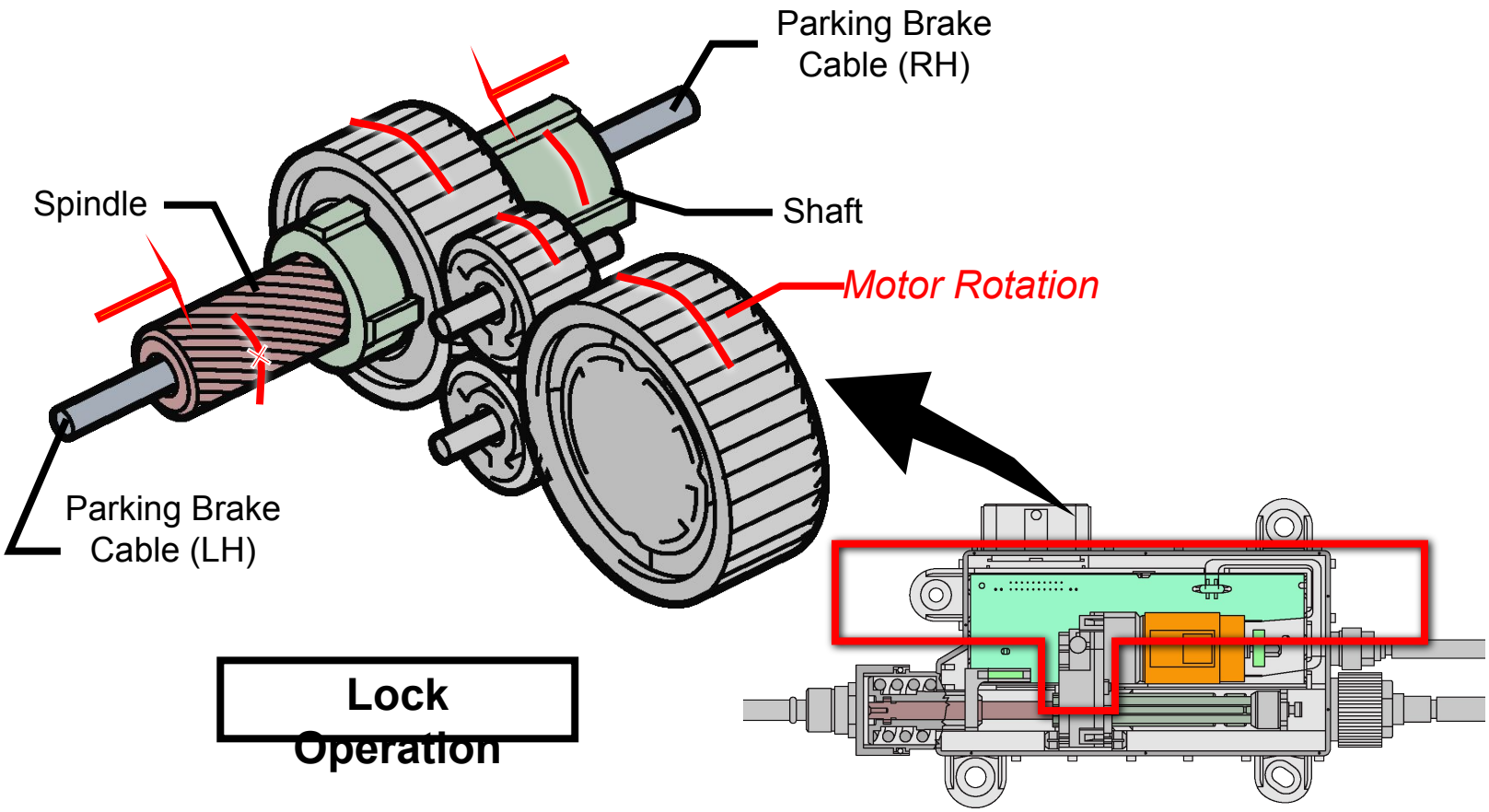
TOYOTA

Today Tomorrow Toyota

Electric Parking Brake

Parking Brake With Bracket Actuator Assembly

– Lock / release mechanism



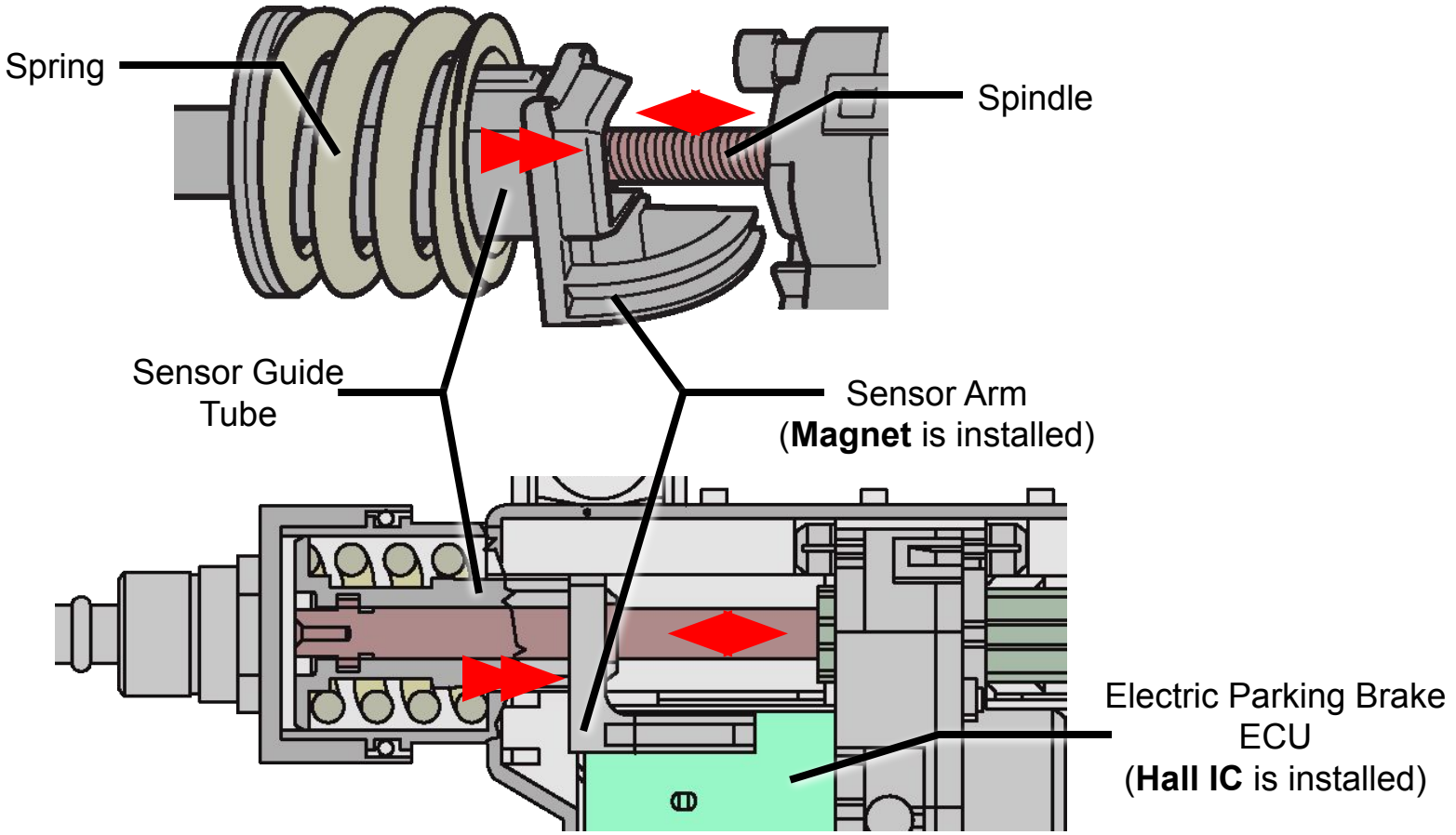
TOYOTA

Today Tomorrow Toyota

Electric Parking Brake

Parking Brake With Bracket Actuator Assembly

– Tension sensor detects the sensor arm position as the cable tension

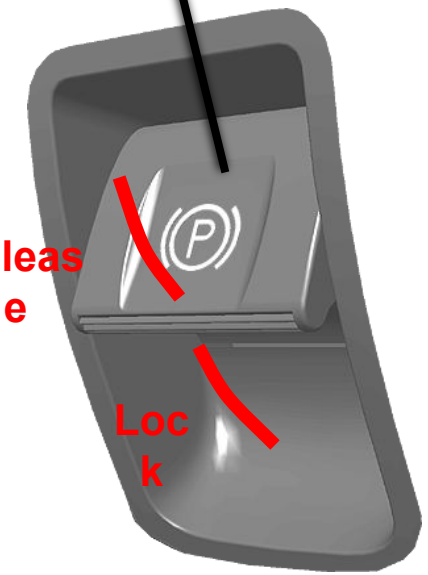


Electric Parking Brake

Electric Parking Brake Switch

– To lock or release the parking brake, push or pull this switch

Electric Parking Brake Switch



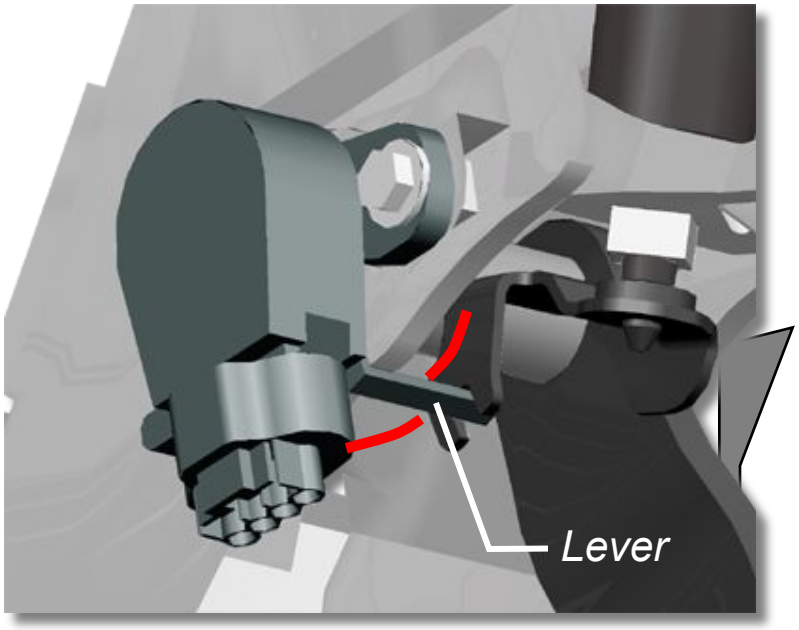
TOYOTA

Today
Tomorrow
Toyota

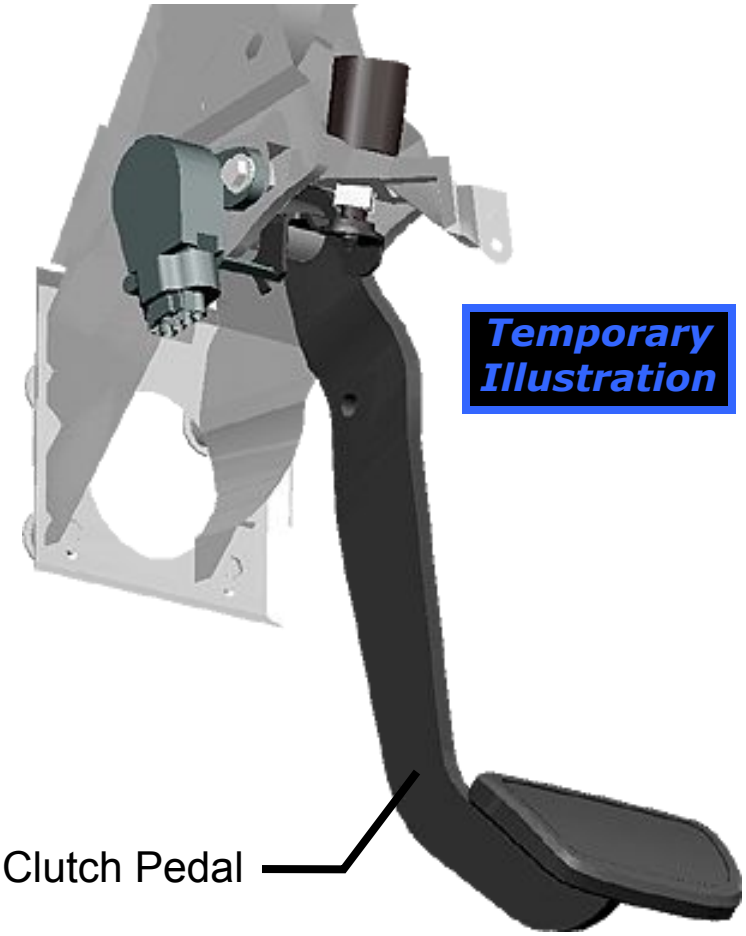
Electric Parking Brake

Clutch Pedal Stroke Sensor

– The non-contact type clutch pedal stroke sensor uses a Hall IC



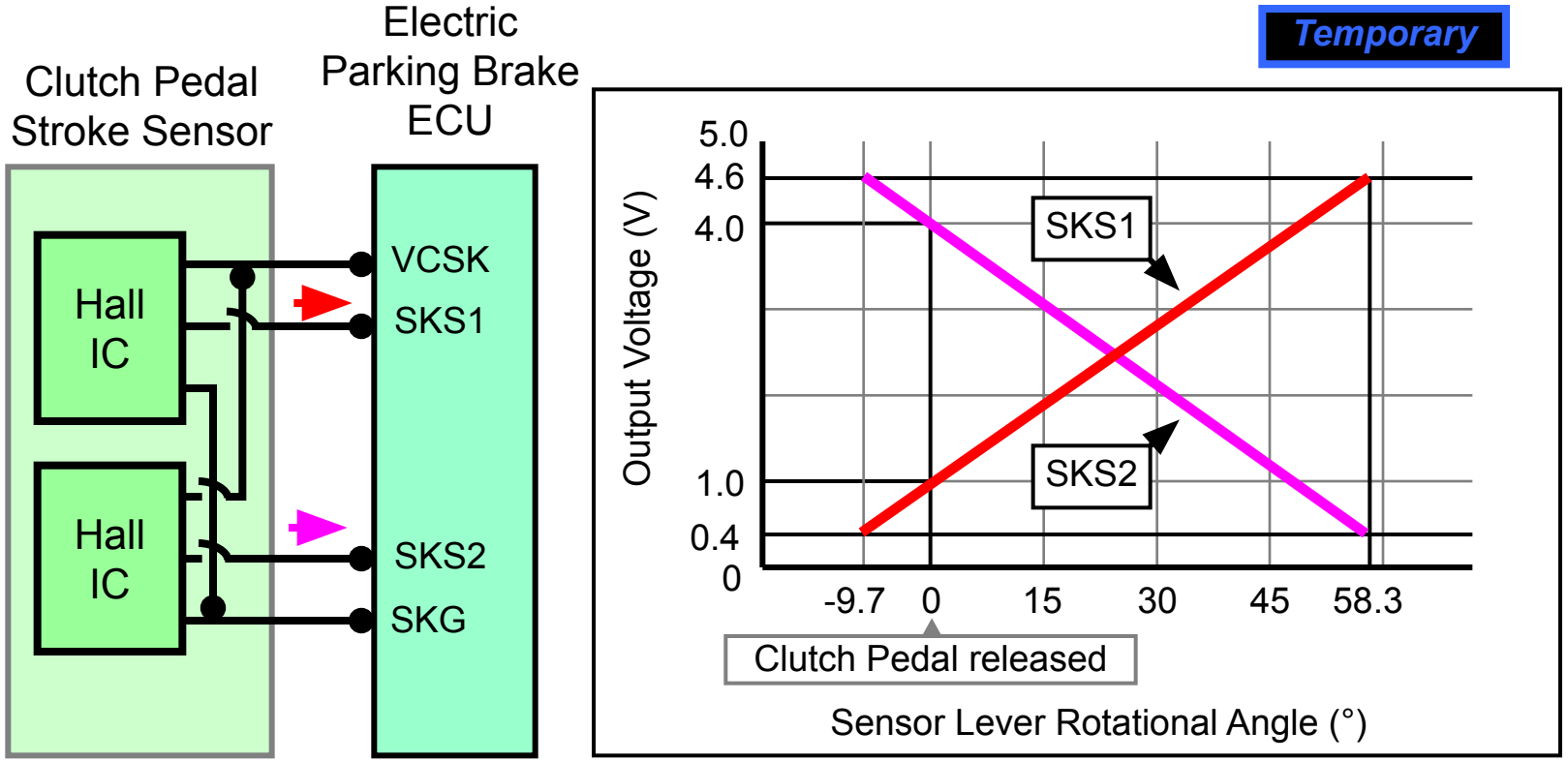
Clutch Pedal Stroke Sensor



Electric Parking Brake

Clutch Pedal Stroke Sensor

– There are two (main, sub) output signals

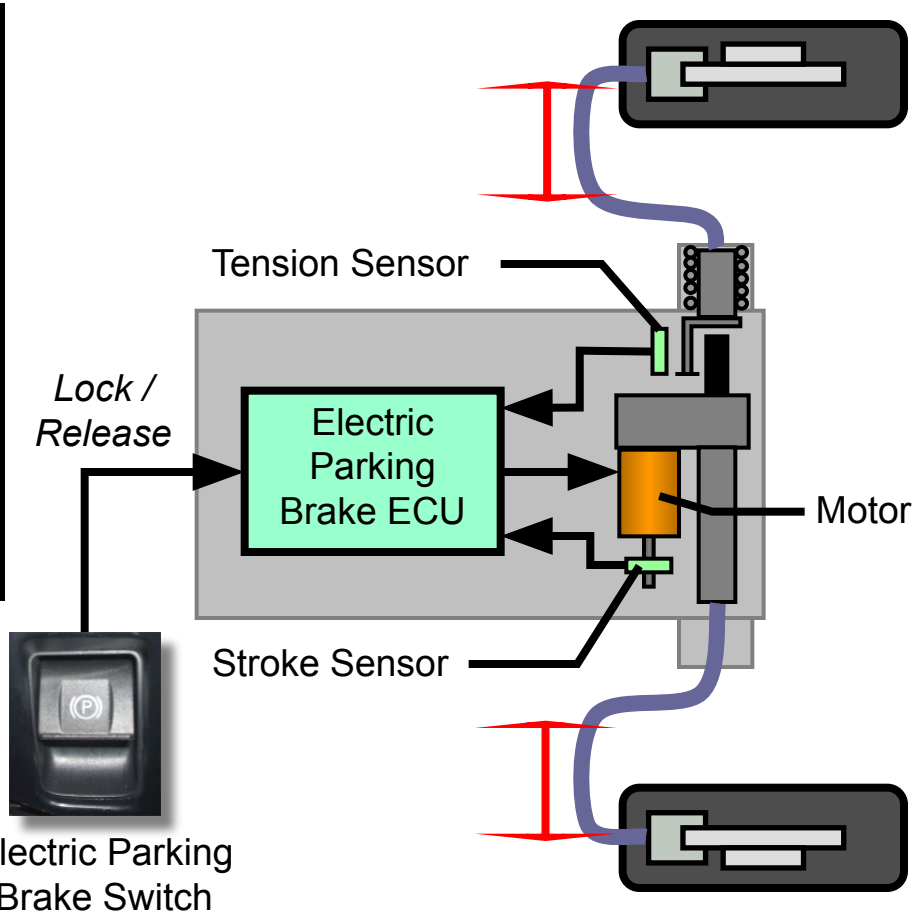


Electric Parking Brake

Manual Operation

– The parking brake is applied or released by operating the electric parking brake switch

Vehicle Condition	Switch Operation	Parking Brake
Stopped	Push	Lock
	Pull	Release
Driving	Push and Hold	Lock
	Release	Release



Electric Parking Brake

Automatic Operation

– 3 automatic operations

1. At Driving

When the parking brake is locked and the vehicle speed is 20 km/h (12 mph) or more, the parking brake releases automatically

2. At Start-off [MT Only]

When the DAR (Drive Away Release) function operates, the parking brake releases automatically

3. At Malfunction [MT Only]

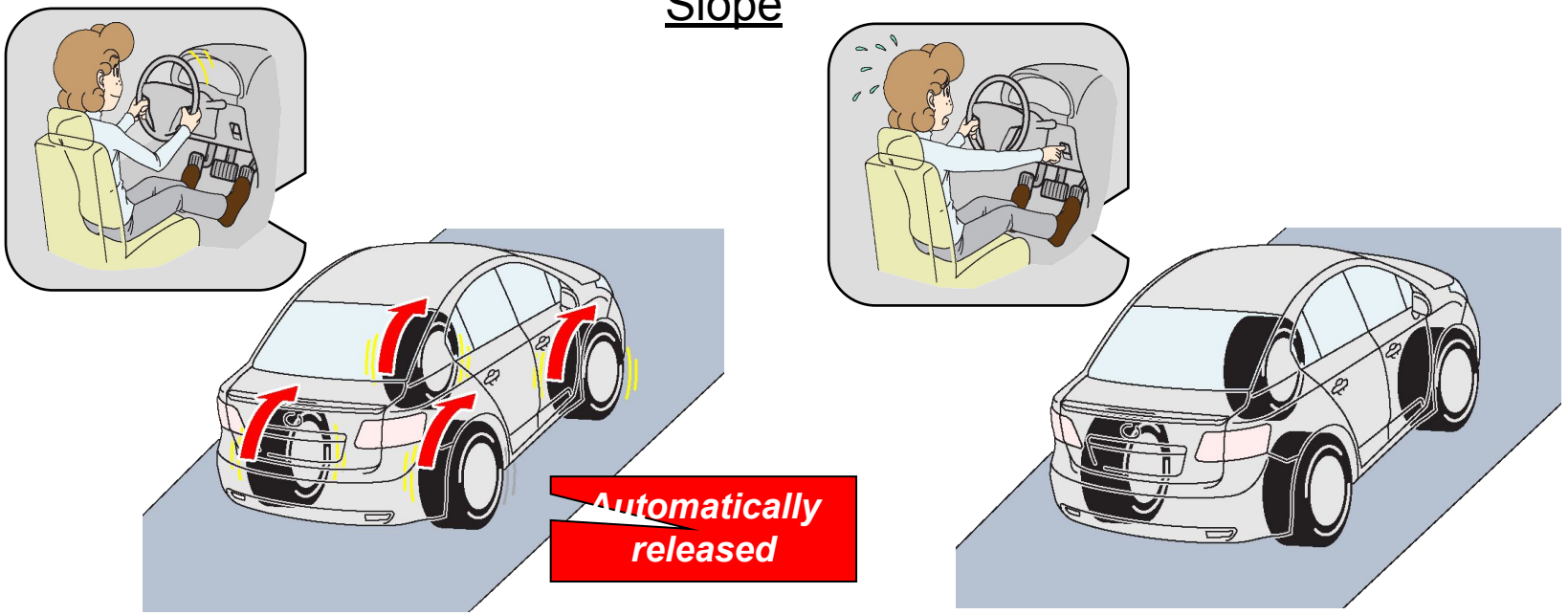
If a malfunction in the electric parking brake switch occurs, the parking brake locks together with the ignition switch being off
***NOTE**: In this case, the parking brake is released through the operation of the DAR function*

Electric Parking Brake

Drive Away Release (DAR) Function [MT Only]

– This function detects the intention of the driver to start driving and automatically releases the parking brake. It assists the driver when start-off on a slope

Example: Start-off on a Slope



With DAR Function

Easy

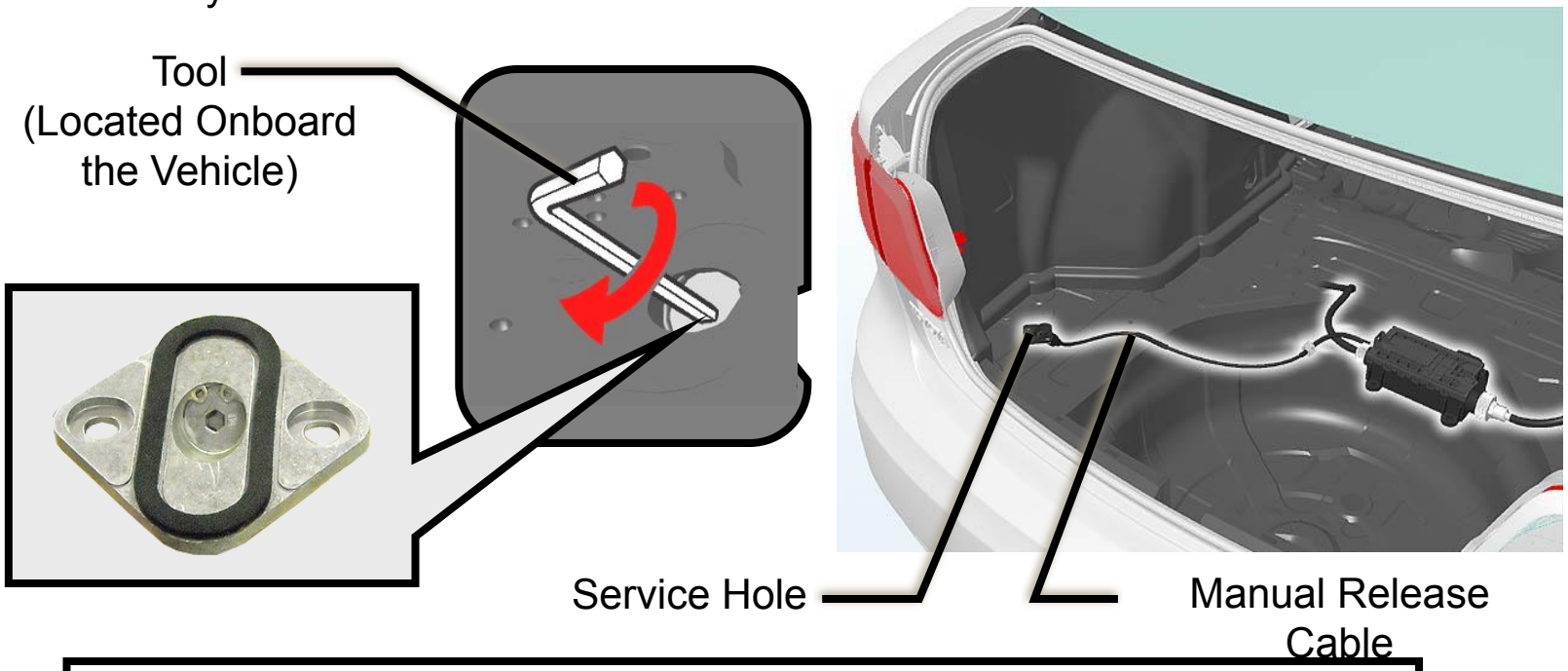
Without DAR Function

Difficult

Electric Parking Brake

Manual Release

– If the electric parking brake system fails, the user can release the parking brake manually



<u>Manual Release Procedure</u>

1. Remove or break the seal covering the service hole
2. Insert the tool and rotate it in clockwise until clutch sounds

   ***<u>NOTE</u>**: Rotate approx. 600 times. (For approx. 20 minutes)*

   If rotate the tool in counterclockwise, it spins free
3. Remove the tool, and cover the service hole with new seal

Service Point (Electric Parking Brake)

Initialization and Calibration

– Perform initialization and calibration when the following cases

Replac
e
Electric Parking Brake ECU
(Parking Brake With Bracket
Actuator Assembly)

Yaw Rate and
Acceleration Sensor

Remove and
Install
Clutch Pedal Stroke Sensor
(MT Only)

Clear Zero Point of Yaw
Rate Sensor and Clutch
Pedal Stroke Sensor

Yaw Rate Sensor and Clutch
Pedal Stroke Sensor Zero Point
Calibration

Service Point (Electric Parking Brake)

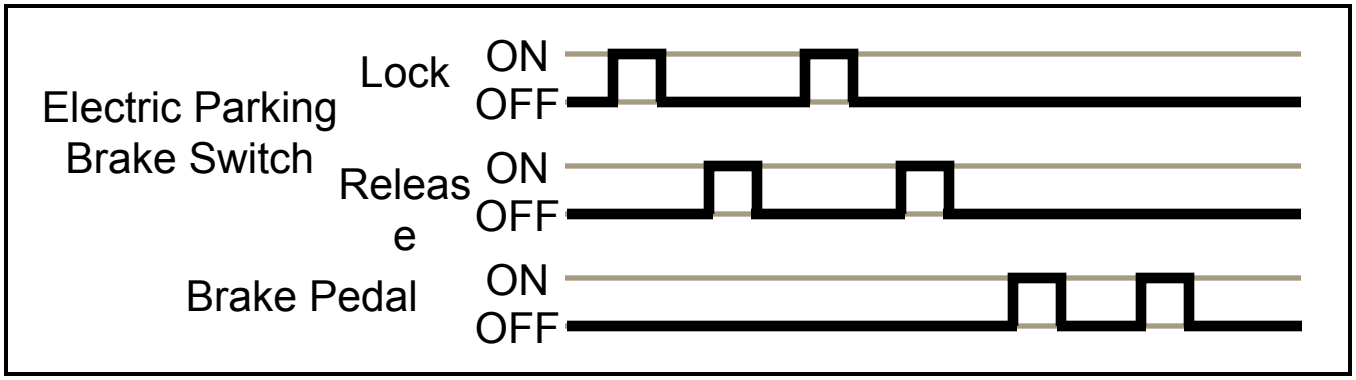
Initialization and Calibration

– Clear Zero Point of Yaw Rate Sensor and Clutch Pedal Stroke Sensor

•When using intelligent tester, perform the “Reset Memory”

•When not using the Intelligent Tester, perform following operation

1. Turn the ignition switch OFF
2. Connect the terminals 13 (TC) and CG (4) of the DLC3
3. Turn the ignition switch ON
4. Perform following procedure within 8 sec.



5. Disconnect the terminals 13 (TC) and 4 (CG) of the DLC3 (With the ignition switch ON)
6. Check that the brake system warning light (yellow indicator) turn on

Service Point (Electric Parking Brake)

Initialization and Calibration

– Yaw Rate Sensor and Clutch Pedal Stroke Sensor Zero Point Calibration

1. Turn the ignition switch ON
2. Check that the brake system warning light (yellow indicator) turn on

3. Enter the Test Mode

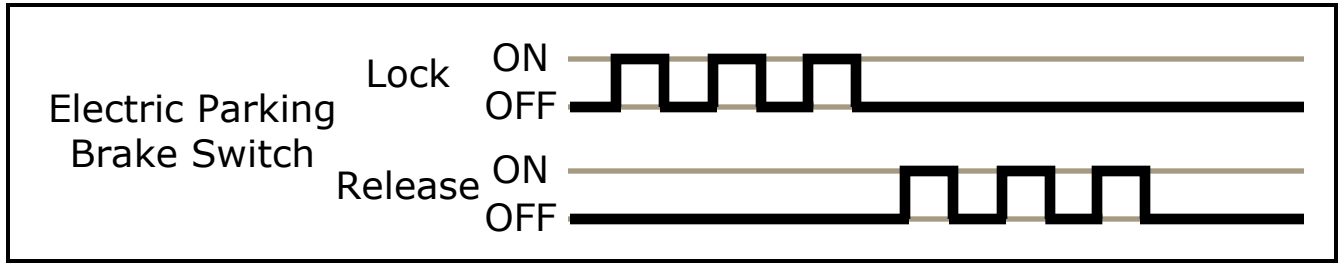
NOTICE: Do not depress the brake pedal during Test Mode

(a). Turn the ignition switch OFF

(b). Connect the terminals 12 (TS) and CG (4) of the DLC3

(c). Turn the ignition switch ON

(d). Perform following procedure within 8 sec.



(e). Check that the PARK warning light blinks (4Hz) in Test Mode

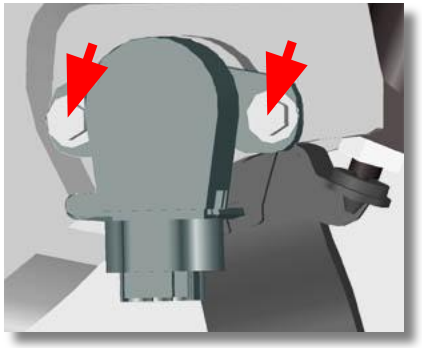
4. Check that the brake system warning light (yellow indicator) turn off

Service Point (Brake Control System)

Clutch Pedal Stroke Sensor

– Installation (new)

1. Tighten the 2 bolts



2. Depress the clutch pedal mighty to break the set pin of the sensor lever

   NOTICE: Take out the set pin from the vehicle

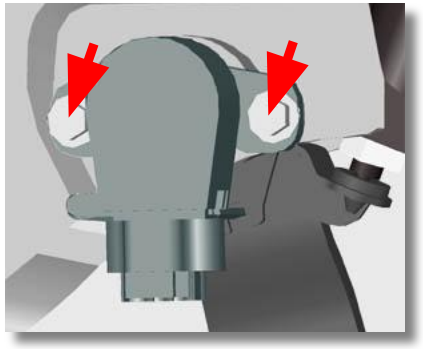
3. Perform the initialization and calibration

Service Point (Brake Control System)

Brake Pedal Stroke Sensor

– Installation (reuse)

1. Temporary tighten the 2 bolts

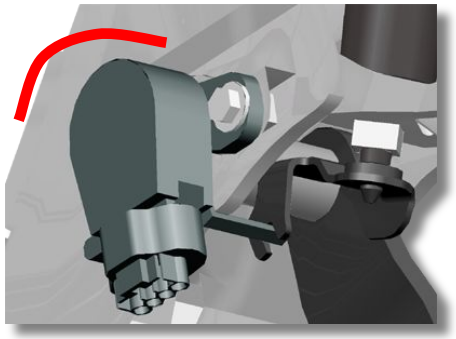


2. Using intelligent tester II, adjust the sensor position

Standard Value
(SKS1 Output Voltage):

0.8 - 1.2 V

Temporary Value



3. Tighten the 2 bolts
4. Perform the initialization and calibration

Electric Parking Brake

Full Release Mode

– Use full release mode when replace the rear brake pad

Activation of Full Release Mode

- When using Intelligent Tester
  Perform the Active Test “Full Release Mode Activation”
- When not using Intelligent Tester
  1. Enter the Test Mode (Connect TS and CG of DLC3 and operate the electric parking brake switch: pull 3 times → push 3 times)
  2. Pull the electric parking brake switch to the release position for 5 sec.

Full Release Mode

- Parking cable is full released
- Lock operation is prohibited

NOTE: This mode continues even if the ignition switch is turned off

De-activation of Full Release Mode

- When using Intelligent Tester
  Perform the Active Test “Full Release Mode De-Activation”
- When not using Intelligent Tester
  Turn the ignition switch to ON and push the electric parking brake switch to the lock position for 5 sec.

Electric Parking Brake

DTC [1/2]

DTC	Detection Item
C1201/64	Engine Control System Malfunction
C1203/73	Vehicle Information Mismatch
C1207/65	Malfunction in Neutral / Reverse Position Switch
C1245/62	Deceleration Sensor
C1336/74	Zero Point Calibration of G Sensor Undone
C1346/75	Zero Point Calibration of Clutch Stroke Sensor Undone
C13A2/22	Engine / Power Switch Malfunction
C13A3/31	Open or Short in Lock Switch Circuit
C13A5/41	Electric Current of Motor
C13A6/42	Open or Short in Circuit of Motor
C13A7/43	Actuator Malfunction
C13A8/44	Tension Sensor Malfunction
C13A9/61	Brake Control System Malfunction
C13AA/71	Electric Parking Brake High Temperature
C13AB/33	Lock Switch Circuit
C13AE/72	System information not Received

Electric Parking Brake

DTC [2/2]

DTC	Detection Item
C13B0/19	ECU Malfunction
C13B1/63	Stroke Sensor Malfunction
C13B2/45	Rotary Sensor Malfunction
U0073/51	Control Module Communication Bus OFF
U0100/53	Lost Communication with ECM/PCM
U0124/55	Lost Communication with Lateral Acceleration Sensor Module
U0129/52	Lost Communication with Brake System Control Module

Electric Parking Brake

Active Test

Function	Item (Tester Display)	Test Details	Control Range
Warning Light	EPB Warning Light	Brake system warning light (Yellow indicator)	ON or OFF
	PKB Light	PARK warning light	ON or OFF
Multi-information Display	Not Avail Display	"PARKING BRAKE INOPERABLE" display	ON or OFF
	Check Display	"CHECK PARKING BRAKE SYSTEM" display	ON or OFF
	Overheat Display	"PARKING BRAKE OVERHEAT" display	ON or OFF
	Release Display	"RELEASE PARKING BRAKE" display	ON or OFF
Parking Brake Actuator	PKB Release1	Electric parking brake release	ON (Release)
	PKB Lock1	Electric parking brake lock	ON (Lock)
	Full Release Mode De-Activation	Parking brake cable full release mode de-activation	-

Steering

Subtitle

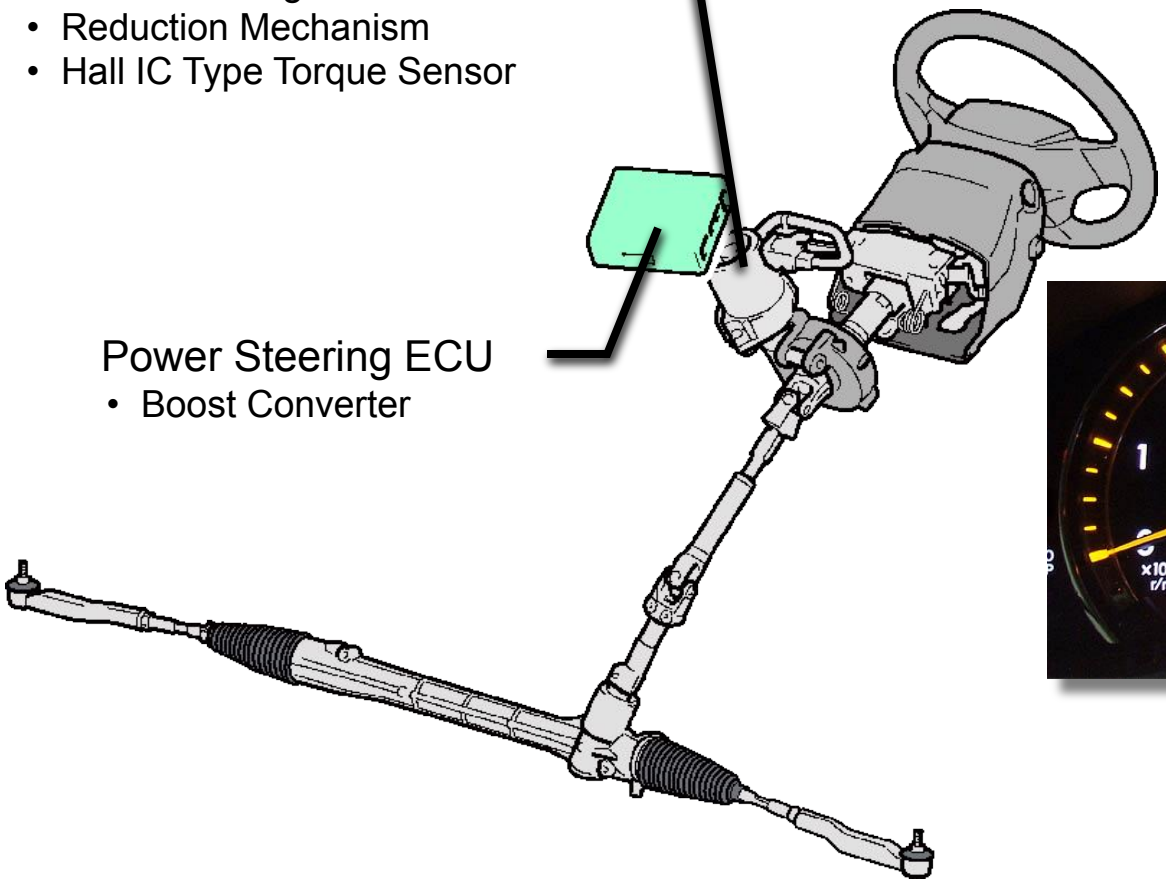
Steering

EPS (Electric Power Steering)

– Motor drives the column shaft

Steering Column Assembly
- 3-phase Brushless Motor with Rotational Angle Sensor
- Reduction Mechanism
- Hall IC Type Torque Sensor

Power Steering ECU
- Boost Converter



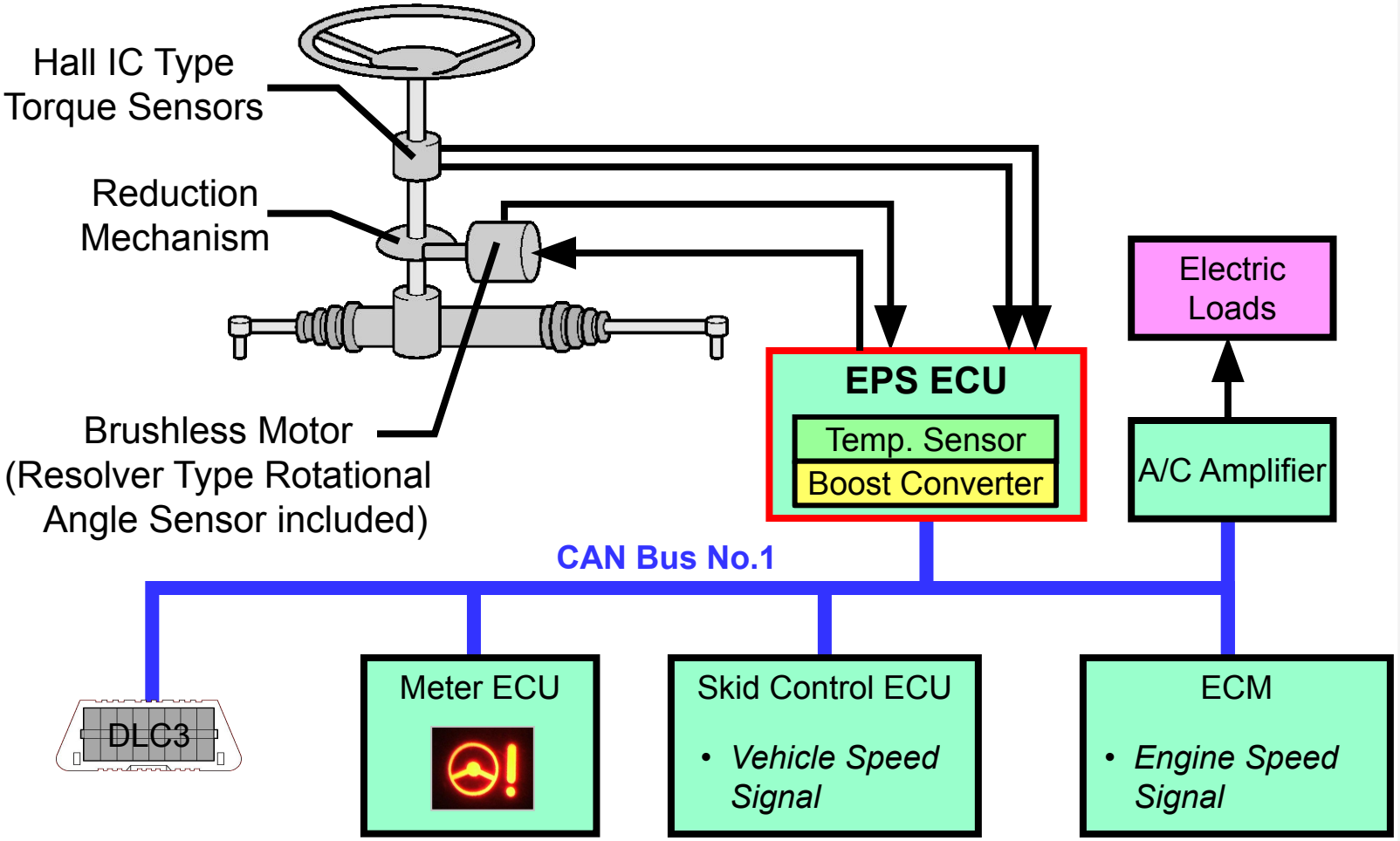
Power Steering Warning Light

TOYOTA

Today Tomorrow Toyota

Steering

System Diagram



Steering

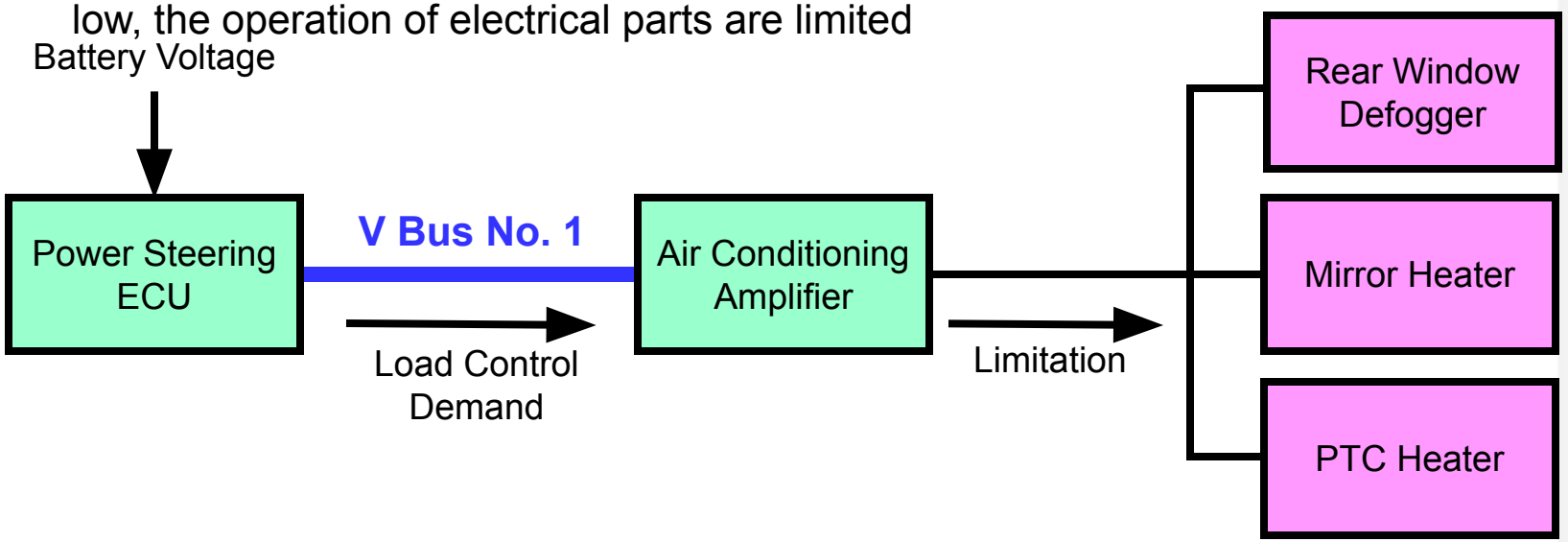
Major Difference From COROLLA / AURIS

Item	New AVENSIS	COROLLA / AURIS
Assist Type	Column Assist Type	←
Power Steering ECU	With Boost Converter	N. A.
Motor	3-phase Brushless Motor	←
Rotation Angle Sensor	Resolver Type	←
Torque Sensor	Hall IC Type	←
Reduction Mechanism	Worm and Wheel Gear	←
Warning Light		
Control	Electric Load Control	N. A.

Steering

Electric Load Control

– In order to prevent reduction of EPS assist force, when battery voltage becomes low, the operation of electrical parts are limited



Control Start Conditions	**Electrical load control starts when both of the following conditions are met** • **Battery voltage is 10 V or less** • **Steering wheel is being turned**
Control Cancellation Conditions	**Electrical load control limits when either of the following conditions is met** • **Steering wheel is not being turned** • **Battery voltage has recovered to more than 12 V**

Thank you