FOREWORD

This manual has been prepared to provide information for the construction, operation and other technical details of SUBARU vehicles.
Read this manual thoroughly and make the most of it to give better service to your customers and improve your knowledge of vehicle maintenance.

All information, illustration and specifications contained in this manual are based on the latest product information available at the time of publication approval.

GENERAL DESCRIPTION
ENGINE (FA24)
DRIVE TRAIN
SUSPENSION SYSTEM
WHEEL & TIRE
BRAKE SYSTEM
STEERING
BODY STRUCTURE
EXTERIOR
INTERIOR TRIM
ENTERTAINMENT
ADVANCED SAFETY SYSTEM
LAN SYSTEM

SUBARU CORPORATION
U9040BE

1 GENERAL DESCRIPTION

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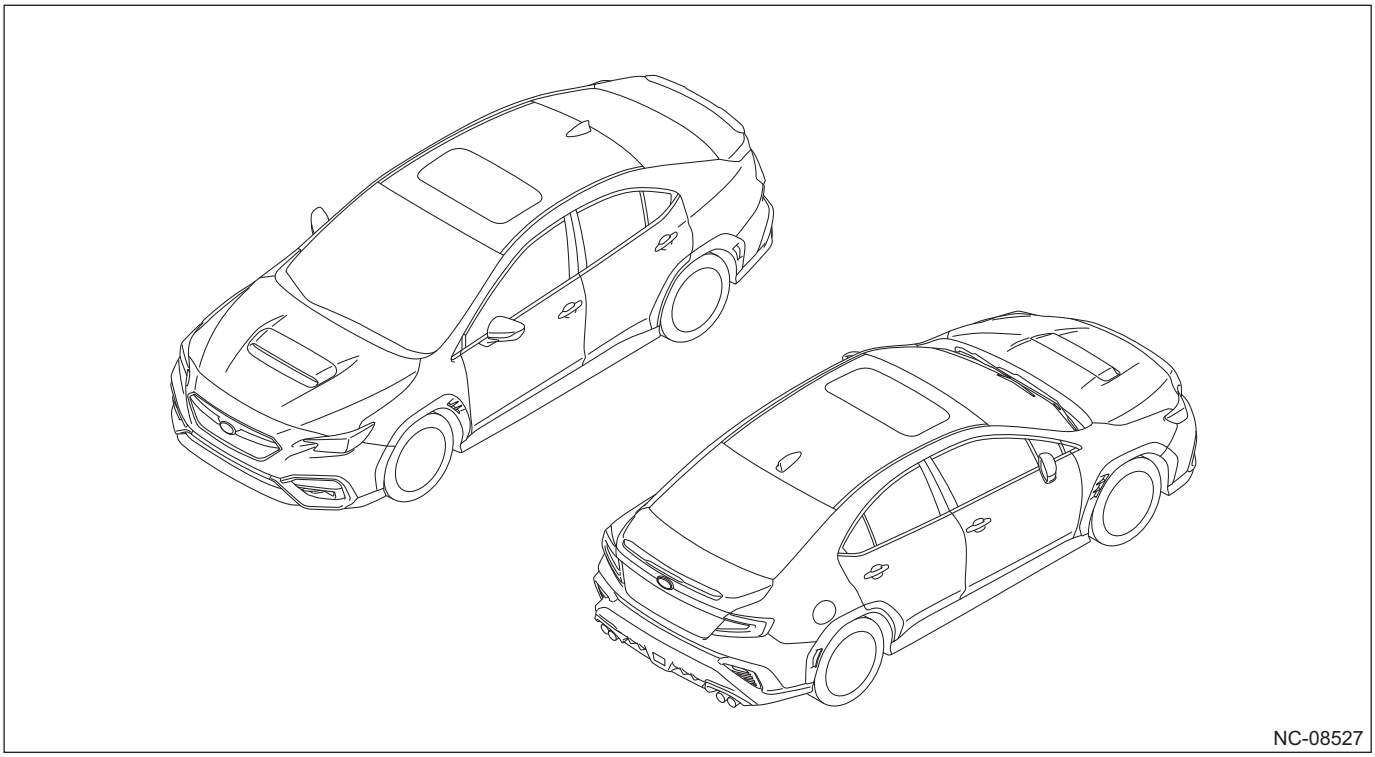
1.1 General Overview

1.1.1 Vehicle Composition List Table

Vehicle shape	Type	Engine	Driving method	Steering wheel position	Destination code	Grade	Transmission
WRX	VB	2.4L DOHC Turbo	AWD	LHD	U4, C0	Base	TY751 (6MT)
					U4	Base EyeSight	TR690 (CVT)
					U4, C0	Premium A	TY751 (6MT)
					U4, C0	Premium B	TY751 (6MT)
					U4, C0	Premium EyeSight	TR690 (CVT)
					U4, C0	Limited	TY751 (6MT)
					U4, C0	Limited EyeSight	TR690 (CVT)
					U4, C0	GT EyeSight	TR690 (CVT)

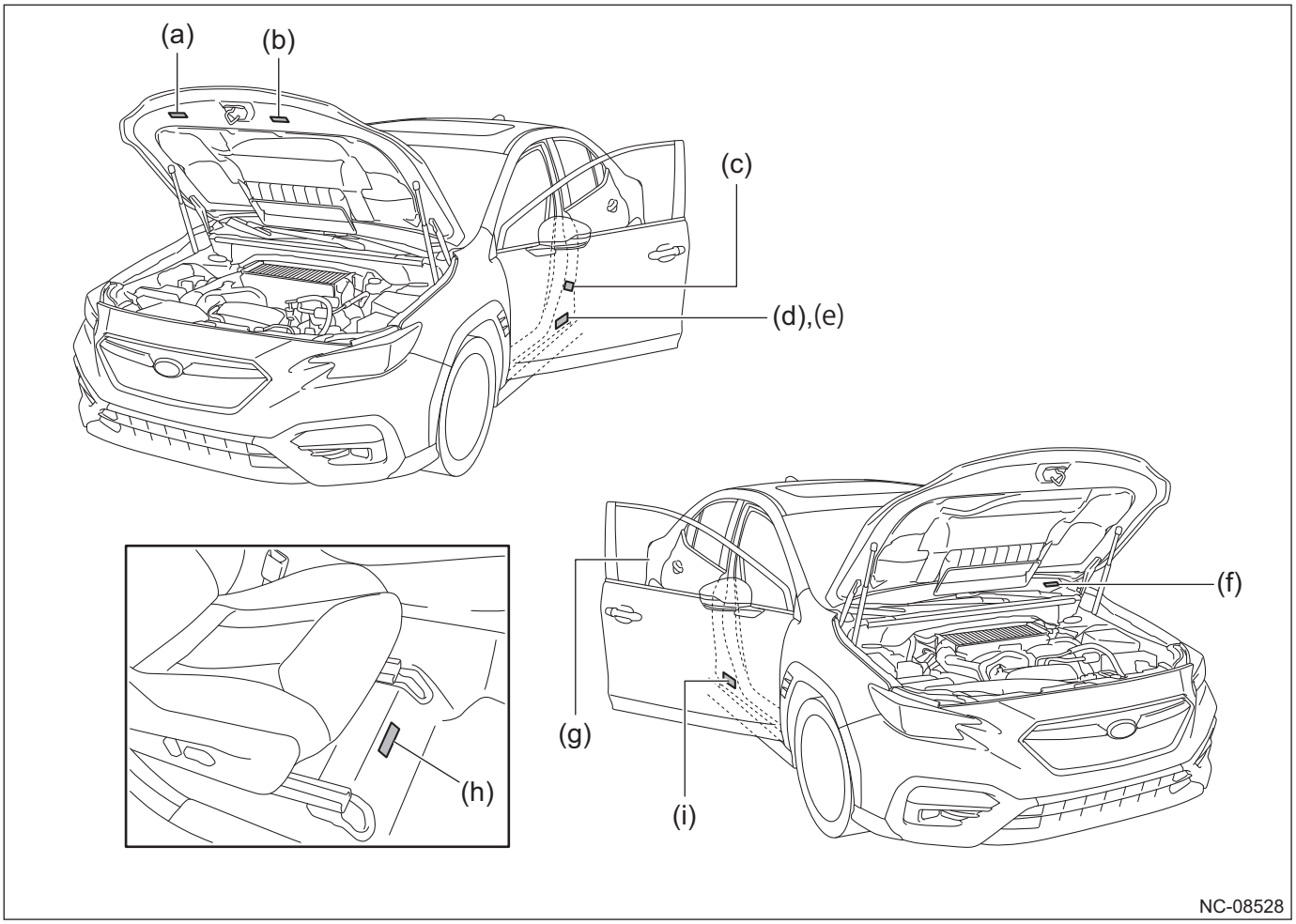
1.1.2 Vehicle Appearance and Dimension



Overall length		in (mm)	183.8 (4,670)
Overall width		in (mm)	71.9 (1,825)
Overall height (in case of curb weight)		in (mm)	57.8 (1,465)
Wheel base		in (mm)	105.2 (2670)*1 105.2 (2675)*2
Tread	Front	in (mm)	61.5 (1,560)
	Rear	in (mm)	61.7 (1570)*1 61.8 (1570)*2
Minimum road clearance		in (mm)	5.4 (135)

*1: *Models with 17-inch tires*
*2: *Models with 18-inch tires*

1.1.3 Identification Number and Label Locations



(a) Air conditioner label
(b) Emission control label
(c) Tire inflation pressure label
(d) FMVSS label (for U4)
(e) CMVSS label (for C0)
(f) VIN label
(g) Fuel label
(h) Vehicle identification number (under the right front floor carpet)
(i) Model number label

1.1.4 Vehicle Model Classification Symbol

VIN

Display example:]JF1VBA############[

The starting and ending brackets ( ] [ ) are stop marks.

#: Differs for each vehicle model.

Digits	Meaning	Details
1 to 3	Manufacturer & vehicle classification	JF1: Passenger vehicle manufactured by SUBARU CORPORATION
4	Car line	V: WRX
5	Body classification	B: SEDAN
6	Displacement class	A: 2.4L turbo 4CYLINDERS GASOLINE 271HP
7	Grade	A: WRX base B: WRX base+EyeSight F: WRX Premium H: WRX Premium+EyeSight K: WRX Limited L: WRX Limited+Navi M: WRX Limited+EyeSight N: WRX Limited+EyeSight+Navi T: WRX GT+EyeSight+RECARO U: WRX GT+EyeSight+Navi+RECARO
8	Restraints system or GVWR class	6: Manual belt + dual airbag + side airbag installed in seat back + curtain airbag installed in roof + knee airbag (driver's seat)
9	Check number	0 through 9 and X
10	Model year	P: 2023MY
11	Transmission type & manufacturing plant	8: Full-time AWD CVT (Gunma Main Plant) 9: Full-time AWD 6-speed MT (Gunma Main Plant)
12 to 17	Serial number	800001 to 999999

Model number label

Applied model

Display example: VBHBY##

#: Differs for each vehicle model

Digits	Meaning	Details
1	Series	V: WRX
2	Body type	B: SEDAN
3	Total engine displacement/ Drive system	H: 2.4 L AWD (DIB)
4	Model year	B: 2022MY
5	Destination	Y: For USA, Canada, and Mexico
6	Grade	D: WRX PREMIUM B E: WRX BASE F: WRX PREMIUM A H: WRX LIMITED J: WRX BASE EyeSight K: WRX PREMIUM EyeSight L: WRX LIMITED EyeSight M: WRX GT EyeSight
7	Fuel feed system/ Transmission	6: DI turbo AWD L-6MT (TY75) 8: DI turbo AWD-CVT (TR69)

Engine type

Display example: FA24FXZ###

#: Differs for each vehicle model

Digits	Meaning	Details
1 and 2	Engine type symbol	FA: 4-cylinder gasoline
3 and 4	Displacement	24: 2.4L
5	Valve train/fuel supply system/steering	F: DOHC DIT (LH)
6	Exhaust regulations	X: Tier3/LEV3
7	Intake/exhaust system	Z: Intake AVCS, exhaust AVCS, TGV, EGR
8	Mounted transmission	B: 6MT H: CVT
9 and 10	Detailed specifications	Used when ordering parts. For details, refer to the parts catalog.

Transmission type

■ MT

Display example: TY751V6###

Digits	Meaning	Details
1	Transmission symbol	T: Transmission
2	Basic transmission system	Y: Full-time AWD MT center differential
3 and 4	Distance between gear centers	75: 2.95 in (75 mm) between main shaft and drive pinion
5	Model series	1: 6MT
6	Transmission basic specifications	V: Full-time AWD single range 6MT with viscous type center differential (without Auto Start-Stop)
7	Mounted engine	6: 2.4L DOHC Turbo
8 to 10	Detailed specifications	Used when ordering parts. For details, refer to the parts catalog.

■ CVT

Display example: TR690#7### (CVT)

Digits	Meaning	Details
1	Transmission symbol	T: Transmission
2	Basic transmission system	R: Full-time AWD CVT
3 and 4	Transmission specification classification	69: Between pulley centers 6.65 in (169 mm)
5	Model series	0: CVT
6	Transmission basic specifications	G: Without Auto Start-Stop, with CVTF cooler (with warmer feature), without CVTF cooler (air cooler) S: Without Auto Start-Stop, with CVTF cooler (with warmer feature), with CVTF cooler (air cooler)
7	Mounted engine	6: 2.4L DOHC Turbo
8 to 10	Detailed specifications	Used when ordering parts. For details, refer to the parts catalog.

Rear differential

Identification	Reduction speed ratio	LSD
E2	4.111	No
E4	4.444	No

1.2 Main Changes

1.2.1 Overview of Changes

ENGINE (FA24)
- The Engine Control Module (ECM) was changed in order to support OBD and due to vehicle specification changes.
- The emissions label was changed for annual regulation compliance.

SUSPENSION
- The shape of the bracket for the electronic control damper on the rear side was changed.

EXTERIOR
- The battery save function was added as a measure against the user forgetting to turn off the lights.

INTERIOR TRIM
- The occupant identification threshold for the airbag control module was changed for compliance with regulations.
- The security system was strengthened for compliance with European CS/SU regulations and as a countermeasure against recent methods of vehicle theft.
- The size of the backup unit (sub battery) was reduced.
- The battery save function was added as a measure against the user forgetting to turn off the lights.

LAN SYSTEM
- A CAN ID for the odometer was added in order to support OBD.
- The Body Integrated Unit (BIU) and front relay control module (FRM) were changed for compliance with European CS/SU regulations.

1.3 List of Abbreviations

1.3.1 Table of Abbreviations

2ndr	Secondary
AAI	Air Assist Injection
AAR	Angular Adjusted Roller
A/B	Airbag
ABS	Anti-lock Brake System
A/C	Air Conditioner
AC	Angular Contact
ACC	Accessory
A/F	Air fuel ratio
ALT	Generator
APS	Accessory Power Supply Socket
Assembly	Assembly
AT	Automatic transmission
ATF	Automatic transmission fluid
AUX	Auxiliary Storage Unit (External storage)
AVCS	Active Valve Control System
AWD	All Wheel Drive
BATT	Battery
BCM	Brake Control Module
BJ	Bell joint
BRKT	Bracket
BSD/RCTA	Blind Spot Detection/Rear Cross Traffic Alert
CAN	Controller Area Network
CCA	Cold Cranking Ampere
CD	Compact Disc
CD-R/RW	CD Recordable/Rewritable
CM	Control Module
COMPL	Complete
CPC	Canister purge control solenoid valve
CPU	Central Processing Unit
CTR	Center
CM	Control Module
CVT	Continuously variable transmission
CVTF	Continuously Variable Transmission Fluid
DCCD	Driver's Control Center Differential (C.DIFF/DCCD)
DOHC	Double overhead camshaft
DOJ	Double offset joint
D/R	Dual-range

DTC	Diagnosis Trouble Code
DU	Drive Unit
DVD	Digital Versatile Disc or Digital Video Disc
EBD	Electronic Brake Distribution
EBJ	Highly efficient compact ball fixed joint
ECM	Engine control module
ECV	Exhaust Pressure Control Valve
EDJ	Highly efficient compact double offset joint
E/G	Engine
EGI	Electronic Gasoline Injection
EGR	Exhaust Gas Recirculation
ELR	Emergency Locking Retractor
EPB	Electronic Parking Brake
ETC	Electronic Throttle Control
EX	Exhaust
F/B	Fuse & Joint Box
FL	Fusible Link
Ft	Front
FWD	Front Wheel Drive
GPS	Global Positioning System
HBA	High Beam Assist (HBA)
HI	High
H/L	Headlight
H/U	Hydraulic Unit
HVAC	Heater, Ventilator and Air Conditioner
ICR	Inrush Current Reduction
I/F	Interface
IG	Ignition
IN	Intake
INT	Intermittent
I/O	Input/Output
IR	Infrared Ray
ISC	Idle Speed Control
LAN	Local Area Network
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LH	LH (Left Hand)
LHD	Left Hand Drive
Lo	Low
LSD	Limited Slip Differential
LWR	Lower
M/B	Main Fuse & Relay Box

MD	Mini Disc
MID	Multi information display
MPI	Multi-point fuel Injection
MP-T	Multi-Plate Transfer
MT	Manual Transmission
NA	Natural Aspiration
NC	Normal Close (Relay)
NO	Normal Open (Relay)
OBD	On-Board Diagnosis
OP	Option Parts
PC	Personal Computer
PCD	Pitch Circle Diameter
PCV	Positive Crankcase Ventilation
PID	Parameter Identification
Pr	Primary
PRG	Power rear gate
P/S	Power steering
PTJ	Pillow tripod joint
P/W	Power window
RAM	Random Access Memory
RH	RH (right hand)
RHD	Right Hand Drive
ROM	Read Only Memory
Rr	Rear
SDI	Subaru Diagnostic Interface
SGP	Subaru Global Platform
SI	Subaru Intelligent
SOHC	Single Overhead Camshaft
SRS	Supplemental restraints system
SSM	Subaru Select Monitor
ST	Special Tool
STD	Standard
SW	Switch
T/B	Turbocharger
TCS	Traction Control System
TCM	Transmission control module
TGV	Tumble Generator Valve
T/M	Transmission
UJ	Universal Joint
UPR	Upper
UV	Ultraviolet
VDC	Vehicle Dynamics Control

VIN	Vehicle Identification Number
ViS-C	Viscous Coupling
VSV	Vacuum Switching Valve
VTD	Variable Torque Distribution
W/H	Wiring Harness

2 ENGINE (FA24)

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2.1 Engine Mechanical

2.1.1 Overview

Overview

- The aim of this model is to support environmental performance, and provide high levels of driving enjoyment in various situations, such as ease of use in ordinary driving as well as acceleration performance that feels extraordinary. As such, this model is equipped with the FA 2.4 L direct-injection turbo engine which combines a cylinder direct fuel injection system with a turbocharger in a horizontally-opposed cylinder engine. This generates linear, powerful torque from low speed ranges while restricting torque dropping in high engine speed ranges, achieving performance that targets total balance.
- AVCS is adopted to enable optimal valve timing according to the driving conditions of the vehicle and driver in order to ensure dynamic performance and enable lower emissions.
- The incorporation of a turbocharger ensures full dynamic performance while the anti-knocking performance, high compression ratio, high efficiency, and other functions of the cylinder direct fuel injection function deliver excellent fuel economy during cruising.
- The tumble generator valve (TGV) generates a tumble according to the driving range. As a result, it forms an homogeneous mixture and improves combustion speed, thereby increasing combustion efficiency and contributing to lower fuel consumption.
- Improved knocking resistance resulting from the improved cylinder gas flow, increased EGR cooler capacity, and improved combustion chamber cooling contribute to improving environmental performance.
- The specifications of the main driving system and valve train system have been optimized, supplementing the rigidity of structural parts in order to reduce transmission and radiation of vibration and noise. This has succeeded in reducing noise in particular driving ranges.
- Adoption of lightweight materials and function elimination and consolidation succeeded in reducing lighter weight.

Specifications

Power unit

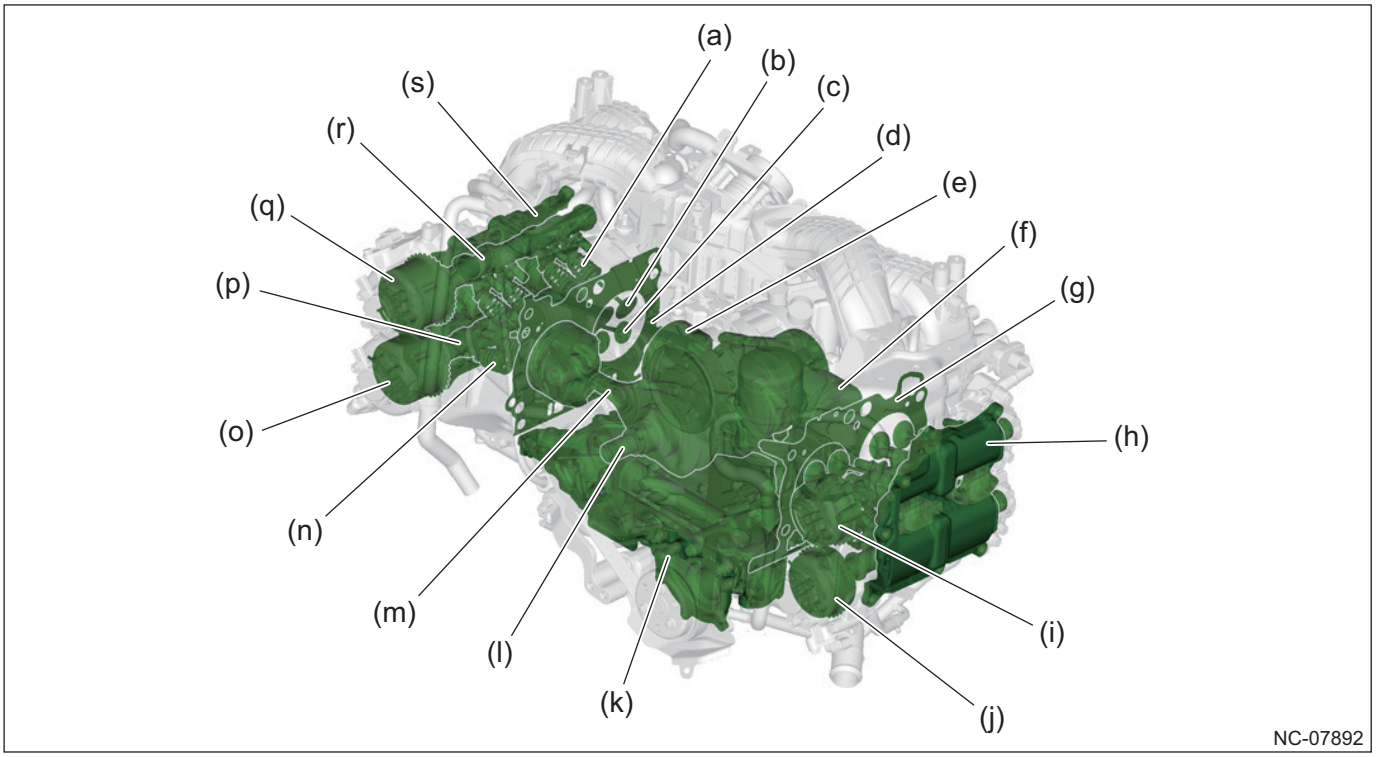
Engine	Transmission type	Maximum output [HP (kW)/(r/min)]	Maximum torque [lb-ft (N-m, kgf-m)/(r/min)]
2.4L DOHC turbo	MT	271 (202)/5,600	258 (350, 35.7)/2,000 to 5,200
	CVT		

Major specification

Engine classification		2.4L DOHC turbo
Engine type		FA24
Cylinder arrangement		Horizontally opposed, water-cooled 4-cylinder, 4-stroke gasoline engine
Fuel supply system		Cylinder direct fuel injection system
Fuel used		Unleaded gasoline (Premium unleaded gasoline is recommended.)
Cylinders		4 cylinders
Bore × Stroke [in (mm)]		3.70 × 3.39 (94.0 × 86.0)
Total displacement [cu in (cm^3)]		146 (2,387)
Compression ratio		10.6
Compression pressure (at 200 to 300 r/min) [psi (kPa, kgf/cm^2)]		196 to 254 (1,350 to 1,750, 14 to 18)
Idling speed (gear shift lever in neutral position (MT), select lever in [P] or [N] range (CVT)) [r/min]	No load	700±100
	A/C ON	700 to 880±100
Ignition timing (BTDC) [r/min]		7°±10°/700
Valve train		Timing chain driven
		Double overhead camshaft
		Roller rocker system
		Shim-adjusted valve clearance system
		Intake/exhaust AVCS
Intake system		With turbocharger

2.1.2 Component

Component layout drawing

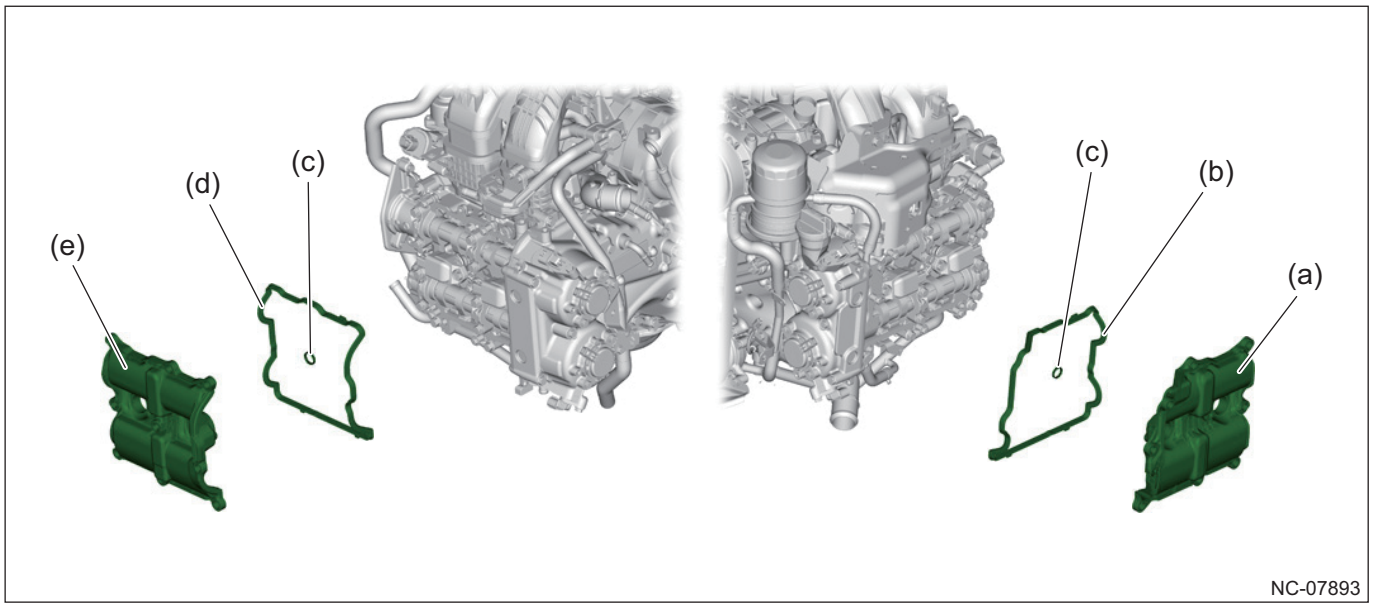


(a) Valve spring (intake)
(b) Intake valve
(c) Exhaust valve
(d) Cylinder head gasket RH
(e) Piston RH
(f) Piston LH
(g) Cylinder head gasket LH
(h) Rocker cover LH
(i) Intake cam sprocket LH
(j) Exhaust cam sprocket LH
(k) Oil pan upper
(l) Crankshaft
(m) Connecting rod
(n) Valve spring (exhaust)
(o) Exhaust cam sprocket RH
(p) Exhaust camshaft RH
(q) Intake cam sprocket RH
(r) Intake camshaft RH
(s) Rocker cover RH

Component details

Rocker cover

A lightweight resin rocker cover is adopted for lighter weight and reduced vibration and noise. Mounting onto the cam carrier is done by constant-scale fastening using the peripheral flange, ensuring sealing performance.



(a) Rocker cover LH
(b) Rocker cover gasket LH
(c) Rocker cover gasket
(d) Rocker cover gasket RH
(e) Rocker cover RH

Cylinder head

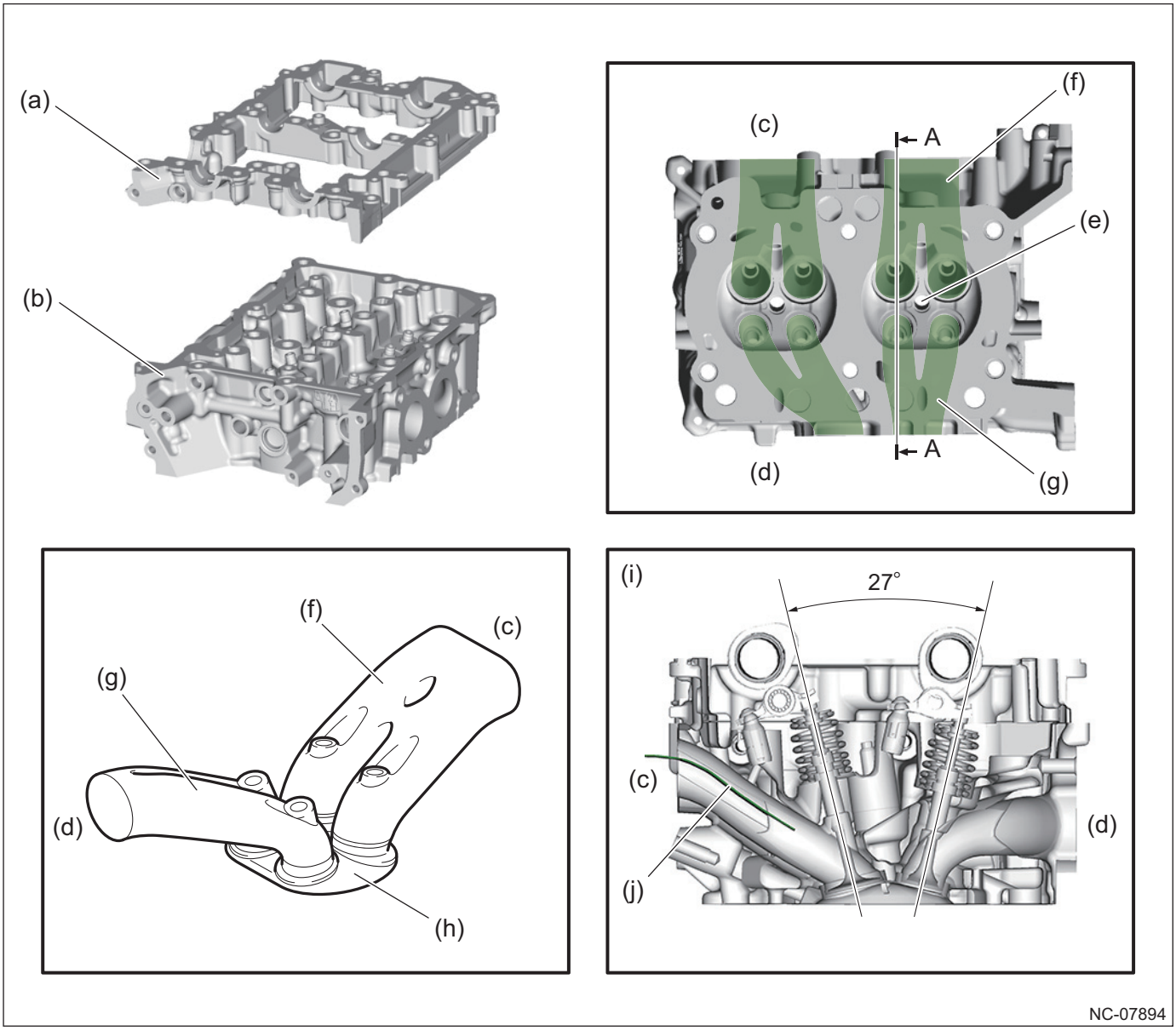
The two-division structure with separated cam carrier structure is used, and the structure of the cylinder head body is simplified to reduce weight.

A pent roof shaped combustion chamber is adopted and the spark plugs are placed in the approximate center of the combustion chambers. More compact combustion chambers are created by setting the valve holding angle to a narrow angle of 27°.

The cross-flow type has been adapted, in which the intake port is located on the top of the engine and the exhaust port on the bottom.

Optimizing the intake port shape increases the amount of intake airflow, while the installation of a metal plate port partition wall (cylinder head plate) and adoption of a tumble generator valve (TGV) reinforce and optimize the tumble flow, improving output and achieving superior fuel efficiency performance and environmental performance.

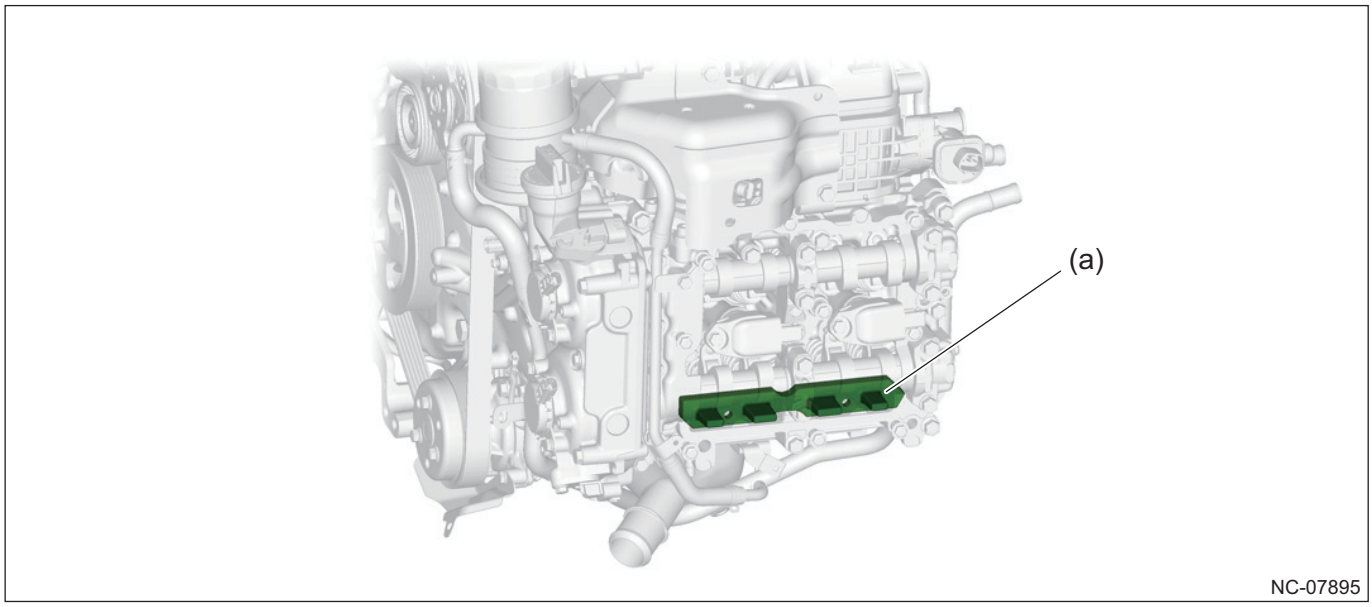
The adoption of long-reach type spark plugs and ensuring a water jacket between the exhaust port and the threaded part of the spark plugs improves cooling performance around the spark plugs, improves anti-knocking performance, and improves combustion.



(a) Cam carrier
(b) Cylinder head
(c) Intake side
(d) Exhaust side
(e) Spark plug hole
(f) Intake port
(g) Exhaust port
(h) Combustion chamber
(i) A-A cross section
(i) Port partition wall (cylinder head plate)

Oil spacer

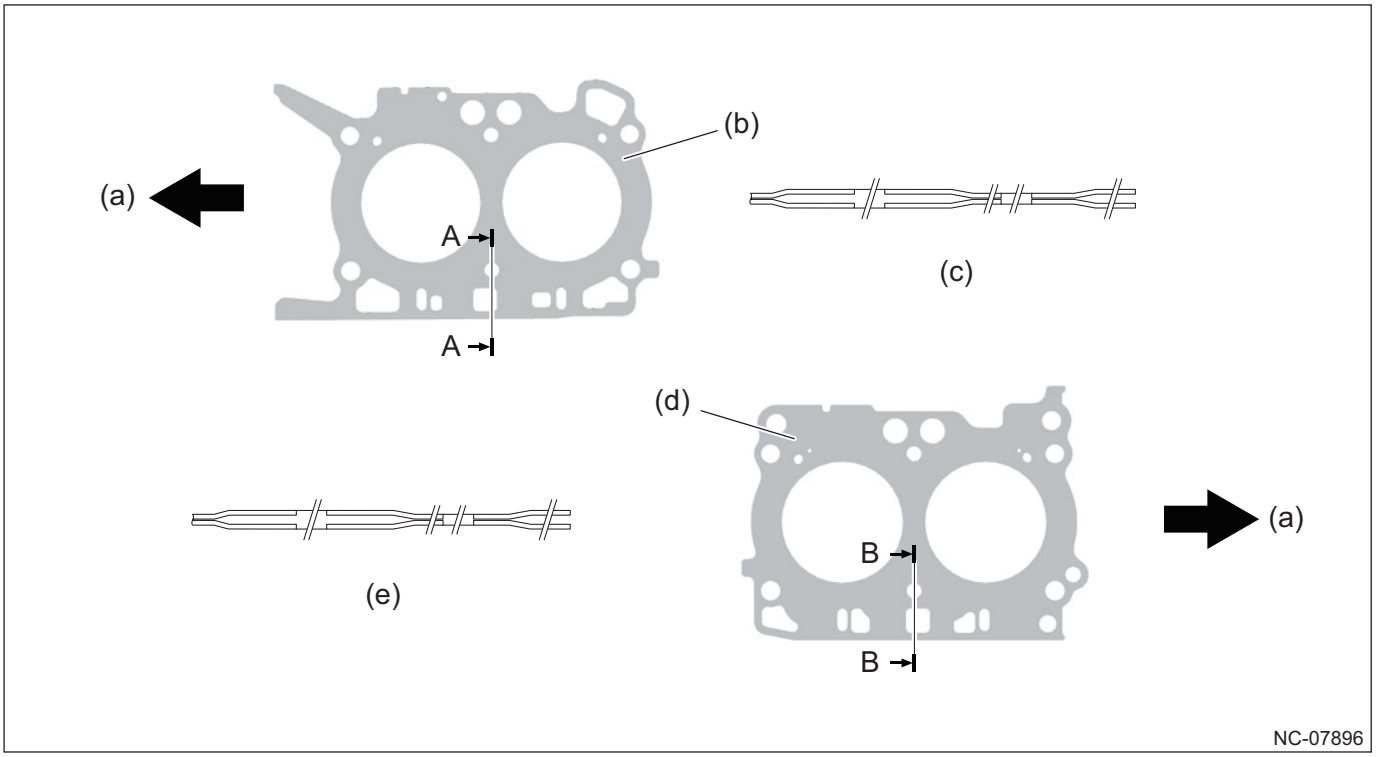
An oil spacer was adopted to reduce the amount of dead space inside the cylinder head. This prevents engine oil from accumulating on one side when turning, and allows the required amount of engine oil to be reduced.



(a) Oil spacer

Cylinder head gasket

The stainless cylinder head gasket is adopted. Coating has been applied to the gasket surface.



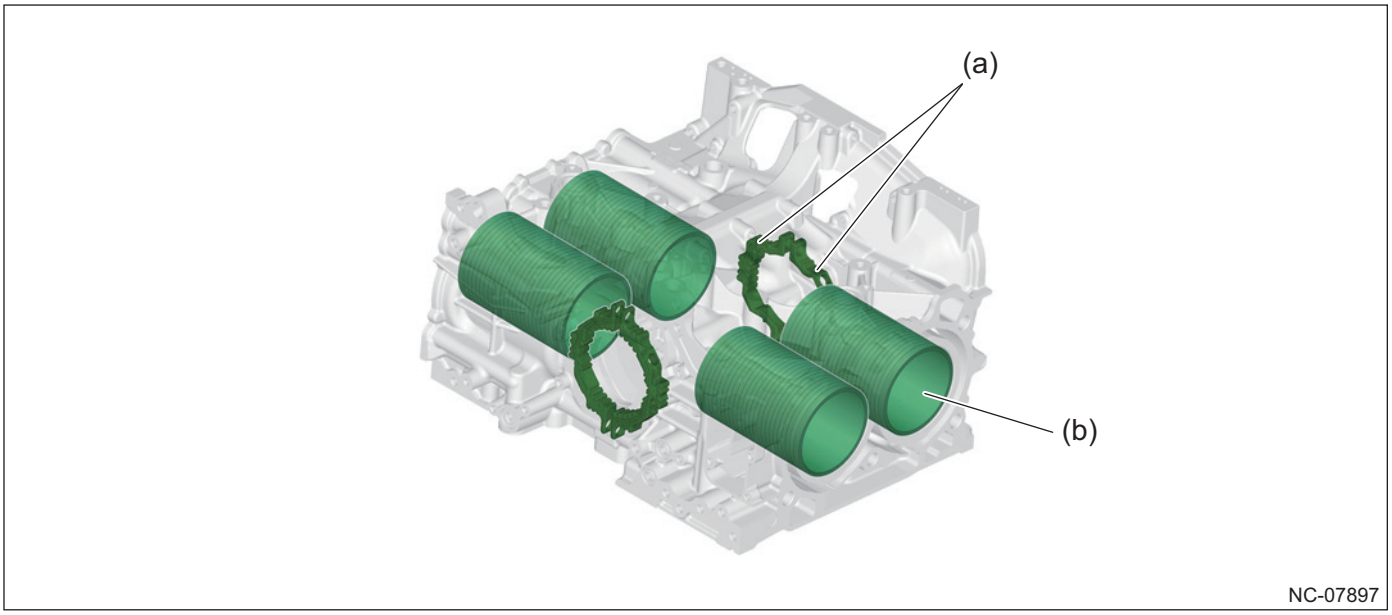
(a) Engine front
(b) Cylinder head gasket LH
(c) A-A cross section
(d) Cylinder head gasket RH
(e) B-B cross section

Cylinder block

An aluminum alloy cylinder block has been adopted.

The shape of the cylinder liner aluminum interface is optimized, ensuring good contact with the cylinder block. The thickness and weight of the cylinder liner were reduced while also reducing the cylinder deformation that occurs when warm.

In order to achieve comfortable vibration and noise performance and sound quality, cast journals of sintered material have been adopted for the #1 and #5 journals. The engine mount fastening points were moved to the oil pan upper and an aluminum mount was adopted to reduce uncomfortable vibration and unpleasant noise.



(a) Journal piece

(b) Cylinder liner

Oil pan upper, oil pan

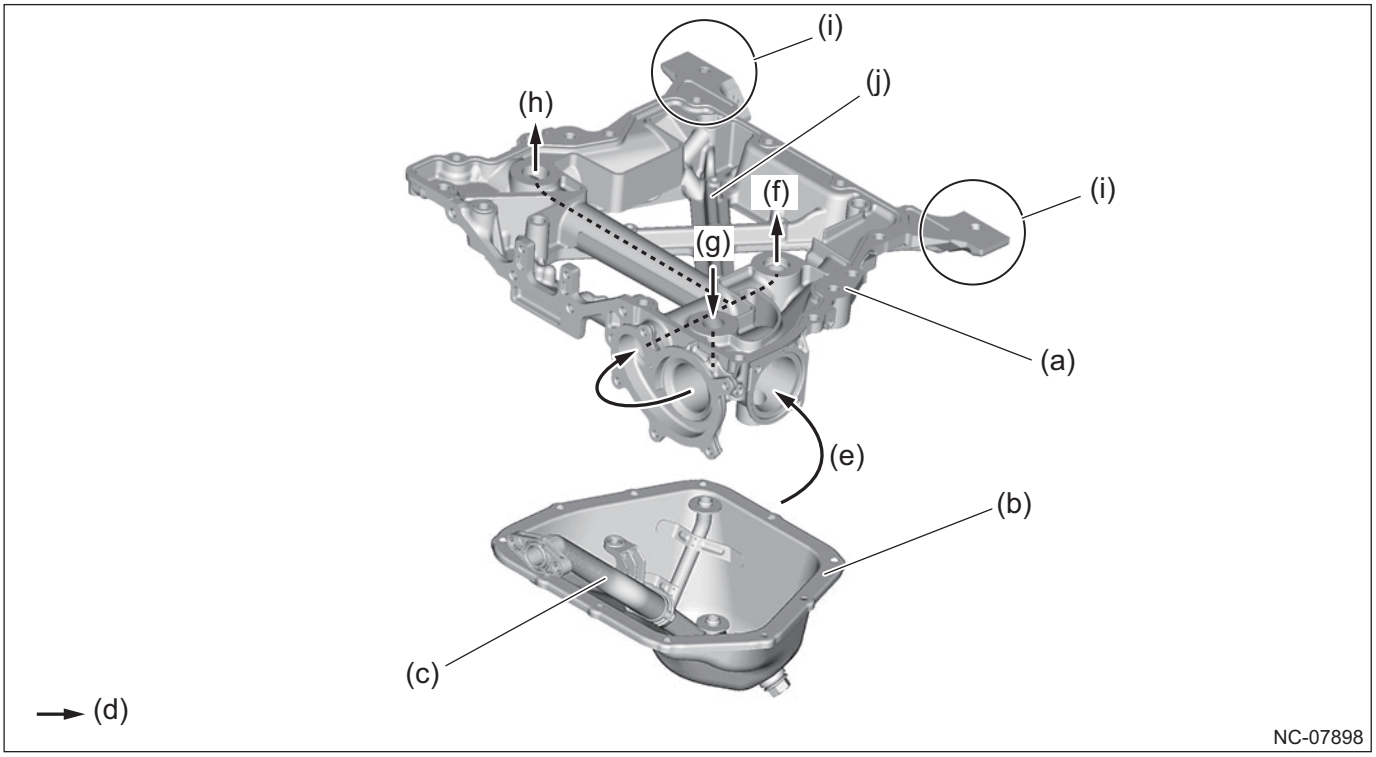
A circuit was created in the oil pan upper that distributes coolant to the cylinder block and cylinder head.

The shape of the cross-ribs on the oil pan upper has been optimized. Vibration and noise are reduced by setting engine mount fastening points and adopting an aluminum front cushion rubber bracket.

The use of an integrated fastening stiffener that joins the cylinder block and transmission case increases overall power unit rigidity, reduces vibration, and reduces weight.

The lightweight plastic oil strainer is adopted. Also, product quality is improved by adopting an oil pan shape that reduces the oil volume when oil is changed.

A stamped iron plate oil pan has been adopted.



(a) Oil pan upper
(b) Oil pan
(c) Oil strainer
(d) Flow of coolant
(e) From radiator
(f) To cylinder block LH
(g) From bottom by-pass
(h) To cylinder block RH
(i) Shape that supports an aluminum mount
(j) Rib

Piston

Piston

- Pistons made of aluminum alloy with light weight and high stiffness are adopted.
- A shallow pan-type cavity shape is adopted for the piston top surface. This can improve fuel efficiency, improve cylinder internal flow in output driving ranges, and provide secure holding.
- Optimization of the skirt shape ensures rigidity and reduces vibration and noise. A striated finish with excellent seizure resistance and resin coating are applied to the piston skirts, reducing noise and friction.
- The oil ring was changed to include a single tab for improved ease of installation.
- A hole to prevent oil ring rotation was added to the piston oil ring groove.
- The layout of the oil removing holes was changed to improve oil removal efficiency.

Top ring

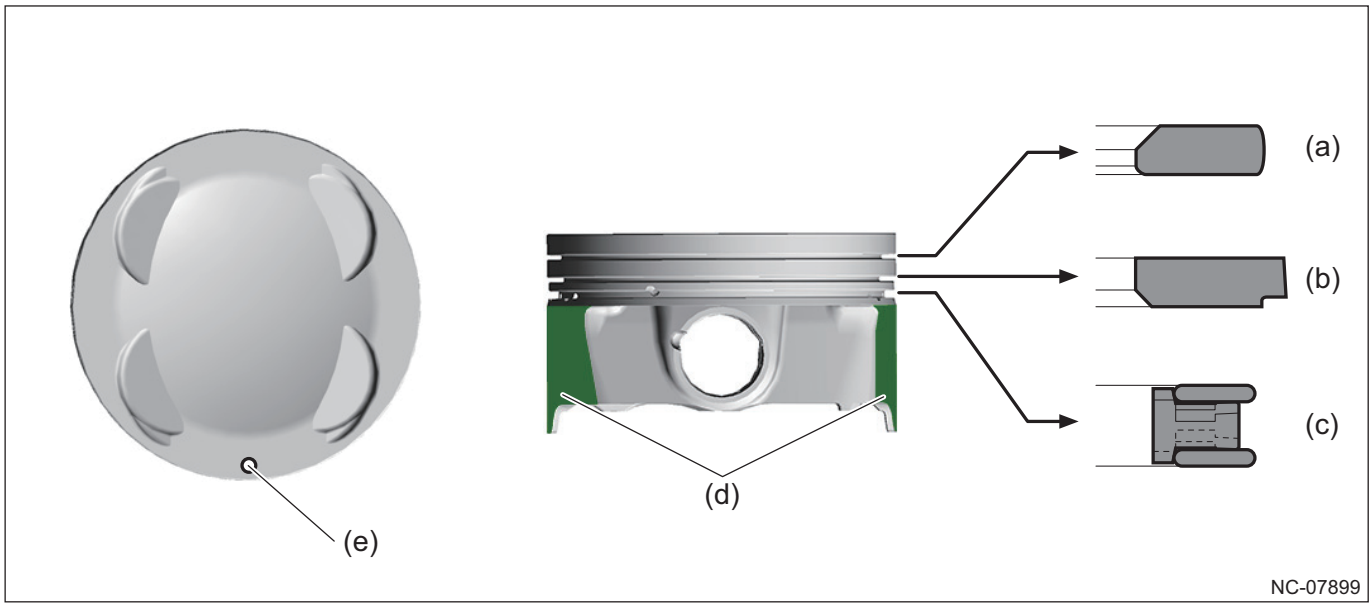
- A high thermal-conducting material is adopted. The fitting gap and tension were optimized in order to reduce friction loss. A PVD coating is applied to the outer peripheral surface, reducing friction and ensuring wear resistance.

Second ring

- The fitting gap and tension were optimized to achieve higher output and reduce friction loss, and a balance cut was added to the bottom of the outer periphery.

Oil ring

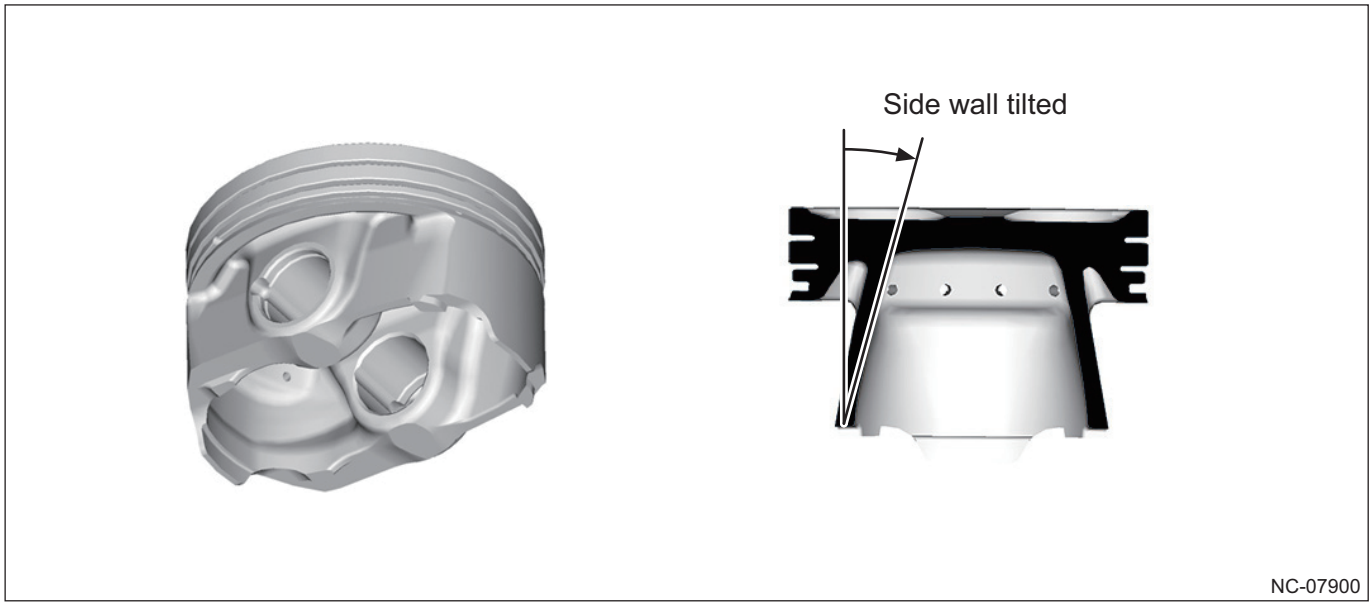
- The tension was optimized and a high-barrel shape was adopted for the outer peripheral surface in order to achieve higher output and reduce friction loss. A PVD coating is applied to the outer peripheral surface, reducing friction and ensuring wear resistance. The oil ring was changed to a single tab type for improved ease of installation.



**The illustration shows a left bank.*

(a) Top ring
(b) Second ring
(c) Oil ring
(d) Resin coating
(e) Front mark

Inclining the side wall makes it possible to better support the combustion load at the piston center, supporting both reduced weight and higher output.



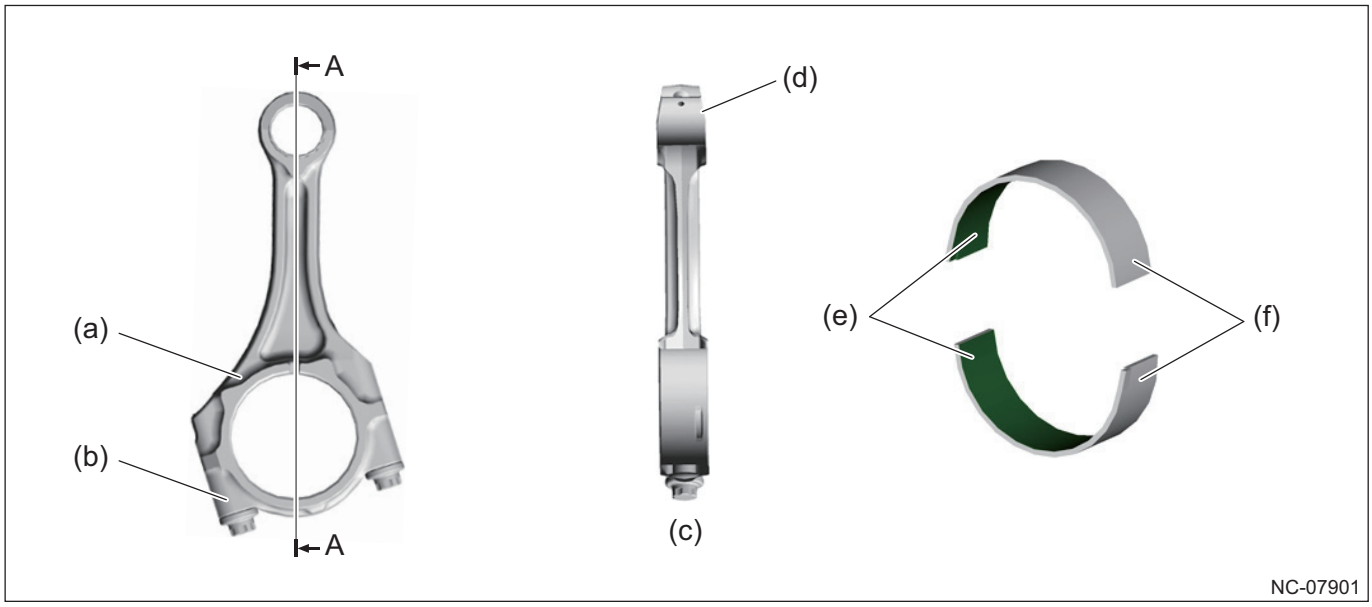
Connecting rod

High-strength steel was adopted for both the connecting rod and connecting rod cap, reducing the weight while still ensuring reliability.

A taper cut was added to the small end of the connecting rod to reduce weight.

Machined micro-grooves on the inside of the connecting rod bearing reduce friction and ensure reliability.

A skew split connecting rod is adopted for the large end in consideration of maintenance.



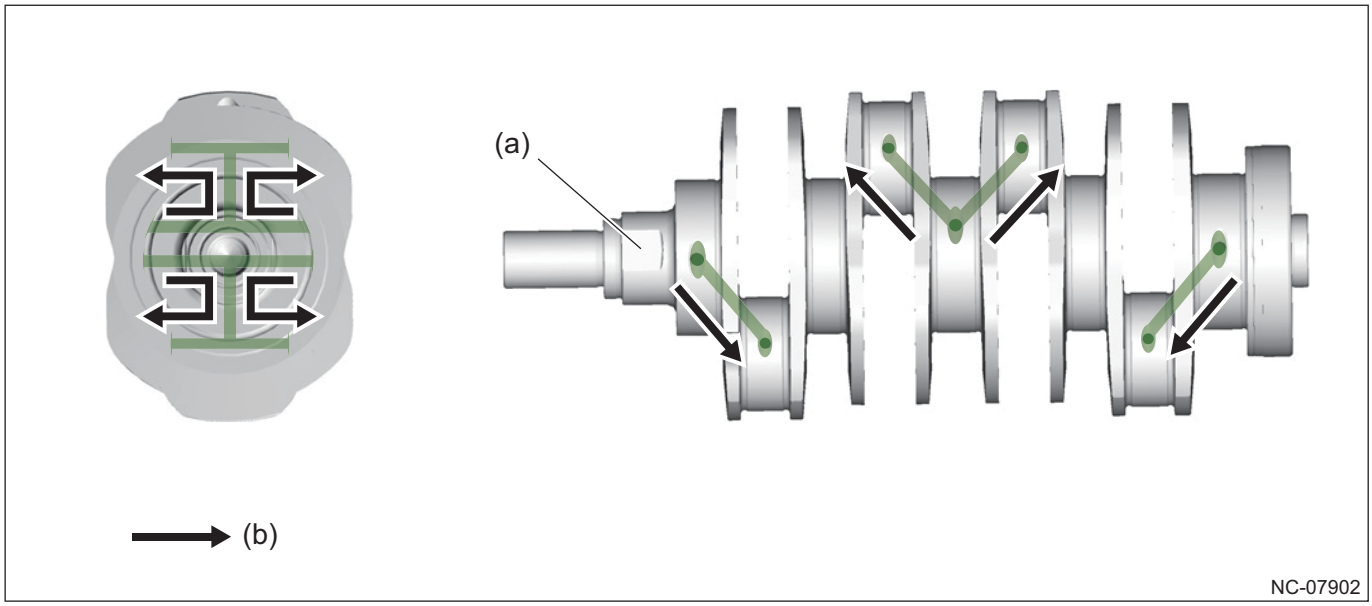
(a) Connecting rod
(b) Connecting rod cap
(c) A-A cross section
(d) Taper cut shape
(e) Micro-groove machining
(f) Connecting rod bearing

Crankshaft

A crankshaft with 5 forged journals and 8 balance weights was adopted.

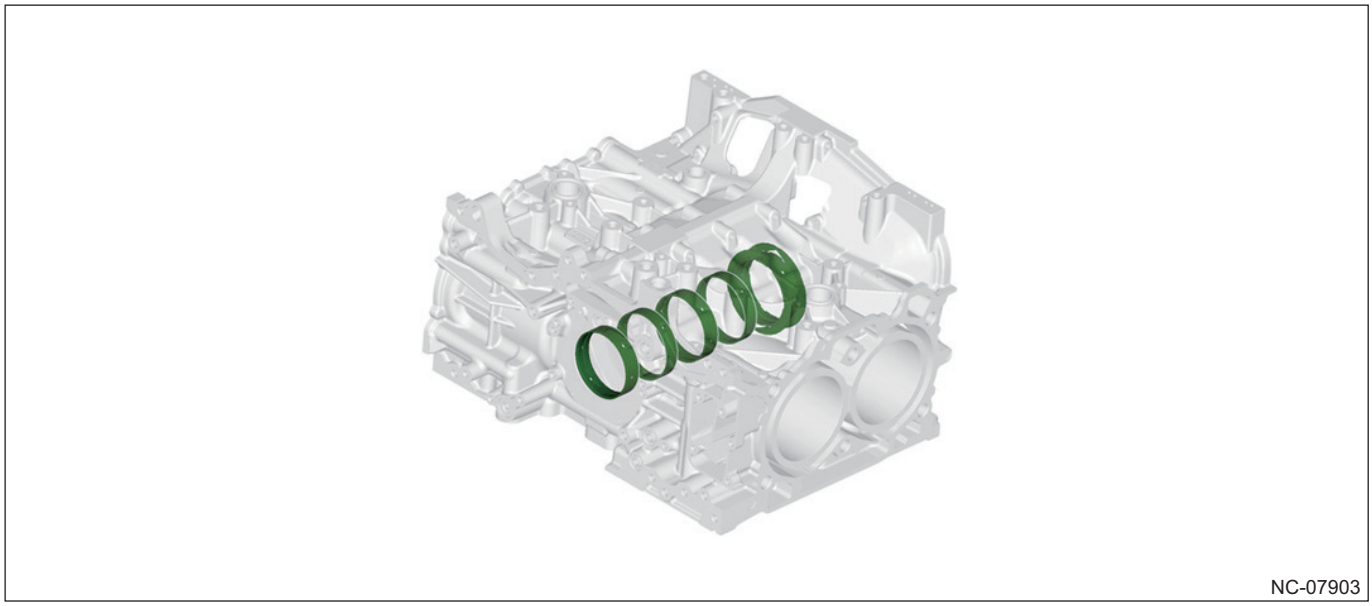
The shape of the oil holes inside the crankshaft was optimized.

Additional flats are machined for driving the scavenge pump.



(a) Machined flats (b) Oil supply direction

An aluminum alloy was adopted for the crankshaft bearing, ensuring resistance to foreign substances while the molybdenum coating on the inside of the bearing reduces friction.



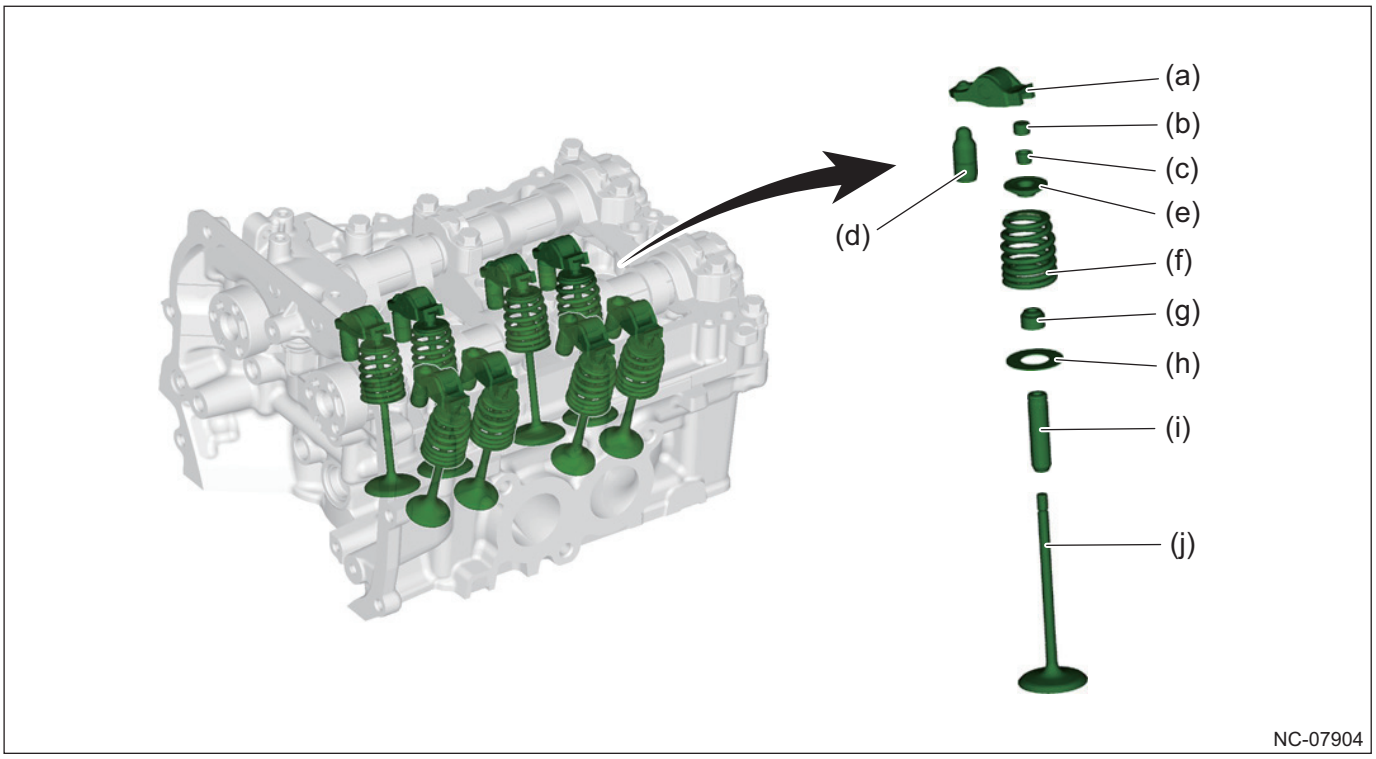
Intake and exhaust valves

In order to improve fuel efficiency, the surface roughness was optimized for the stems of both the intake valve and exhaust valve to reduce friction.

A hollow exhaust valve shaft is used, and the valve is filled with a combination of sodium + getter material that provides excellent cooling performance.

Cone-shaped valve spring is adopted to inhibit surging and reduce weight.

The adoption of a roller rocker in the valve train reduces friction.

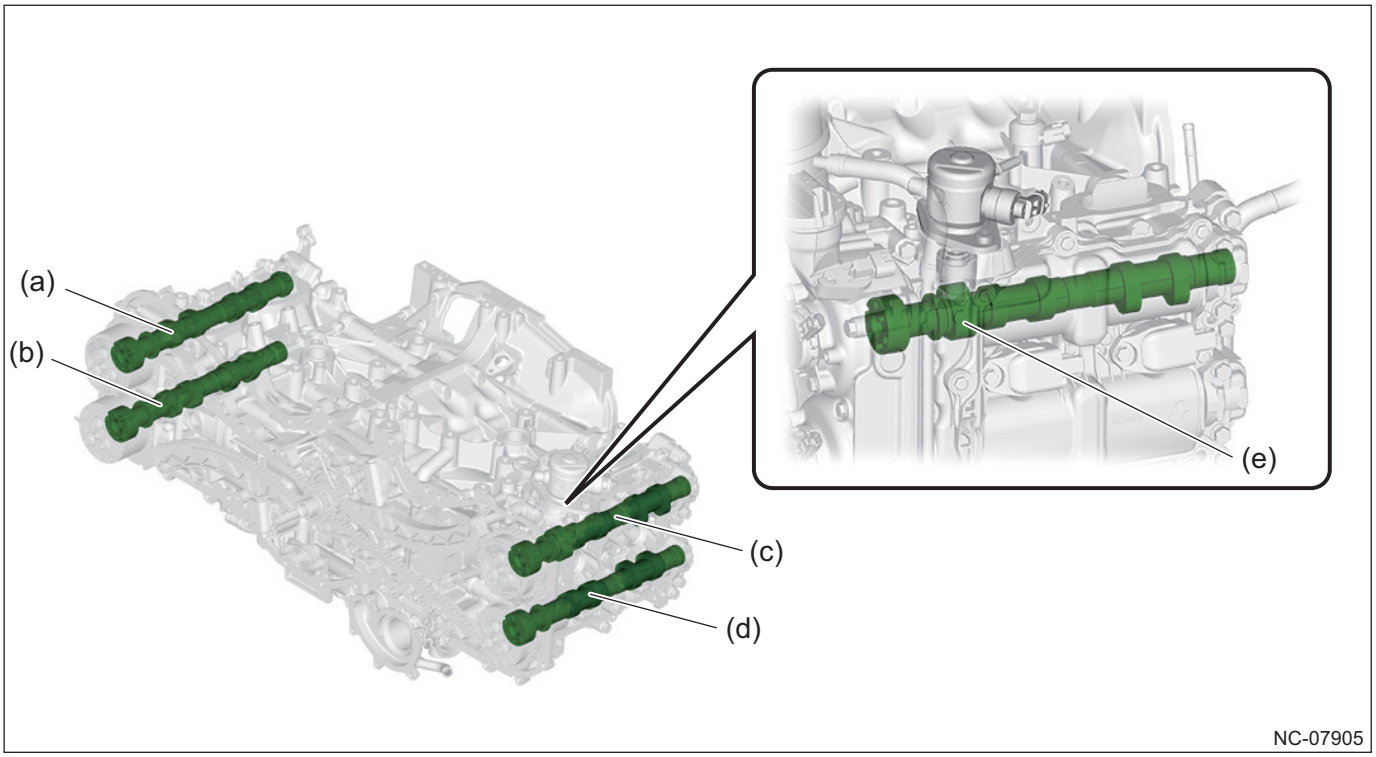


(a) Roller rocker arm
(b) Valve shim
(c) Valve collet
(d) Roller rocker arm pivot
(e) Valve spring retainer
(f) Valve spring
(g) Valve oil seal
(h) Valve spring seat
(i) Valve guide
(j) Valve

Camshaft

A sintered assembly has been adopted for the camshaft. The hollow structure and reduced thickness help to reduce weight.

The cam that drives the high-pressure fuel pump was placed on the intake camshaft LH front end.



(a) Intake camshaft RH
(b) Exhaust camshaft RH
(c) Intake camshaft LH
(d) Exhaust camshaft LH
(e) High-pressure fuel pump drive cam

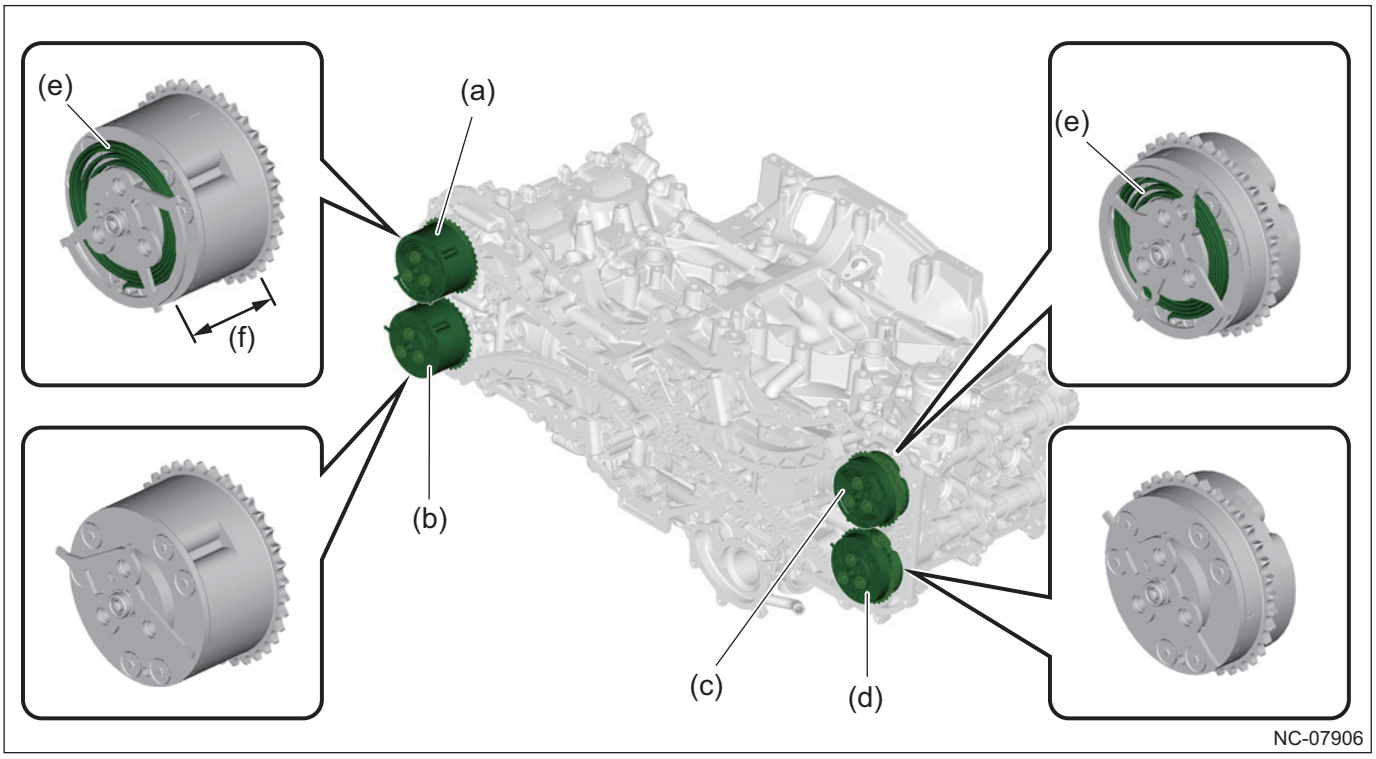
Cam sprocket

AVCS has been adopted for the camshaft on the intake side and exhaust side.

A high-efficiency rotor type with low drive friction was adopted.

The thickness of the cam sprocket is thinned to secure clearance in the engine compartment and ensure safety in the event of a collision, while also reducing weight.

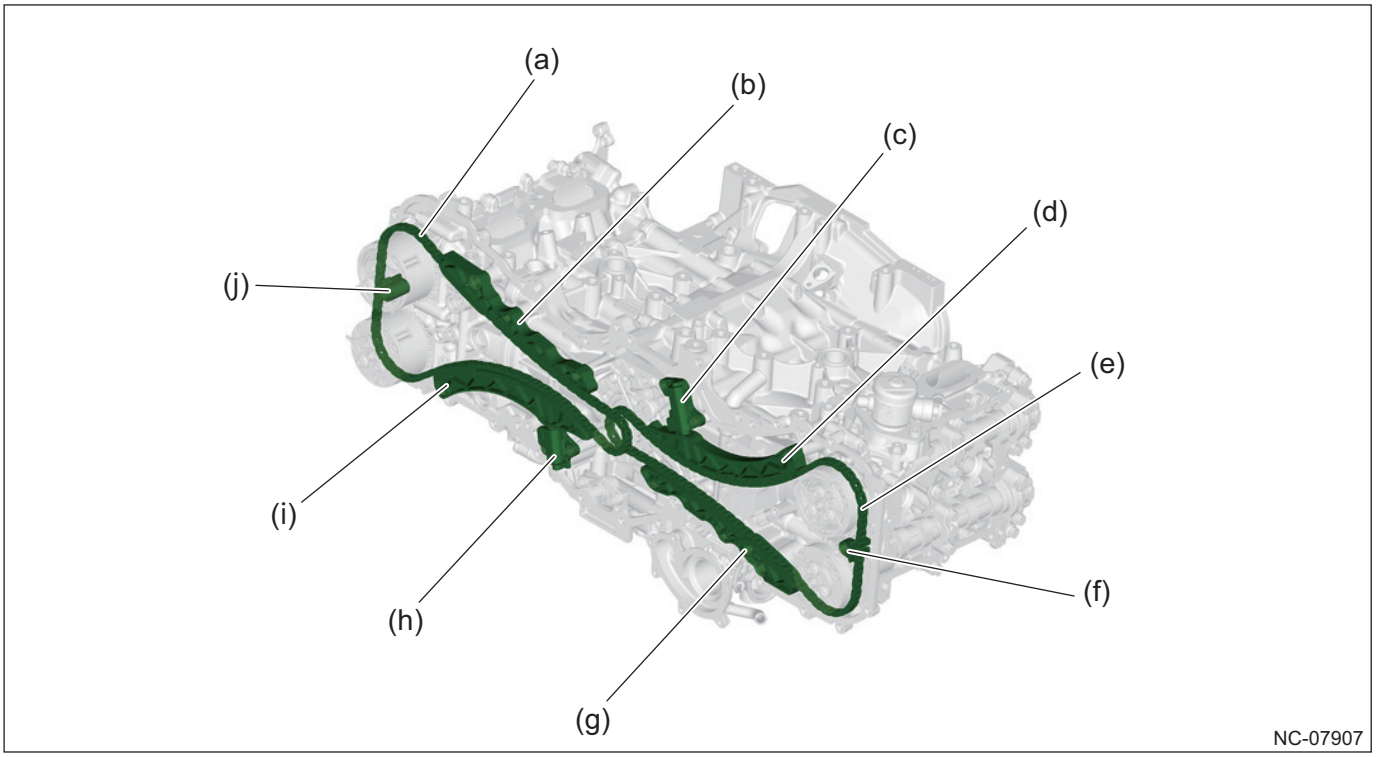
An assist spring was adopted in order to ensure AVCS response on the intake side.



(a) Intake cam sprocket RH
(b) Exhaust cam sprocket RH
(c) Intake cam sprocket LH
(d) Exhaust cam sprocket LH
(e) Assist spring
(f) Reduced thickness

Timing chain

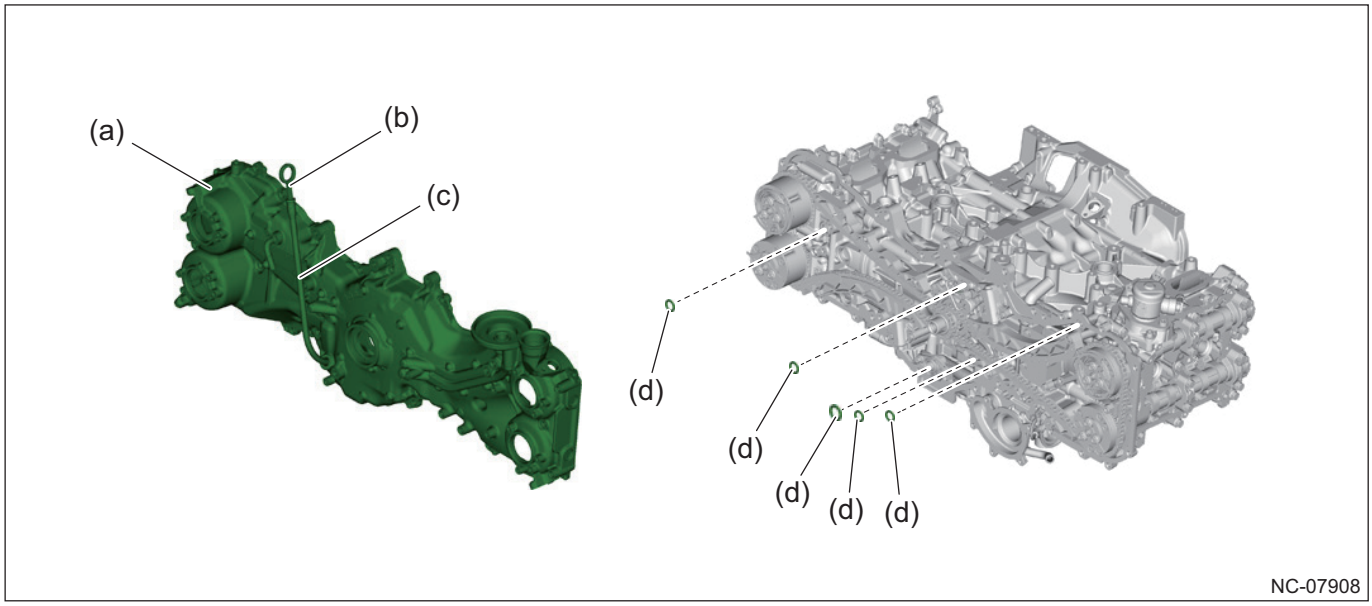
A ratchet-type hydraulic tensioner has been adopted. The chain tensioner LH structure uses an inner sleeve structure, and oil is retained inside the chain tensioner. For the chain tensioner RH, the structure of sealing with the cylinder block has been revised to retain the oil of the oil passages. This achieves low vibration, low noise, and smooth chain drive when starting. Also, the chain tensioner body was changed to aluminum to reduce weight.



(a) Timing chain
(b) Chain guide RH
(c) Chain tensioner LH
(d) Chain tension lever
(e) Timing chain
(f) Side chain guide LH
(g) Chain guide LH
(h) Chain tensioner RH
(i) Chain tension lever
(j) Side chain guide RH

Chain cover

The chain cover uses aluminum alloy, and contains the oil pump and lubricant passage.

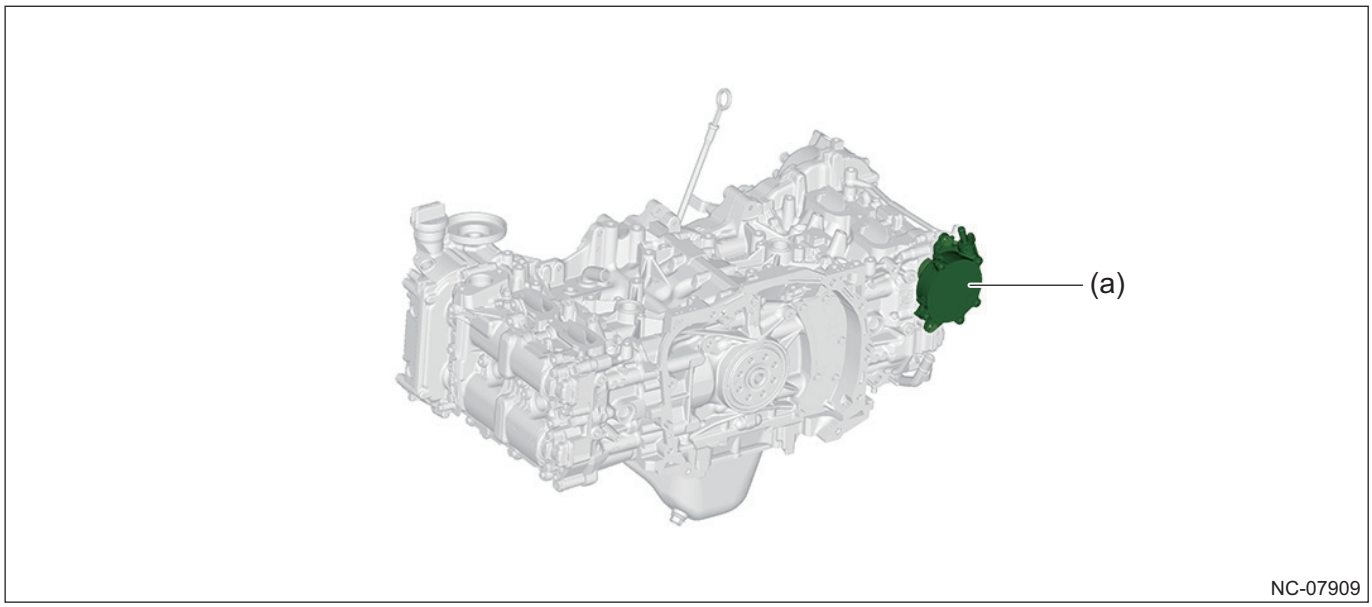


(a) Chain cover
(b) Oil level gauge
(c) Oil level gauge guide
(d) O-ring

Vacuum pump

■ MT

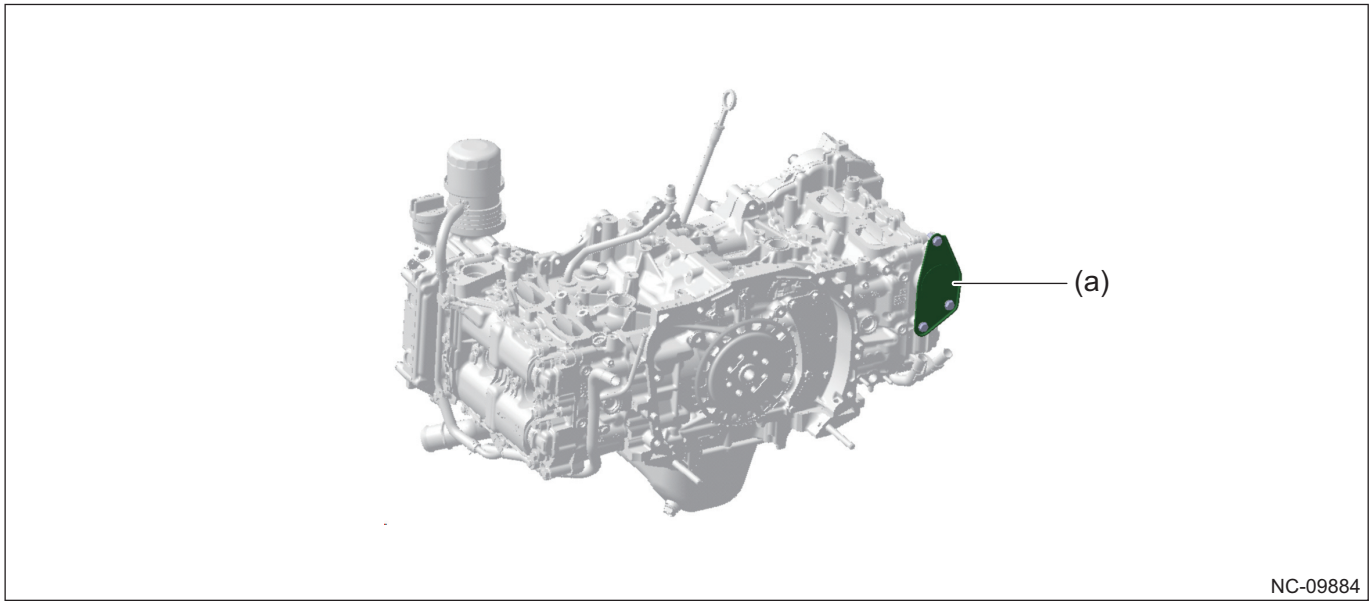
- A vacuum pump is adopted to support the increase in negative pressure required.
- The vacuum pump is mounted on the rear end of the engine, and is driven by the intake camshaft RH.



(a) Vacuum pump

■ CVT

- The vacuum pump is eliminated because the required negative pressure can be satisfied with the electronic control booster. Due to the adoption of a common cylinder head structure, a plate is installed to cover the vacuum pump mounting holes.

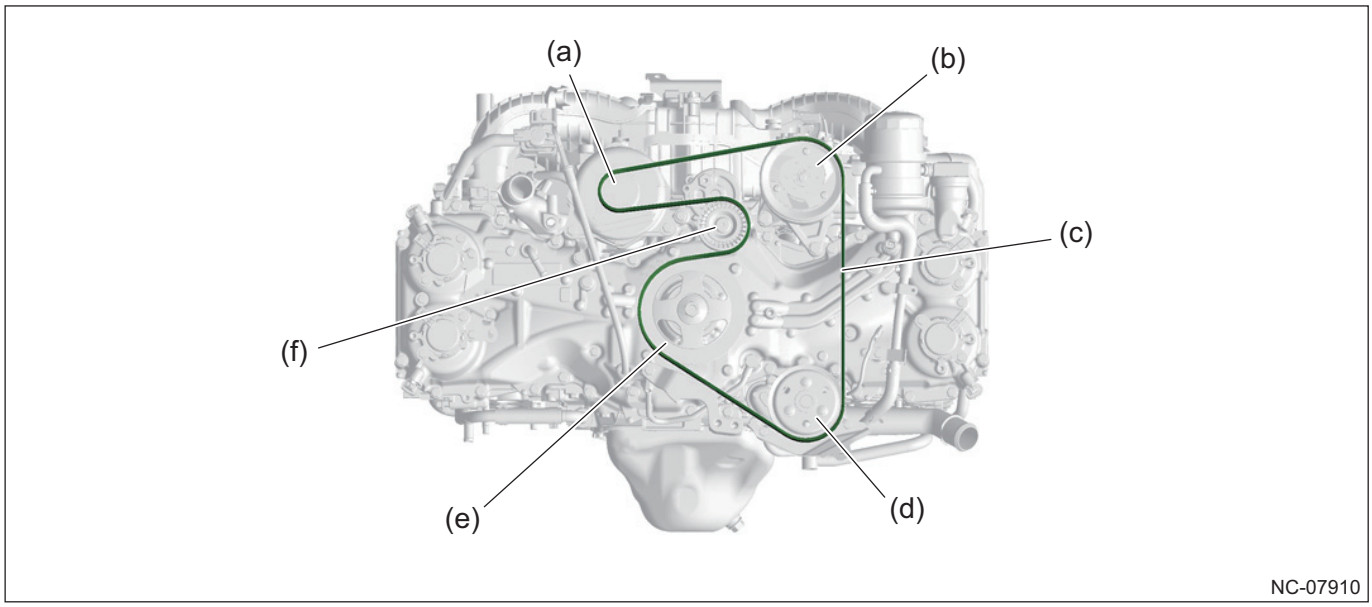


(a) Plate

Belt system

A serpentine belt drive system that uses a single belt to drive all auxiliary devices has been adopted.

The adoption of a V belt tensioner helps achieve long belt and auxiliary device lifetimes, as well as maintenance-free operation. It also improves serviceability when the belt is removed and reinstalled. Belt tension is maintained at the correct level by a spring inside the V belt tensioner.

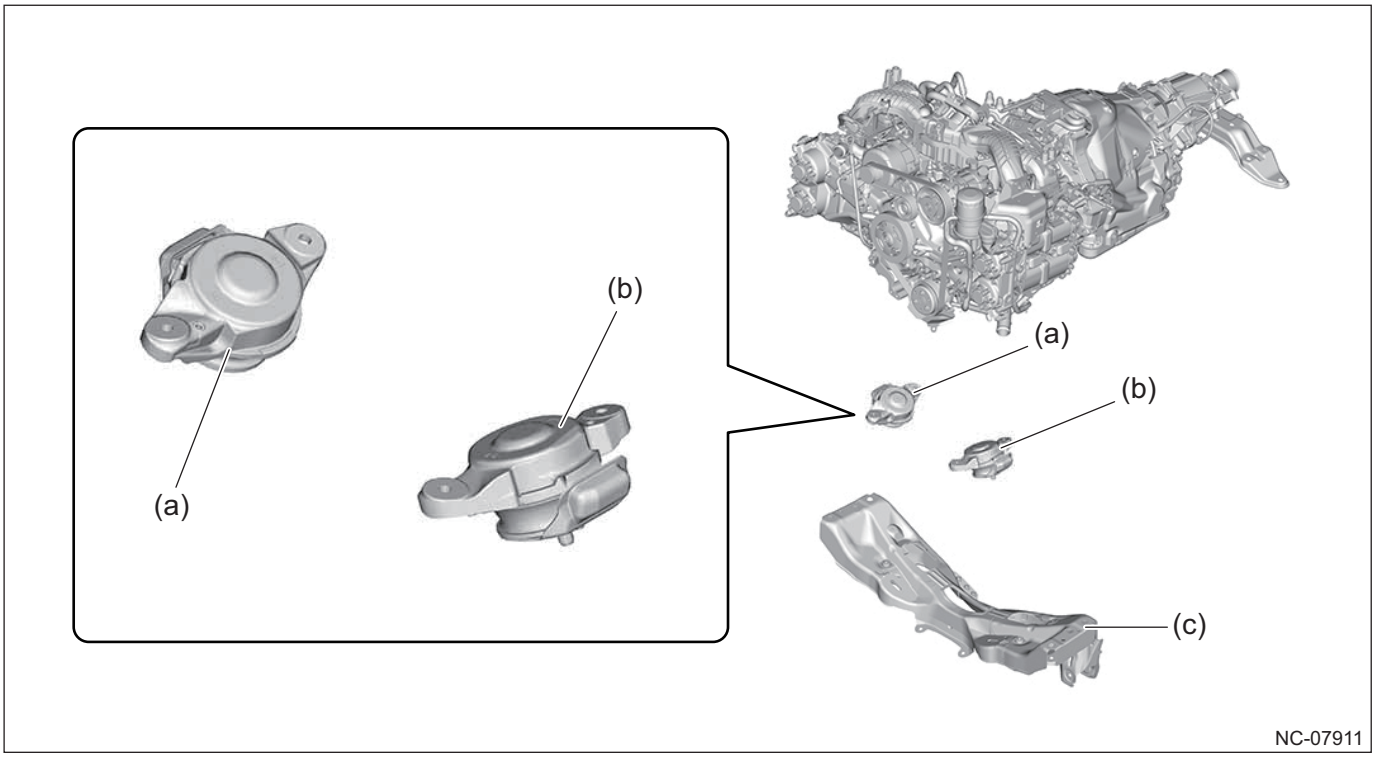


(a) Generator
(b) Compressor assembly
(c) V-belt
(d) Water pump assembly
(e) Crank pulley
(f) V belt tensioner

Engine mount

A liquid-filled mount is adopted for the front cushion rubber.

Changing to an aluminum front cushion rubber bracket reduces vibration transmitted from the engine to the vehicle body, improving vibration and noise performance.



(a) Front cushion rubber RH
(b) Front cushion rubber LH
(c) Crossmember

2.2 Fuel System

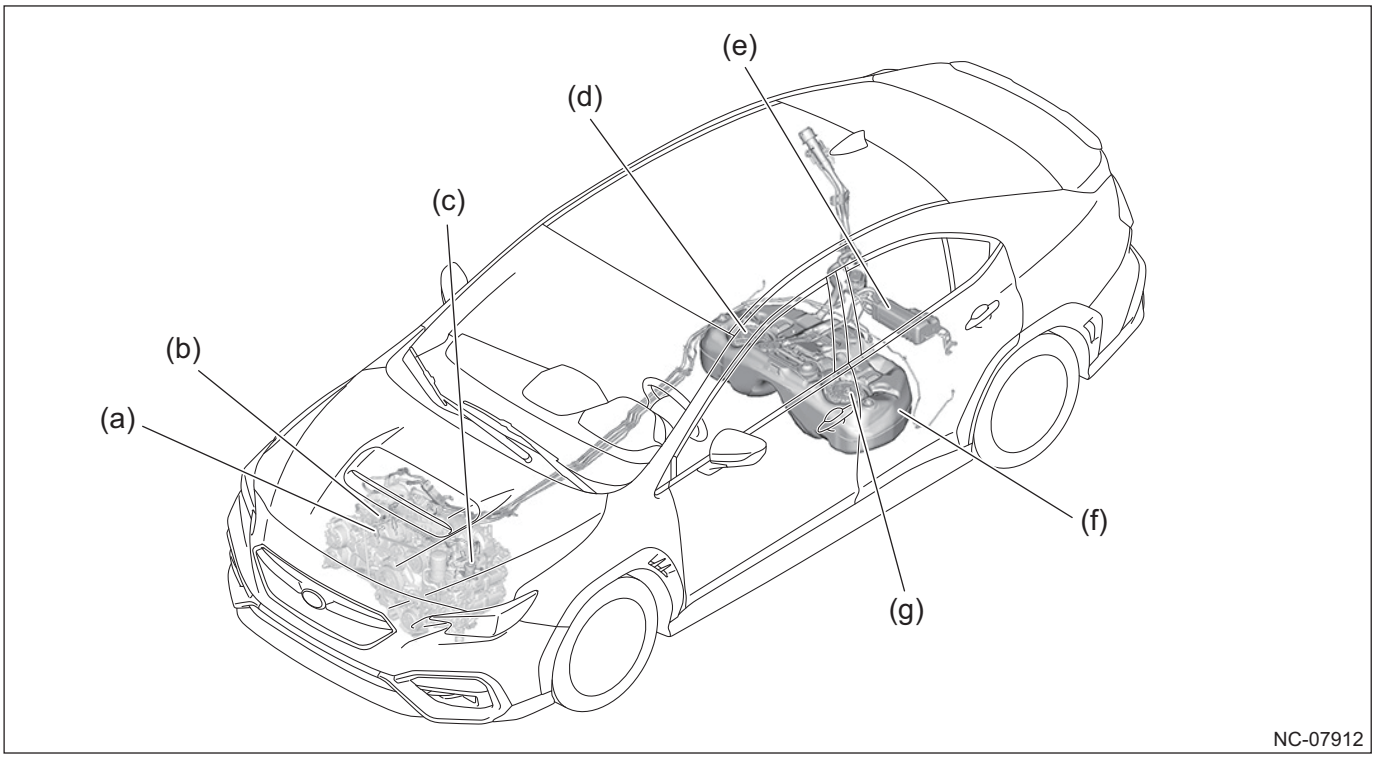
2.2.1 Overview

Overview

- A cylinder direct fuel injection system is adopted.
- A fuel return less system is used, and fuel pressure control is performed by a pressure regulator that is installed inside the fuel pump assembly.
- A resin straddle-type fuel tank has been adopted.
- The structure covers the high-pressure system fuel pipe with an insulator that reduces vibration and noise.
- In order to improve fuel system safety performance in the event of a collision, a structure is adopted which protects the fuel pipe with metal plate protectors.

2.2.2 Component

Component layout drawing



(a) Fuel injector assembly
(b) Fuel pressure sensor
(c) High-pressure fuel pump
(d) Fuel pump assembly
(e) Canister
(f) Fuel tank
(g) Fuel sub level sensor

Component details

Fuel tank

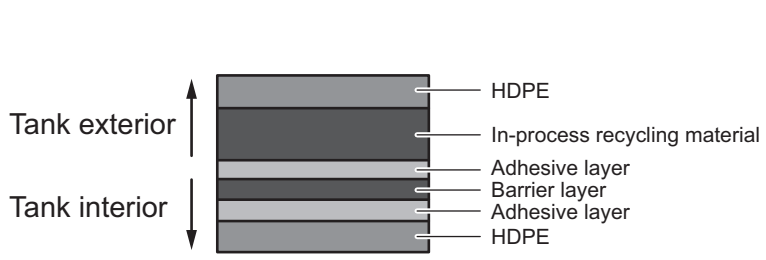
A resin fuel tank has been adopted in order to reduce vehicle weight. It uses a 6-layer resin structure to achieve low fuel permeability.

The fuel tank capacity is 16.6 US gal (63 liters, 13.9 Imp gal).

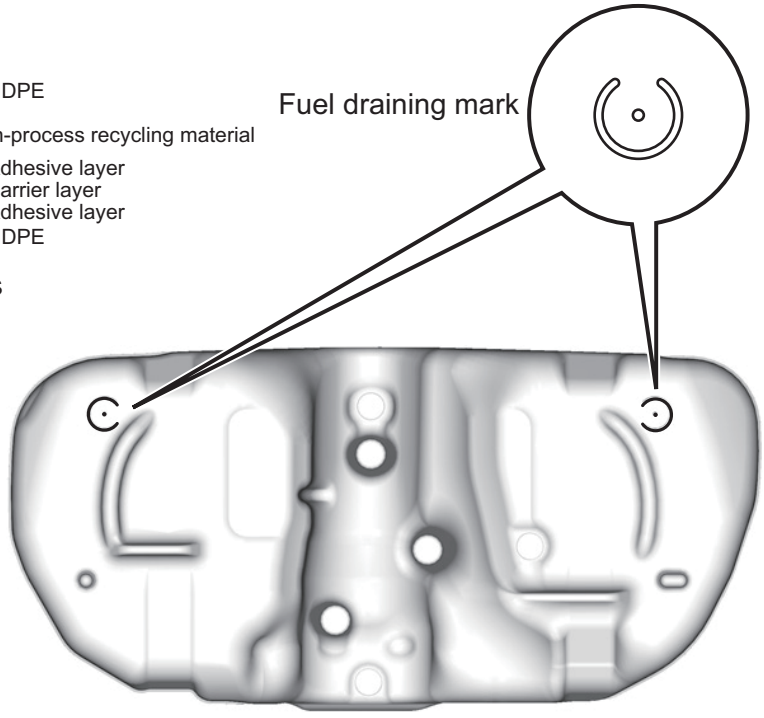
A straddle type tank shape is used so that the propeller shaft and other parts can pass through the center portion of the fuel tank assembly. As a result, a jet pump for fuel transport is adopted for the fuel chamber on the low-pressure fuel pump side.

The fuel level sensor is installed in both the right and left chambers for correctly notifying the remaining capacity of the straddle type tank to the driver.

Fuel draining marks are set on the bottom surface of the fuel tank to clarify and simplify the position adjustment of the fuel draining device, and to securely drain fuel when disassembling.



Structure of fuel tank layers



Fuel tank view from underneath

HDPE (High Density Polyethylene): High Density Polyethylene

Light weight and high strength, with superior water and solvent resistance.

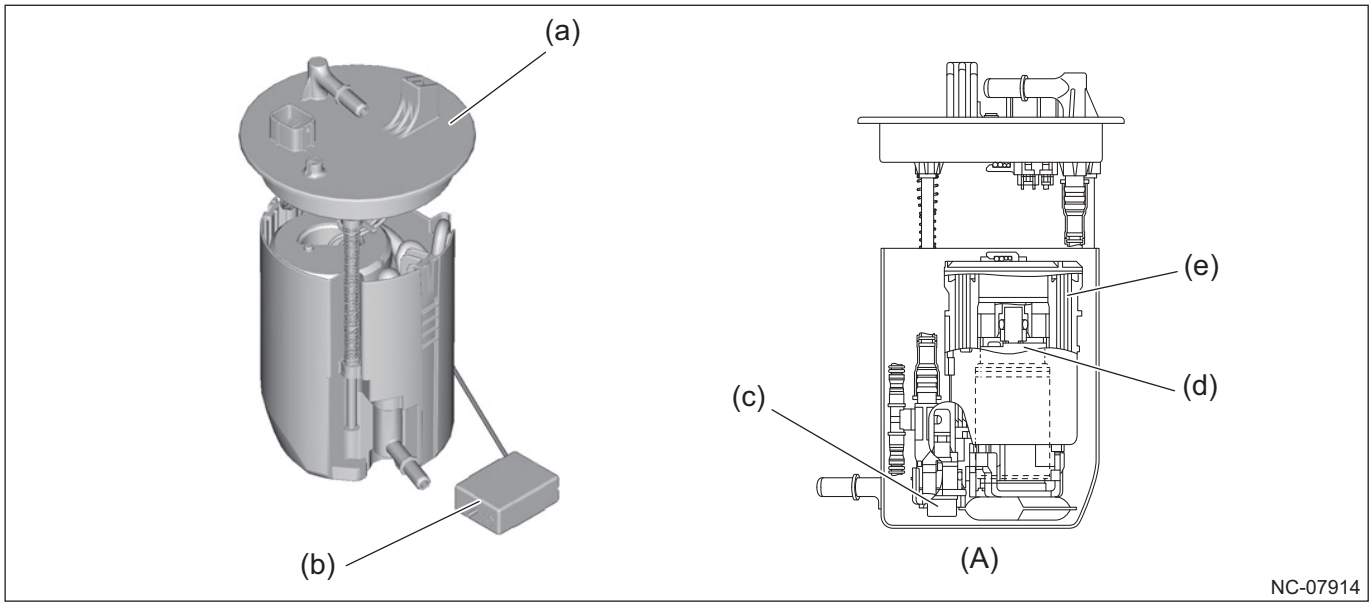
NC-07913

Fuel pump assembly

A fuel pump assembly which integrates the fuel pump, fuel filter, and fuel level sensor has been adopted.

The fuel pump is the circumferential flow type in-tank fuel pump. This fuel pump sends the fuel under pressure to the high-pressure fuel system.

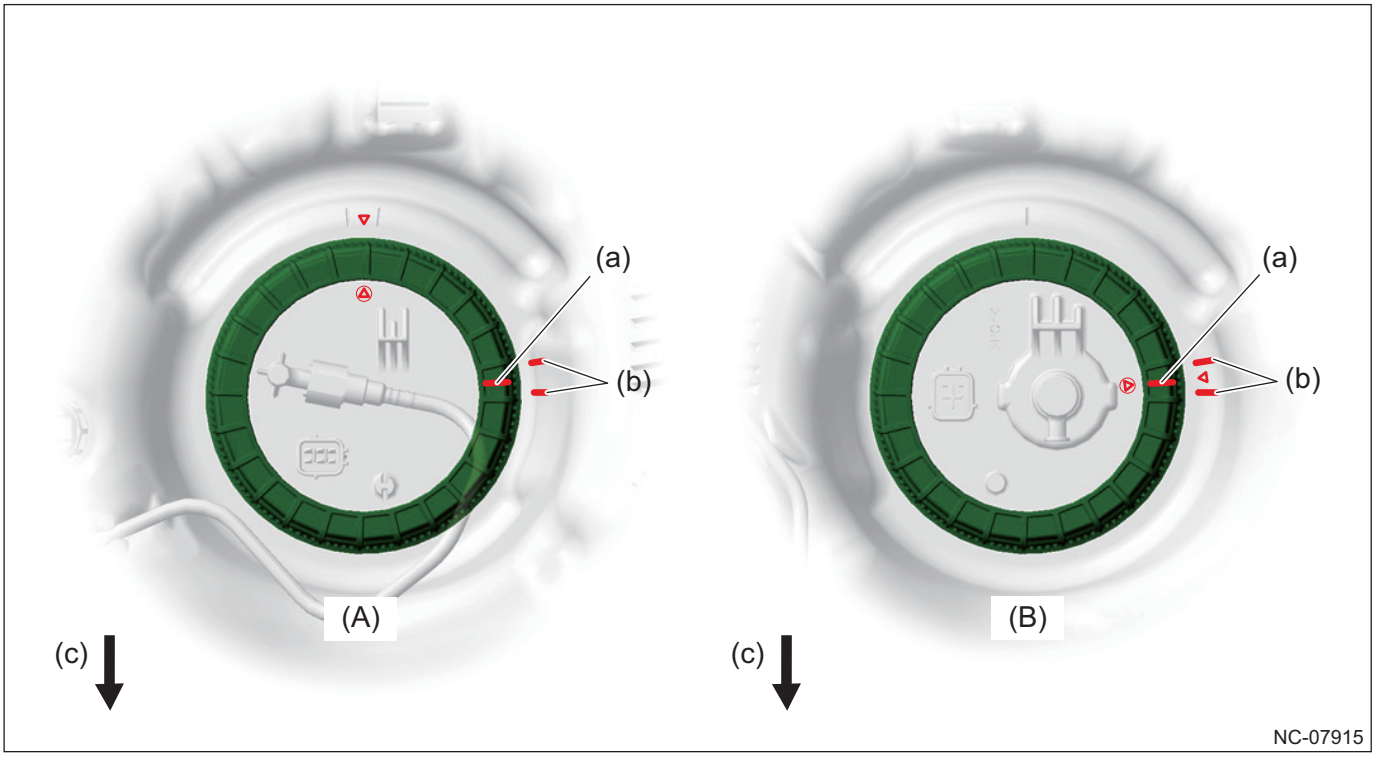
In order to ensure safety in the event of a front collision, side collision, lateral rollover or other accident that turns the vehicle upside down (when airbags are deployed), or a rear-end collision (when airbags are not deployed), a system is adopted that turns OFF the fuel pump in response to the signal transmitted from the airbag CM, preventing fuel leaks.



(A) Cross section

(a) Fuel pump assembly
(b) Fuel level sensor
(c) Pressure regulator
(d) Fuel pump
(e) Fuel filter

Angle fastening type ring nuts are adopted for installing the fuel pump assembly and the fuel sub level sensor. When tightening the ring nut, the ring nut mark is aligned within the attachment position termination range marks (fuel tank side). This enables visual confirmation and improves workability.



(A) Fuel pump assembly

(B) Fuel sub level sensor

(a) Ring nut mark

(b) Attachment position termination range marks (fuel tank side)

(c) Vehicle front side

High-pressure fuel pump

■ Construction

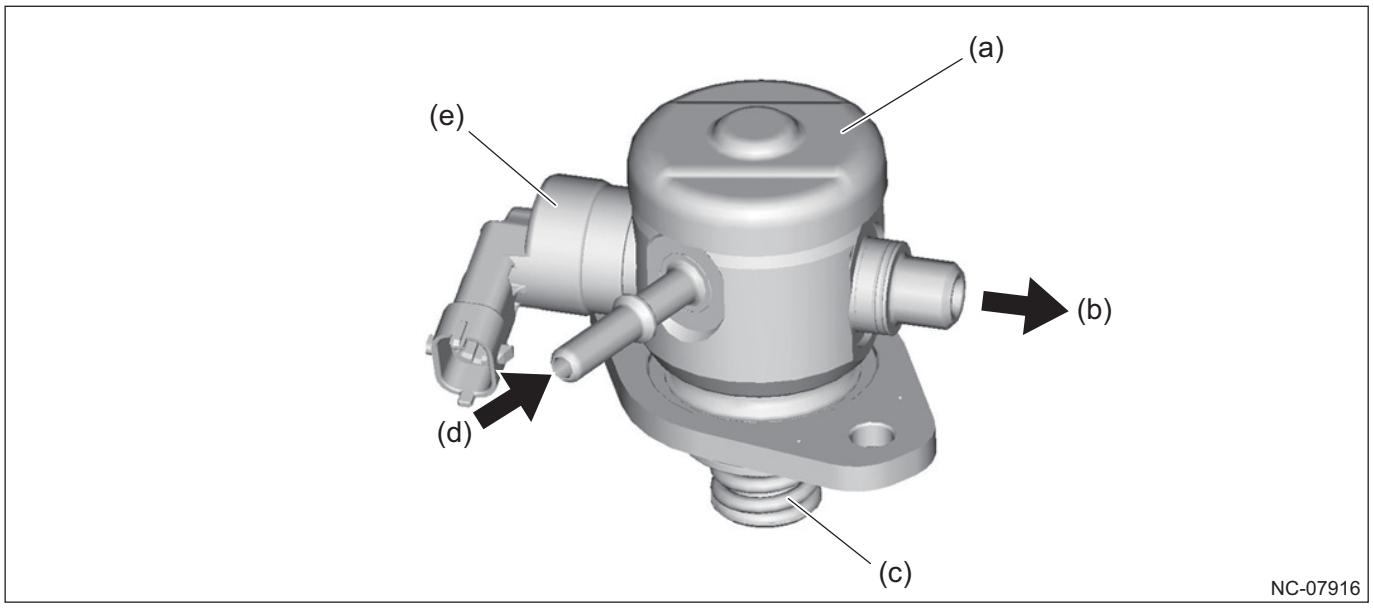
Drive torque is reduced by adopting a highly efficient single plunger and a roller lifter.

The fuel pump is composed of a solenoid spill valve that regulates the volume of high-pressure fuel discharged, a plunger driven by the intake camshaft LH that pressurizes the fuel, a check valve that mechanically opens and closes the passage to the high-pressure fuel delivery pipe, and a relief valve that is used when fuel pressure becomes abnormal. The solenoid spill valve, check valve, and relief valve are integrated to reduce weight and make the system more compact.

The high-pressure fuel pump is installed on the cam carrier LH and is driven by the cam on the front end of the intake camshaft LH.

The function of the pulsation damper installed at the low-pressure fuel inlet of the high-pressure fuel pump has been improved. This further reduces fuel pulsation and reduces the lower-limit fuel pressure in order to improve vibration and noise.

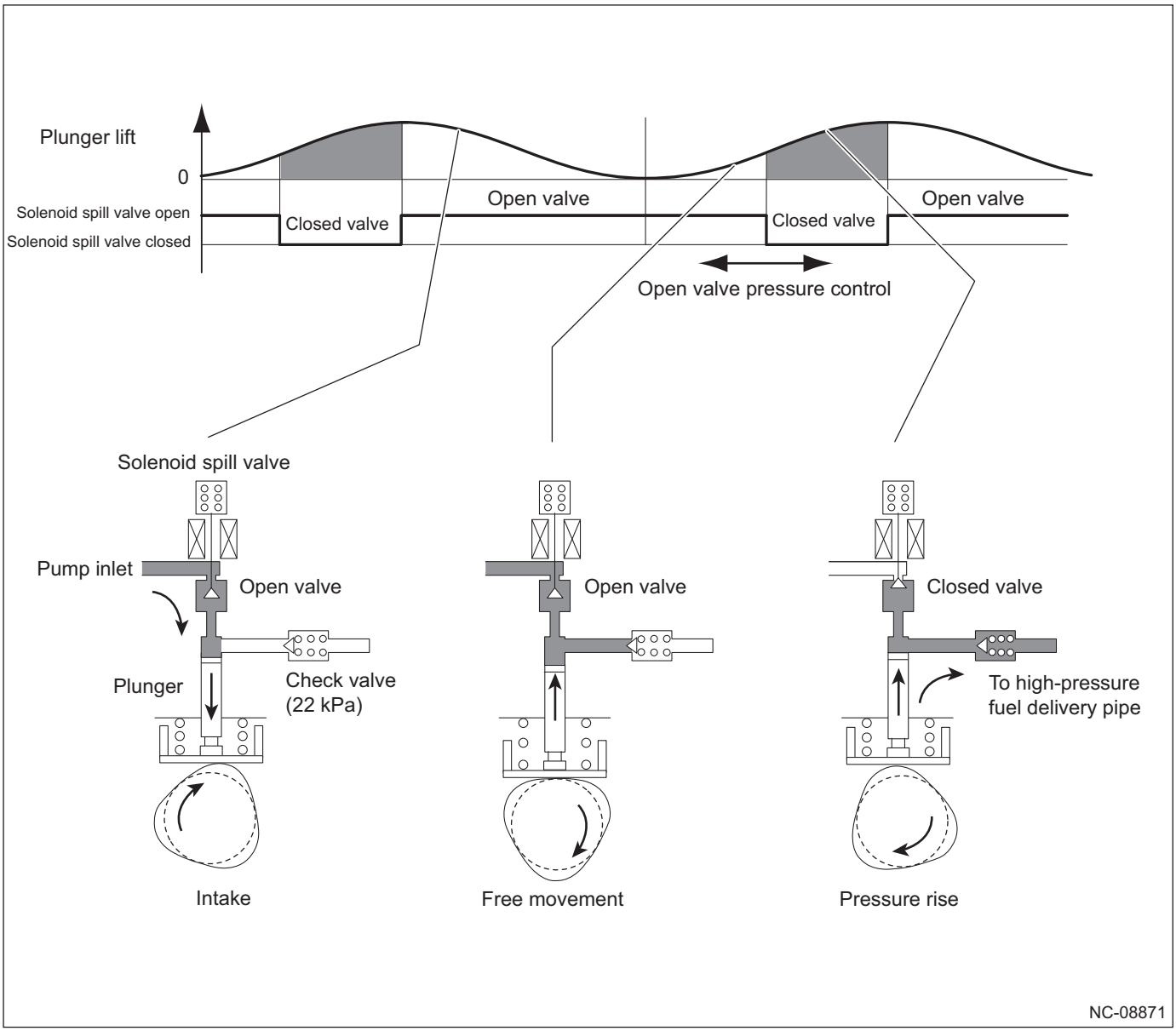
Tapered seal metal fasteners are adopted to fasten the high-pressure fuel pipe.



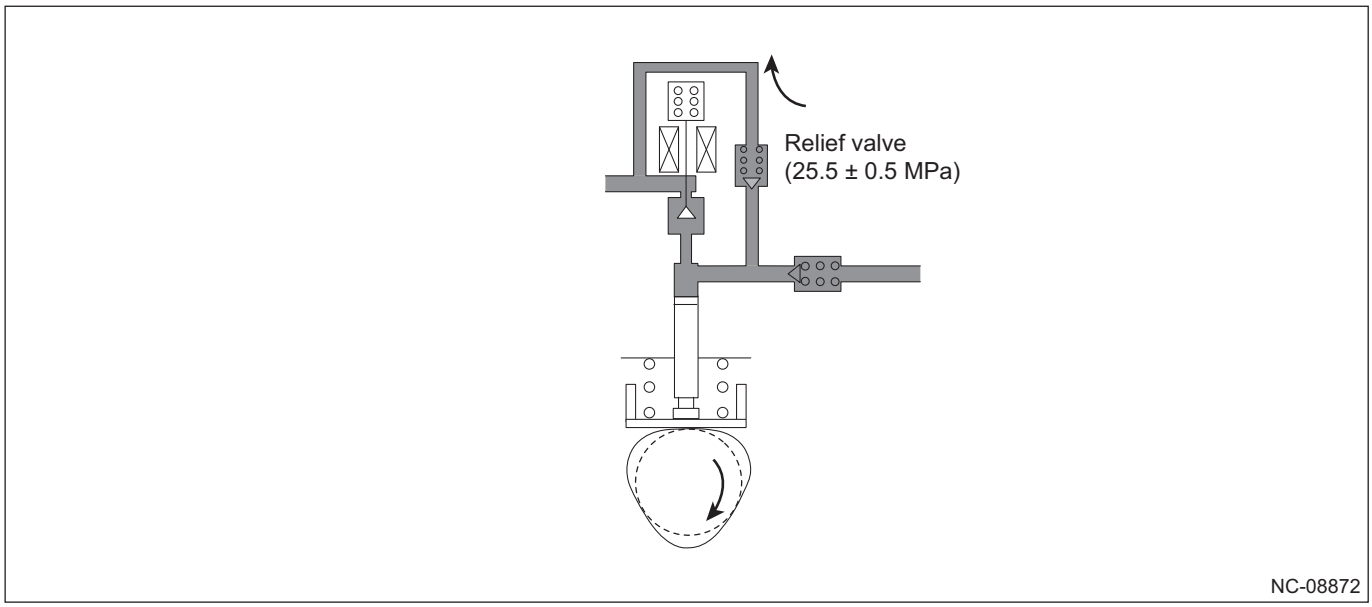
(a) Damper
(b) High pressure fuel outlet
(c) Plunger
(d) Low pressure fuel inlet
(e) Solenoid spill valve

■ Operation

The fuel is pressurized by the up-down movement of the plunger. When the solenoid spill valve on the pump intake side is closed at the optimal timing during pressurized process, it is controlled that the fuel becomes the necessary fuel pressure and the amount of fuel. When the solenoid spill valve is closed at early timing, the valid stroke of the plunger becomes long, and then the fuel is more pressurized.

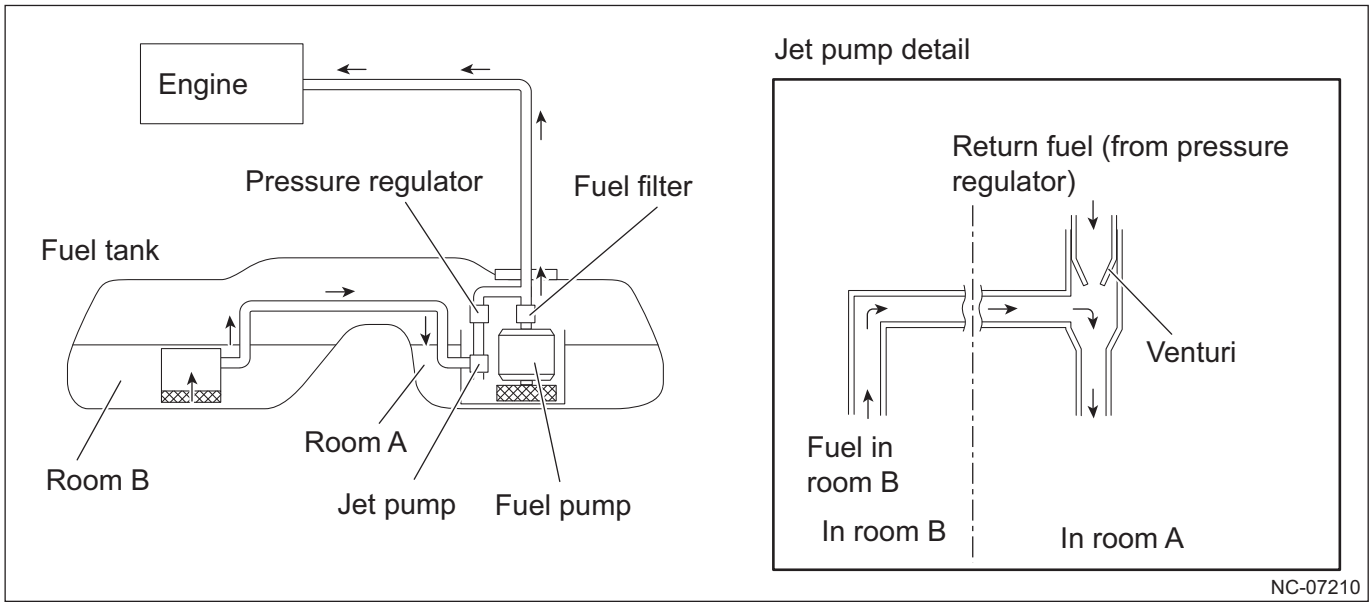


The fuel is returned to high-pressure fuel pump when the fuel pressure in the fuel delivery pipe rises to a specific value.



Jet pump

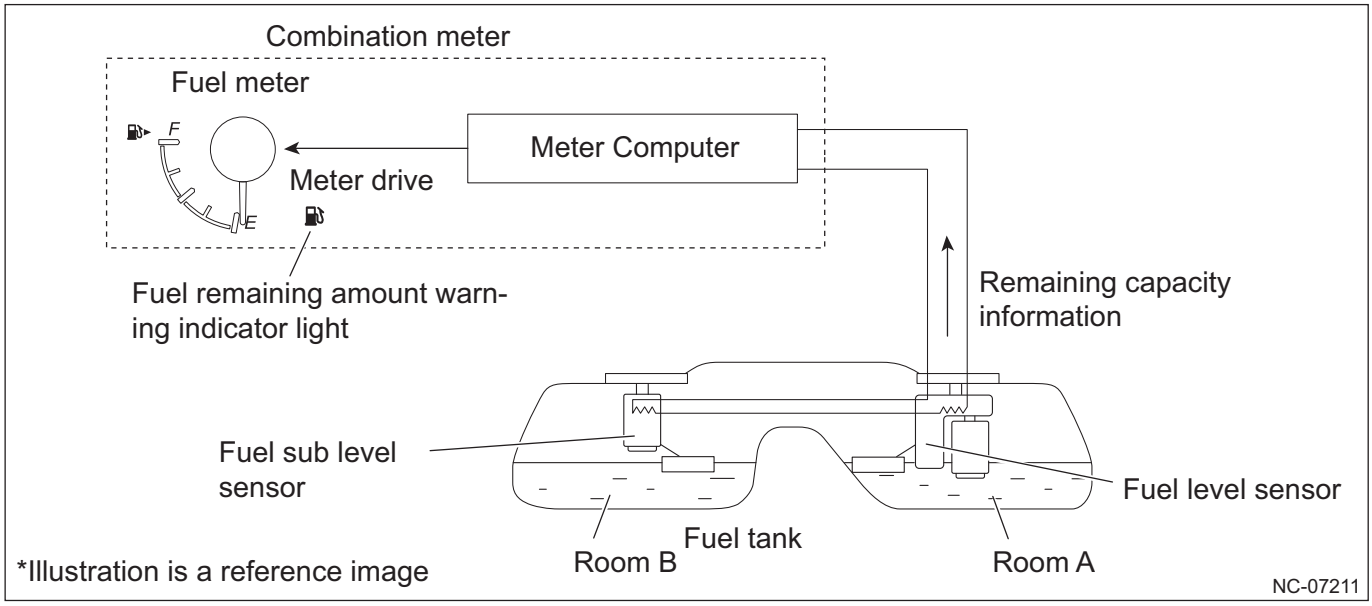
When the fuel level decreases in the straddle-type fuel tank, it is divided into two chambers (A and B) and fuel remains in chamber B. When the return fuel passes through the venturi of the jet pump, the remaining fuel is transported to chamber A by means of negative pressure.



Fuel level sensor

To correctly notify the driver of the remaining capacity of the straddle type tank, fuel level sensors are installed in series in the 2 chambers A and B, and the sensors notify the meter computer of the remaining capacity in both chambers.

The Engine Control Module (ECM) transmits the EFI control information to the meter computer via CAN communication. The meter computer calculates the remaining amount of gasoline based on the signals from the 2 fuel level sensors and the Engine Control Module (ECM), and drives the fuel meter.



Fuel delivery pipe

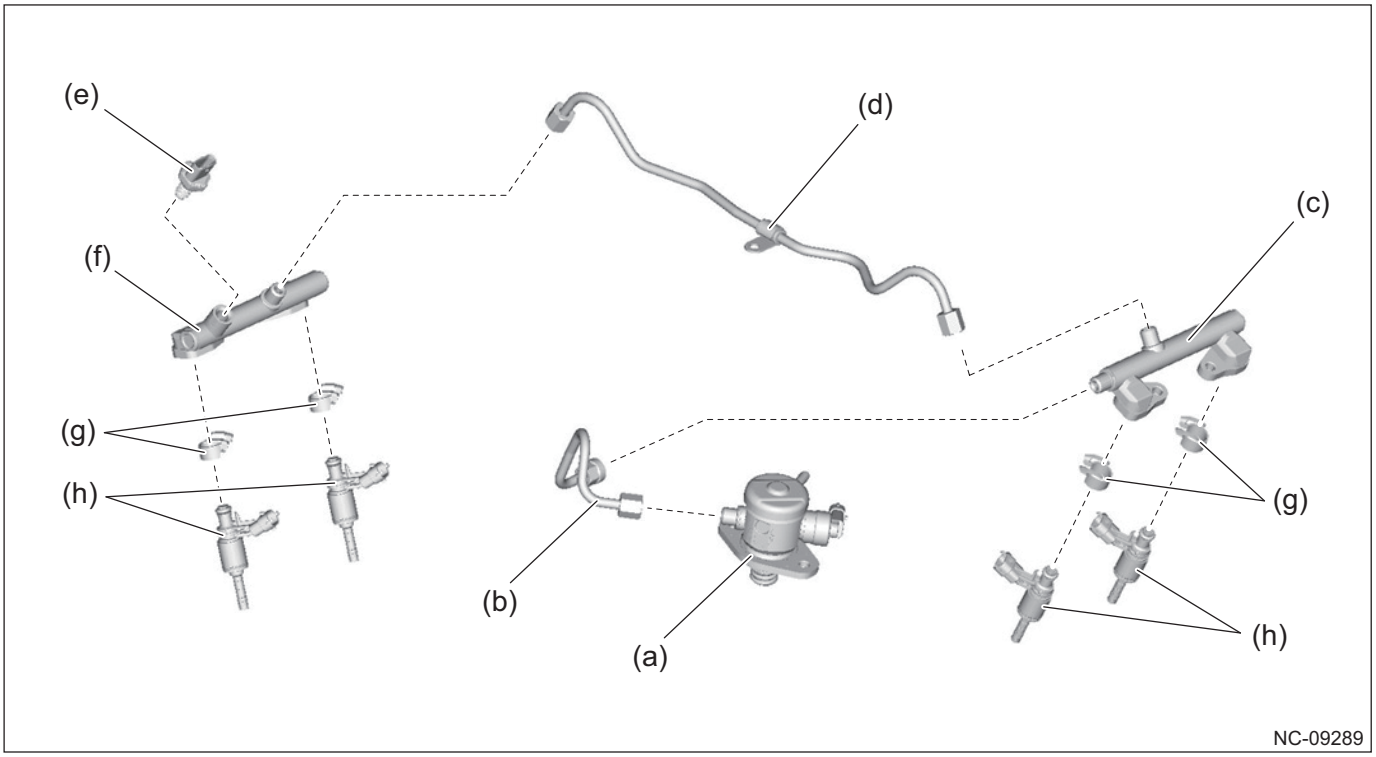
Chrome molybdenum steel fuel delivery pipes have been adopted.

A fuel pressure sensor is installed on the fuel injector pipe RH.

Taper seal metal fastening is adopted for the fuel delivery pipe between the high-pressure fuel pump and fuel injector pipe LH, and between fuel injector pipe LH/RH. In order to improve fuel seal yield strength, the tightening torque for the high-pressure fuel delivery pipe has been changed.

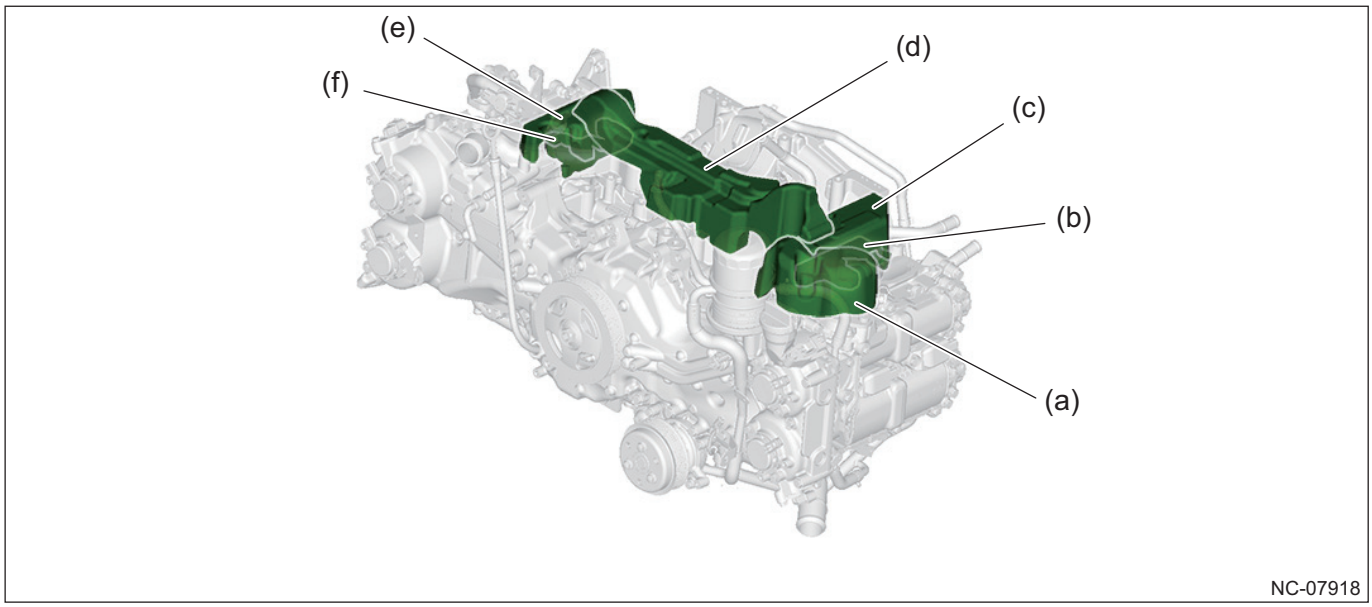
A holder has been adopted on the mounting part of the fuel injector assembly. The structure continually presses the fuel injector with spring force to prevent the fuel injector from moving as combustion pressure is applied to the fuel injector when fuel pressure is low at engine start. This increases air tightness and reduces vibration and noise.

An O-ring seal and backup ring have been adopted for the fuel injector assembly. This reduces fuel injector operating noise transmission and improves quietness, while also ensuring sealing performance of the fastened part.



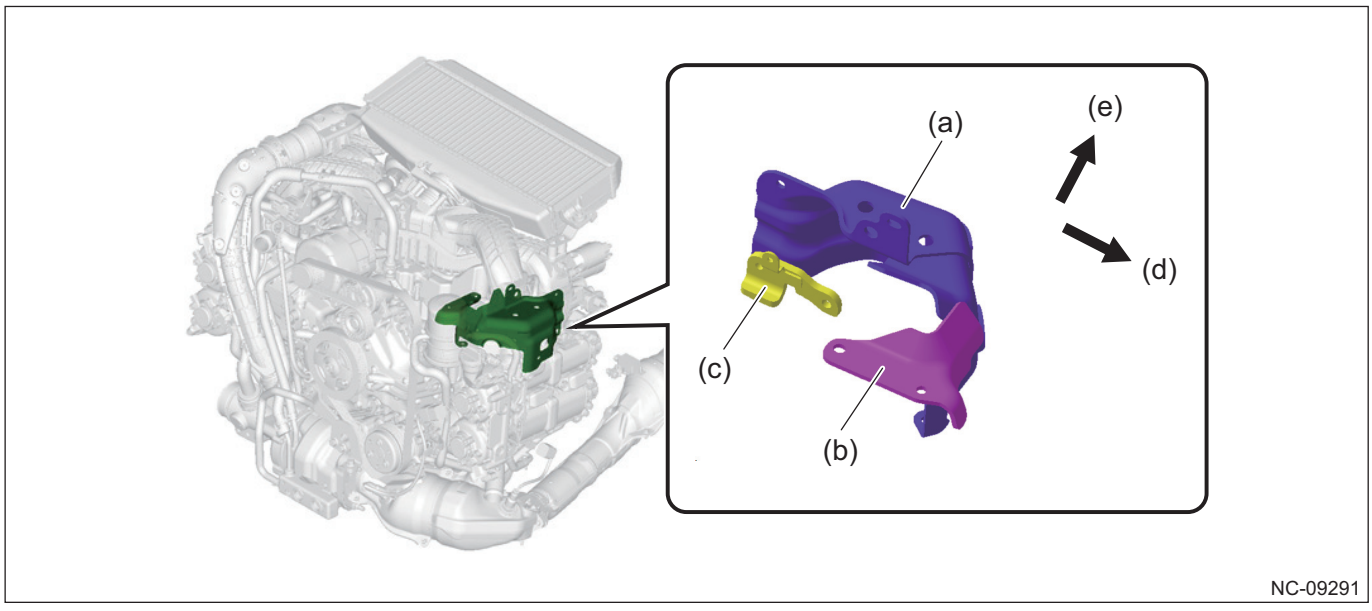
(a) High-pressure fuel pump
(b) High-pressure fuel delivery pipe
(c) Fuel injector pipe LH
(d) High-pressure fuel delivery pipe assembly
(e) Fuel pressure sensor
(f) Fuel injector pipe RH
(g) Holder
(h) Fuel injector assembly

The structure covers the high-pressure fuel pipe with an insulator that reduces vibration and noise.



(a) Fuel pump insulator
(b) Fuel pipe insulator No. 5
(c) Fuel pipe insulator No. 4
(d) Fuel pipe insulator No. 3
(e) Fuel pipe insulator No. 2
(f) Fuel pipe insulator No. 1

In order to protect against collisions from an angled direction, two fuel protectors are installed onto the fuel pump, protecting the high-pressure fuel system in the event of a collision.



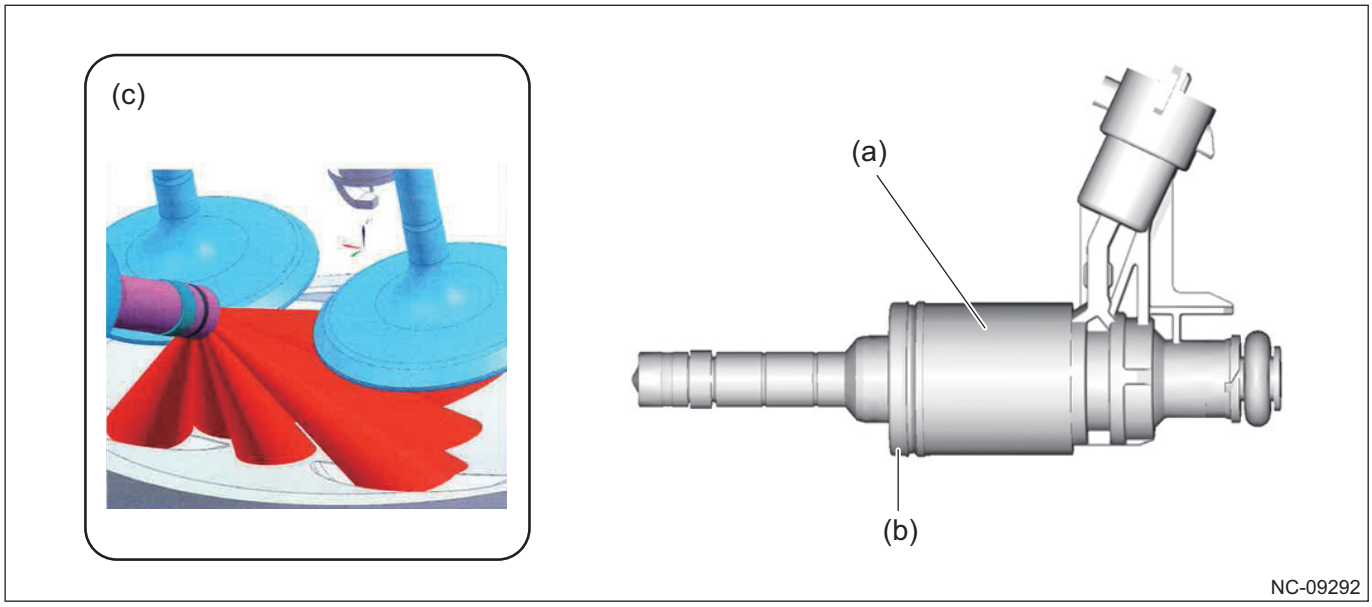
(a) Fuel pipe protector No. 2
(b) Fuel pipe protector No. 1
(c) Protector stay
(d) Front of vehicle
(e) Left side of vehicle

Fuel injector assembly

Multi hole injectors are adopted for creating ideal combustion according to the driving conditions, and a spray guide method is adopted for directly generating the air-fuel mixture around the plug.

The use of a fuel spray shape that is an optimal match for the tumble flow inside the cylinder, and preventing fuel from adhering to the cylinder liner, help to improve fuel efficiency performance and reduce emissions.

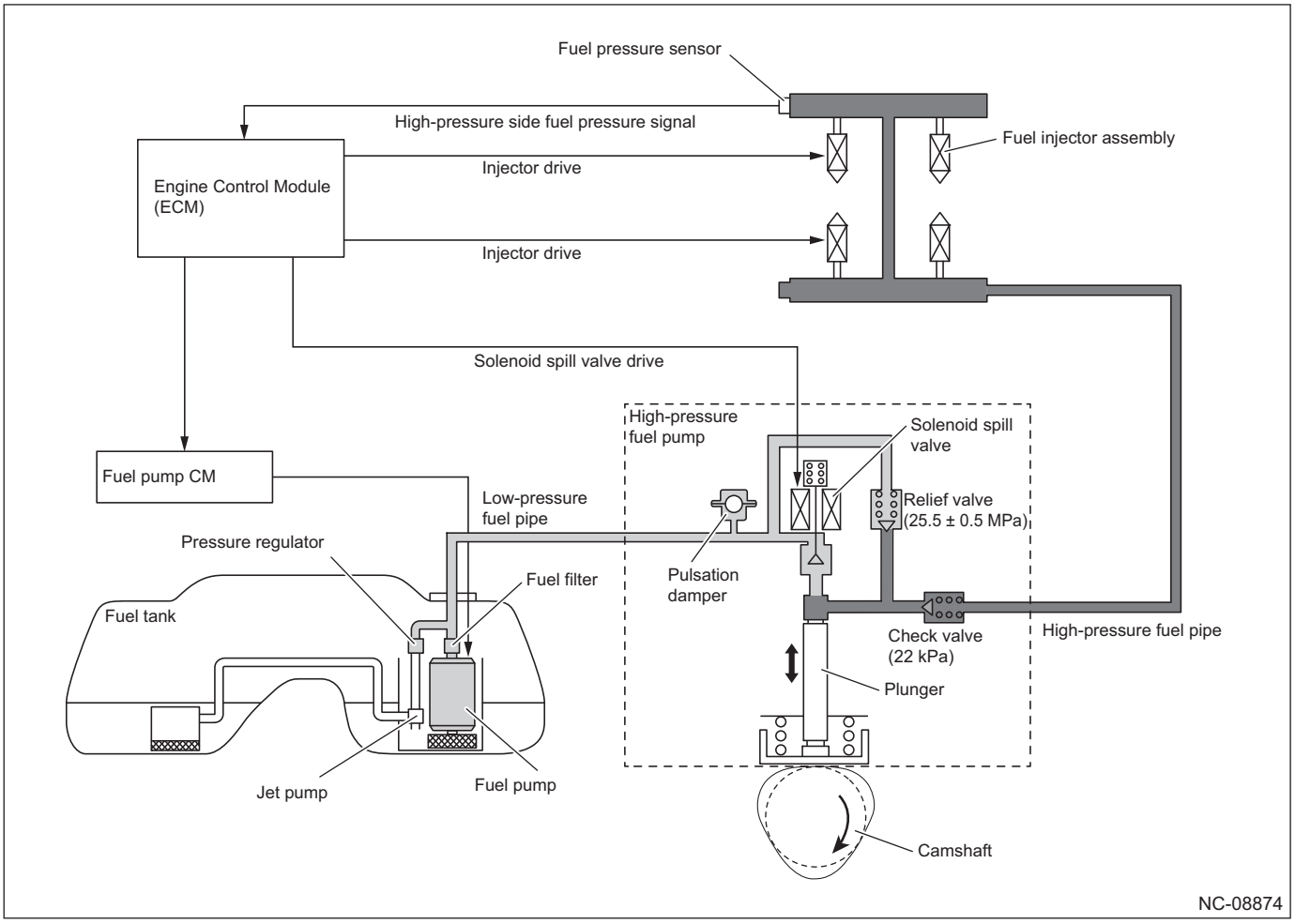
In order to reduce injector operating noise, a decoupling that uses current control was adopted to suppress the clamping sound when the plunger valve opens.



(a) Fuel injector assembly
(b) Decoupling
(c) Image of fuel spray

2.2.3 Construction and Operation

System diagram



System details

Cylinder direct fuel injection system

The system injects high-pressure gasoline directly into the cylinder from the fuel injector assembly and from intake stroke to compression stroke of the engine.

■ Output improvement

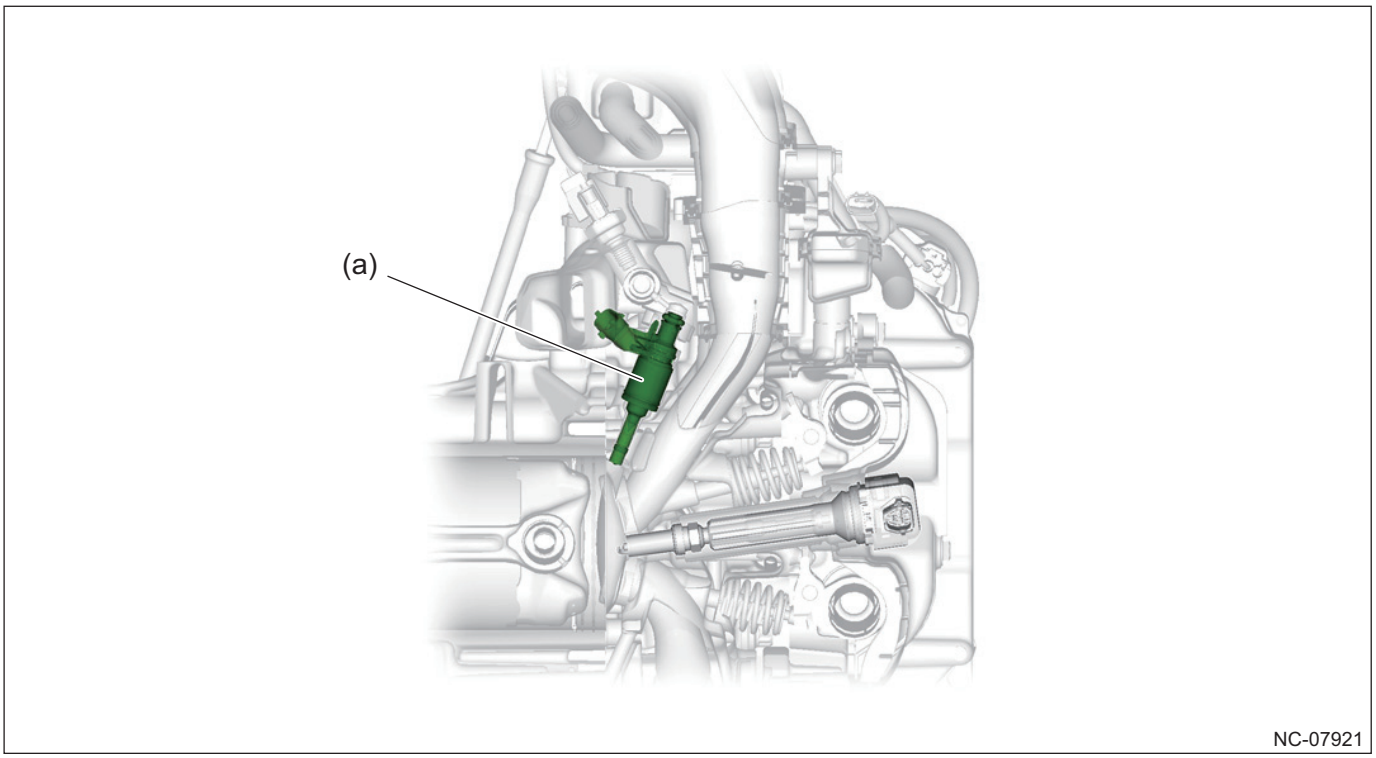
When the system injects fuel directly into the cylinder at high temperature, the cylinder is cooled by vaporization heat of the fuel and the cylinder temperature decreases, increasing torque in all speed ranges. This achieves both low fuel consumption and higher output.

■ Downsizing

The high anti-knocking performance allows a turbocharger to be easily installed, greatly contributing to reducing engine emissions. Displacement was reduced to reduce mechanical loss, and a turbocharger was added, in order to achieve low fuel consumption during cruising while also maintaining dynamic performance that is equal to or better than a large-displacement natural air intake engine.

■ Exhaust gas reduction

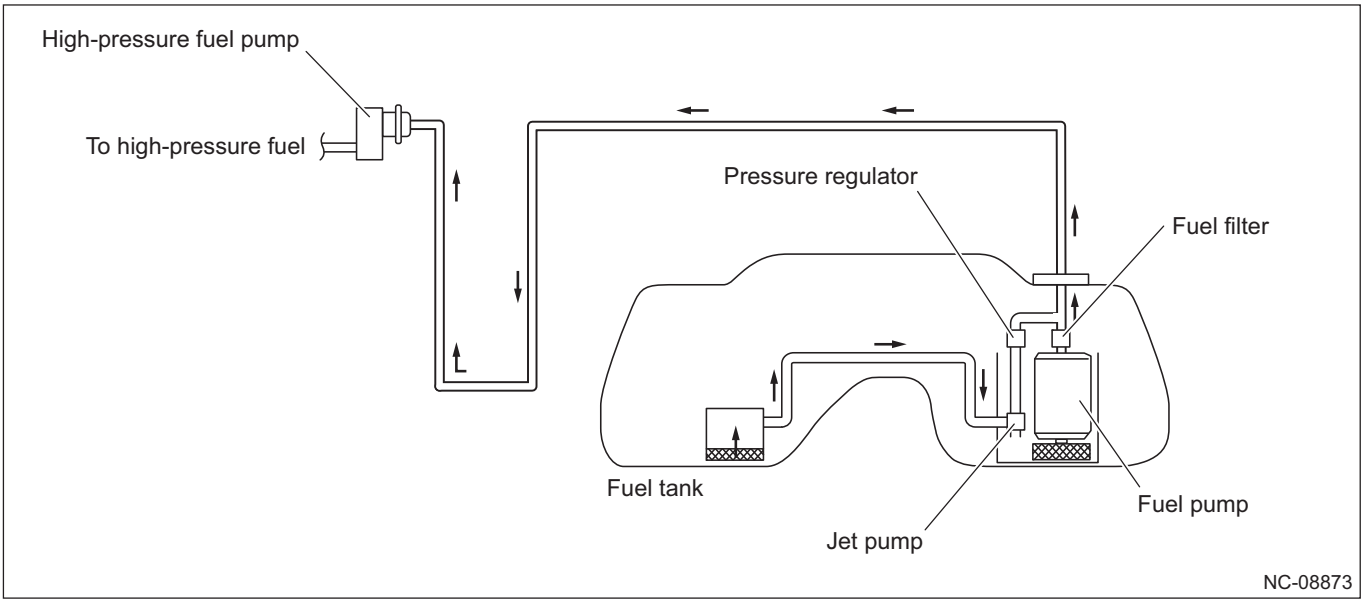
The system facilitates fuel atomization and air mixture by using multistage injection during fast idle to reduce exhaust gas.



(a) Fuel injector assembly

Fuel return less system

Fuel pressure control in the low-pressure fuel system is performed by a pressure regulator installed in the fuel pump assembly. This returns fuel within the fuel tank and supplies only the amount that will be consumed by the engine at constant pressure. As a result, the heated fuel that passes through the engine compartment does not return to the fuel tank, reducing the generation of fuel evaporation gas inside the fuel tank and contributing to improved emissions performance.



2.3 Emission control system

2.3.1 Overview

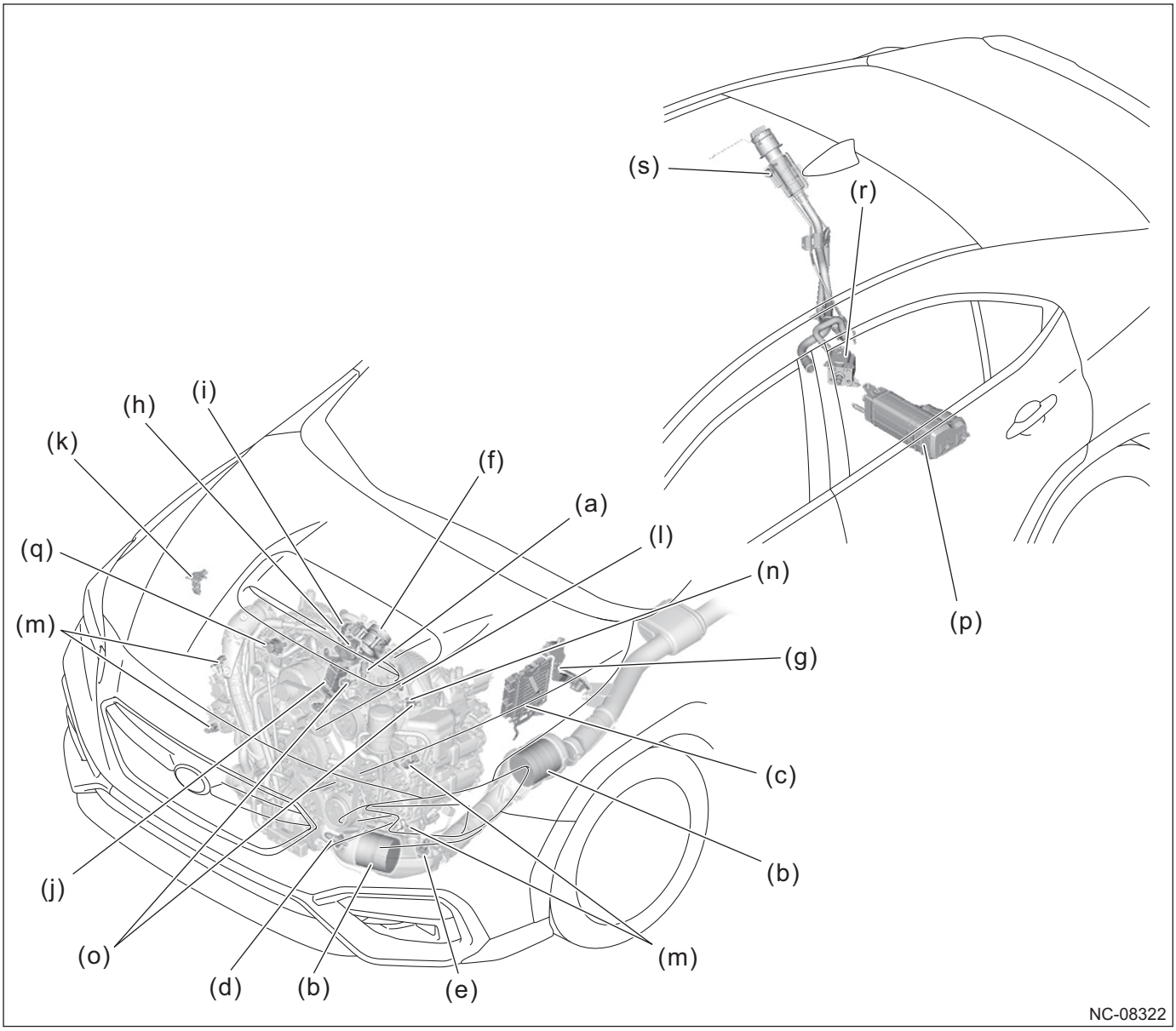
Overview

The following systems are adopted for the emission control system.

Crankcase emission control system
Fuel evaporation gas emission prevention system • Evaporative leak check module system
EGR (Exhaust Gas Recirculation) system

2.3.2 Component

Component layout drawing



(a) PCV valve

(b) Ternary catalysts

(c) Engine control module (ECM)

(d) Front oxygen (A/F) sensor

(e) Rear oxygen sensor

(f) Throttle body
- Throttle position sensor
- Throttle motor

(g) Accelerator pedal position sensor

(h) Manifold pressure and intake air temperature sensor

(i) EGR control valve

(j) EGR cooler

(k) Airflow and intake air temperature sensor

(l) Crankshaft position sensor

(m) Camshaft position sensor

(n) Engine coolant temperature sensor

(o) Knock sensor

(p) Canister

(q) Purge control solenoid valve

(r) ELCM

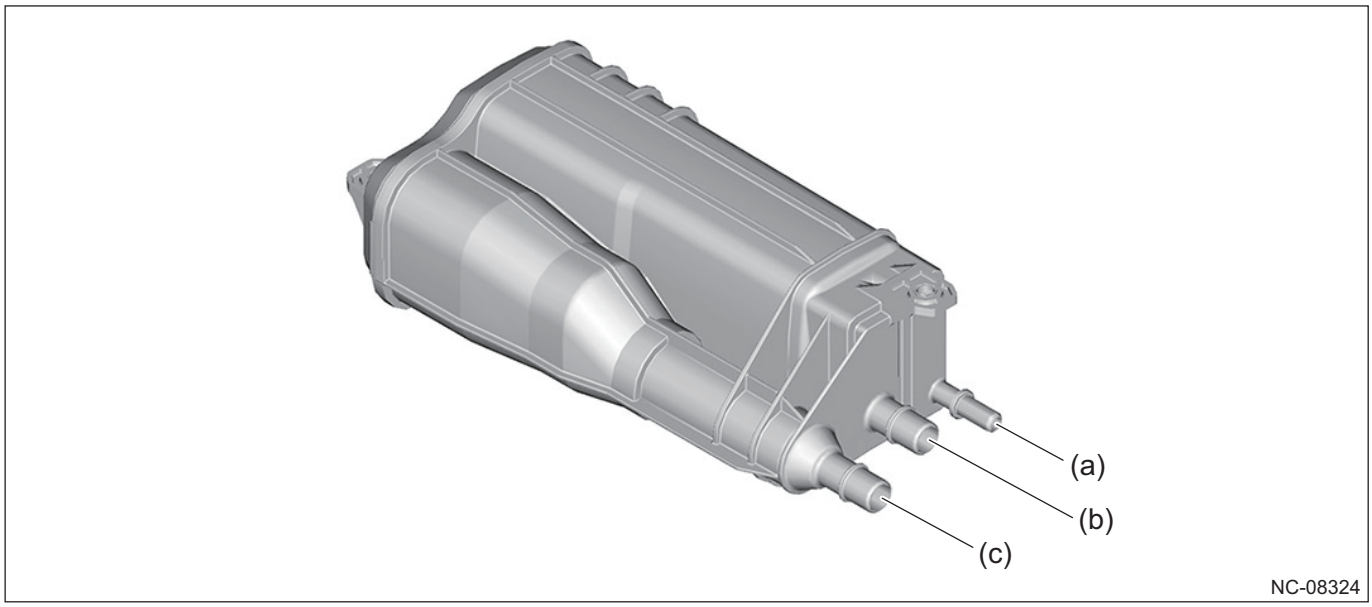
(s) Drain filter

Component details

Canister

The canister purge control that transports the fuel evaporation gas from the fuel tank to the intake port to combust the gas is adopted.

The canister is mounted at the rear of the fuel tank.

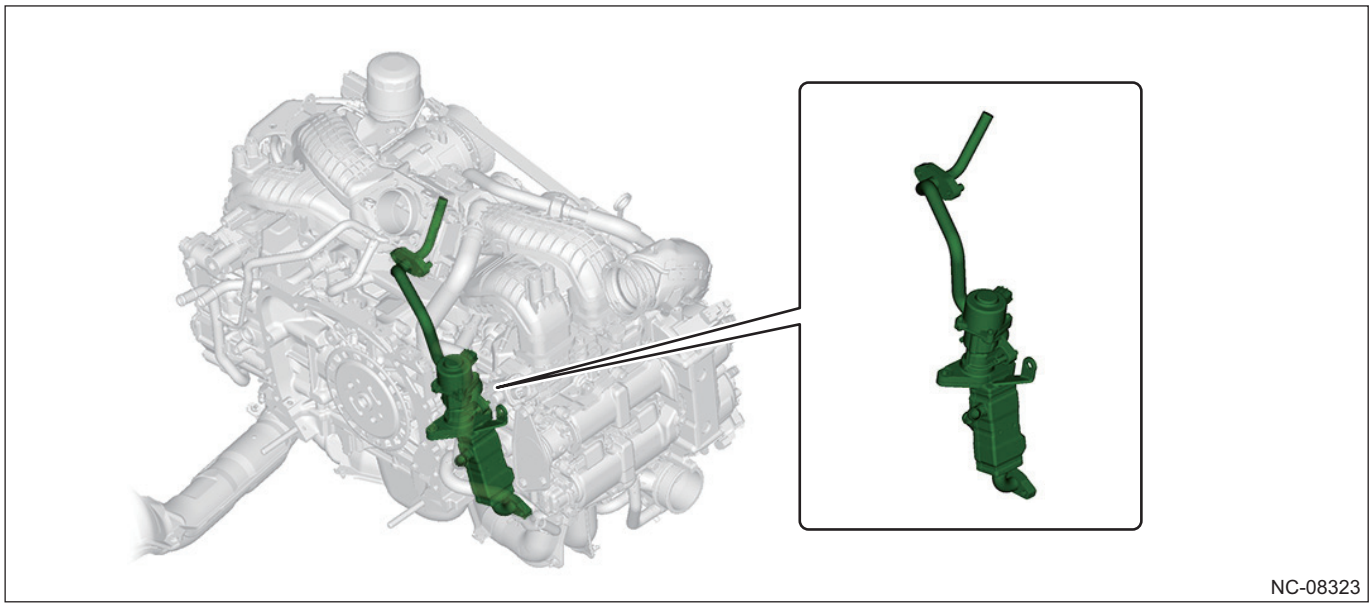


(a) To purge control solenoid valve
(b) From fuel tank
(c) To ELCM

EGR cooler, EGR control valve, EGR pipe

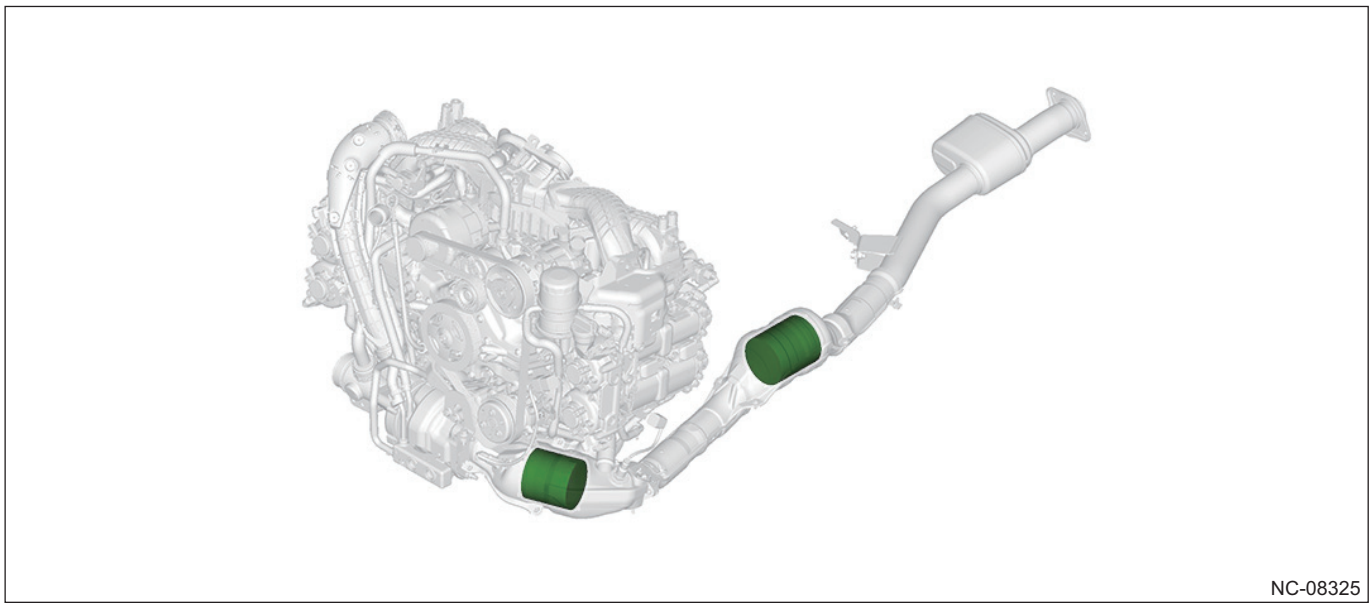
Fuel efficiency is ensured by adopting a high efficiency core, shortening the pipe length, and reducing pressure loss by increasing the EGR gas volume.

The end of the pipe that protrudes into the intake manifold is optimized to distribute EGR gas more evenly to each cylinder and reduce combustion fluctuation, ensuring the increase in EGR gas needed to improve fuel efficiency.



Ternary catalyst

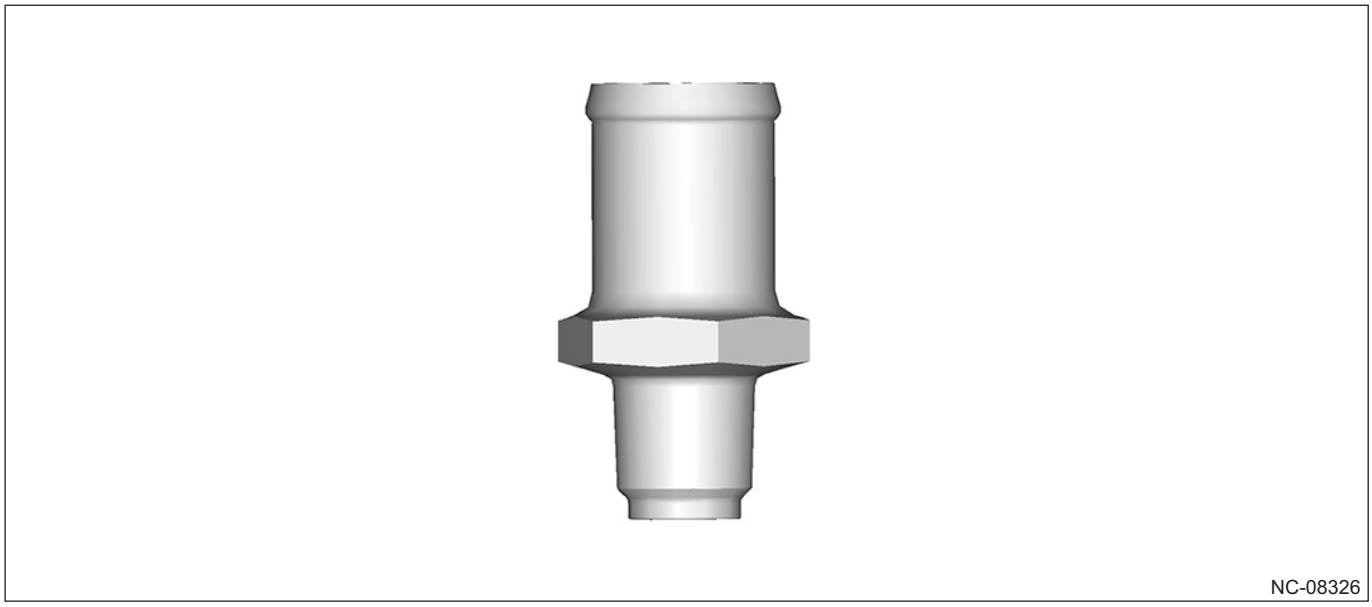
The ternary catalysts are positioned at the front exhaust pipe and center exhaust pipe, ensuring sufficient emissions performance.



PCV valve

Optimizing the PCV valve nipple and air scavenging hose diameter ensures compliance with North America OBD regulations.

A steel PCV valve is adopted to ensure durability.



2.3.3 Construction and Operation

Main component functions

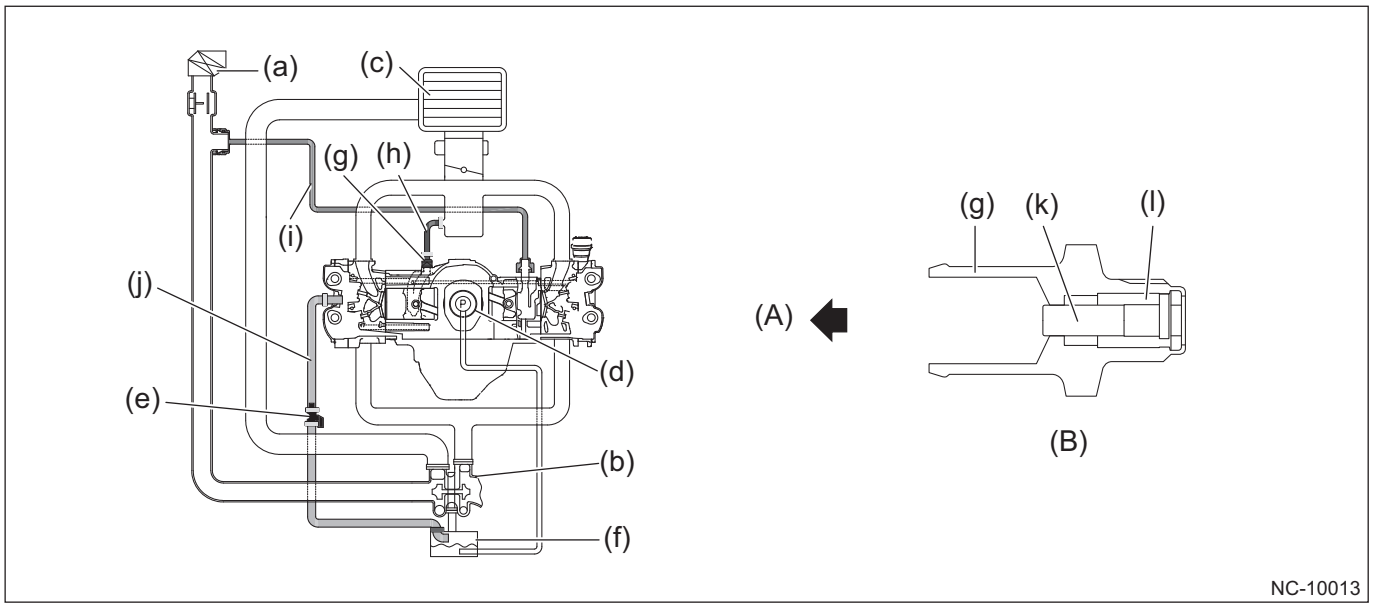
Name		Function and construction
PCV valve		Blowby gas is inhaled into the intake manifold from the crankcase, and the blowby gas and air-fuel mixture are combusted.
Ternary catalyst		NOx is deoxidized when HC and CO in the exhaust gas are oxidized.
Engine Control Module (ECM)		This receives input signals from various sensors, compares the signals with stored data, and transmits a signal to optimally control the air-fuel ratio and injection timing.
Front oxygen (A/F) sensor		This detects the concentration of oxygen in the exhaust gas.
Rear oxygen sensor		This detects the concentration of oxygen in the exhaust gas.
Throttle position sensor	Throttle position sensor	This detects the throttle opening angle.
	Throttle motor	This receives the signal from the Engine Control Module (ECM) and operates the throttle valve.
Accelerator pedal position sensor		This detects the accelerator pedal position.
Manifold pressure sensor		This detects the absolute pressure of the intake manifold.
Air flow sensor		This detects the intake airflow.
Intake air temperature sensor		This detects the temperature of the intake air inside the air cleaner case.
Crankshaft position sensor		This detects engine speed (rotation number).
Camshaft position sensor		This detects the reference signal for determining the cylinder in which combustion occurs.
Engine coolant temperature sensor		This detects the coolant temperature.
Knock sensor		This detects knocking of the engine.
Canister		This absorbs the fuel evaporation gas occurring in the fuel tank at engine stop and discharges the gas into the combustion chamber at engine start to completely combust the gas. This prevents HC discharge into the atmosphere.
Purge control solenoid valve		This receives the signal from the Engine Control Module (ECM) and controls the discharge of fuel evaporation gas which is absorbed in the canister.
EGR control valve		This recirculates exhaust gas into the combustion chamber, reducing the oxygen concentration of the intake air and lowering the combustion temperature, thereby reducing NOx emissions.
EGR cooler		
ELCM		This monitors any fuel evaporation gas leaking from the fuel tank and canister. It conducts diagnosis several hours after the engine stops, and notifies the driver if there is any gas leakage.

System details

Crankcase emission control system

The PCV system prevents air pollution caused by blow-by gas discharged from the crankcase.

Two PCV connection hose systems are installed. When the throttle valve opening angle is small and load is low, little blow-by gas is produced and the negative pressure of the intake manifold is strong. As a result, blow-by gas is suctioned from the primary side. When the throttle valve opening angle is large and load is high, large amounts of blow-by gas are produced. As a result, blow-by gas is suctioned from the secondary side.



(A) To intake manifold

(B) PCV valve cross section

(a) Air cleaner
(b) Turbocharger
(c) Intercooler
(d) Scavenge pump
(e) Detection connector
(f) Catch tank
(g) PCV valve
(h) Primary-side PCV (scavenging) hose
(i) Secondary-side PCV (fresh air) hose
(j) Pressure-adjusting hose
(k) Valve
(l) Spring

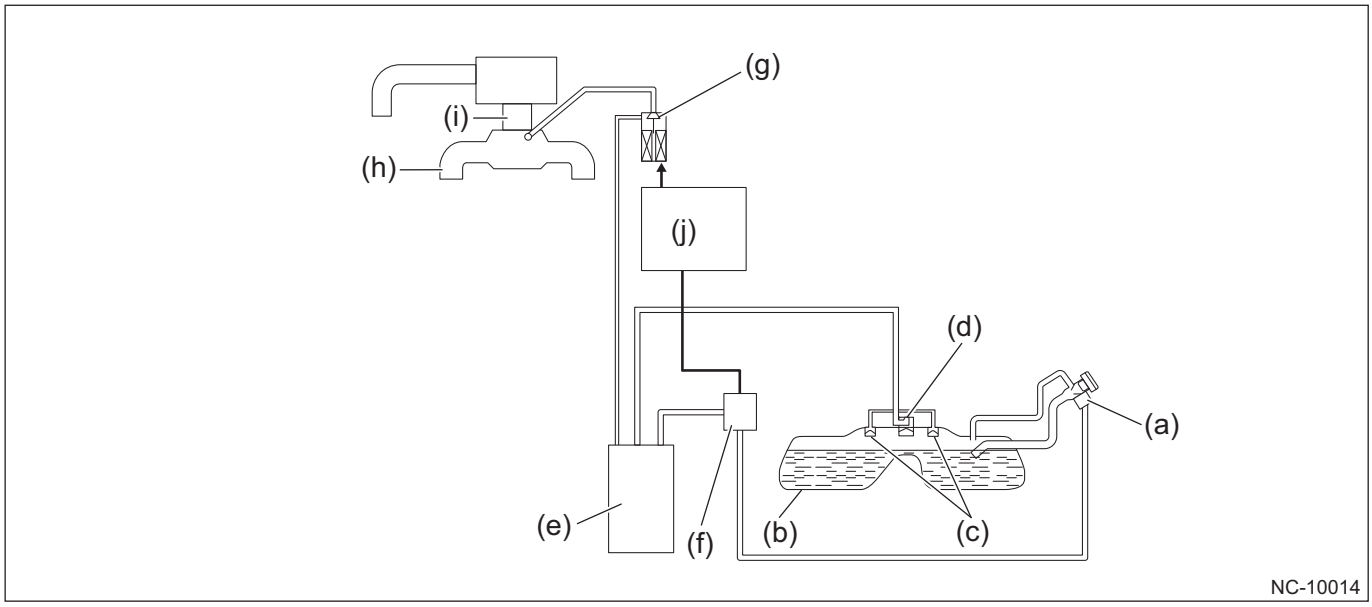
Fuel evaporation gas emission prevention system

The fuel evaporation gas emission prevention system prevents fuel evaporation gas from being discharged into the atmosphere. This system is composed of a canister, purge control solenoid valve, fuel cut valve, evaporative leak check module system, and pipes connecting the components.

The evaporation fuel in the fuel tank is led to the canister through the evaporation fuel line and is absorbed with active carbon in the canister. The fuel tank line includes the fuel cut valve.

The purge control solenoid valve is optimally controlled by the Engine Control Module (ECM) according to the engine conditions.

The fuel cut valve is included in the fuel tank line. The float moves up and blocks the pipe as the oil level of the fuel in the fuel tank rises, stopping the fuel from flowing into the evaporation fuel line.



(a) Drain filter

(b) Fuel tank

(c) Fuel cut valve

(d) Vent valve

(e) Canister

(f) Evaporative leak check module

(g) Purge control solenoid valve

(h) Intake manifold

(i) Throttle body
- Throttle position sensor
- Throttle motor

(j) Engine Control Module (ECM)

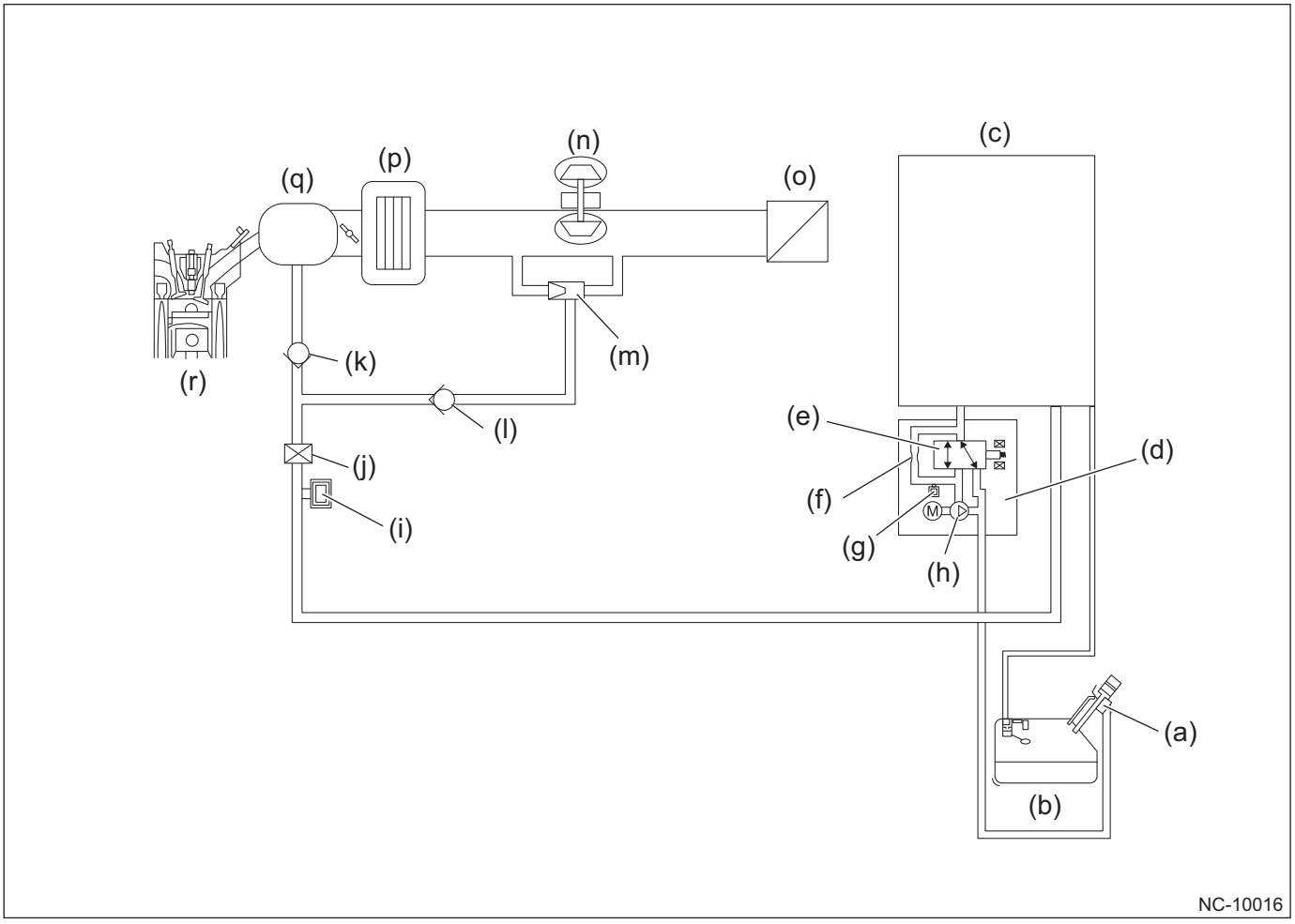
■ Evaporative leak check module system

The evaporative leak check module system is composed of a reference orifice (diameter 0.02 in (0.5 mm)), vacuum pump (for introducing negative pressure into the evaporation line), switching valve (for switching negative pressure introduction passages), and pressure sensor.

In order to accurately conduct evaporation leak check diagnosis, operation and evaporation leak check diagnosis is started by a signal from the Engine Control Module (ECM) when a fixed time has elapsed after the engine stopped and the evaporation pressure stabilized.

The evaporative leak check module system conducts evaporation leak check diagnosis by introducing negative pressure into the evaporation line by an internal pump while the engine is stopped.

Evaporation leak check diagnosis frequency is increased and forced evaporation leak check diagnosis is enabled while the engine is stopped, enabling to reliably verify completion of the repair after evaporation system maintenance work is complete.

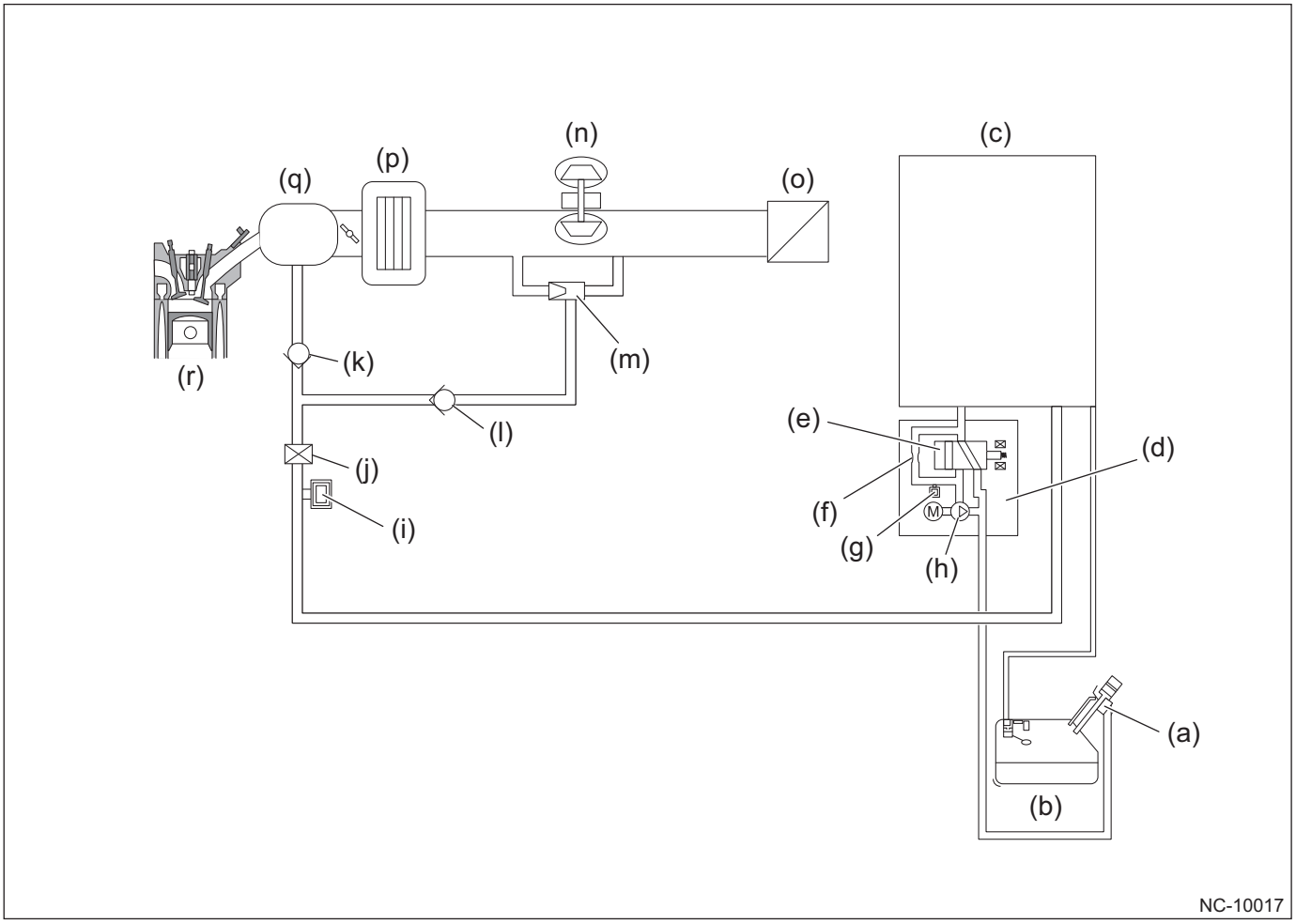


(a) Drain filter
(b) Fuel tank
(c) Canister
(d) Evaporative leak check module
(e) Switching valve
(f) Reference orifice
(g) Pressure sensor
(h) Vacuum pump
(i) Purge line pressure sensor
(j) Purge control solenoid valve
(k) Check valve (intake manifold side)
(l) Check valve (ejector side)
(m) Ejector
(n) Turbocharger
(o) Air cleaner
(p) Intercooler
(q) Intake manifold
(r) Engine

Operation during normal driving

Vacuum pump: not operating

Switching valve: not operating (atmosphere release)

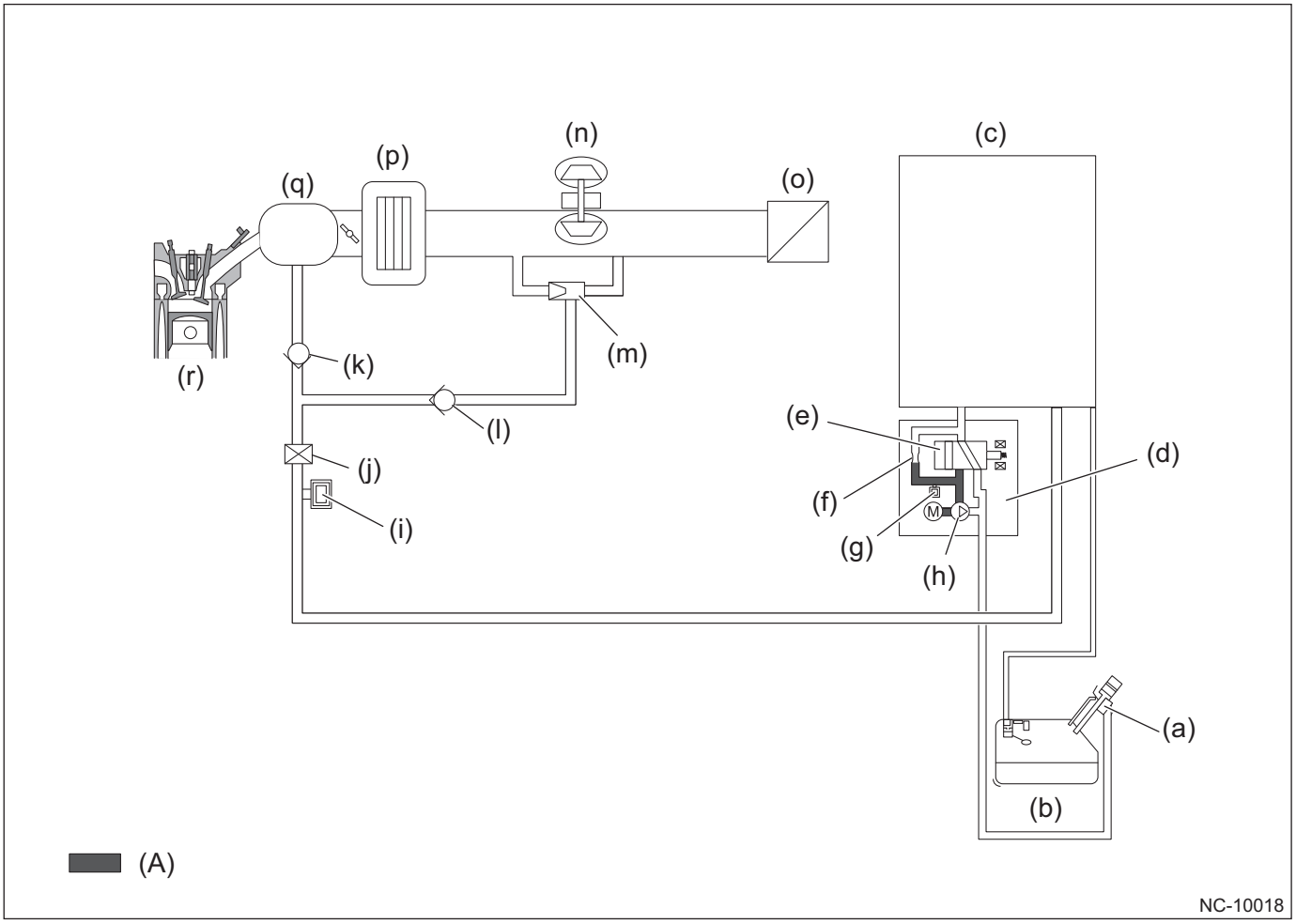


(a) Drain filter
(b) Fuel tank
(c) Canister
(d) Evaporative leak check module
(e) Switching valve
(f) Reference orifice
(g) Pressure sensor
(h) Vacuum pump
(i) Purge line pressure sensor
(j) Purge control solenoid valve
(k) Check valve (intake manifold side)
(l) Check valve (ejector side)
(m) Ejector
(n) Turbocharger
(o) Air cleaner
(p) Intercooler
(q) Intake manifold
(r) Engine

■ Operation during diagnosis (during reference orifice pressure detection)

Vacuum pump: operating

Switching valve: not operating (atmosphere release)



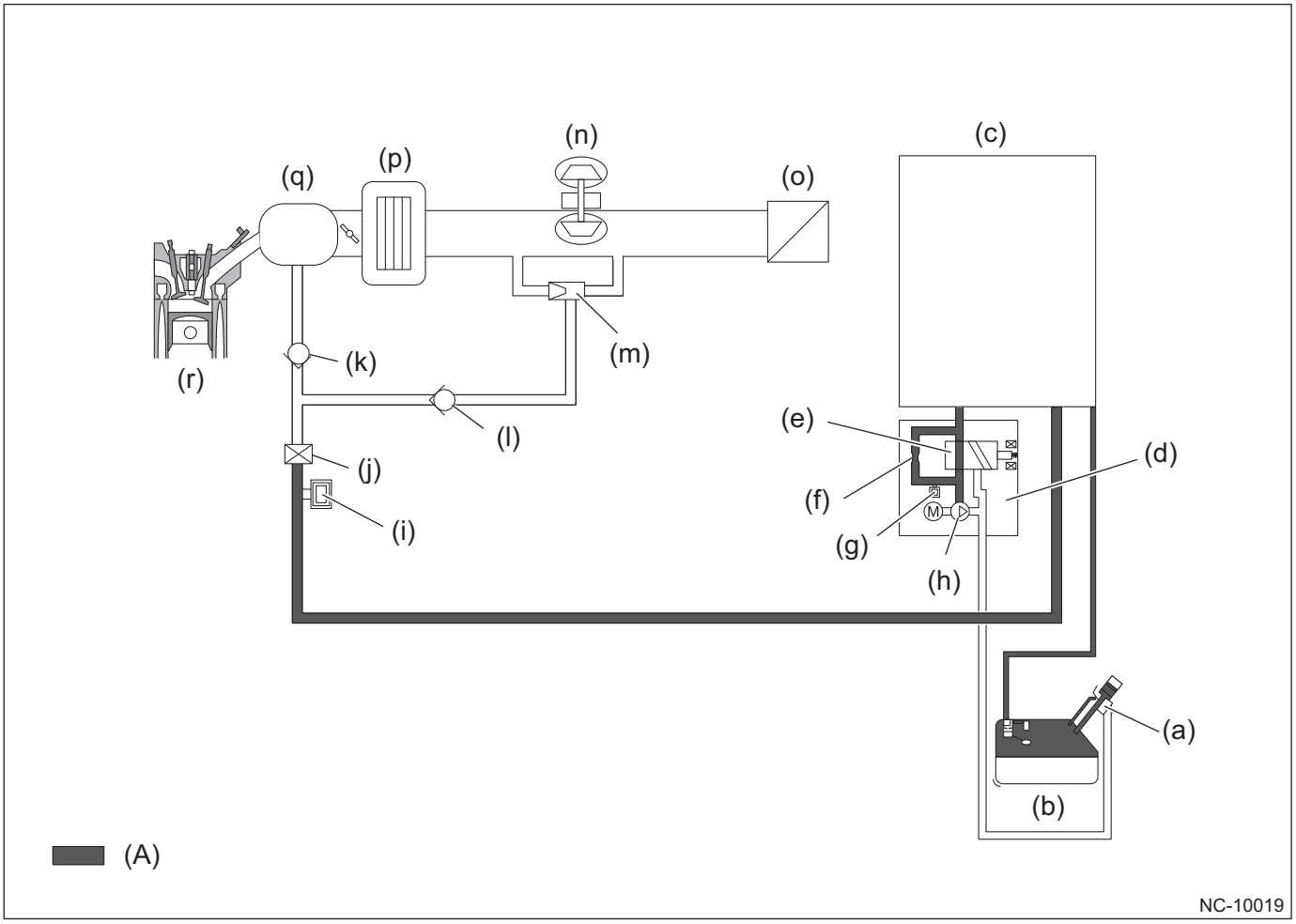
(A) Negative pressure

(a) Drain filter
(b) Fuel tank
(c) Canister
(d) Evaporative leak check module
(e) Switching valve
(f) Reference orifice
(g) Pressure sensor
(h) Vacuum pump
(i) Purge line pressure sensor
(j) Purge control solenoid valve
(k) Check valve (intake manifold side)
(l) Check valve (ejector side)
(m) Ejector
(n) Turbocharger
(o) Air cleaner
(p) Intercooler
(q) Intake manifold
(r) Engine

▮ Operation during diagnosis (during negative pressure introduction)

Vacuum pump: operating

Switching valve: operating (closed)



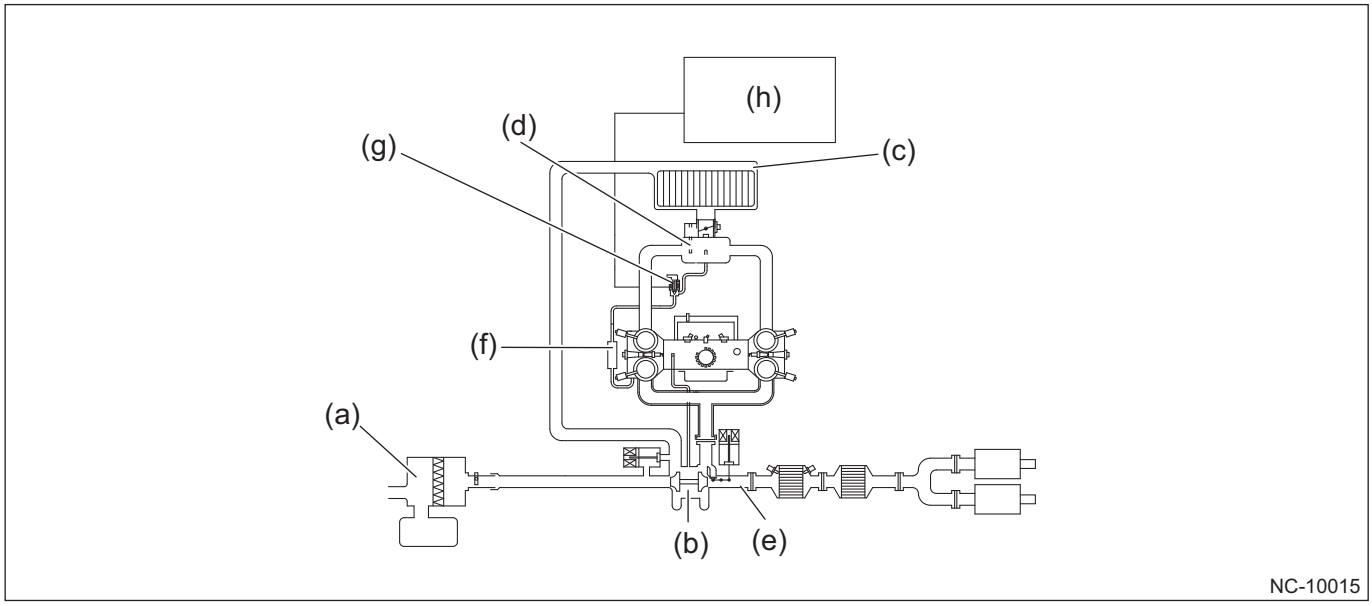
(A) Negative pressure

(a) Drain filter
(b) Fuel tank
(c) Canister
(d) Evaporative leak check module
(e) Switching valve
(f) Reference orifice
(g) Pressure sensor
(h) Vacuum pump
(i) Purge line pressure sensor
(j) Purge control solenoid valve
(k) Check valve (intake manifold side)
(l) Check valve (ejector side)
(m) Ejector
(n) Turbocharger
(o) Air cleaner
(p) Intercooler
(q) Intake manifold
(r) Engine

EGR (Exhaust Gas Recirculation) system

This system recirculates an optimally controlled supply of exhaust gas into the combustion chamber according to the driving conditions, reducing the oxygen concentration of the intake air and lowering the combustion temperature, thereby reducing NO_X emissions.

The recirculated exhaust gas is controlled by the EGR control valve. Cooling of the exhaust gas by the high-efficiency EGR cooler increases the amount of exhaust gas, reducing NO_X emissions and ensuring low fuel consumption.



(a) Air cleaner
(b) Turbocharger
(c) Intercooler
(d) Intake manifold
(e) Exhaust pipe
(f) EGR cooler
(g) EGR control valve
(h) Engine control module (ECM)

2.4 Intake and Exhaust System

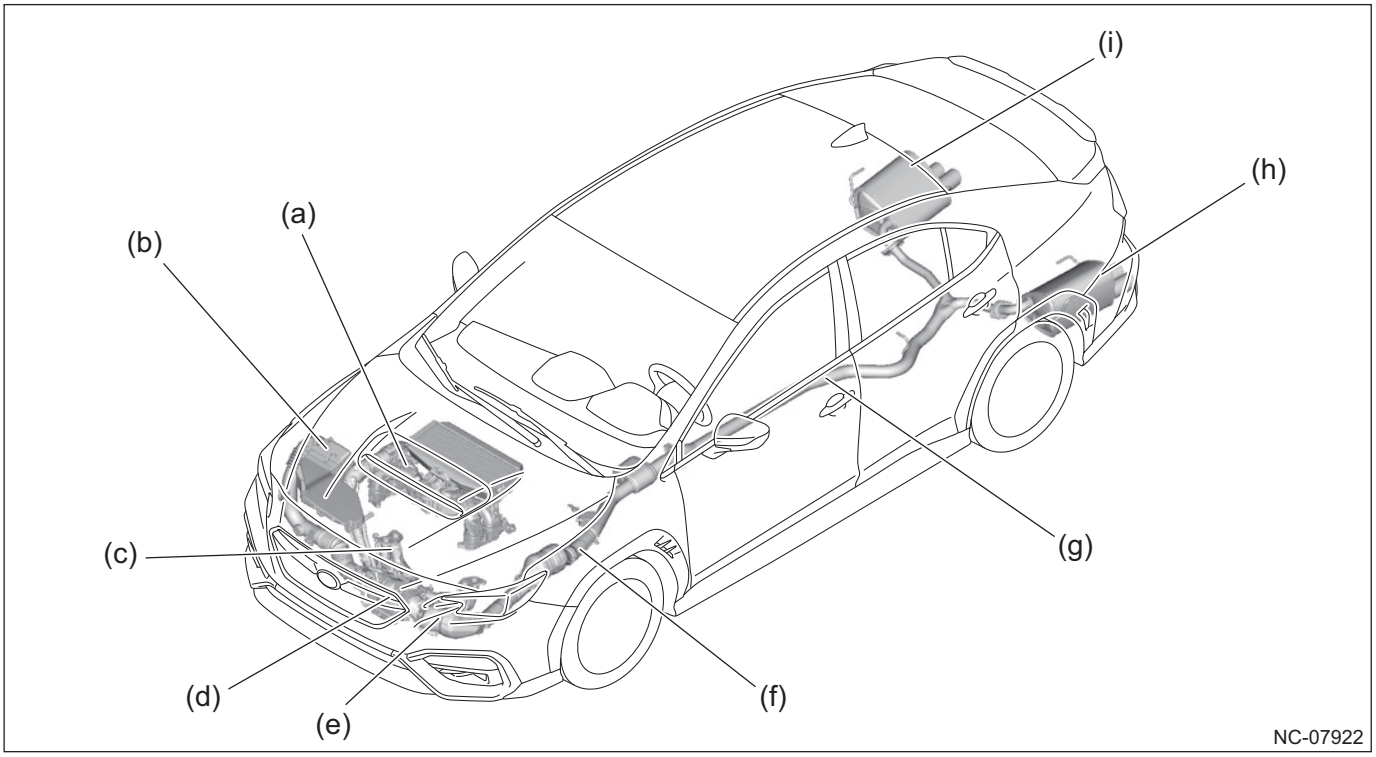
2.4.1 Overview

Overview

- An intake system is adopted that can reduce noise and vibration and increase output.
- A single-valve type electronic control throttle body has been adopted.
- A stainless steel exhaust pipe has been adopted to reduce weight and ensure corrosion resistance.
- The ternary catalysts are positioned at the center exhaust pipe (front) and center exhaust pipe (rear), ensuring sufficient emissions performance.

2.4.2 Component

Component layout drawing



(a) Intake manifold assembly
(b) Air cleaner
(c) Front exhaust pipe
(d) Turbocharger
(e) Center exhaust pipe (front)
(f) Center exhaust pipe (rear)
(g) Rear exhaust pipe
(h) Muffler LH
(i) Muffler RH

Component details

Air cleaner

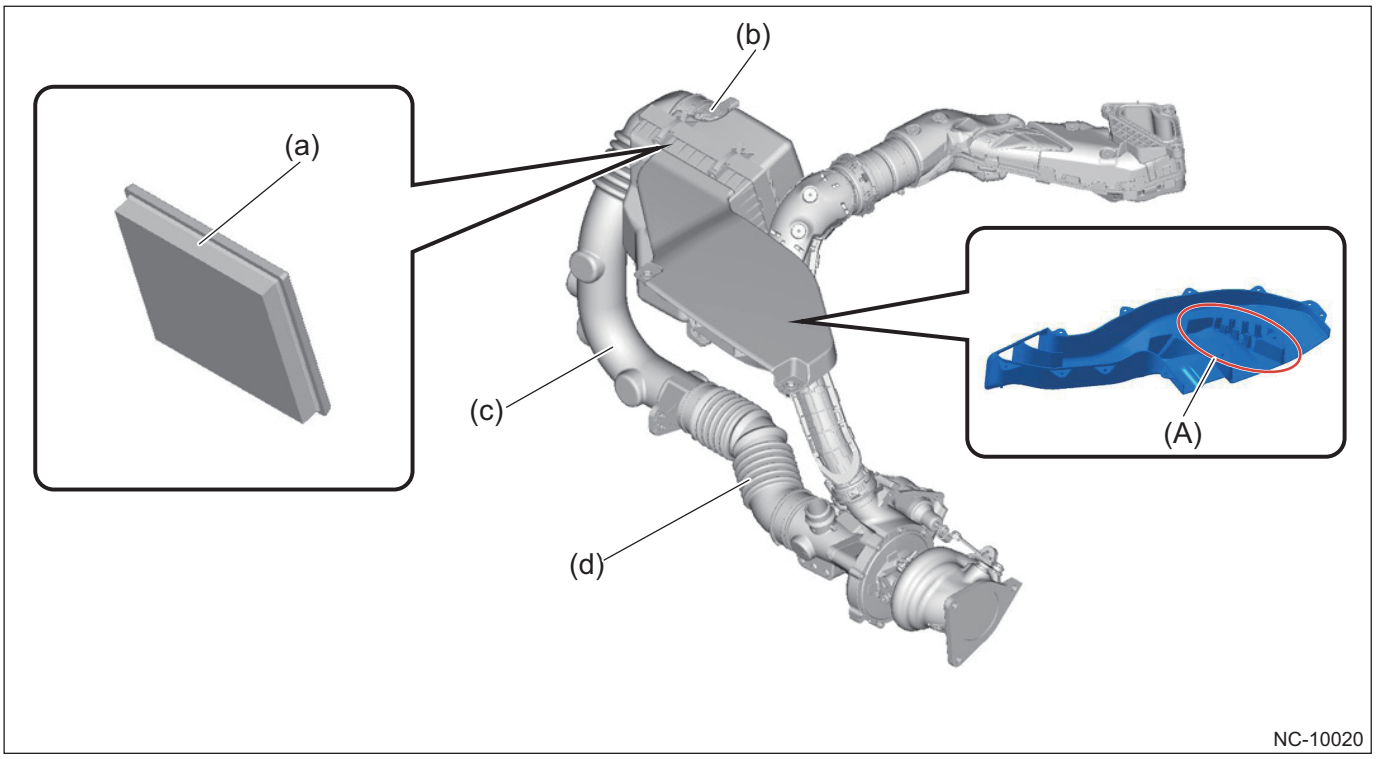
An airflow and intake air temperature sensor are installed on the upper air cleaner case.

A dry paper filter is adopted for the air cleaner element.

An HC adsorption filter is adopted on the air cleaner case upper. It adsorbs the fuel evaporation gas that accumulated in the intake system while the engine was stopped, and prevents it from being discharged into the atmosphere.

A muffler structure (splitter) is adopted for the air intake duct to reduce unpleasant wind noise that is transmitted to the cabin from the turbocharger.

The bellows part of the turbocharger duct assembly was changed from a separate rubber boot to an integrated resin molded part in order to reduce weight.



(A) Muffler structure (splitter)

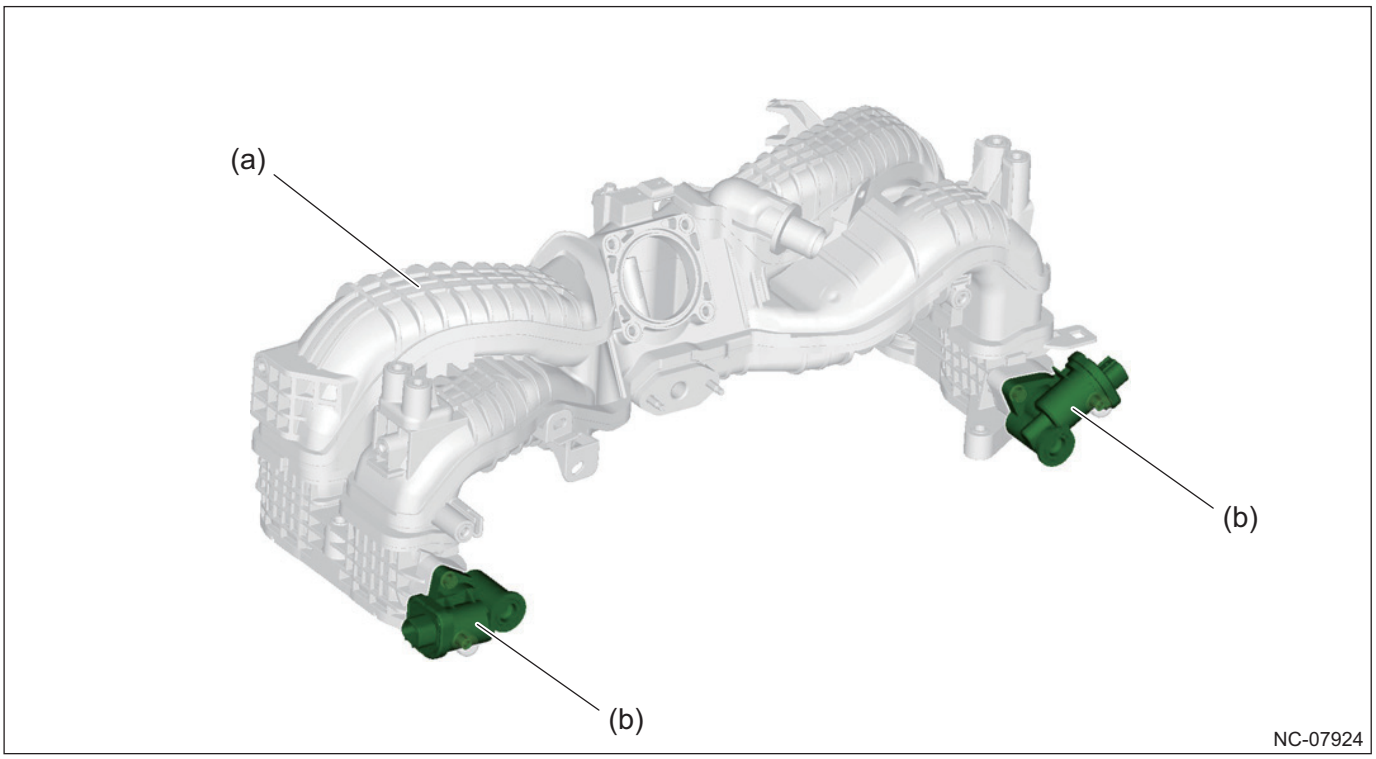
(a) Air cleaner element
(b) Air flow and intake air temperature sensor
(c) Turbocharger duct assembly
(d) Air intake boot

Intake manifold assembly

A resin intake manifold assembly is used to reduce weight.

The tumble generator valve (TGV) is changed to resin and integrated with the intake manifold.

A collector chamber is adopted and performs optimal EGR distribution in order to achieve high levels of fuel efficiency performance, output performance, and collision performance. The intake manifold assembly is also made more compact in order to accommodate the installation of a large-size intercooler.



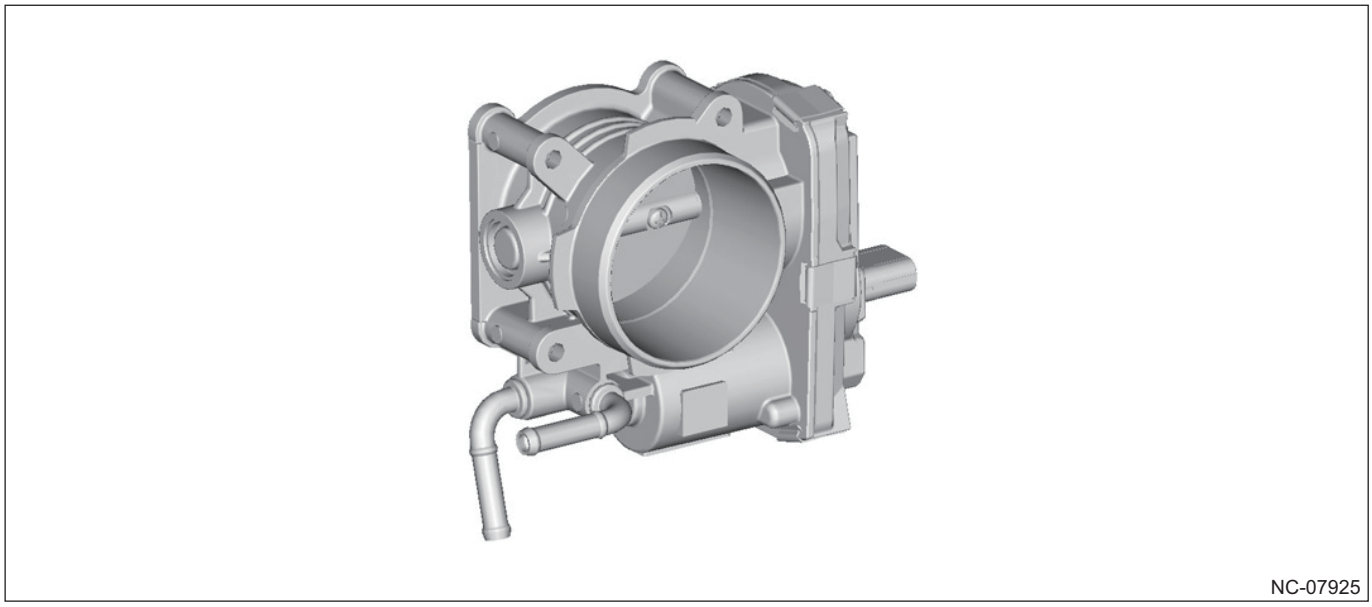
(a) Intake manifold assembly

(b) Tumble generator valve (TGV) actuator

Throttle body

A DC motor with quick response and low power consumption is adopted as the motor which drives the throttle valve.

A structure with reduced weight is adopted for inside the throttle body. It also supports the adoption of an intercooler shaft seal.

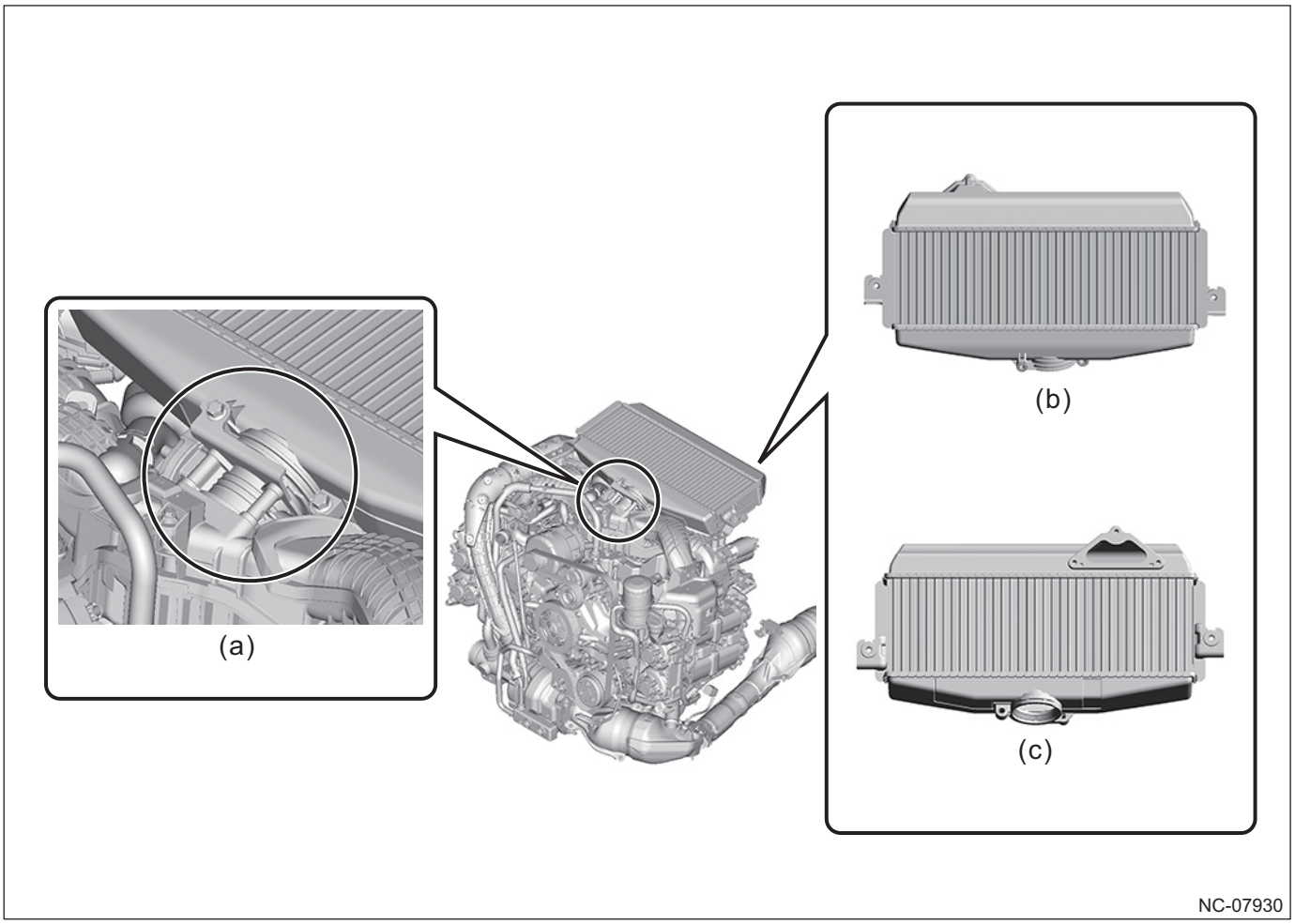


Intercooler

The intake air is compressed and extremely hot after passing through the turbocharger. As a result the air itself expands, reducing boost efficiency. In order to increase boost efficiency, an intercooler is installed immediately before the throttle body and cools the intake air.

The intercooler is air-cooled, and air that is directed from the intake duct in the engine hood passes through the intercooler core, cooling the intake air.

A vertical flow type was adopted in order to achieve both collision performance and power performance. The tube between the intercooler outlet and throttle was eliminated and changed to a shaft seal structure.



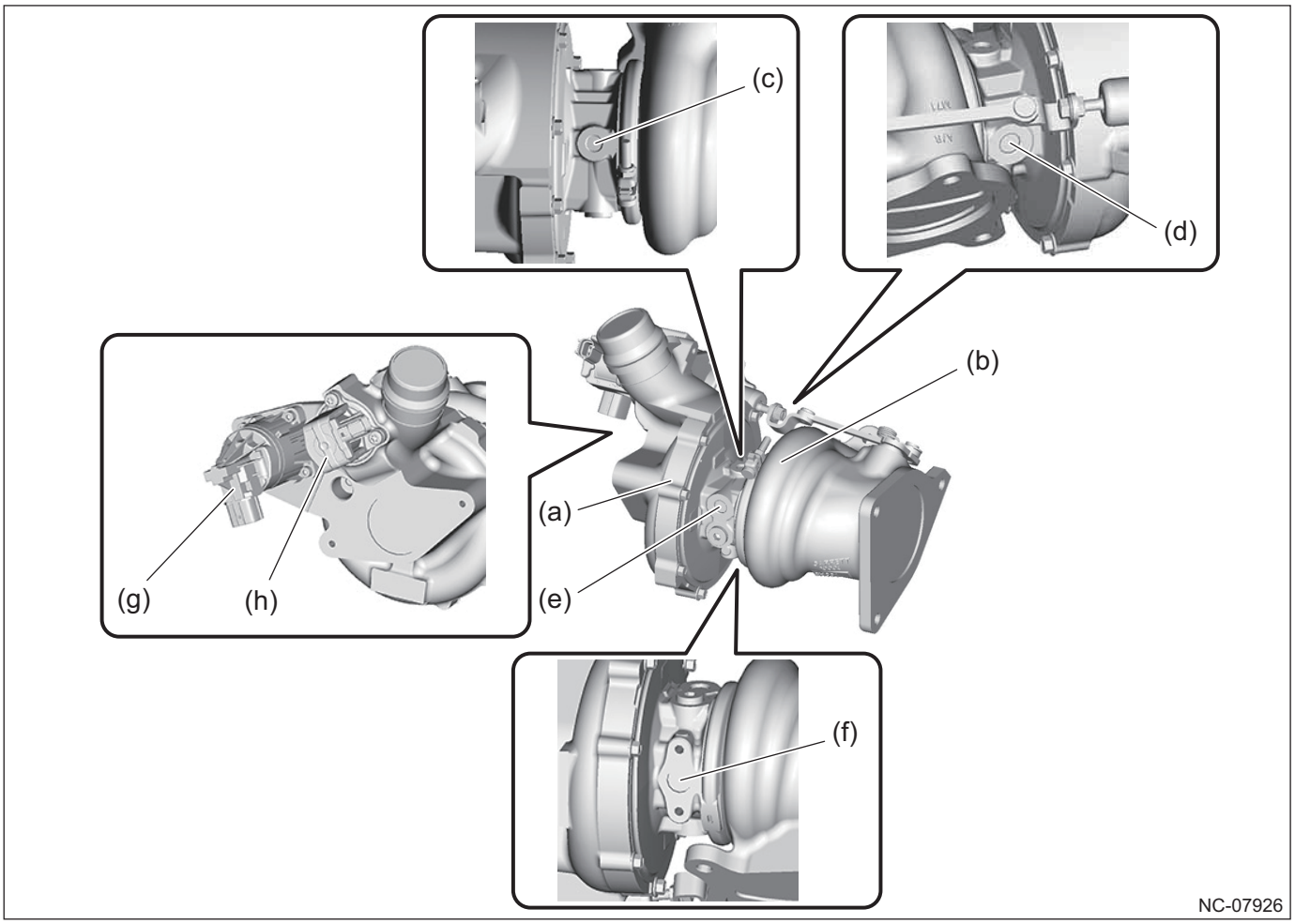
(a) Between intercooler outlet and throttle
(b) Intercooler front side
(c) Intercooler back side

Turbocharger

A water-cooled turbocharger is adopted. The turbine is contained in a lightweight, thin, and heat resistant cast case, and the compressor housing is made of thin cast aluminum alloy. The turbine and compressor shaft are supported by a semi-floating type metal bearing system.

An electronic control wastegate valve is adopted. It contributes to improving fuel efficiency and exhaust gas purification performance by reducing pumping loss and accelerating warm-up when the engine starts.

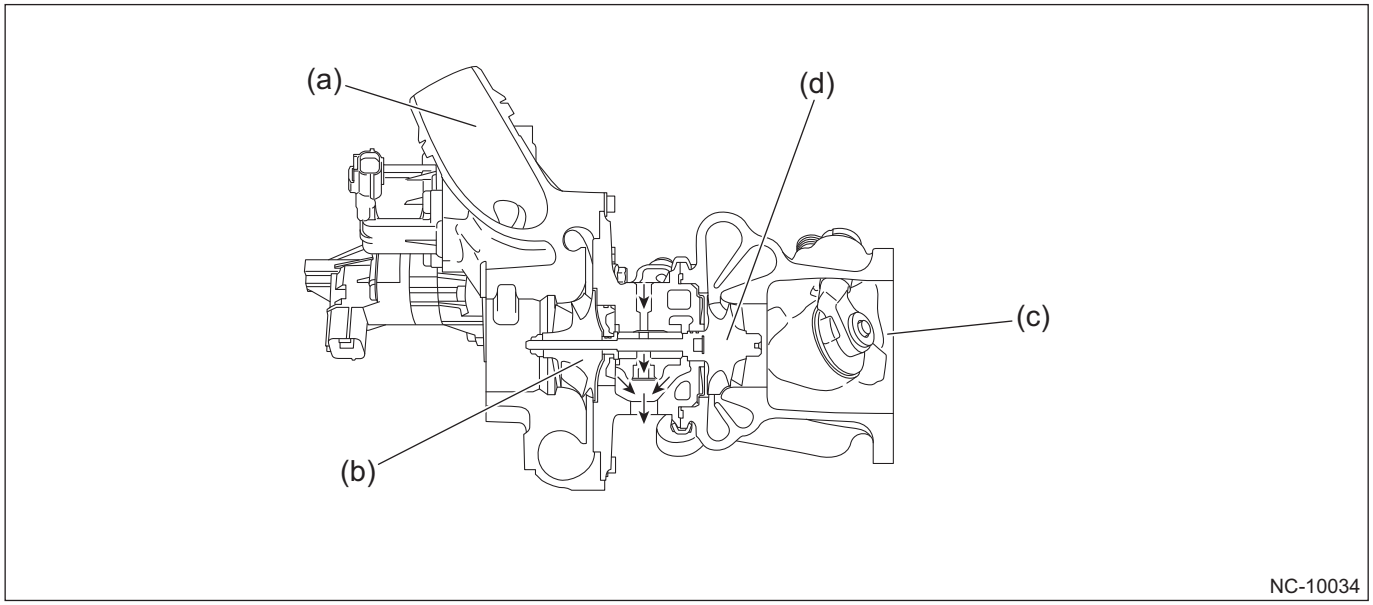
An electronic control air by-pass valve is adopted. The layout is optimized to reduce weight, and more precise valve control during deceleration was also achieved.



(a) Compressor housing
(b) Turbine housing
(c) Lubrication oil intake port
(d) Coolant intake port
(e) Coolant outlet port
(f) Lubrication oil outlet port
(g) Electronic control wastegate valve
(h) Electronic control air by-pass valve

■ Turbocharger lubrication

The turbocharger is lubricated by engine oil that is delivered from the oil pump. In order to support the super-high speeds of the turbocharger turbine and compressor shaft that can reach up to several hundred thousand rpm, a semi-floating type bearing is adopted, and a sufficient oil film is formed on both the inside and outside as the parts rotate. The oil supplied to the turbocharger also functions to cool the turbine, and prevents heat from the exhaust gas from being transmitted to the bearing.



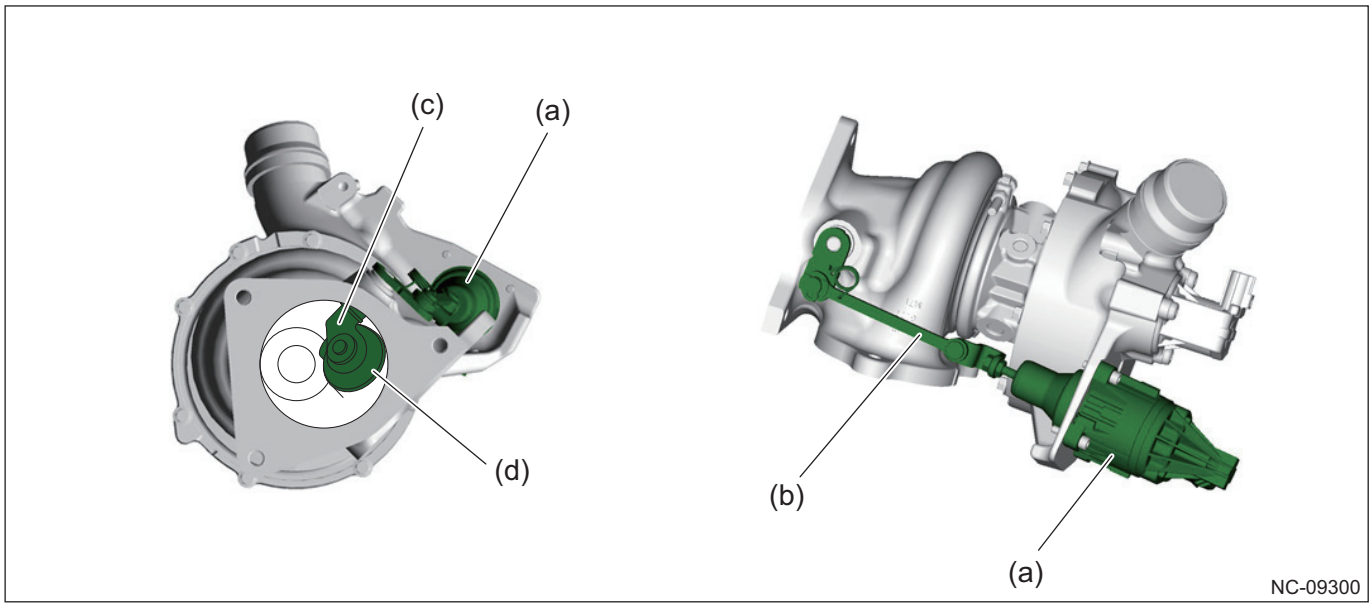
(a) Compressor housing
(b) Compressor wheel
(c) Turbine housing
(d) Turbine wheel

Electronic control wastegate valve

When the throttle valve is open and the engine speed has risen, the amount of exhaust gas increases. As a result, the turbine speed, boost pressure, and engine output all rise. However if the resulting boost pressure becomes too high, knocking may occur and an excessive heat load may be applied to the pistons and other engine components. In the worst case, the engine may be damaged. The wastegate valve is installed in order to prevent this.

The change to an electronic control wastegate valve allows more precise control. The wastegate valve maintains the prescribed boost pressure according to signals from the ECM.

Ordinarily the wastegate valve is controlled so it is open.

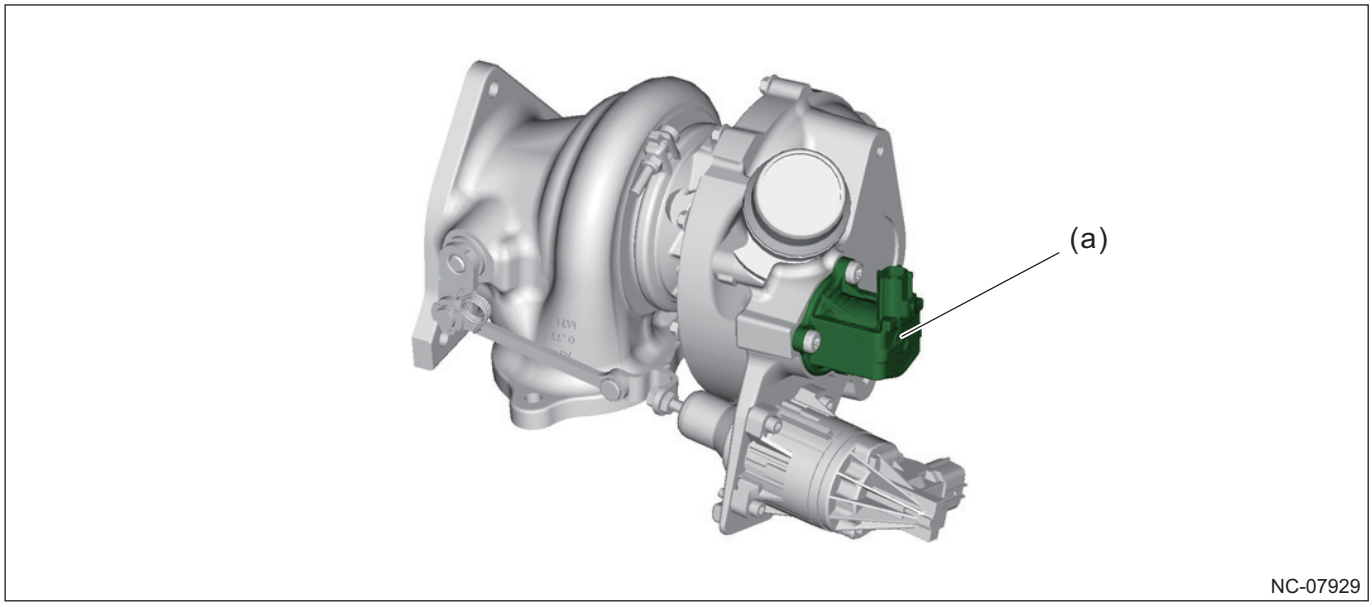


(a) Electronic control wastegate valve
(b) Rod
(c) Wastegate arm
(d) Poppet valve

Electronic control air by-pass valve

When the throttle valve closes quickly, the air pressure in the passage between the turbocharger and the throttle body can increase suddenly and cause a surge. An air by-pass valve and air passage are installed in order to prevent this. The air by-pass valve causes intake air to by-pass the turbocharger and flow directly to the upstream side, reducing the pressure in the air passage.

The adoption of electronic control for the air by-pass valve allows more precise control and achieves both improved output characteristics and surge resistance. In order to further improve surge resistance, a structure that is integrated with the turbocharger is adopted for the air by-pass valve.



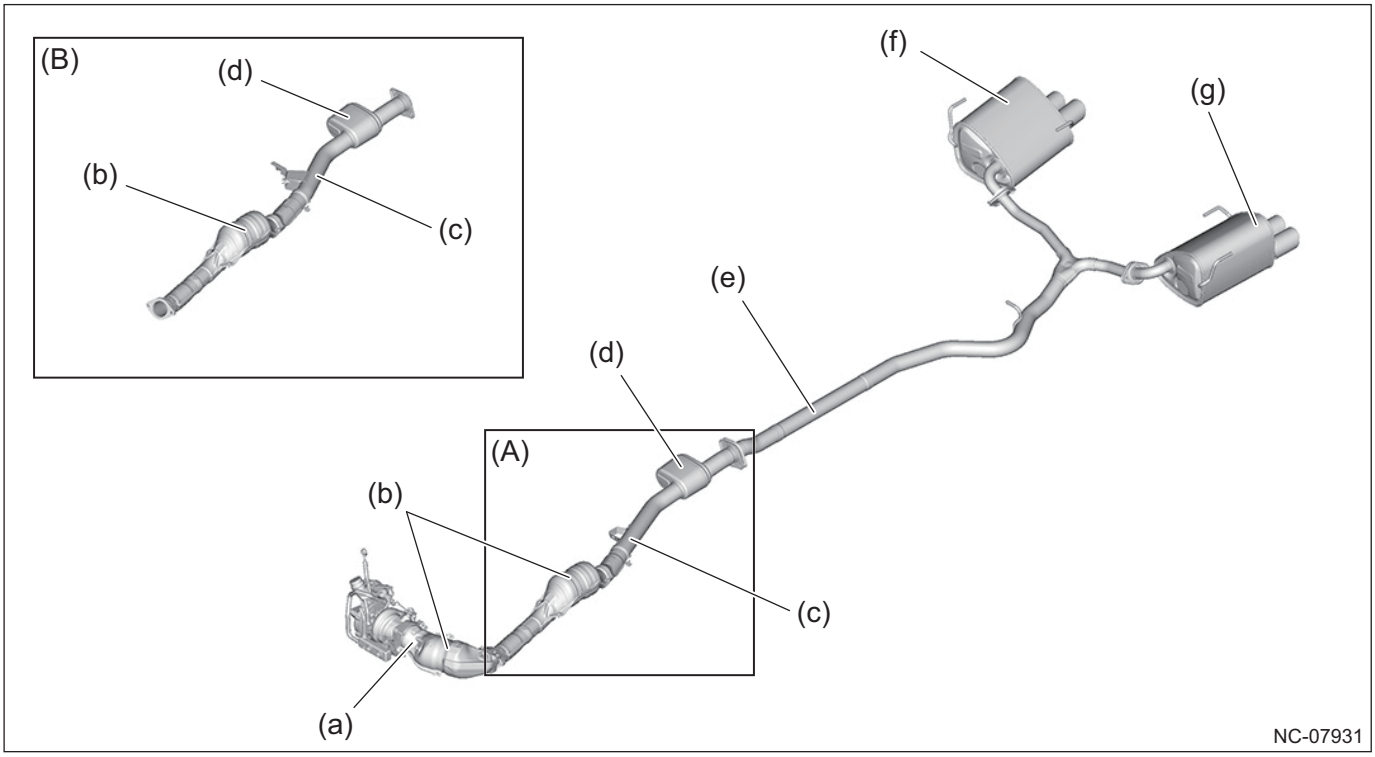
(a) Electronic control air by-pass valve

Exhaust pipe

Stainless exhaust manifold and exhaust pipe are adopted to ensure weight reduction and corrosion resistance.

The ternary catalysts are arranged directly after the turbocharger and at the side of the transmission to ensure sufficient emissions performance. The ternary catalyst mounted directly after the turbocharger reduces emissions immediately after engine start (when the engine is cold).

In order to reduce weight, a single pipe and bellows are adopted for the exhaust pipe, and the flanges are made smaller.



(A) MT

(B) CVT

(a) Center exhaust pipe (front)
(b) Ternary catalysts
(c) Center exhaust pipe (rear)
(d) Sub muffler
(e) Rear exhaust pipe
(f) Muffler RH
(g) Muffler LH

2.4.3 Construction and Operation

System details

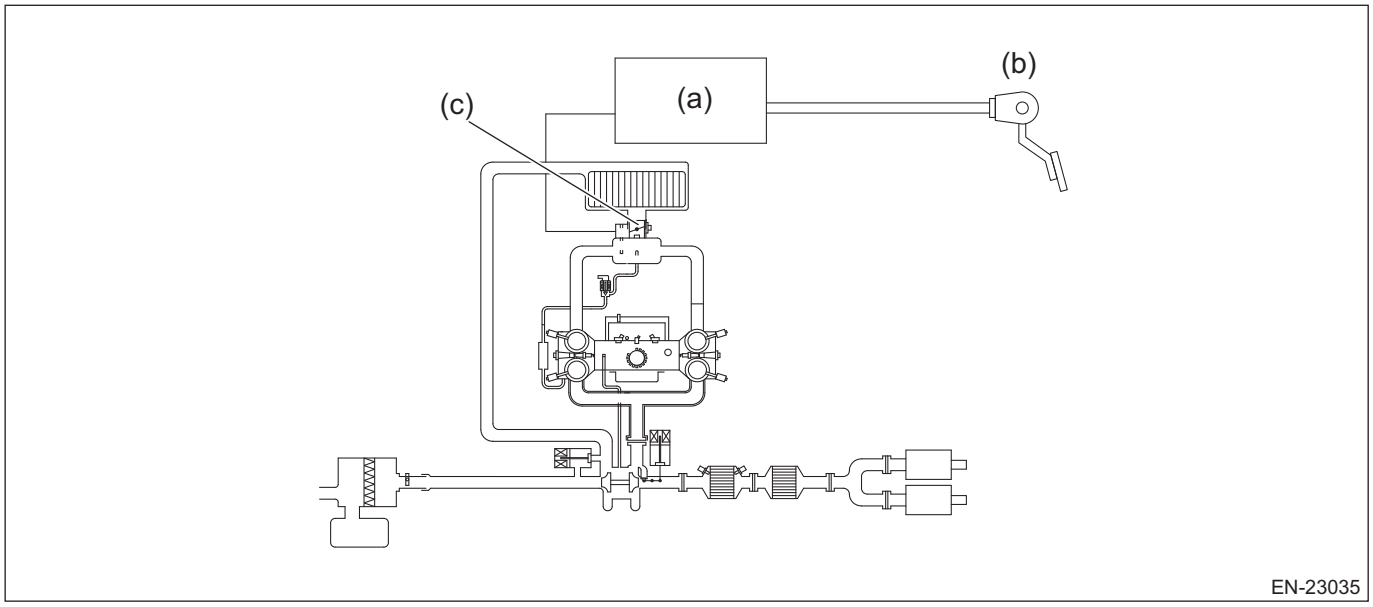
Electronic throttle system

The electronic throttle system detects how much the accelerator pedal is depressed by means of the accelerator position sensor, and the ECM utilizes the throttle motor to precisely drive the throttle valve.

The operation of the driver (amount of accelerator pedal depression) is transmitted to the ECM from the accelerator pedal position sensor installed on the accelerator pedal. The ECM decides the throttle opening angle according to the driving conditions and drives the throttle motor. The throttle valve opening angle is fed back to the ECM by the throttle position sensor.

Accelerator pedal position sensor and throttle position sensor have dual system installed internally and continuously monitor system errors.

When an anomaly is detected in the system, the system notifies the driver of the anomaly with the warning light in the meter and then stops the motor.



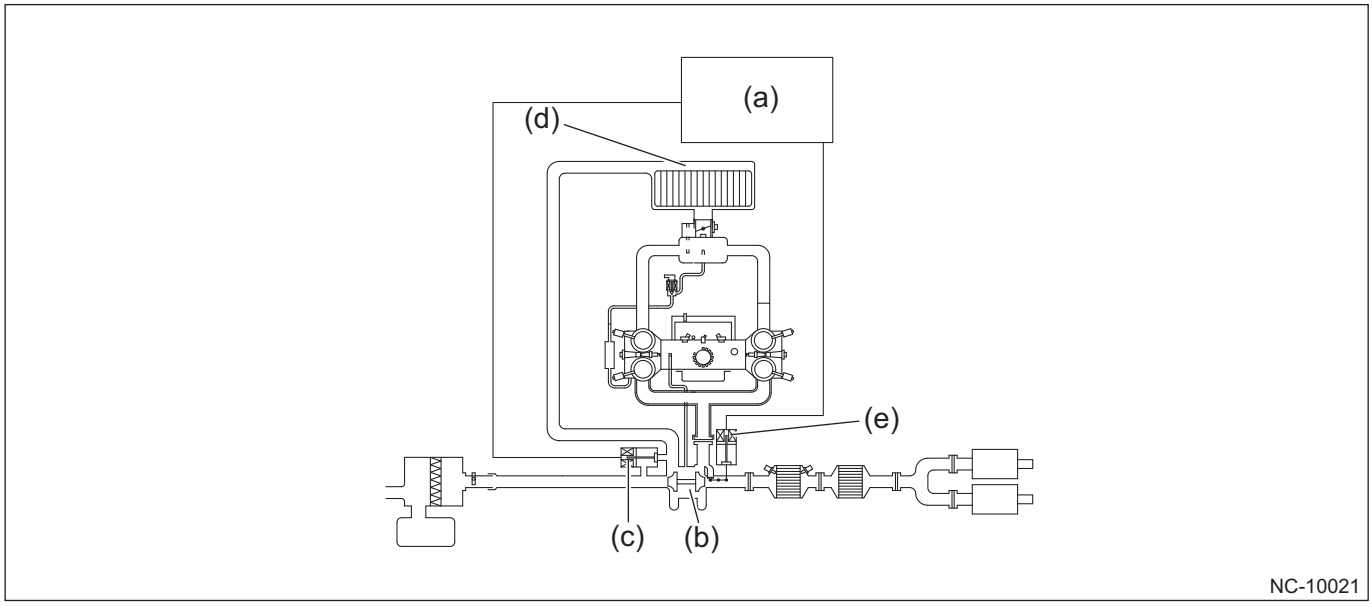
(a) ECM
(b) Accelerator pedal position sensor
(c) Throttle motor

Turbocharger system

The turbocharger system is composed of the water-cooled turbocharger, air-cooled intercooler, wastegate valve, and other parts.

This turbocharger system controls the boost pressure according to changes in the atmospheric pressure. As a result, this system is not affected by the change in atmospheric pressure and can deliver stable performance in areas at high elevations.

The use of a turbocharger layout with the turbocharger on the bottom lowers the thermal capacity in order to improve catalyst temperature rise performance when starting, and the larger catalyst volume provides superior durability against exhaust gases.



(a) ECM
(b) Turbocharger
(c) Electronic control air by-pass valve
(d) Intercooler
(e) Electronic control wastegate valve

2.5 Cooling System

2.5.1 Overview

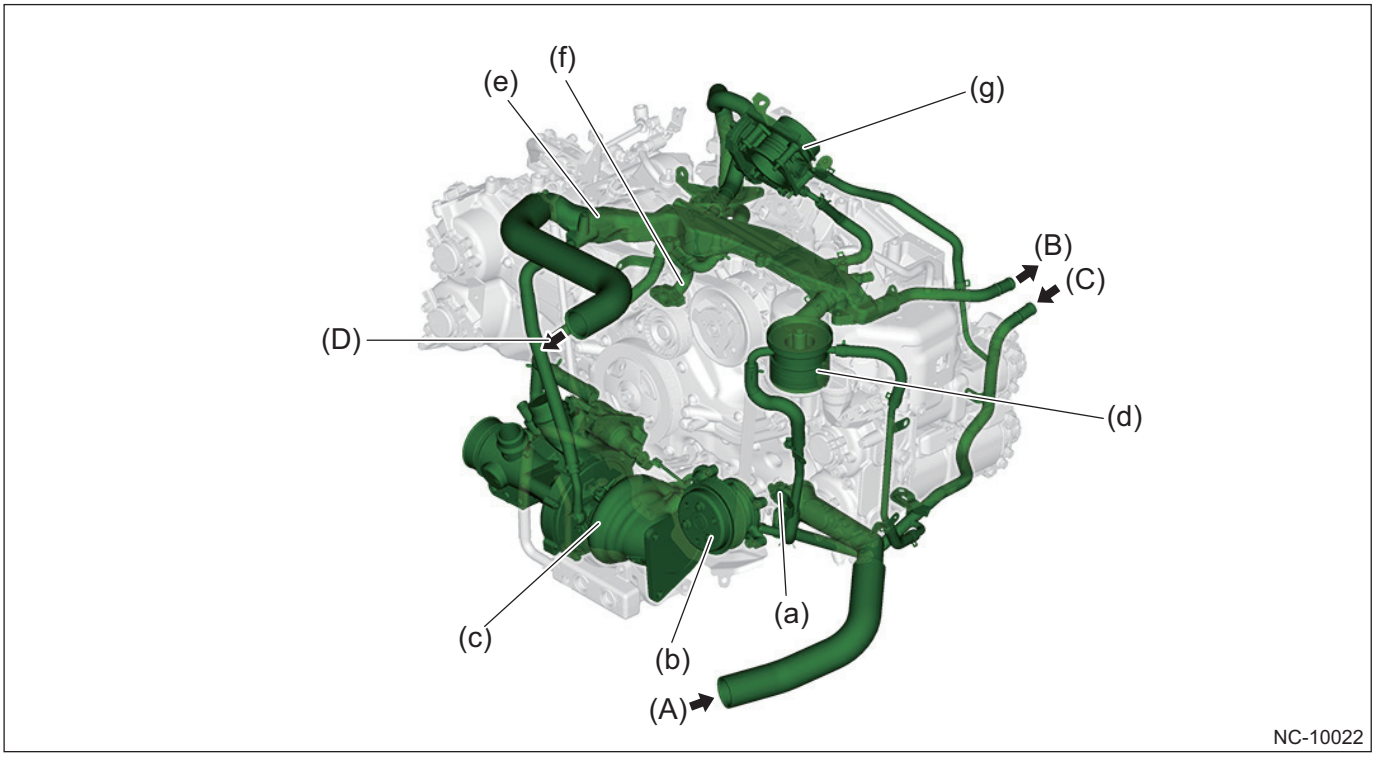
Overview

- A forced pressurized coolant circulation system was adopted for the cooling method, with a bottom bypass type, in which the thermostat equipped with the bypass valve is installed on the water pump.
- The reservoir tank is made of semitransparent plastic and the coolant amount can be easily checked. Coolant is refilled to the reservoir tank.
- The ECM controls the operations of the radiator main fan and sub fan according to the signals from the engine coolant temperature sensor, vehicle speed sensor, and A/C pressure sensor.
- The water-cooled engine oil cooler is installed to improve engine reliability.

2.5.2 Component

Component layout drawing

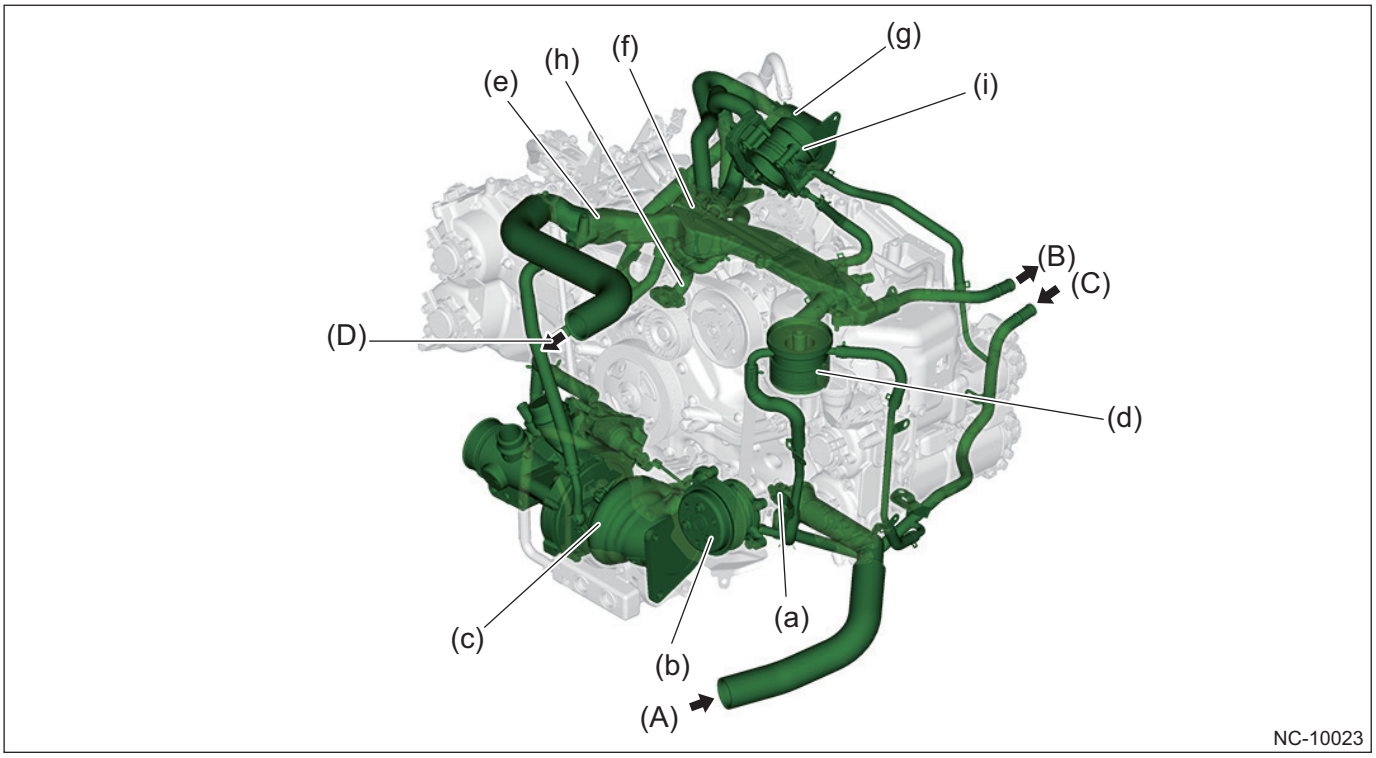
Flow of coolant (MT)



(A) From radiator
(B) To heater core
(C) From heater core
(D) To radiator

(a) Thermostat
(b) Water pump
(c) Turbocharger
(d) Oil cooler
(e) Water pipe assembly
(f) EGR cooler
(g) Throttle body

Flow of coolant (CVT)



(A) From radiator
(B) To heater core
(C) From heater core
(D) To radiator

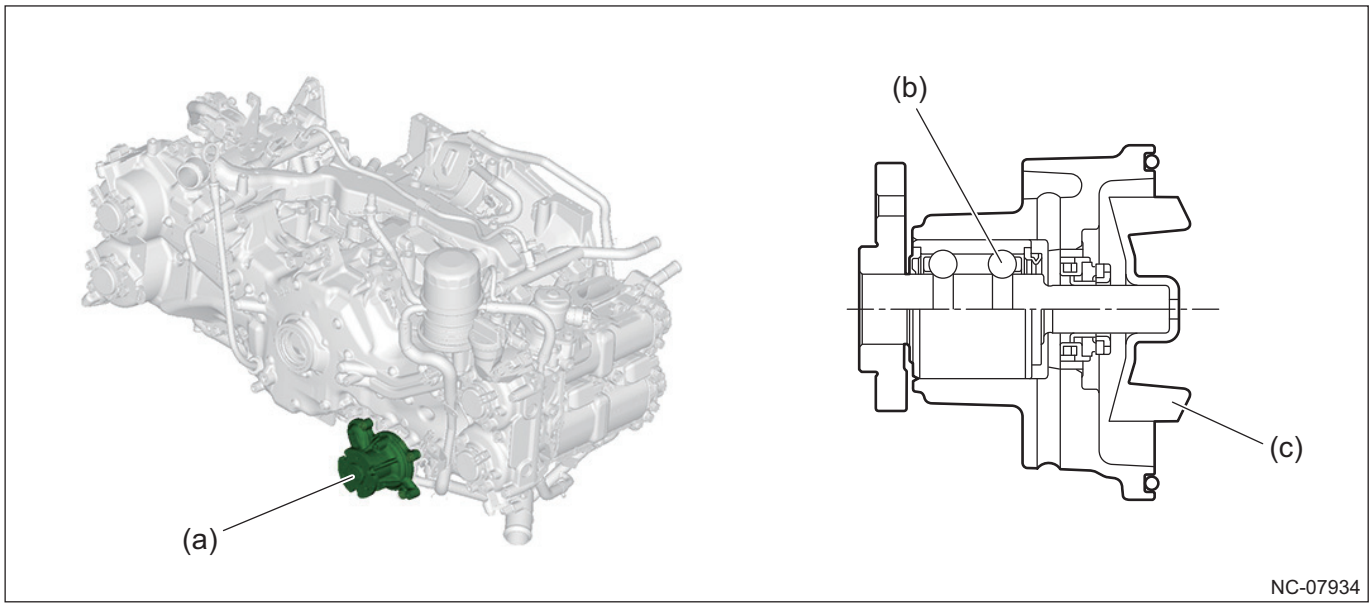
(a) Thermostat
(b) Water pump
(c) Turbocharger
(d) Oil cooler
(e) Water pipe assembly
(f) Thermostat (for CVTF cooler)
(g) CVTF cooler (with warmer feature)
(h) EGR cooler
(i) Throttle body

Component details

Water pump

The water pump assembly is installed on the oil pan upper and is driven by a V-belt.

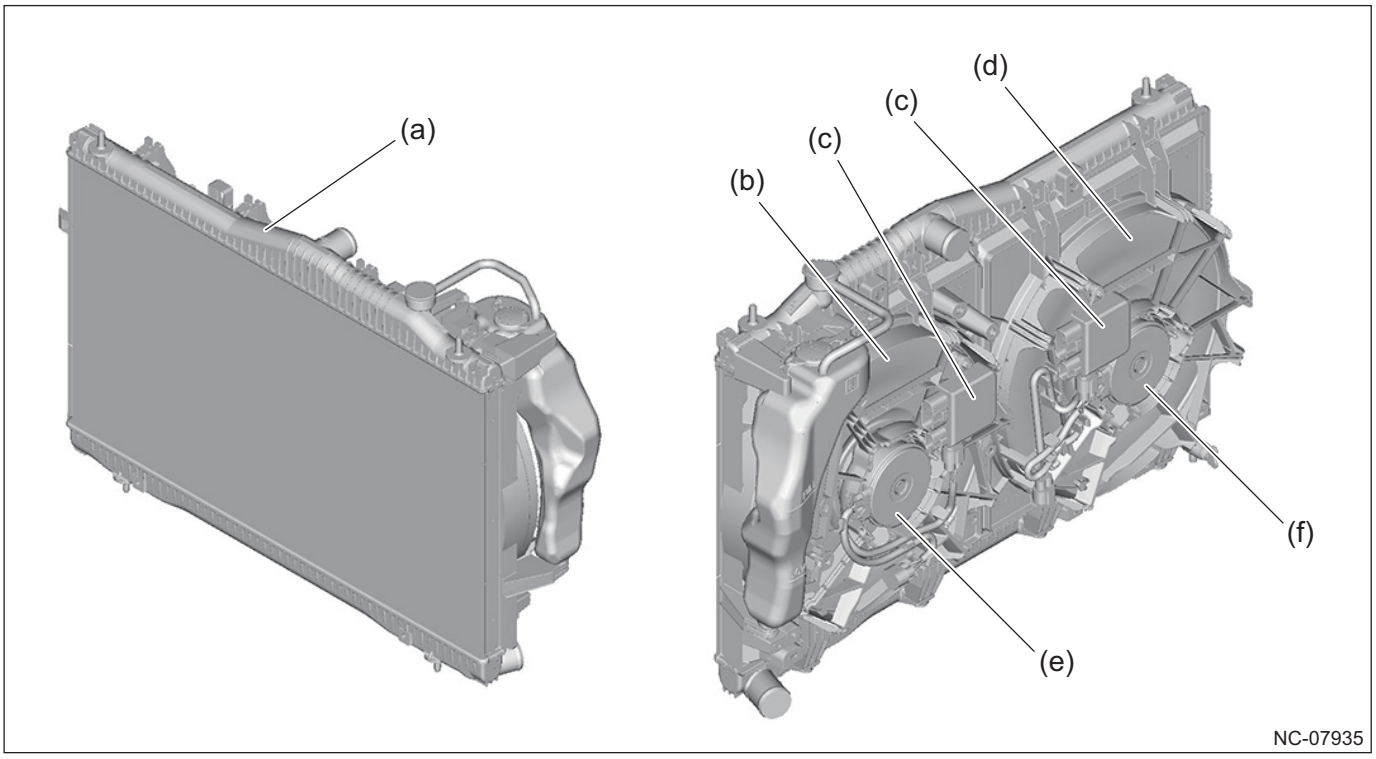
The bearing diameter and pulley thickness are changed to accommodate the higher tension of the auxiliary belt. Thinning of the housing was also performed to reduce weight.



(a) Water pump assembly
(b) Bearing
(c) Pump impeller

Radiator

A down-flow type aluminum core radiator assembly is adopted. The larger radiator size and smaller pitch of the radiator core louvers increase the airflow surface area and improve cooling performance.



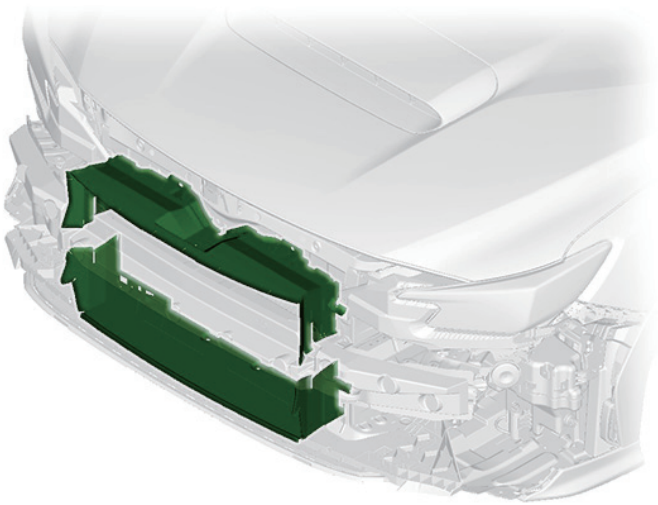
(a) Radiator
(b) Radiator main fan
(c) PWM controller
(d) Radiator sub fan
(e) Main fan motor
(f) Sub fan motor

Radiator fan

The cooling fan motor improves fuel efficiency, reduces power consumption, reduces noise, and reduces inrush current due to a PWM controller that can perform control according to the load.

Air guide

Full ducting was adopted for the air guides that guide air efficiently to the radiator, improving cooling efficiency.



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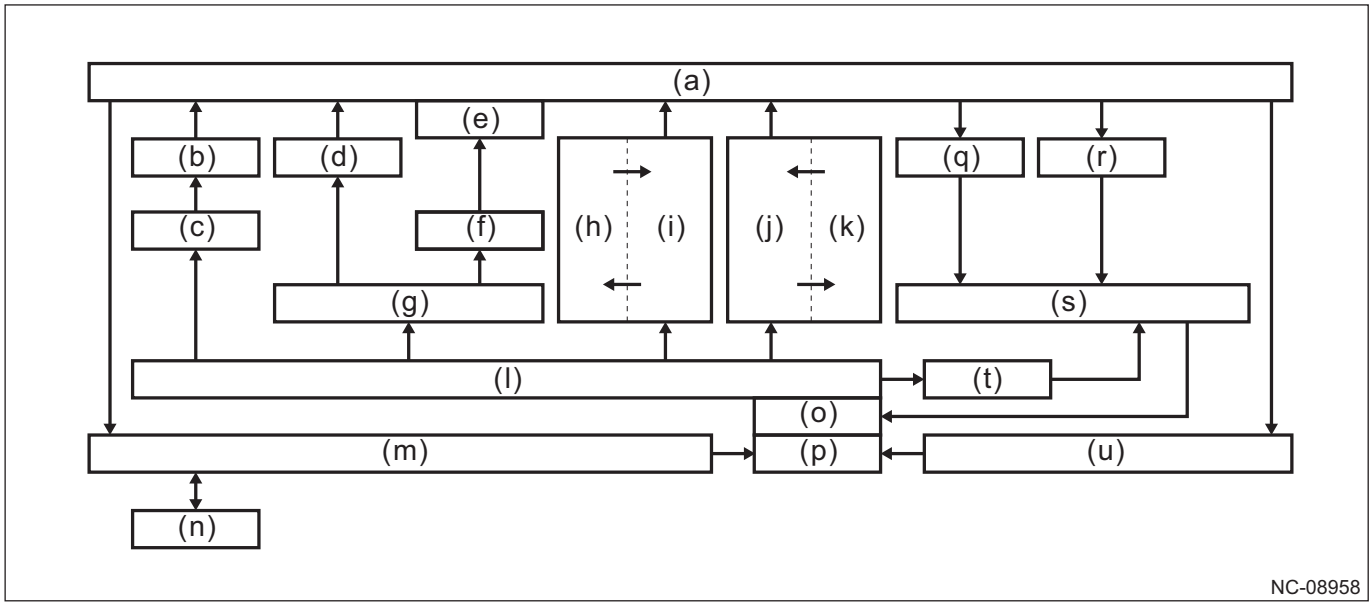
2.5.3 Construction and Operation

System diagram



(a) Water tank pipe assembly
(b) Turbocharger
(c) Air intake duct
(d) EGR cooler
(e) Thermostat (for CVTF cooler) (CVT)
(f) CVTF cooler (with warmer feature) (CVT)
(g) Water pipe RH
(h) Cylinder head RH
(i) Cylinder block RH
(j) Cylinder block LH
(k) Cylinder head LH
(l) Oil pan upper
(m) Radiator
(n) Reservoir tank
(o) Water pump assembly
(p) Thermostat
(q) Throttle body
(r) Heater core
(s) Water pipe LH
(t) Engine oil cooler
(u) Bottom by-pass passage

System details

Cooling fan system

The Engine Control Module (ECM) decides the optimal cooling fan speed based on the engine coolant temperature, air conditioning operating status, engine speed, and vehicle speed, and sends a signal to the cooling fan controller in order to control the cooling fan speed.

2.6 Lubrication System

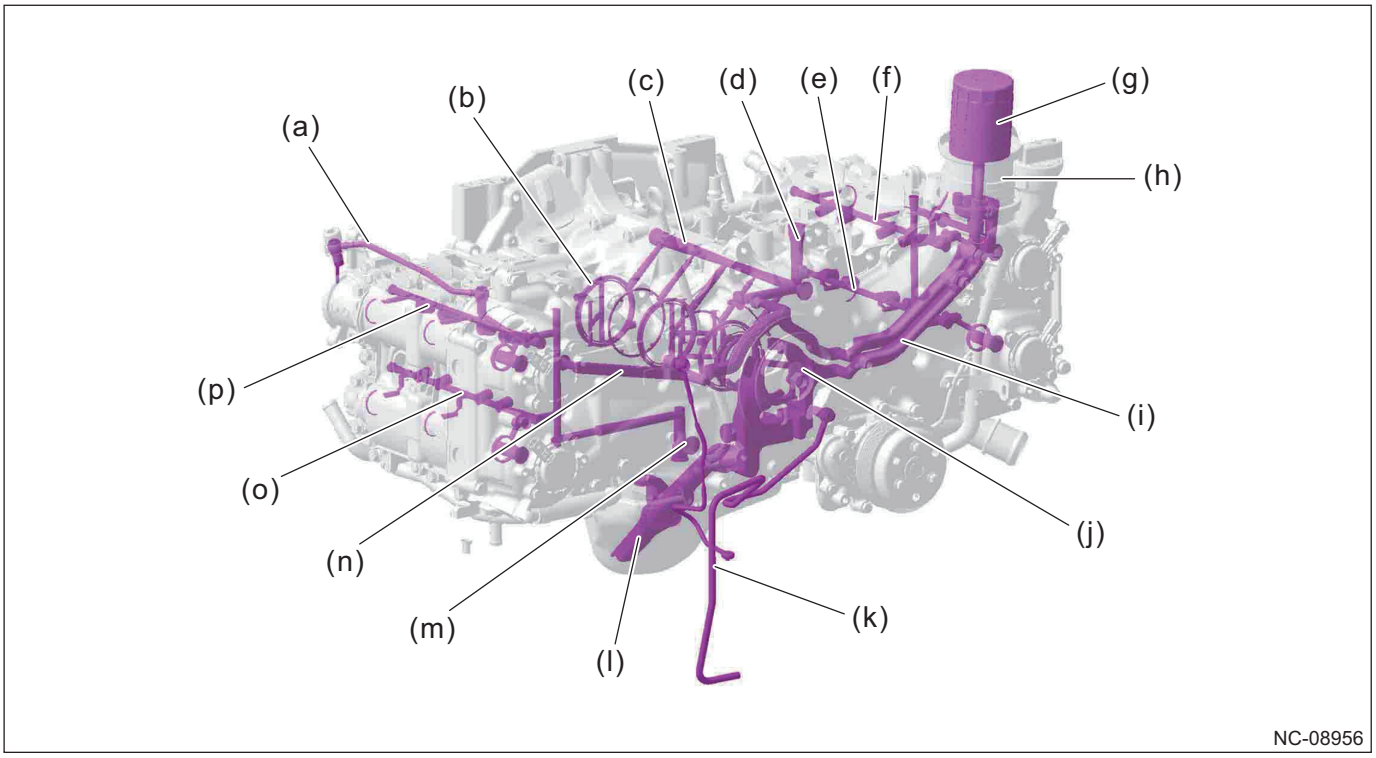
2.6.1 Overview

Overview

- Full pressure feed and full filter methods are adopted for lubrication.
- The oil pump and the oil passage are built into the timing chain cover to create a front module for the system and improve serviceability. Also, oil pump that drives in front of the crankshaft is adopted.

2.6.2 Component

Component layout drawing

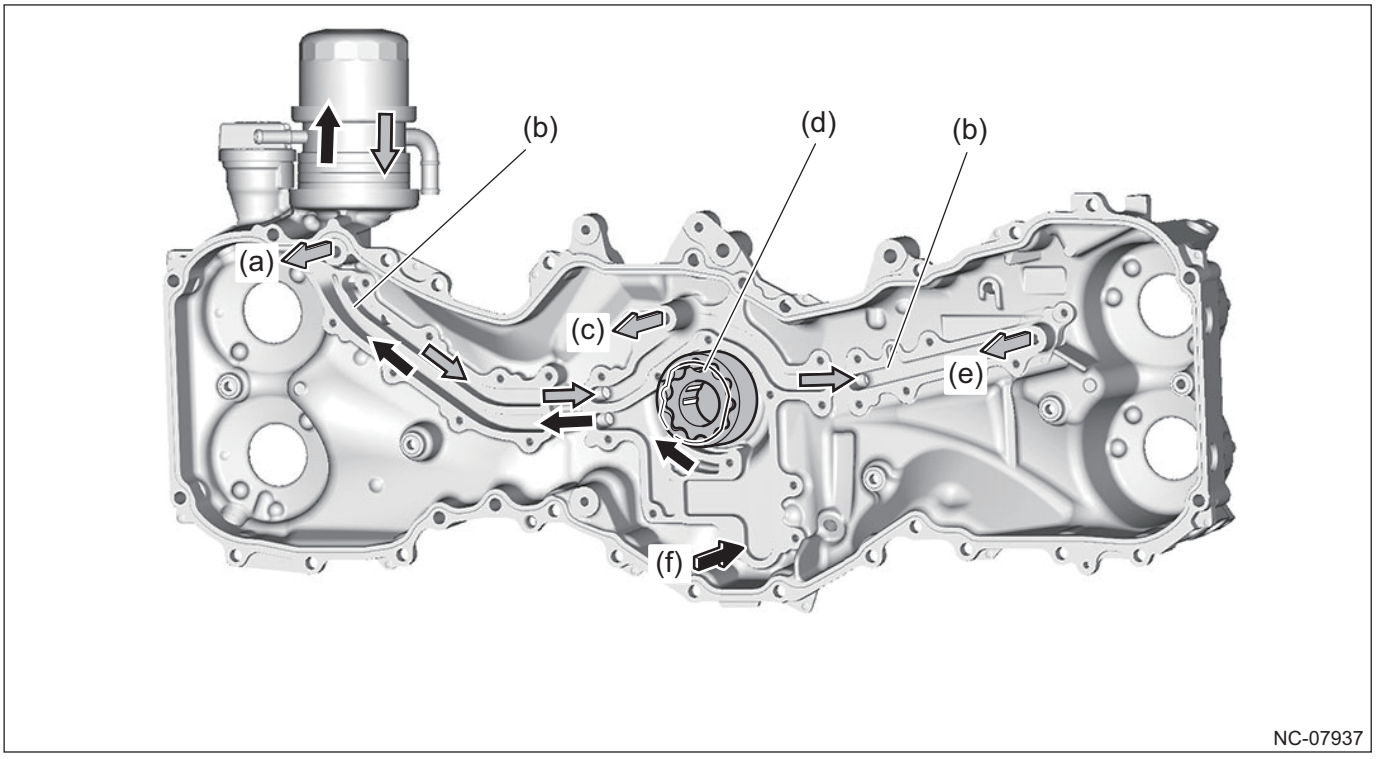


(a) Oil pipe (MT)
(b) Crankshaft journal oil passage
(c) Main oil passage
(d) Chain tensioner LH oil passage
(e) Exhaust cam carrier LH oil passage
(f) Intake cam carrier LH oil passage
(g) Oil filter
(h) Engine oil cooler
(i) Oil passage in chain cover
(j) Oil pump
(k) External pipe for turbocharger lubrication
(l) Oil strainer
(m) Chain tensioner RH oil passage
(n) Oil passage in chain cover
(o) Exhaust cam carrier RH oil passage
(p) Intake cam carrier RH oil passage

Component details

Oil pump

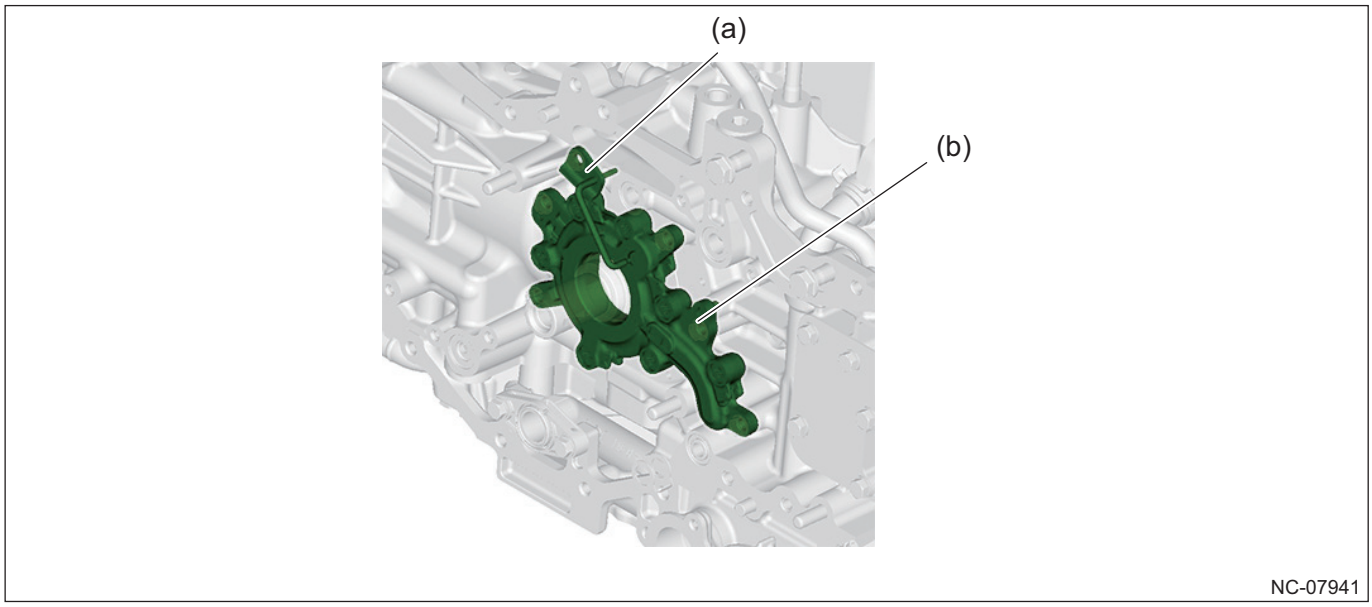
The oil pump uses a compact and highly efficient multi toothed trochoid rotor that is driven directly by the crankshaft, and is installed inside the chain cover. The discharge volume has been optimized and the diameter of the drive rotor reduced, resulting in lower friction.



(a) To cylinder head LH
(b) Oil passage
(c) To cylinder block LH
(d) Oil pump
(e) To cylinder head RH
(f) From oil pan

Scavenge pump

A scavenge pump that is driven by the front of the crankshaft has been adopted. The oil passages from the turbocharger oil catch tank were optimized and lighter weight was achieved.

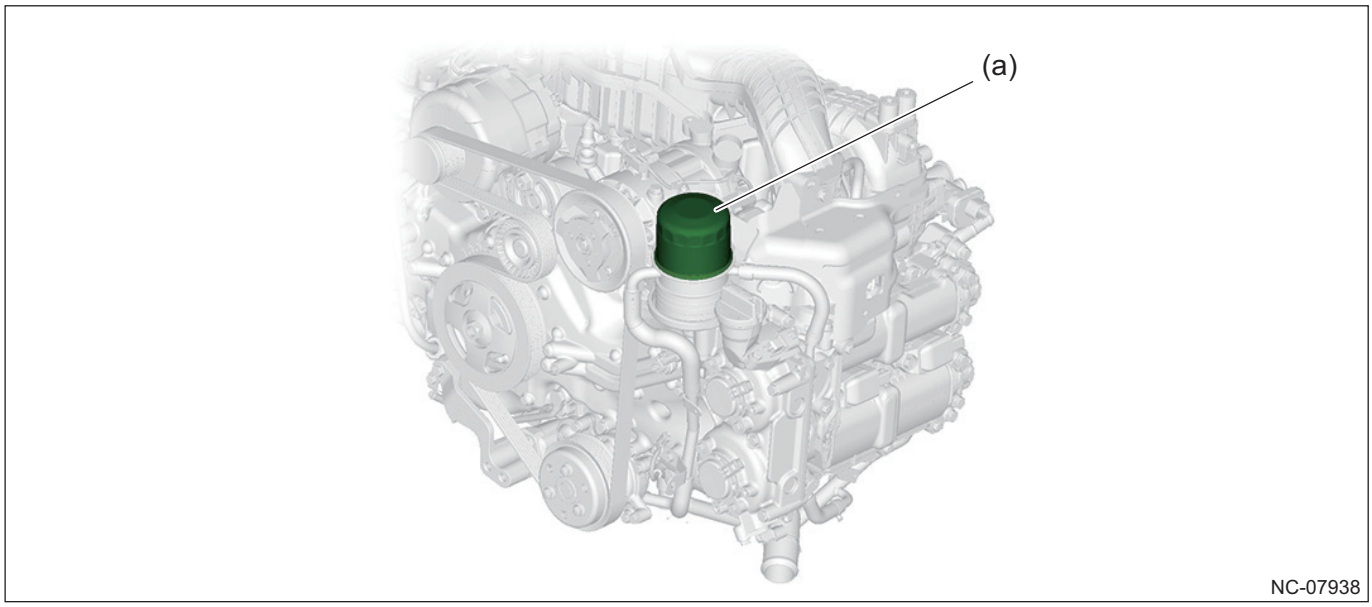


(a) Oil jet

(b) Scavenge pump

Oil filter

A compact and lightweight oil filter which is installed inside the relief valve has been adopted. The oil receiver is installed on the top side of the engine to improve serviceability.

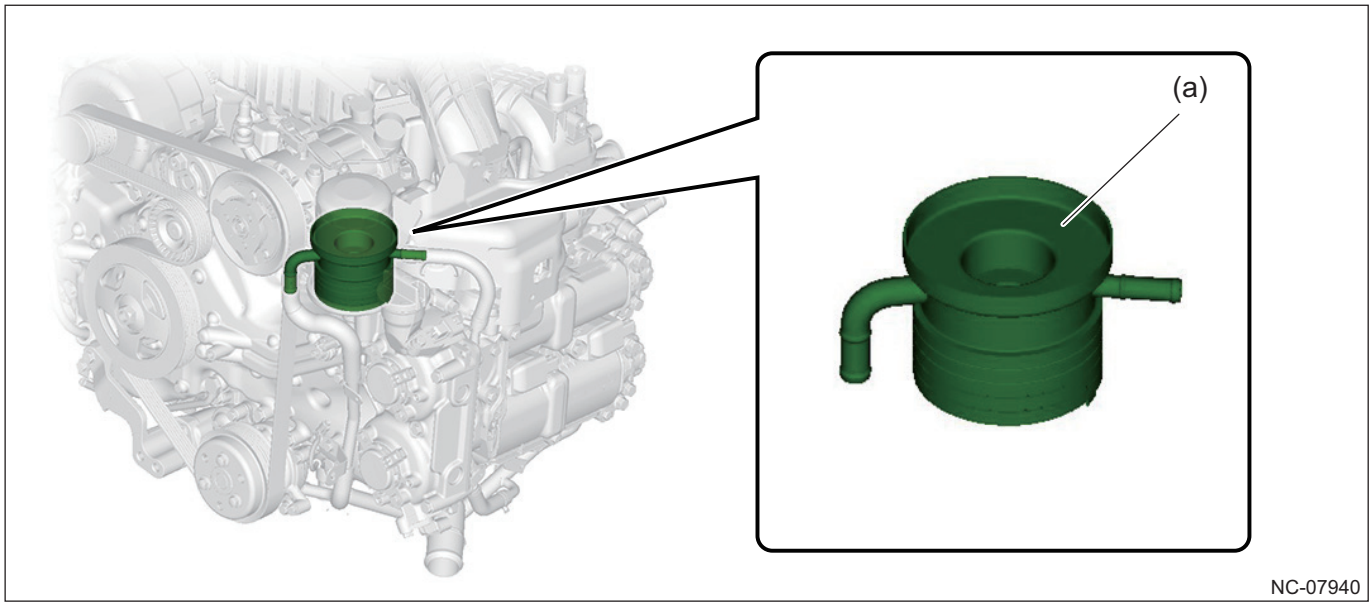


(a) Oil filter

Engine oil cooler

A water-cooled engine oil cooler has been adopted and improves oil cooling performance.

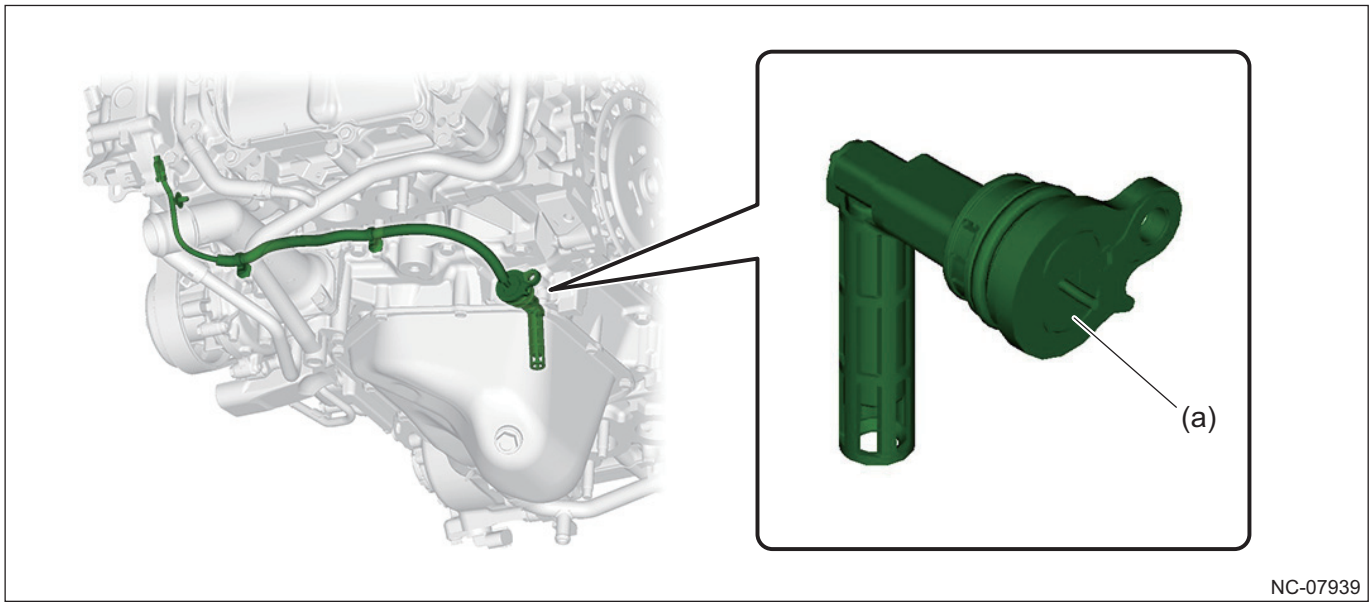
The layout of the coolant pipes is changed to secure space for installation of a fuel protector, improving collision safety performance.



(a) Engine oil cooler

Oil level switch

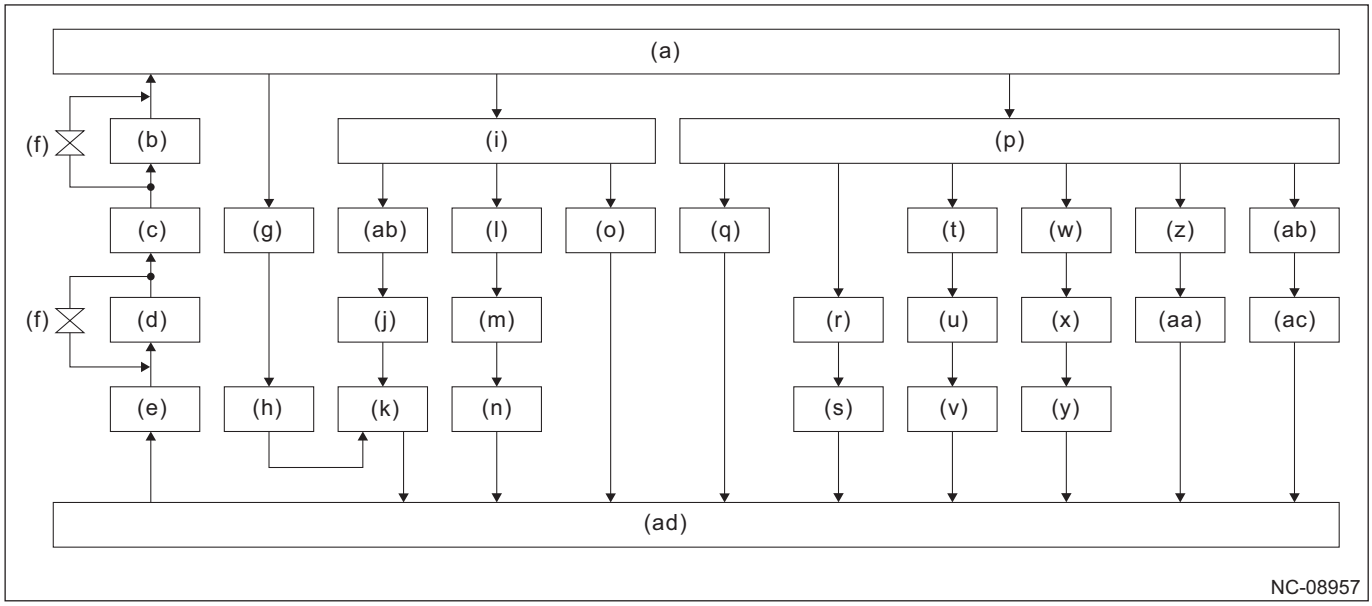
The size and weight of the oil level switch are reduced. A system which detects the oil level while the engine is stopped is adopted to improve oil level detection accuracy.



(a) Oil level switch

2.6.3 Construction and Operation

System diagram



(a) Oil passage in chain cover
(b) Oil filter
(c) Engine oil cooler
(d) Oil pump
(e) Oil strainer
(f) Relief valve
(g) Turbocharger
(h) Oil catch tank
(i) Cylinder block LH
(j) Oil jet
(k) Scavenge pump
(l) Crankshaft journal
(m) Crankshaft pin
(n) Connecting rod
(o) Chain tensioner LH
(p) Cylinder head
(q) Roller rocker arm pivot
(r) Oil jet in cylinder head
(s) Roller rocker arm
(t) Cam carrier
(u) Camshaft journal
(v) AVCS
(w) Cam carrier RH
(x) Oil pipe (MT)
(y) Vacuum pump (MT)
(z) Cam carrier LH
(aa) Fuel pump lifter
(ab) Cylinder block RH
(ac) Chain tensioner RH
(ad) Oil pan

2.7 Engine Control System

2.7.1 Overview

Overview

In the engine control system, the engine control module (ECM) performs comprehensive control including EGI, ignition timing control, AVCS, and electronic throttle control.

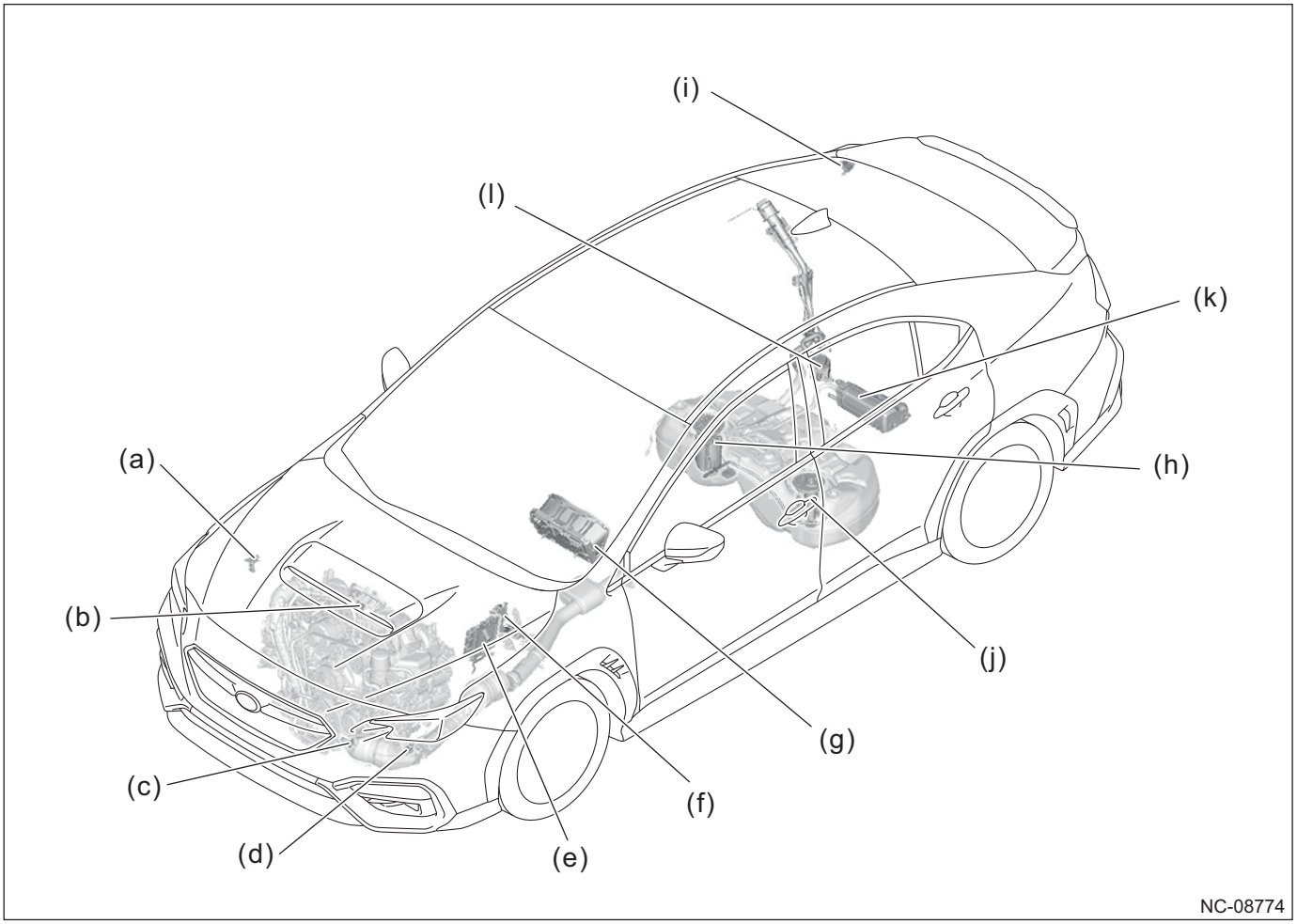
CAN communication is used for communication between the engine control module (ECM) and other computers.

The diagnosis (self diagnosis) function and the fail-safe function are installed for when problems occur.

2.7.2 Component

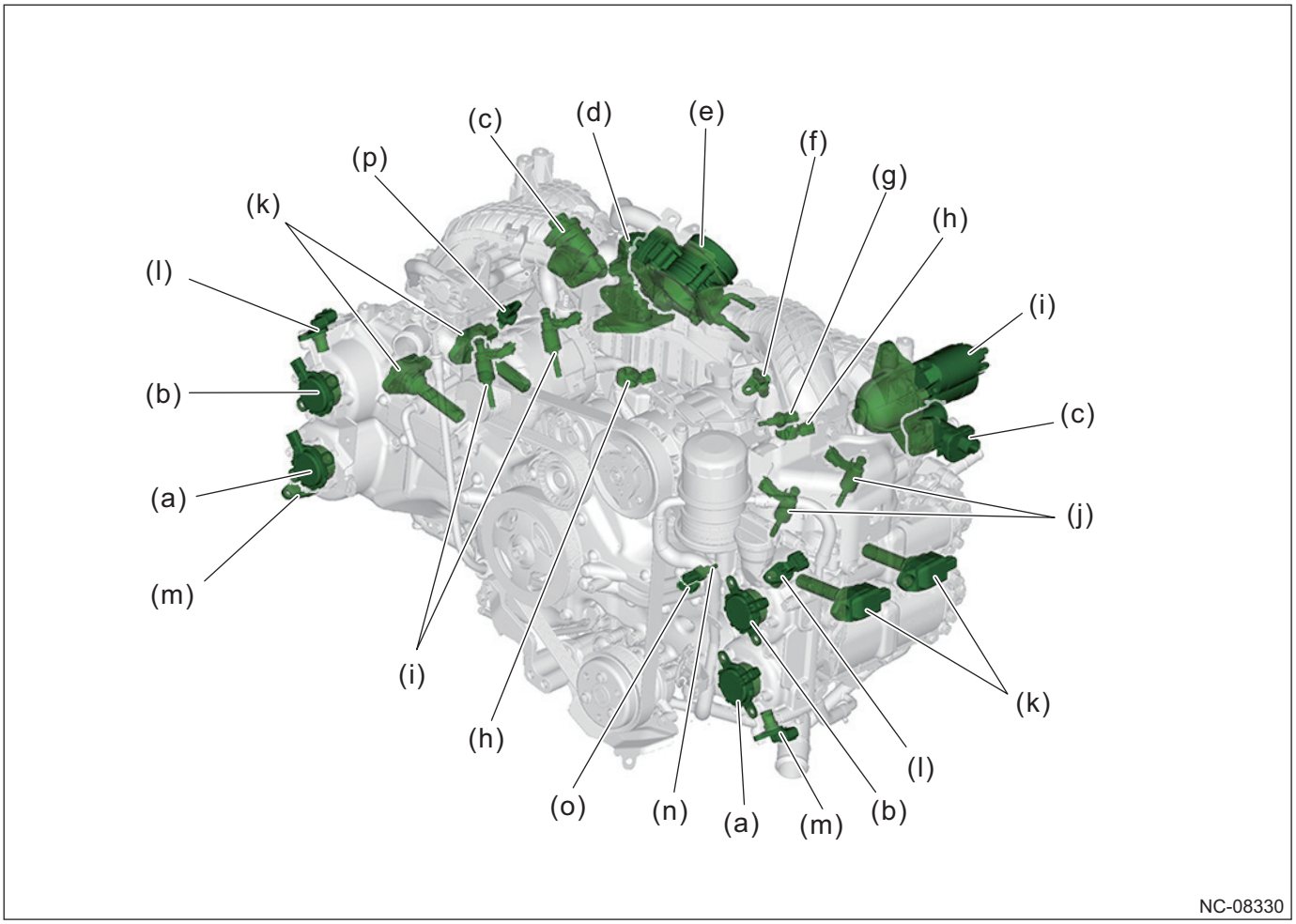
Component layout drawing

Main component 1



(a) Air flow and intake air temperature sensor
(b) Manifold pressure and intake air temperature sensor
(c) Front oxygen (A/F) sensor
(d) Rear oxygen sensor
(e) Engine control module (ECM)
(f) Accelerator pedal position sensor
(g) Combination meter
(h) Fuel pump assembly
(i) Fuel pump CM
(j) Fuel sub level sensor
(k) Canister
(l) ELCM

Main component 2



(a) Exhaust oil control solenoid

(b) Intake oil control solenoid

(c) Tumble generator valve (TGV)

(d) EGR control valve

(e) Throttle body
- Throttle position sensor
- Throttle motor

(f) Crankshaft position sensor

(g) Engine coolant temperature sensor

(h) Knock sensor

(i) Starter

(j) Fuel injector assembly

(k) Ignition coil

(l) Intake camshaft position sensor

(m) Exhaust camshaft position sensor

(n) Engine oil temperature sensor

(o) Engine oil pressure switch

(p) Fuel pressure sensor

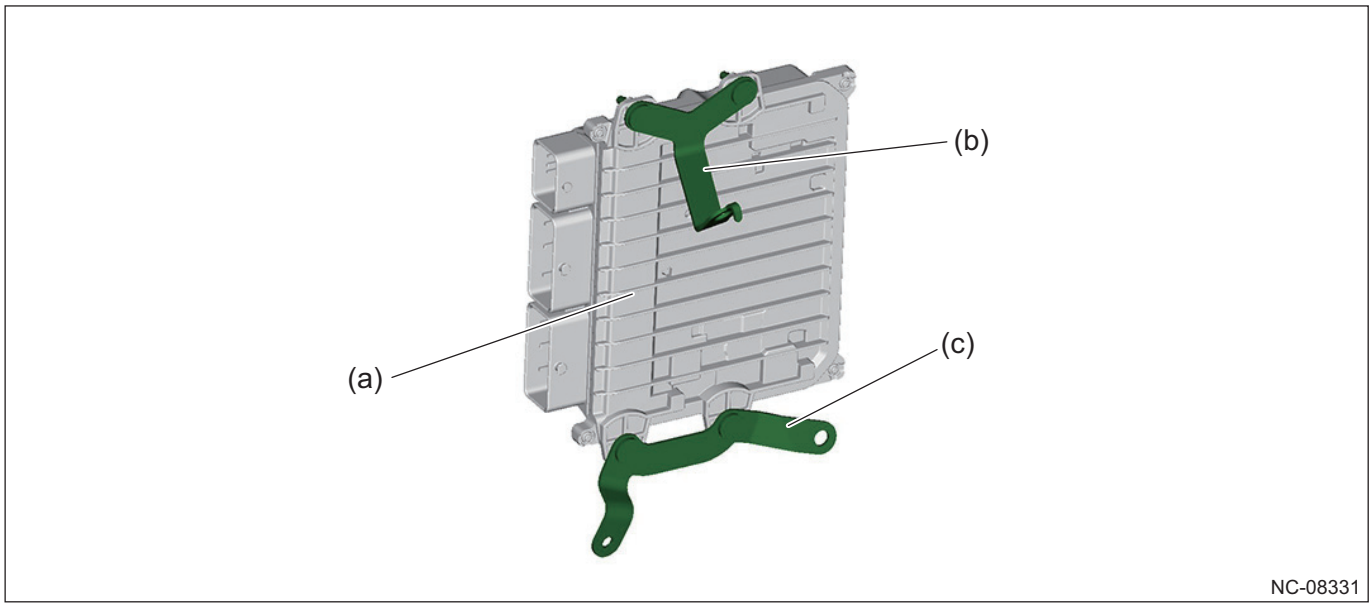
Component details

Engine Control Module (ECM)

The engine control module (ECM) is installed in the engine compartment and performs control including fuel injection control, electronic advance angle control, AVCS valve timing control, electronic throttle system control, EGR control, and canister purge control.

The shape of the engine control module (ECM) is optimized to reduce weight. The number of device I/O terminals was increased, and the interior communication standard has been updated to the latest standard.

The engine control module (ECM) bracket is split into an upper and lower part in order to reduce weight.

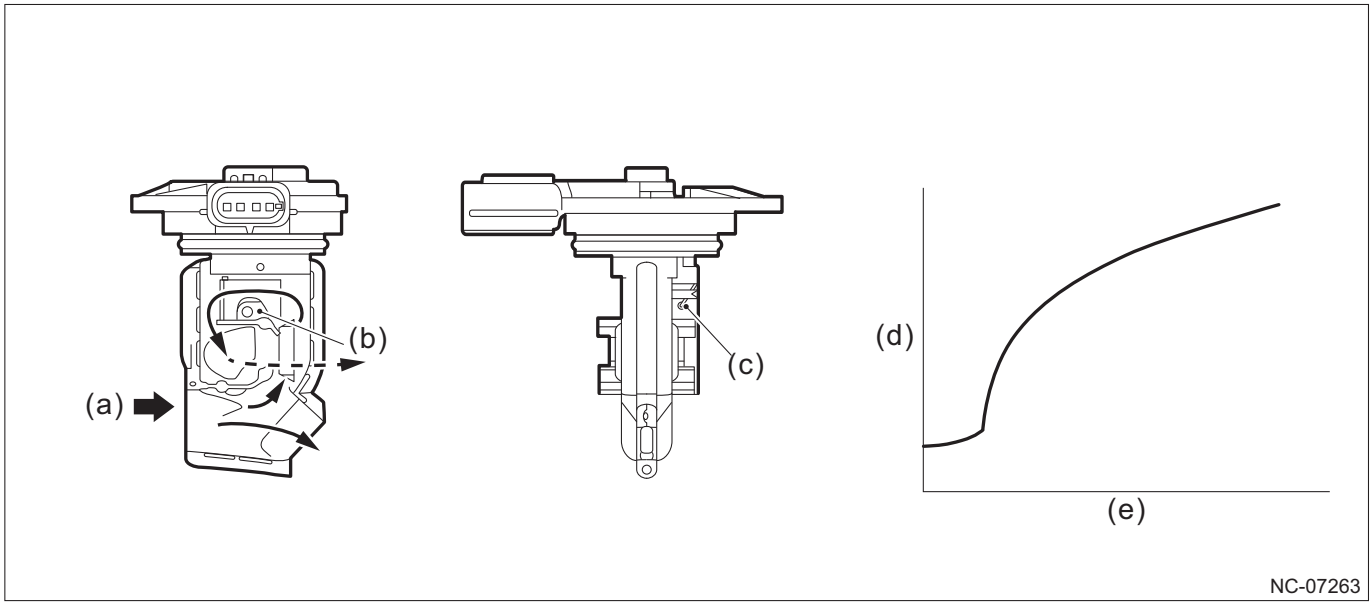


(a) Engine Control Module (ECM)
(b) Engine control module (ECM) bracket 1
(c) Engine control module (ECM) bracket 2

Air flow and intake air temperature sensor

The air flow and intake air temperature sensor are combined in a single part. This unit is installed in the air cleaner case and measures intake air amount and temperature.

The measured intake air amount and temperature are converted into electrical signals, and the signals are transmitted to the Engine Control Module (ECM). The Engine Control Module (ECM) uses these signals to control injection, ignition timing, and the fuel injection amount.

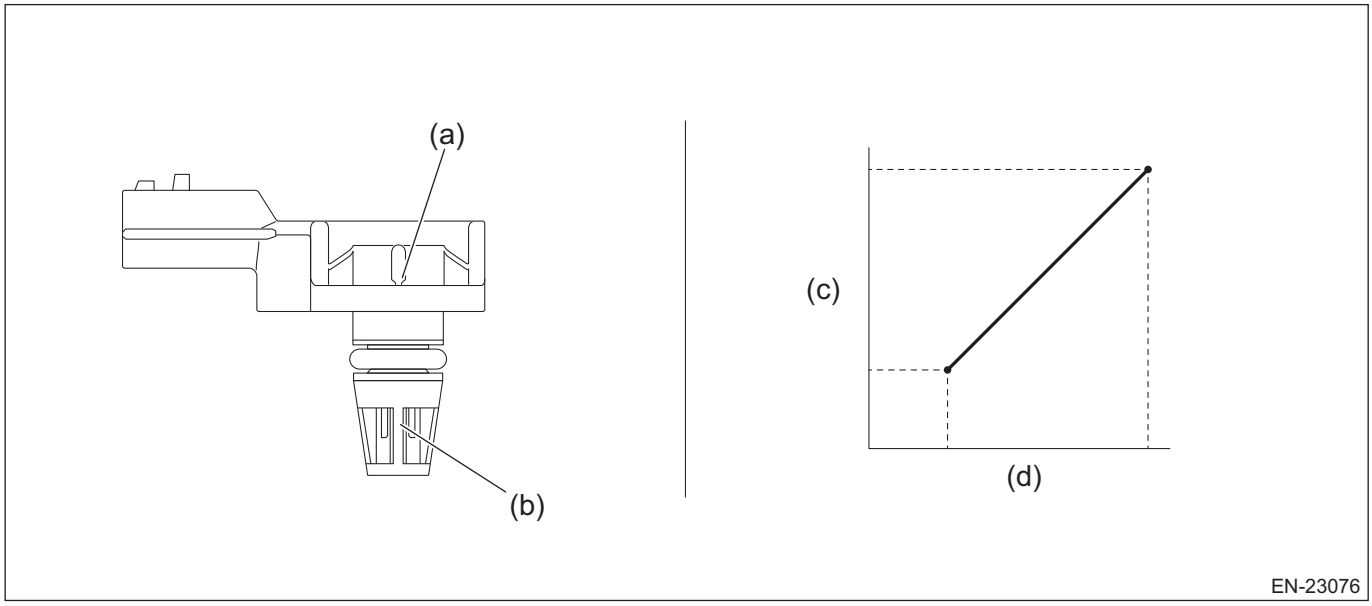


(a) Air
(b) Air flow sensor
(c) Intake air temperature sensor
(d) Frequency (kHz)
(e) Amount of intake air (lb (kg)/s)

Manifold pressure and intake air temperature sensor

The manifold pressure & intake air temperature sensor is installed in the intake manifold and measures the intake air pressure and the intake air temperature.

The measured intake air pressure and temperature are converted into electrical signals, and the signals are transmitted to the engine control module (ECM). The engine control module (ECM) uses these signals to control injection, ignition timing, and the fuel injection amount.

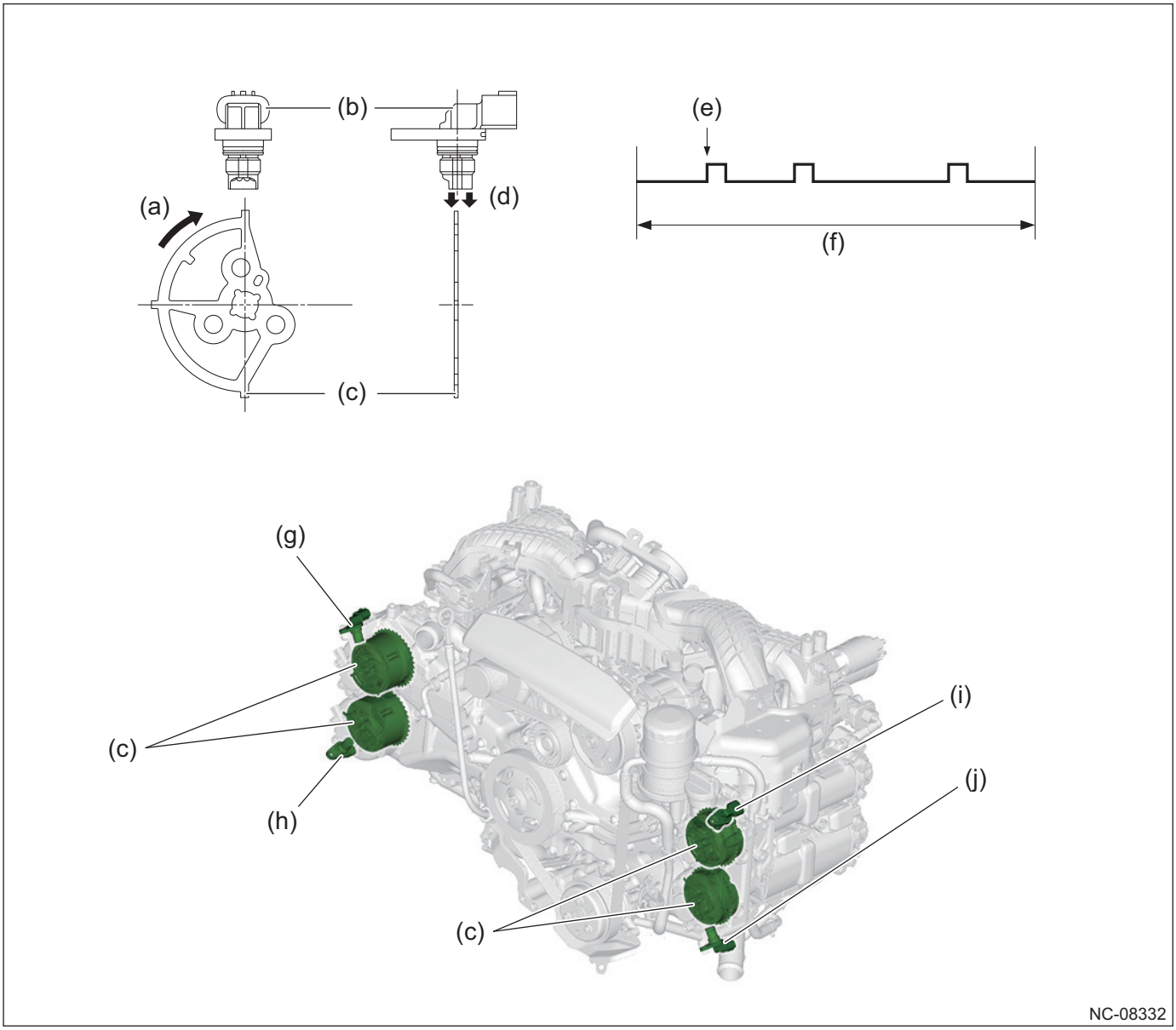


(a) Manifold pressure sensor
(b) Intake air temperature sensor
(c) Output voltage (V)
(d) Absolute pressure (kPa)

Camshaft position sensor

The camshaft position sensor plate is installed on the intake and exhaust AVCS, and this sensor detects the rotation position of the camshaft in order to detect the phases of the camshaft and the crankshaft. A GMR (Giant Magneto Resistance) element type is adopted for the camshaft position sensor.

The system detects the phases of the camshaft and the crankshaft based on the signals transmitted from the camshaft position sensor and the crankshaft position sensor, and performs AVCS valve timing control based on these phases.



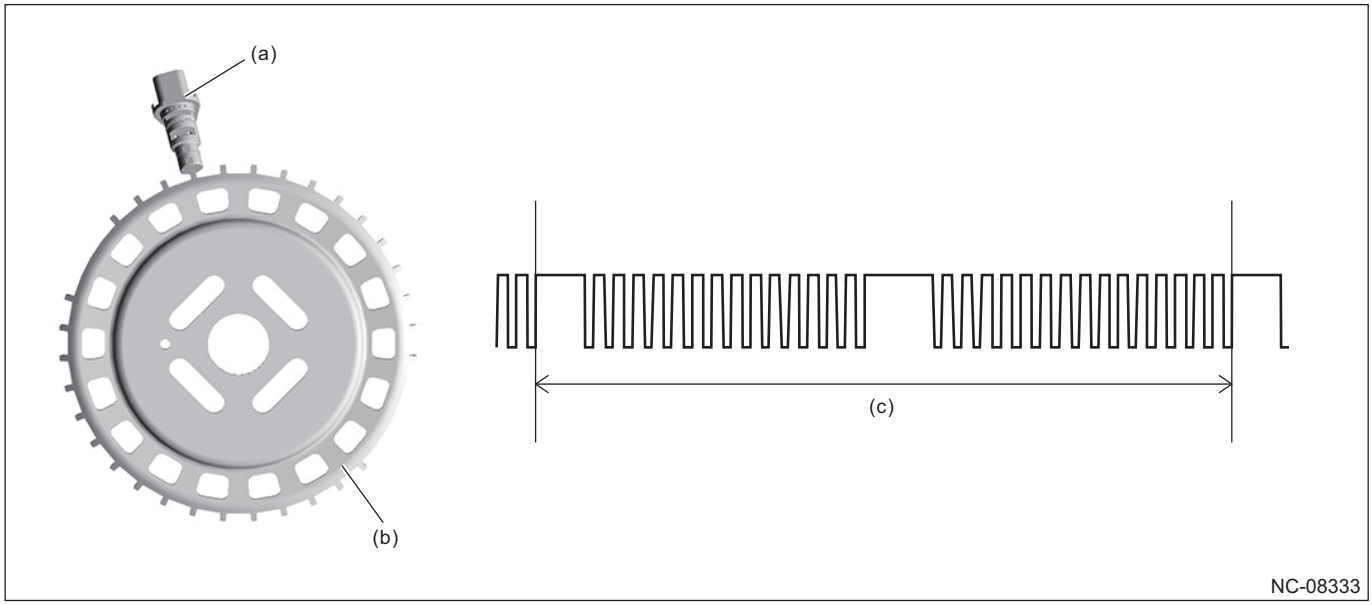
(a) Rotation direction
(b) Camshaft position sensor
(c) Camshaft position sensor plate
(d) Magnetic field
(e) Detecting point
(f) One camshaft rotation (two crankshaft rotations)
(g) Camshaft position sensor (intake RH side)
(h) Camshaft position sensor (exhaust RH side)
(i) Camshaft position sensor (intake LH side)
(j) Camshaft position sensor (exhaust LH side)

Crankshaft position sensor

The crankshaft position sensor generates one pulse when one of the outer teeth of the crankshaft position sensor plate (that rotates together with the crankshaft) passes in front of the sensor. The Engine Control Module (ECM) counts the pulses to determine the angular position of the crankshaft.

A semiconductor type crankshaft position sensor has been adopted.

When the crankshaft rotates, there is a moment at which each tooth matches the position of the crankshaft position sensor. At that time, the air gap changes between the pickup of the sensor and the crankshaft position sensor plate, and as a result the magnetic flux of the coil in the sensor changes. The change in magnetic flux induces a voltage pulse in the sensor, and the pulse is transmitted to the engine control module (ECM).

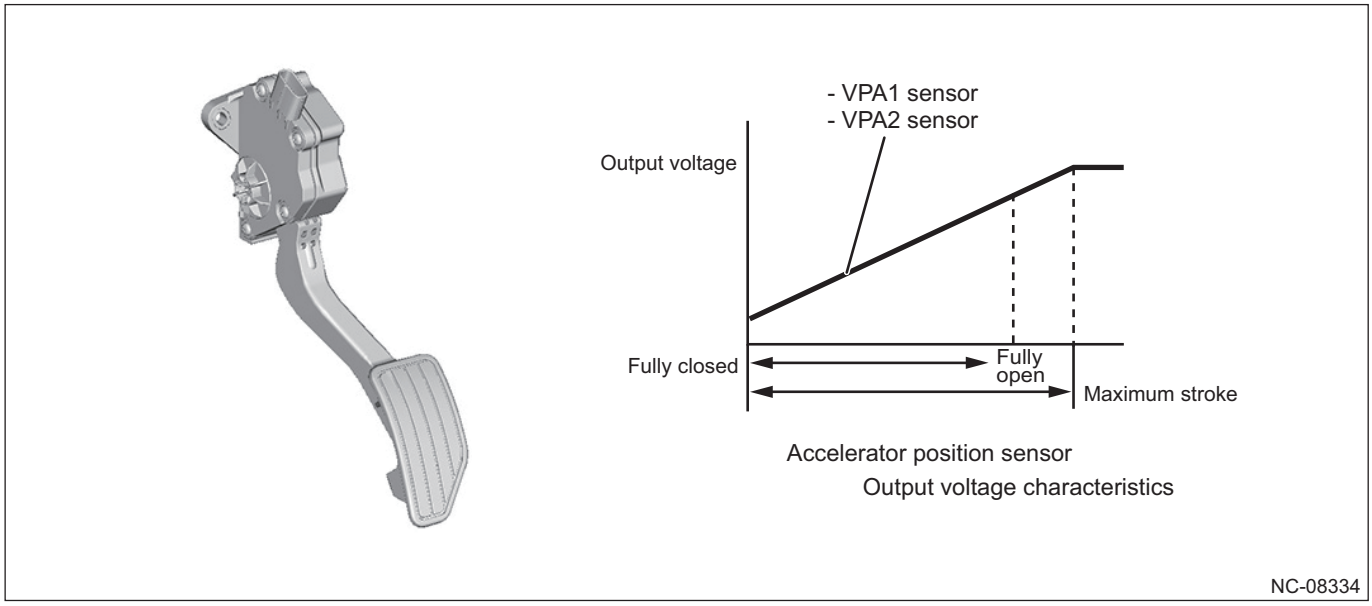


(a) Crankshaft position sensor
(b) Crankshaft position sensor plate
(c) One crankshaft rotation

Accelerator pedal position sensor

The accelerator pedal position sensor is installed in the accelerator pedal and detects the changes in magnetic field which corresponds to the depression amount of the accelerator pedal as an electric signal. Non-contact method that uses a hall element is adopted for the sensor.

The system compares outputs of the VP1 sensor and the VP2 sensor which have the same output characteristic to determine problems.



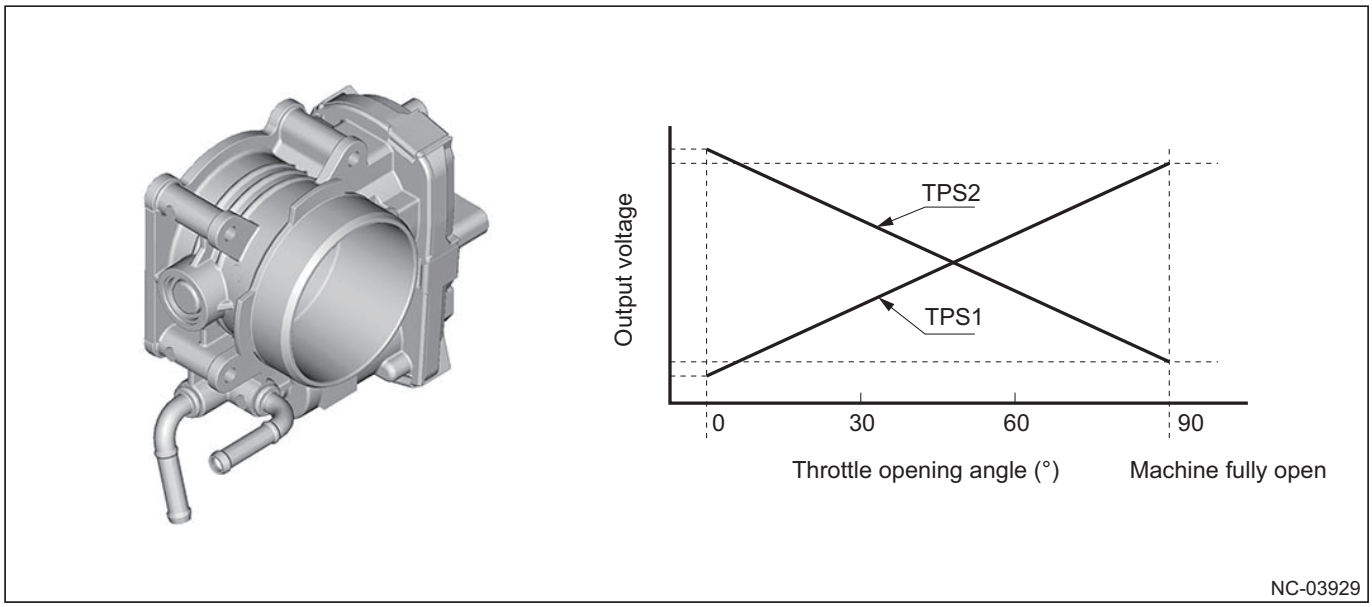
Throttle body

The throttle body is composed of the throttle position sensor and throttle motor.

The throttle position sensor detects the throttle valve opening angle, and a non-contact detection method using a Hall element is used in it.

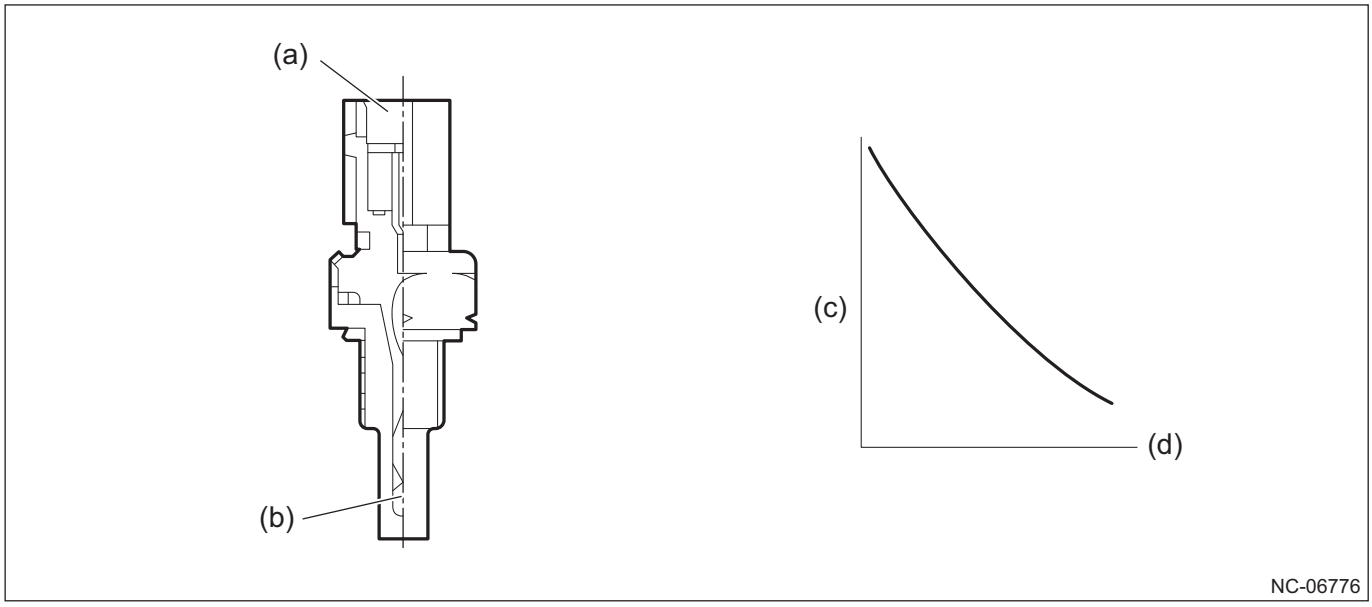
The throttle motor opens and closes the throttle valve.

The use of 2 sensors that have different sensor output characteristics strengthens fail-safe functions and ensures reliability.



Engine coolant temperature sensor

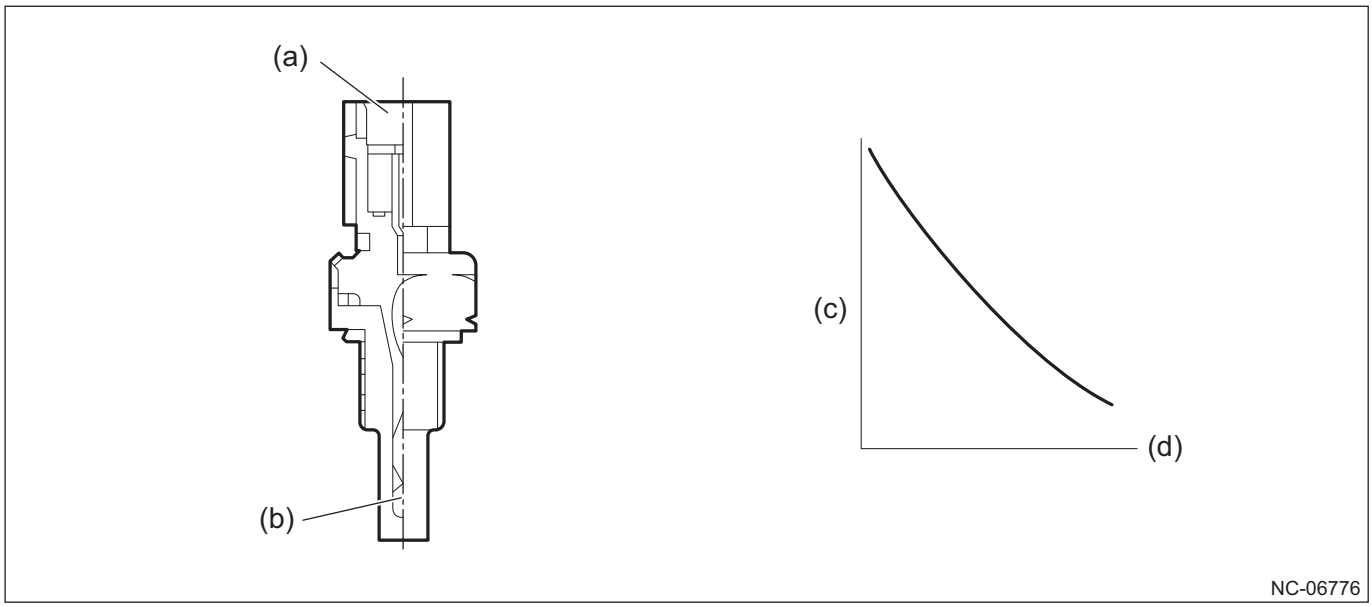
The installation position of the engine coolant temperature sensor was provided directly above the outlet of the engine coolant pipe from the engine main body, increasing sensing accuracy and improving engine control performance. This sensor uses a thermistor in which the resistance decreases as the temperature increases. The resistance signal is sent as coolant temperature information to the Engine Control Module (ECM) in order to control the engine.



(a) Connector
(b) Thermistor
(c) Resistance value (kΩ)
(d) Temperature (°F (°C))

Engine oil temperature sensor

The engine oil temperature sensor is installed on the chain cover. This sensor uses a thermistor in which the resistance decreases as the temperature increases. The resistance signal is sent as oil temperature information to the Engine Control Module (ECM) in order to control the engine.

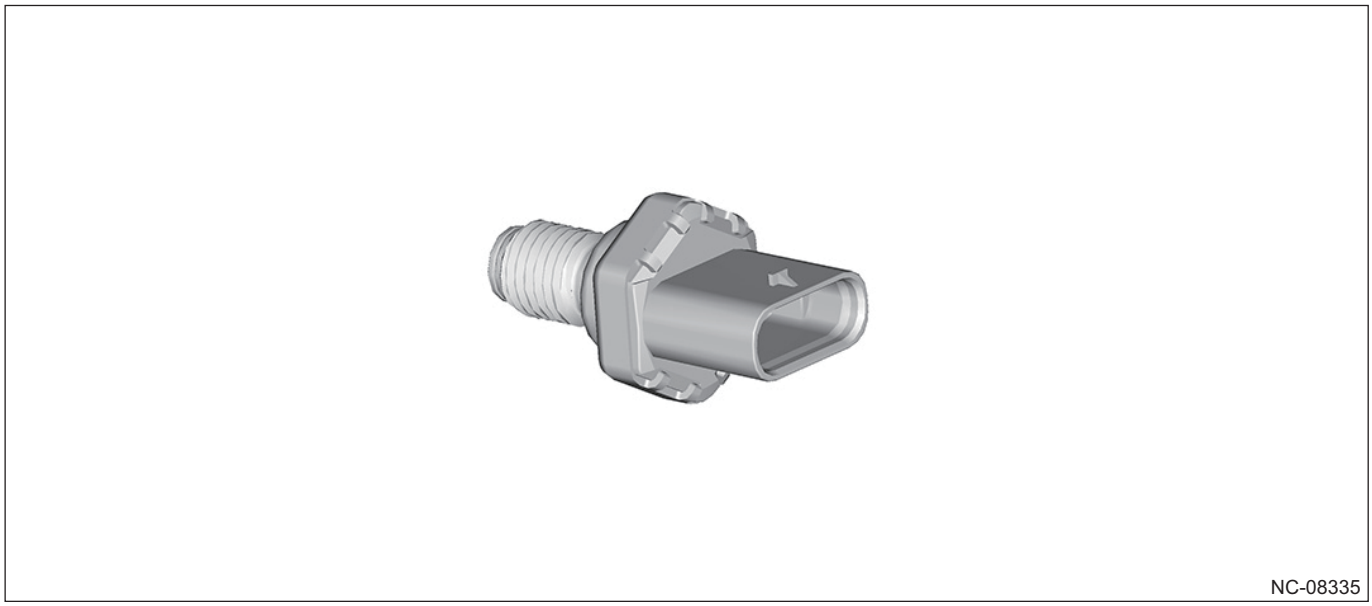


(a) Connector
(b) Thermistor
(c) Resistance value (kΩ)
(d) Temperature (°F (°C))

Fuel pressure sensor

The fuel pressure sensor is composed of a silicon chip that detects the fuel pressure.

The fuel pressure sensor is a semiconductor pressure sensor that utilizes the property of electrical resistance that changes when pressure is applied to a crystal (silicon). It converts the fuel pressure to an electrical signal, amplifies it, and sends it as the fuel pressure signal to the Engine Control Module (ECM).

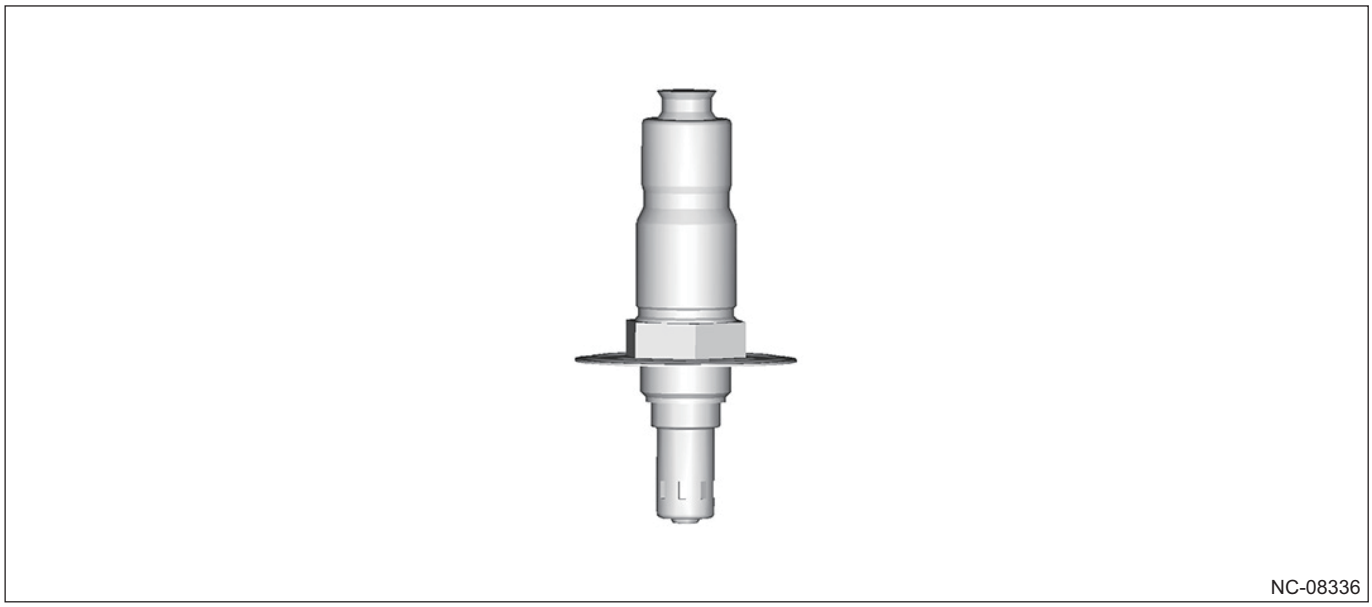


Front oxygen (A/F) sensor

The front oxygen (A/F) sensor is installed on the upstream side of the front ternary catalyst in order to surely detect the air-fuel ratio condition of the exhaust gas.

Oxidized zirconium (Z_rO_2) is used in the front oxygen (A/F) sensor. Oxidized zirconium has a characteristic of generating electromotive force when both surfaces contact oxygen ion that has different concentration. The electromotive force changes depending on the difference in oxidized concentration. With this characteristic, this sensor can linearly detect the status of exhaust gas and precisely control the air-fuel ratio compared to the rear oxygen sensor which detects lean or rich from theoretical air-fuel ratio.

On the sensor section, the outer surface of the oxidized zirconium contacts exhaust gas and the inner surface contacts atmosphere to obtain the current output from the sensor. Also, since the output characteristic of the front oxygen (A/F) sensor stabilizes at about 1292 °F (700 °C), the sensor is designed as a layer type to shorten the heating time.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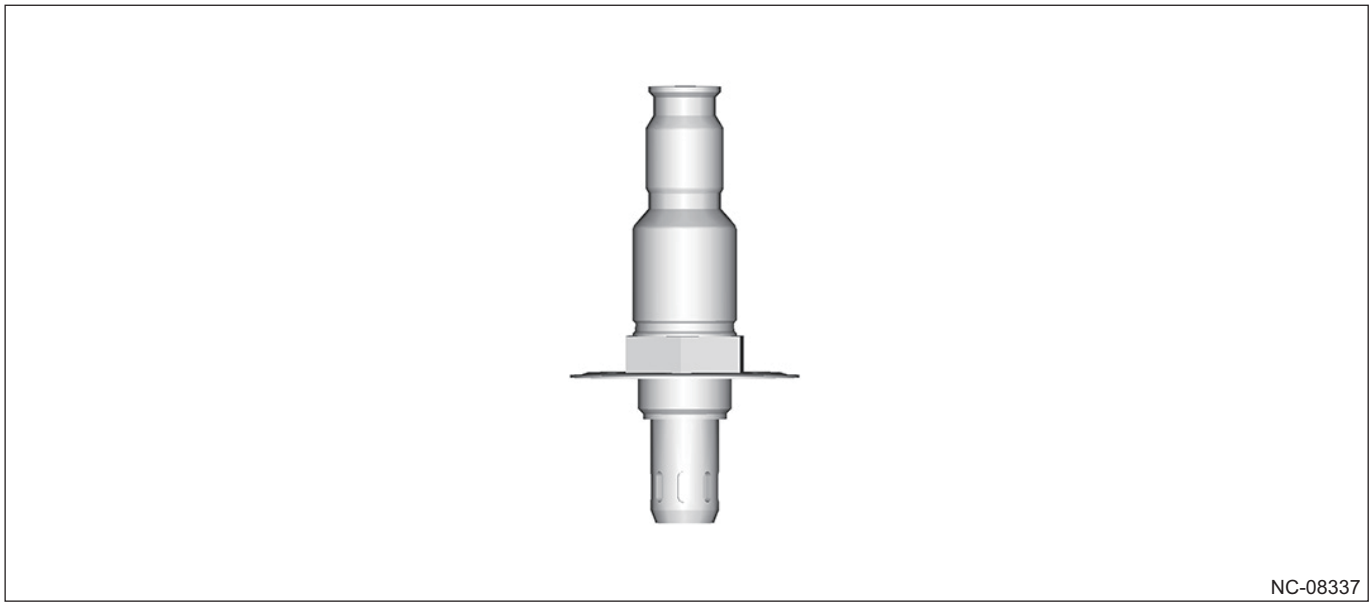
Rear oxygen sensor

The rear oxygen sensor is installed on the downstream side of the front ternary catalyst and detects whether the oxygen concentration in the exhaust gas is higher or lower than the theoretical air-fuel ratio.

Zirconium tube (ceramic) is used for the rear oxygen sensor and generates voltage if there is a difference in oxygen ion concentration inside and outside the tube.

A ceramic heater is installed because the output characteristic of the rear oxygen sensor stabilizes at around 572 to 752°F (300 to 400°C).



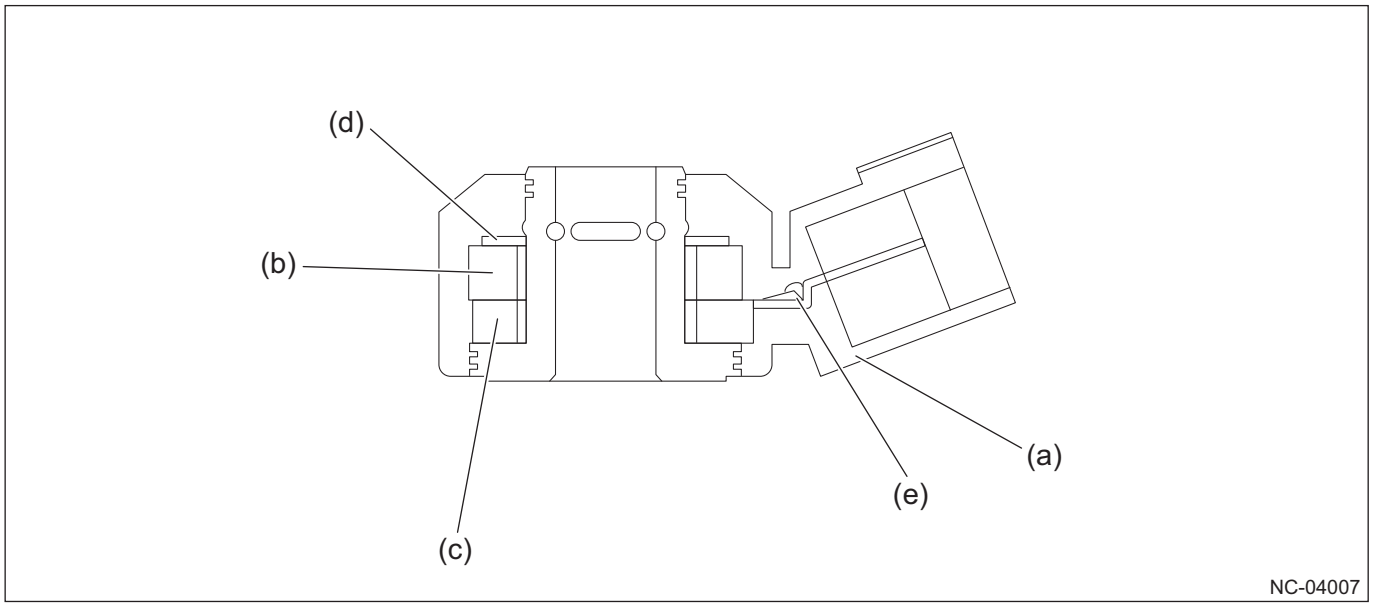
Knock sensor

The knock sensor is installed on the cylinder block and detects the knocking occurring in the engine.

The knock sensor has a built-in piezoelectric element to convert the vibration caused by knocking into an electric signal.

A knock sensor is installed for both the right and left cylinder blocks to ensure reliability.

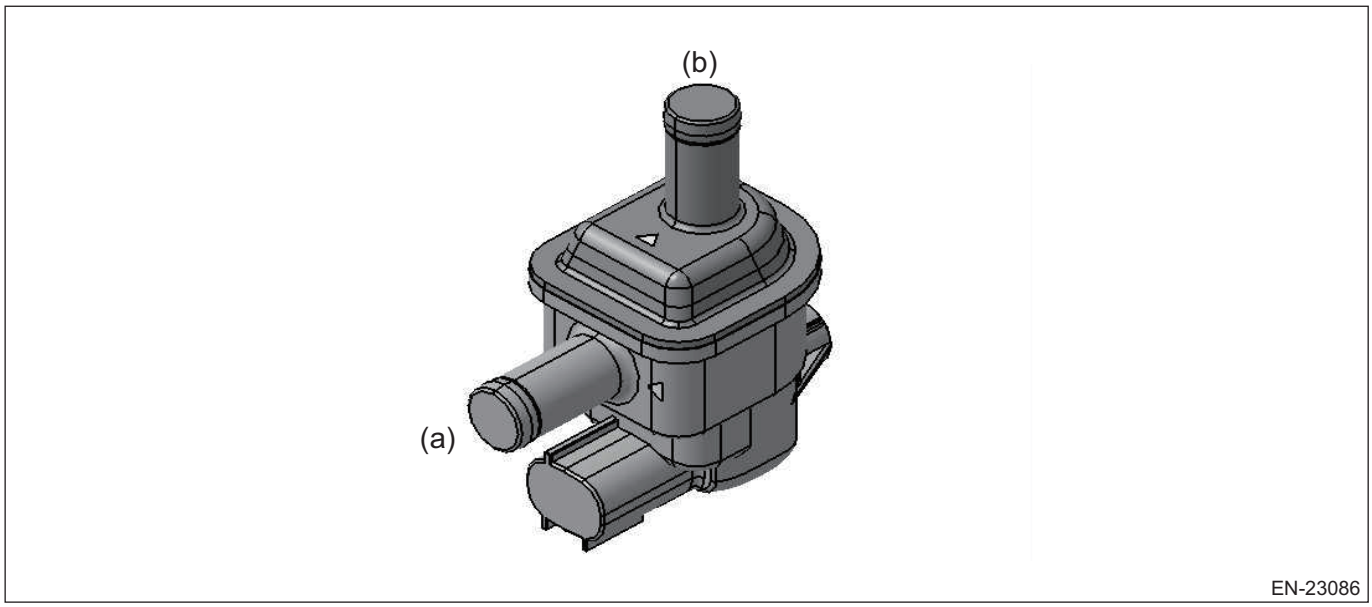
In addition to the piezoelectric element, the sensor is composed of weight and case. When knocking occurs in the engine, the weight moves in the case and then a voltage occurs in the piezoelectric element.



(a) Case
(b) Weight
(c) Piezoelectric element
(d) Washer
(e) Resistance

Purge control solenoid valve

The purge control solenoid valve is installed in the evaporation fuel line between the canister and the intake manifold. The valve is installed on the front side of the intake manifold and suctions the fuel evaporation gas stored in the canister into the intake manifold and the duct upstream of the turbocharger.



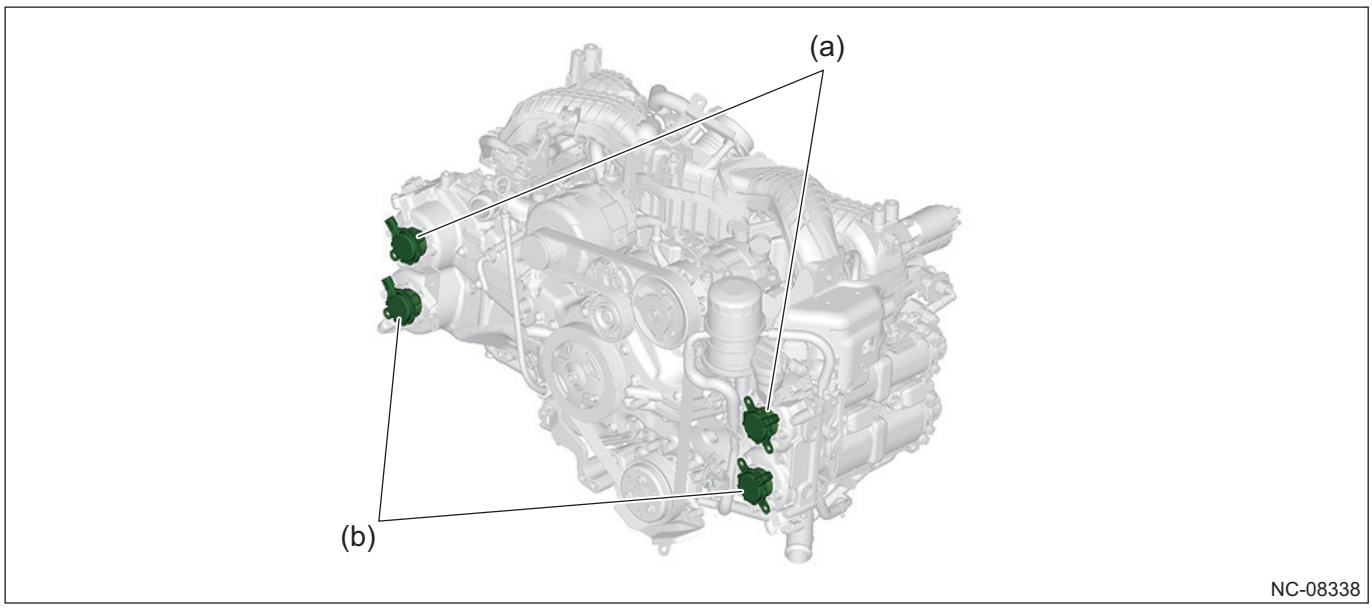
(a) From canister

(b) To intake manifold and duct upstream of the turbocharger

Oil control solenoid

The intake oil control solenoid and exhaust oil control solenoid are installed on the chain cover.

The duty signal from the Engine Control Module (ECM) is used to continually control the amount of shaft movement and switch the spool valve oil passage in order to produce the optimal valve timing.



(a) Intake oil control solenoid

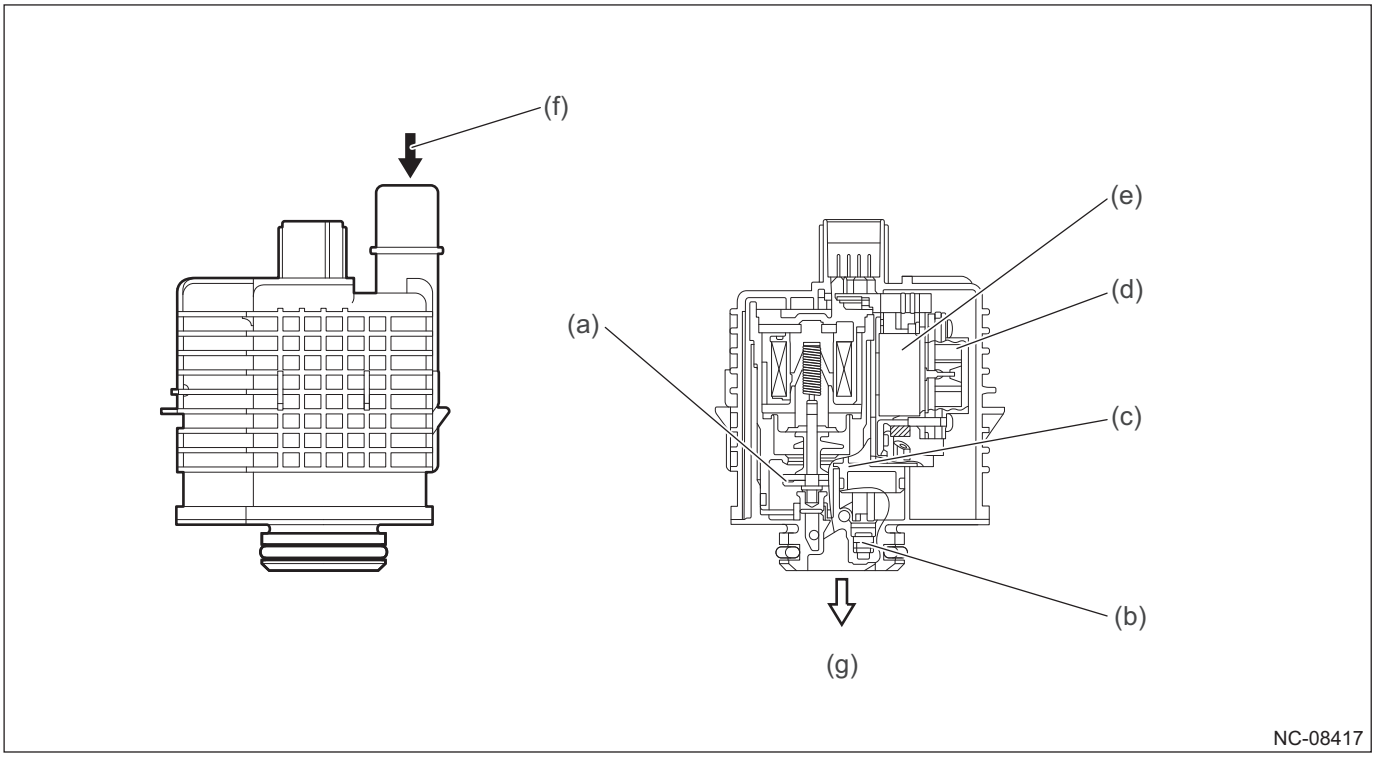
(b) Exhaust oil control solenoid

ELCM

The ELCM is composed of the switching valve, reference orifice, pressure sensor, vacuum pump, and pump motor.

At the switching valve, the flow passage is switched according to the signals received from the Engine Control Module (ECM).

A DC brushless motor is used as the pump motor.

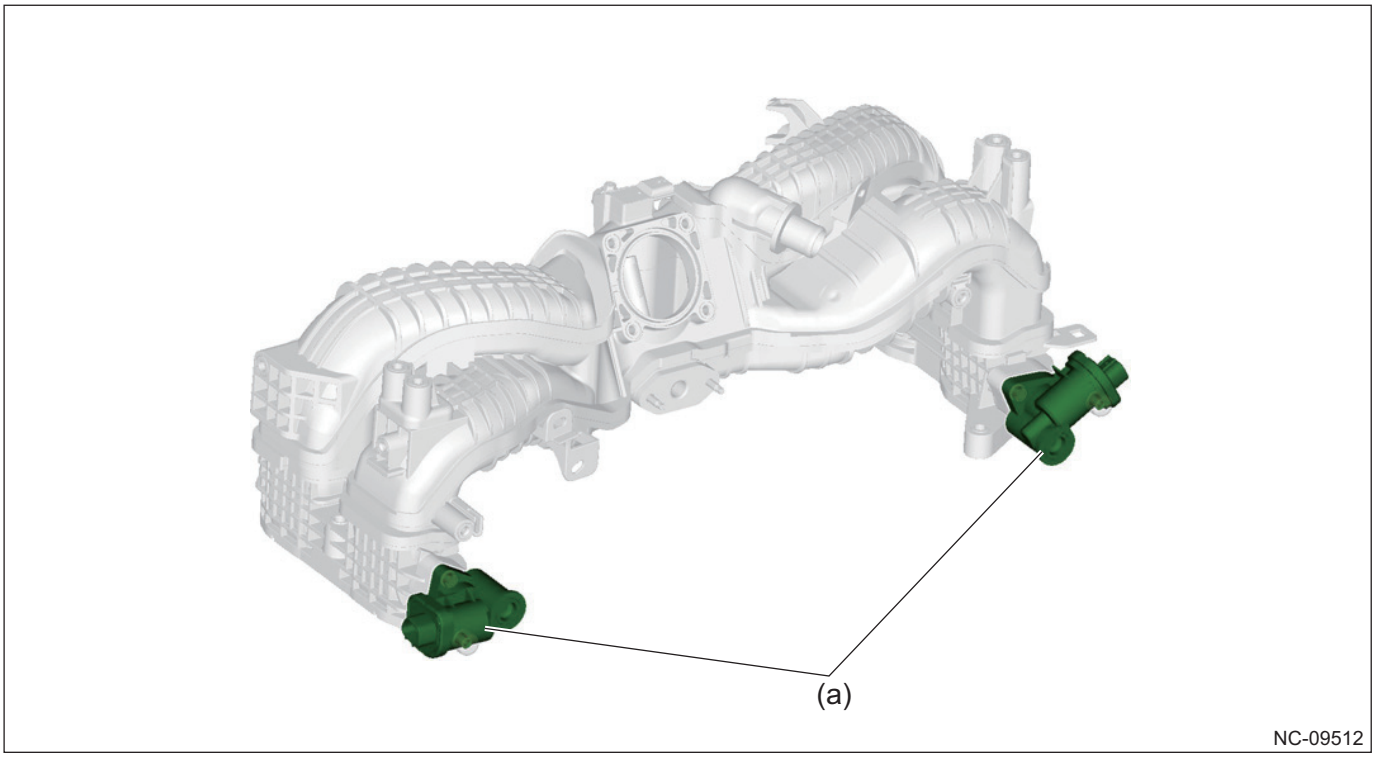


(a) Switching valve
(b) Reference orifice
(c) Pressure sensor
(d) Pump motor
(e) Vacuum pump
(f) Fresh air
(g) To canister

Tumble Generator Valve (TGV)

The tumble generator valve (TGV) is installed in the intake manifold.

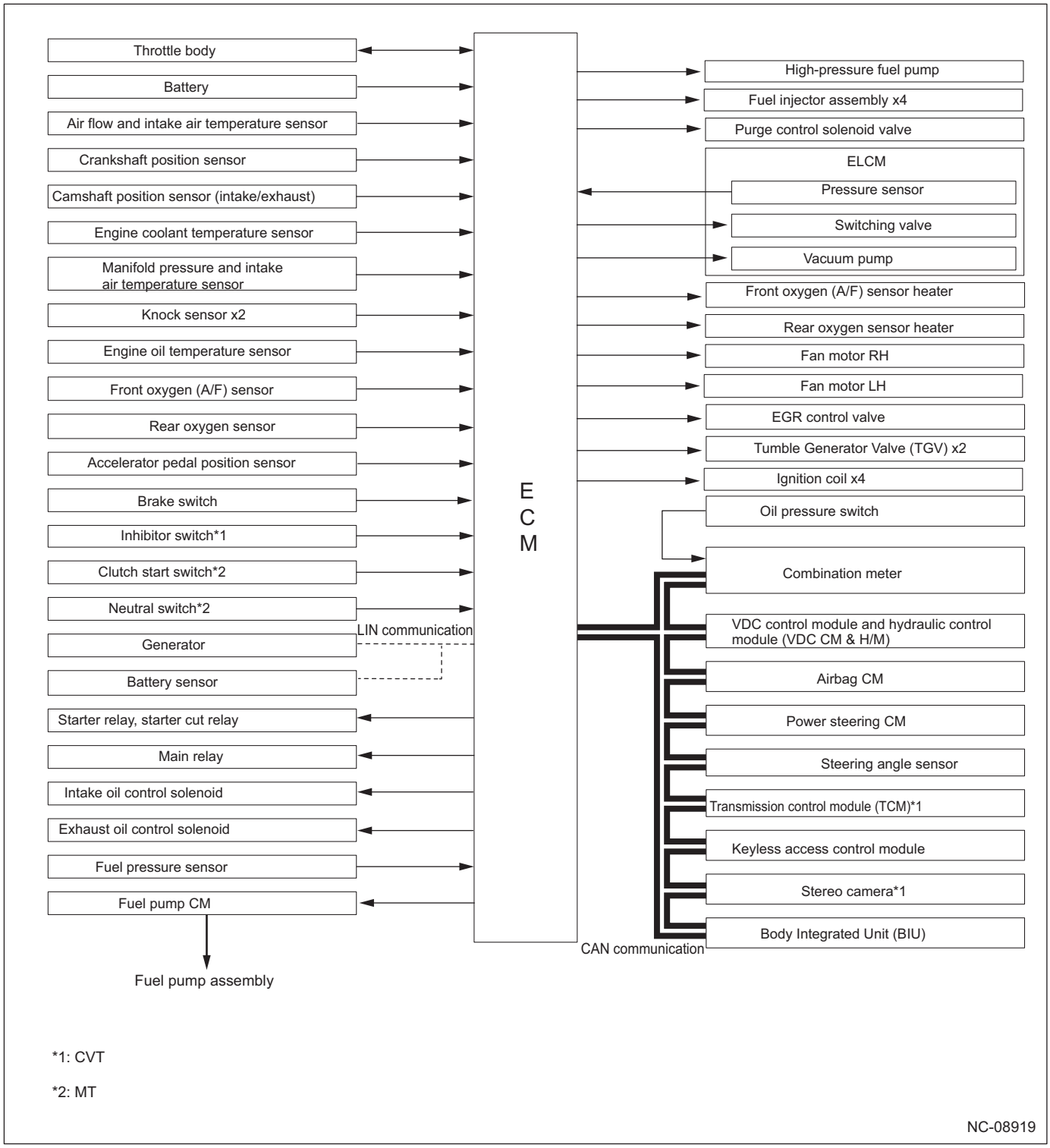
The tumble generator valve (TGV) is opened and closed to generate the necessary tumble according to the driving range, such as at cold start and when idling.



(a) Tumble generator valve (TGV)

2.7.3 Construction and Operation

System diagram



Main component functions

List of sensors

Name		Function and construction
Air flow sensor		This detects the intake airflow.
Intake air temperature sensor		This detects the temperature of the intake air inside the air cleaner case.
Manifold pressure sensor		This detects the absolute pressure of the intake manifold.
Crankshaft position sensor		This detects the crankshaft angle and engine speed.
Camshaft position sensor		This detects the reference signal for determining the cylinder in which combustion occurs.
Accelerator pedal position sensor		This detects the accelerator pedal opening angle.
Throttle body	Throttle position sensor	This detects the throttle opening angle.
Engine coolant temperature sensor		This detects the coolant temperature.
Engine oil temperature sensor		This detects the engine oil temperature.
Fuel pressure sensor		This detects the fuel pressure (high-pressure side).
Front oxygen (A/F) sensor		This detects the concentration of oxygen in the exhaust gas.
Rear oxygen sensor		This detects the concentration of oxygen in the exhaust gas.
Knock sensor		This detects knocking of the engine.
Battery sensor		This detects the battery current, voltage, and temperature.
Pressure sensor (ELCM)		This detects the ELCM pressure and sends the signal to the Engine Control Module (ECM).

List of actuators

Name		Function and construction
Fuel pump CM		Performs stepless control of the fuel pump assembly speed based on signals from the engine control module (ECM).
Ignition coil		This sends the ignition check signal.
Fuel pump assembly		This sends fuel under pressure from the fuel tank to the fuel injector assembly and high-pressure fuel pump.
High-pressure fuel pump		• This pressurizes the fuel from the fuel pump assembly to high pressure. • This controls the fuel pressure (high pressure) to the delivery pressure according to the driving condition based on the drive signals from the Engine Control Module (ECM).
Fuel injector assembly		This injects fuel directly into the top of the combustion chamber based on the injector drive signals from the Engine Control Module (ECM).
Oil control solenoid		This controls the camshaft phase to produce the optimal valve timing.
Purge control solenoid valve		This receives the signal from the Engine Control Module (ECM) and controls the discharge of fuel evaporation gas which is absorbed in the canister.
Throttle body	Throttle motor	This receives the signal from the Engine Control Module (ECM) and operates the throttle valve.
EGR control valve		This controls the opening of the EGR control valve according to the driving conditions.
Tumble Generator Valve (TGV)		This opens and closes the tumble generator valve (TGV) based on the signals received from the engine control module (ECM).
Switching valve (ELCM)		This opens and closes the fresh air passage based on the signals received from the Engine Control Module (ECM).
Vacuum pump (ELCM)		This applies vacuum to the ELCM based on the signals received from the Engine Control Module (ECM).

System control

Control list

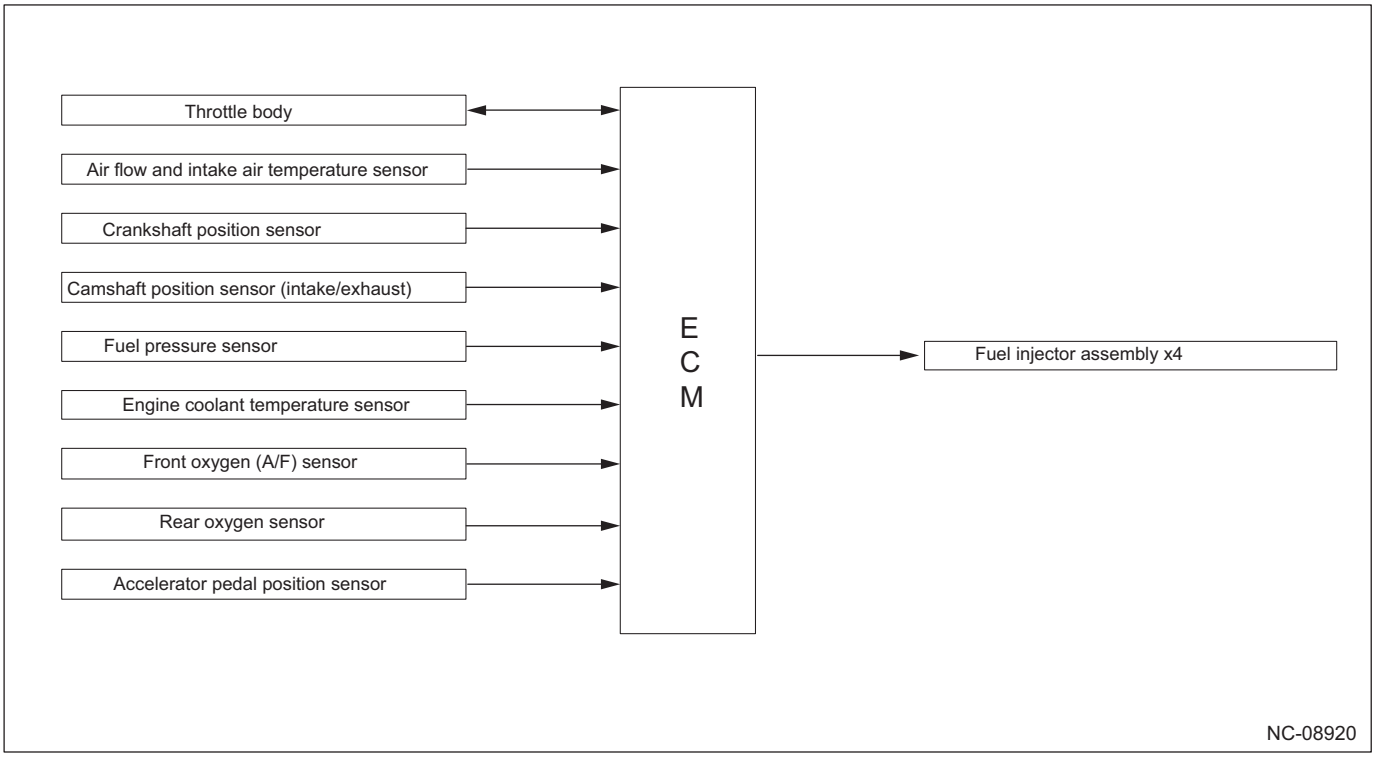
Control name	Function
Fuel injection control	Based on the signals from each sensor, this applies correction to the basic injection timing that was calculated according to the engine conditions in order to perform optimal fuel injection.
Ignition timing control	Based on the signals from each sensor, this applies correction to the basic ignition timing that was calculated according to the engine conditions in order to perform optimal ignition.
Electronic throttle control	Based on the signals from each sensor, this applies correction to the throttle opening angle that was calculated according to the engine conditions in order to perform optimal control of the throttle opening angle.
AVCS	This controls the optimal intake and exhaust valve timing according to the engine conditions.
Low-pressure fuel pump control	This turns the fuel pump assembly ON/OFF based on the IG ON signal, engine speed signal, and other information. It stops operation of the fuel pump assembly based on a signal from the airbag CM.
High-pressure fuel pump control	This controls the high-pressure fuel pump delivery pressure by controlling the solenoid spill valve according to the engine conditions.
Front oxygen (A/F) sensor heater control	This turns the front oxygen (A/F) sensor heater ON/OFF according to the coolant temperature and driving conditions.
Rear oxygen sensor heater control	This turns the rear oxygen sensor heater ON/OFF according to the coolant temperature and driving conditions.
Canister purge control	This controls the canister purge flow according to the engine conditions.
Tumble generator control	This generates the necessary tumble according to the driving range.
ELCM control	Operation and evaporation leak check diagnosis is started by a signal from the Engine Control Module (ECM) when a fixed time has elapsed after the engine stopped and the evaporation pressure stabilized.
Brake override	Equipped with the control to improve safety performance by prioritizing the brake and controlling the engine output when the accelerator and brake pedal are both pressed by mistake.
CAN communication	A communications IC which can exchange large amounts of information using a single communication line is adopted for communication with other CM.

System details

Fuel injection control

This detects the intake airflow by means of the air flow and intake air temperature sensor, and controls the fuel injection amount.

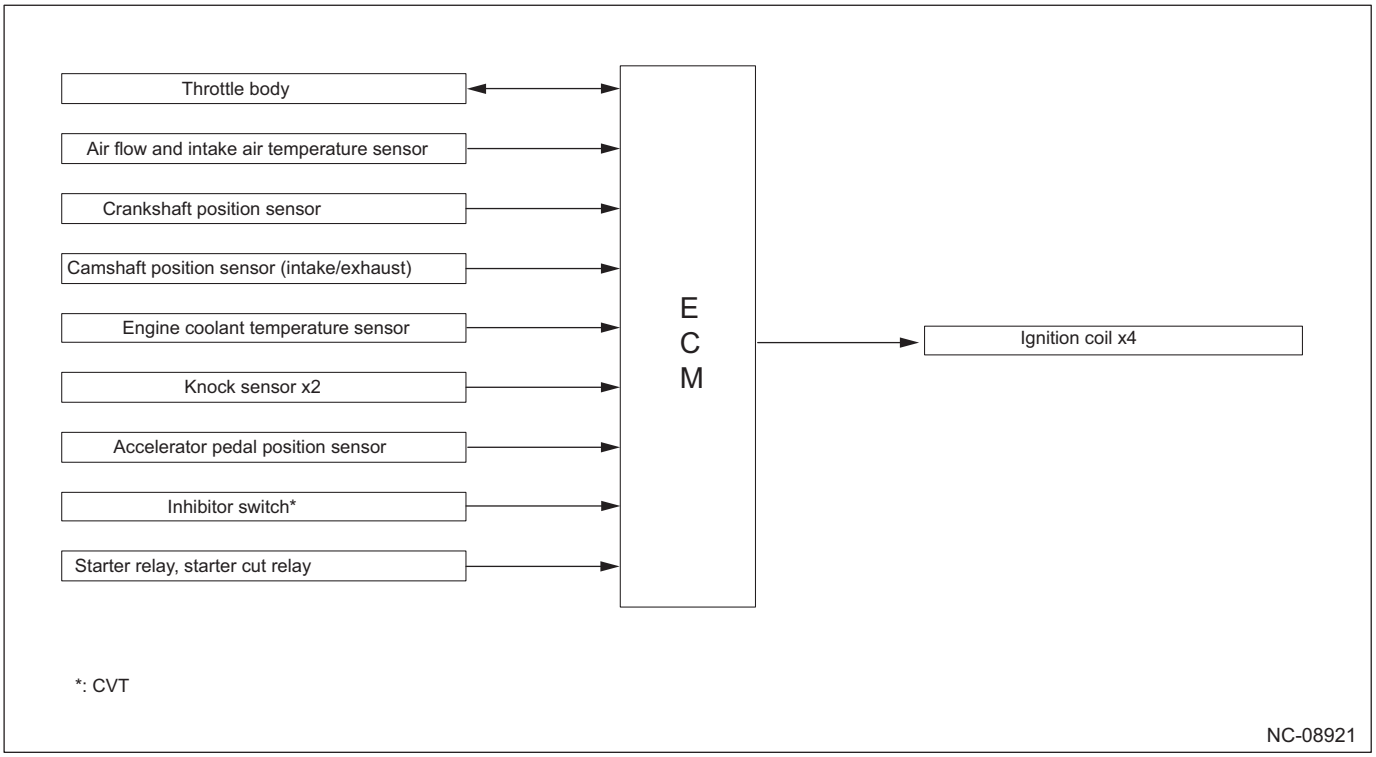
Based on the signals from various sensors, the engine control module (ECM) controls the amount of fuel injected and the injection timing at the fuel injector assembly according to the engine speed and engine load to produce the optimal combustion conditions. This reduces engine oil dilution, lowers fuel consumption, improves emissions performance, and increases output.



Ignition timing control

Based on the signals from various sensors, this selects the optimal ignition timing and sends the ignition signal to the ignition coil.

Highly precise knock control using a knock sensor is adopted.



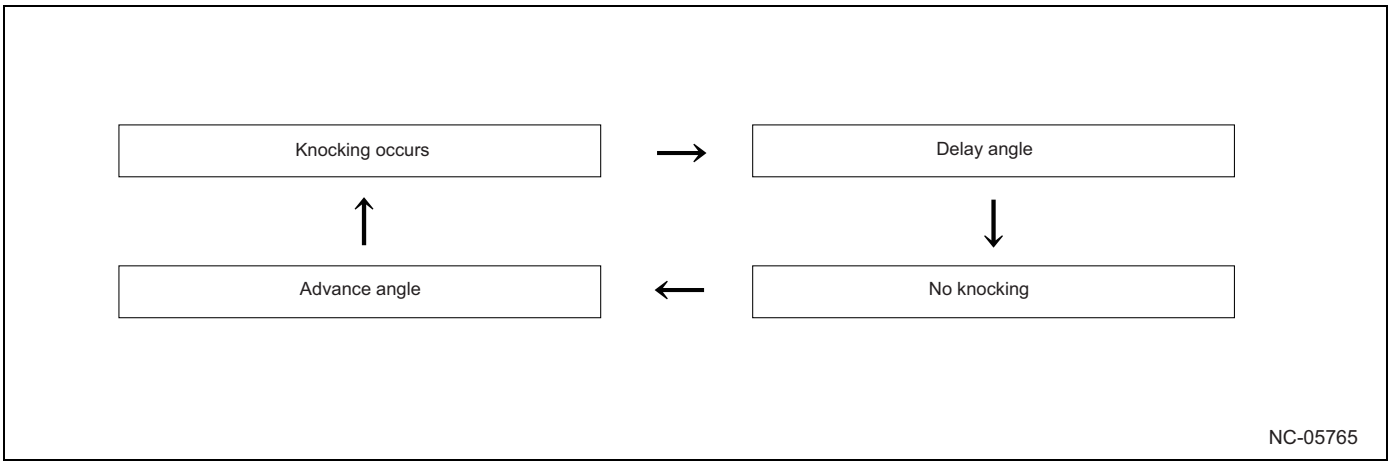
Calculating the ignition timing: Ignition timing = A. Initial set ignition timing or B. Basic advance angle + C. Correction advance angle

A. Fixed advance angle characteristics	When the engine starts, the angel is fixed at 5° BTDC. When the service terminal is short-circuited and the throttle is off, the angle is fixed at 10° BTDC.
B. Basic advance angle characteristics	Based on the signals from various sensors, the optimal ignition timing is selected based on the standard values (map) of the Engine Control Module (ECM).
C. Correction advance angle characteristics	Based on the signals from various sensors, the appropriate advance angle or delay angle is selected according to the engine conditions.
C-1. Warm-up advance angle characteristics	When the engine coolant temperature is low, the ignition timing is advanced according to the driving conditions.
C-2. Idle stabilization advance angle characteristics	When the idle speed decreases, the ignition timing is advanced in order to stabilize the idle speed. When the speed increases, the timing is delayed.
C-3. Knock correction delay angle	When knocking occurs, the ignition timing is corrected based on the signal from the knock sensor.

■ Knock control system

When knocking is detected, this delays the timing in fixed increments according to the size of the knocking until knocking stops.

When knocking stops, the timing is advanced in fixed increments. If knocking occurs again at this time, the timing is delayed again.

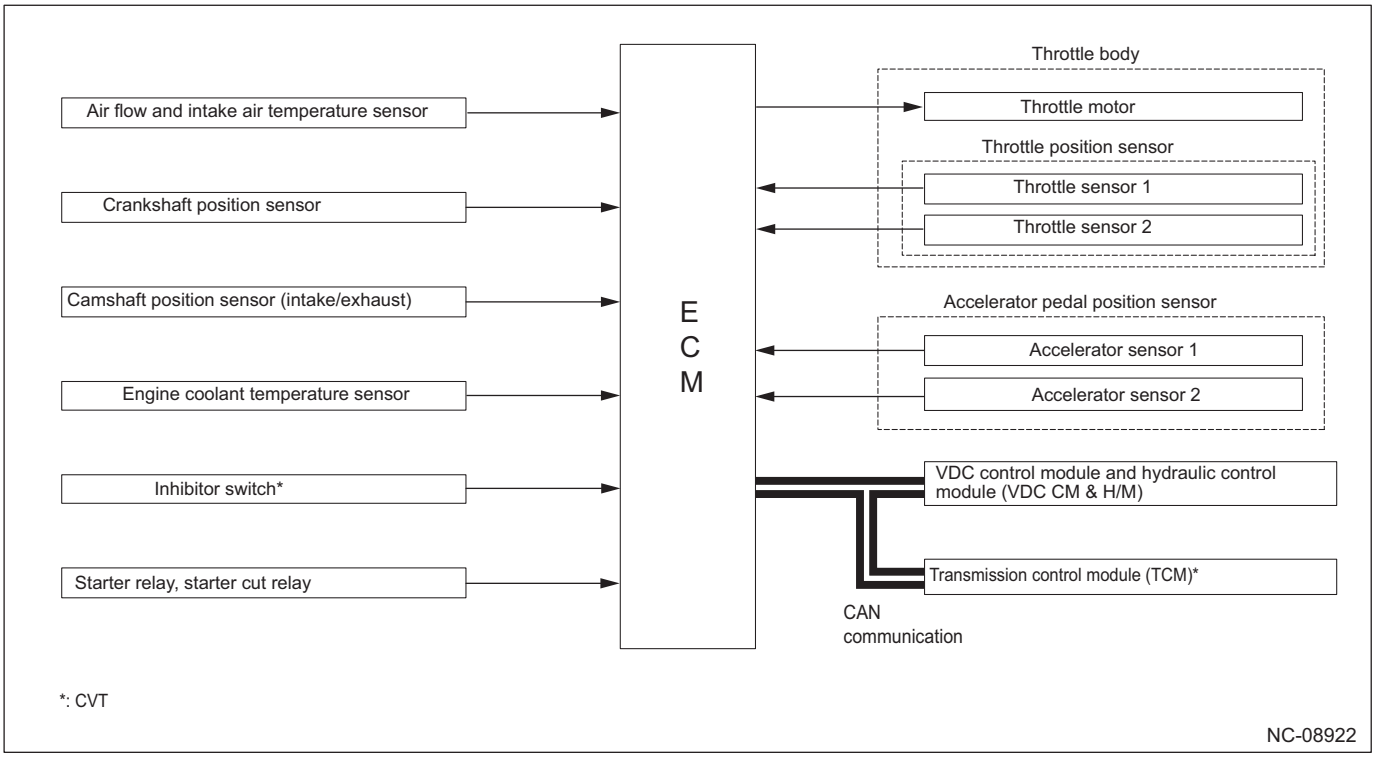


Electronic throttle control

This achieves good accelerator control performance and vehicle stability in all driving ranges as a result of optimal engine output control according to the acceleration opening angle which is performed as central control by the Engine Control Module (ECM).

The ordinary throttle opening angle control and idle speed control functions are performed by the throttle body.

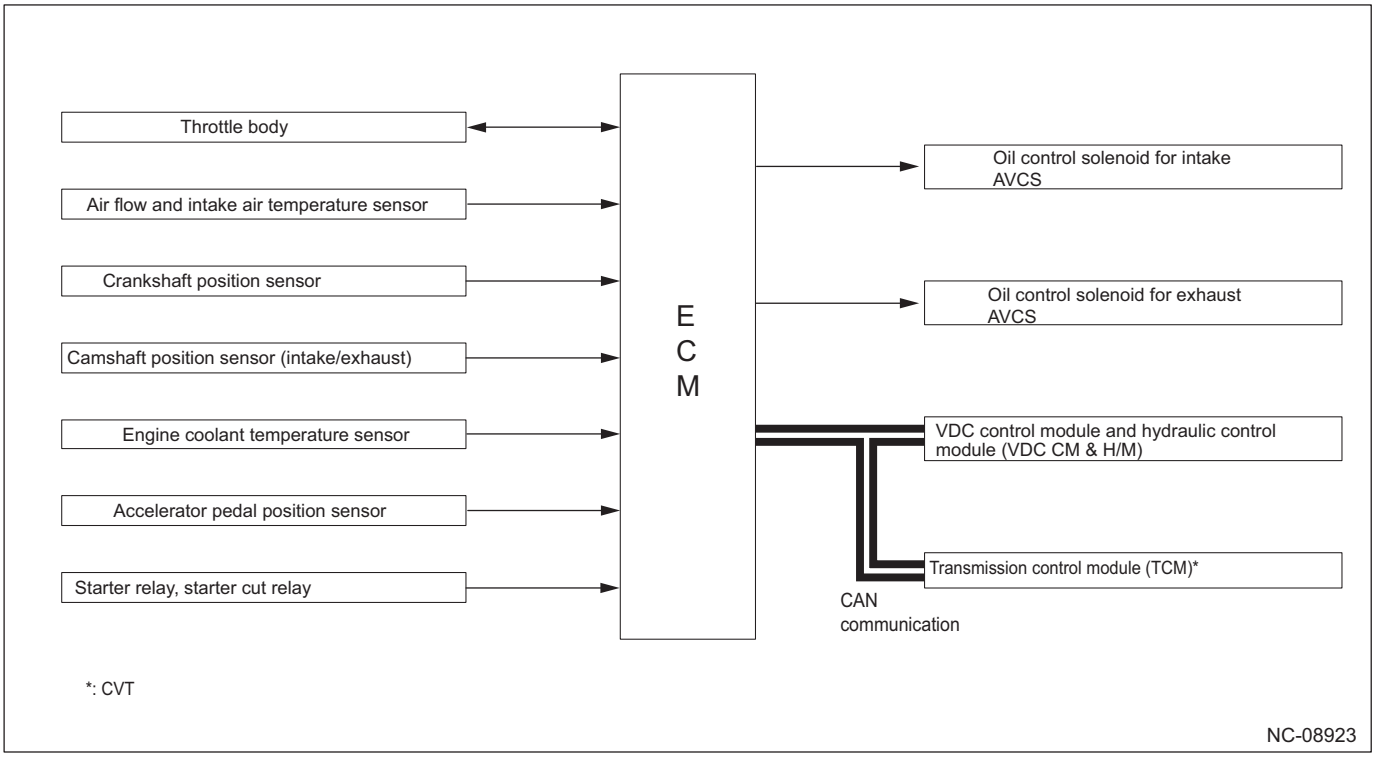
The sensor circuits of the throttle position sensor and accelerator position sensor utilize redundant circuits in order to reinforce the fail-safe function and ensure reliability.



AVCS

AVCS constantly changes the phase angle of the camshaft sprocket to the camshaft to optimize the timing when the valve opens and closes.

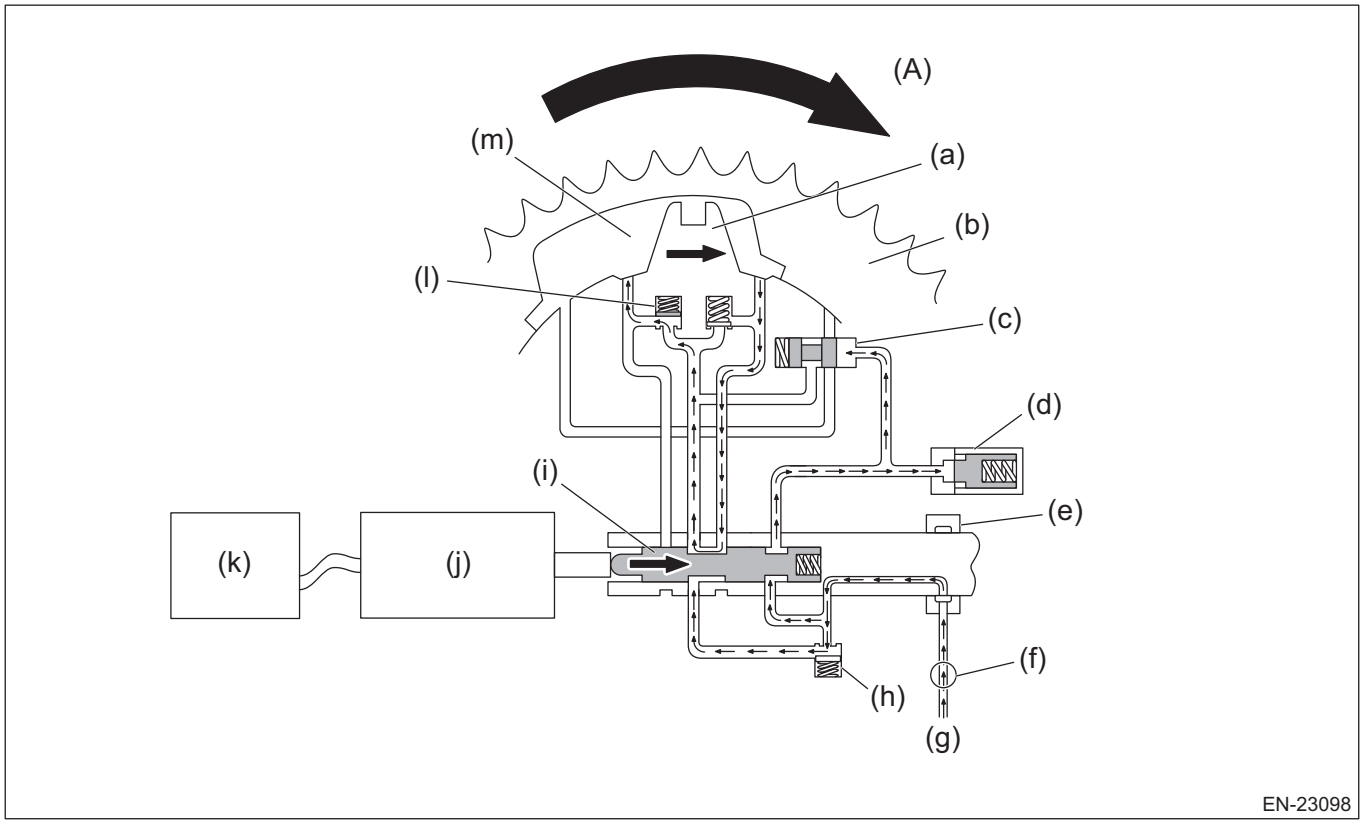
The Engine Control Module (ECM) determines the optimal camshaft angle according to the crank angle by referencing the engine speed, vehicle speed, throttle opening angle, and other relevant parameters. The oil control solenoid moves the spool and switches the oil passage between the advance angle and delay angle chambers installed in the camshaft sprocket under the control of the Engine Control Module (ECM). This continuously changes the phase angle between the camshaft sprocket and the camshaft.



■ Advance angle

When the oil control solenoid operates in response to the signal transmitted from the Engine Control Module (ECM), the spool valve moves to the right side. Due to the negative cam torque, the oil pressure of the delay angle chamber is applied in the advance angle oil pressure chamber through the advance angle check valve. The rotor vane integrated in the camshaft rotates in the advance angle direction according to rotation of the housing and the sprocket (engine rotation driven by the timing chain), and advances the valve timing angle.

Since the detent oil passage is closed due to being pushed by the oil pump, the detent valve does not operate.



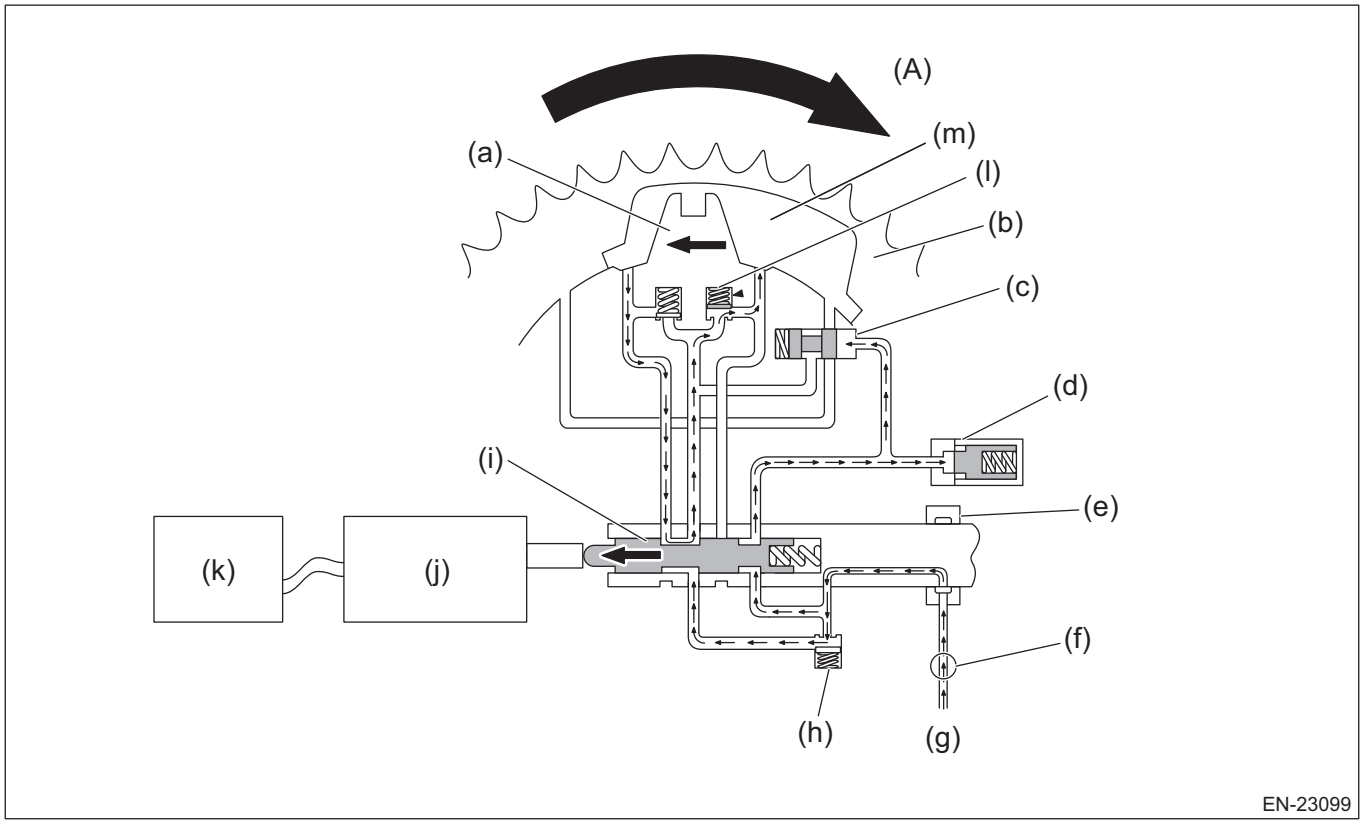
(A) Cam sprocket rotation direction

(a) Rotor vane
(b) Housing and sprocket
(c) Detent valve
(d) Lock pin
(e) Front camshaft cap
(f) Oil pump
(g) From oil strainer
(h) Inlet check valve
(i) Spool valve
(j) Oil control solenoid
(k) Engine control module (ECM)
(l) Advance angle check valve
(m) Advance angle oil pressure chamber

■ Delay angle

When the oil control solenoid operates in response to the signal transmitted from the Engine Control Module (ECM), the spool valve moves to the left side. Due to the positive cam torque, the oil pressure of the advance angle chamber is applied in the delay angle oil pressure chamber through the delay angle check valve. The rotor vane integrated in the camshaft rotates in the delay angle direction against the rotations of the housing and the sprocket (engine rotation driven by the timing chain), and delays the angle of valve timing.

Since the detent oil passage is closed due to being pushed by the oil pump, the detent valve does not operate.



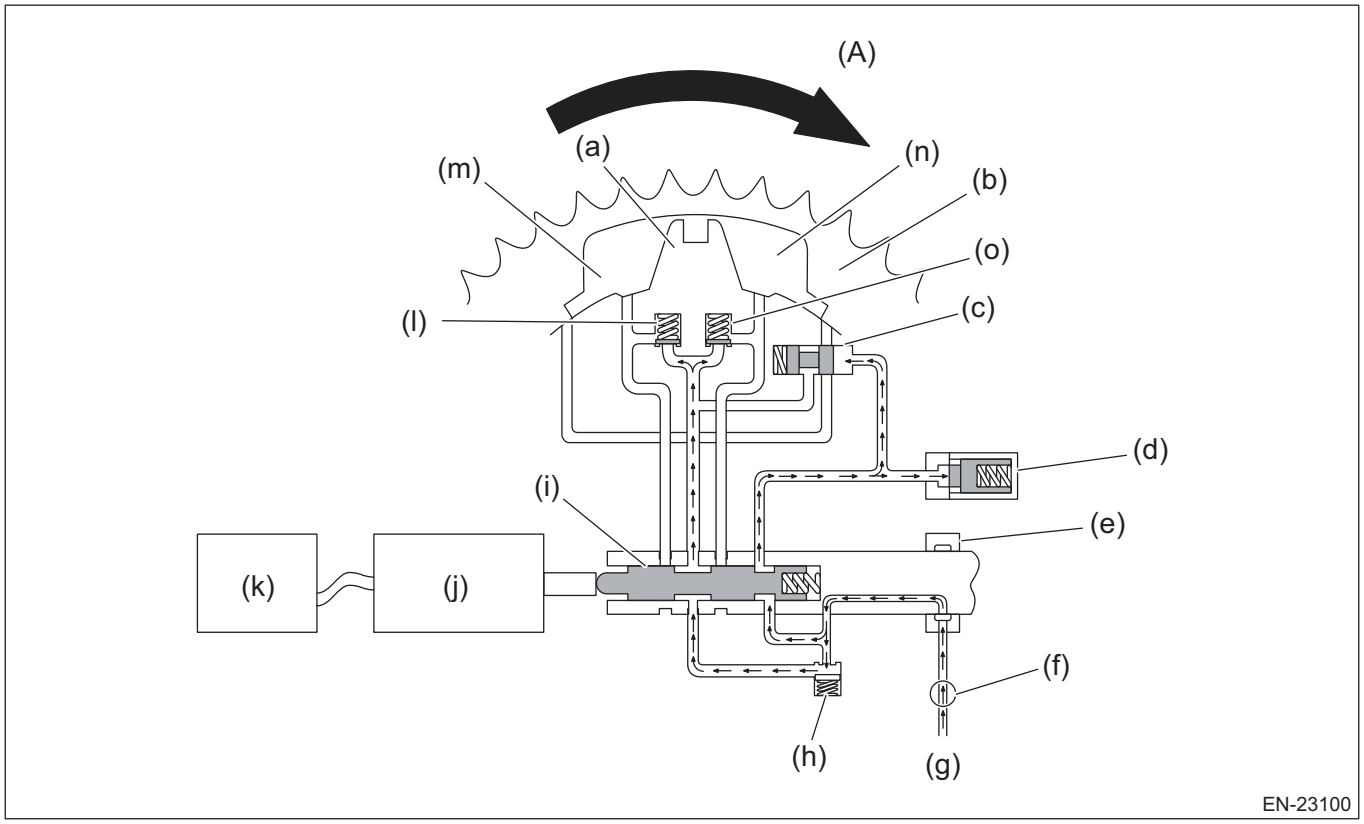
(A) Cam sprocket rotation direction

(a) Rotor vane
(b) Housing and sprocket
(c) Detent valve
(d) Lock pin
(e) Front camshaft cap
(f) Oil pump
(g) From oil strainer
(h) Inlet check valve
(i) Spool valve
(j) Oil control solenoid
(k) Engine control module (ECM)
(l) Delay angle check valve
(m) Delay angle oil pressure chamber

■ Holding

When the oil control solenoid operates in response to the signal transmitted from the Engine Control Module (ECM), the spool valve is held in the center position. When the spool valve and the check valve are closed in each interior oil passage, these valves hold at any position. The rotor vane integrated in the camshaft holds at any position against the rotations of the housing and the sprocket (engine rotation driven by the timing chain), and holds the valve timing.

Since the detent oil passage is closed due to being pushed by the oil pressure of the oil pump, the detent valve does not operate.



(A) Cam sprocket rotation direction

(a) Rotor vane
(b) Housing and sprocket
(c) Detent valve
(d) Lock pin
(e) Front camshaft cap
(f) Oil pump
(g) From oil strainer
(h) Inlet check valve
(i) Spool valve
(j) Oil control solenoid
(k) Engine control module (ECM)
(l) Advance angle check valve
(m) Advance angle oil pressure chamber
(n) Delay angle oil pressure chamber
(o) Delay angle check valve

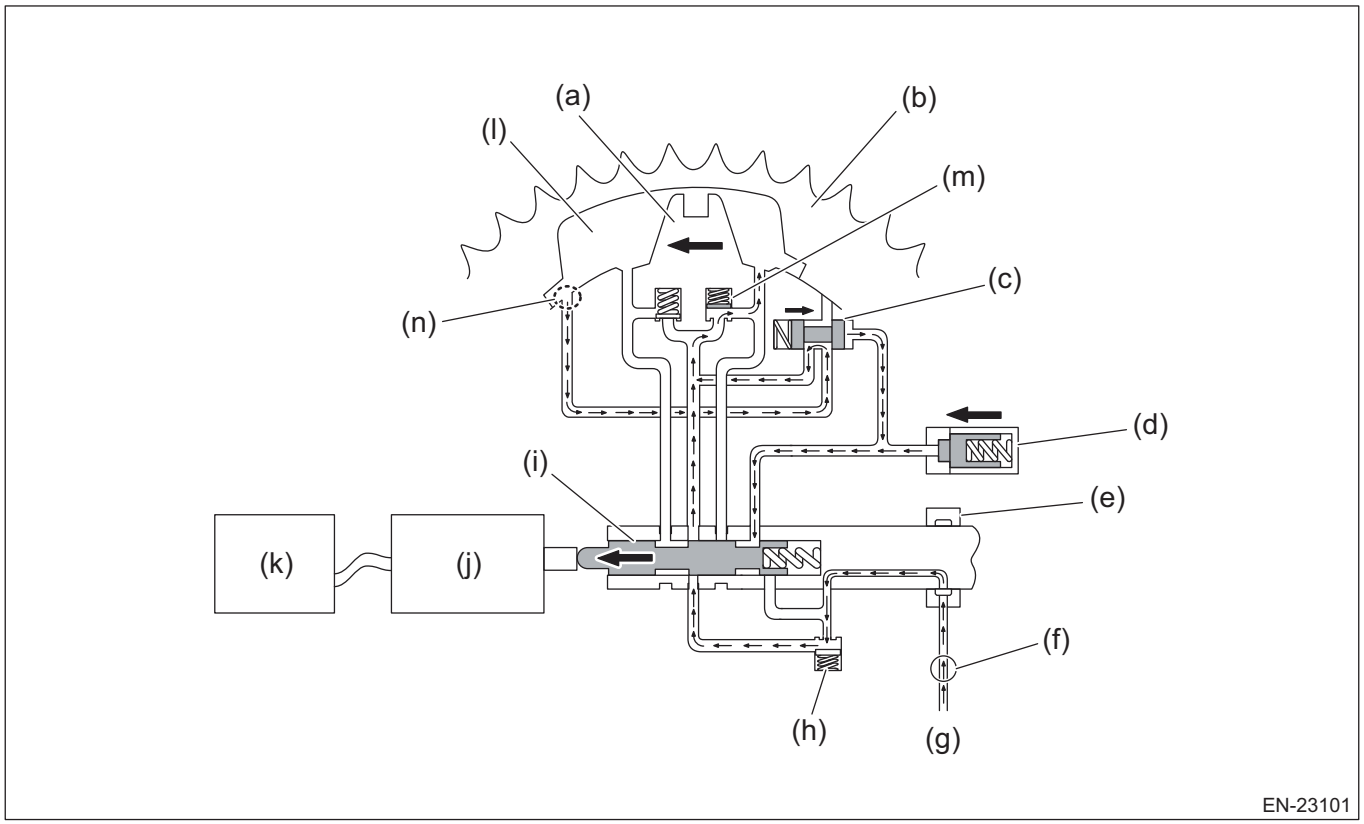
■ Intermediate lock

When the oil control solenoid is turned off (IG OFF), the spool valve moves and operates the detent valve, and oil flows through the detent oil passage. This moves the rotor to the locking position and engages the lock pin.

The overlap when engine starts is optimized to prevent blow back amount of the exhaust gas to the intake port and improve fuel consumption and start performance.

Reference

In the following diagram, the detent port in the advance angle oil pressure chamber is opened and oil is passing through the detent valve and flowing into the delay angle oil passage side and the delay angle oil passage chamber.



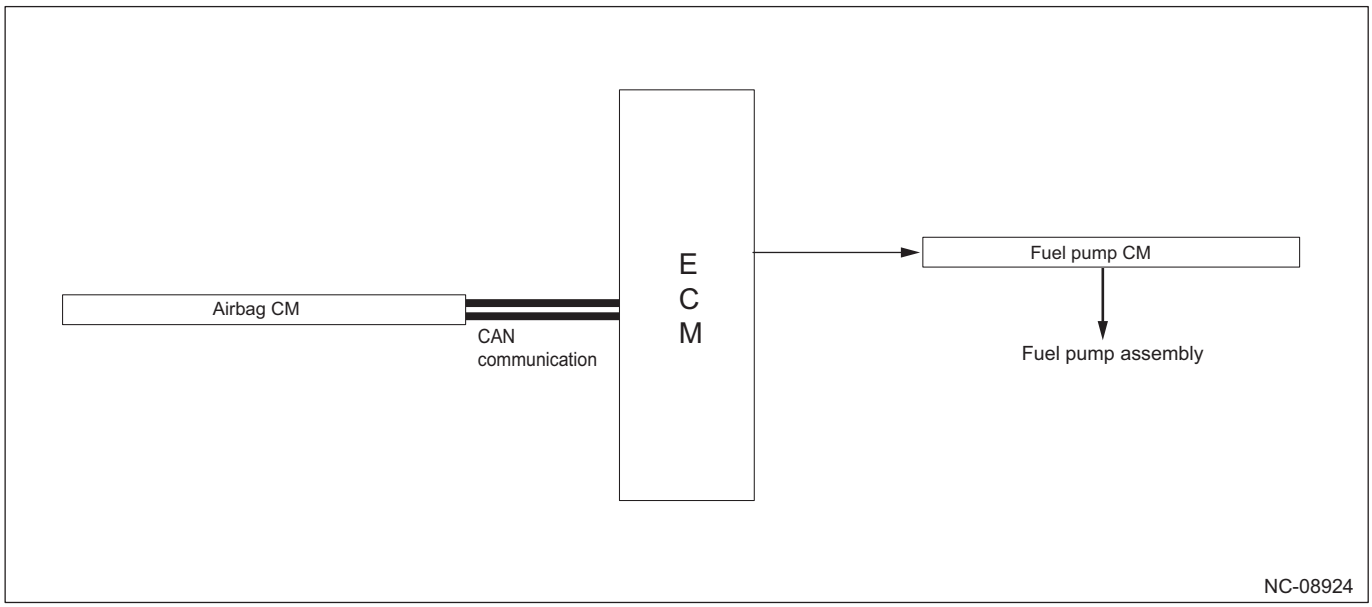
(a) Rotor vane
(b) Housing and sprocket
(c) Detent valve
(d) Lock pin
(e) Front camshaft cap
(f) Oil pump
(g) From oil strainer
(h) Inlet check valve
(i) Spool valve
(j) Oil control solenoid
(k) Engine control module (ECM)
(l) Advance angle oil pressure chamber
(m) Delay angle check valve
(n) Detent port

Low-pressure fuel pump control

The fuel pump CM controls the fuel pump assembly based on the drive request signal (duty signal) received from the engine control module (ECM).

The fuel pump CM controls the fuel pump assembly in order to provide stepless control of fuel pump speed from low speeds to high speeds. This reduces electricity consumption and ensures fuel efficiency.

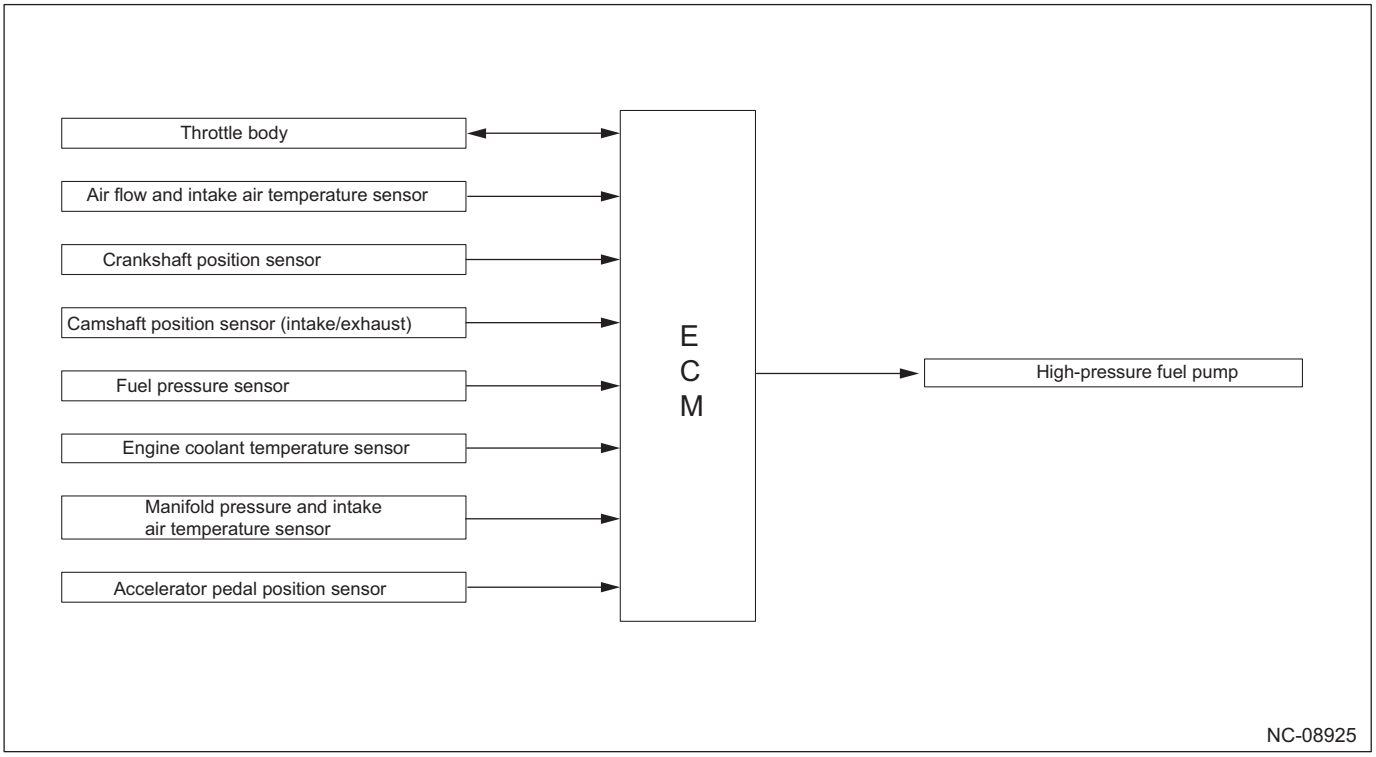
In addition to when the engine is stopped, the fuel pump assembly also stops when the airbags are activated.



High-pressure fuel pump control

The Engine Control Module (ECM) performs the variable control of the high-pressure fuel pressure according to the driving conditions. The system reduces drive torque and noise by utilizing the solenoid spill valve control and discharging only the necessary amount of fuel.

The Engine Control Module (ECM) detects the fuel pressure from the fuel pressure sensor that is installed on the fuel pipe, and performs feedback control so the fuel pressure matches the target value.

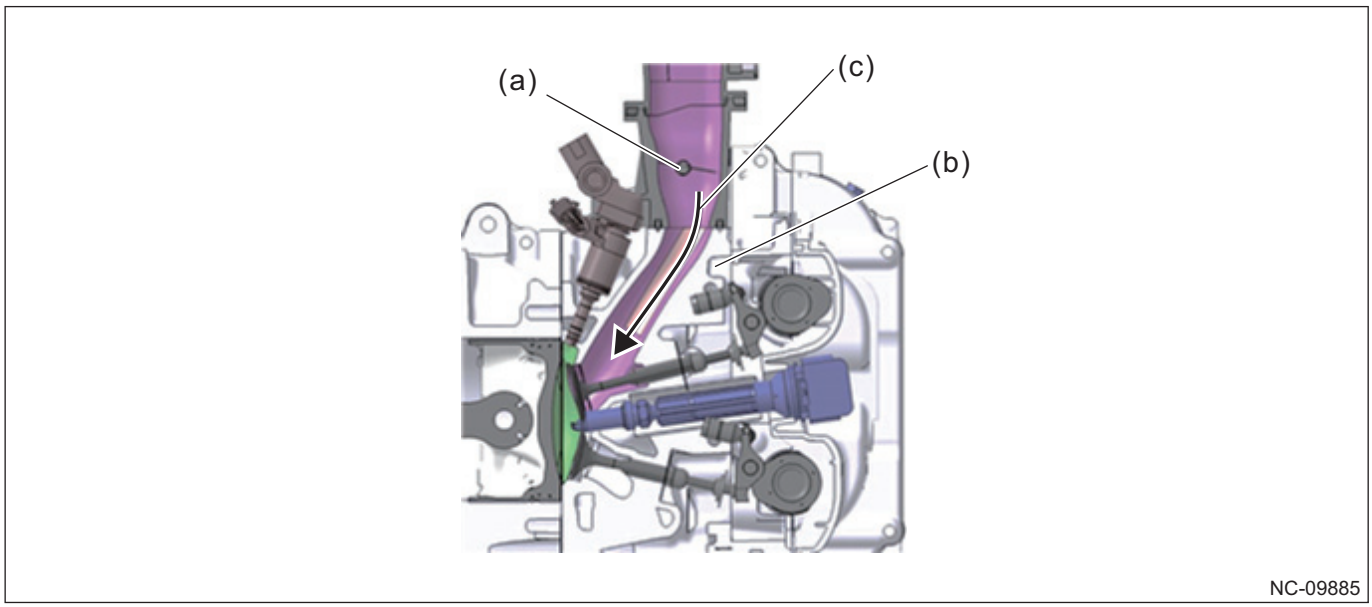


Tumble generator control

This generates the necessary tumble according to the driving range such as at cold start and when idling.

The tumble generator valve is closed when more tumble is required, increasing the airflow speed by blocking one of the passages. This generates tumble which produces a vortex in the combustion chamber and improves fuel efficiency.

Reducing the tumble leakage amount, optimizing the opening area, and integrating the intake port and combustion chamber results in better fuel efficiency while ensuring emissions performance.



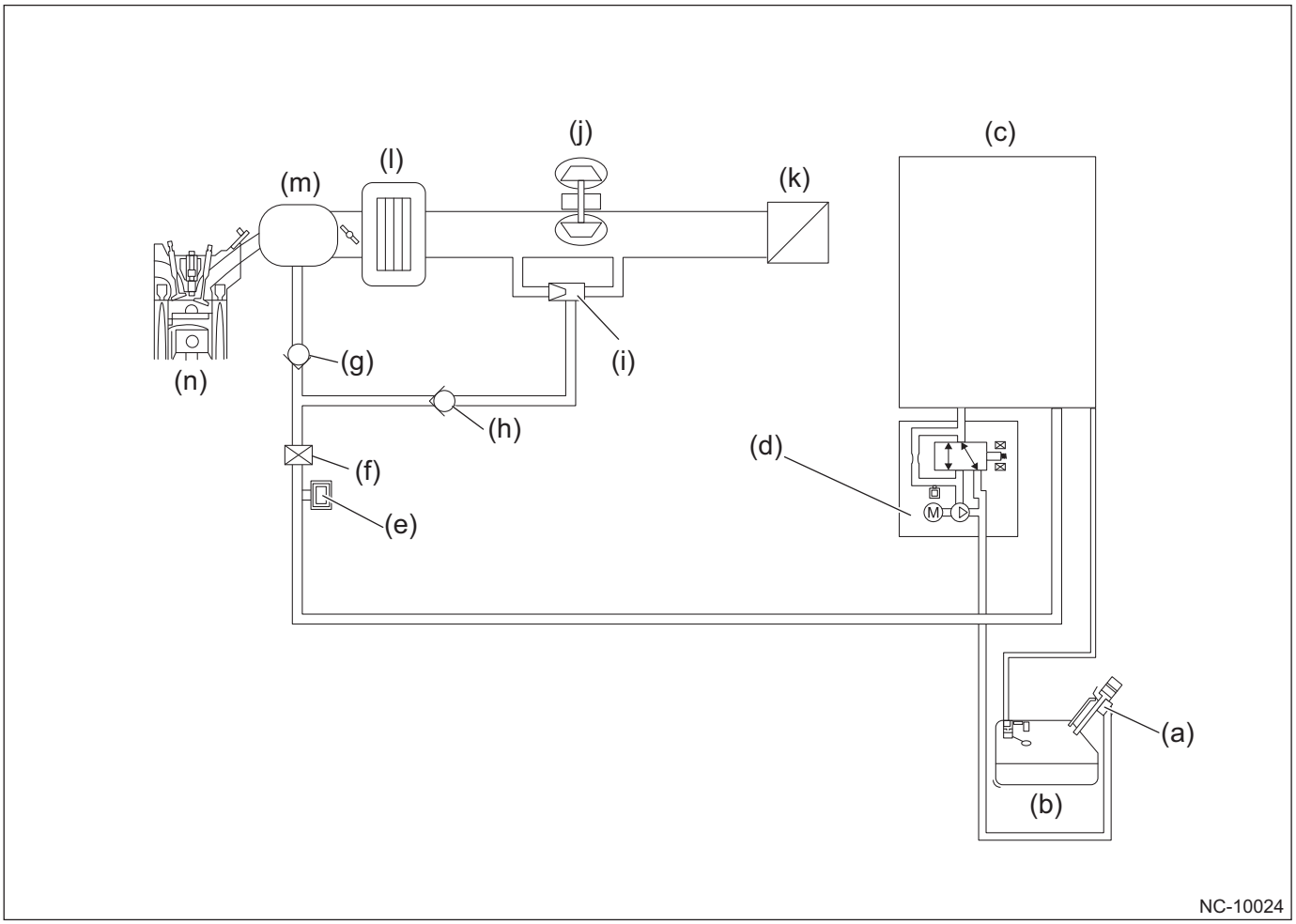
(a) Tumble generator valve (TGV)

(b) Cylinder head

(c) Intake passage when tumble generator valve (TGV) is closed

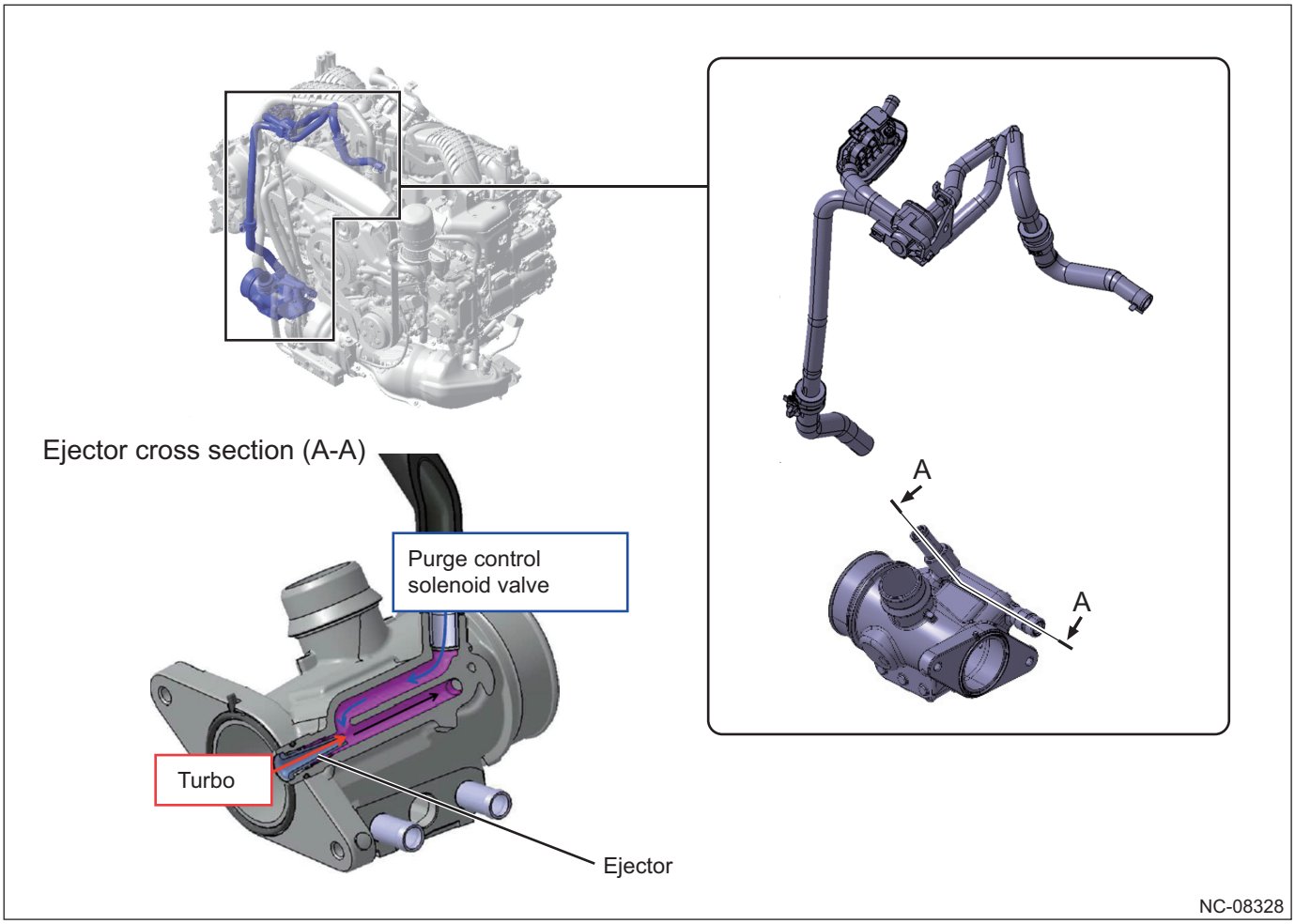
Canister purge control

The engine control module (ECM) operates the purge control solenoid valve to suction fuel evaporation gas into the engine from the canister according to the engine conditions. Installation of the purge control solenoid valve in the front side of the intake manifold, and the addition of an ejector onto the turbocharger, make it possible to perform the purge process even during boost. A detection sensor has been added so that it is possible to detect leakage of fuel evaporation gas.



(a) Drain filter
(b) Fuel tank
(c) Canister
(d) Evaporative leak check module
(e) Purge line pressure sensor
(f) Purge control solenoid valve
(g) Check valve (intake manifold side)
(h) Check valve (ejector side)
(i) Ejector
(j) Turbocharger
(k) Air cleaner
(l) Intercooler
(m) Intake manifold
(n) Engine

Ejector system



Fail-safe

When an abnormality occurs in a sensor signal, either the standard value in the Engine Control Module (ECM) is used to continue control or else the engine is stopped.

Diagnosis

Using the diagnosis tool, it is possible to call the diagnostic code data, perform active tests, and in other ways perform accurate and detailed failure diagnosis.

2.8 Ignition

2.8.1 Overview

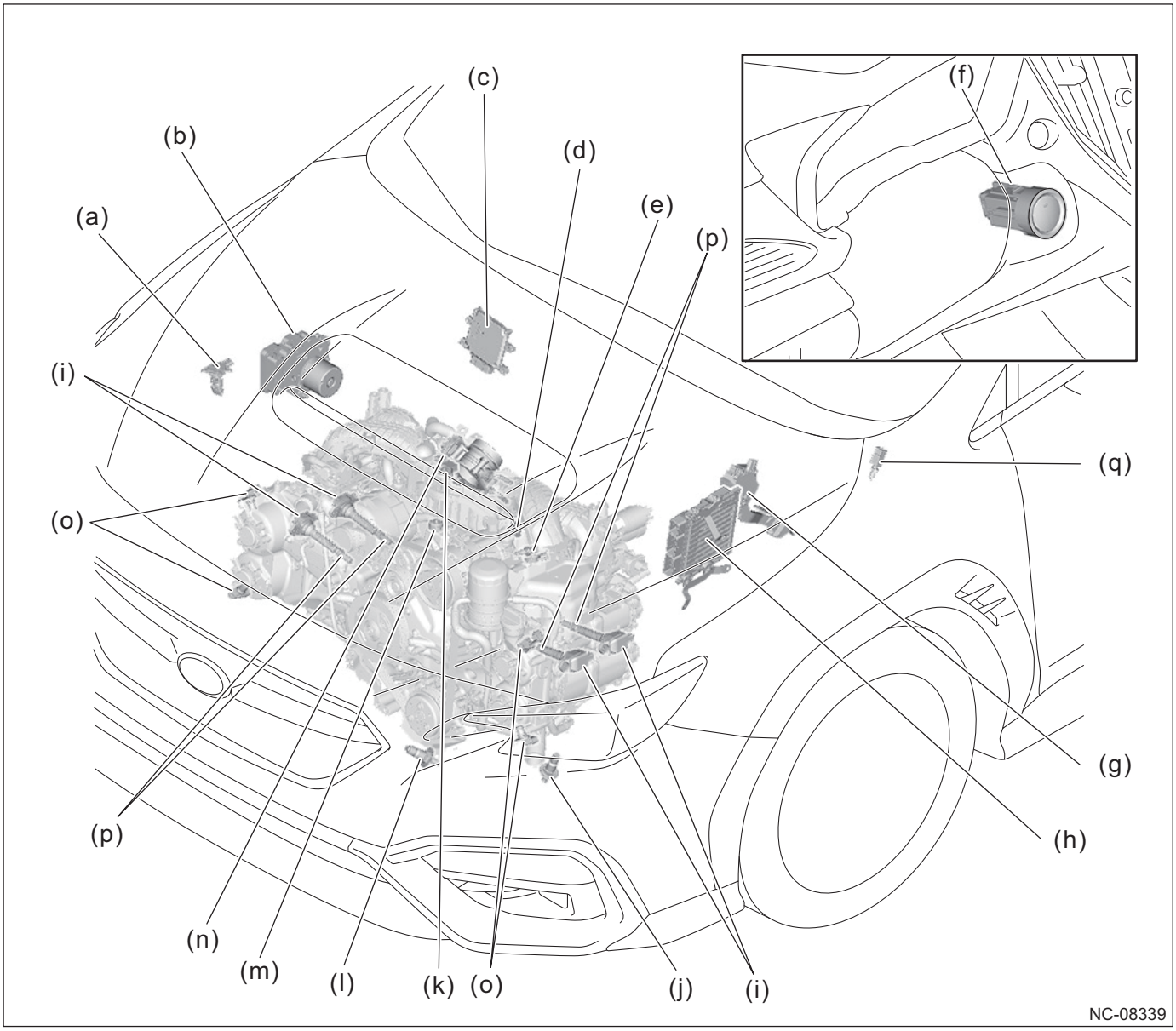
Overview

A direct ignition system is adopted to increase the ignition timing accuracy and completely eliminate adjustment of the ignition timing.

An electronic advance angle system is adopted. Based on signals from various sensors, the Engine Control Module (ECM) controls the ignition timing according to the engine conditions.

2.8.2 Component

Component layout drawing



(a) Air flow and intake air temperature sensor

(b) VDC control module and hydraulic control module (VDC CM & H/M)

(c) Transmission control module (TCM) (CVT)

(d) Crankshaft position sensor

(e) Engine coolant temperature sensor

(f) Engine switch (models with keyless access & push button start)

(g) Accelerator pedal position sensor

(h) Engine control module (ECM)

(i) Ignition coil

(j) Rear oxygen sensor

(k) Manifold pressure and intake air temperature sensor

(l) Front oxygen (A/F) sensor

(m) Knock sensor

(n) Throttle body
- Throttle position sensor

(o) Camshaft position sensor

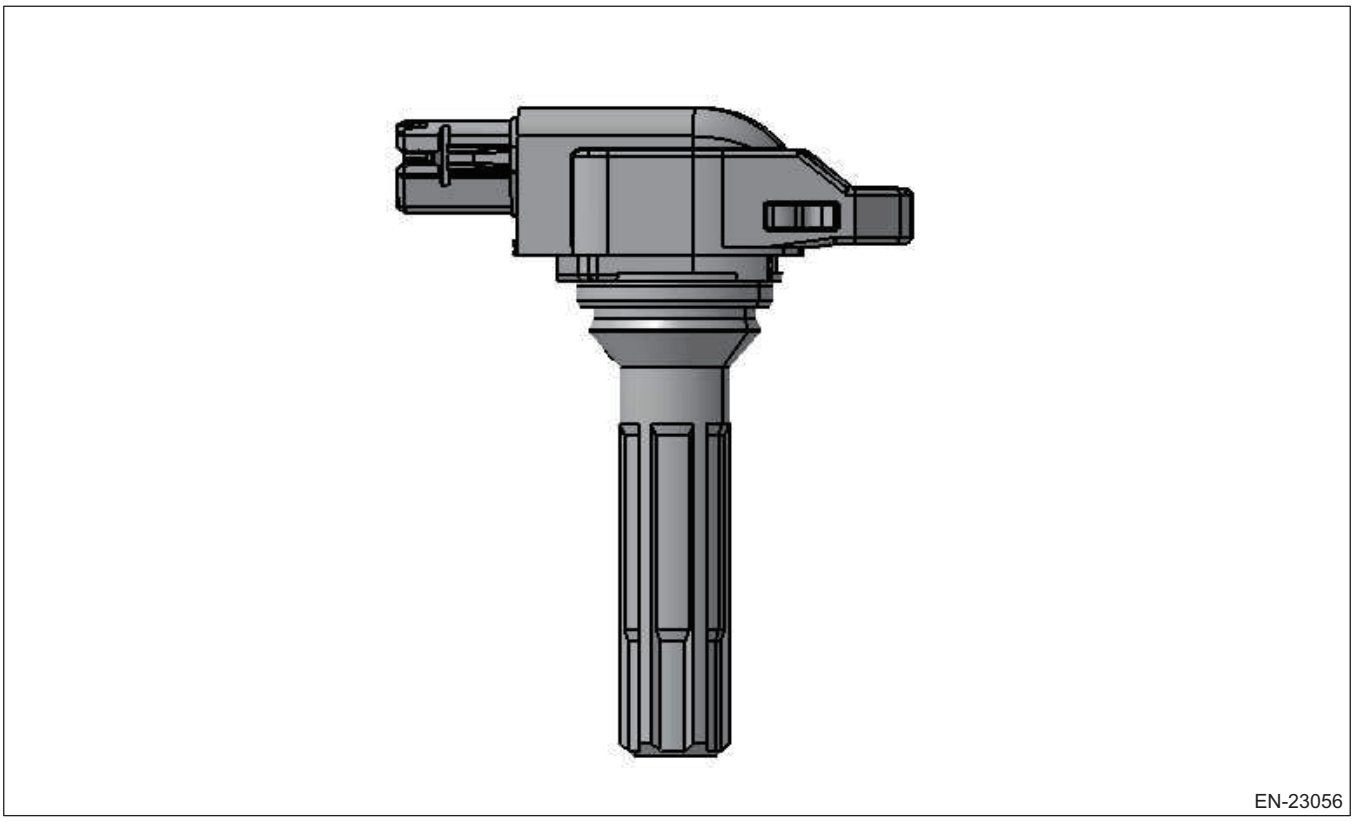
(p) Spark plug

(q) Ignition key switch (models without keyless access & push button start)

Component details

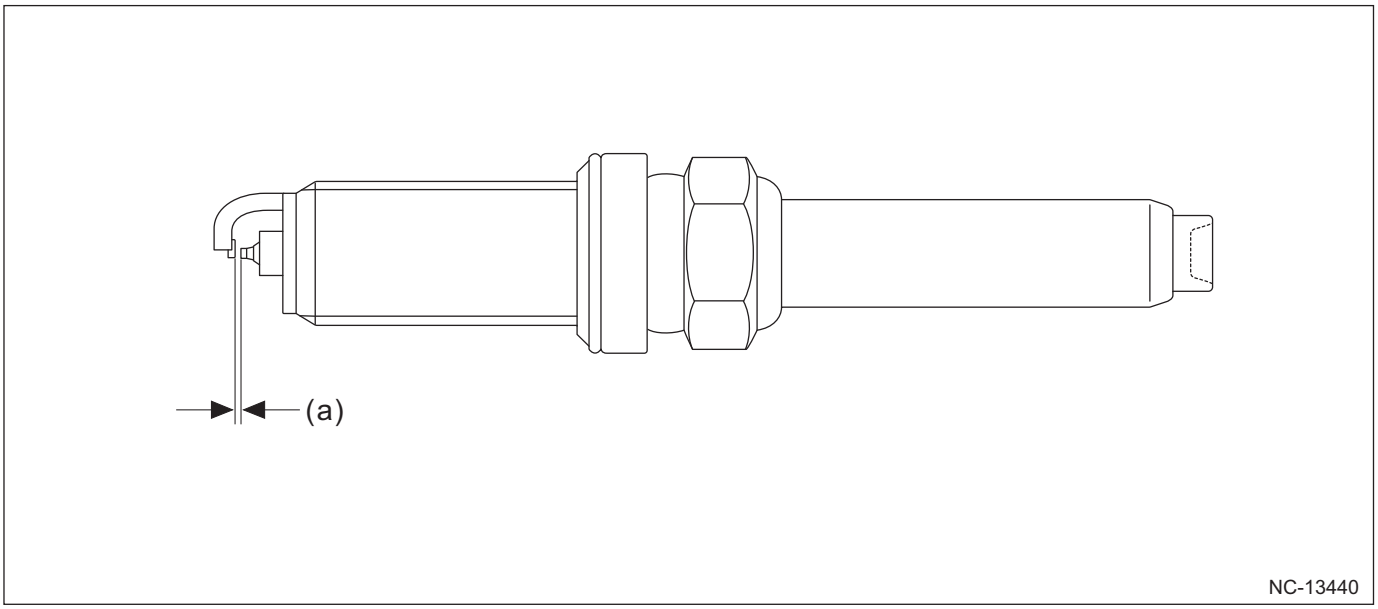
Ignition coil

The coil has a small and lightweight built-in igniter that induces high voltage on the secondary coil side in response to the signal transmitted from the Engine Control Module (ECM).



Spark plugs

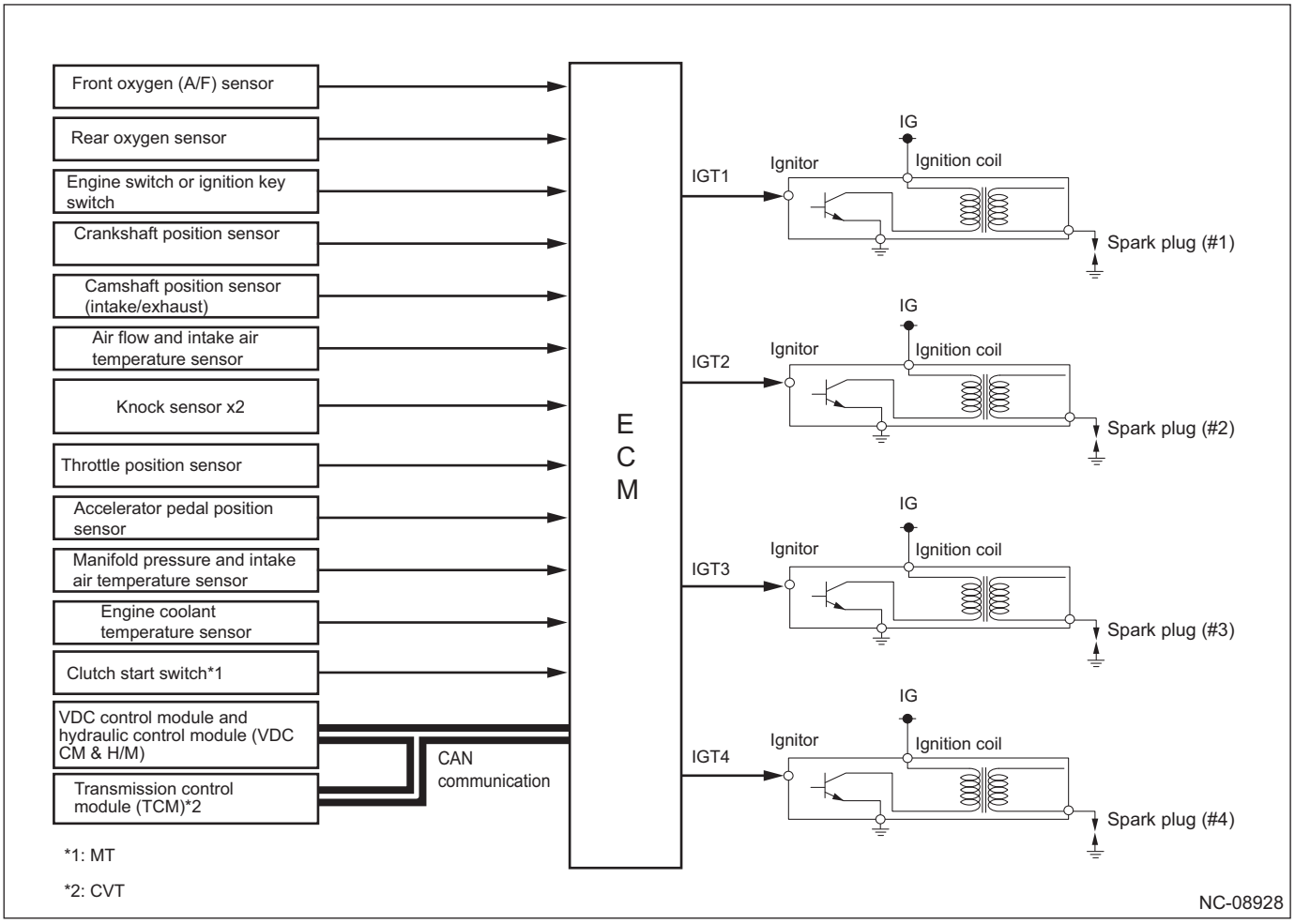
Iridium alloy has been adopted for the center electrode. The iridium alloy has extremely good wear resistance, allowing the center electrode to be made thinner. This allows more reliable ignition and also ensures durability.



(a) Gap: 0.020 to 0.024 in (0.5 to 0.6 mm)

2.8.3 Construction and Operation

System diagram



2.9 Starting/Charging System

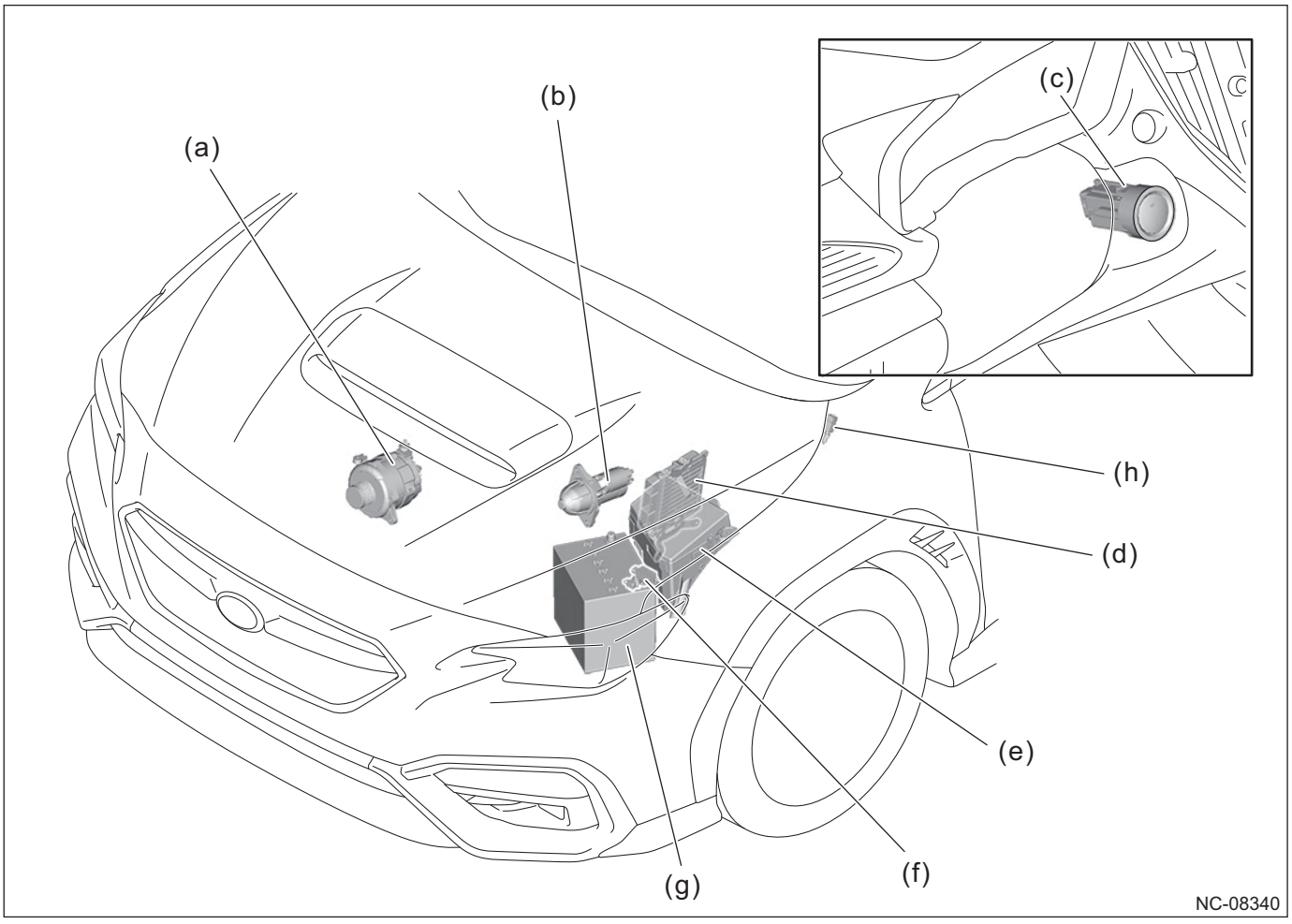
2.9.1 Overview

Overview

The starting/charging system optimally controls the starter drive time and electricity generation by the generator through the Engine Control Module (ECM).

2.9.2 Component

Component layout drawing



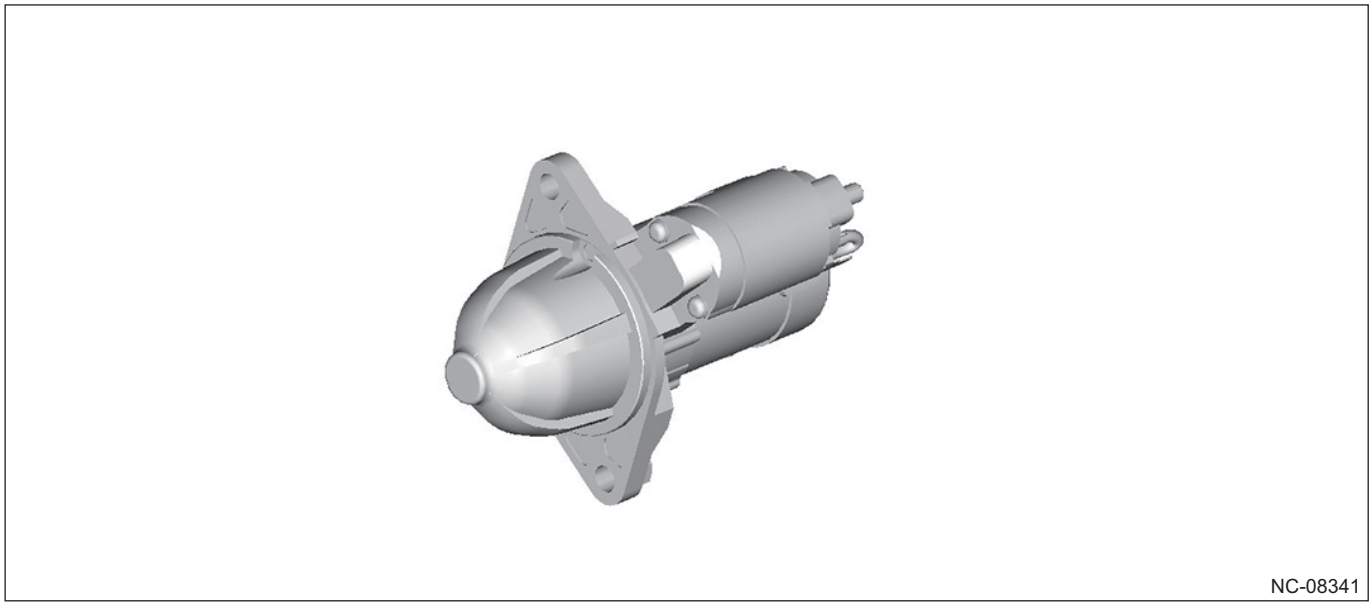
(a) Generator
(b) Starter
(c) Engine switch (models with keyless access & push button start)
(d) Engine Control Module (ECM)
(e) M/B (main fuse & relay box)
(f) Battery sensor
(g) Battery
(h) Ignition key switch (models without keyless access & push button start)

Component details

Starter

A small and lightweight planetary starter is adopted.

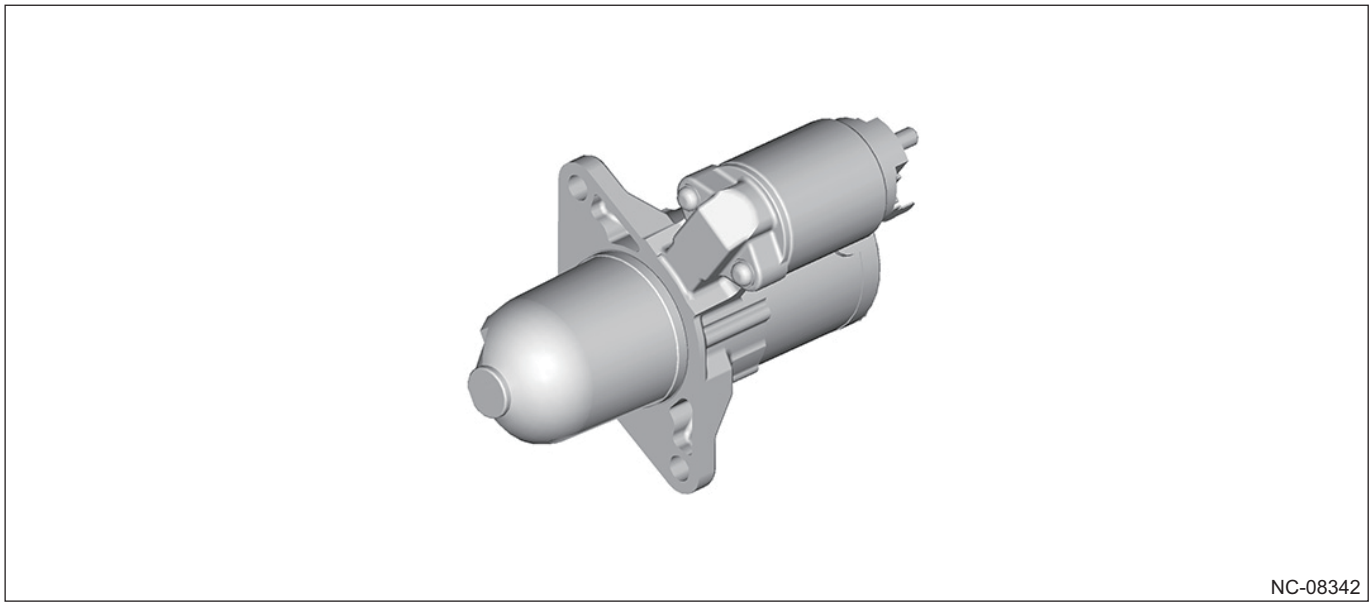
CVT



Starter specifications (CVT)

Type	Planetary
Rated voltage (V)	12
Rated output (kW)	1.2

MT

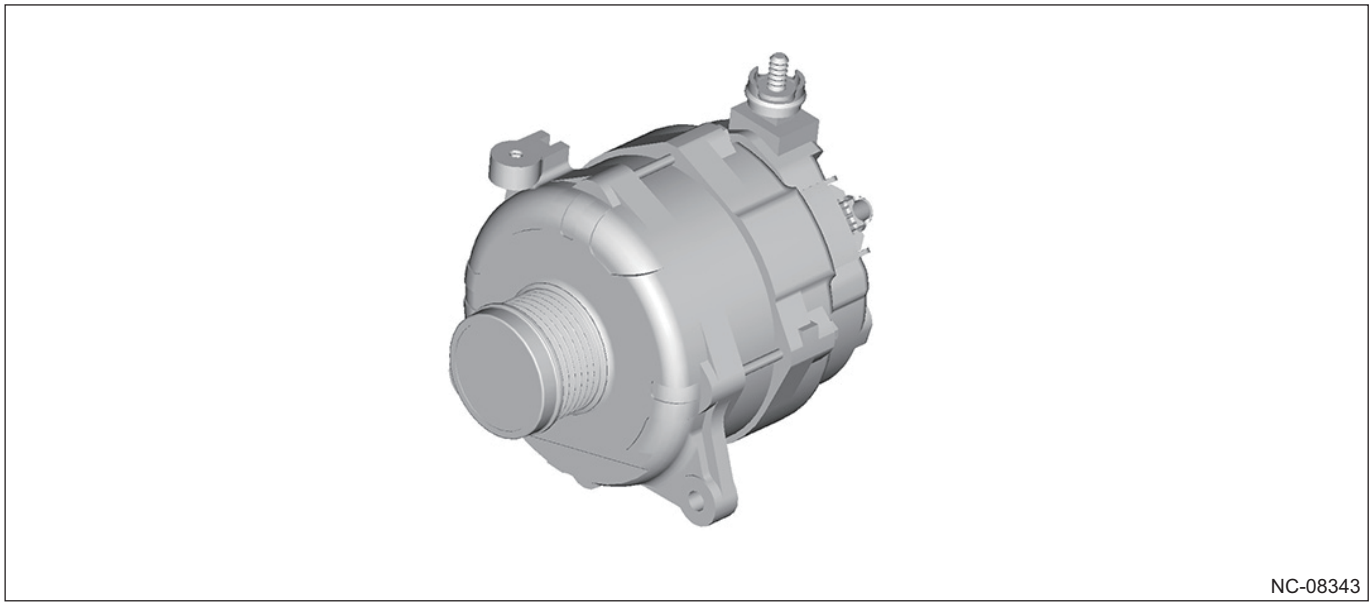


Starter specifications (MT)

Type	Planetary
Rated voltage (V)	12
Rated output (kW)	1.0

Generator

A small and lightweight generator with high output and efficiency is adopted.

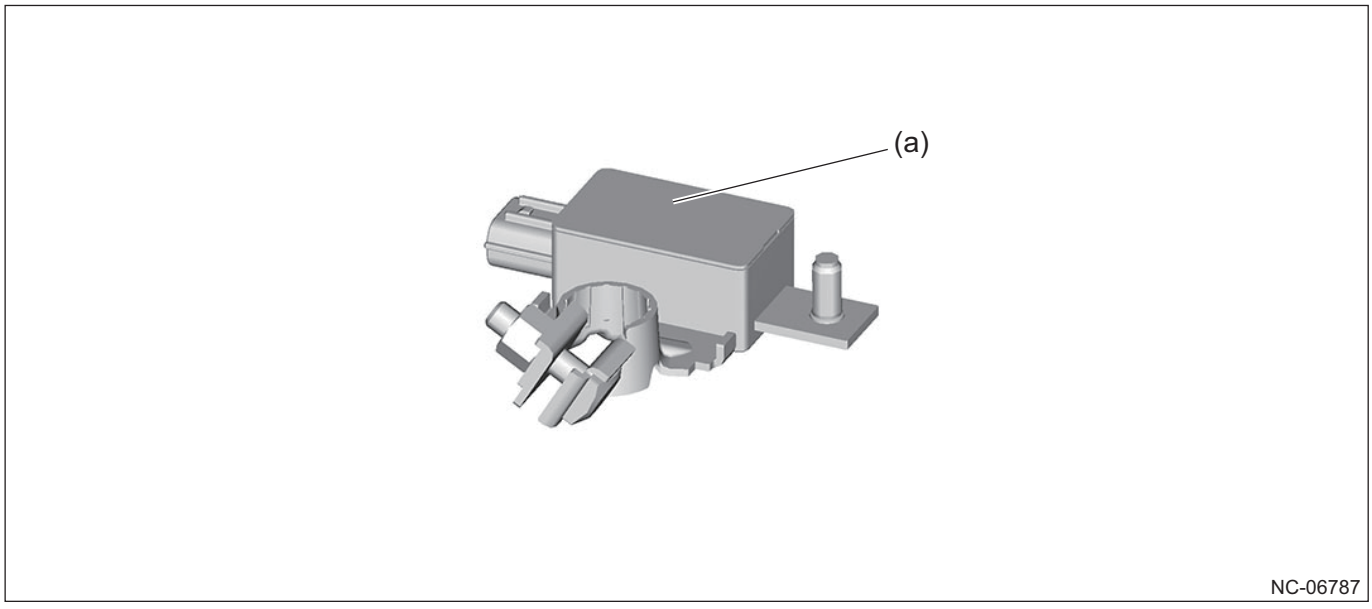


Generator specifications

Rated voltage (V)	12
Rated output (A)	150

Battery sensor

Battery sensor that measures charge and discharge currents of a battery, voltage, and temperature is adopted to accurately maintain charge conditions of a battery. Various types of measurement data are transmitted via the circuit for communication with the Engine Control Module (ECM). The Engine Control Module (ECM) controls the amount of power generation by the generator based on this data, and manages the battery charge conditions.



(a) Battery sensor

2.9.3 Construction and Operation

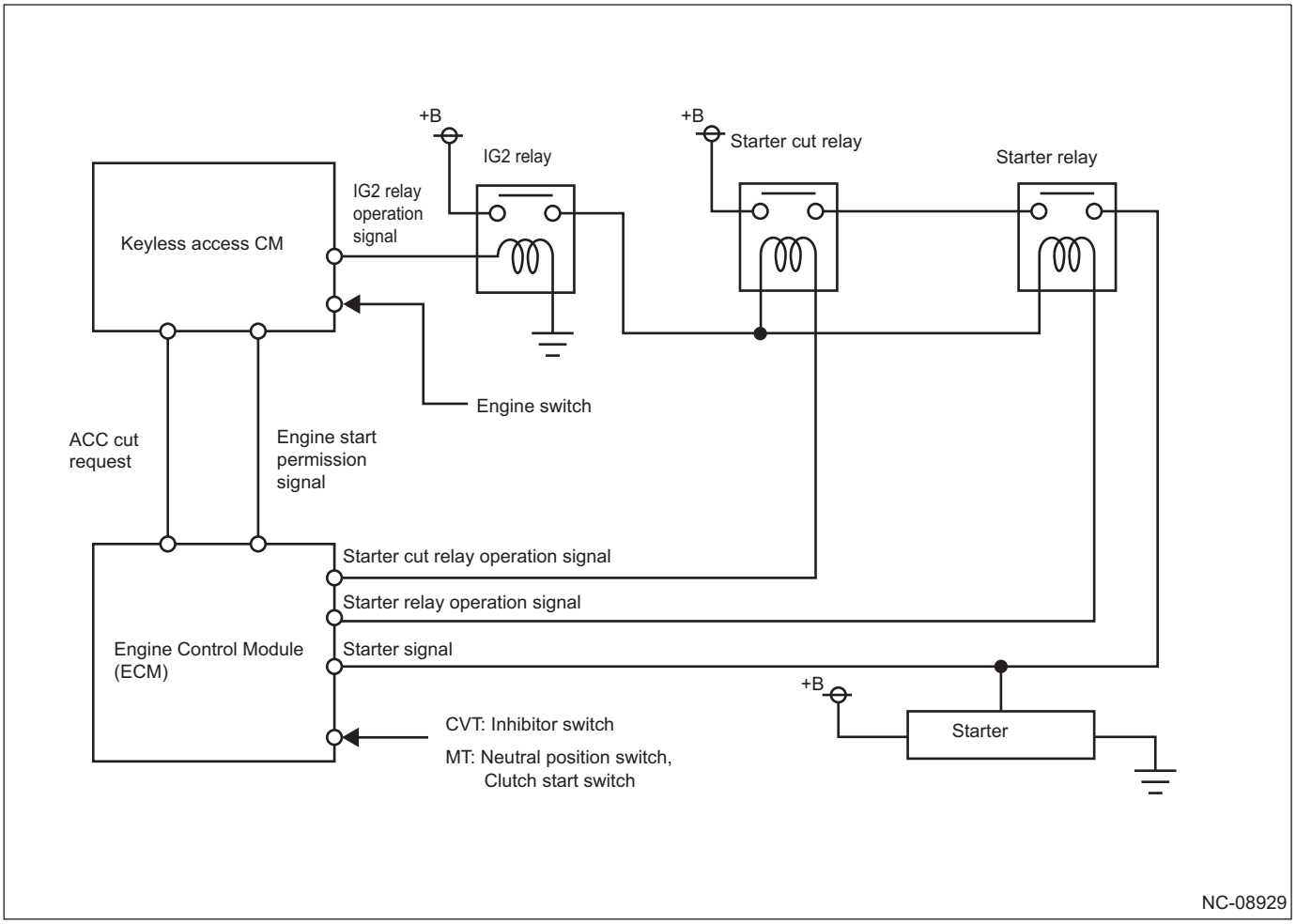
System details

Starting system

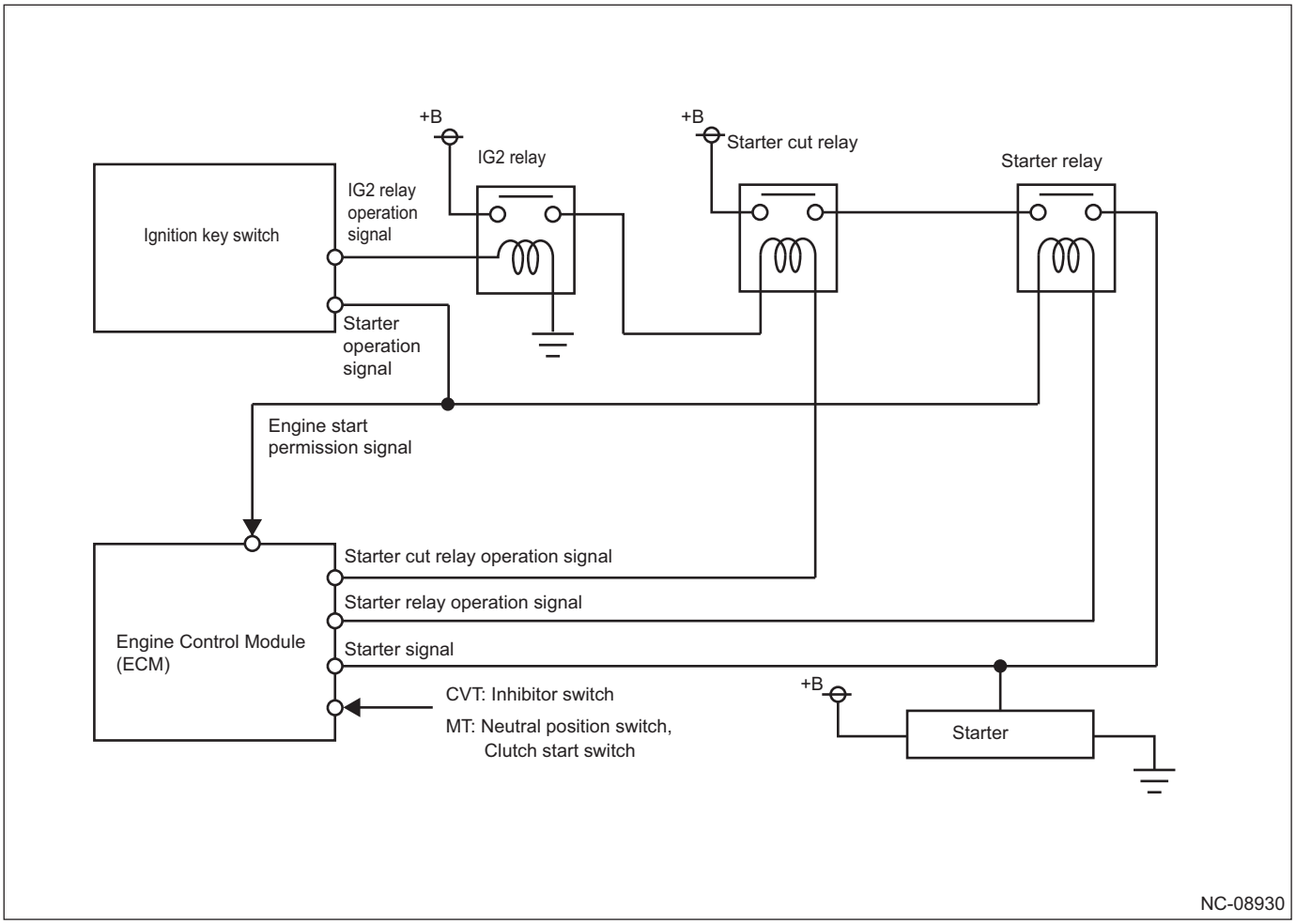
When the keyless access CM receives the start signal from the engine switch, the keyless access CM transmits the engine start permission signal to the Engine Control Module (ECM). When the engine control module (ECM) receives the engine start permission signal, it judges the conditions and operates the starter relay to start the starter. (Models with keyless access & push button start)

When the engine control module (ECM) receives the start signal from the ignition key switch, it judges the conditions and operates the starter relay to start the starter. (Models without keyless access & push button start)

Models with keyless access & push button start

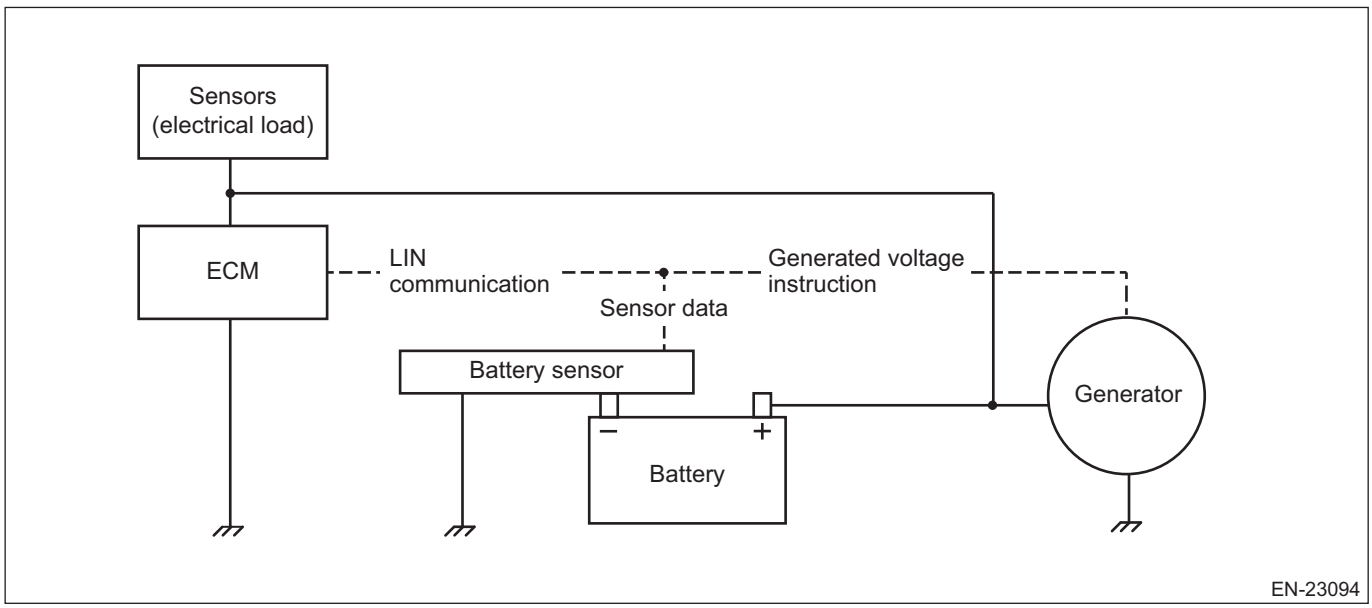


Models without keyless access & push button start



Charging system

The Engine Control Module (ECM) controls the power generation load of the generator according to the vehicle driving conditions and optimally controls the generated voltage.



3 DRIVE TRAIN

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3.1 General Overview

3.1.1 Overview

Overview

This chapter describes a set of mechanisms that transmits power to tires.

The drive train is mainly composed of the following parts.

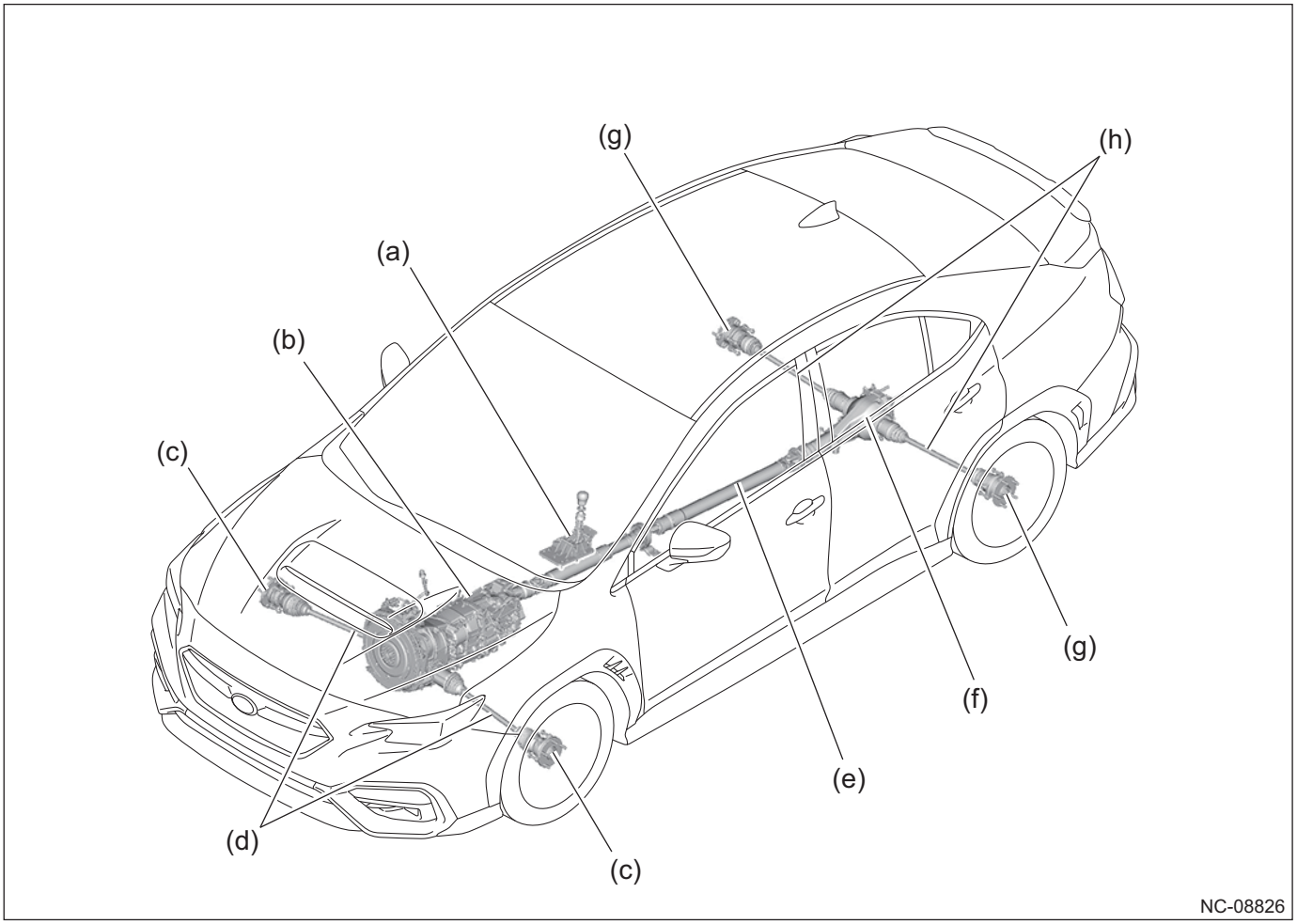
- Transmission: Device that reduces or increases the engine speed and transmits force to the drive wheels.
- Differential: Device that absorbs the rotation differences between right and left and front and rear drive wheels that occur when turning, etc.
- Propeller shaft: Shaft that transmits drive force from the transmission to the rear differential.
- Drive shaft: Shaft that transmits drive force from the differential to the drive wheels.

Also, the mechanism which selects the shift position of the transmission is described in Control System.

3.1.2 Component

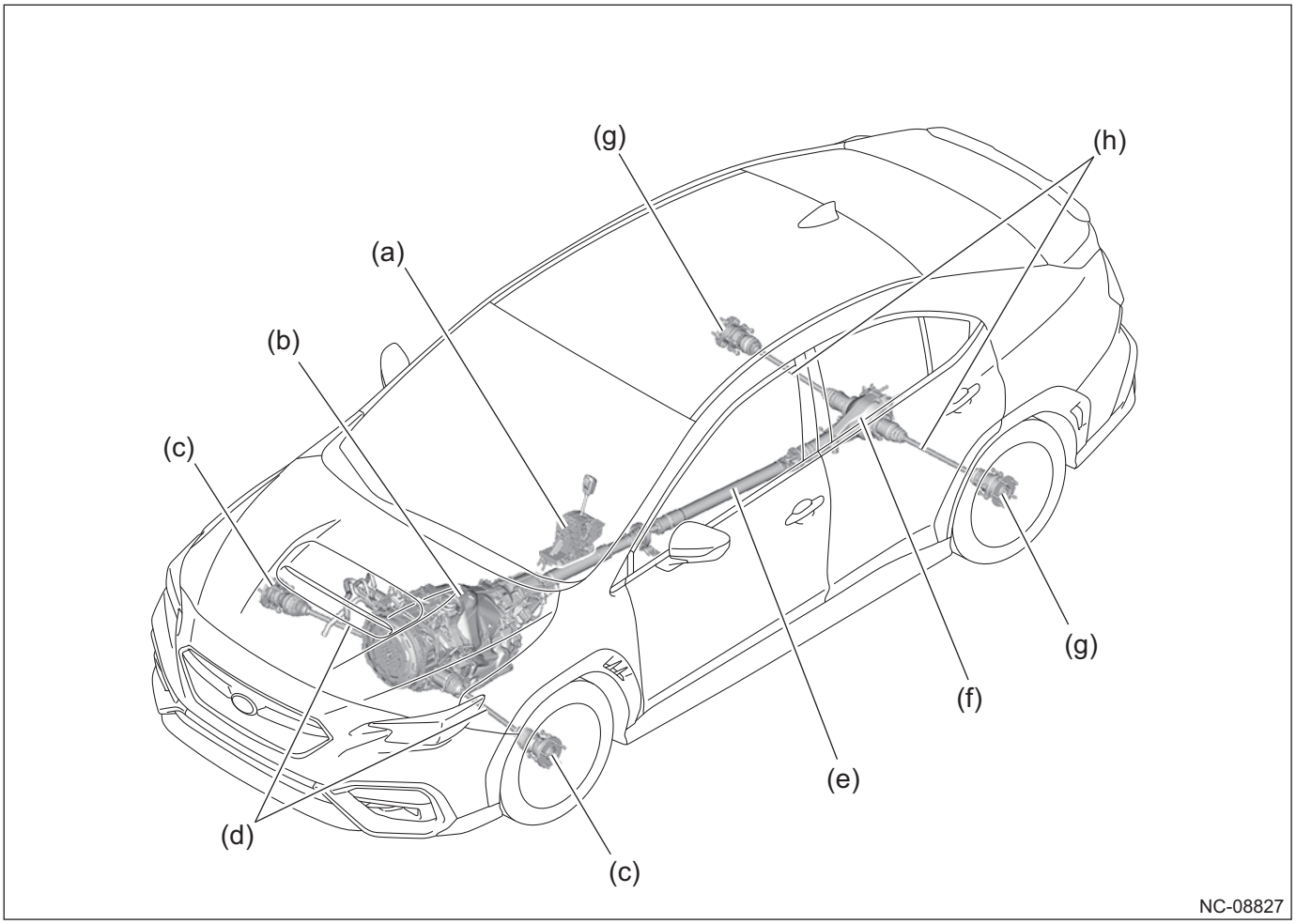
Component layout drawing

Manual transmission (MT)



(a) Control system
(b) Manual transmission (MT)
(c) Front axle
(d) Front drive shaft
(e) Propeller shaft
(f) Rear differential
(g) Rear axle
(h) Rear drive shaft

Continuously Variable Transmission (CVT)



(a) Control system
(b) Continuously variable transmission (CVT)
(c) Front axle
(d) Front drive shaft
(e) Propeller shaft
(f) Rear differential
(g) Rear axle
(h) Rear drive shaft

3.2 Control system

3.2.1 Overview

Overview

The following components, systems, etc. are adopted for the control system.

MT

- Leather-wrapped shift knob
- Shift lever boot with red stitching
- Cable-type gearshift system
- Slider-type gear shift lever

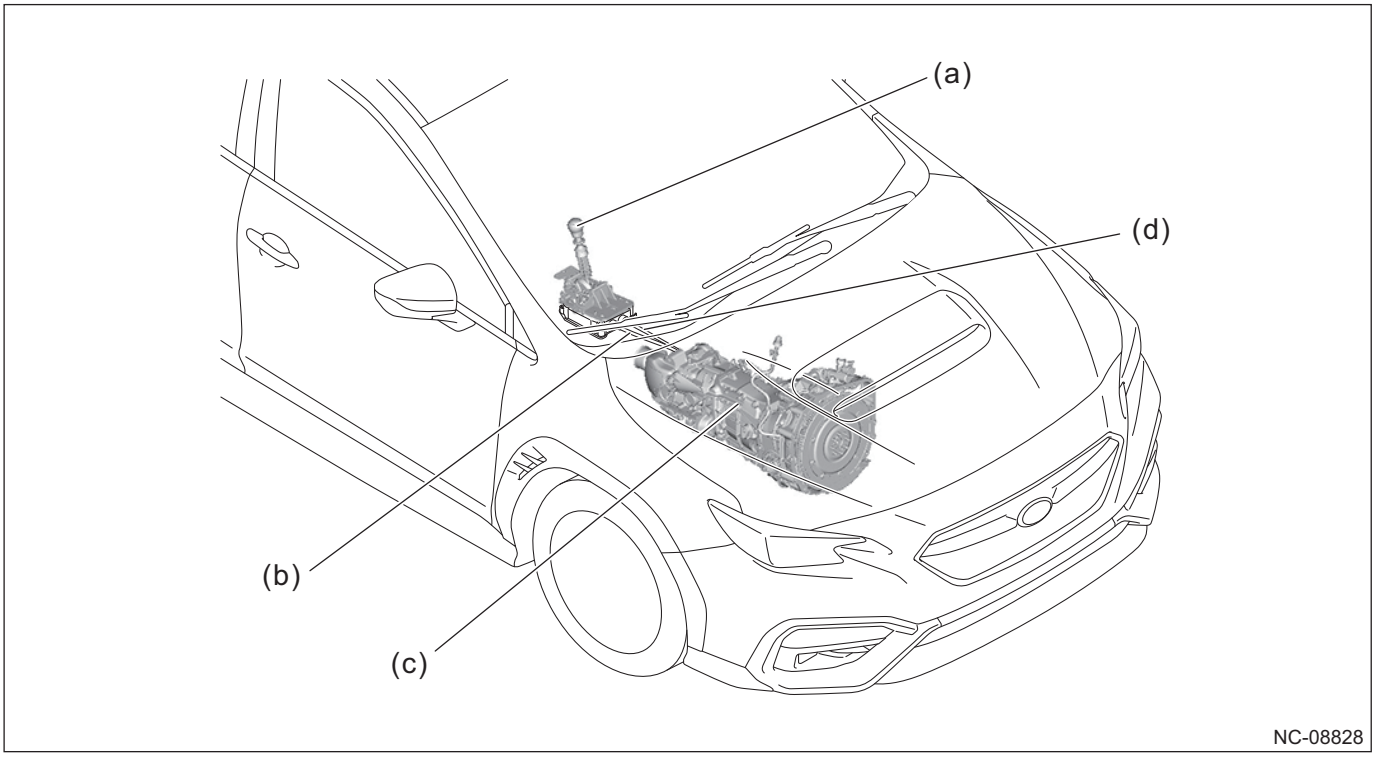
CVT

- Leather-wrapped select lever grip
- Shift boot specification select lever
- Select lever boot with red stitching
- High-gloss black indicator dial face
- White nighttime indicator illumination
- Cast black paint shift panel
- Shift indicator cover with decoration on the silver paint or cast black paint shift panel (for some grades)
- Manual mode

3.2.2 Component

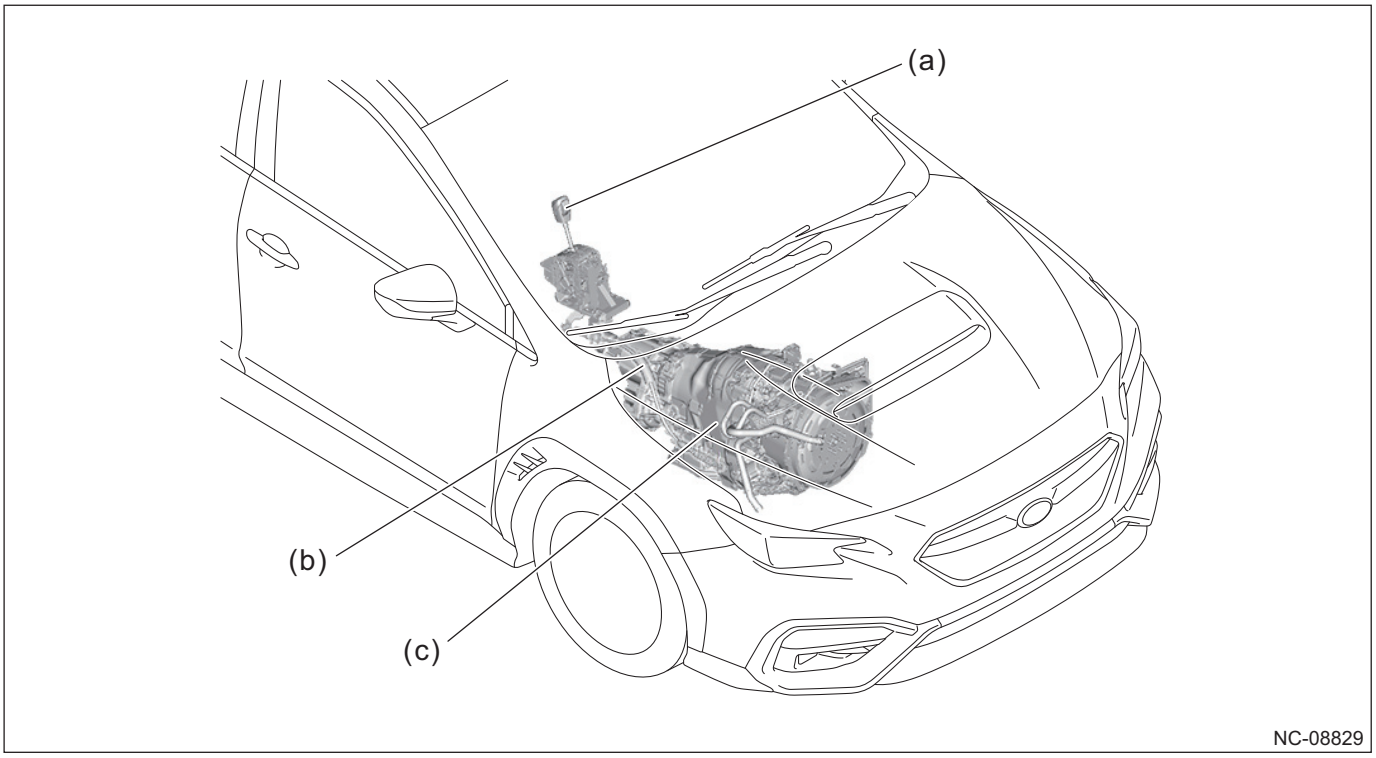
Component layout drawing

Shift control system (MT)



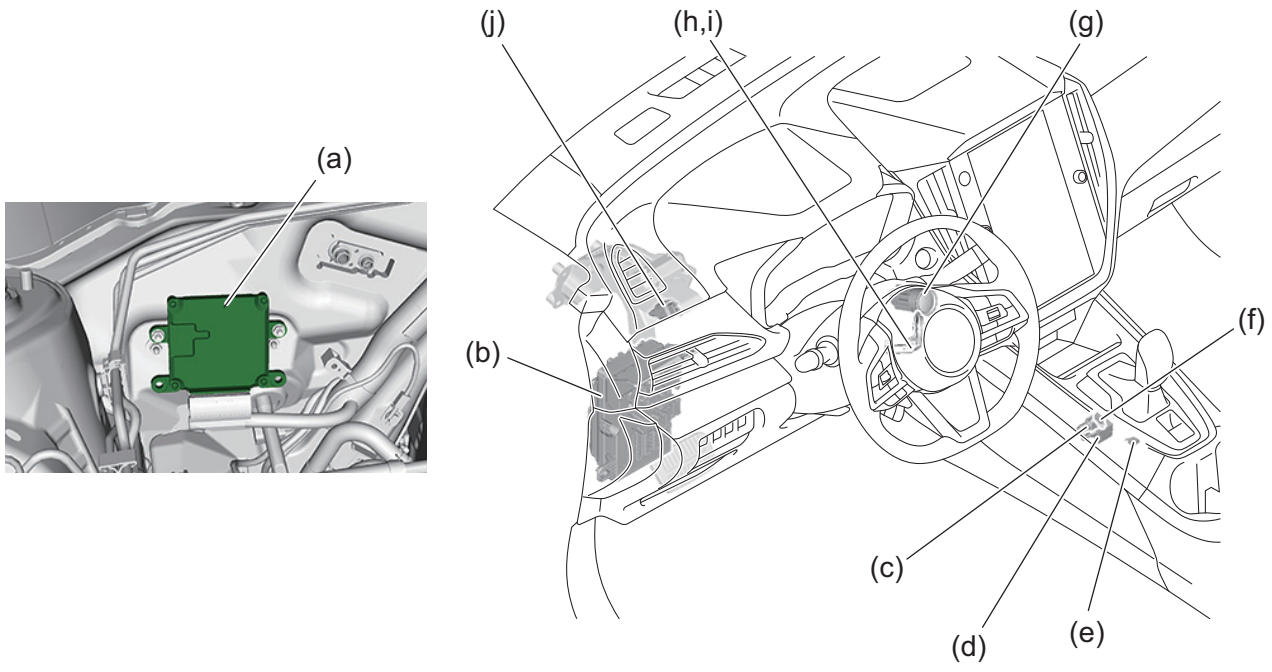
(a) Gear shift lever
(b) Select cable
(c) Manual transmission assembly
(d) Shift cable

Shift control system (CVT)



(a) Select lever
(b) Control cable
(c) Continuously variable transmission (CVT)

Shift lock control system



(a) Transmission control module (TCM)

(b) Body Integrated Unit

(c) Shift lock rod

(d) Solenoid unit

(e) M mode switch

(f) P range switch

(g) Engine switch (models with keyless access & push button start)

(h) Key lock solenoid (models without keyless access & push button start)

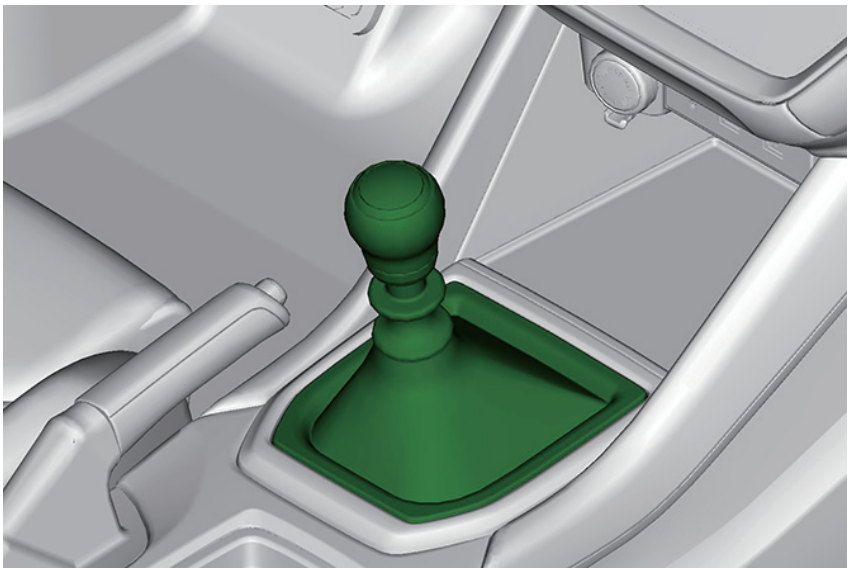
(i) Key warning switch (models without keyless access & push button start)

(j) Stop light switch

Component details

Shift control (MT)

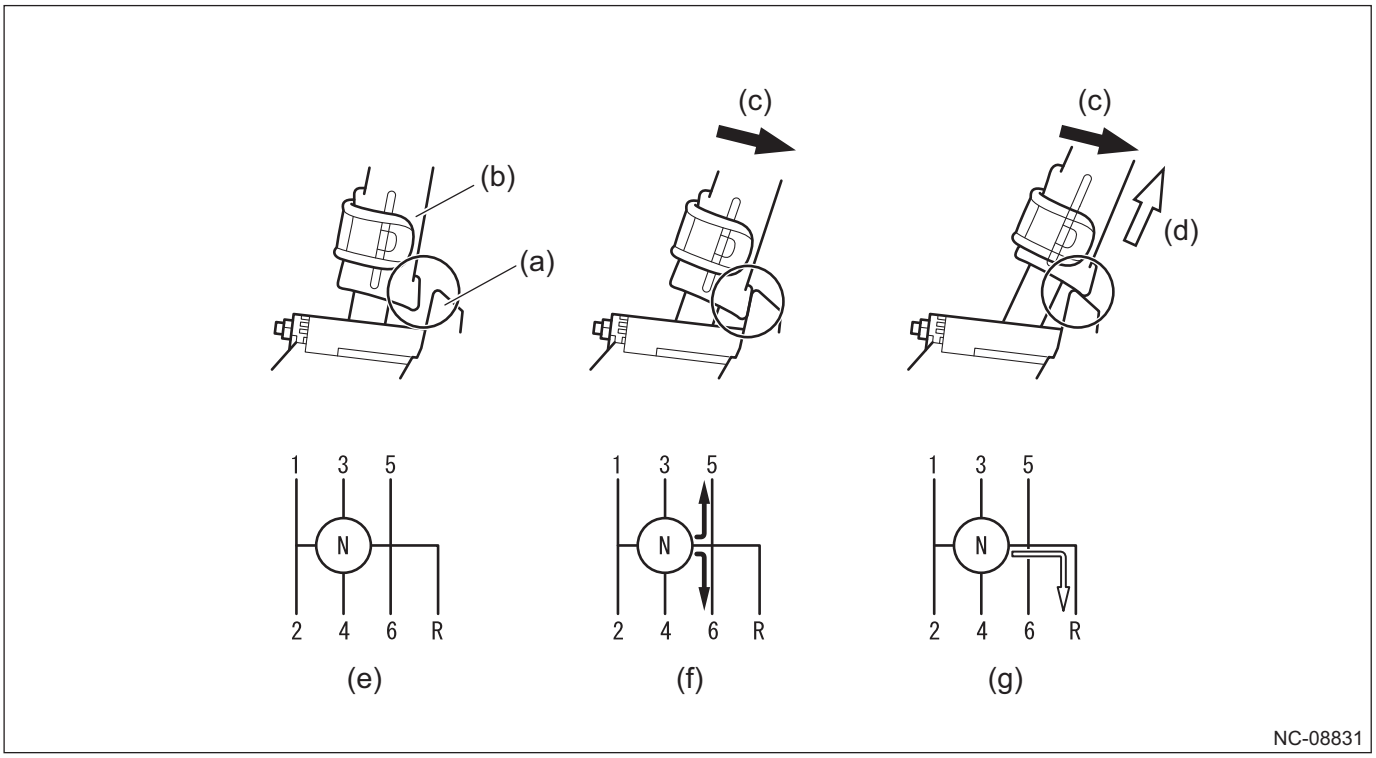
A leather-wrapped shift knob is adopted.



NC-08843

■ Reverse mistaken operation prevention mechanism

A slider type of gear shift lever is adopted to prevent mistaken operation when starting off or reversing. The shift can only be changed to reverse while pulling up the slider of the shift lever boot.

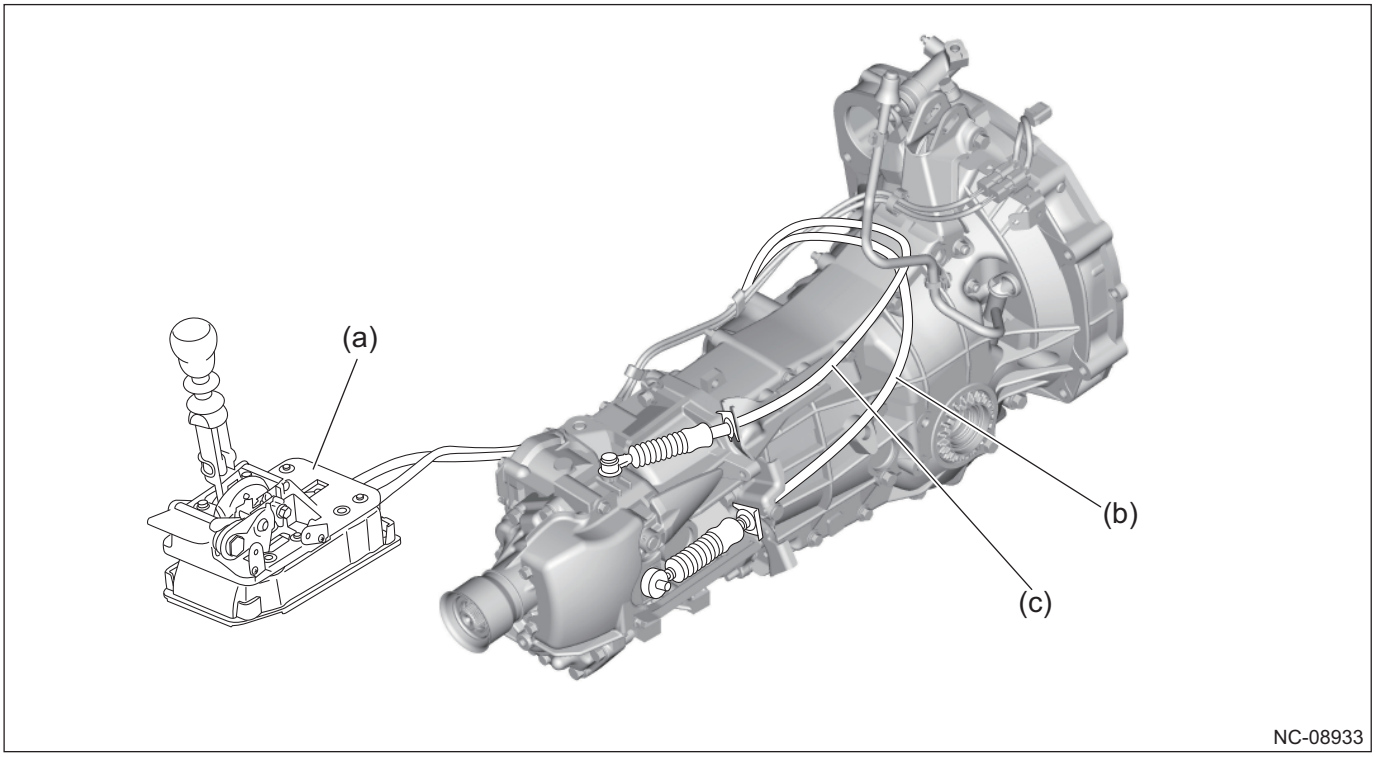


(a) Stopper cover
(b) Slider
(c) Select direction
(d) Pull up
(e) N position
(f) Selecting 5th speed or 6th speed
(g) Selecting reverse

■ Gearshift system

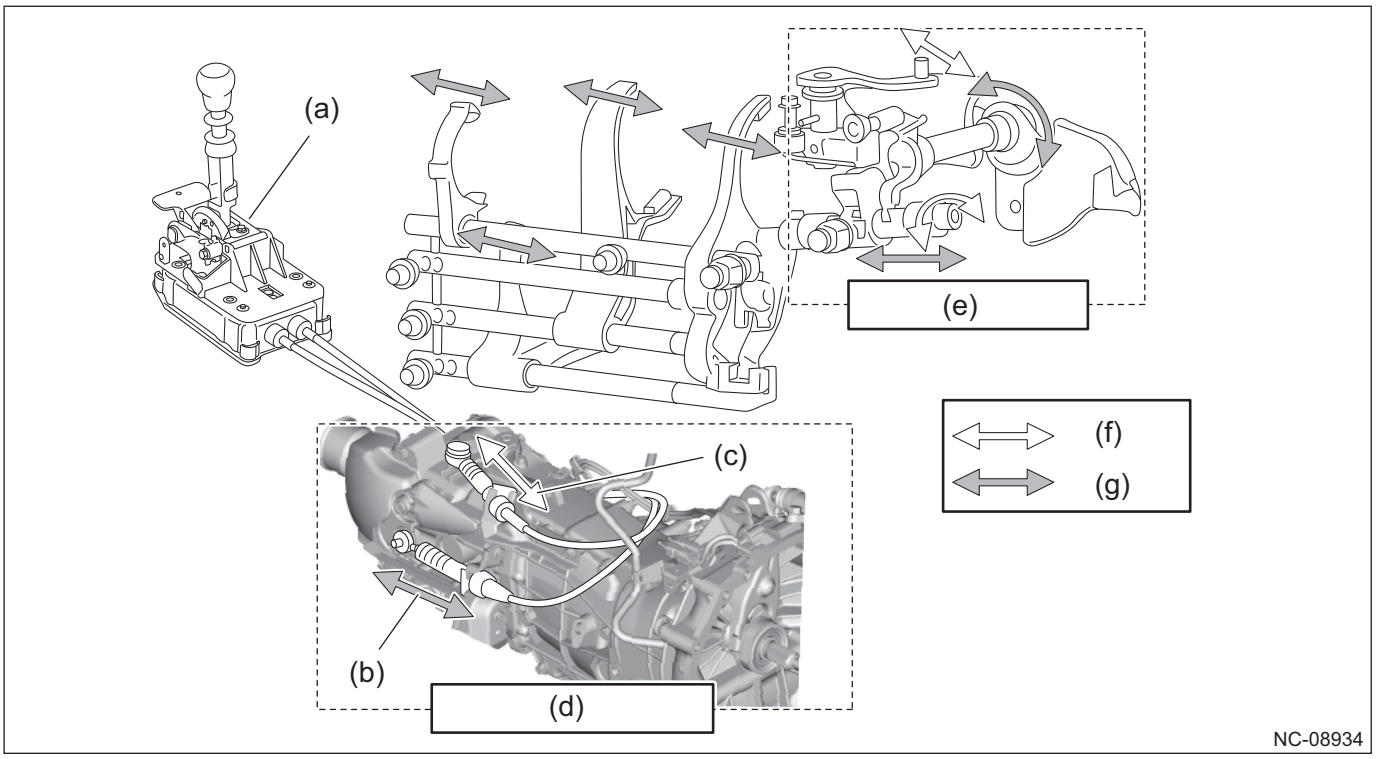
A cable-type gear shift lever for a 6-speed manual transmission is adopted.

This provides a shift feeling that combines smooth shift operation with a clear in-position feel.



(a) Gear shift lever assembly
(b) Shift cable
(c) Select cable

Movement of the cable-type gearshift



(a) Gear shift lever assembly
(b) Shift cable
(c) Select cable
(d) Cable shift
(e) Link structure
(f) Select movement
(g) Shift movement

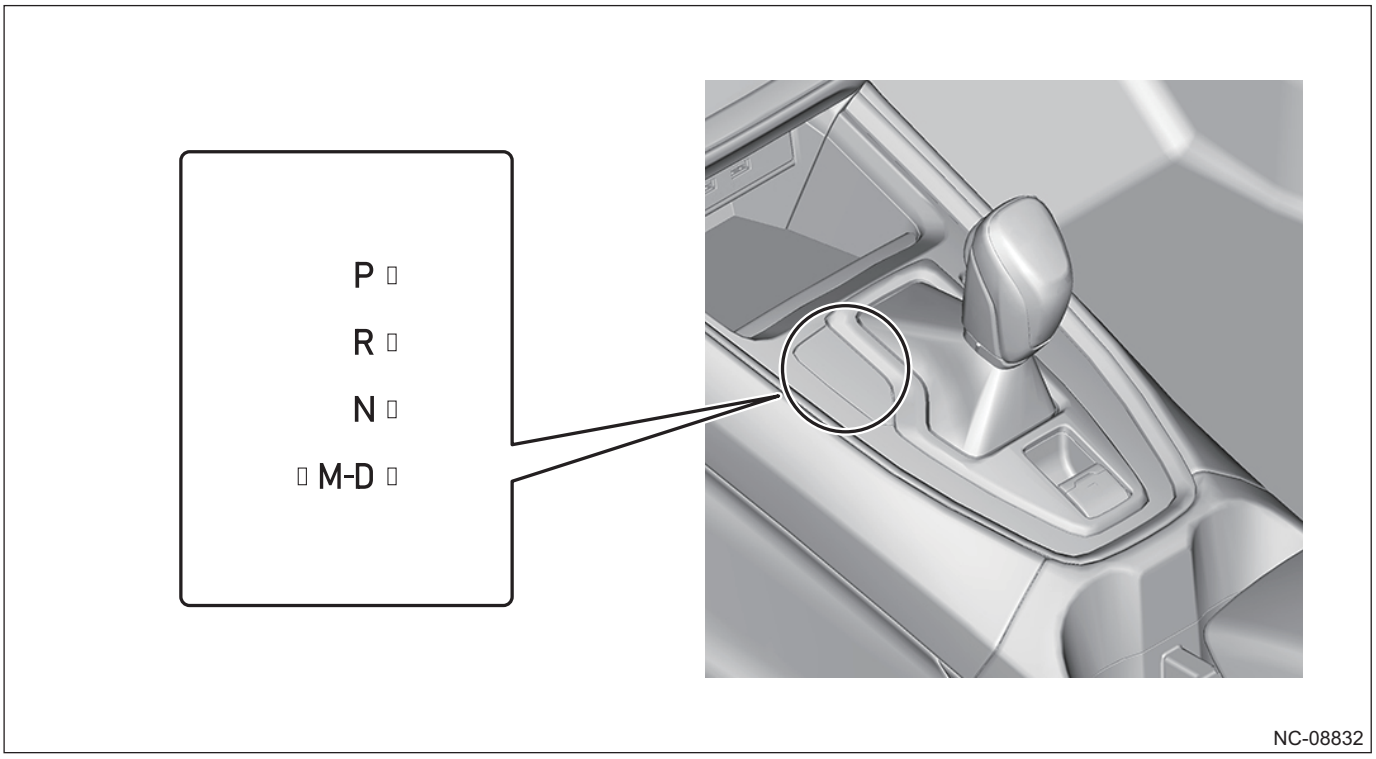
Shift control (CVT)

The shift boot design is adopted to improve the texture.

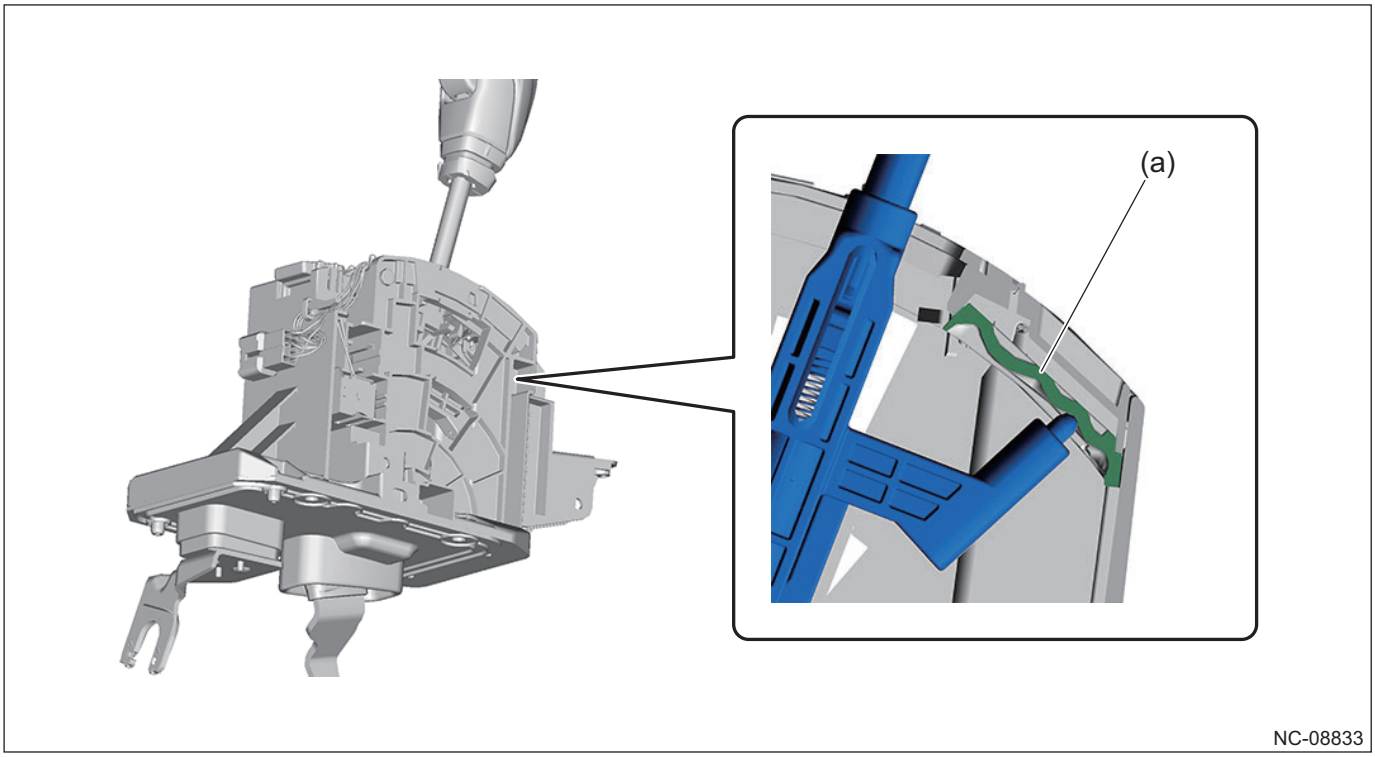
The shift pattern is straight (PRND) + Manual mode (M)

The mode can be switched to the Manual mode by moving the select lever sideways from the D range.

The select lever mechanism is equipped with a detent spring and a detent plate, providing more accurate shifting of the select lever.



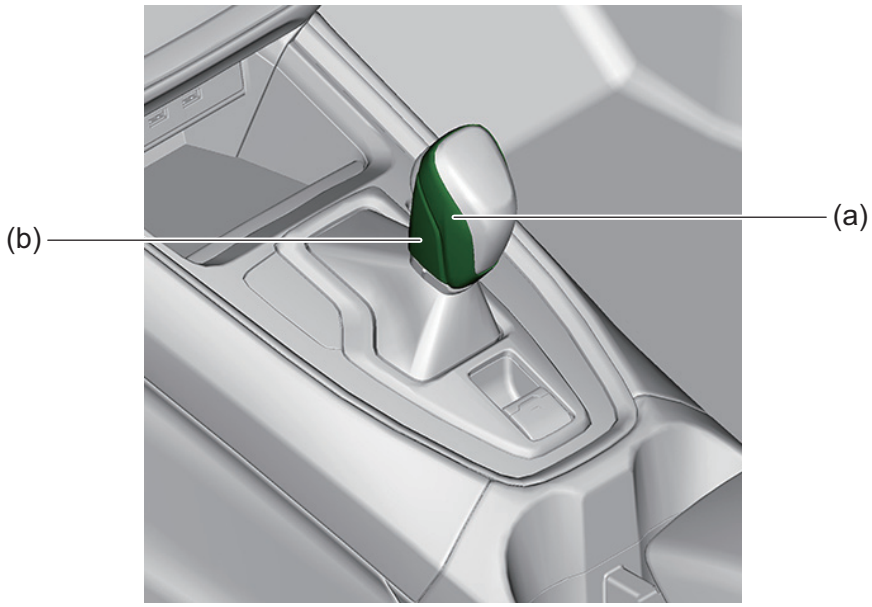
Soft resin is used for the detent plate in order to produce smooth lever operability. This improves the quality feel of shift lever operation.



(a) Soft resin

■ Select lever grip

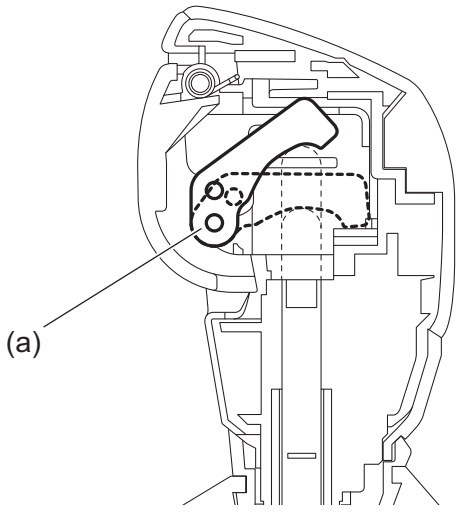
A leather-wrapped select lever grip has been adopted. Cast black decoration is available for the decoration.



NC-08834

(a) Cast black decoration (b) Leather-wrapped

A spring was added on the select lever side, and the reaction force of this spring reduces the occurrence of looseness even with rapid shift operations, improving the feeling of quality when operating the select lever.



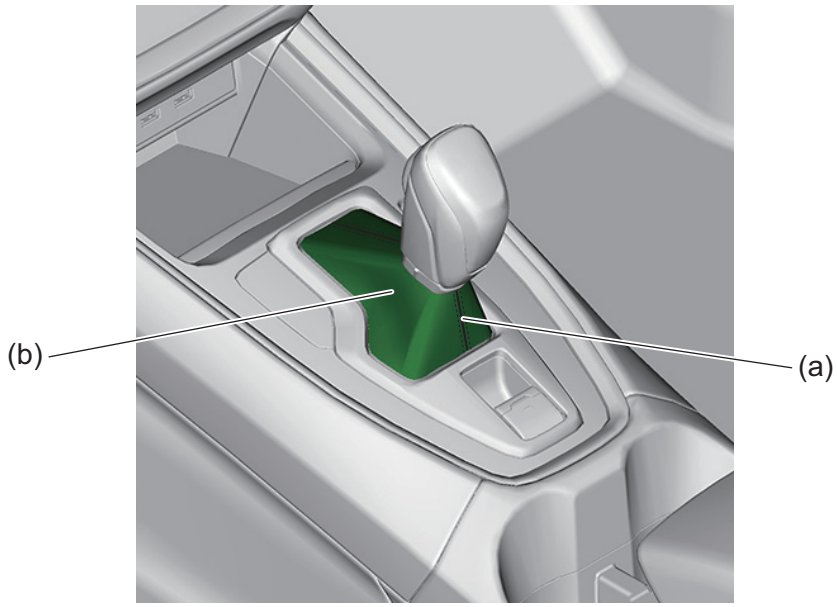
NC-05333

(a) Button link

■ Select lever boot

A boot with double stitching is adopted for an expression of high quality.

Red stitching is available for the double stitching.



NC-08835

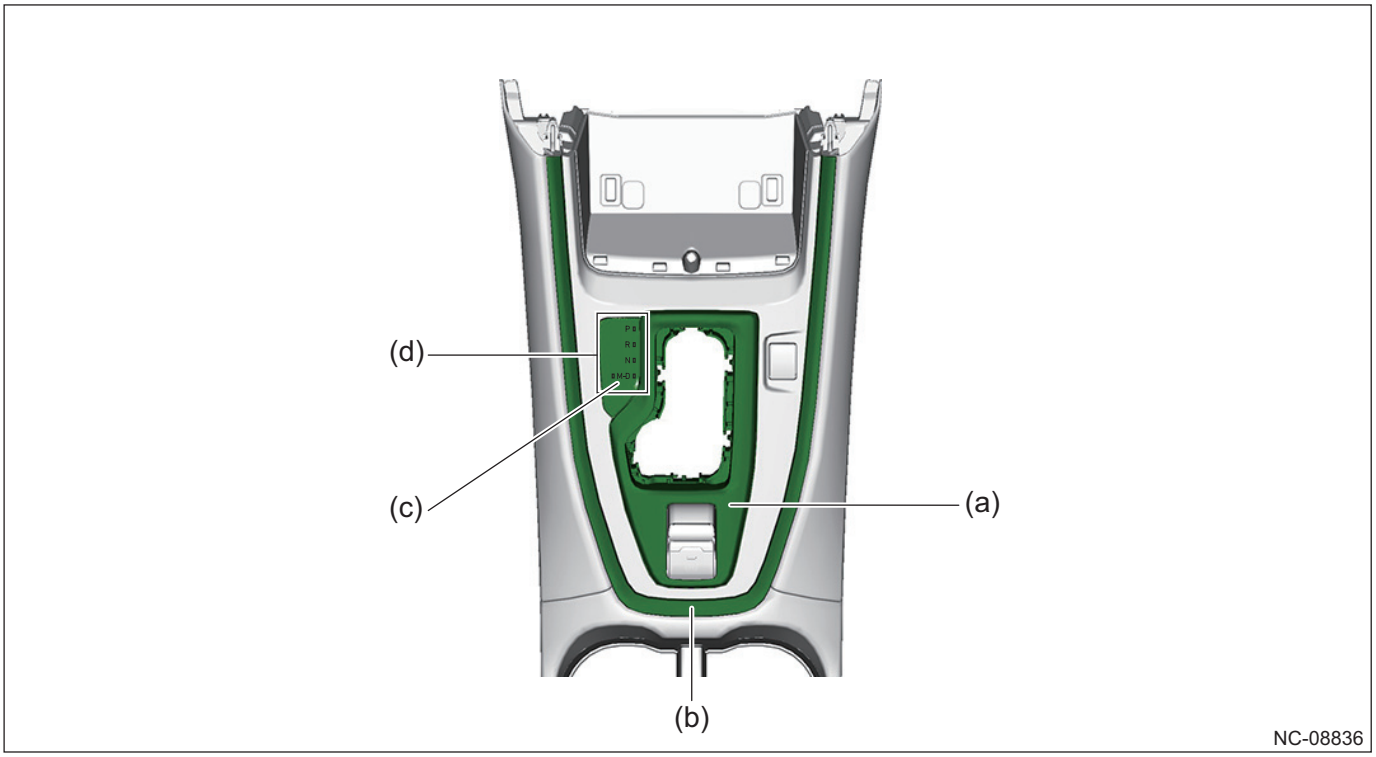
(a) Stitching

(b) Boot

■ Shift indicator cover

A cast black paint shift panel, silver or cast black paint shift panel decorations (for some grades), and high-gloss black indicator dial face are adopted to produce a feeling of high quality.

Indicators with pointers are adopted. White is used as the nighttime illumination color for indicator letters, producing a feeling of unity with the interior and improving visibility when shifting.

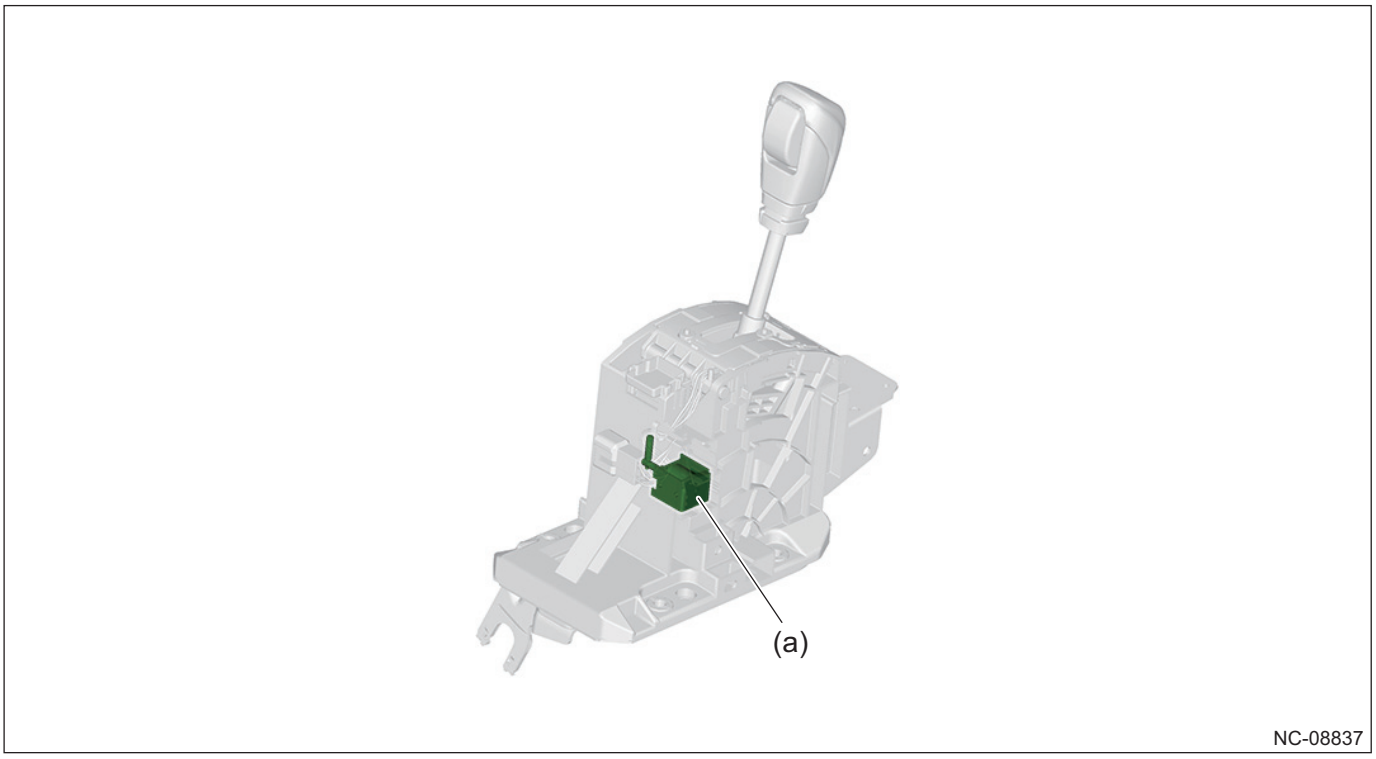


(a) Shift panel (cast black paint)
(b) Shift panel decoration (silver/cast black paint)
(c) Indicator dial face (high gloss black)
(d) Indicator + Pointer

■ Shift lock solenoid

The shift lock solenoid is installed in the select lever. When the following conditions are all satisfied, the shift lock solenoid is energized to release the shift lock.

- IG "ON"
- TCM P range detection or P range detection switch "ON"
- Stop light switch "ON"

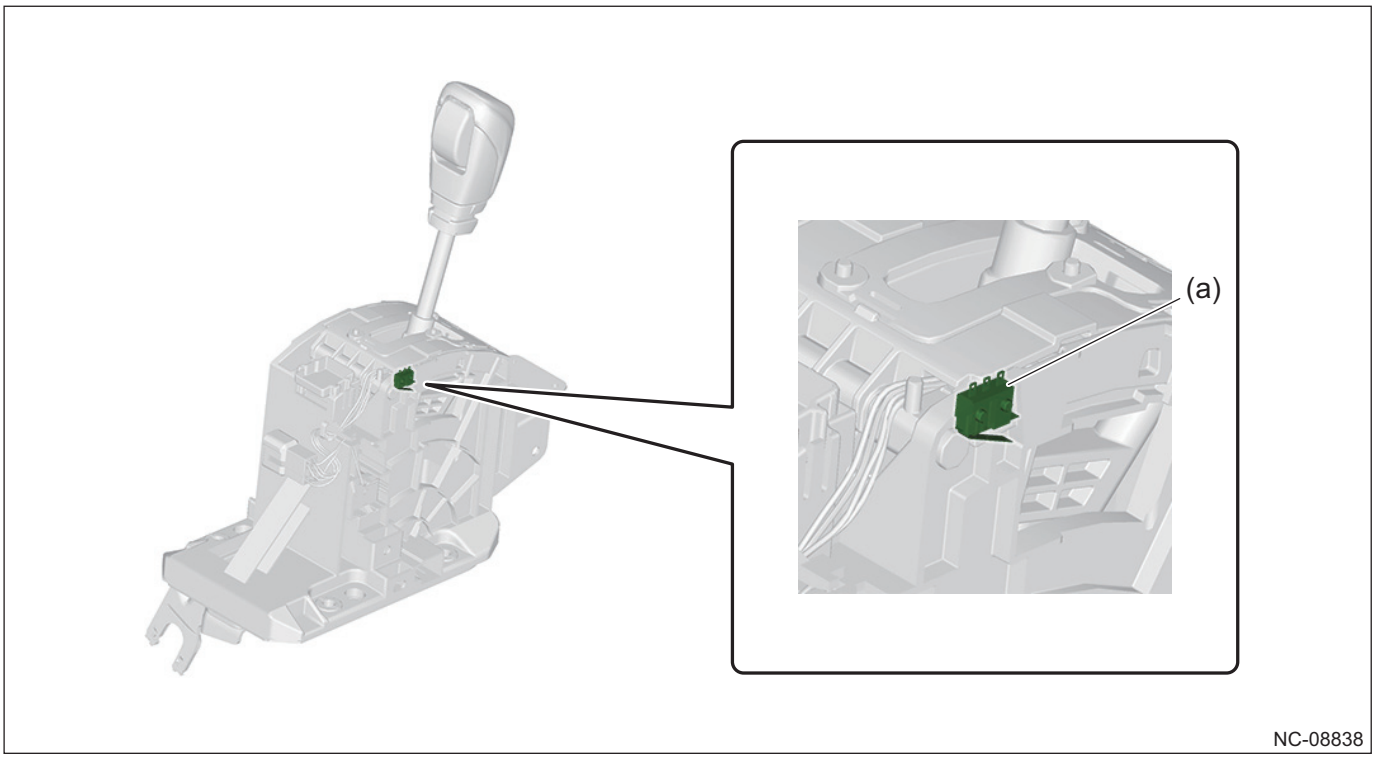


(a) Shift lock solenoid

■ P range switch

The P range switch is installed in the select lever. The switch detects that the select lever is located at the "P" position.

When the select lever is in the "P" position, the system is ON. When the select lever is in a position other than the "P" position, the system is OFF.

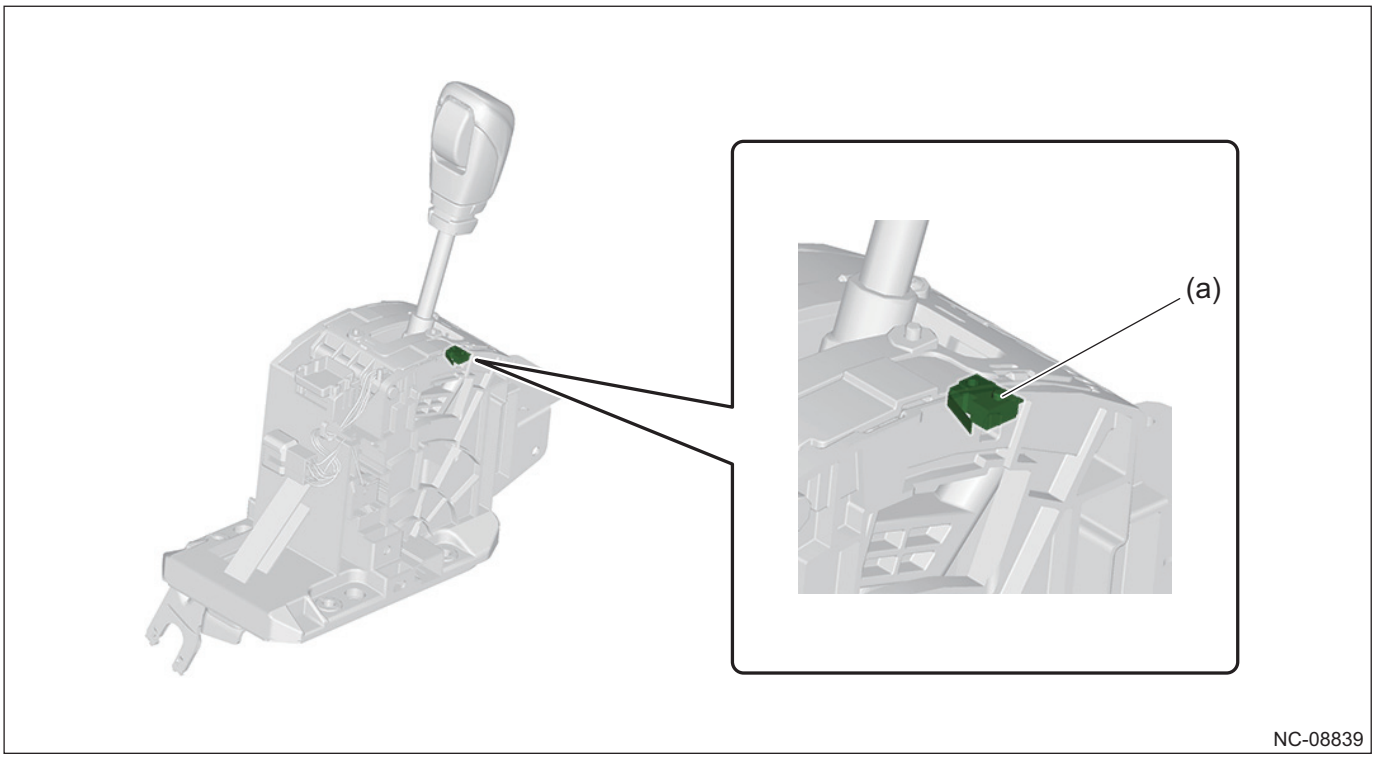


(a) P range switch

■ M mode switch

The M mode switch is installed in the select lever. The switch detects that the select lever is located in the M range.

When the select lever is in the M range, the system is ON. When the select lever is in a position other than the M range, the system is OFF.

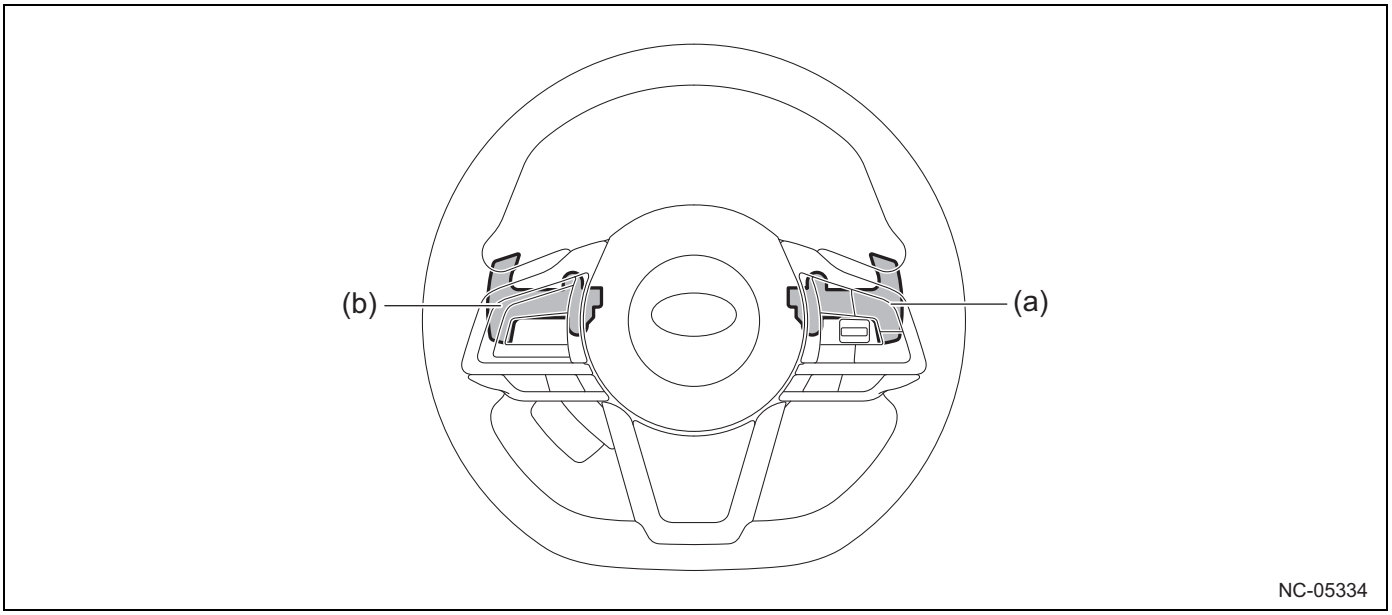


(a) M mode switch

Paddle shift switch (CVT)

When the select lever is shifted to the M range while in the D range, the transmission enters Manual mode. By operating a paddle switch located on the steering wheel, the driver can quickly select the appropriate gear at any time for fast braking or acceleration without releasing the steering wheel and enjoy the sporty driving

When the driver wants to shift gears while driving in manual mode, the driver can shift up or down by operating the paddle shift switch (+) or the paddle shift switch (-). The gear to shift is indicated on the shift indicator in the multi information display at that time.

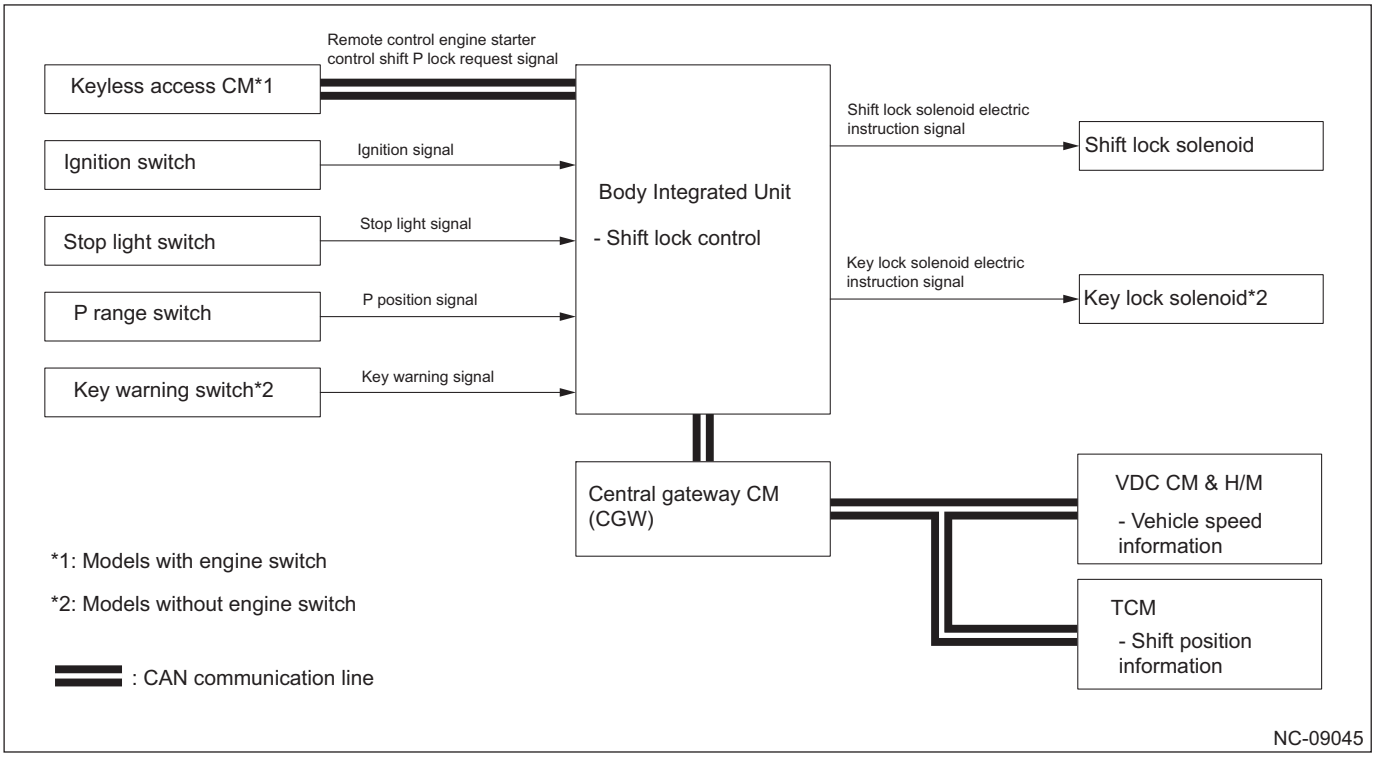


(a) Paddle shift switch (+)

(b) Paddle shift switch (-)

3.2.3 Construction and Operation

System diagram



System details

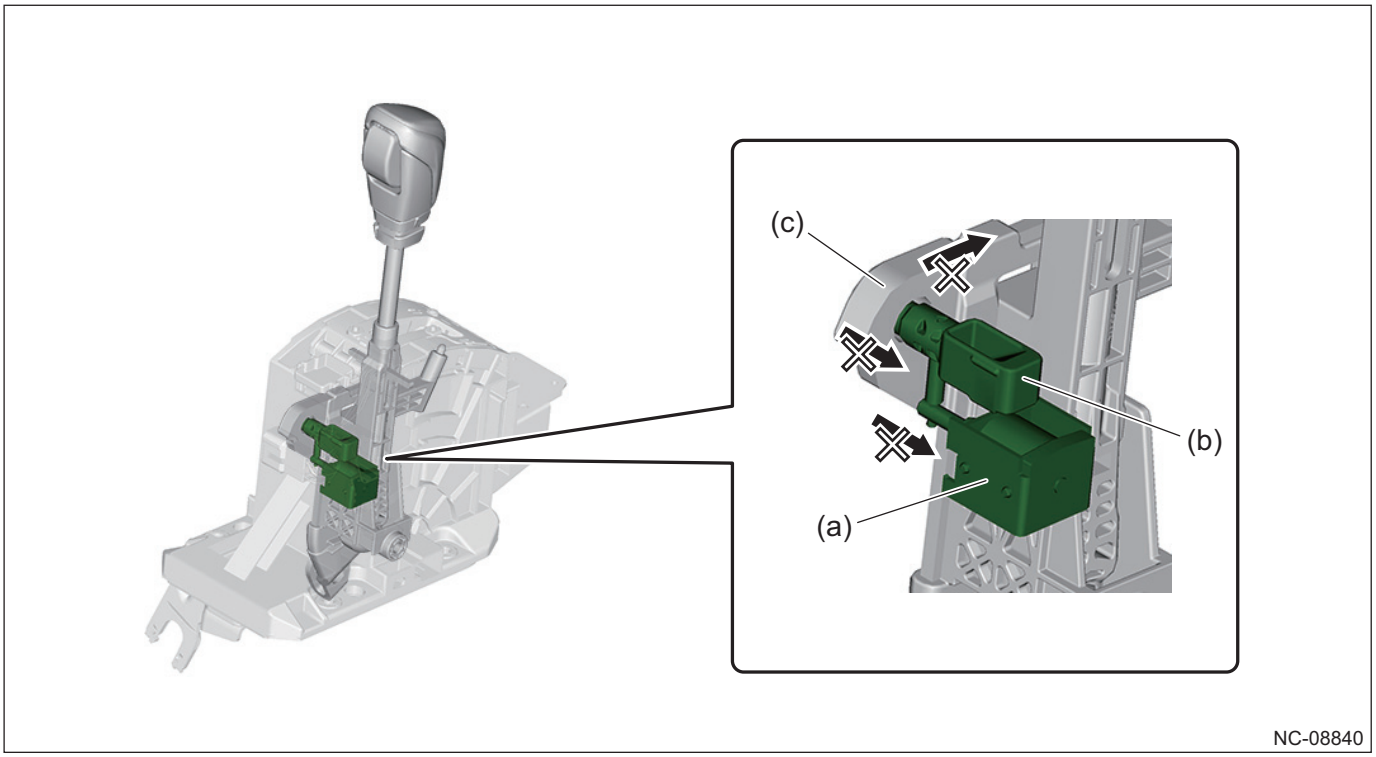
Shift lock system (CVT)

For improved safety during initial acceleration, the shift lock system prevents the select lever from being moved to any position other than the "P" position unless the brake pedal is depressed. The shift lock system includes the components of the select lever such as the shift lock rod, shift lock solenoid, and detent arm.

■ Shift lock

When the select lever is at the "P" position, the shift lock rod remains at the lock position.

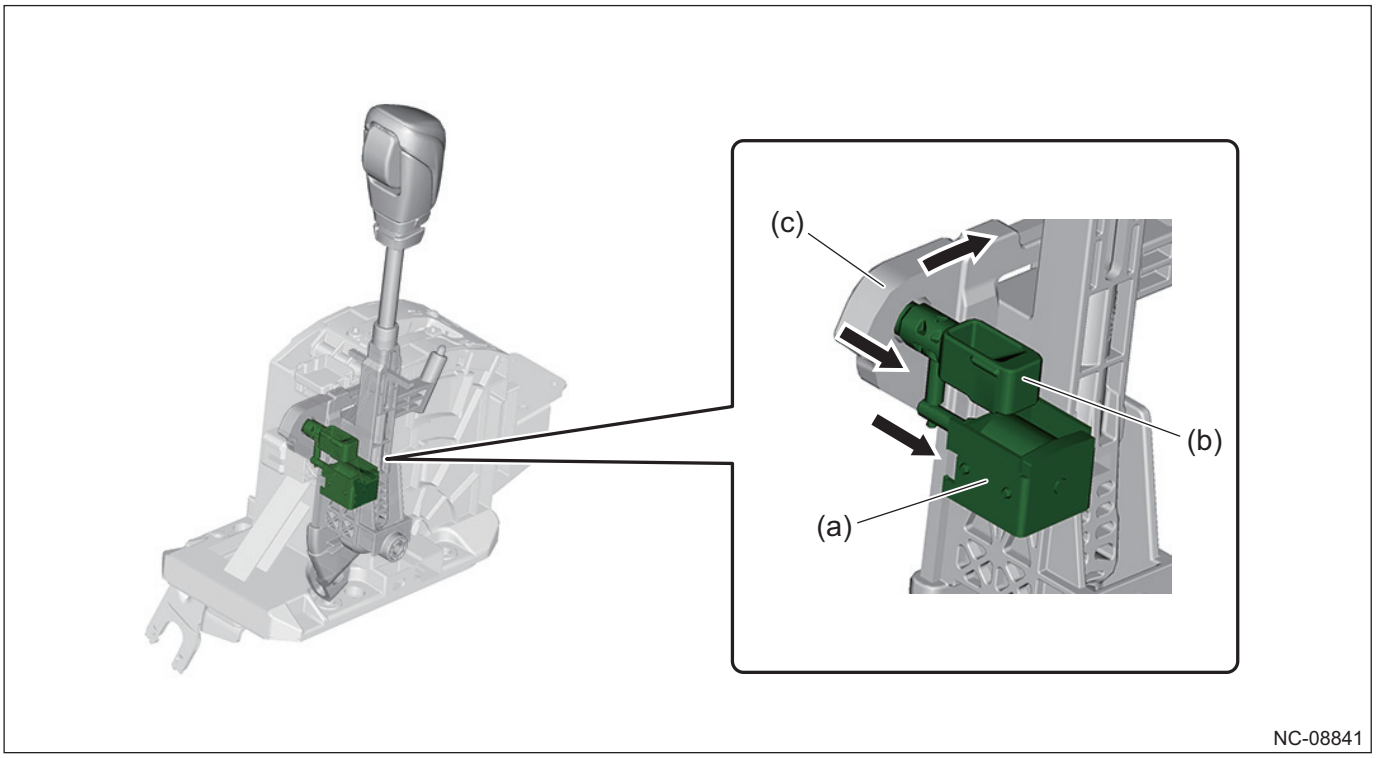
When the engine is started with the lever in "P" position and the brake pedal is not depressed, the shift lock solenoid is OFF and the shift lock rod locks the detent arm in the P position. Therefore, the shift position cannot move from the P position.



(a) Shift lock solenoid
(b) Shift lock rod
(c) Detent arm

■ Shift lock release

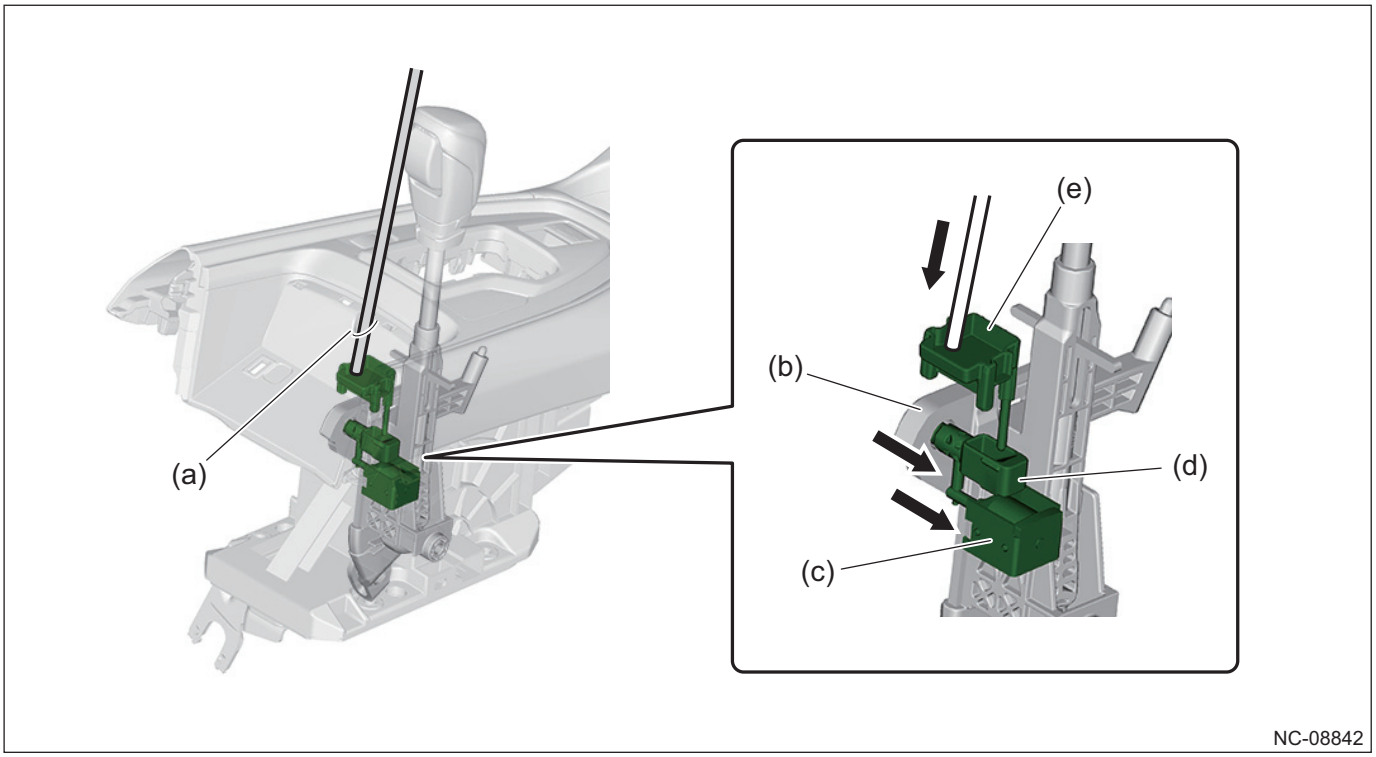
When the brake pedal is depressed with the ignition ON, the shift lock solenoid turns on and pulls the shift lock solenoid plunger to unlock the detent arm of the shift lock rod. This allows the select lever to move from the P position.



(a) Shift lock solenoid
(b) Shift lock rod
(c) Detent arm

■ Shift lock force release

When the shift lock is not released due to shift lock solenoid failure or electrical system problems, insert a thin flat tip screwdriver or the like into the shift lock release hole of the shift indicator panel and push the shift lock release to release the shift lock. Pushing the shift lock release will move the shift lock rod and release the shift lock.



(a) Shift lock release hole
(b) Detent arm
(c) Shift lock solenoid
(d) Shift lock rod
(e) Shift lock release

N-R lock control (CVT)

This control prevents the select lever from accidentally entering the R position while driving. This is to prevent damaging parts such as the reverse brake. Once the vehicle exceeds a specified speed, the Body Integrated Unit turns OFF the shift lock solenoid (in the solenoid unit) of the select lever. This activates the N-R lock mechanism, preventing the select lever from being operated from the N range to the R range and prevents the transmission from entering reverse.

Reference

CVT reverse prevention control prevents gear shifts to the R position by not generating the reverse brake control pressure when the select lever accidentally enters the R position while driving at the specified speed or faster. This is to prevent damaging parts such as the reverse brake. This control also prevents damage to parts on the CVT side resulting from unintended operation.

Key interlock function (models without engine switch)

When the select lever is in a position other than P, the key lock solenoid located inside the key cylinder presses out the lock pin, preventing the ignition key from being turned to the LOCK position. When the select lever is moved to P, the select lever assembly P range switch activates. As a result, the key lock solenoid is no longer able to push out the lock pin, allowing the key to be turned to the LOCK position and removed from the ignition switch.

3.3 Clutch

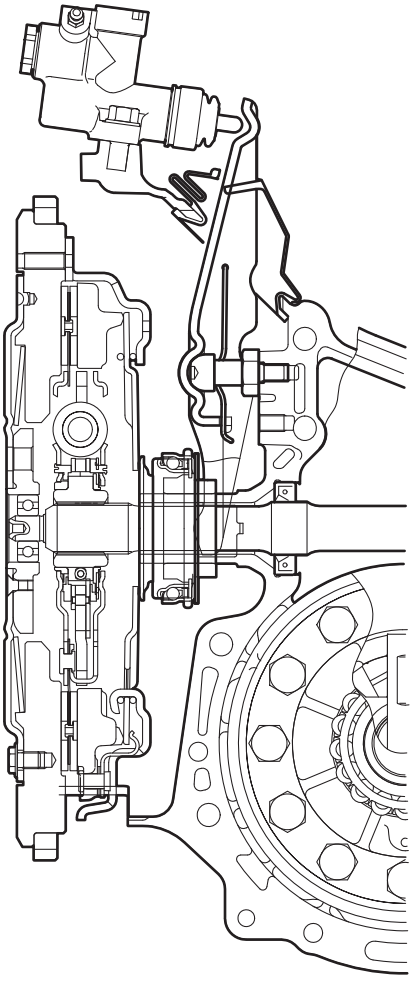
3.3.1 Overview

Overview

A dry, single disc, diaphragm type of clutch mechanism is provided in vehicles equipped with the TY75 manual transmission.

A push-type clutch is adopted.

A mechanism is used in which the clutch control system utilizes the hydraulic pressure that is generated in the master cylinder when the pedal is depressed to operate the release fork. This produces smooth operation and highly reliable clutch control that minimizes frictional resistance.



NC-08290

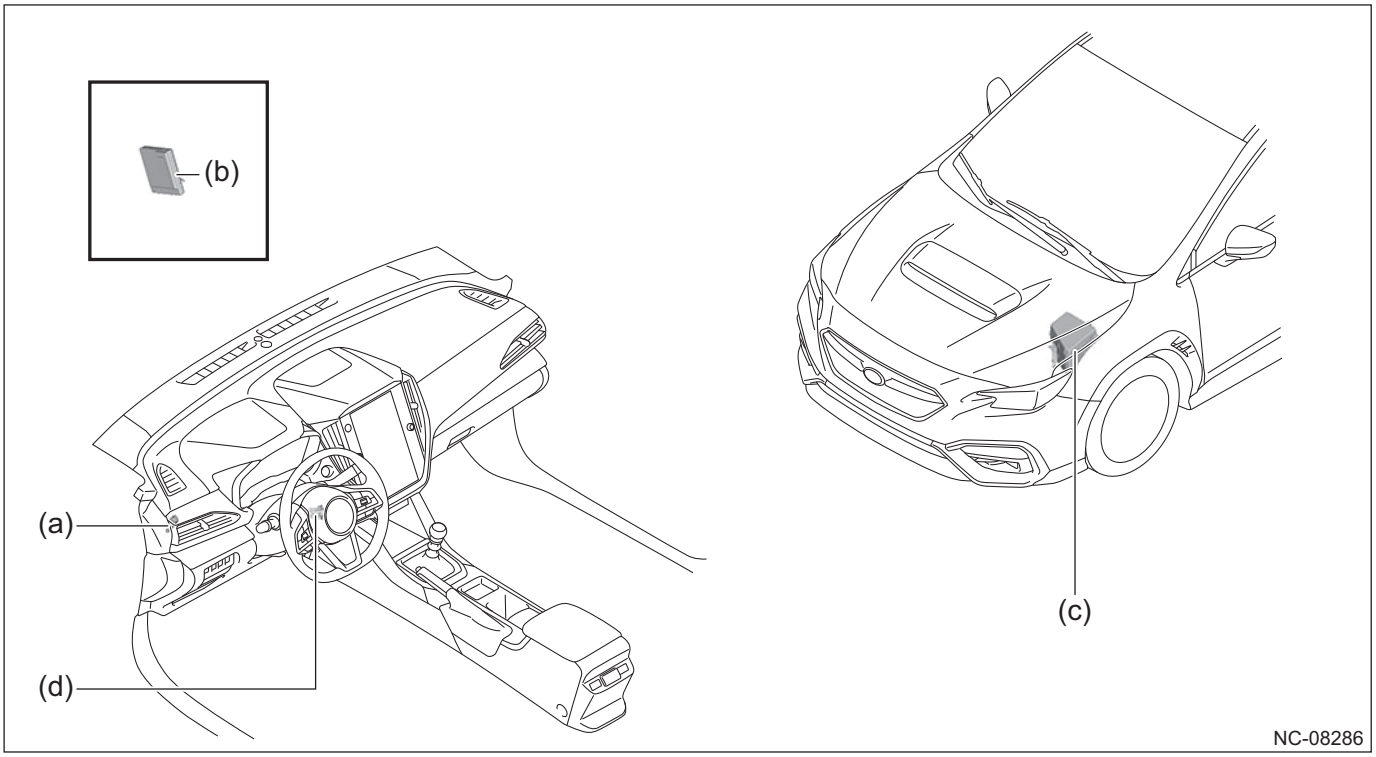
Specifications

Clutch specifications

Transmission type		TY75
Engine type		FA24
Clutch assembly	Type	Dry, single disc, diaphragm type
	Operation method	Oil pressure type
Clutch cover	Type	Push-type
	Size (in (mm))	9.449 (240)
	Installation load (Ibf (N, kgf))	1889 (8400, 856)
Clutch disc	Outer diameter × inner diameter × thickness (in (mm))	9.449 × 6.299 × 0.154 (240 × 160 × 3.9)
	Material	Semi mold
Clutch master cylinder	Type	Plunger type
	Bore (in (mm))	0.75 (19.05)
Operating cylinder	Type	Non-adjustable type
	Bore (in (mm))	0.875 (22.22)
Clutch pedal assembly	Stroke (in (mm))	5.315 (135)
	Pedal lever ratio	6.16

3.3.2 Component

Component layout drawing



(a) Clutch start switch
(b) Keyless access CM*1
(c) Starter relay (in main fuse & relay box)
(d) Ignition or starter switch assembly*2

**1: Models with keyless access & push button start system*
**2: Models without keyless access & push button start system*

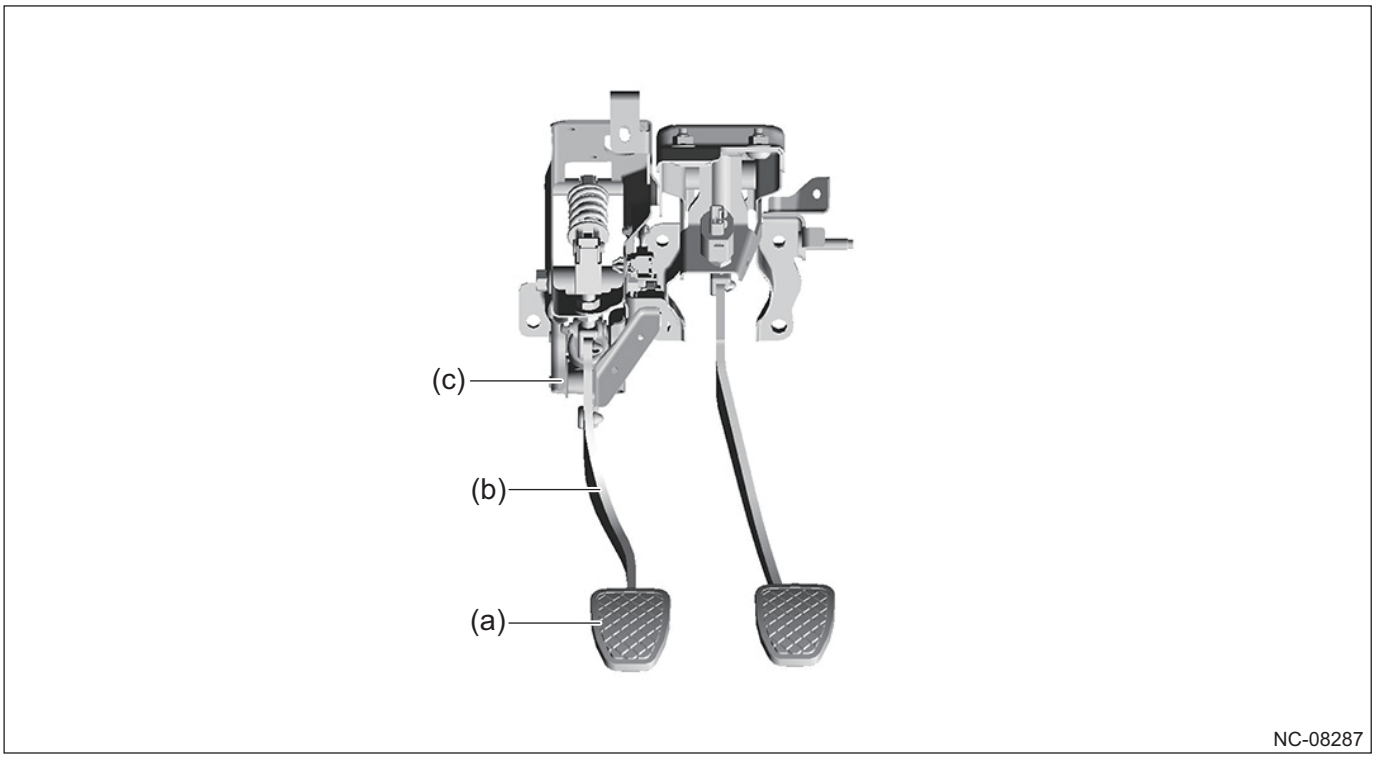
Component details

Clutch pedal assembly

A system of directly installing the master cylinder onto the hydraulic clutch pedal is adopted.

The clutch pedal pad position and lever length are optimized to ensure clutch operability.

Starter interlock control using the clutch start switch is adopted, ensuring safety at engine start.

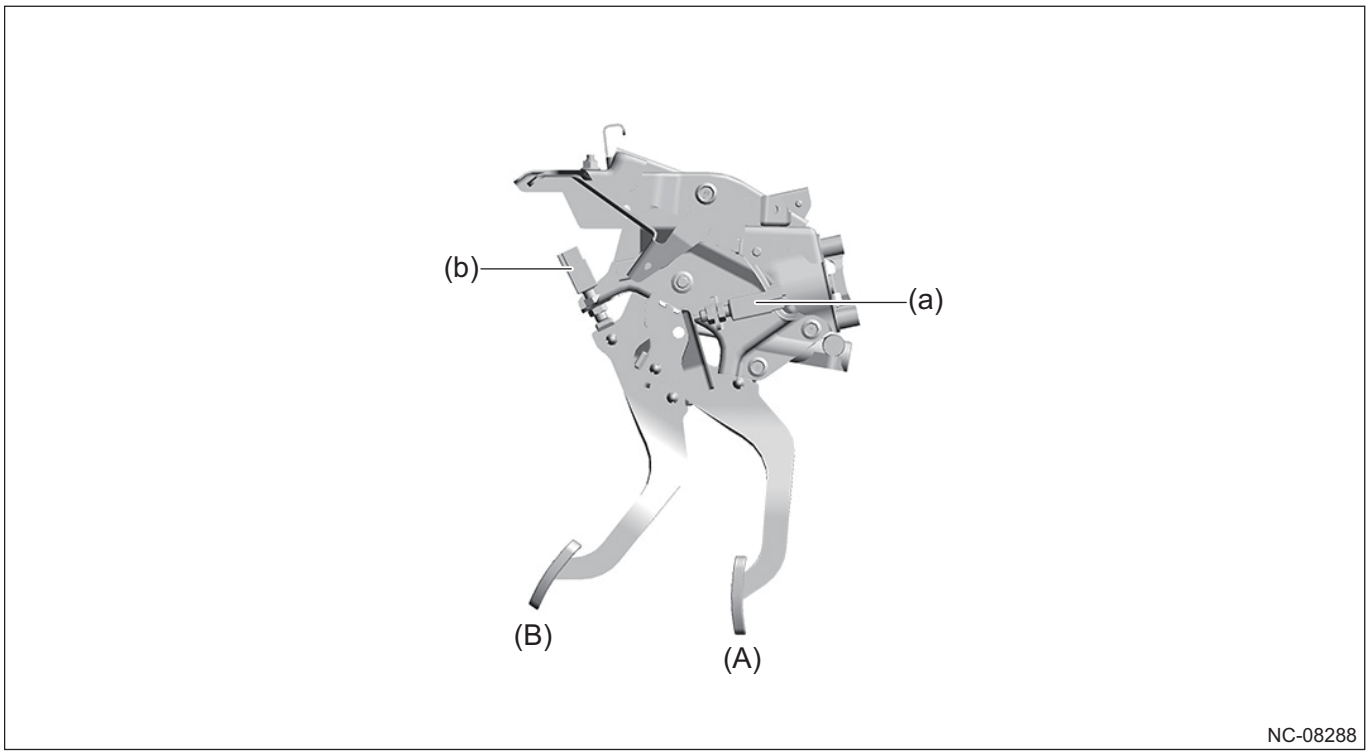


(a) Clutch pedal pad
(b) Clutch pedal
(c) Clutch master cylinder

■ Clutch start switch, clutch switch

The clutch start switch is installed on the clutch pedal bracket. When the clutch pedal is fully depressed, the switch is pressed and turns ON.

A clutch switch is also installed for control of cruise control.



(A) When clutch pedal is depressed

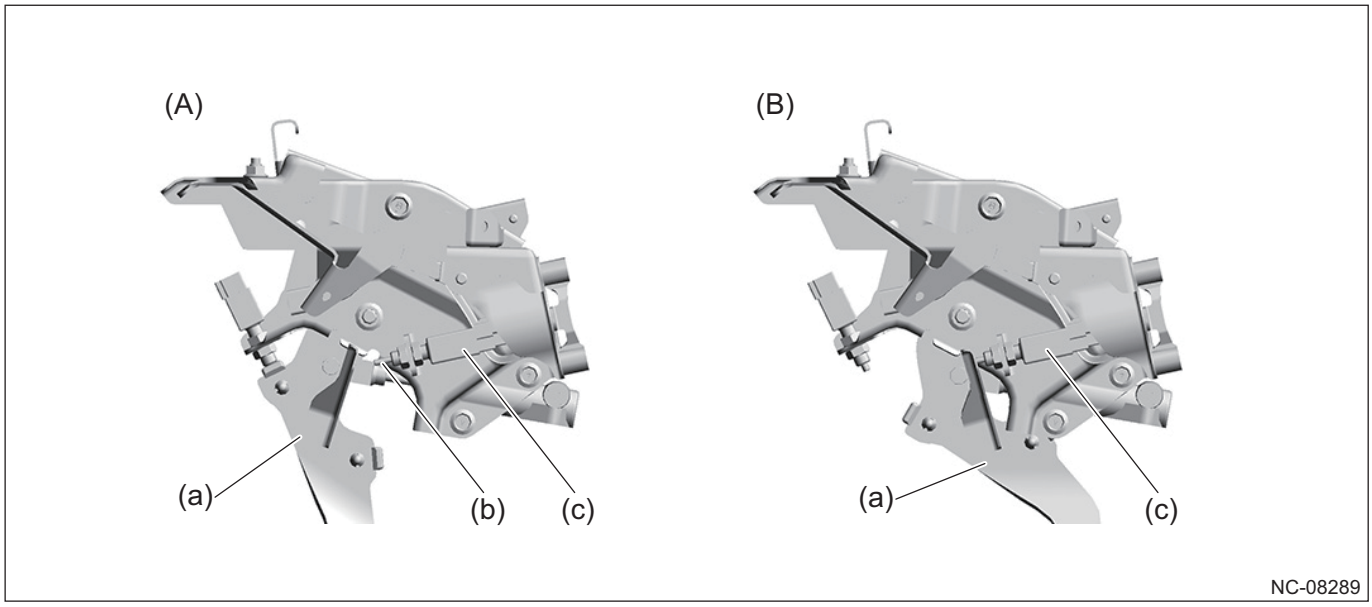
(B) When clutch pedal is released

(a) Clutch start switch

(b) Clutch switch

Starter interlock control using the clutch start switch

When the clutch pedal is fully depressed, the pedal-side stopper presses in the push-rod of the clutch start switch. When the push-rod is pressed in, the switch turns ON, the ignition switch and starter circuit are joined, and engine start is possible.



(A) When clutch switch is OFF

(B) When clutch switch is ON

(a) Clutch pedal

(b) Push-rod

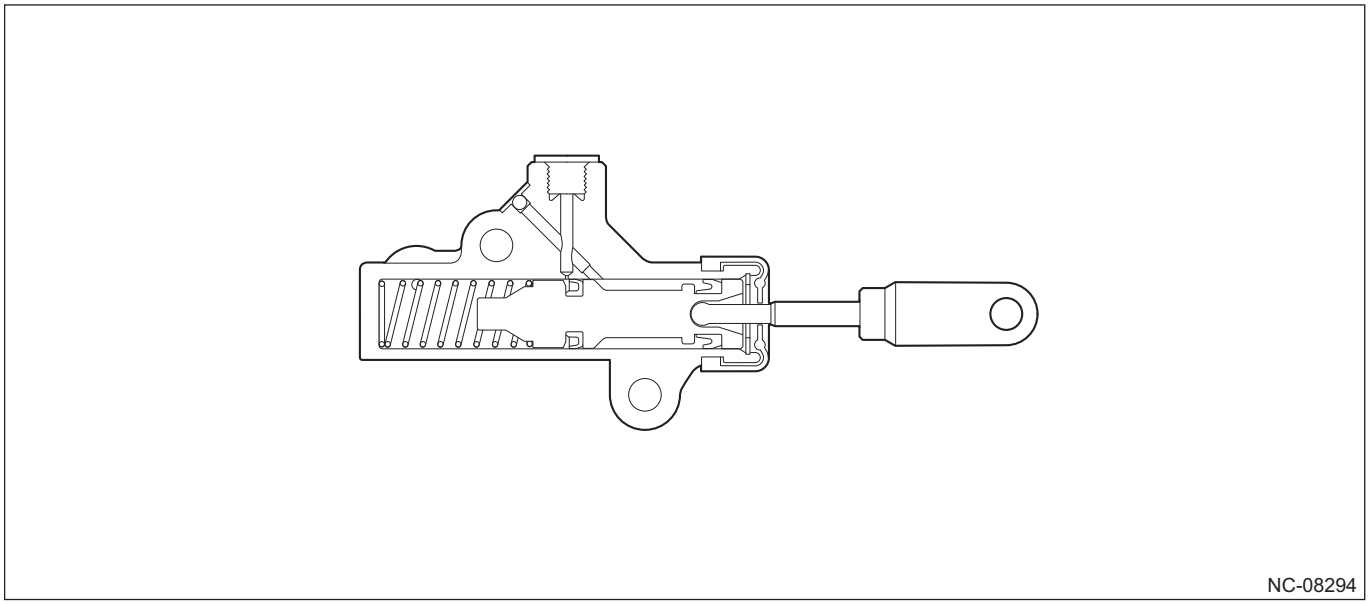
(c) Clutch start switch

Clutch master cylinder

A plunger-type clutch master cylinder with a cylinder diameter of 0.75 in (19.05 mm) is adopted.

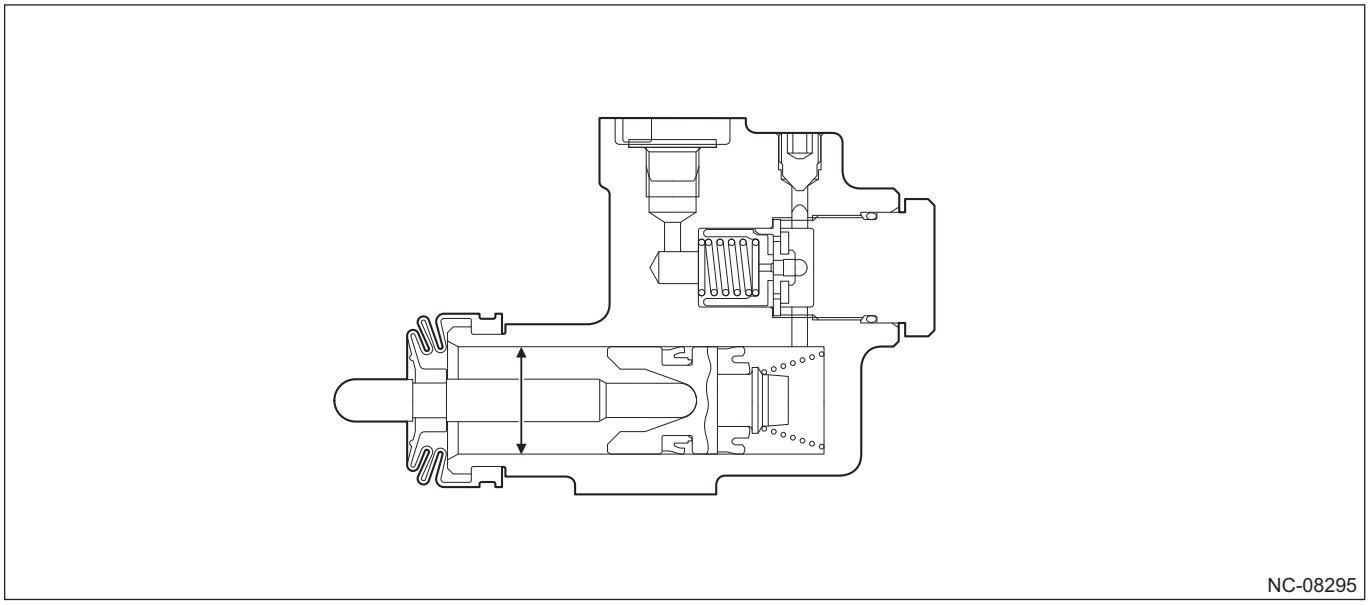
The reservoir tank is integrated with the master cylinder to save space.

A type where the clutch master cylinder is installed onto the clutch pedal is adopted, and the clutch master cylinder is placed inside the vehicle interior.



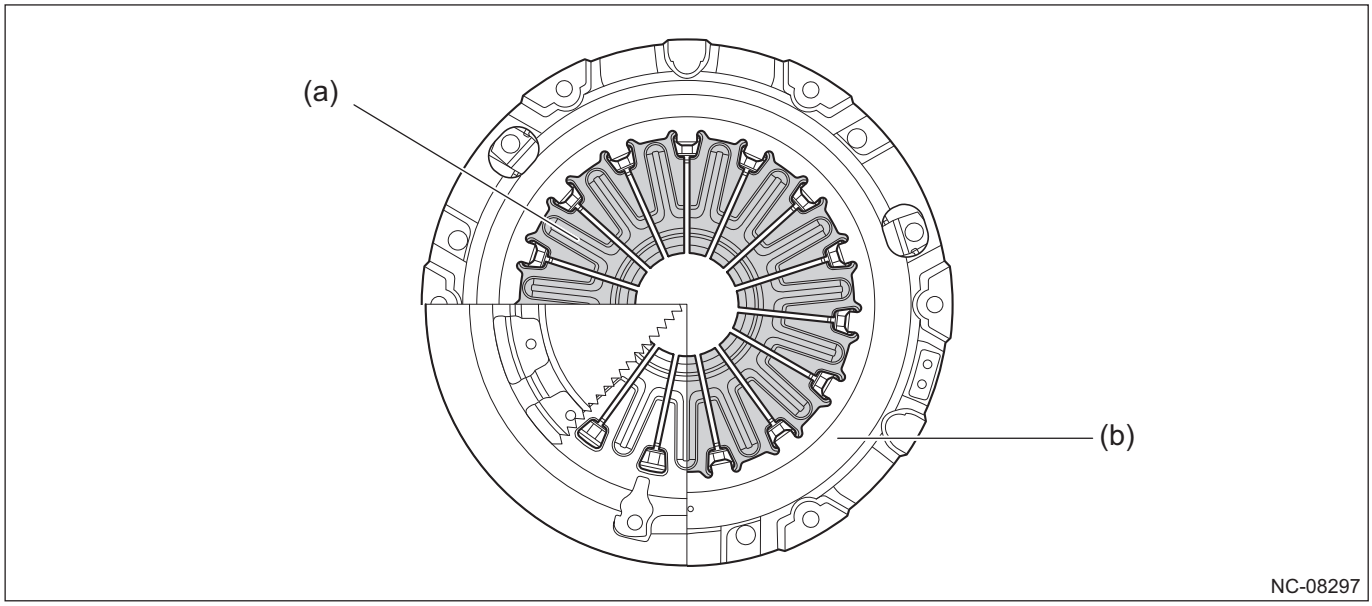
Operating cylinder

A non-adjustable type of operating cylinder with a cylinder diameter of 0.875 in (22.22 mm) is adopted.



Clutch cover

A diaphragm type spring is adopted for the clutch cover.

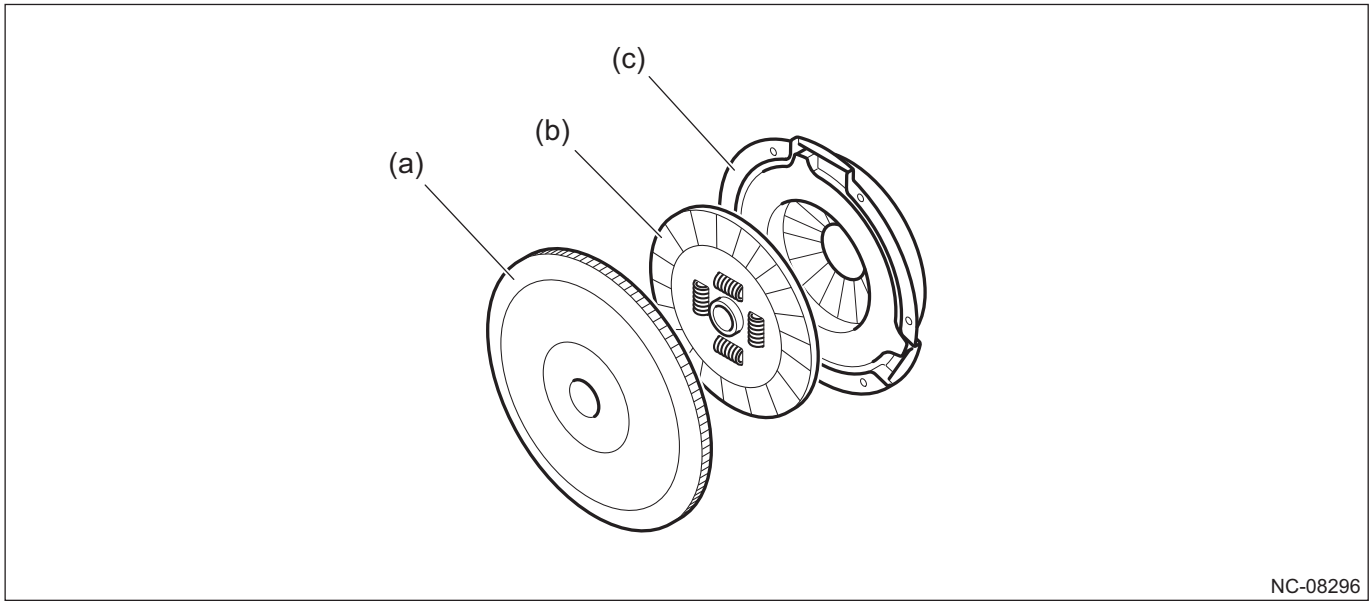


(a) Diaphragm type spring
(b) Clutch cover

Flywheel

The flywheel is a flexible type with damping mechanism, and is composed of a drive plate, reinforcement materials, and mass flywheel.

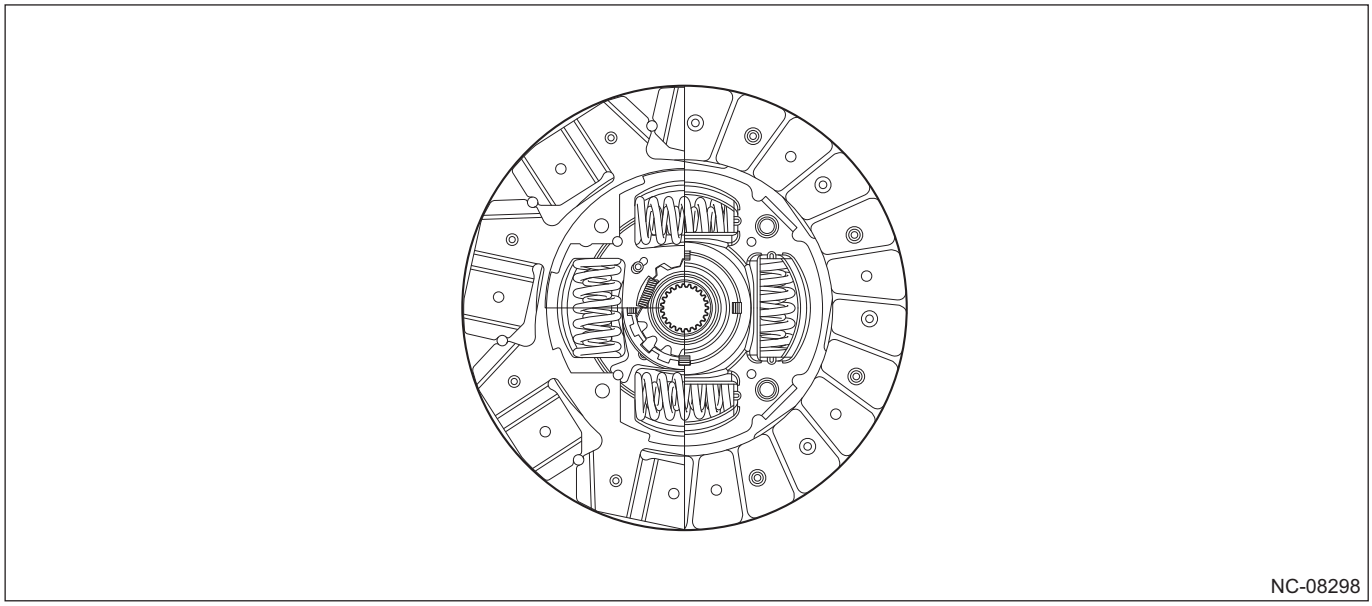
The characteristic of this type of flywheel is low vibration and noise because the engine output is transmitted from the crankshaft to the clutch disc via the drive plate and mass flywheel.



(a) Flywheel
(b) Clutch disc
(c) Clutch cover assembly

Clutch disc

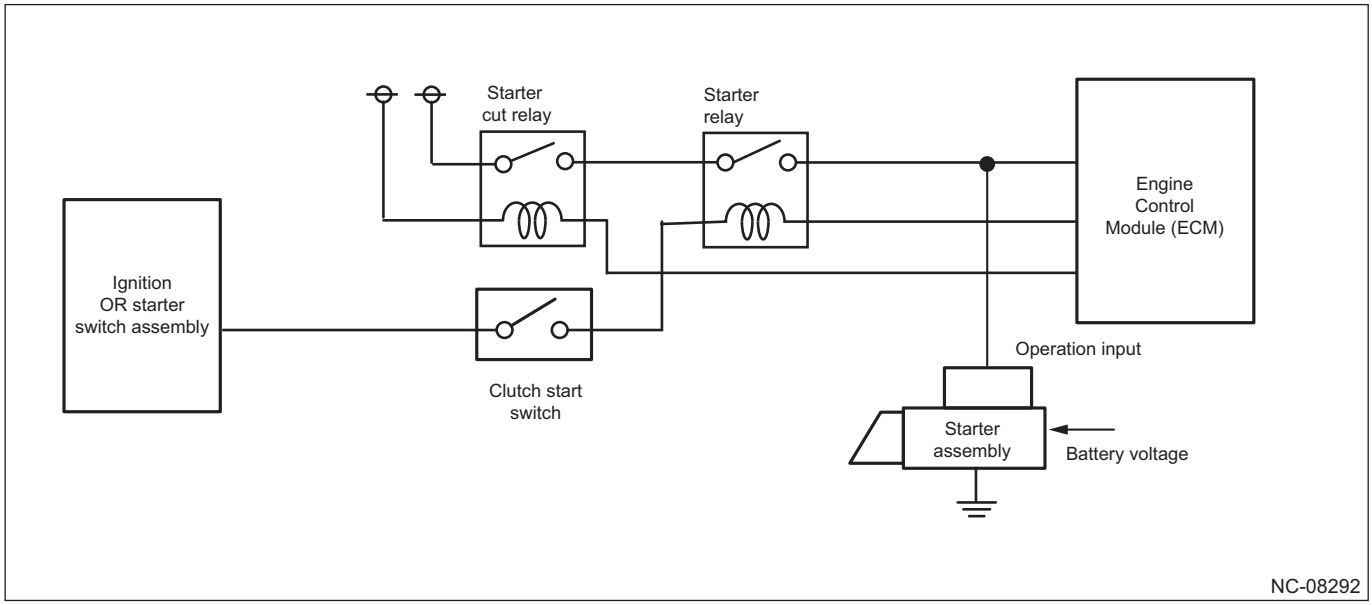
A semi mold type of clutch disc is adopted.



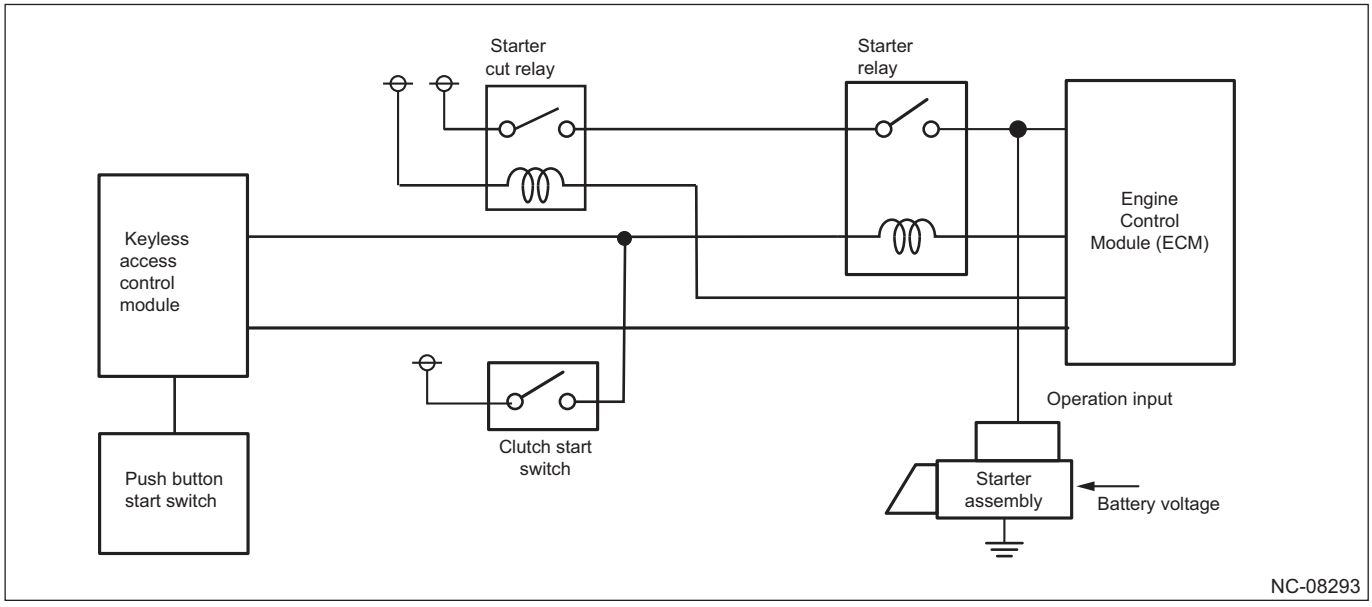
3.3.3 Construction and Operation

System diagram

Models without keyless access & push button start system



Models with keyless access & push button start system



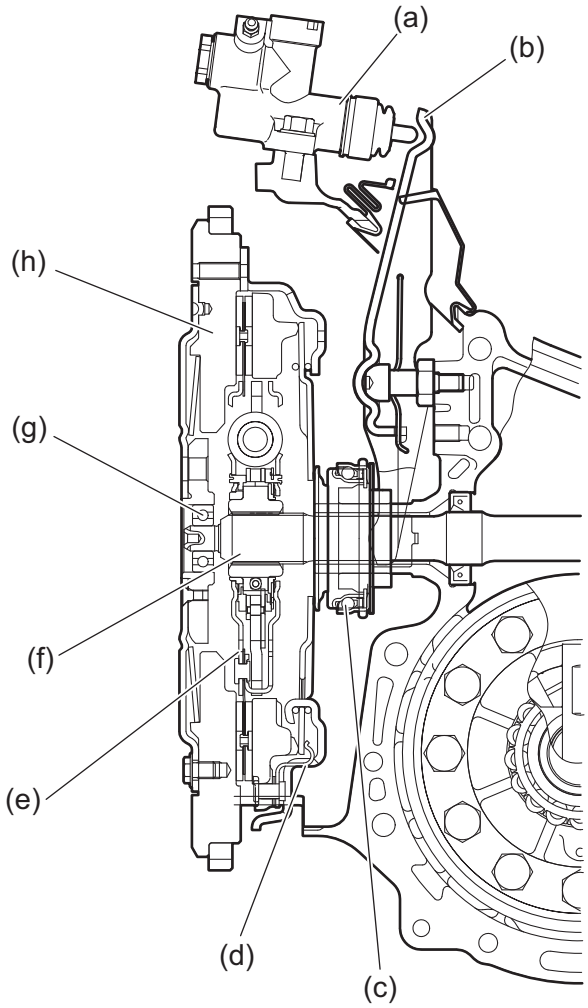
System details

Clutch system

■ Construction and Operation

When depressing force is applied to the clutch pedal, the release lever moves. This causes the release bearing to slide on the guide, pressing on the center of the diaphragm spring. The diaphragm spring is deformed, and the force which was previously pressing on the pressure plate is lost. As a result, the flywheel, clutch disc, and pressure plate are disconnected and drive force is cut off.

In the push-type clutch, the point where force operates is located at the end of each diaphragm spring finger, and the pressure plate is pressed against the clutch disc at these points. When cutting off the transmission of power, the diaphragm spring is deformed, with the inner side of the spring finger ends being the force points (based on the lever principle). This separates the pressure plate from the clutch disc.



NC-08291

(a) Operating cylinder
(b) Release lever
(c) Release bearing
(d) Clutch cover
(e) Clutch disc
(f) Transmission main shaft
(g) Ball bearing
(h) Flywheel

Starter interlock control

Starter interlock control is adopted for vehicles equipped with the TY75 manual transmission.

In this system, a clutch start switch is provided between the starter switch (models without keyless access & push button start system) or keyless access control module (models with keyless access & push button start system) and the starter relay circuit in order to prohibit starter operation when the clutch pedal is not depressed.

Even if engine start is operated while the clutch pedal is not depressed (clutch start switch OFF), the starter does not operate because the starter relay is not ON.

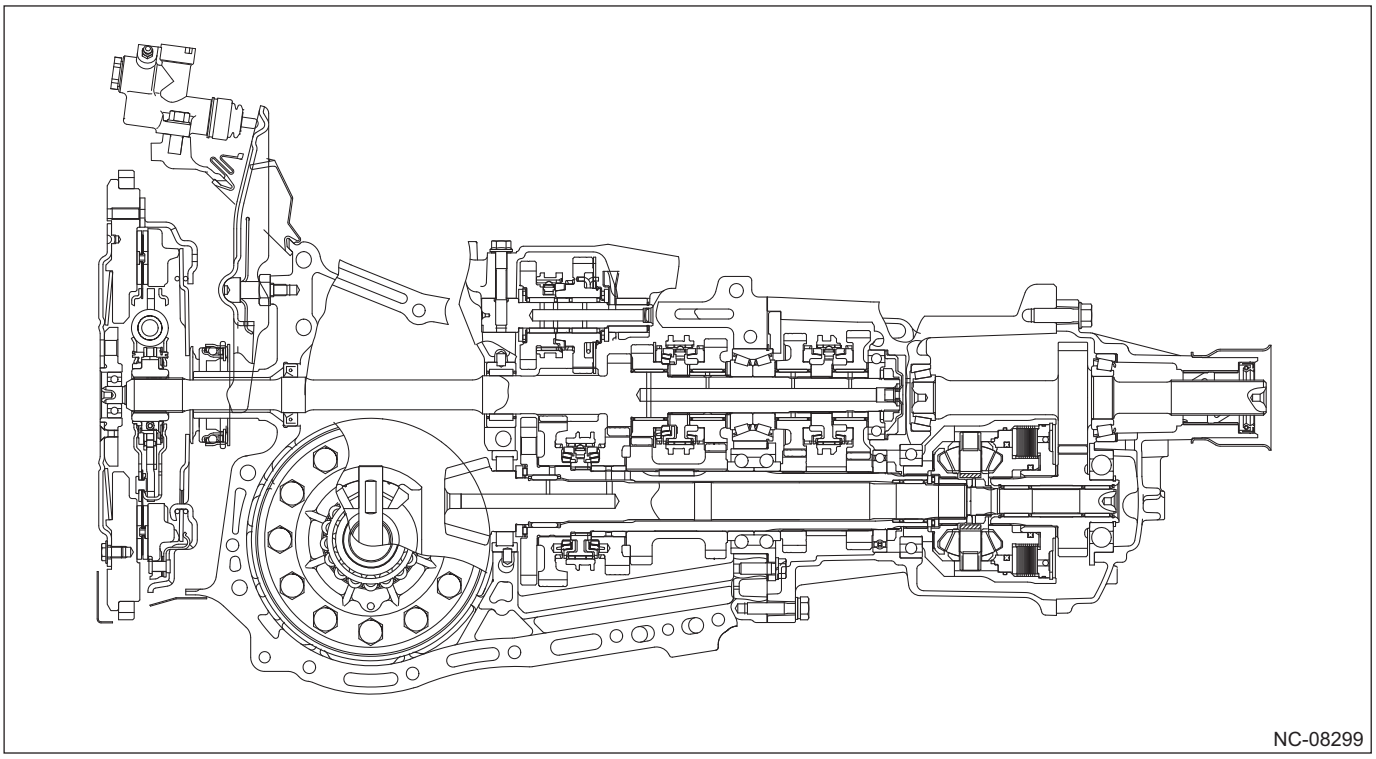
When engine start is operated while the clutch pedal is depressed (clutch start switch ON), the starter relay turns ON and the starter operates.

3.4 TY75 Manual Transmission & Center Differential

3.4.1 Overview

Overview

- A TY75 6-speed manual transmission assembly is adopted.
- The TY75 6-speed manual transmission is composed of 6 forward gears and 1 reverse gear, and all gears are equipped with a inertia lock-type synchronizer.
- The gear ratio settings were optimized for the vehicle weight in order to achieve both acceleration performance and fuel efficiency.
- The drive system utilizes a full-time 4WD system with a design that integrates the transfer gear assembly including the center differential assembly, front differential, and center differential into a single module.
- The transmission and differential are contained in an aluminum case that is split into a left and right part, and also serve as the clutch housing. The rear includes a transfer case and extension case which are joined together, and these cases include part of other transmission assembly as well as the transfer gear and center differential.
- The center differential is composed of the bevel gear set and the viscous coupling located behind it. It absorbs speed differences between the front axle and rear axle. Together with 1 set of transfer gears, it transmits drive force from the transmission to the drive pinion shaft and propeller shaft.
- The viscous coupling functions as an element for differential limiting.
- A helical gear is used in the transmission gears. The reverse gear reverses the direction of rotation from the main shaft reverse drive via the reverse idler gear.
- A vibration damping sheet is applied to the transfer cover, reducing vibration and noise. (for some grades)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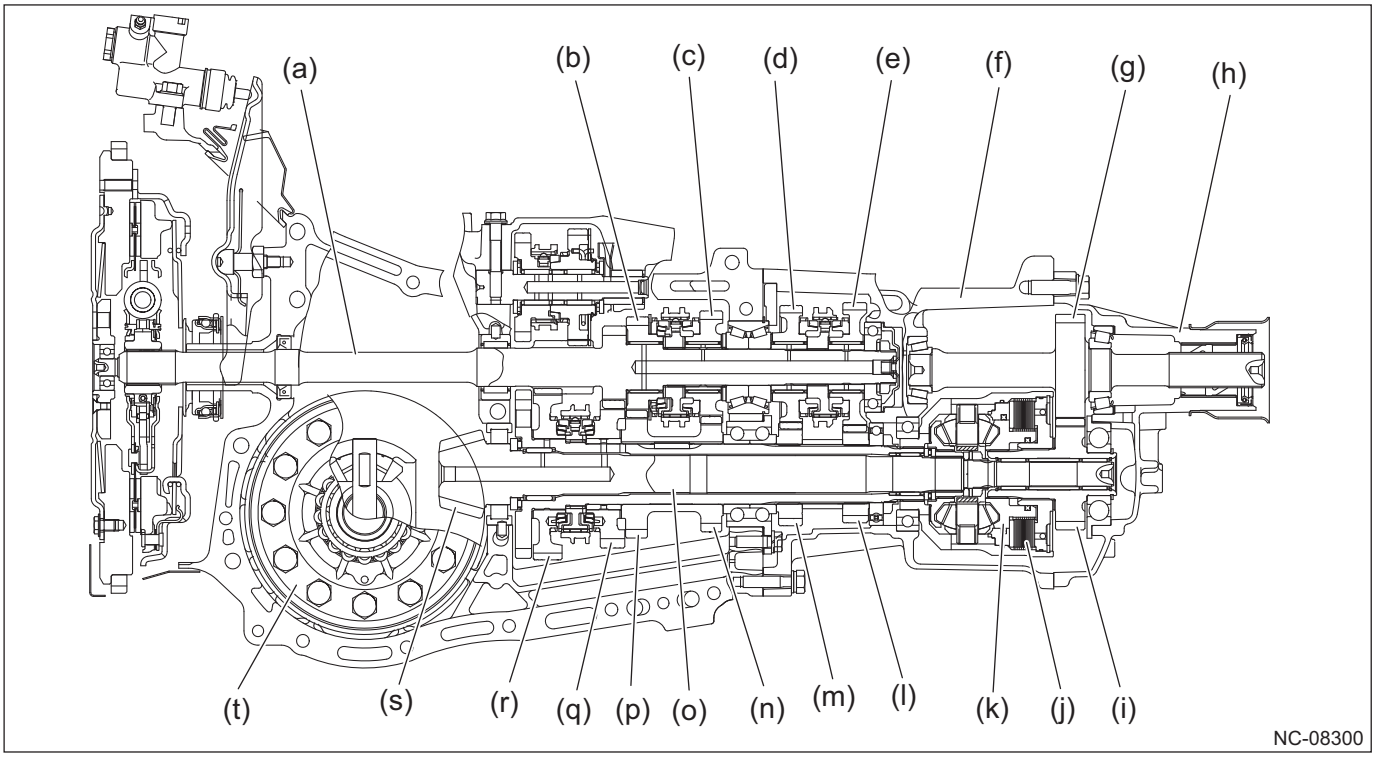
Specifications

Transmission specifications

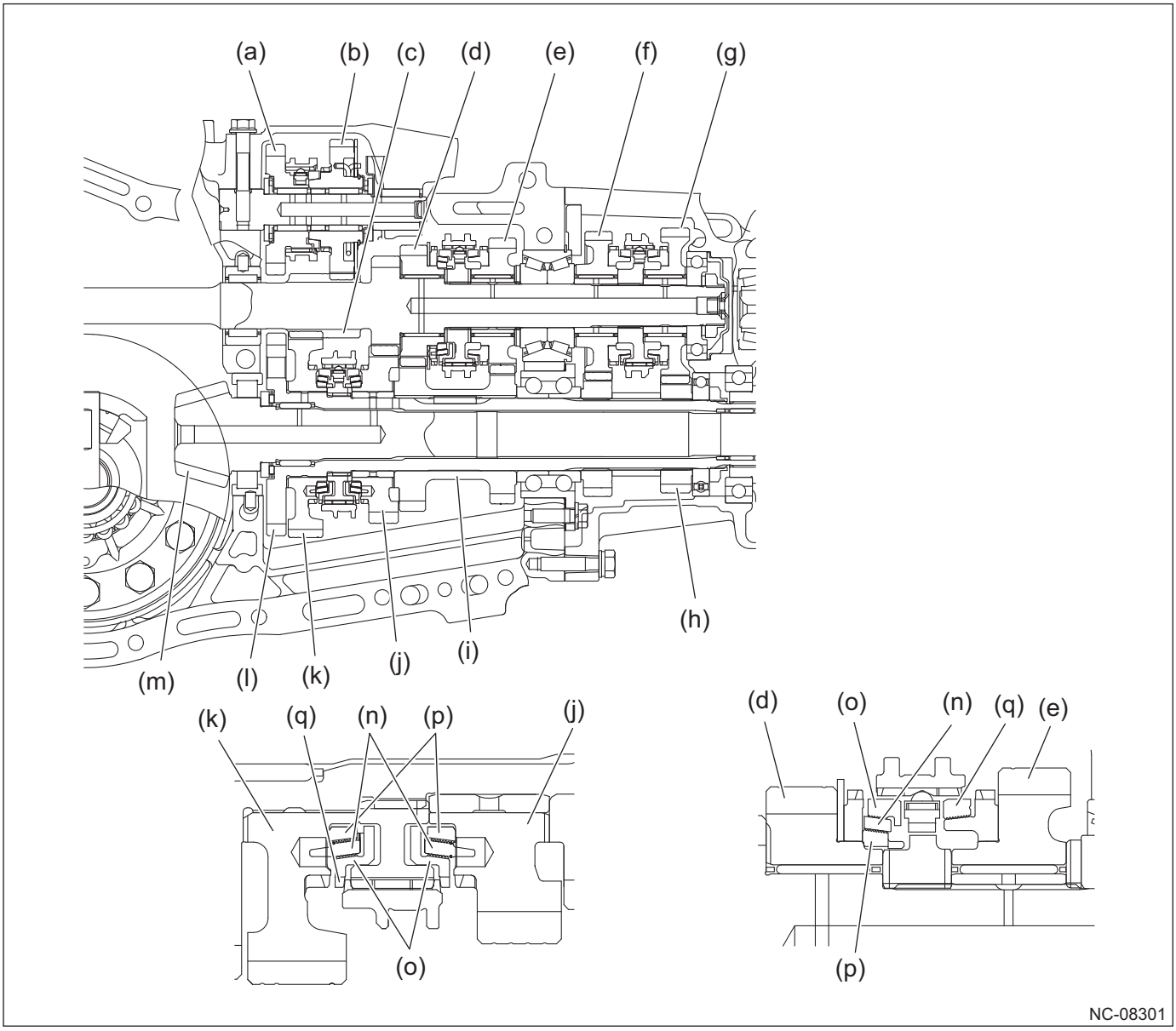
Engine type	FA24
Transmission type	TY75
Driving method	4WD (4 wheel drive)
Type	Forward: Always engaged type Reverse: Always engaged type (with scissors gear)
1st	3.455
2nd	1.947
3rd	1.367
4th	1.029
5th	0.825
6th	0.667
Reverse	3.636
Final	4.111
Name of oil used	SUBARU GEAR OIL EXTRA MT
Oil capacity (US qt (liters, Imp qt))	0.872 (3.3, 2.904)

3.4.2 Component

Component layout drawing



(a) Main shaft
(b) 3rd drive gear
(c) 4th drive gear
(d) 5th drive gear
(e) 6th drive gear
(f) Transfer case
(g) Transfer driven gear
(h) Extension case
(i) Transfer drive gear
(j) Viscous coupling
(k) Center differential assembly
(l) 6th driven gear
(m) 5th driven gear
(n) 4th driven gear
(o) Driven shaft (counter shaft)
(p) 3rd driven gear
(q) 2nd driven gear
(r) 1st driven gear
(s) Drive pinion shaft
(t) Front differential assembly



(a) Reverse idler gear No. 2
(b) Reverse idler gear
(c) Reverse drive gear
(d) 3rd drive gear
(e) 4th drive gear
(f) 5th drive gear
(g) 6th drive gear
(h) 6th driven gear
(i) 3rd-4th driven gear
(j) 2nd driven gear
(k) 1st driven gear
(l) Reverse driven gear
(m) Drive pinion shaft
(n) Synchronizer cone
(o) Outer balk ring
(p) Inner balk ring
(q) Balk ring

Component details

Cases

The case shape and rib layout are optimized to ensure high rigidity.

A housing, case, and cover made of cast aluminum are adopted.

Shift and select mechanism

All gears are equipped with a inertia lock-type synchronizer.

The synchromesh mechanism places the 1st gear and 2nd gear on the drive pinion shaft side, and the 3rd through 6th gears on the main shaft side. The reverse idler gear is placed on the reverse idler gear shaft.

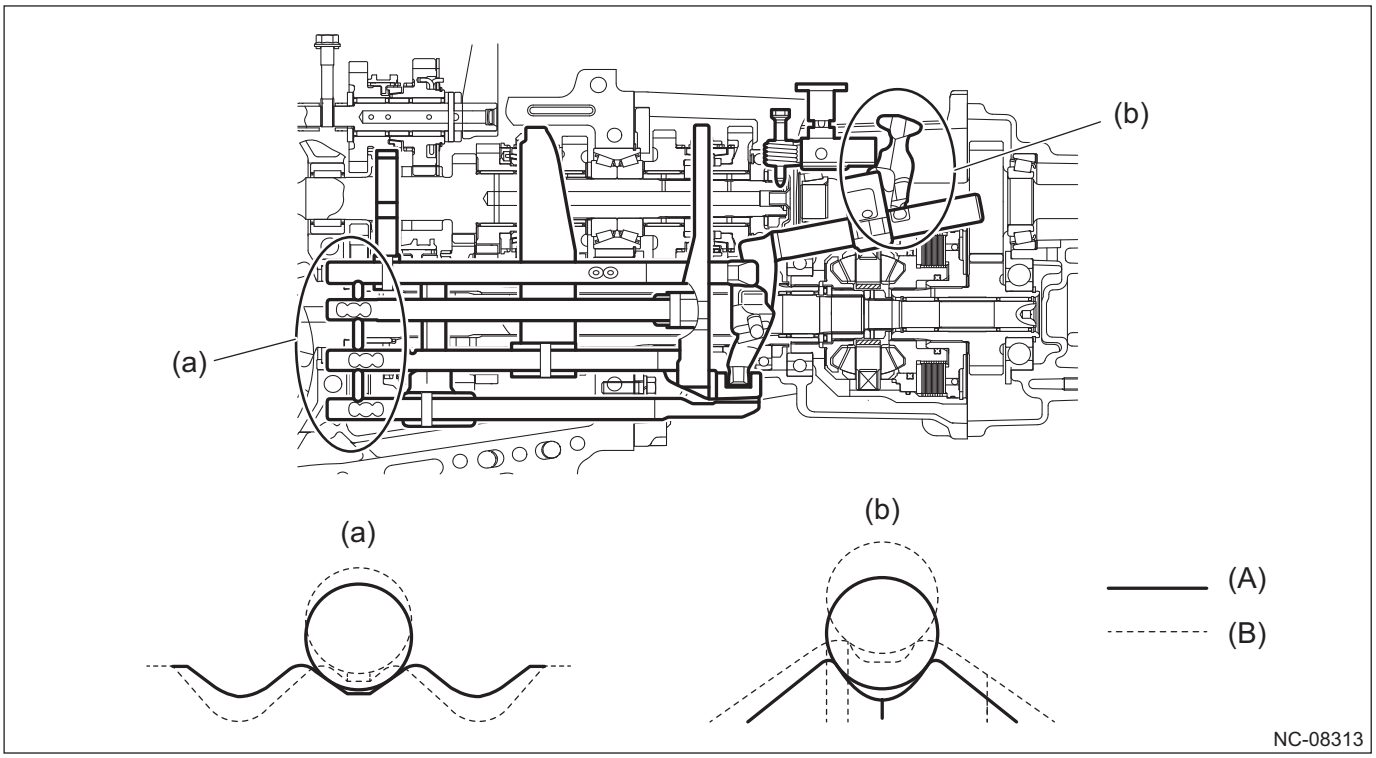
A triple cone synchronizer mechanism is adopted for the 1st gear and 2nd gear.

A double cone synchromesh mechanism is adopted for the 3rd gear.

The shifter fork and fork rod include a detent mechanism with a plunger that contains a ball, and is supported by a slideable ball bearing.

The detent mechanism provides the detent feel which improves the in-position feeling for the driver, and the slideable ball bearing reduces the shift lever operating force.

The fork rod detent shape is optimized, and the shift profile is improved to optimize shift operability including the pulled-in feeling and feeling of fitting in place when shifting is completed.



(A) New model vehicle

(B) Existing model vehicle

(a) Fork rod

(b) Shifter arm

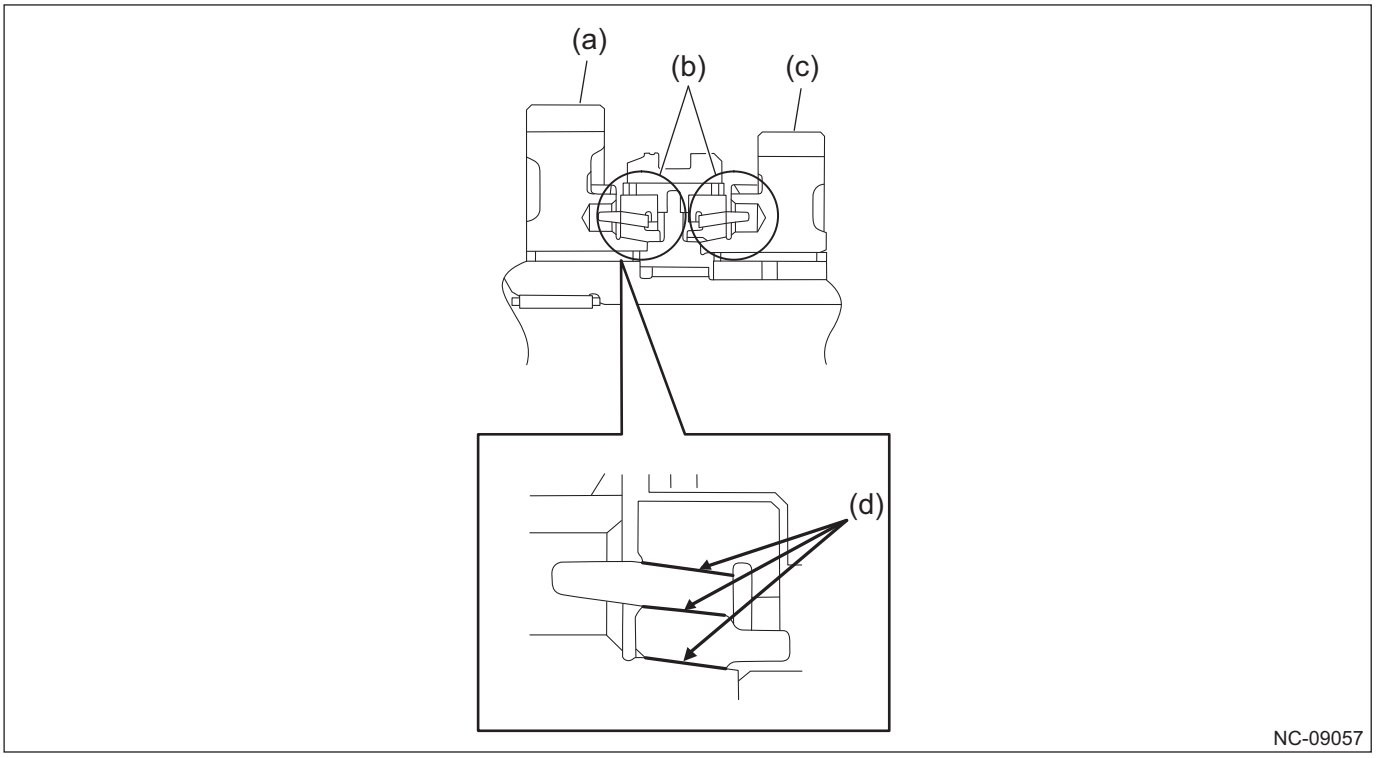
■ Triple cone synchronizer

A triple cone synchronizer mechanism is adopted for the 1st gear and 2nd gear.

The triple cone synchronizer is composed of the outer balk ring, synchronizer cone, inner balk ring, and the 1st and 2nd driven gear cones.

The triple cone synchronizer includes 3 friction interfaces. This means that in addition to the 2 coaxial interfaces located between the synchronizer cone and the inner/outer balk rings (same as the double cone synchronizer), there is a 3rd friction interface between the inner surface of the inner balk ring and the cones on the 1st and 2nd driven gears.

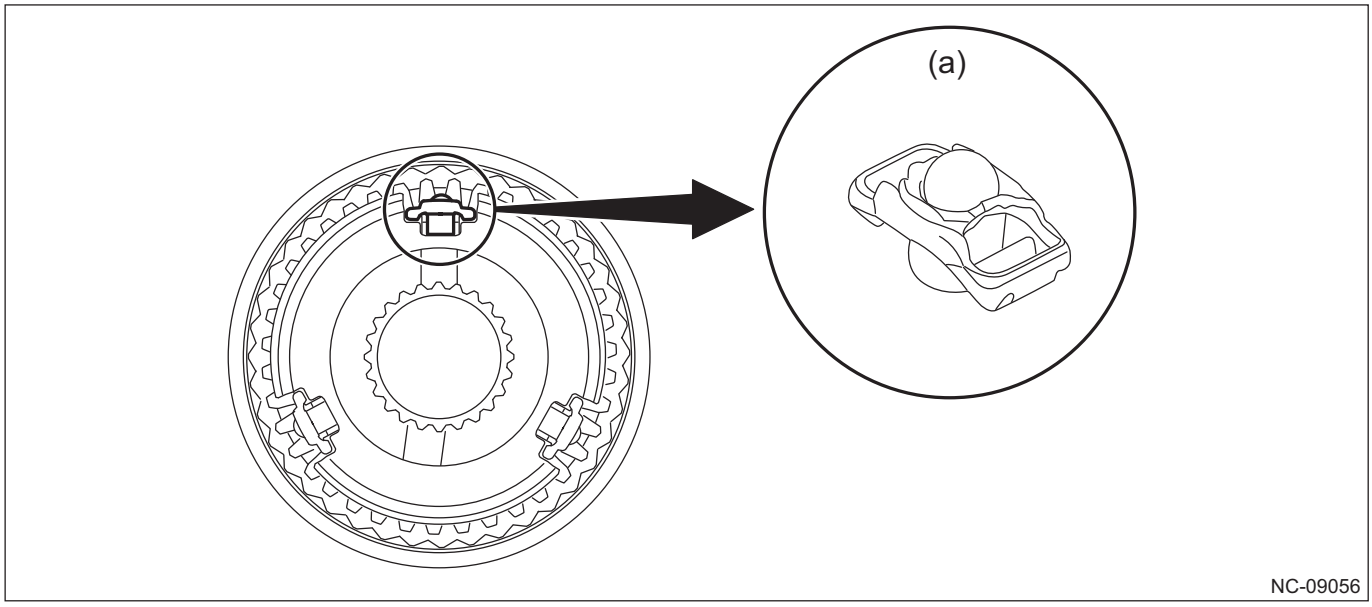
As a result, friction force is higher, and a triple cone type produces greater synchronizing power than a double cone type.



(a) 1st driven gear
(b) Triple cone synchronizer
(c) 2nd driven gear
(d) Cone surface

■ Shorter stroke and reduced operating force

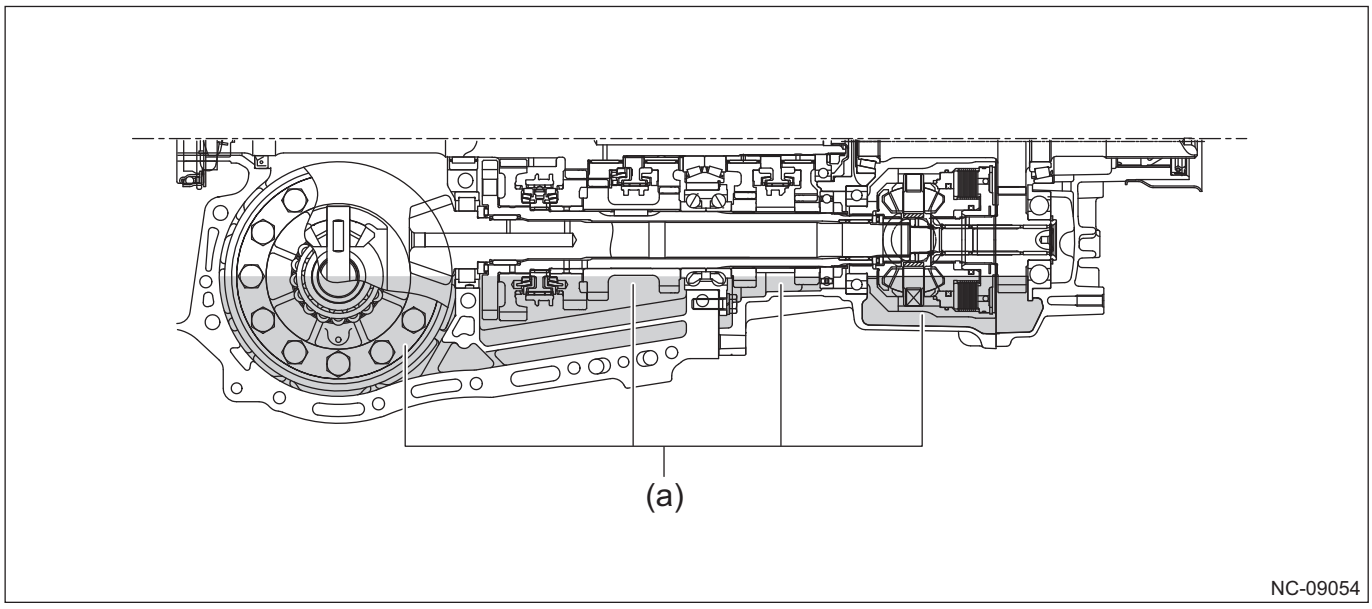
A ball key is adopted to ensure shift operability.



(a) Ball key

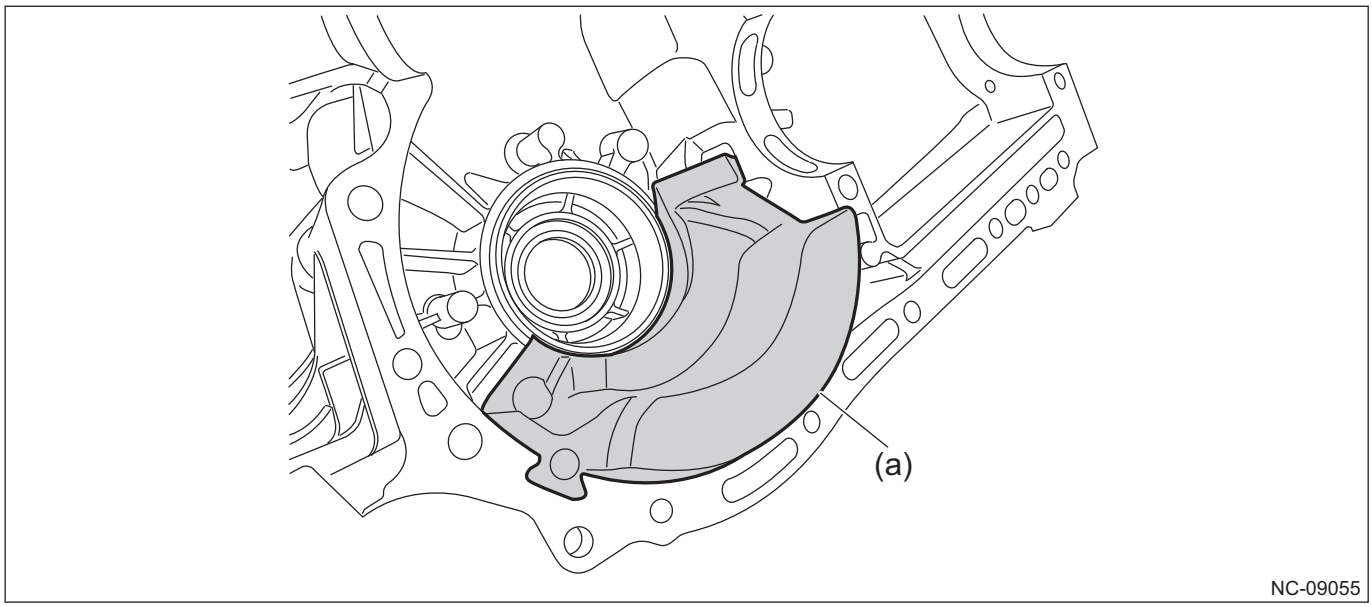
■ Reduced stirring resistance by reducing the oil volume.

Improvements to the lubricant path have optimized the dynamic oil level height at each part, reducing stirring resistance and improving fuel efficiency performance.



(a) Oil volume reduction (optimization of dynamic oil level)

The front differential chamber utilizes a baffle plate that reduces stirring resistance.

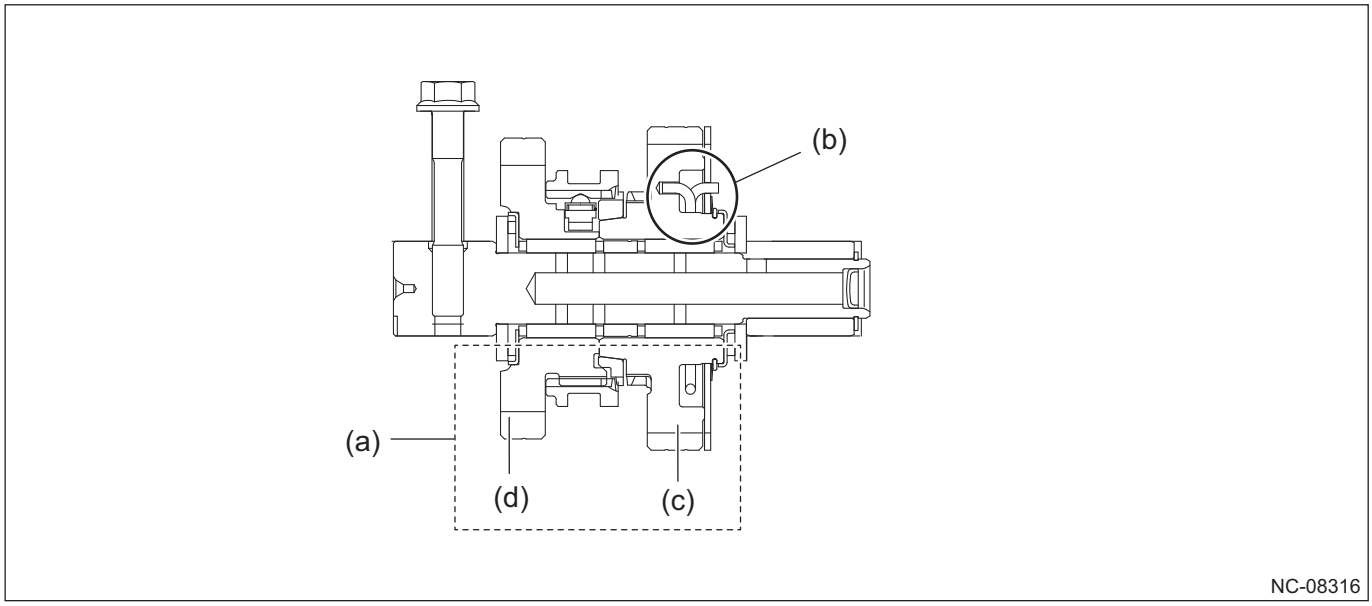


(a) Baffle plate

■ Reverse idler gear

A reverse carbon synchronizer is adopted in order to ensure balk ring strength.

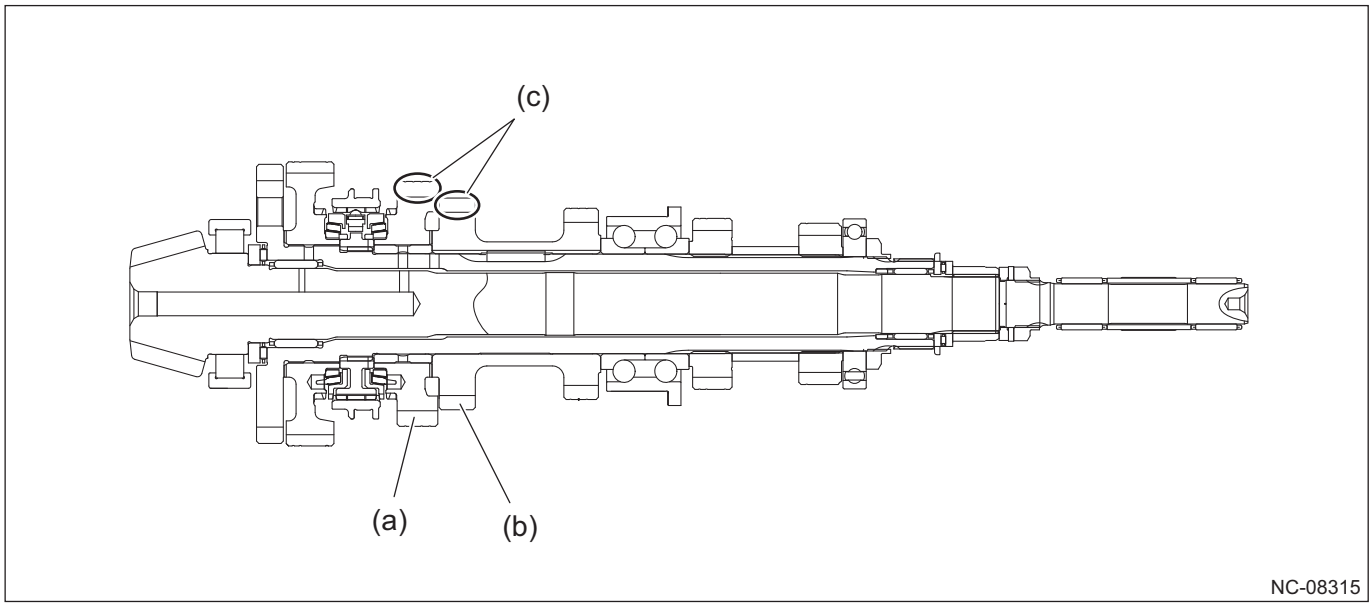
In order to ensure vibration and noise restraining performance, a scissors gear is installed on the reverse idler gear.



(a) Addition of reverse carbon synchronizer
(b) Scissors gear
(c) Reverse idler gear
(d) Reverse idler gear No. 2

■ Gear honing

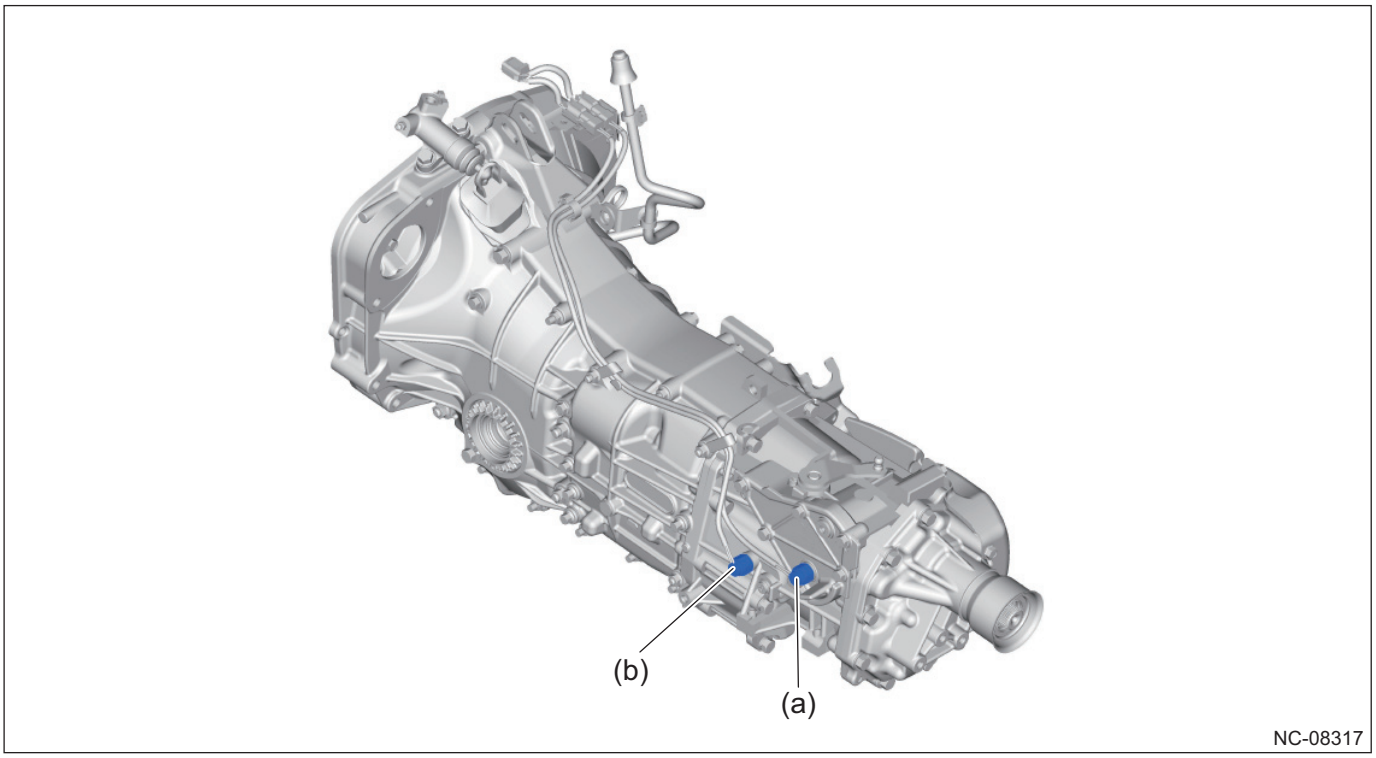
Honing was adopted as the tooth surface finishing for the 2nd driven gear and 3rd driven gear. This creates the optimal gear tooth surface and reduces noise and vibration.



(a) 2nd driven gear
(b) 3rd driven gear
(c) Honing

Switch layout

A neutral position switch and back-up light switch are provided to detect the neutral position and reverse position, respectively.

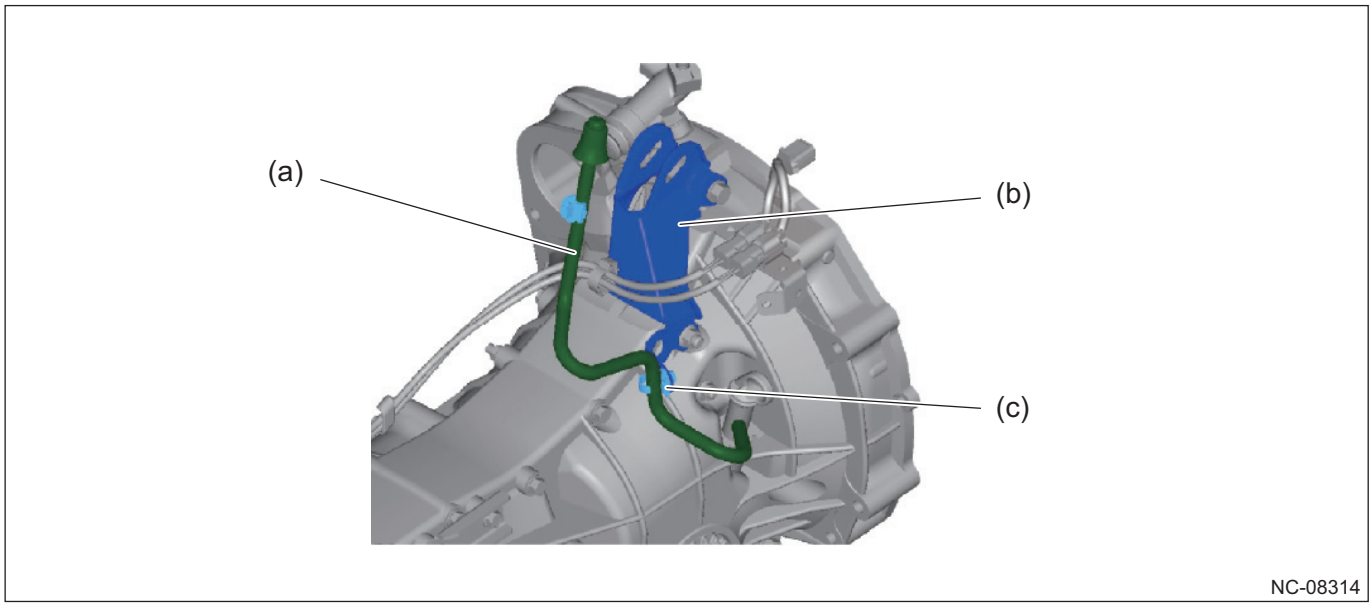


(a) Neutral position switch

(b) Back-up light switch

Air breather hose

In order to prevent water from intruding into the transmission, the air breather hose mounting position was moved to a position higher than the transmission. It is also fastened to the air breather hose bracket and body.

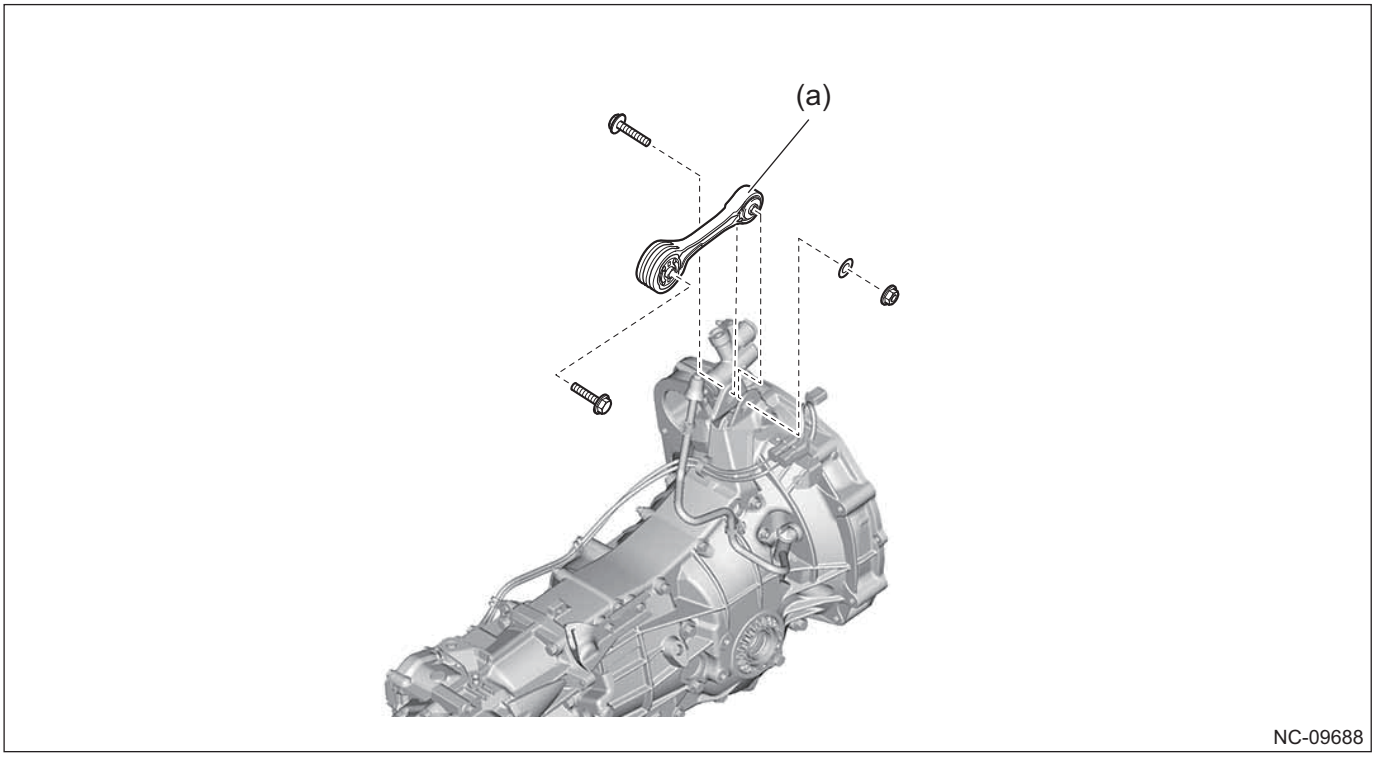


(a) Air breather hose
(b) Pitching stopper bracket
(c) Air breather hose bracket

Transmission mount

■ Front

A pitching stopper type is adopted as the transmission front mount.

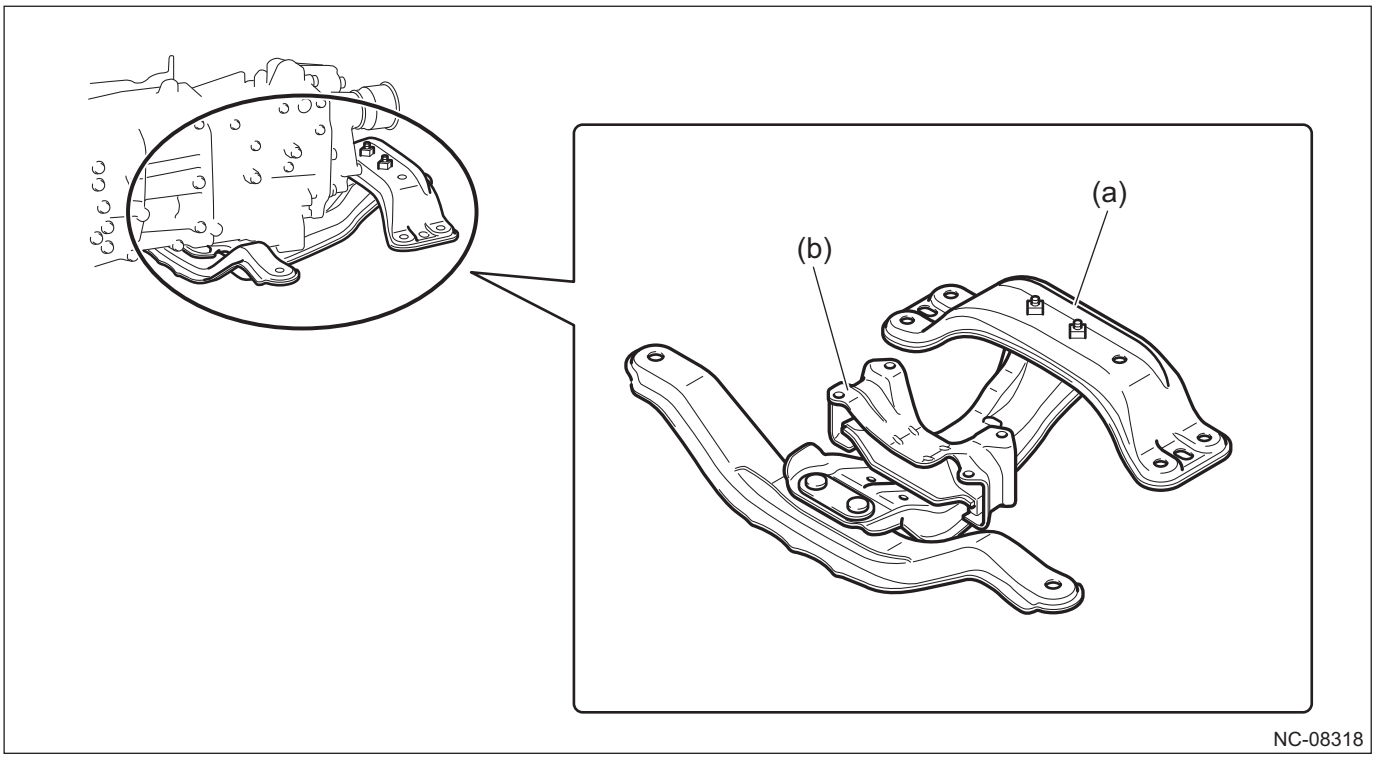


(a) Pitching stopper rod

■ Rear

The shape of the transmission rear cross member is changed to match the body following the adoption of the Subaru Global Platform.

The spring constant of the transmission cushion rubber is raised in order to ensure steering stability.

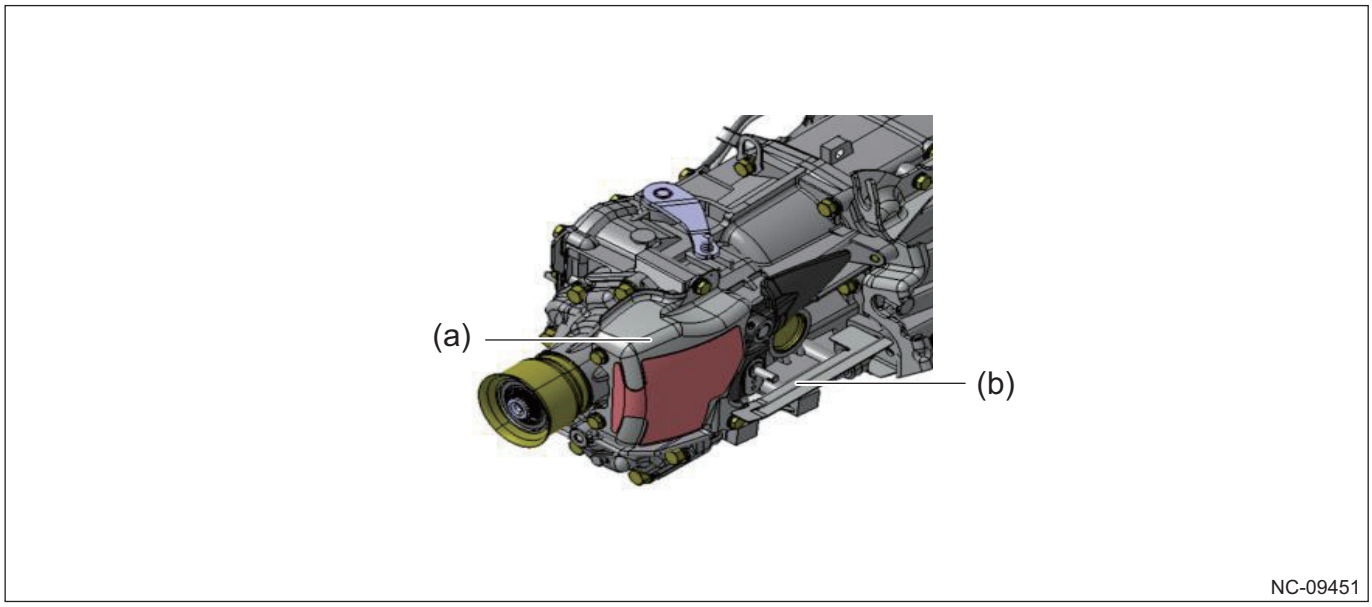


(a) Transmission rear crossmember

(b) Transmission cushion rubber

Transfer cover and dust cover

A cover is added to the transfer case & extension case assembly to protect the shift function when driving on rough roads.

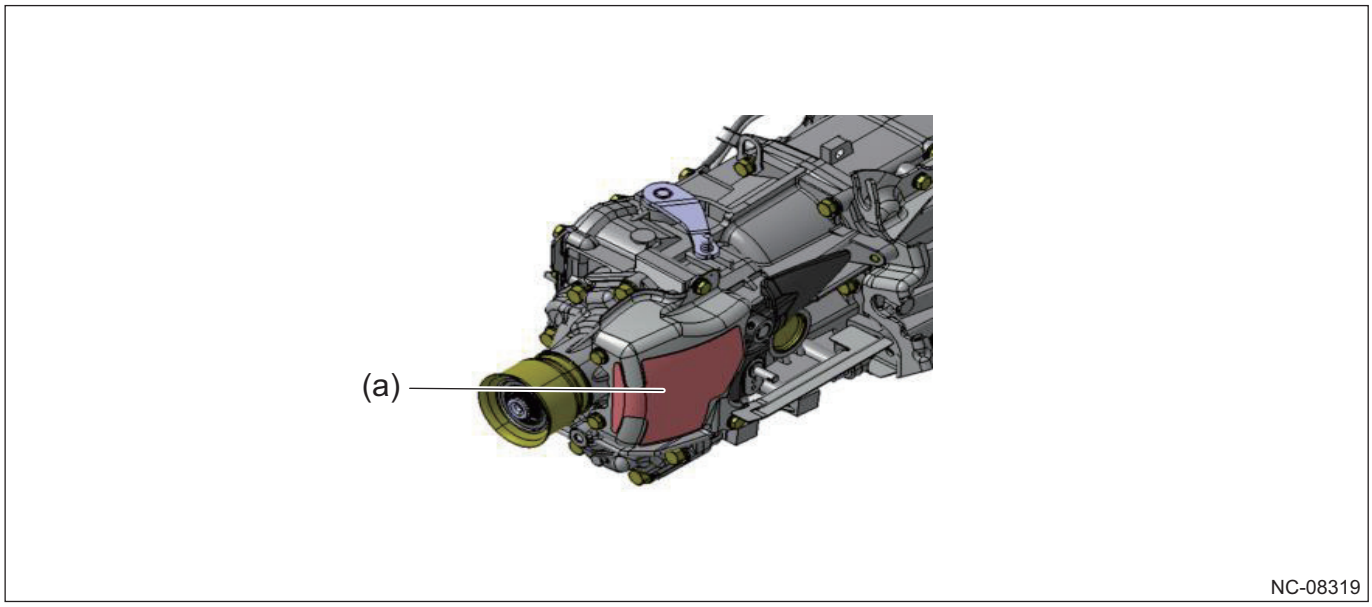


(a) Transfer cover

(b) Dust cover

Damping sheet (for some grades)

Attaching a high-performance damping sheet that has excellent and stable damping effects over a wide temperature range to the transfer cover reduces vibration and noise.



(a) Damping sheet

3.4.3 Construction and Operation

Power transmission mechanism

Gear train

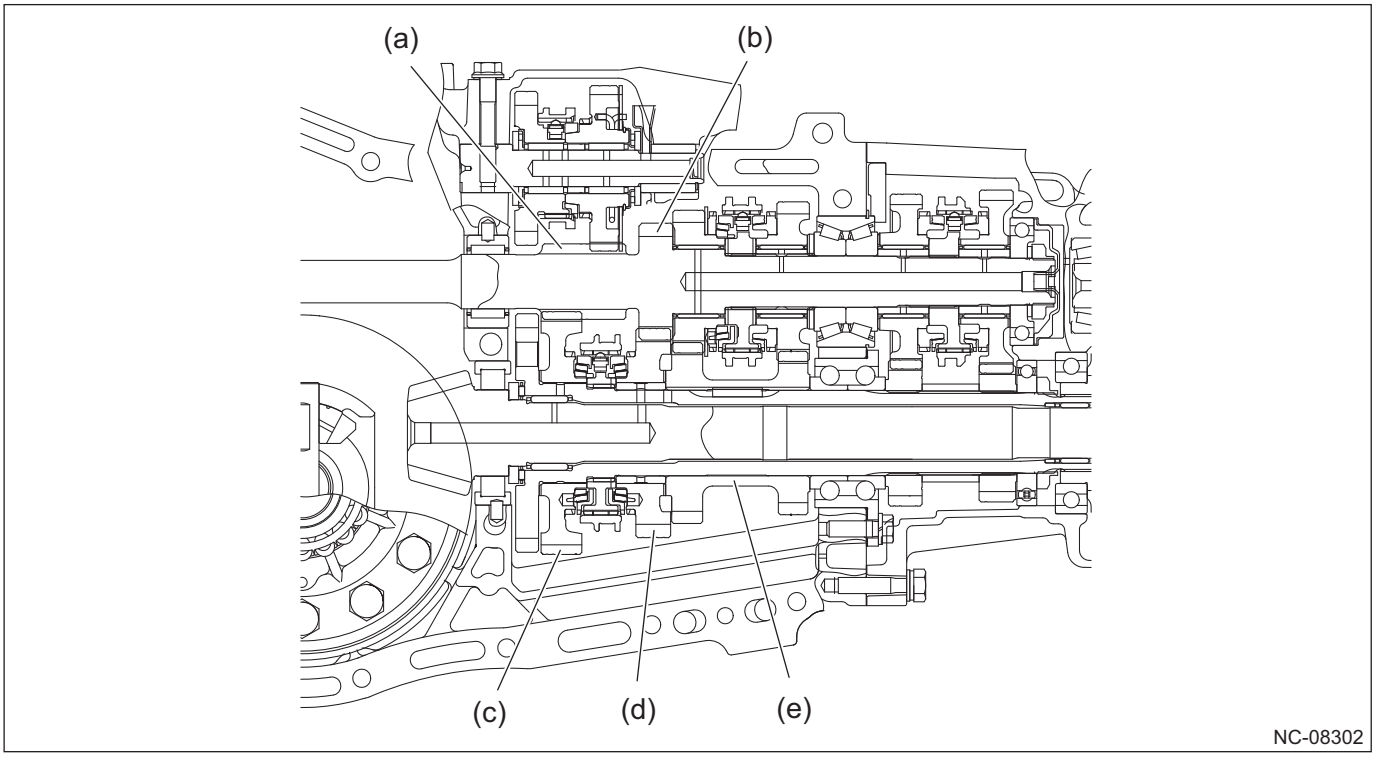
Power from the engine is transmitted from the clutch disc to the transmission main shaft. Therefore the main shaft rotates continuously as long as the clutch is engaged. As described below, rotation of the main shaft during driving is changed to different speeds by the gears and drives the driven shaft. The figure below shows the gear layout. The gears which rotate in the same direction as the main shaft are the 1st gear, 2nd gear, and reverse idler gear.

The 3rd-4th and 5th-6th coupling sleeves also rotate in the same direction as the main shaft. The reverse idler gear is an always engaged type (with scissors gear)

■ Operation

▮ When in neutral

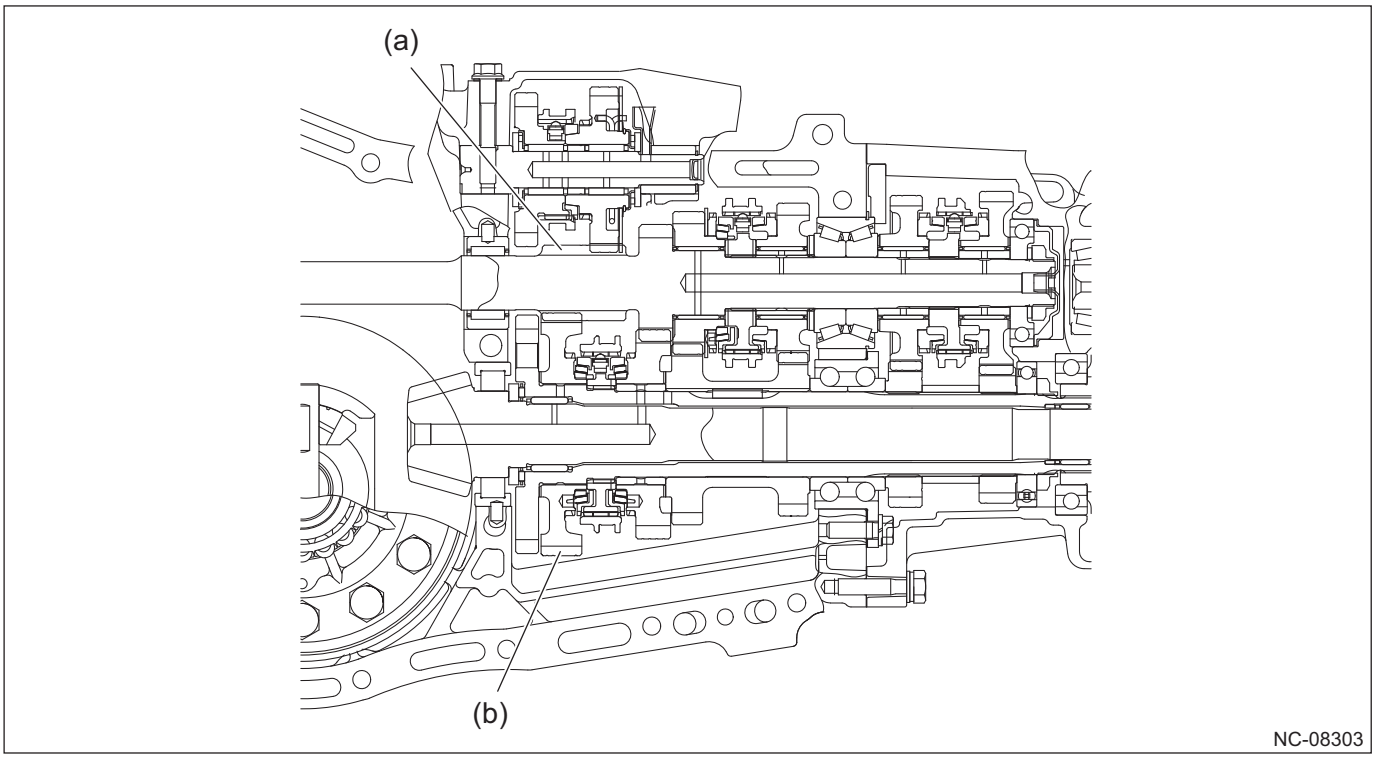
When the clutch engages, the main shaft rotates. Because no gear shift operation has been performed, the driven gear, which is always engaged with the 1st drive gear and 2nd drive gear, rotates freely on the driven shaft. Therefore the driven shaft does not rotate and power is not transmitted. When in neutral, the 1st and 2nd drive gears, driven gear, and reverse idler gear rotate continually.



(a) 1st drive gear
(b) 2nd drive gear
(c) 1st driven gear
(d) 2nd driven gear
(e) 3rd-4th driven gear

When in 1st gear

The power that is input to the main shaft is transmitted from the 1st drive gear to the 1st driven gear, and is transmitted to the driven shaft via the coupling sleeve and synchronizer hub. As described before, it then connects to the center differential and the power is transmitted to the tires via the drive pinion shaft for the front wheels and via the transfer gear for the rear wheels.

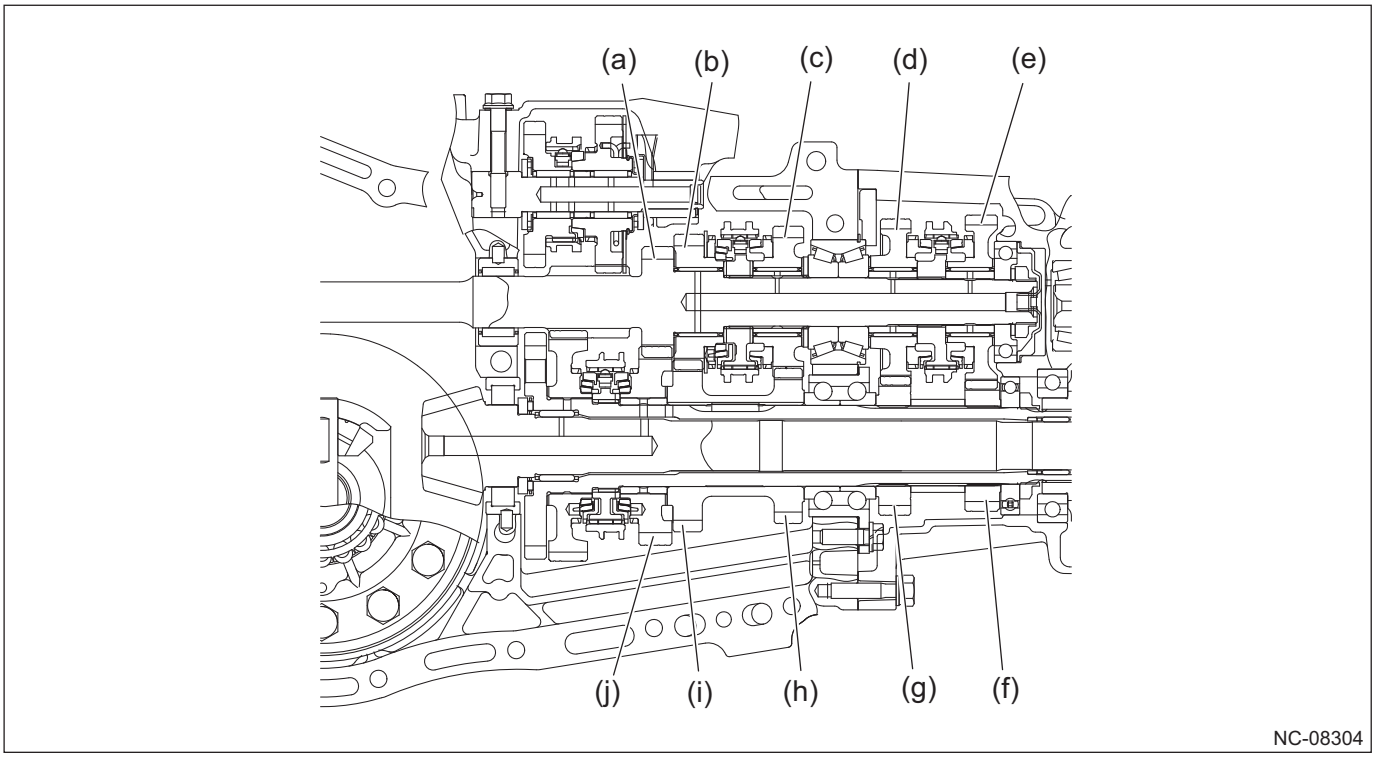


(a) 1st drive gear

(b) 1st driven gear

When in 2nd, 3rd, 4th, 5th, and 6th gears

Power transmission in 2nd gear occurs in the same way as 1st gear. It is transmitted from the 2nd drive gear to the 2nd driven gear, and is transmitted to the driven shaft via the coupling sleeve and synchronizer hub. In 3rd through 6th gears, power is transmitted from the main shaft to the hub and sleeve. In 3rd gear, power is transmitted from the 3rd drive gear to the 3rd driven gear, and is transmitted to the driven shaft. As described before, it then connects to the center differential and the power is transmitted to the tires via the drive pinion shaft for the front wheels and via the transfer gear for the rear wheels.

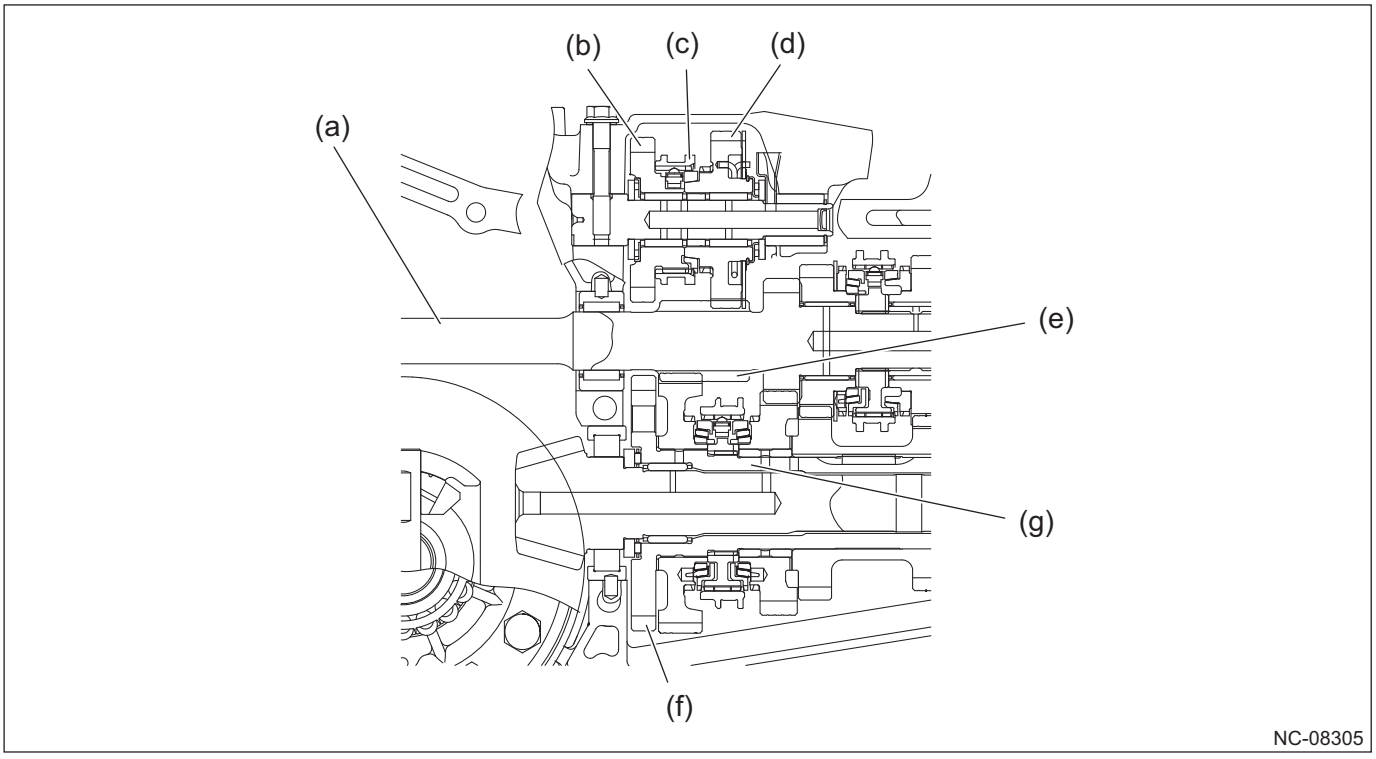


(a) 2nd drive gear
(b) 3rd drive gear
(c) 4th drive gear
(d) 5th drive gear
(e) 6th drive gear
(f) 6th driven gear
(g) 5th driven gear
(h) 4th driven gear
(i) 3rd driven gear
(j) 2nd driven gear

When in reverse

The reverse drive gear is incorporated in the main shaft. The reverse idler gear and reverse idler gear No. 2 are placed on a separate shaft from the main shaft and driven shaft. The reverse drive gear is always engaged with the reverse idler gear, and the reverse driven gear is always engaged with the reverse idler gear No. 2.

When the driver shifts to reverse, the reverse idler gear and reverse idler gear No. 2 rotate synchronized via the reverse sleeve, and power is transmitted to the reverse driven gear. Power is transmitted from the main shaft to the reverse drive gear, reverse idler gear, reverse sleeve, and reverse idler gear No. 2, and is transmitted through the reverse driven gear to rotate the driven shaft in the reverse direction and connects to the center differential.



(a) Main shaft
(b) Reverse idler gear No. 2
(c) Reverse sleeve
(d) Reverse idler gear
(e) Reverse drive gear
(f) Reverse driven gear
(g) Driven shaft

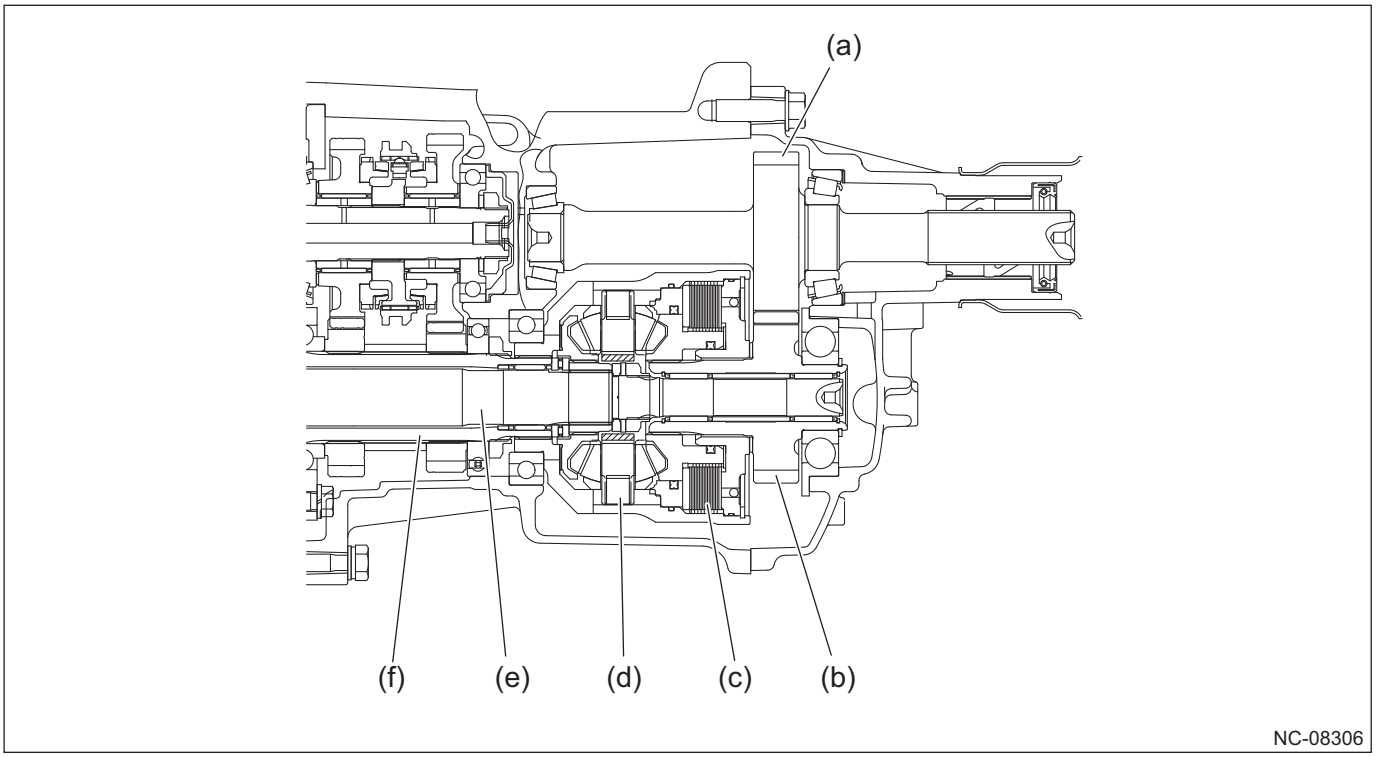
Center differential

The center differential is composed of the bevel gear set and viscous coupling.

The center differential includes a function which distributes engine torque to the front and rear drive shafts, and a function which absorbs differences in rotating speeds between the front wheels and rear wheels.

Engine torque travels from the transmission driven shaft into the center differential case. Next the engine torque passes through the bevel gear set and is distributed to the drive pinion shaft and transfer drive gear. The torque is transmitted from the drive pinion shaft to the front differential, and from the transfer drive gear to the transfer driven gear, propeller shaft, and rear differential.

When the front or rear wheels spin, the viscous coupling limits the differential motion of the bevel gear set, transmitting sufficient torque to the front and rear wheels and ensuring that suitable drive force is delivered.

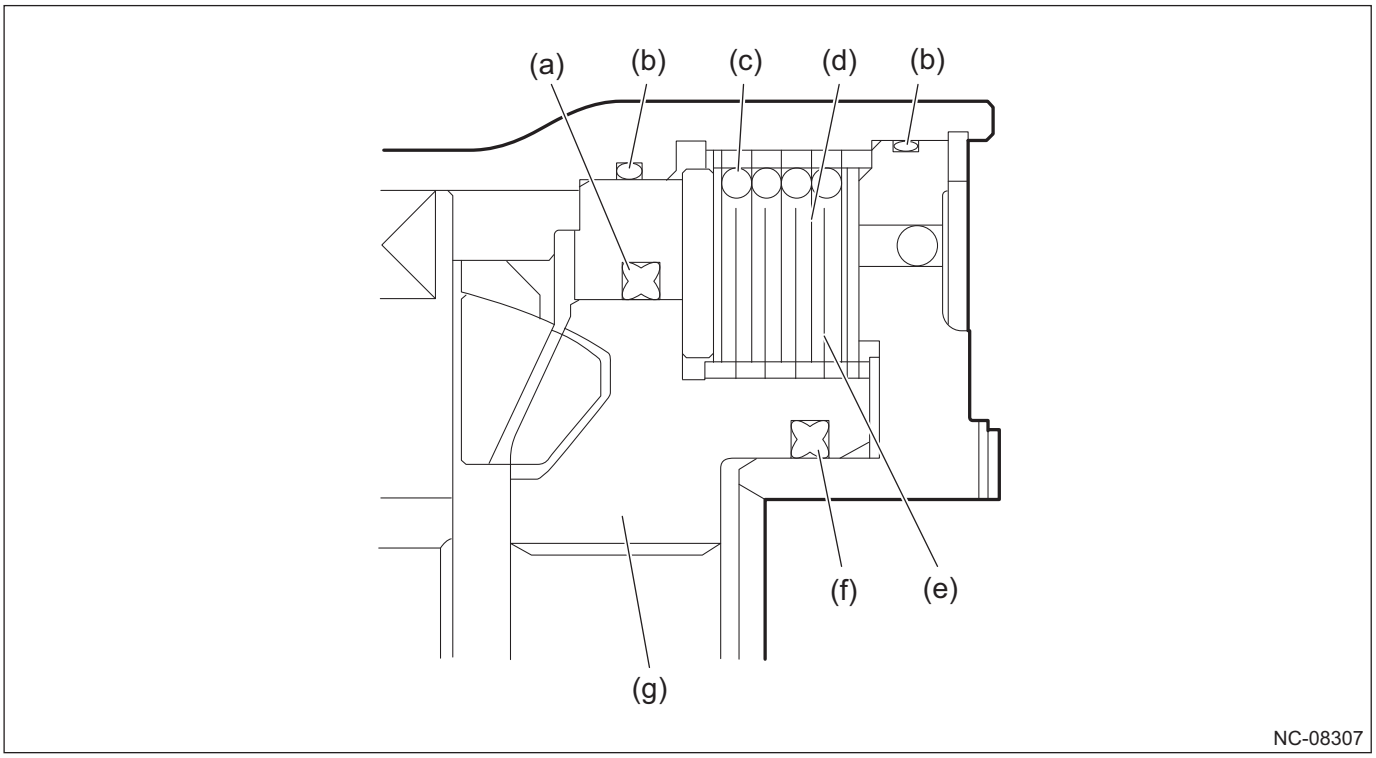


(a) Transfer driven gear
(b) Transfer drive gear
(c) Viscous coupling
(d) Center differential (with viscous coupling)
(e) Drive pinion shaft
(f) Driven shaft

■ Viscous Coupling

The viscous coupling is composed of multiple inner plates and outer plates arranged in alternating sequence, and a mixture of silicon oil and air that is injected into the sealed space formed between the center differential case and differential gear set.

The inner peripheries of the inner plates are spline-connected to the side gear, and the outer peripheries of the outer plates are spline-connected to the center differential case. Spacer rings ensure space between each of the outer plates. Because there are no spacer rings between the inner plates, the inner plates can move slightly in the axial direction. X cross-section rings are used in order to prevent the silicon oil from becoming pressurized and leaking when a large speed difference occurs between the front and rear axles.

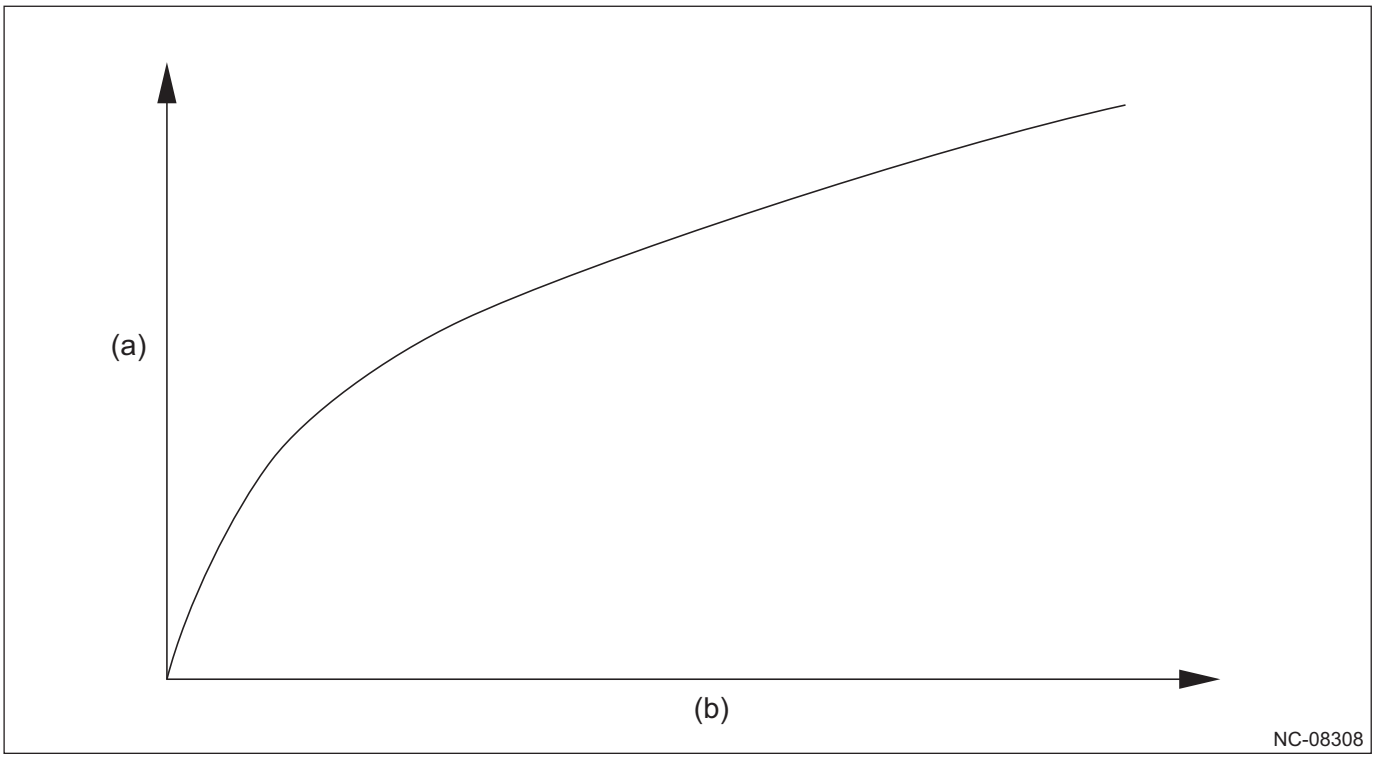


(a) X cross-section ring
(b) O-ring
(c) Spacer ring
(d) Outer plate
(e) Inner plate
(f) X cross-section ring
(g) Side gear (rear)

Torque characteristics

When a speed difference occurs between the center differential case and rear side gear, shear force is generated in the silicon oil between the outer plates and inner plates. At this time, torque is transmitted between the center differential case and rear side gear by the silicon oil.

If the speed difference becomes large, it increases the size of the shear force generated in the silicon oil. The relationship between torque transmission and speed difference is as shown in the graph below. As you can see in this graph, when the speed difference is smaller, torque transmission is also smaller.



(a) Torque transmission (b) Speed difference

Hump phenomenon

If the speed difference continues, the temperature of the silicon oil rises and it expands. This increases the internal pressure of the viscous coupling and presses the inner plates onto the outer plates, generating friction torque between the plates. This phenomenon is called “Hump”.

The internal pressure and temperature drop immediately after hump occurs because the speed difference between the center differential case and rear side gear is eliminated (the differential locks immediately). As a result, the viscous coupling returns to torque transmission operation by ordinary shear force. (The hump phenomenon does not occur during ordinary operating conditions.)

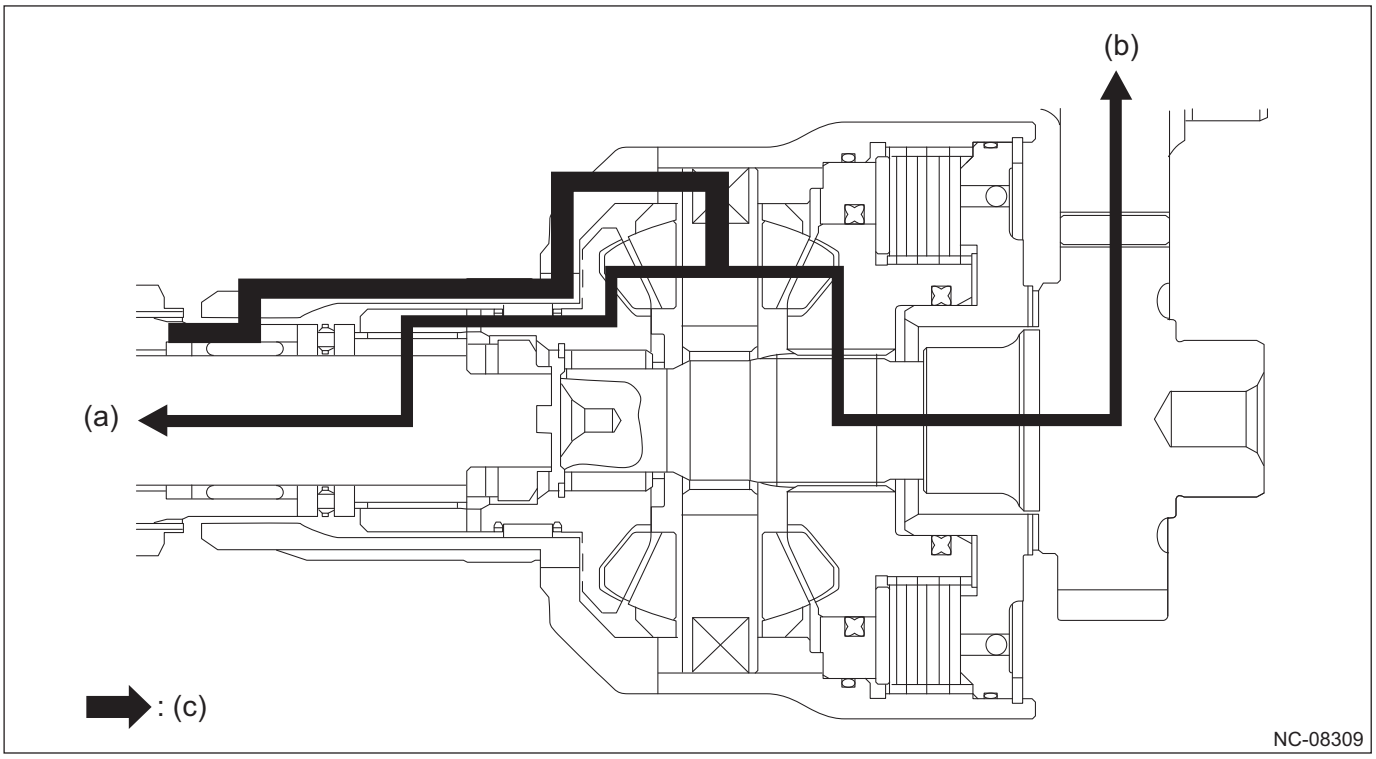
■ Operation

When there is no speed difference between the front and rear wheels, the center differential distributes engine torque in a 50:50 ratio to the front and rear wheels.

When a speed difference occurs between the front and rear wheels, the center differential controls it with the viscous coupling and absorbs the speed difference.

▮ During normal driving

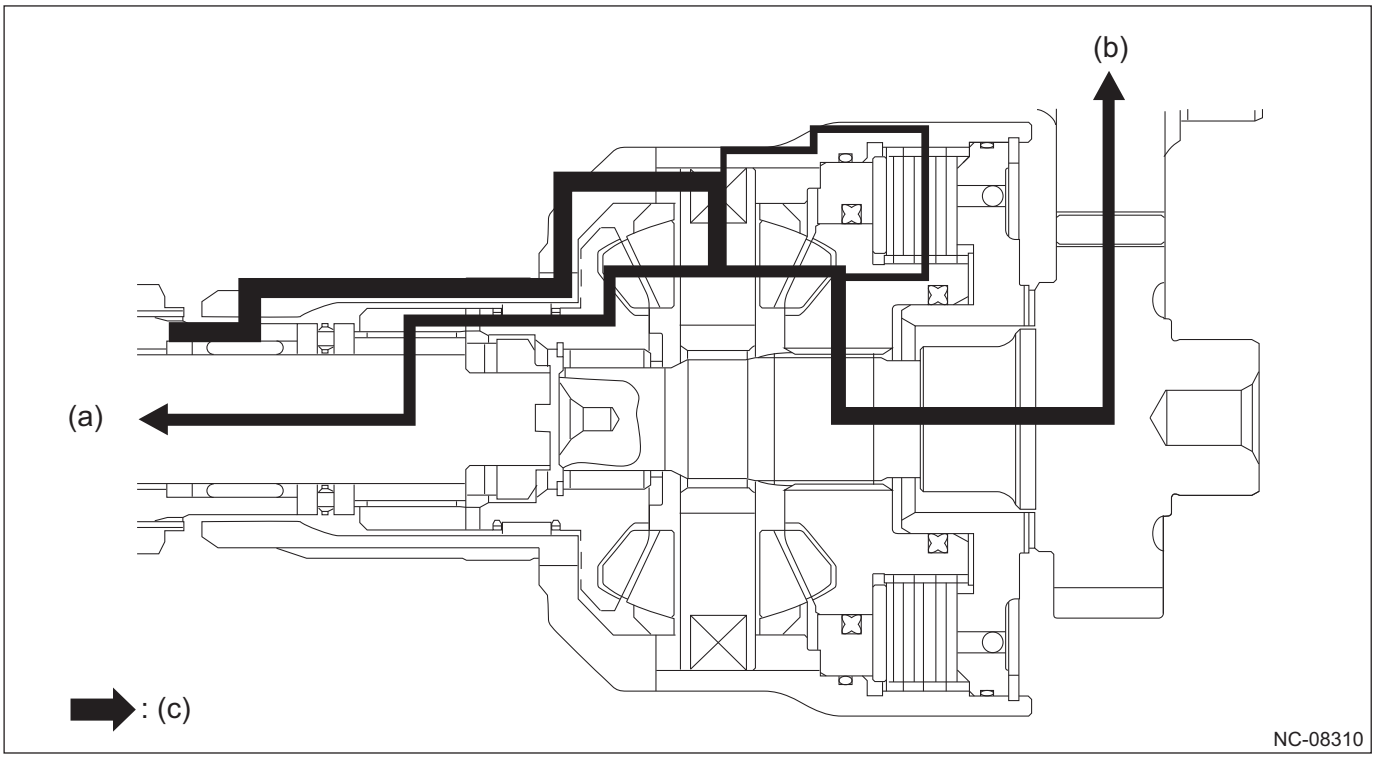
When driving straight at constant vehicle speed on a flat road, all 4 wheels rotate at the same speed. The center differential distributes engine torque equally to the front and rear wheels.



(a) To front differential
(b) To rear differential
(c) Engine torque

When turning at low speed

When turning at low speed, a speed difference occurs not only between the left and right wheels, but also between the front and rear wheels. This means that the front wheels are rotating faster than the rear wheels. At this time, the center differential operates to absorb the speed difference and allow smooth driving. Although the speed difference in this case is small, the function of the viscous coupling transmits more torque to the rear than to the front.

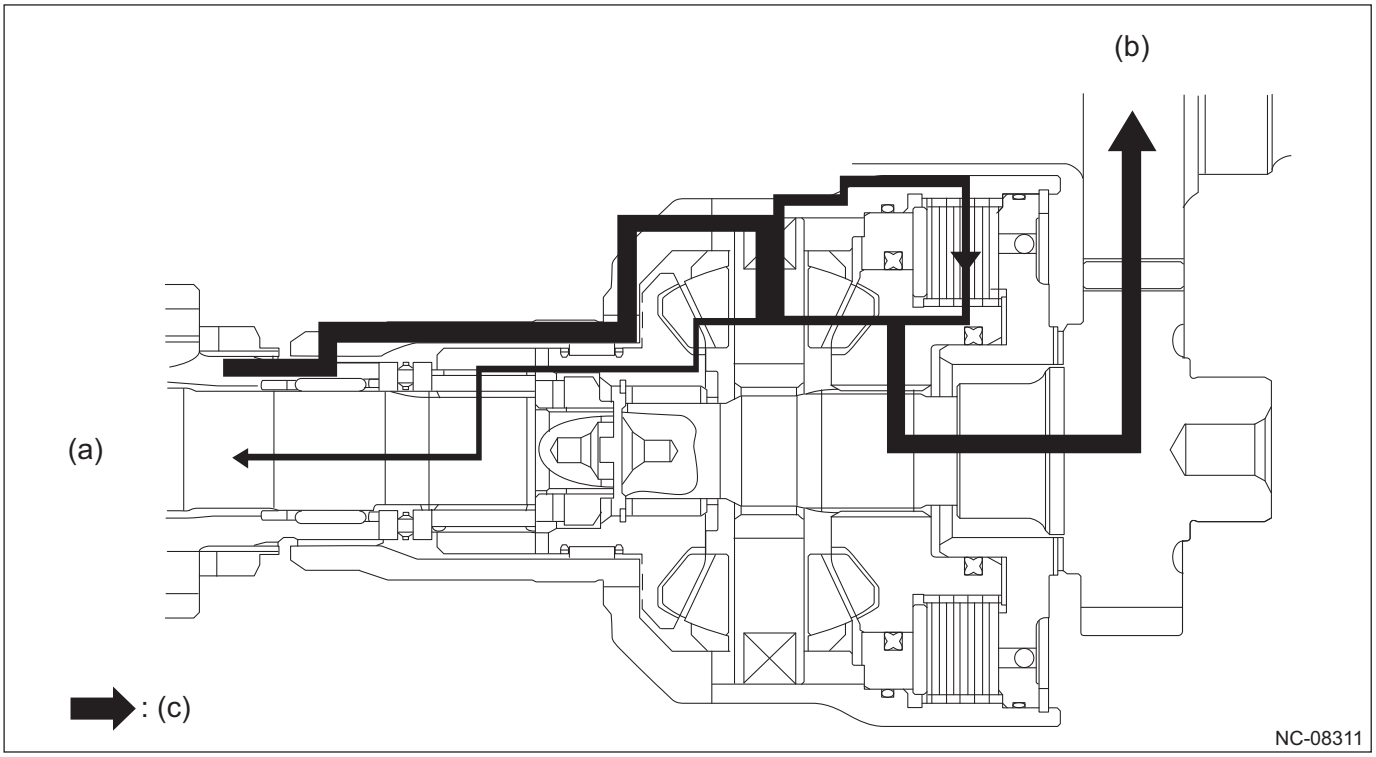


(a) To front differential
(b) To rear differential
(c) Engine torque

▮ Driving on a rough road or slippery road surface

When the front wheels are on a slippery road surface

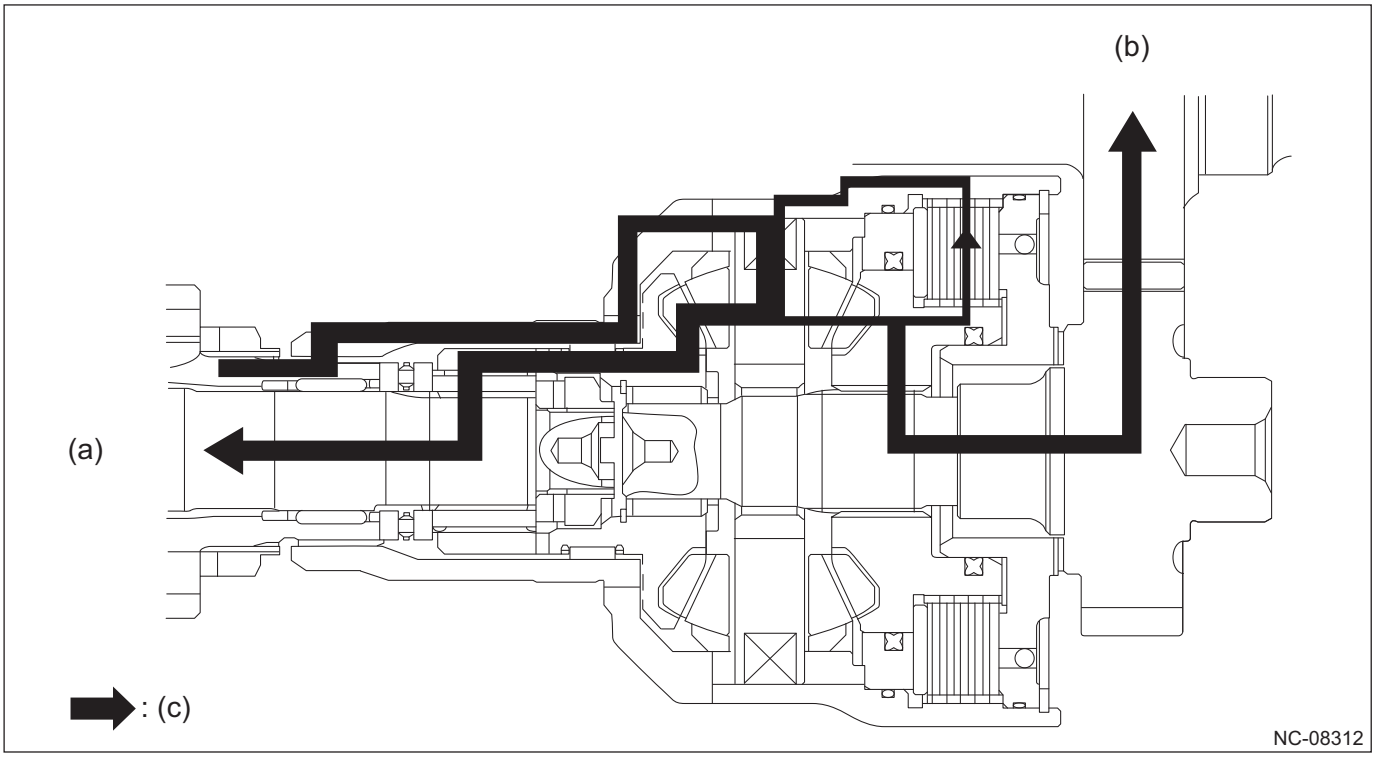
When the front wheels begin to spin, the speed difference between the front and rear drive shafts generates large shear torque. As a result, the torque transmitted to the rear wheels becomes much larger than the torque transmitted to the spinning front wheels. This ensures drive force and driving stability on a rough road or slippery road.



(a) To front differential
(b) To rear differential
(c) Engine torque

When the rear wheels are on a slippery road surface

When the vehicle starts accelerating suddenly from a stop with the rear wheels on a slippery road surface, the rear wheels begin to spin. The resulting speed difference between the front and rear drive shafts generates large shear torque in the opposite direction from when the front wheels are on a slippery road surface. As a result, the torque distributed to the front wheels becomes much larger than the torque distributed to the rear wheels.



(a) To front differential
(b) To rear differential
(c) Engine torque

3.5 TR690 Continuously Variable Transmission (CVT)

3.5.1 Overview

Overview

The vehicle is equipped with the lightweight compact CVT with the advanced environmental performance and vibration and noise restraining performance.

This CVT has the following major characteristics.

- A torque converter with lock-up is adopted to ensure vehicle starting performance by adding a creep phenomenon.
- The expanded ratio coverage and lighter weight of the automatic continuously variable transmission mechanism improves the drive quality as well as the environmental performance. Also, the variator chain pin arrangement pattern and the edge profile are optimized for supreme quietness.
- When switching from forward to reverse, the combination of double-pinion planetary gear and a hydraulic actuation wet type multi-plate clutch increases the drive force when reversing.
- Independent secondary pressure control is adopted to optimize the oil pressure and reduce the pump work, thus improving fuel efficiency.
- Low viscosity CVT fluid is adopted for improved fuel efficiency.
- Adopting fixed gear position control provides a feeling of acceleration that matches the engine and vehicle speeds. Sporty shift control is achieved through blipping control when down-shifting and by other engine cooperative control.
- An 8-speed manual mode is adopted to enable selection of the optimal gear ratio.
- VTD-AWD (electronic control AWD with uneven and variable torque distribution) is adopted for the AWD system.
- SI-DRIVE is adopted. (for some grades)
- Drive mode is adopted. (for some grades)

Specifications

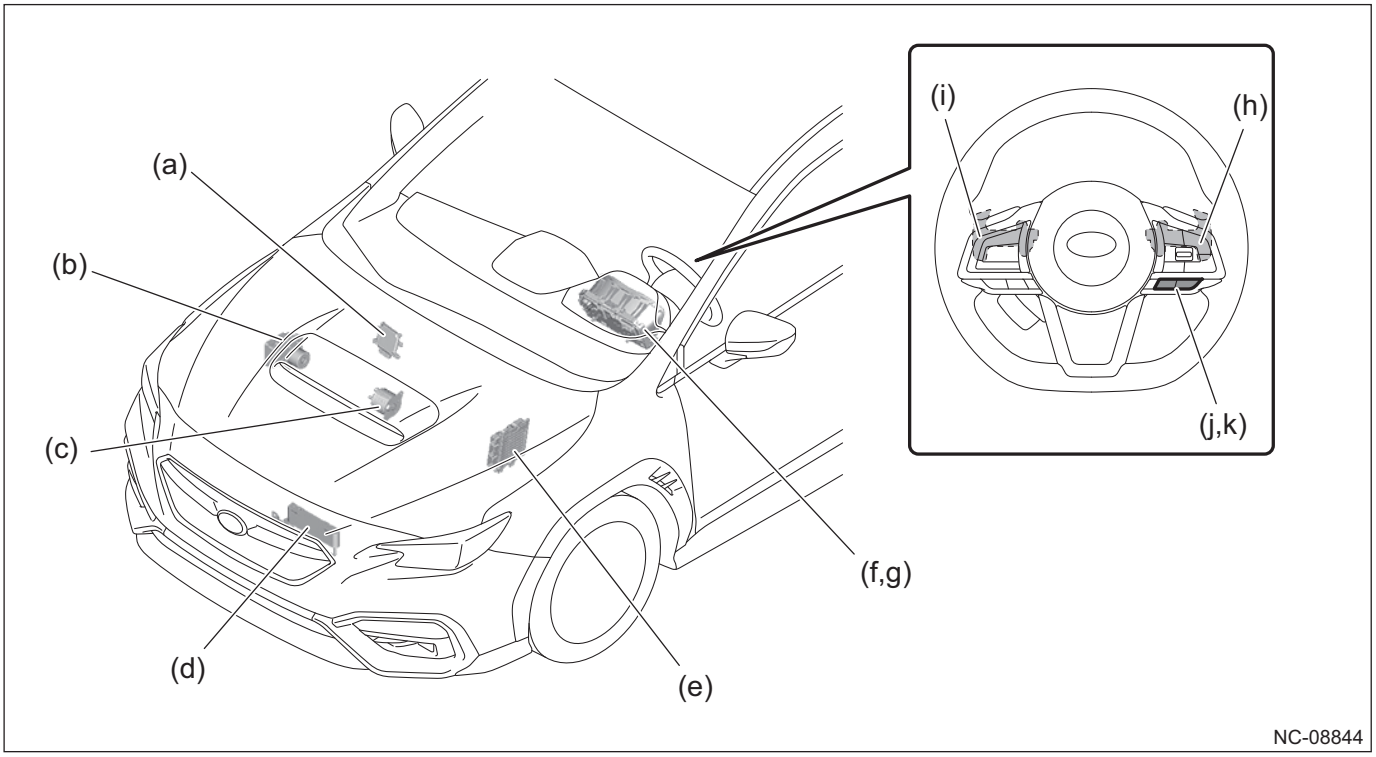
Continuously variable transmission

Driving method		AWD
Transmission type		TR690
Torque converter type		With 3-element, single stage, 2-phase lock-up mechanism
Main gear ratio	Low	3.490
	OD	0.506
	REV	3.394
Pulley specification	Pulley ratio (Low)	2.628
	Pulley ratio (OD)	0.381
	Ratio coverage	6.901
Gear ratio	Primary reduction gear	1.000
	Secondary reduction gear	1.229
	TRF gear	1.081
	Front final gear	4.111
	REV gear	0.972
Forward/reverse switching element	Forward	Wet type multi-plate clutch: 1 set
	Reverse	Wet type multi-plate brake: 1 set
AWD mechanism		VTD-AWD (electronic control AWD with uneven and variable torque distribution)
Torque converter	Nominal diameter (in (mm))	φ9.69 (246)
	Stall torque ratio	2.04
	Stall speed (r/min)	2010 to 2510
CVTF	Name	Subaru High Torque CVT Fluid LV
	Oil amount (US qt (liter, Imp qt))	With air-cooled cooler: 12.9 (12.2, 10.7) Without air-cooled cooler: 12.6 (11.9, 10.5)
Front differential gear oil	Name	SUBARU GEAR OIL EXTRA MT
	Oil amount (US qt (liter, Imp qt))	1.3 (1.2, 1.1)

3.5.2 Component

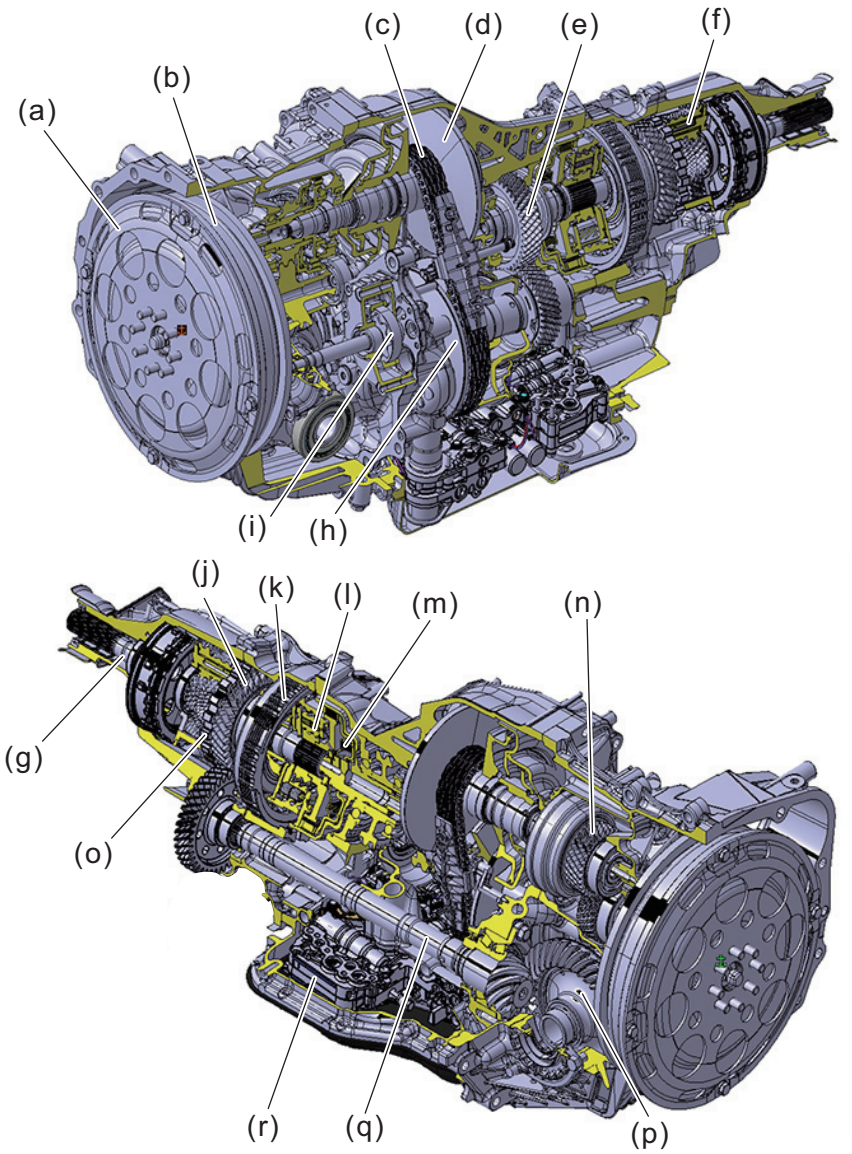
Component layout drawing

CVT control-related devices



(a) TCM
(b) VDC CM & H/M
(c) CVTF cooler (with warmer feature)
(d) CVTF cooler (air cooler)
(e) Engine control module (ECM)
(f) Combination meter
(g) Multi information display
(h) Paddle shift switch (+)
(i) Paddle shift switch (-)
(j) SI-DRIVE switch (for some grades)
(k) Drive mode switch (for some grades)

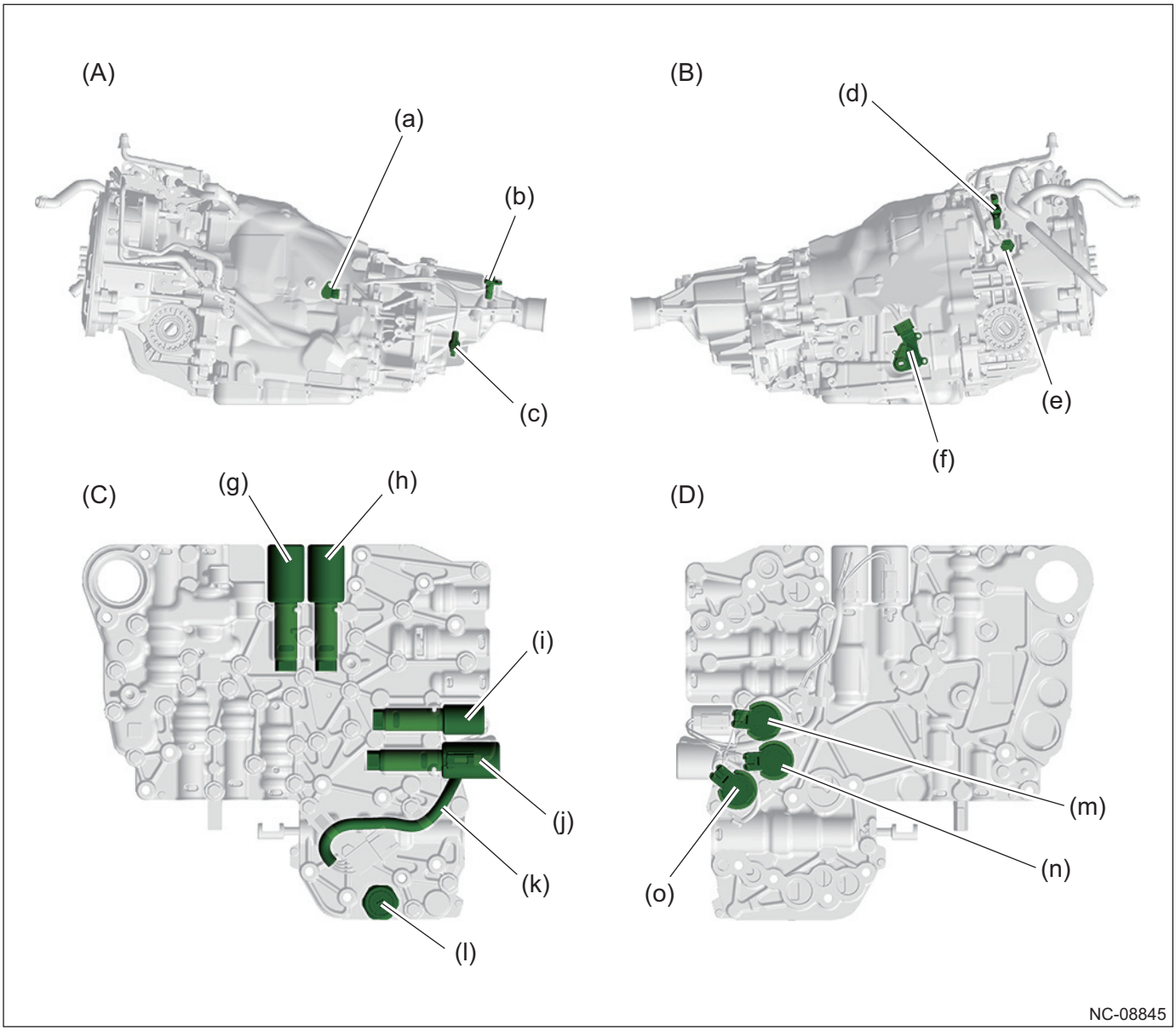
CVT gear train



NC-09704

(a) Drive plate
(b) Torque converter
(c) Variator chain
(d) Primary pulley
(e) Secondary reduction gear
(f) Center differential
(g) Rear drive shaft
(h) Secondary pulley
(i) Oil pump
(j) Transfer gear
(k) Reverse brake
(l) Planetary gear
(m) Forward clutch
(n) Primary reduction gear
(o) Parking gear
(p) Front differential
(q) Drive pinion shaft
(r) Control valve

CVT electronic control devices



(A) Transmission left side
(B) Transmission right side

(a) Secondary speed sensor
(b) Rear wheel speed sensor
(c) Front wheel speed sensor
(d) Primary speed sensor
(e) Secondary pressure sensor
(f) Inhibitor switch
(g) Line pressure solenoid
(h) Secondary solenoid

(C) Control valve lower side
(D) Control valve upper side

(i) F&R solenoid
(j) AWD solenoid
(k) CVTF temperature sensor
(l) Line pressure sensor
(m) Primary UP solenoid
(n) Primary DOWN solenoid
(o) Lock-up duty solenoid

Component details

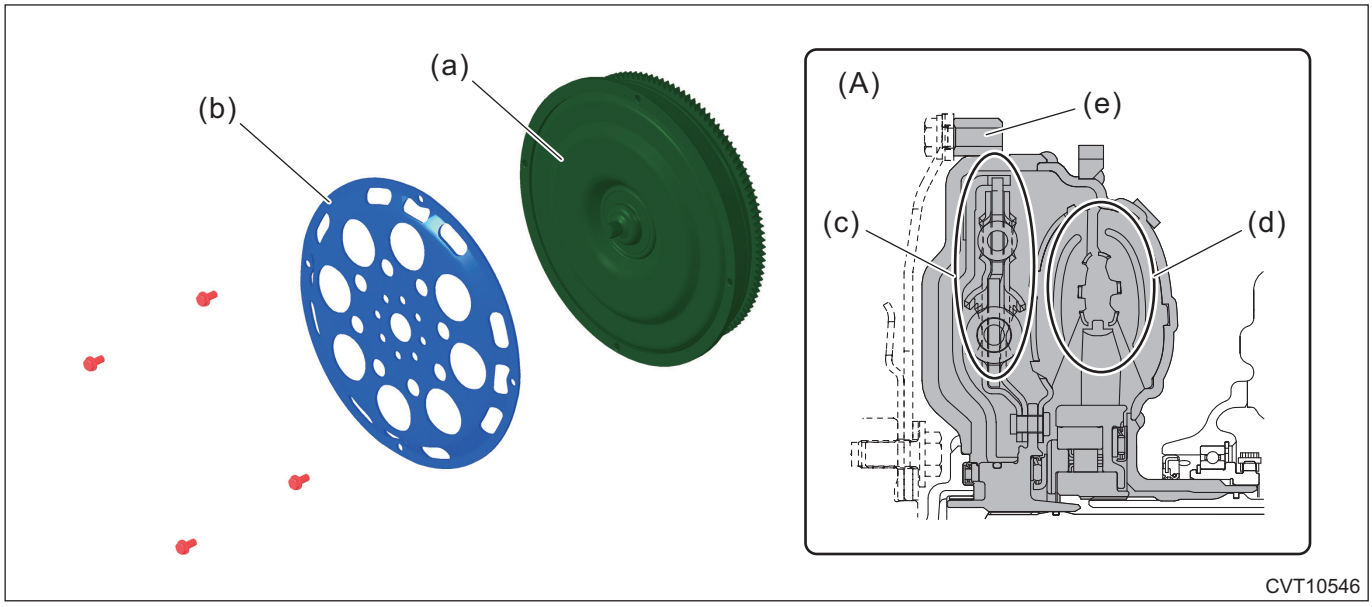
Torque converter

The torque converter features both high fluid performance and high damper performance to match the vehicle weight.

The torus (flow passage shape formed by an impeller and a turbine) that enables reduction of space is made ultra-flat, and the fluid performance is optimized to ensure driving agility that does not feel restrained by the vehicle weight.

The damper construction is adopted to absorb engine torque fluctuations and realize high ride quality. Also, the lock-up clutch damper with low rigidity is adopted to reduce vibration.

The addition of an inertia mass to the outside of the torque converter reduces vibration.

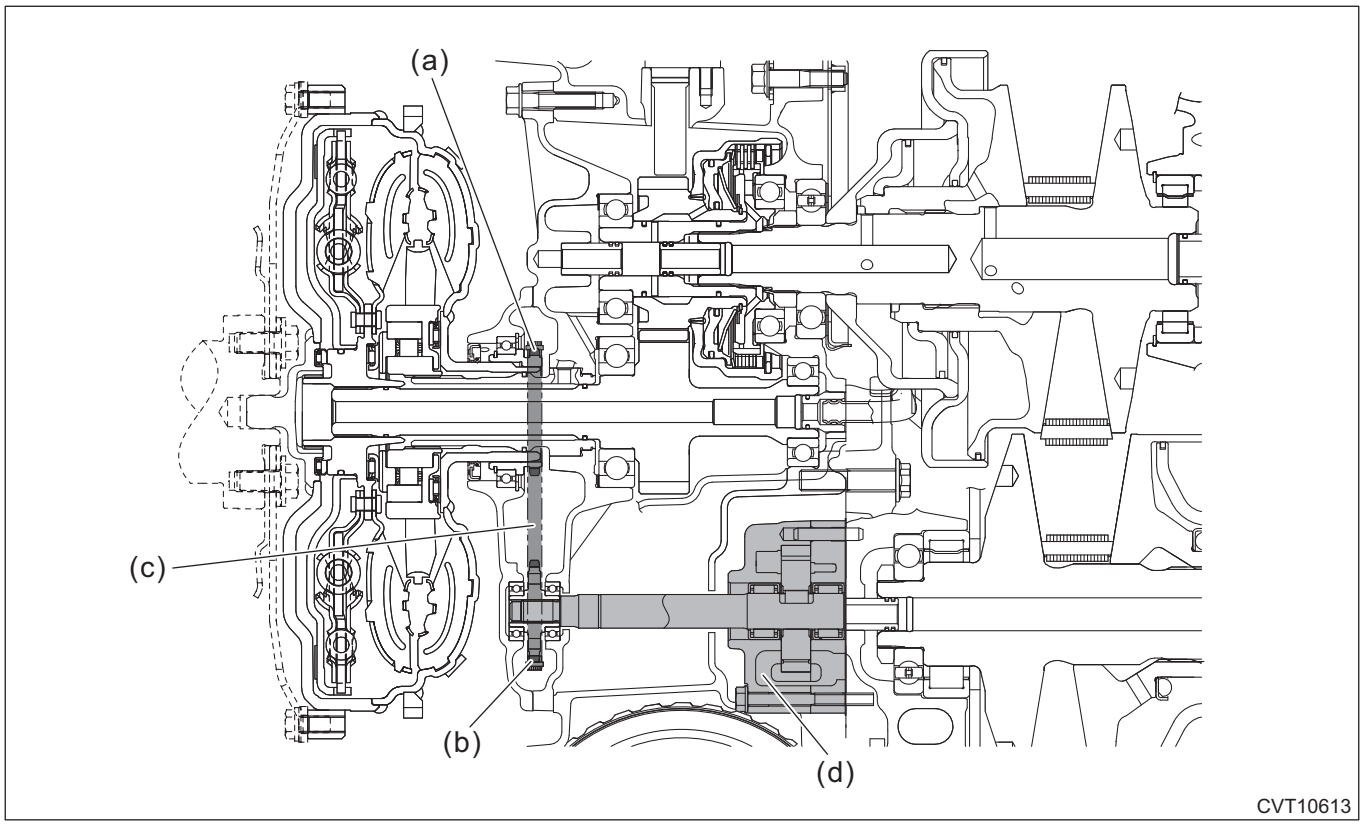


(A) Torque converter cross section

(a) Torque converter
(b) Drive plate
(c) Damper
(d) Torus
(e) Inertia mass

Oil pump

The oil pump uses the oil pump chain to connect the oil pump drive sprocket that is installed on the torque converter case and the oil pump driven sprocket on the oil pump. While the engine is running, the oil pump is continuously driven by the torque converter, which is connected to the drive plate that is directly connected to the engine crankshaft.



(a) Oil pump drive sprocket
(b) Oil pump driven sprocket
(c) Oil pump chain
(d) Oil pump

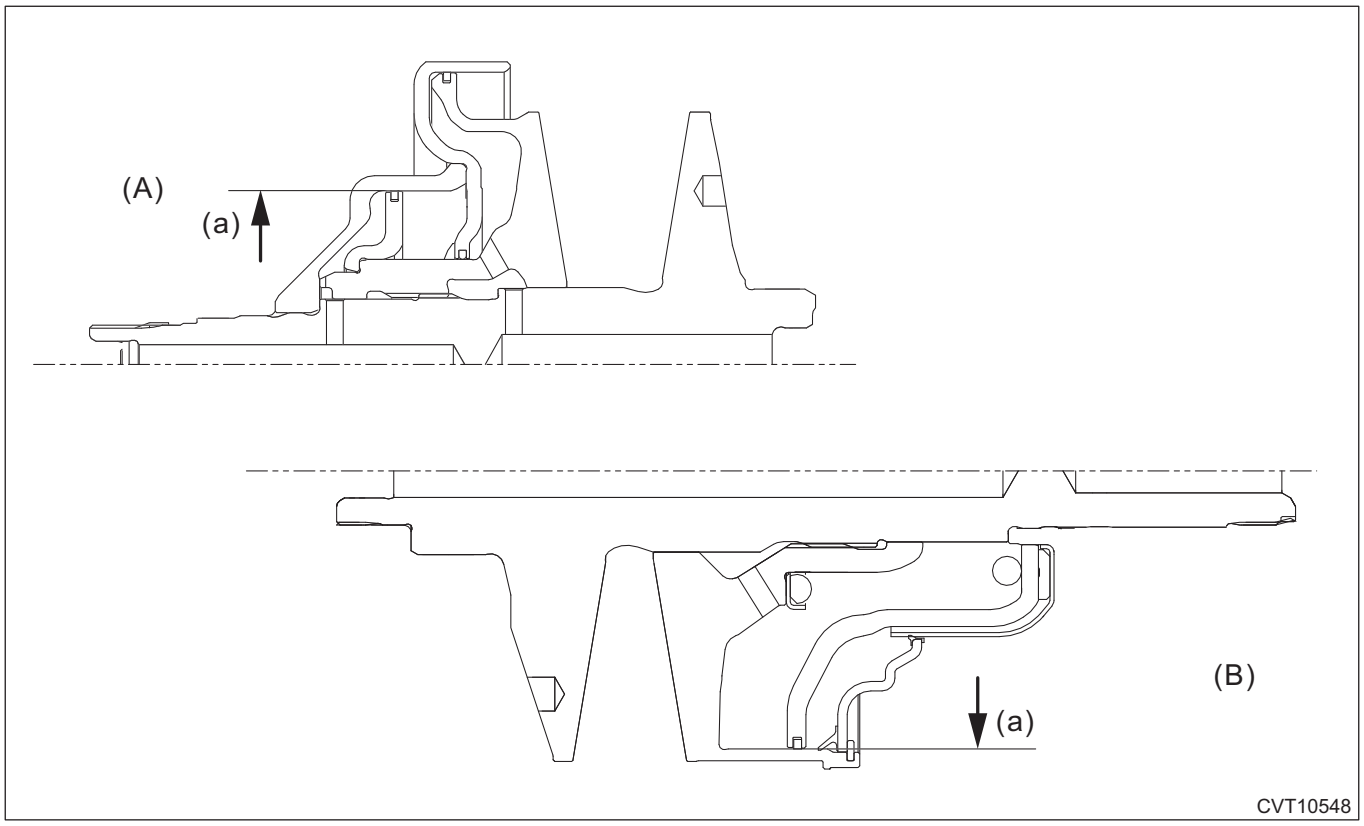
Pulley and chain

Ratio coverage has been increased to 6.901 for a wider range that ensures power performance and improves fuel efficiency.

A reduction in chain noise was achieved by improvements including adoption of a random pitch variator chain, addition of damping material to the pulley support, and reinforcing the noise shield cover.

■ Primary pulley, secondary pulley

Pulley specifications are optimized and the deceleration ratio in low range was expanded.



(A) Primary pulley

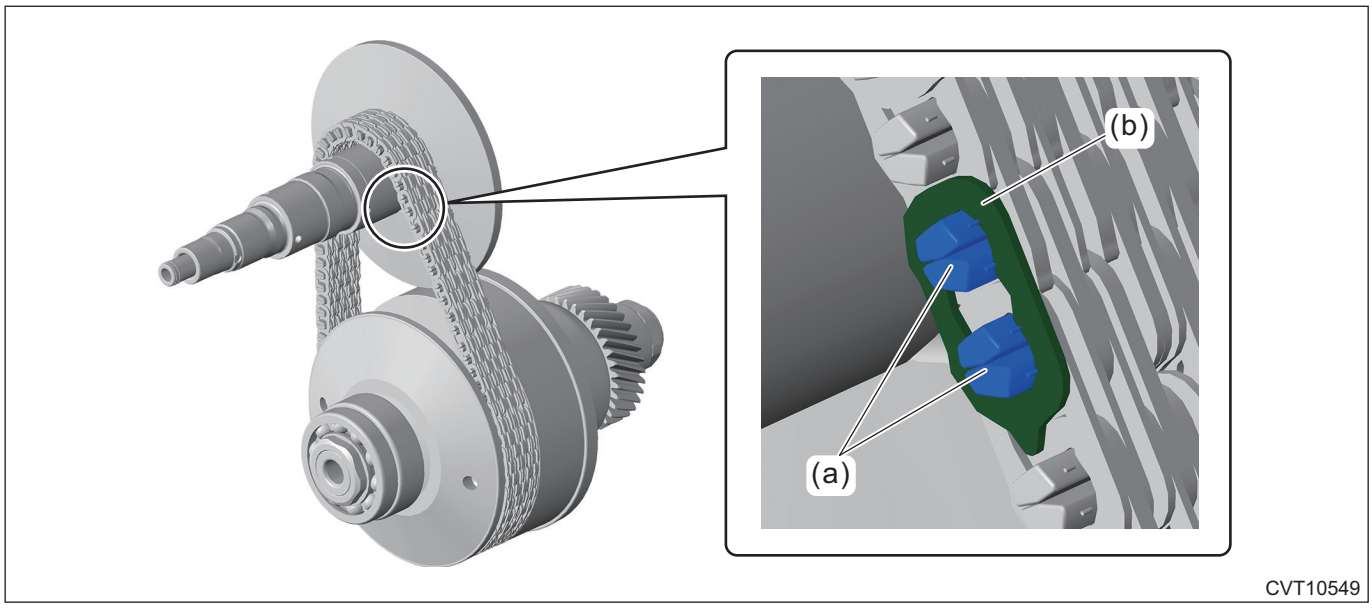
(B) Secondary pulley

(a) Cylinder diameter (pressure bearing surface area)

■ Variator chain

The adoption of a chain-type metal belt has made it possible to reduce the winding diameter of the variator chain. This allows use of a smaller pulley and achieves wider ratio coverage. The superior transmission efficiency of the variator chain improves driving performance and fuel efficiency performance in all speed ranges.

Guide rails are installed on both the tense side and slack side, reducing string vibration of the chain and reducing chain noise. Chain noise was also lowered by optimizing the pin layout pattern and the end shape, adding damping material to the pulley support, and reinforcing the noise shield cover.



(a) Pin

(b) Link plate

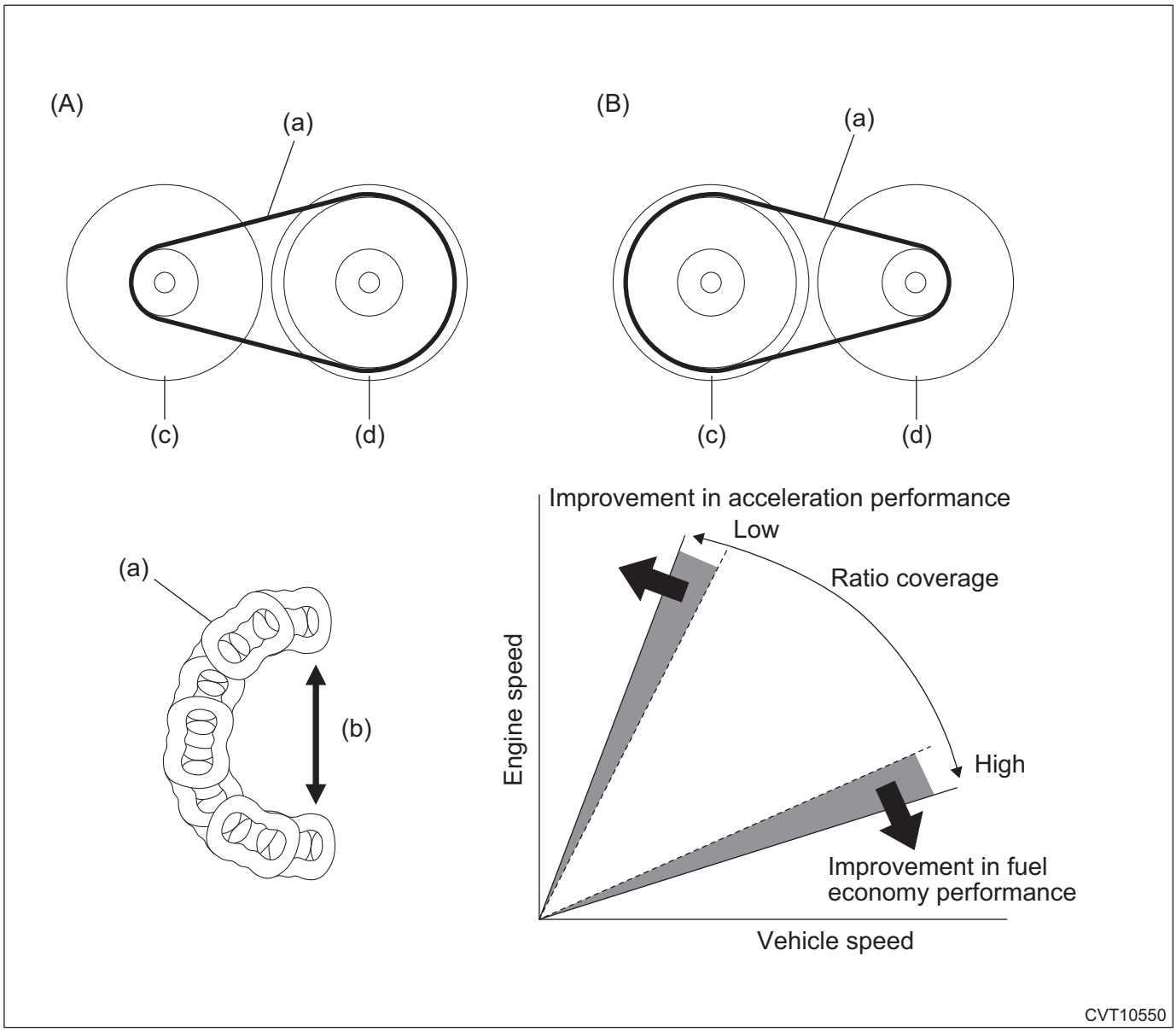
■ Ratio coverage

The CVT changes speeds by changing the "winding diameter" of the variator chain from the primary pulley to the secondary pulley.

The adoption of a variator chain allows the winding diameter to be reduced, expanding the transmission speed range and expanding the ratio coverage to 6.901, placing it in the top CVT class.

The ratio coverage is expanded to improve starting performance and fuel efficiency.

- Since the reduction speed ratio increases at low gear, acceleration performance at startup improves.
- Since the reduction speed ratio decreases at high gear, the engine speed decreases at high speed cruise driving and fuel efficiency improves.



(A) At low gear

(B) At high gear

(a) Variator chain

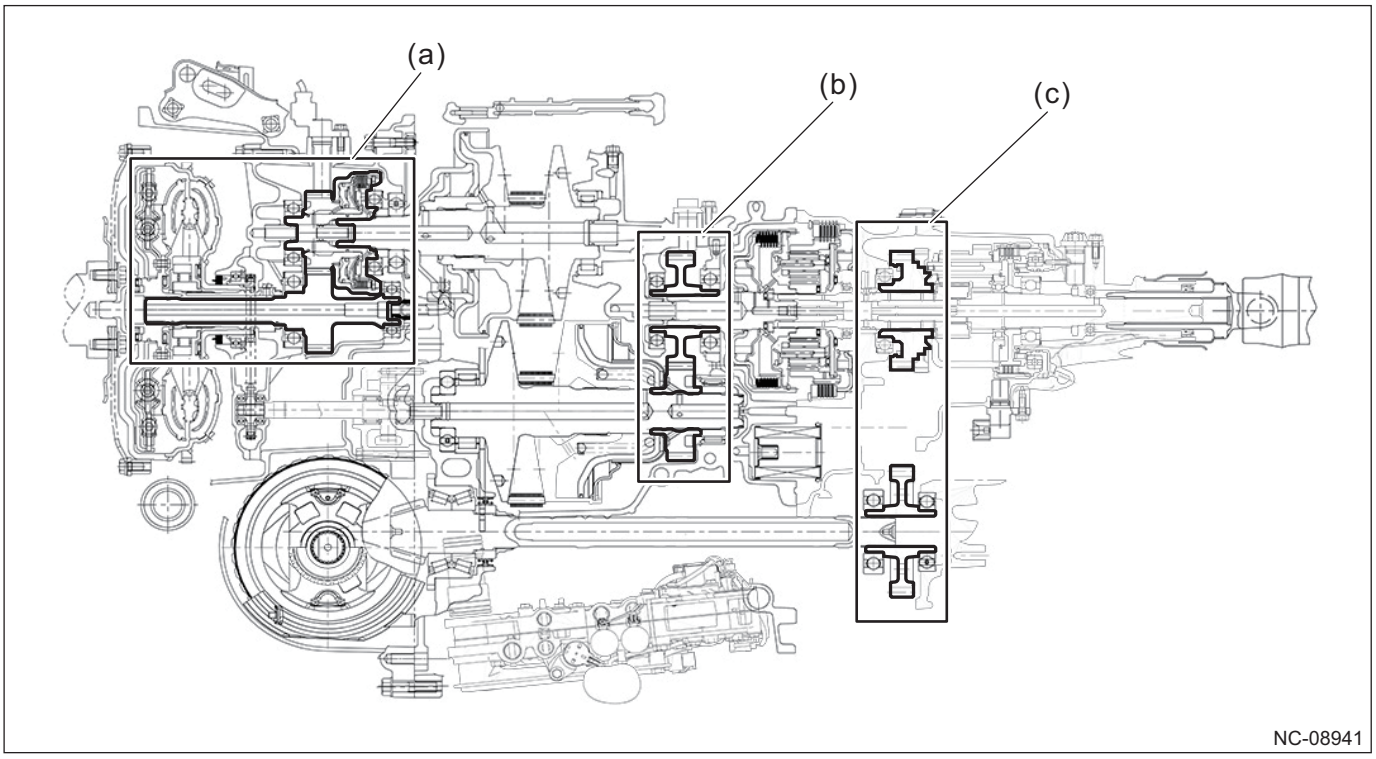
(b) Winding diameter

(c) Primary pulley

(d) Secondary pulley

Reduction gear

The gear ratios of the secondary reduction gear and transfer gear are optimized, and the overall gear ratio is lowered. The gear shape and tooth shape are optimized, resulting in less gear noise.

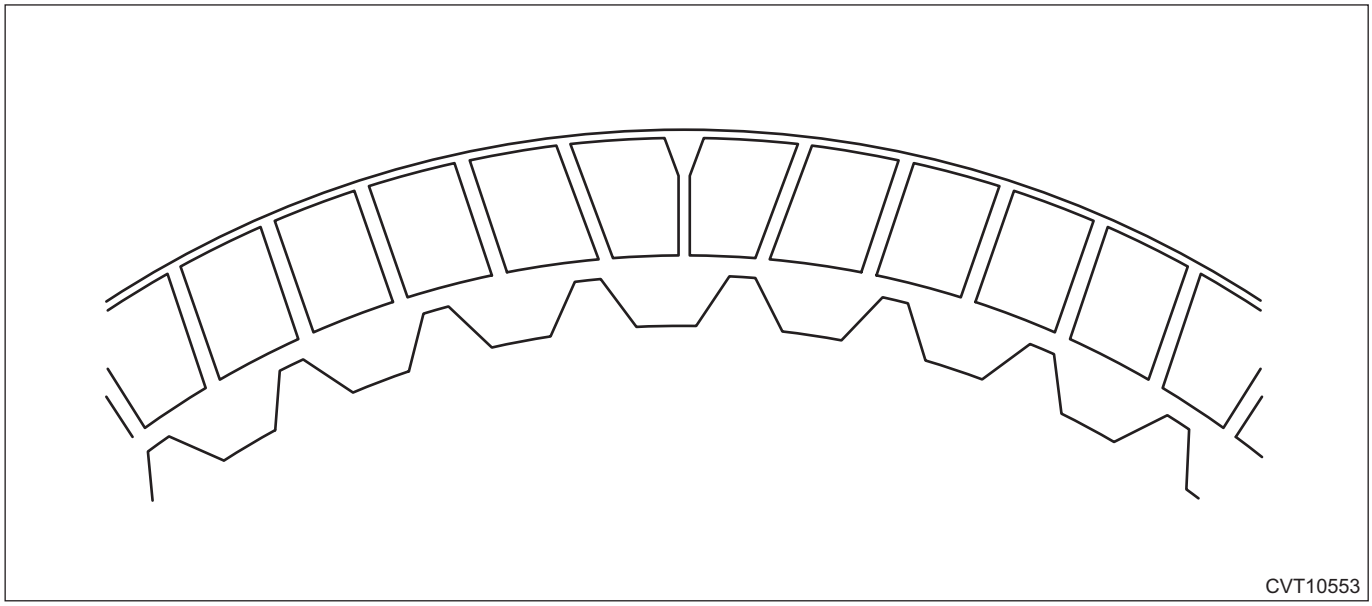


(a) Primary reduction gear
(b) Secondary reduction gear
(c) Transfer gear

Reverse brake

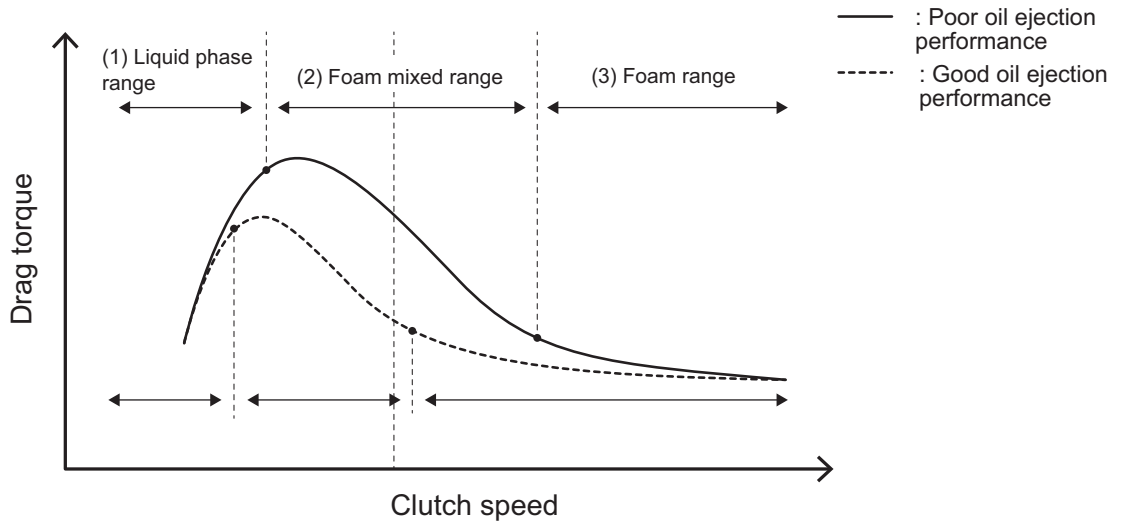
Adopting a segmented drive plate friction material and improving the oil ejection performance when moving forward with the clutch idled reduces the drag torque generated by clutch dragging and improves fuel efficiency performance.

Drive plate



CVT10553

Resulting reduction in drag torque

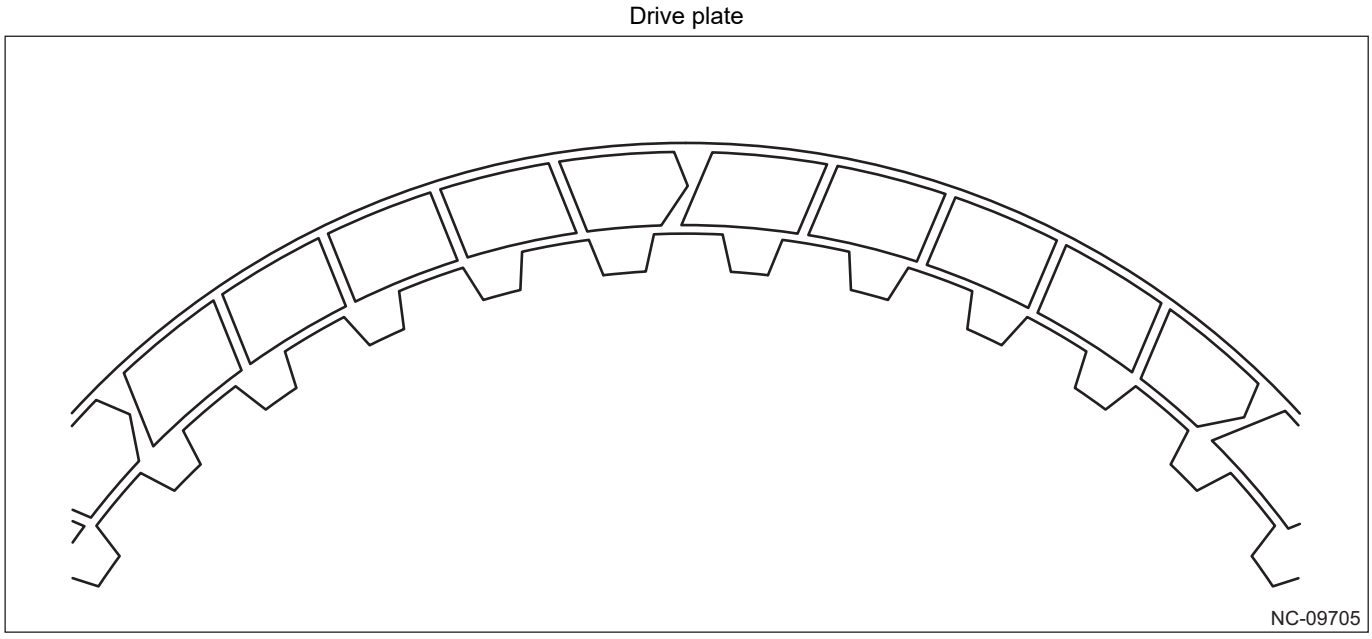


(1) Liquid phase (as the speed rises, the drag torque also rises)
(2) Two layers of gas and liquid (speed rises, centrifugal force ejects the oil, gas enters between the plates, and the drag torque rises)
(3) Gas phase (oil ejected by rotation, and almost no drag torque rate of change due to speed)

CVT10554

Forward clutch

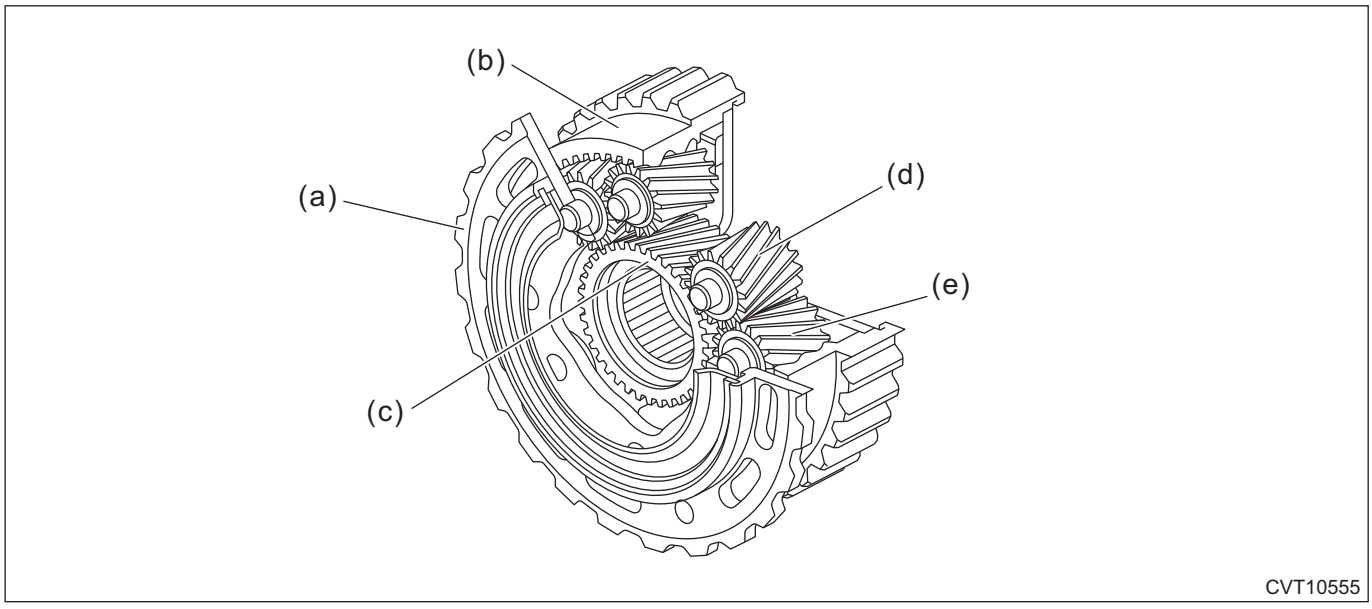
The friction force of the drive plate facing surface was optimized, improving the quality feel during select operation.



Planetary gear

A double pinion planetary structure has been adopted for the forward and reverse switching mechanism. This lowers the gear ratio when reversing, thereby increasing the drive force when reversing uphill, over a step, or in similar circumstances.

The material and structure of the planetary carrier have been optimized for higher strength.



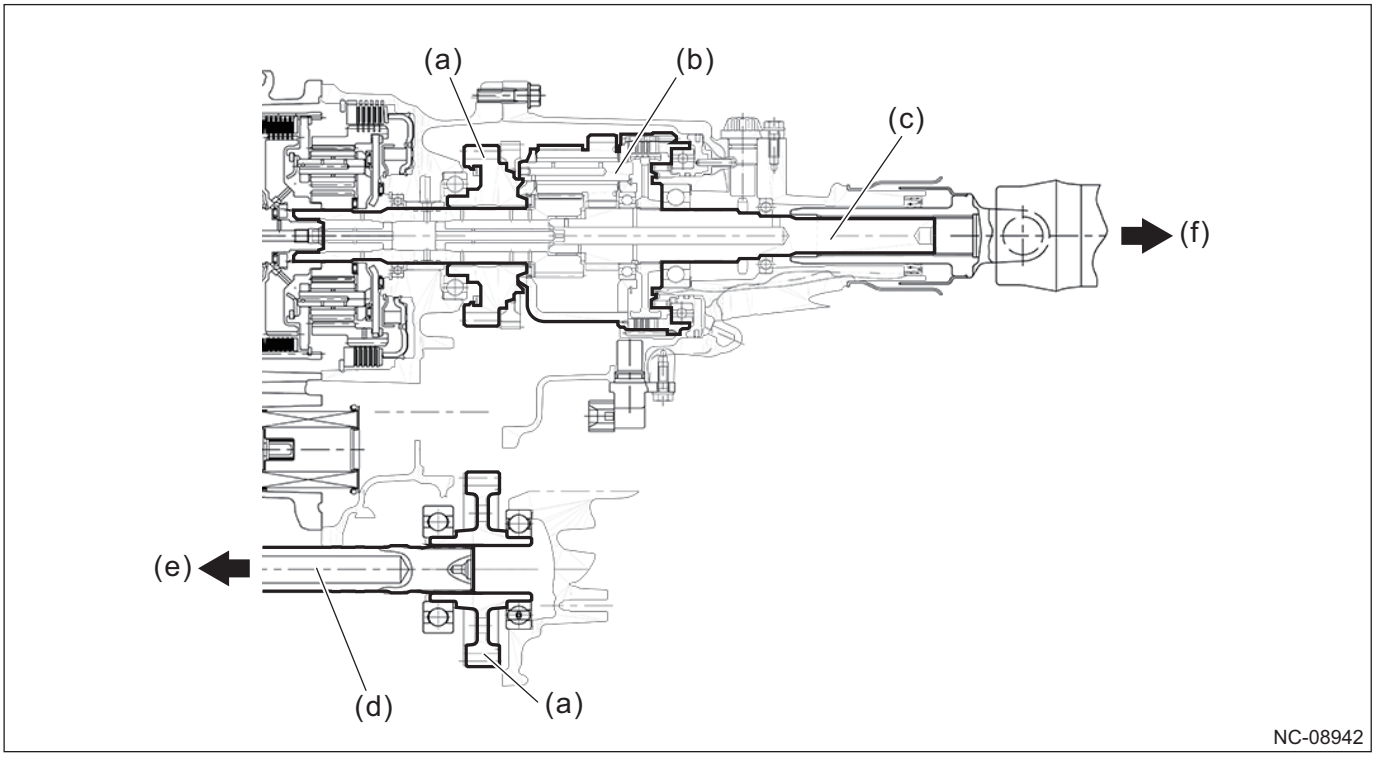
(a) Planetary carrier
(b) Internal gear
(c) Sun gear
(d) Inner planetary pinion gear
(e) Outer planetary pinion gear

AWD mechanism

VTD-AWD (electronic control AWD with uneven and variable torque distribution) is adopted for the AWD system.

The center differential distributes torque unevenly with a front:rear ratio of 45:55, distributing larger torque to the rear wheels for smooth handling on a curve. The torque distribution is continually varied according to the driving conditions, ensuring both stability during straight driving and high cornering performance.

The VTD-AWD drive force distribution system combines a multiple planetary gear type center differential installed on the extension case at the rear of the transmission, and a hydraulic activation multi-plate limited slip differential (LSD) located between the output components of the center differential. Differential limiting control is performed by the TCM according to the driving conditions and road surface conditions.



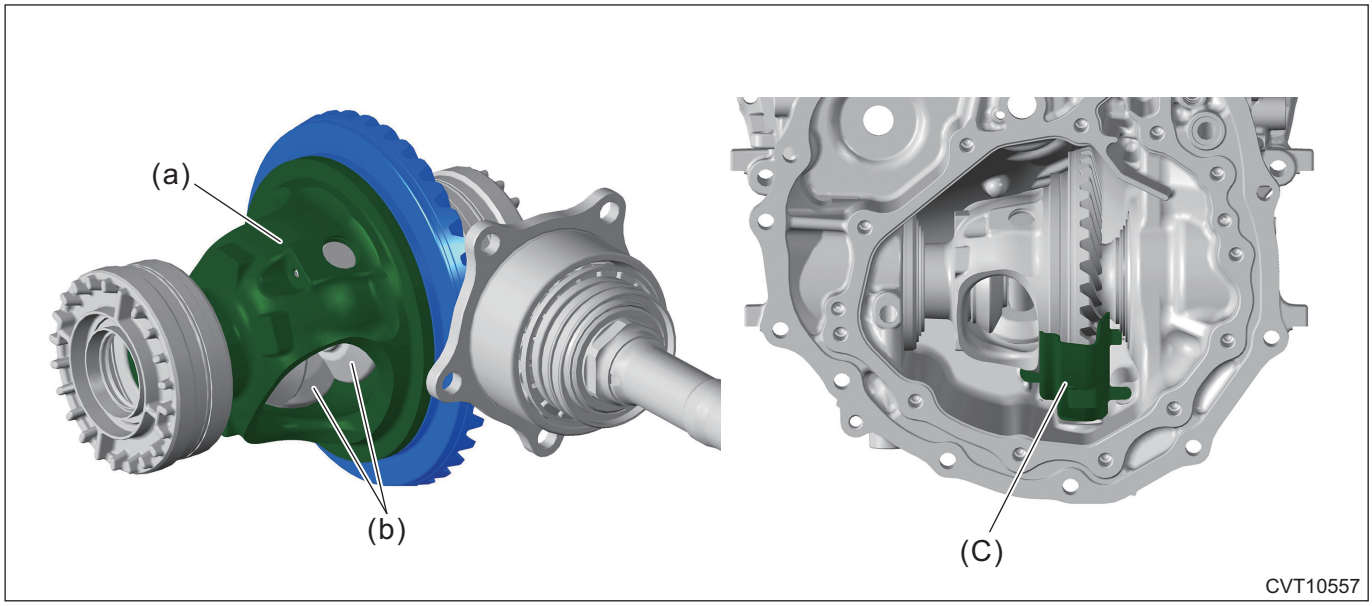
(a) Transfer gear
(b) Center differential
(c) Rear drive shaft
(d) Drive pinion shaft
(e) To front wheels
(f) To rear wheels

Front differential

The adoption of a welded integrated type differential case reduces weight and reduces stirring resistance, improving fuel efficiency performance.

Changing to a forged differential gear improves impact strength.

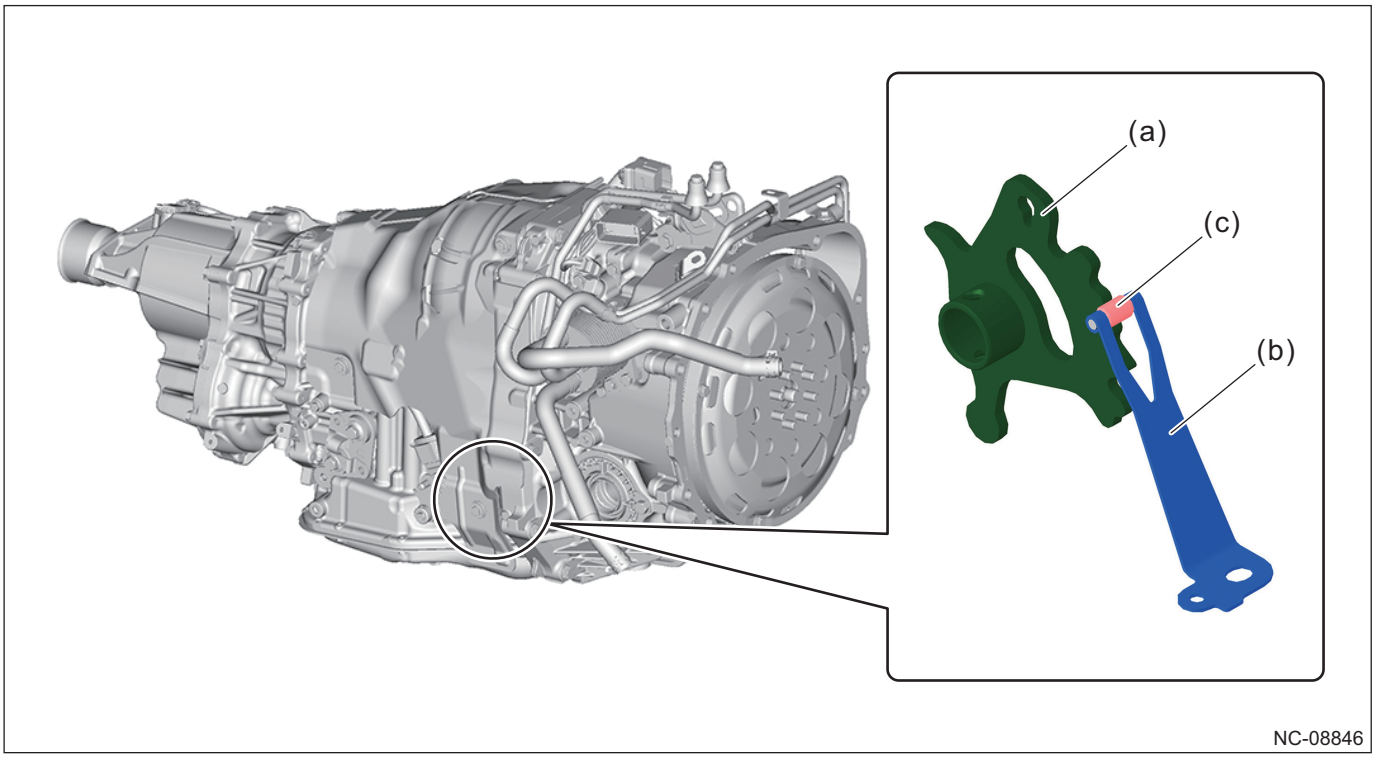
A differential baffle was adopted, reducing stirring resistance.



(a) Differential case
(b) Differential gear
(c) Differential baffle

Transmission control device

The manual plate tooth shape is optimized, and a roller bearing is added for the detent spring tip, producing smooth select lever operation.



(a) Manual plate
(b) Detent spring
(c) Roller bearing

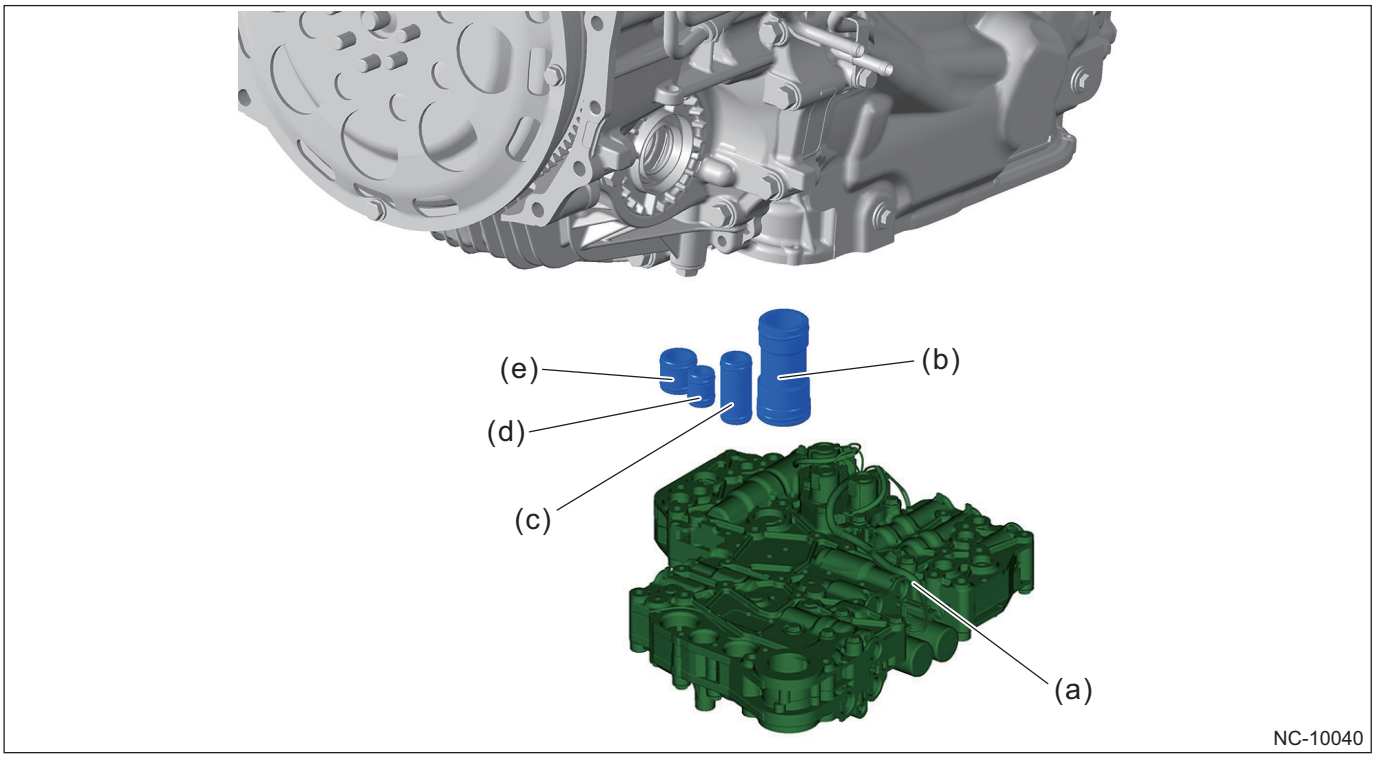
Control valve

The control valve with the various built-in valves that switch the oil passage and adjust the oil pressure is installed on the bottom of the transmission.

The oil pressure control and select circuit orifice are optimized in order to improve fuel efficiency performance and quietness.

As a result of optimizing independent secondary pressure control, the sizes of the line pressure solenoid and secondary solenoid were reduced. This results in lighter weight and improved fuel efficiency.

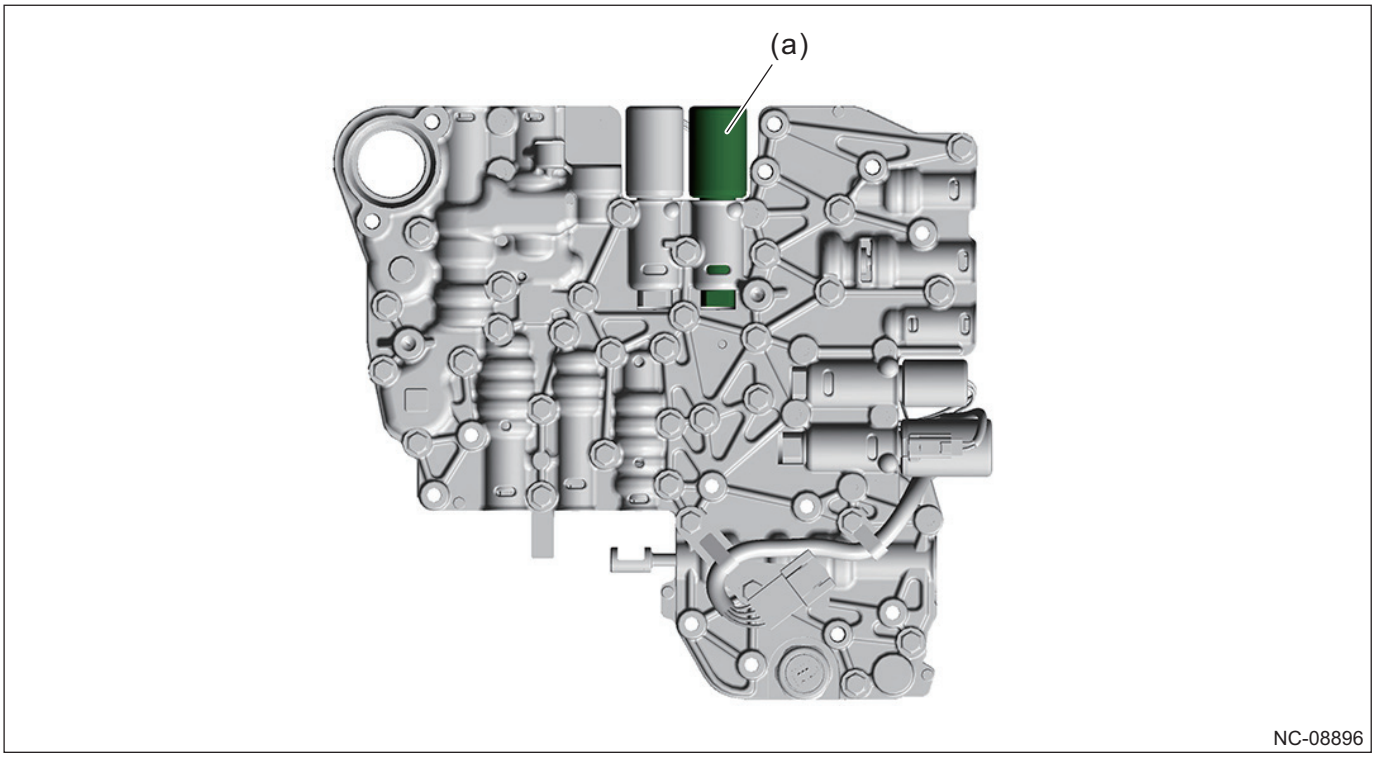
A linear solenoid is adopted for the AWD solenoid in order to improve AWD clutch (AWD control) control performance and reduce vibration.



(a) Control valve
(b) CVTF pipe
(c) Pressure pipe
(d) Pressure pipe
(e) Pressure pipe

■ Secondary solenoid

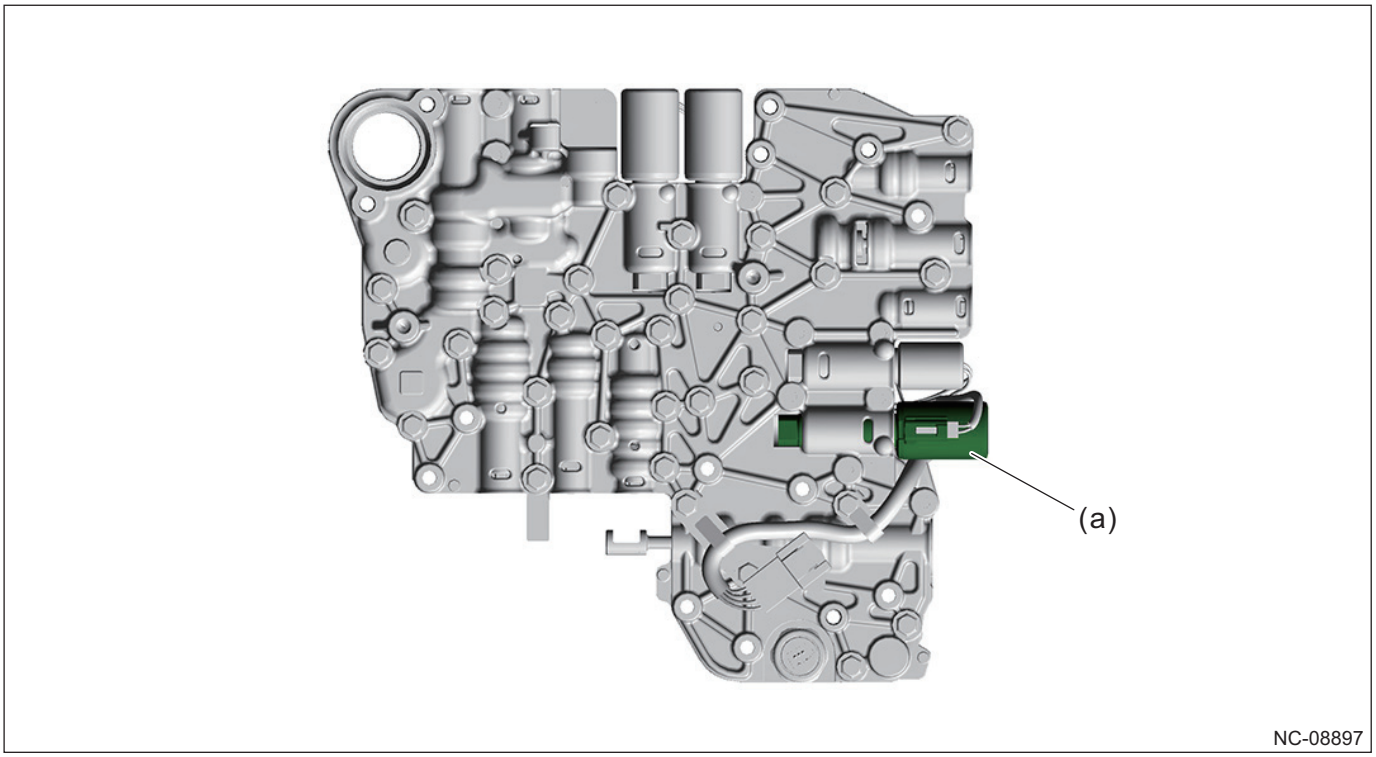
The secondary solenoid is installed on the LWR side of the control valve body. The current is controlled by the signal sent from TCM. This adjusts the secondary pressure and controls the secondary pressure necessary for transmitting torque by the chain.



(a) Secondary solenoid

■ AWD solenoid

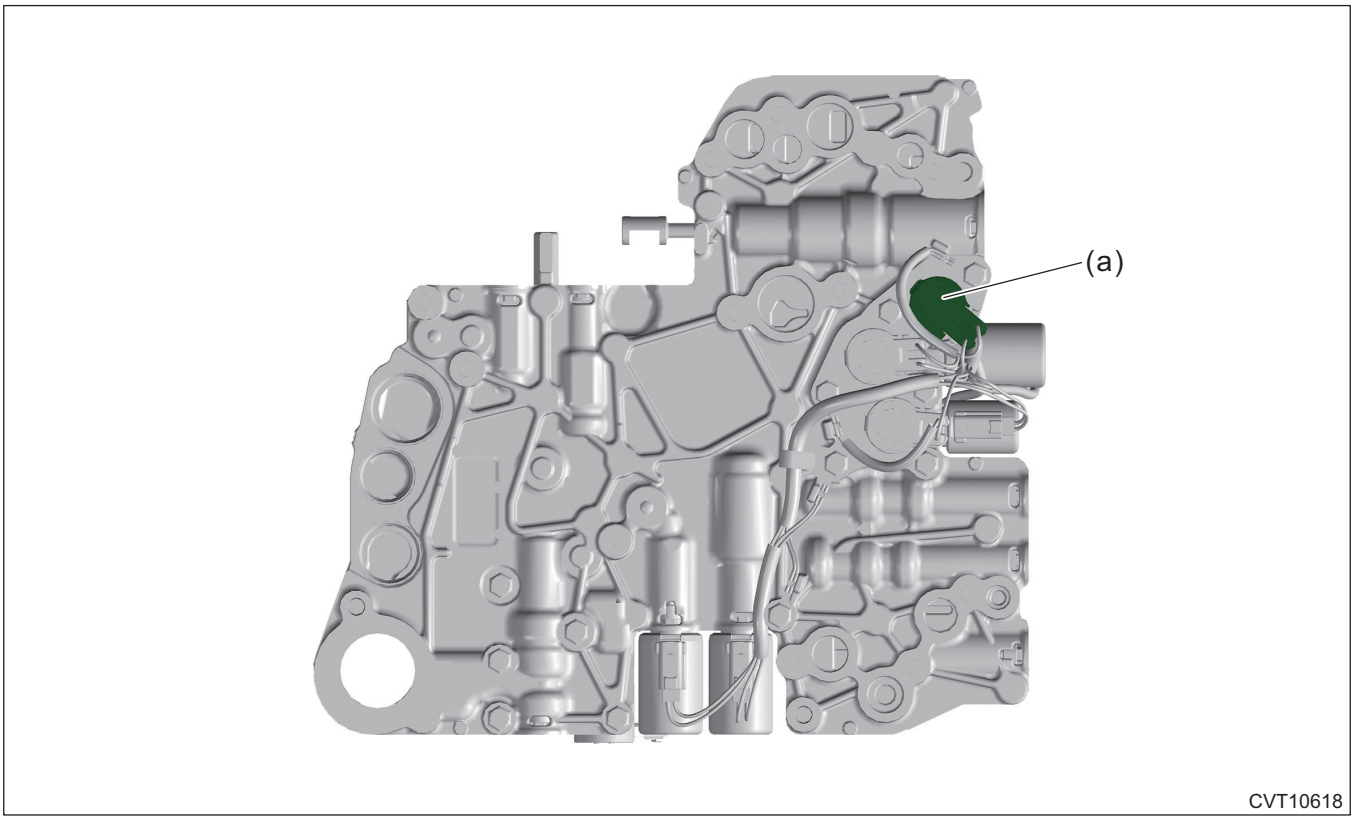
The AWD clutch solenoid is installed on LWR side of the control valve body. The current is controlled by the signal sent from TCM. This adjusts the AWD clutch pressure and controls the distribution of torque to the front and rear wheels.



(a) AWD solenoid

■ Lock-up duty solenoid

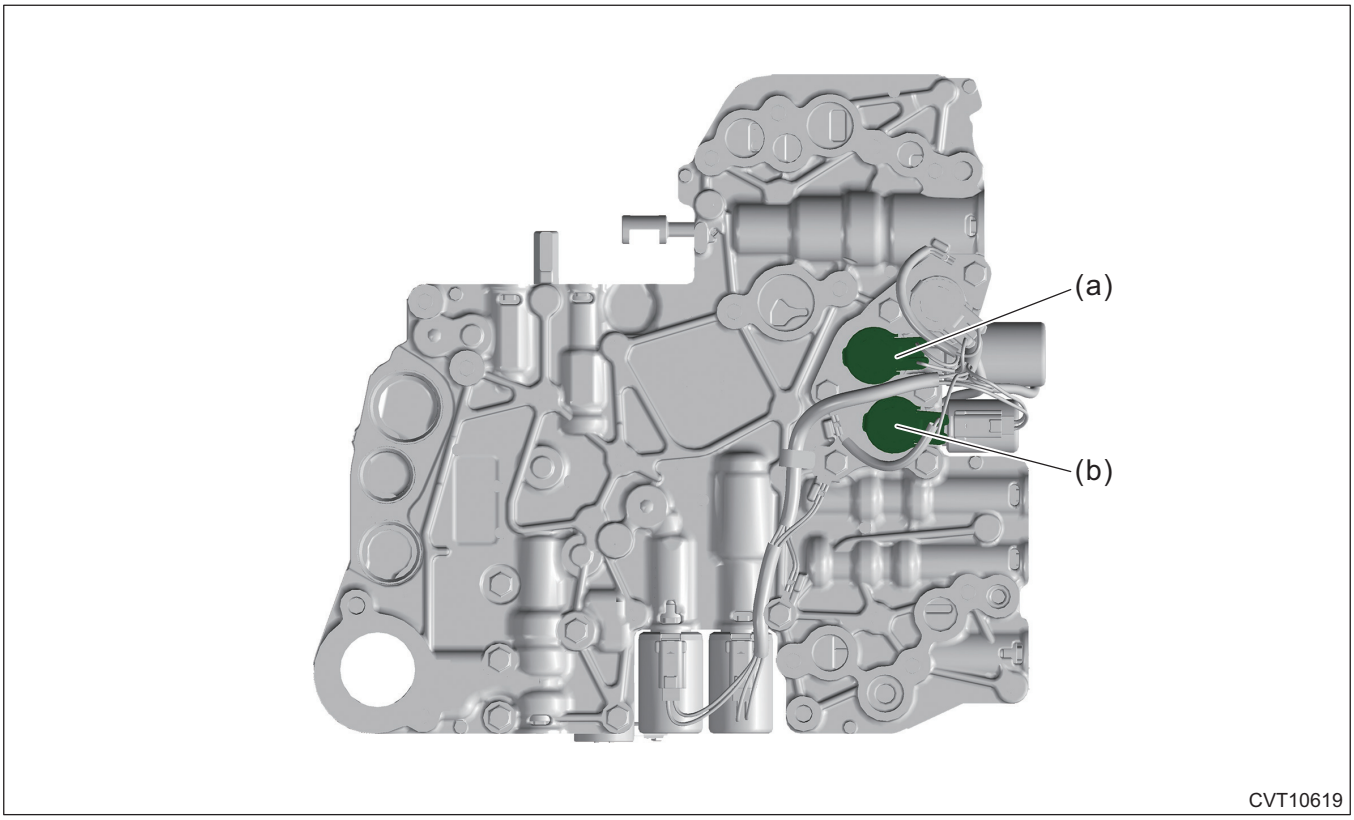
The lock-up duty solenoid is installed on the UPR side of the control valve body. The current is controlled by the signal sent from TCM. This engages and releases the lock-up clutch.



(a) Lock-up duty solenoid

■ Primary DOWN solenoid, UP solenoid

The primary DOWN solenoid and primary UP solenoid are installed on the UPR side of the control valve body. The current is controlled by the signal sent from TCM. This increases or decreases the pressure applied to the primary solenoid and adjusts the flow rate to control gear ratio changes with the chain belt.

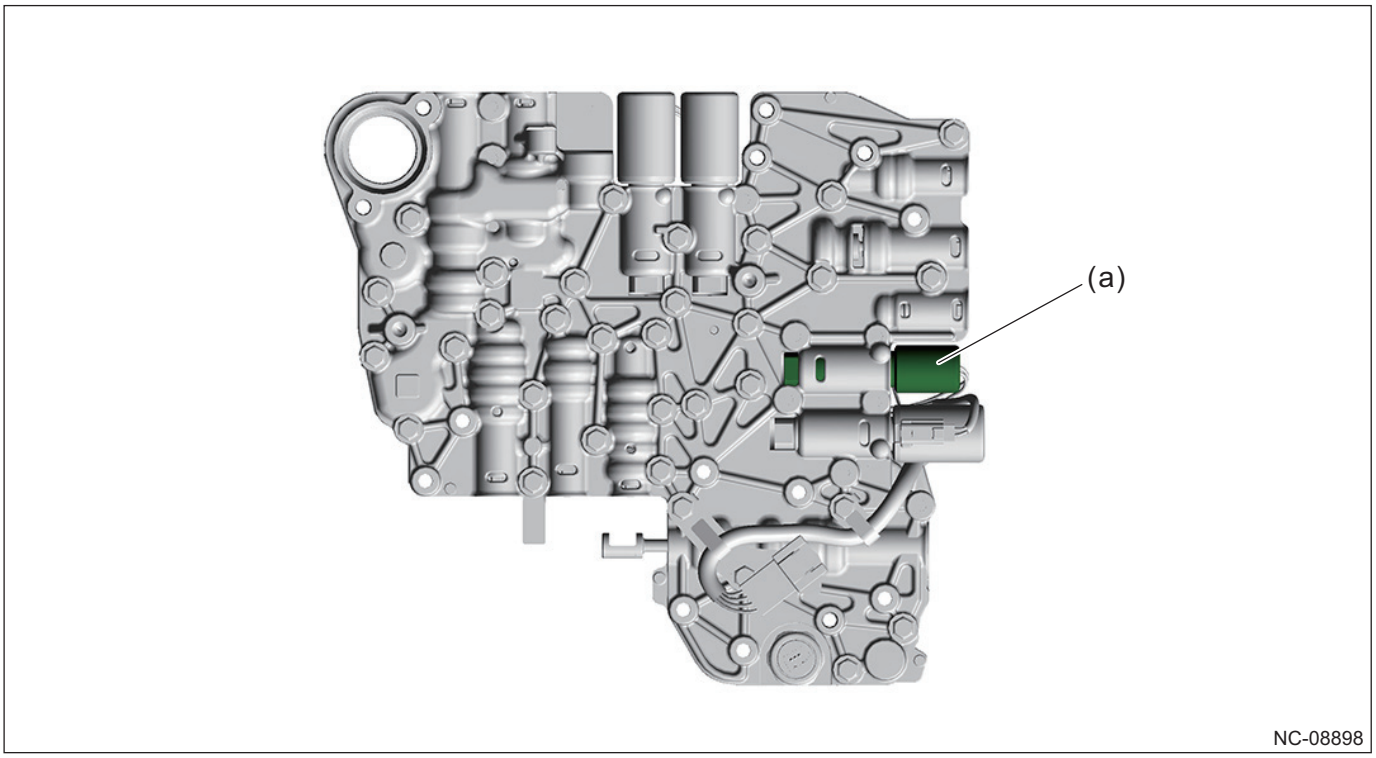


(a) Primary DOWN solenoid

(b) Primary UP solenoid

■ F&R solenoid

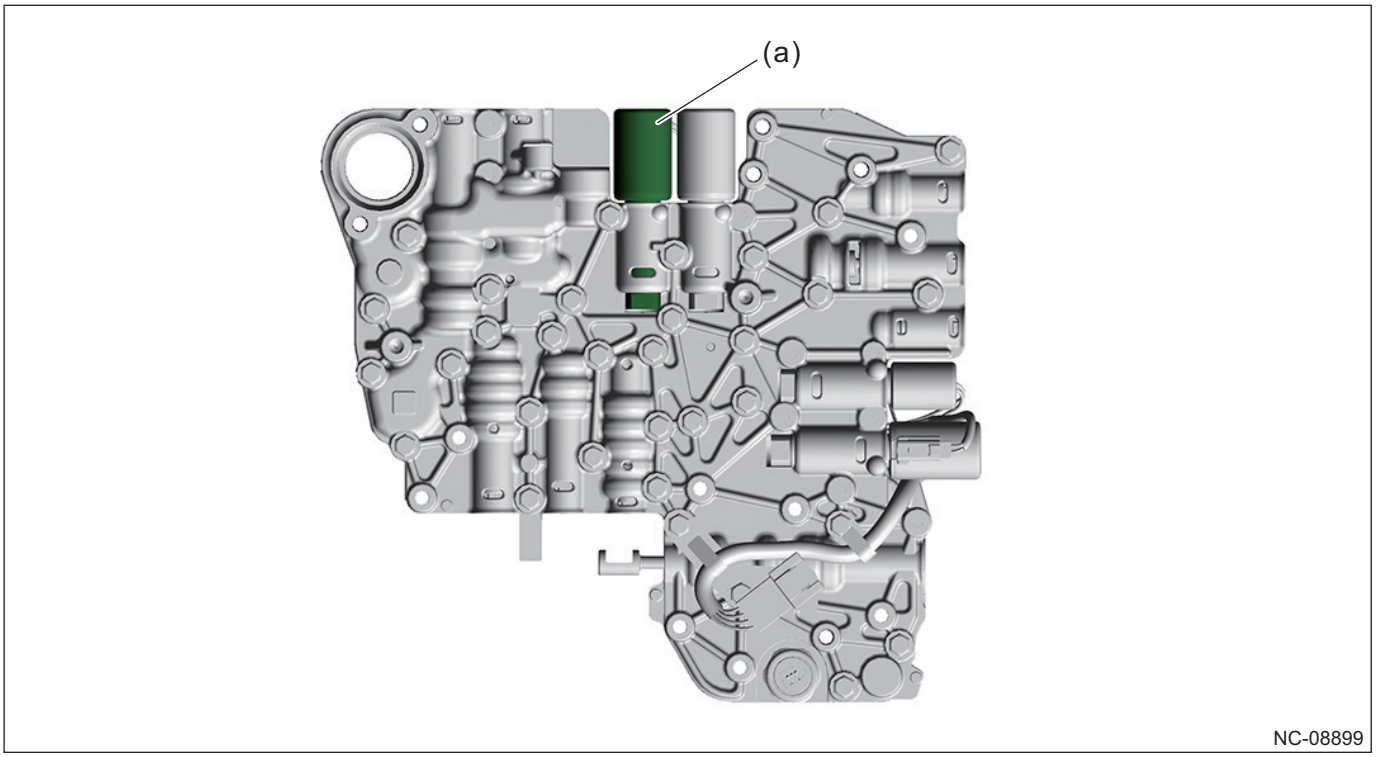
The F&R clutch solenoid is installed on LWR side of the control valve body. The current is controlled by the signal sent from TCM. This adjusts the F&R clutch pressure and controls the F&R clutch pressure.



(a) F&R clutch solenoid

■ Line pressure solenoid

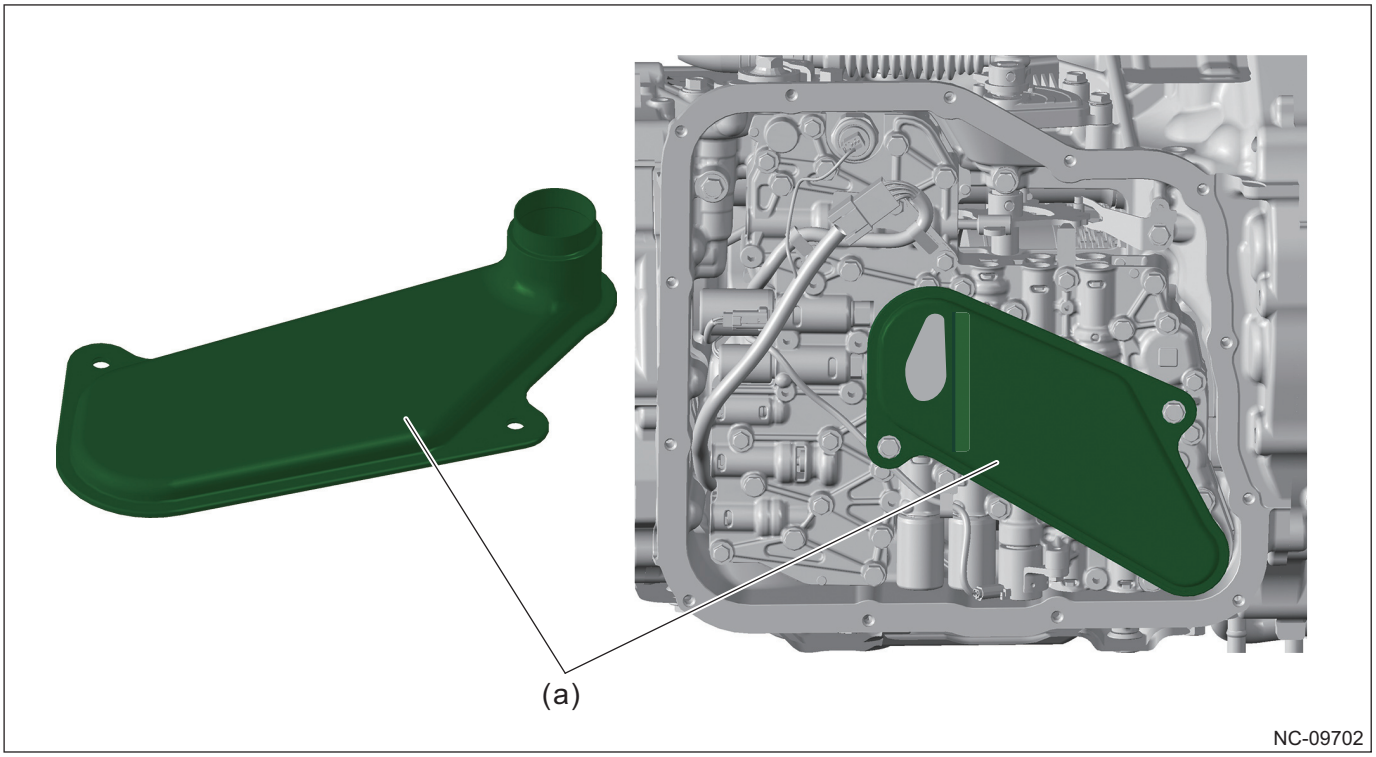
The line pressure solenoid is installed on the LWR side of the control valve body. The current is controlled by the signal sent from TCM. It controls the line pressure, controlling the CVT fluid discharged from the oil pump to the optimal level according to the driving conditions.



(a) Line pressure solenoid

Oil strainer

Pleat mesh is adopted for the oil strainer, reducing weight and saving space.



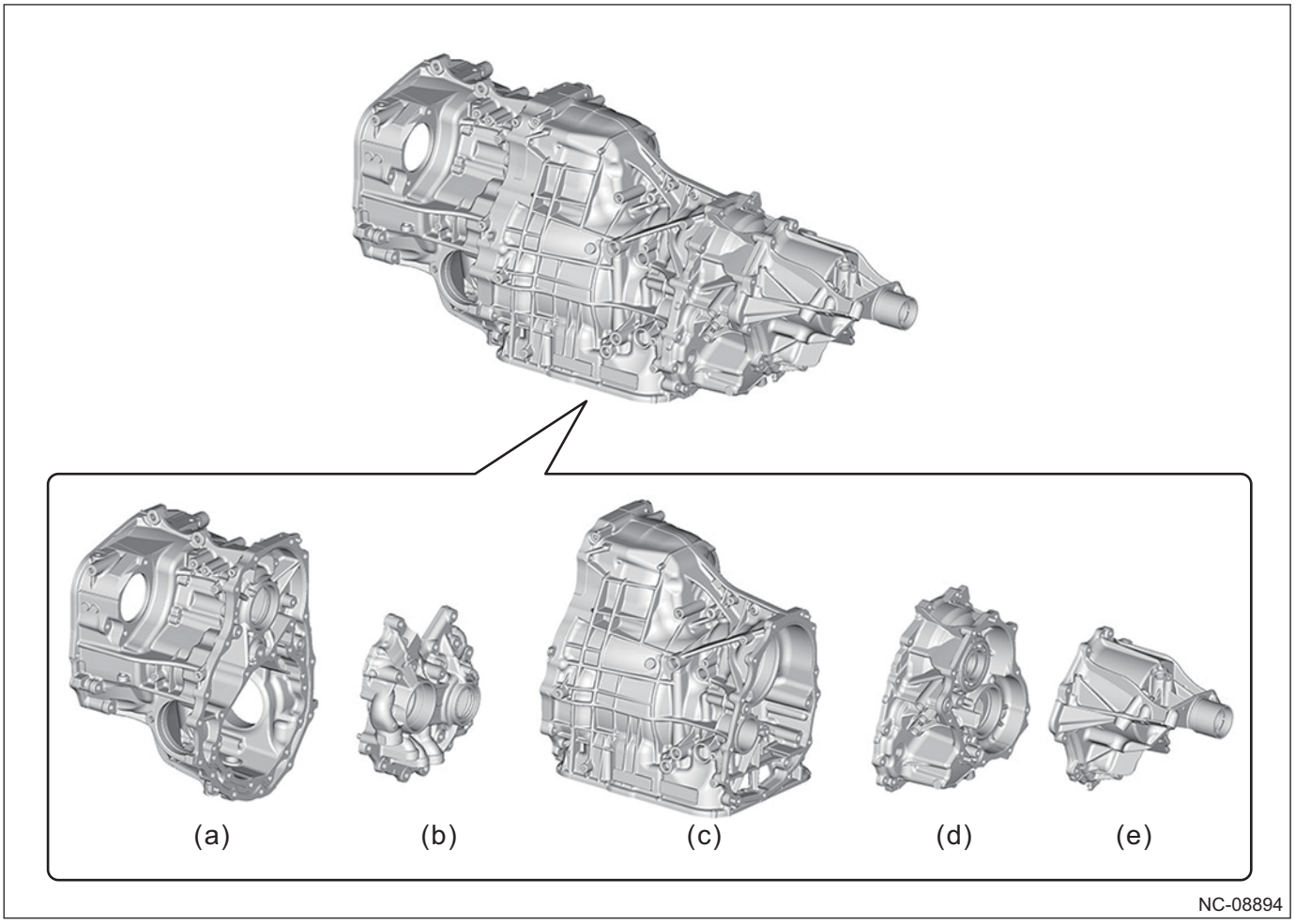
(a) Oil strainer

Fuel conservation oil

Using low viscosity oil reduces power loss, improving fuel efficiency performance. It also reduces oil pump noise.

Cases

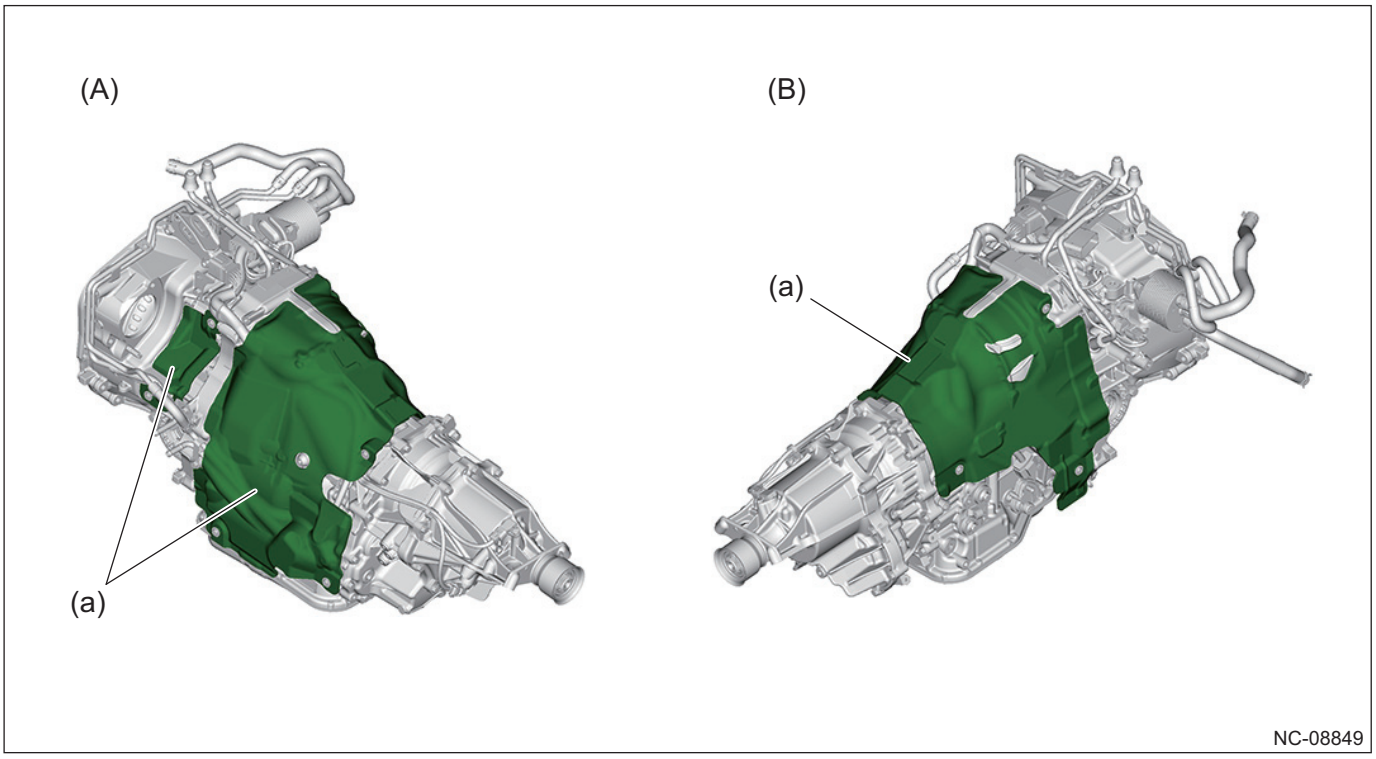
The rigidity of various cases has been improved, reducing vibration and noise, and improving collision safety.



(a) Converter case
(b) Drive pinion retainer
(c) Transmission case
(d) Intermediate case
(e) Extension case

Noise shield cover

A noise shield cover is installed on the transmission case and converter case, improving noise and vibration performance.



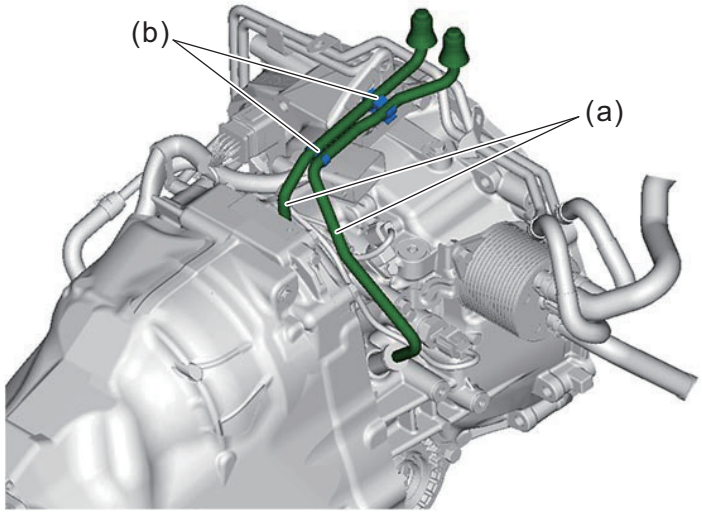
(A) Left

(B) Right

(a) Noise shield cover

Air breather hose

The end of the air breather hose is fixed to the vehicle body floor above the transmission, and a large breather cap is adopted to improve the ability to prevent moisture and foreign substances from entering the transmission.



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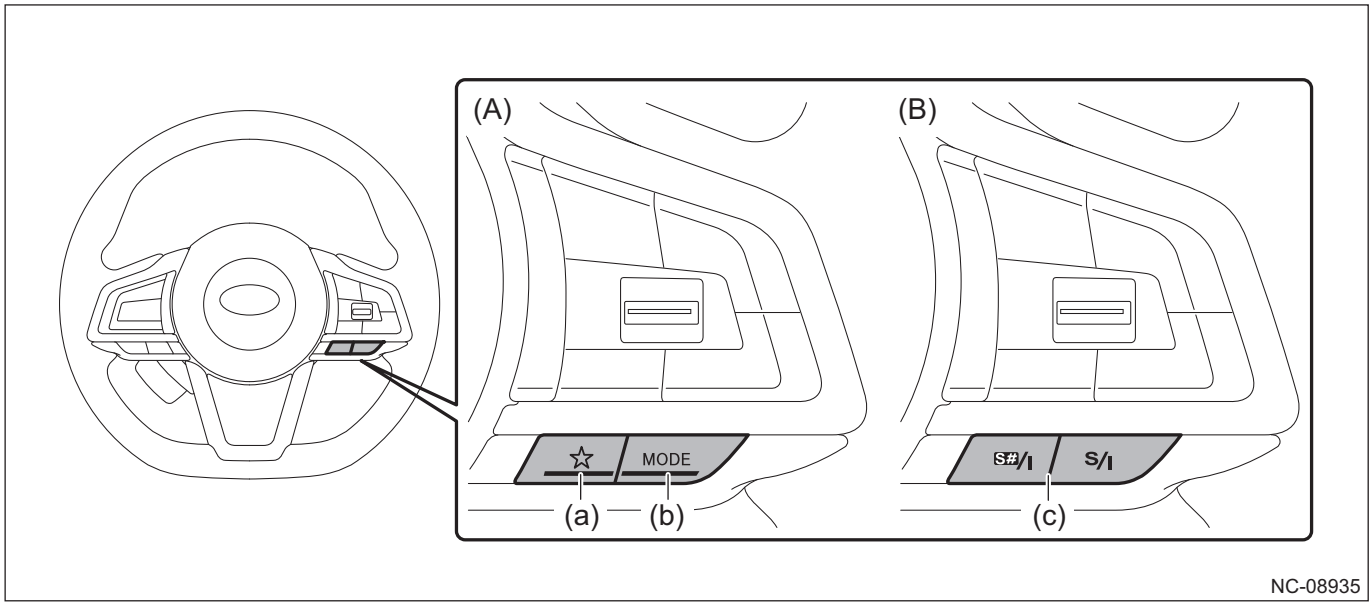
(a) Air breather hose

(b) Fixing clip

Drive mode select switch/SI-DRIVE switch

A drive mode select switch and SI-DRIVE switch are adopted in the steering pad switches. (for some grades)



(A) Models with drive mode select

(B) Models with SI-DRIVE

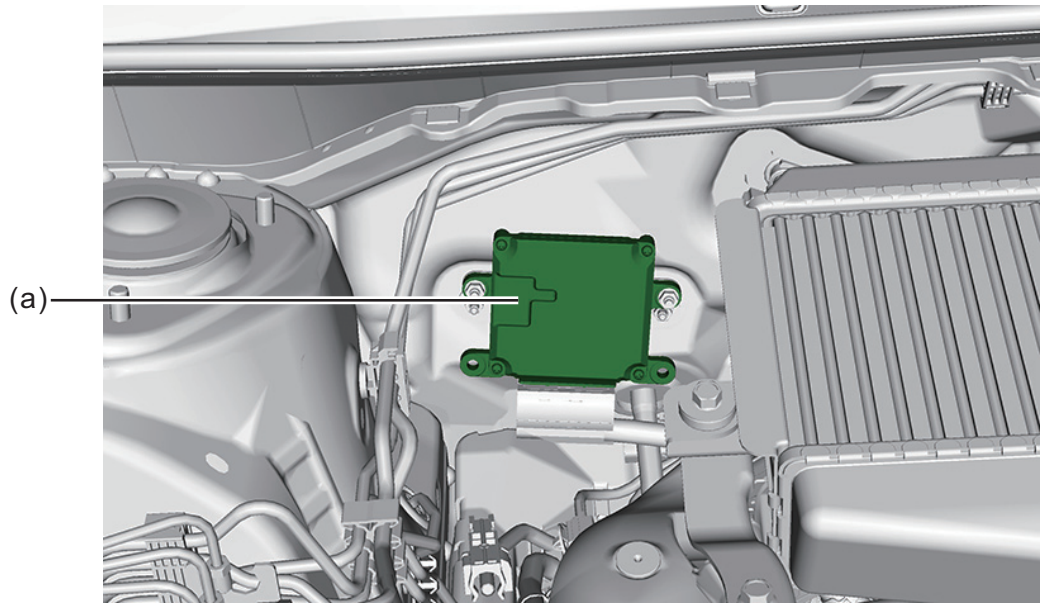
(a) Individual switch

(b) MODE switch

(c) SI-DRIVE switch

TCM

The TCM is placed inside the engine compartment, and a TCM connector with waterproof specifications is adopted.



(a) TCM

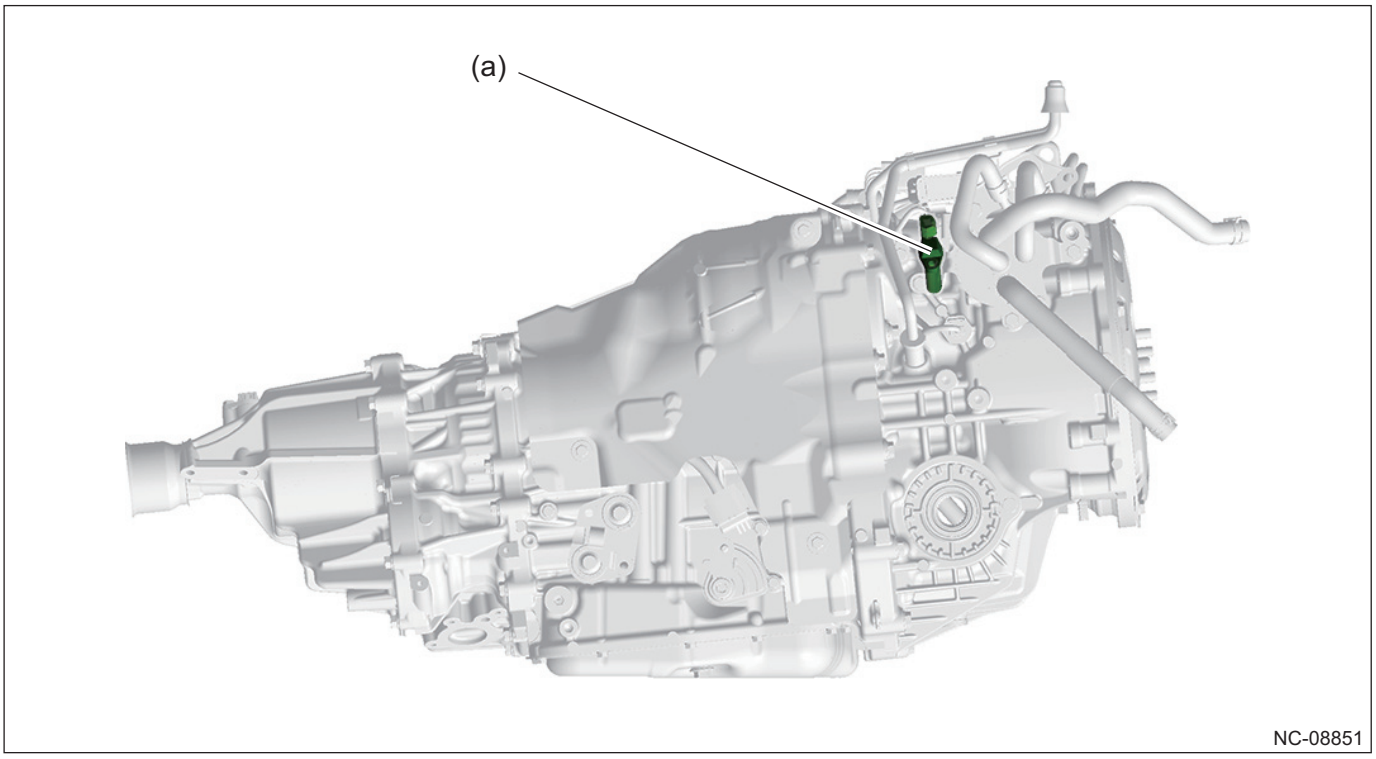
Switches, sensors

Switches and sensors are installed on the transmission assembly.

■ Primary speed sensor

The primary speed sensor is installed on the right side of the transmission case.

This sensor uses a Hall element sensor to detect the rotation speed of the front reduction driven gear, and sends a square waveform signal to the TCM. This controls gear changes.

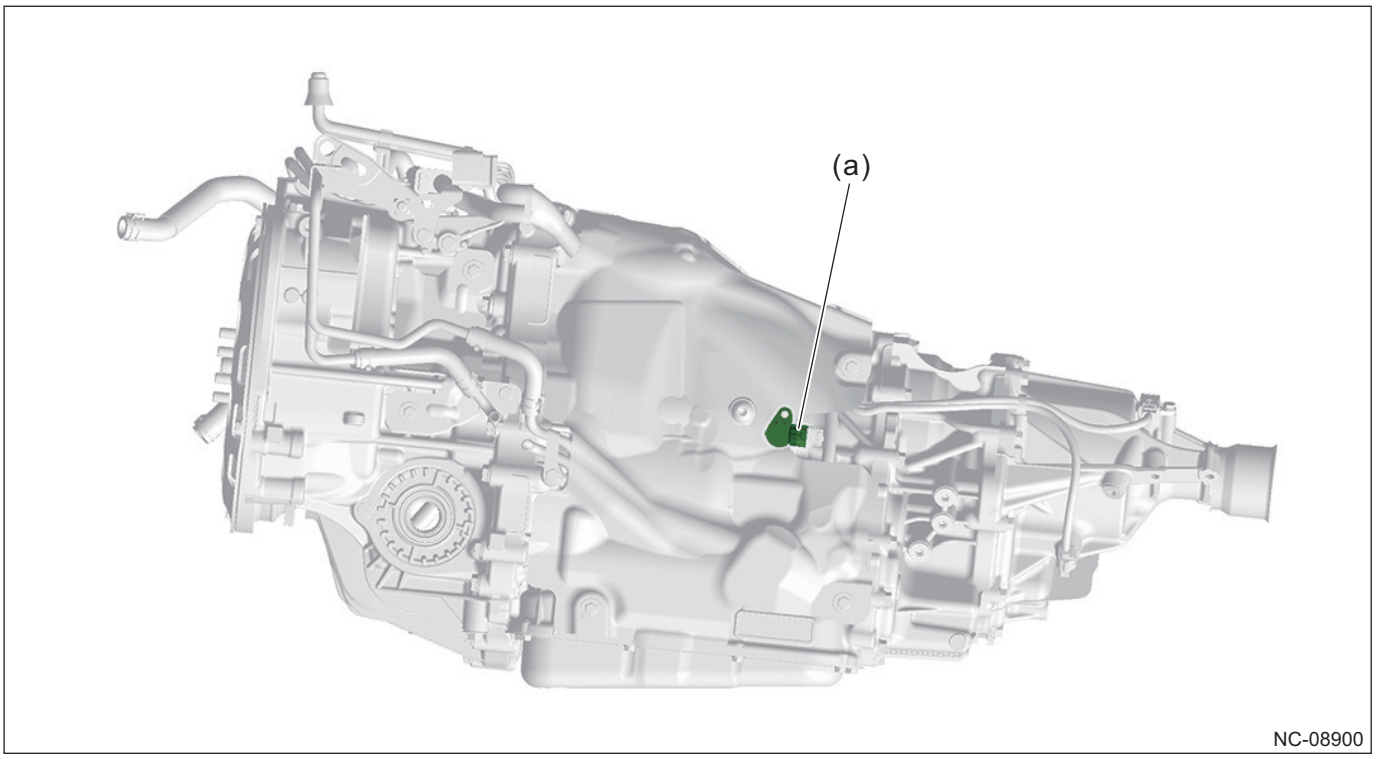


(a) Primary speed sensor

■ Secondary speed sensor

The secondary speed sensor is installed on the left side of the transmission case.

This sensor uses the Hall element sensor to detect the rotation speed of the reduction driven gear, and sends a square waveform signal to the TCM. This controls gear changes.

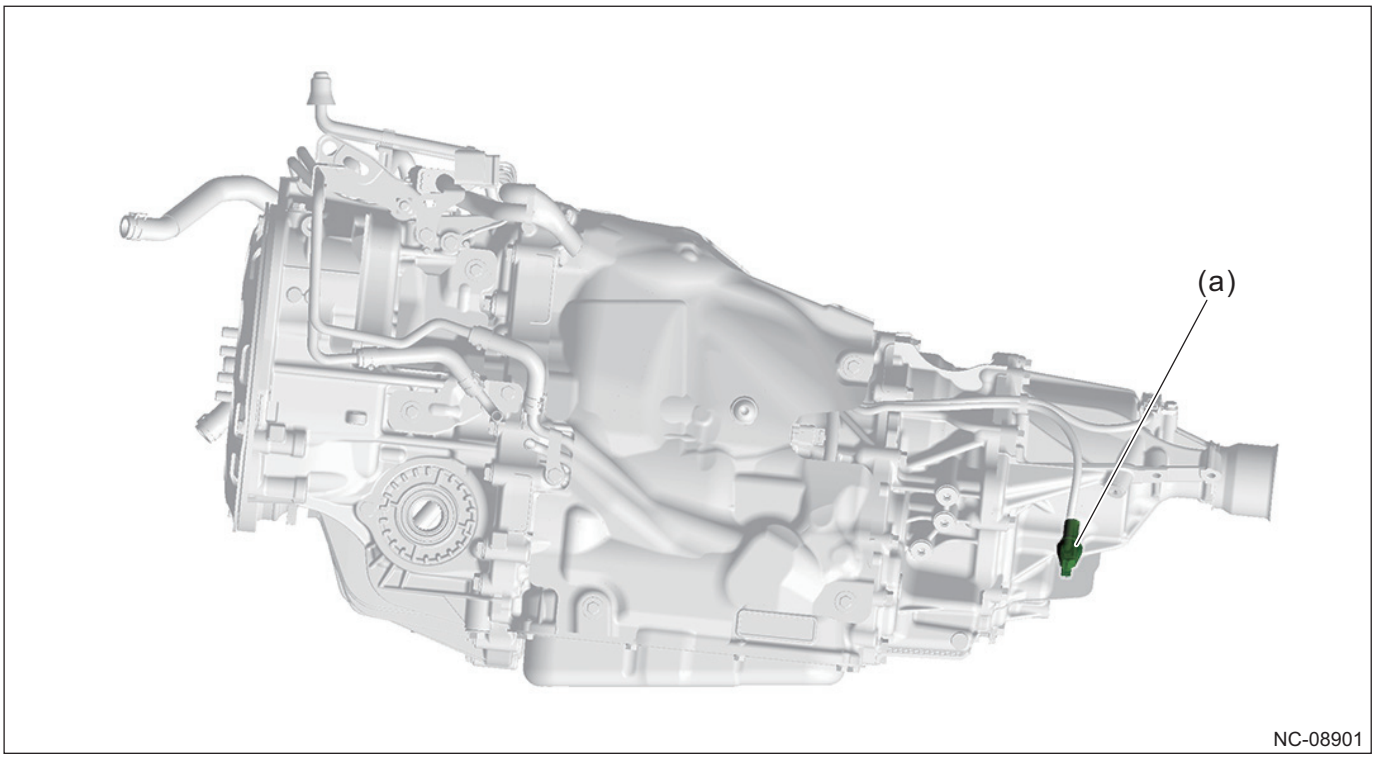


(a) Secondary speed sensor

■ Front wheel speed sensor

The front wheel speed sensor is installed on the left side of the extension case.

This sensor uses a Hall element sensor to detect the rotation speed of the VTD drum, and sends a square waveform signal to the TCM. This is used to control the AWD clutch pressure.

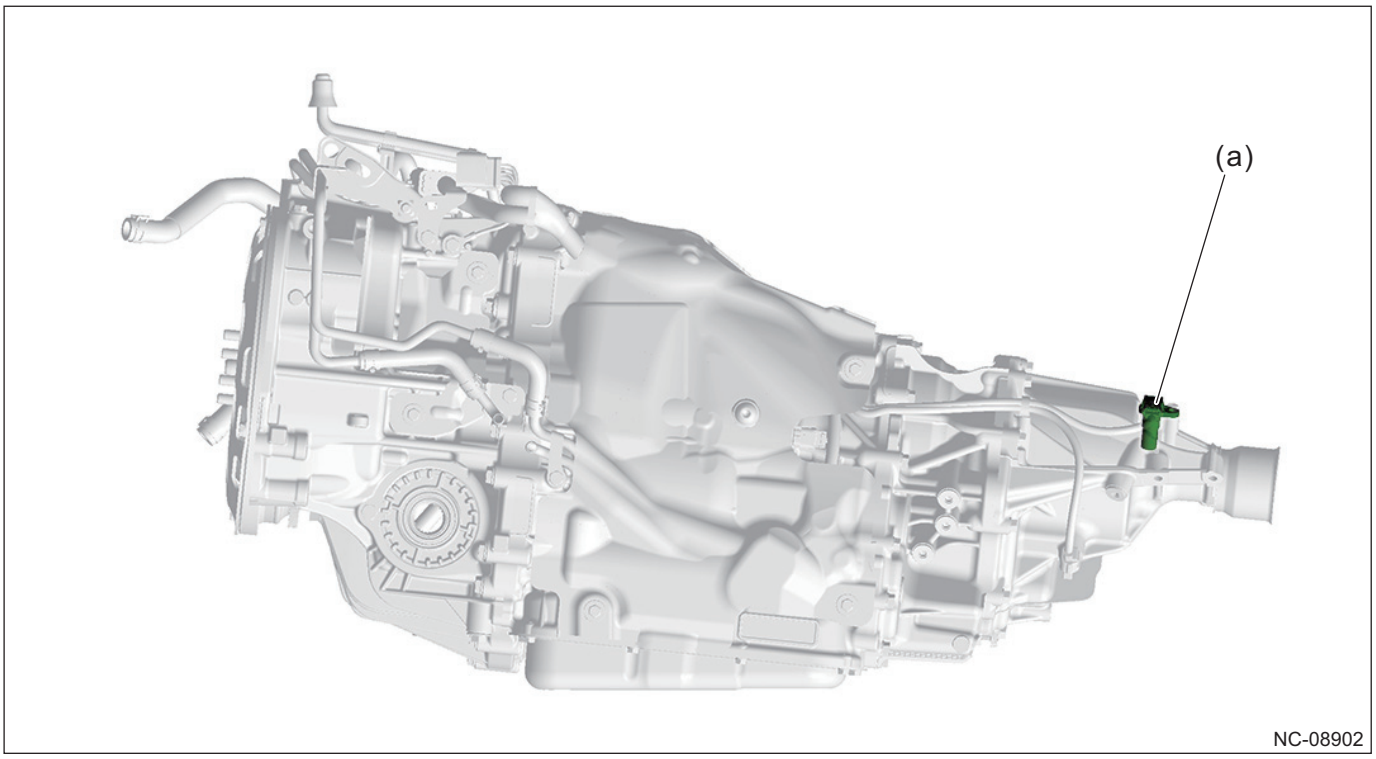


(a) Front wheel speed sensor

■ Rear wheel speed sensor

The rear wheel speed sensor is installed on the top of the extension case.

This sensor uses a Hall element sensor to detect the rotation speed of the rear drive shaft, and sends a square waveform signal to the TCM. This is used to control the AWD clutch pressure.

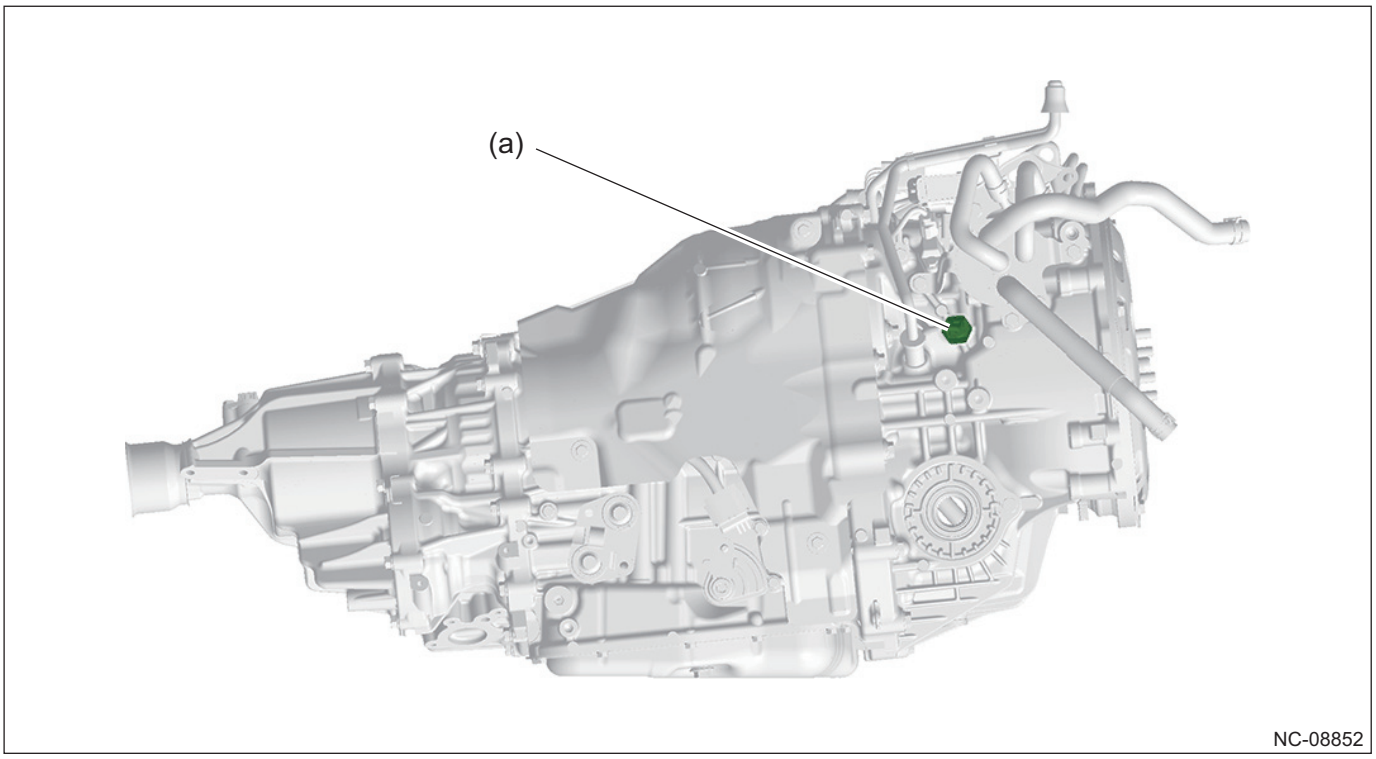


(a) Rear wheel speed sensor

■ Secondary pressure sensor

The secondary pressure sensor is installed on the right side of the transmission case.

It detects the oil pressure in the secondary hydraulic circuit and is used to control the oil pressure applied to the secondary hydraulic circuit.

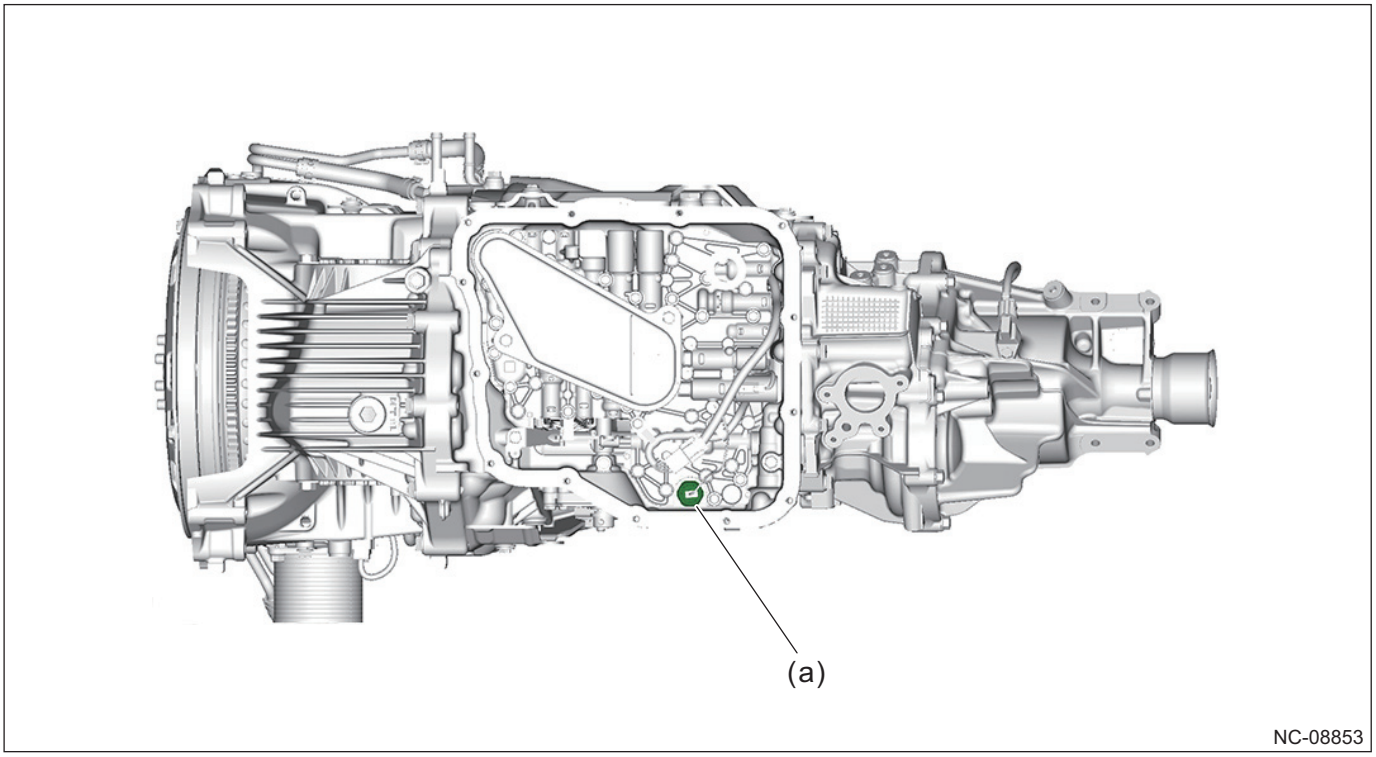


(a) Secondary pressure sensor

■ Line pressure sensor

The line pressure sensor is installed on the control valve body on the bottom of the transmission case.

This detects the oil pressure output from the oil pump to control the line pressure.



(a) Line pressure sensor

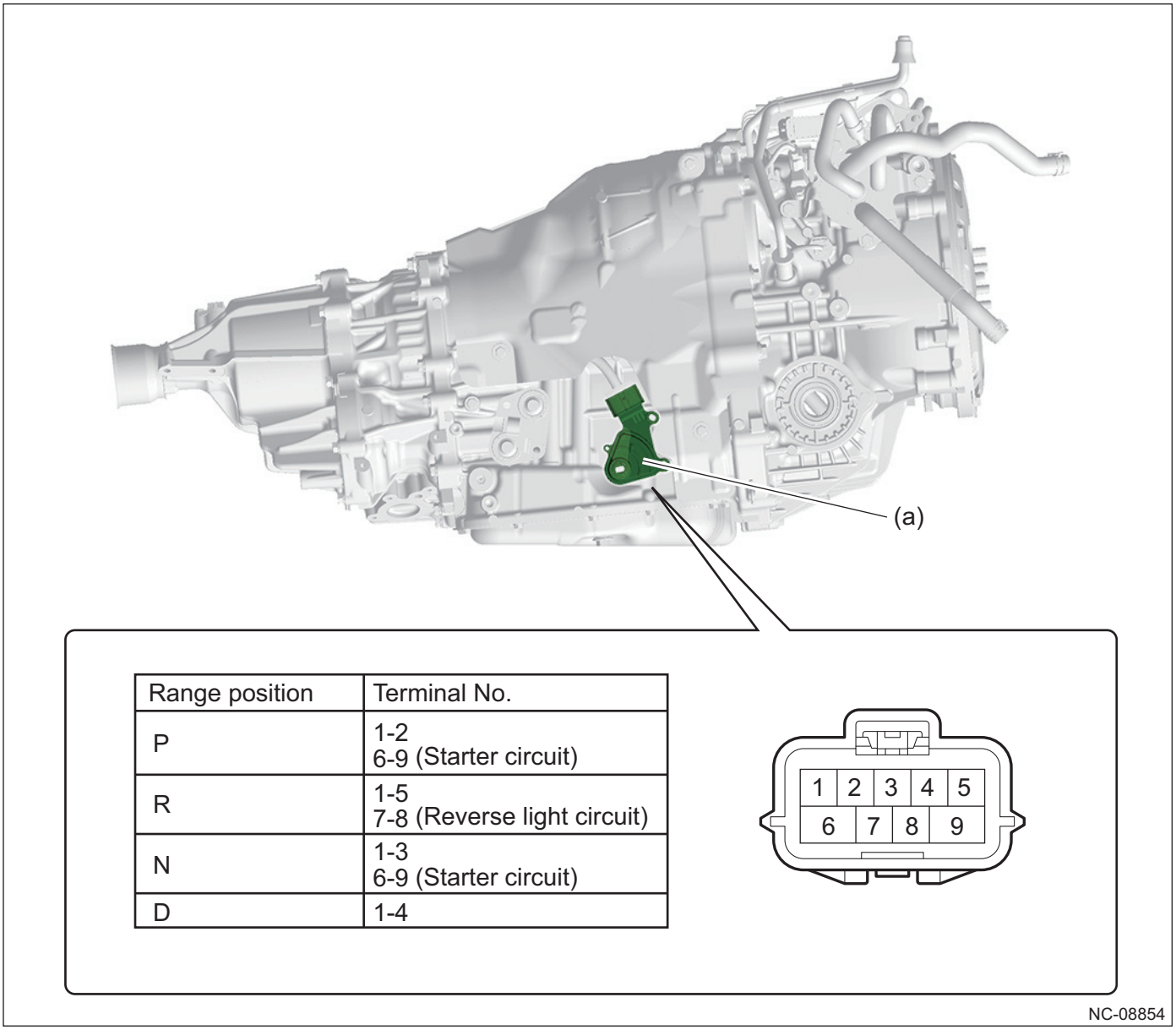
■ Inhibitor switch

The inhibitor switch ensures the safety when engine starts. The switch is installed on the right side of the transmission case and operates by the select lever. When the select lever is in P or N position, the electric circuit in the inhibitor switch is energized to activate the starter circuit and then the engine can start.

When the select lever is in R or D position, the P and N starter circuit in the inhibitor switch is cut off. This keeps the engine from cranking.

When in the R position, the switch connects to the backup light circuit to turn on the backup lights.

In addition to the above functions, the inhibitor switch also detects the selected range position and sends a range signal to the TCM.



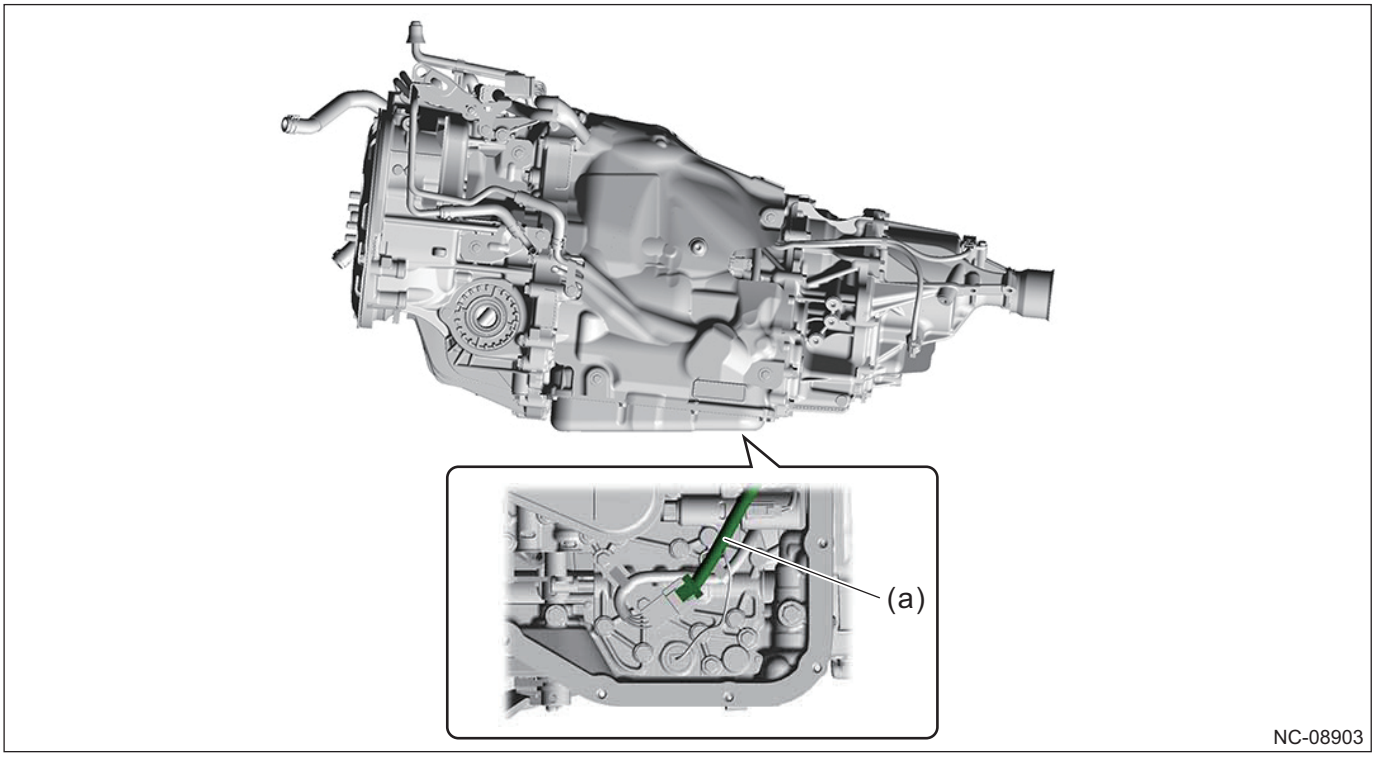
Range position	Terminal No.
P	1-2 6-9 (Starter circuit)
R	1-5 7-8 (Reverse light circuit)
N	1-3 6-9 (Starter circuit)
D	1-4

(a) Inhibitor switch

■ CVTF temperature sensor

A thermistor type CVTF temperature sensor is adopted, and is installed inside the covering of the transmission harness.

It detects the CVTF temperature in the oil pan and outputs the temperature as an electrical resistance signal.



(a) CVTF temperature sensor

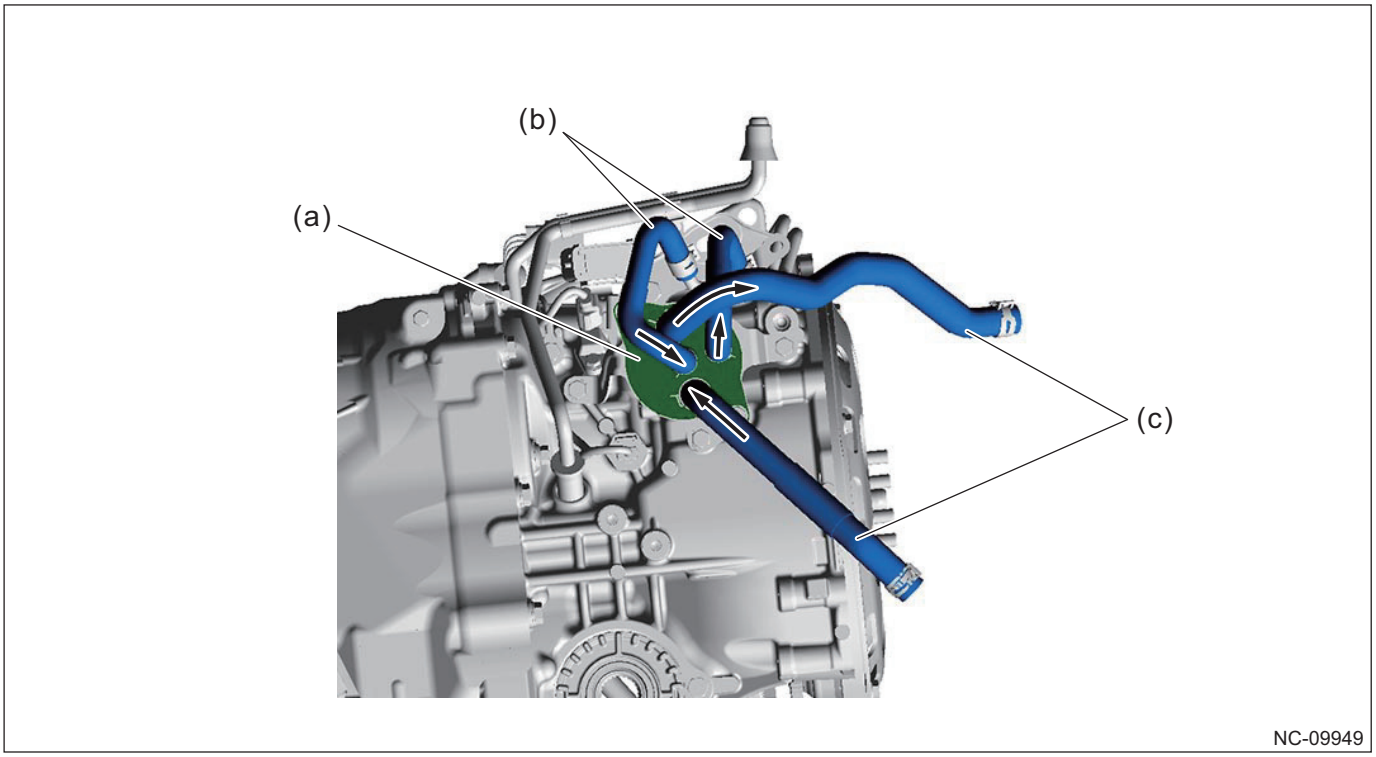
CVTF cooler (with warmer feature)

The CVTF cooler with warmer feature is adopted.

The friction is reduced and the fuel economy is improved by using engine coolant to quickly increase CVTF temperature and by reducing CVTF viscosity.

When the CVTF temperature is low, the system functions as the oil warmer for faster raising of the CVTF temperature. This helps to raise the CVTF temperature faster when the CVT unit is cold.

When the CVTF temperature is high, the system functions as the oil cooler for decreasing the CVTF temperature, and the CVTF is cooled to maintain the proper temperature.

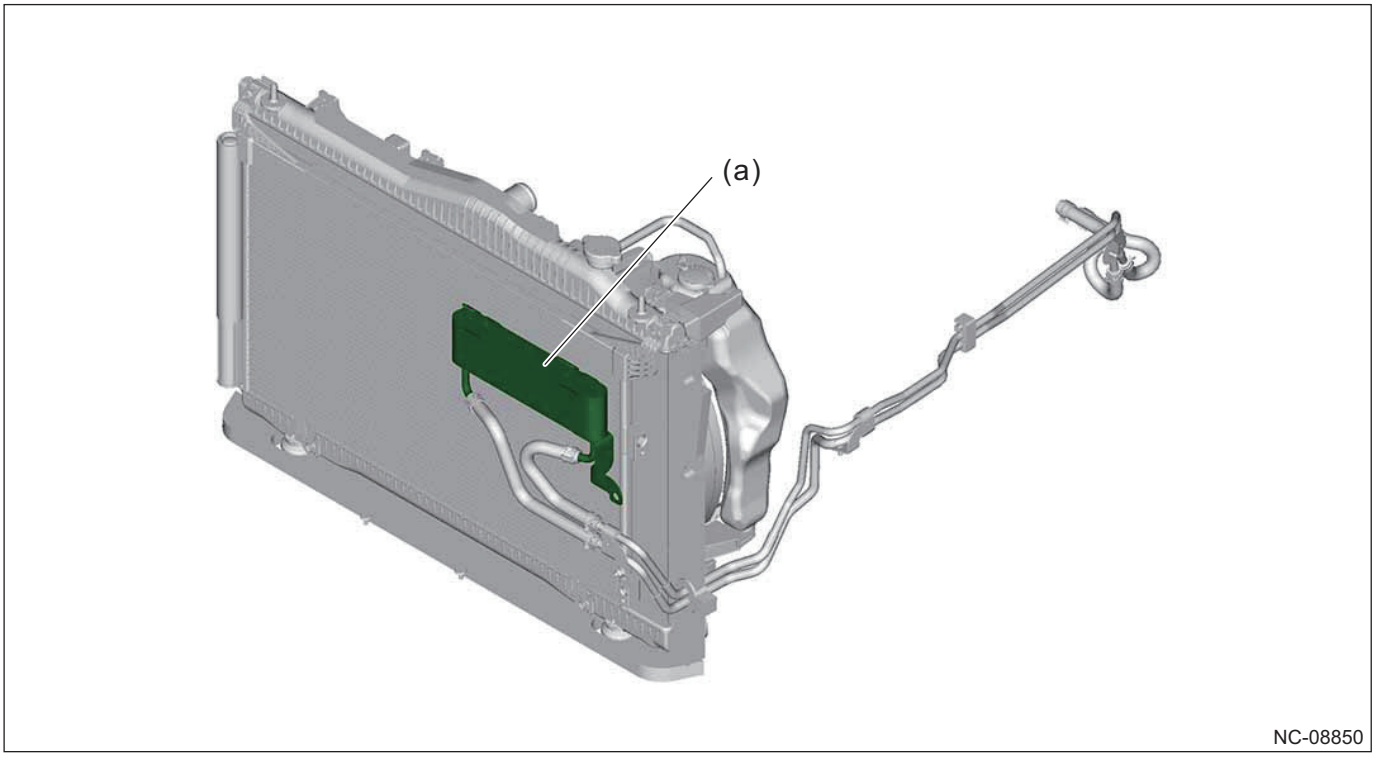


(a) CVTF cooler (with warmer feature)
(b) CVTF cooler hose
(c) Engine coolant hose

CVTF cooler (air cooler)

An air-cooled CVTF cooler is adopted, and is installed in front of the radiator.

The CVTF cooler (air cooled) is composed of hoses and pipes.

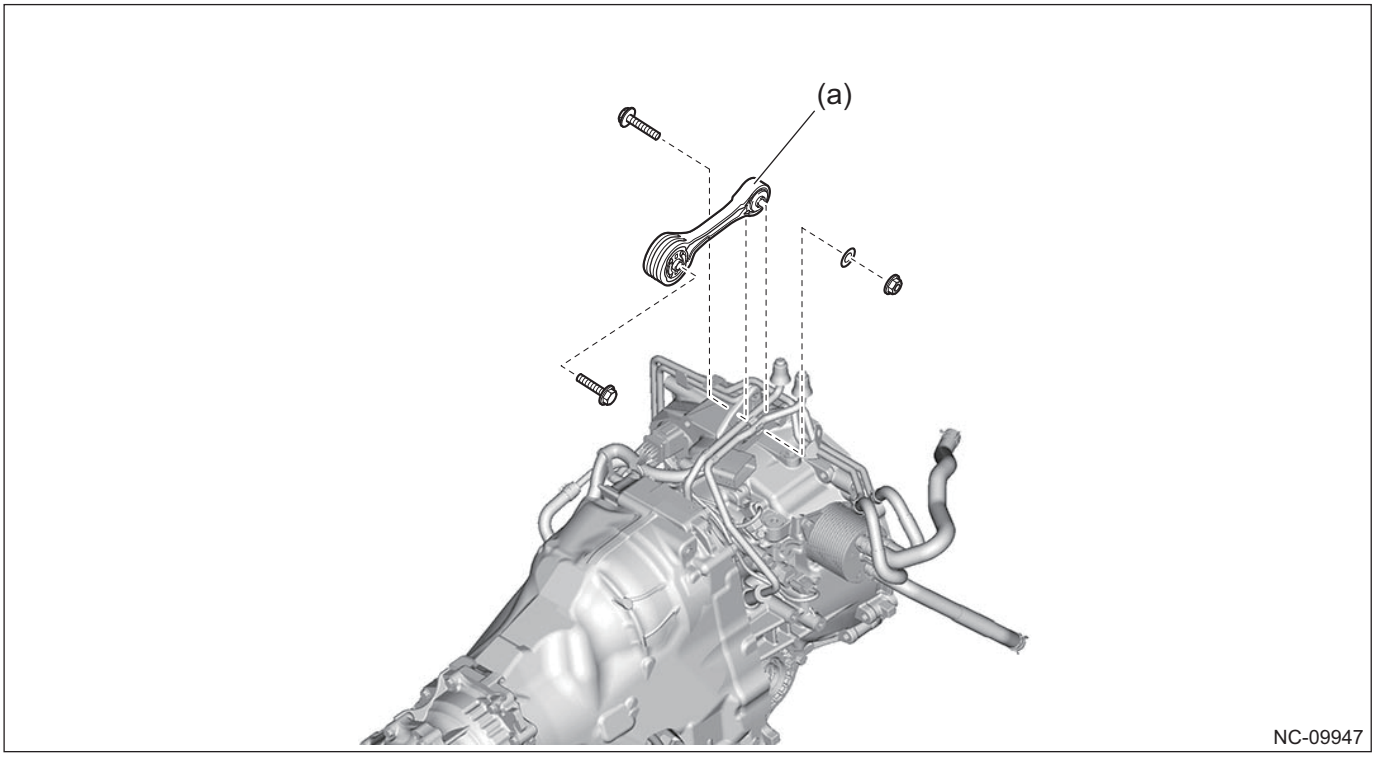


(a) CVTF cooler (air cooled)

Transmission mount

■ Front

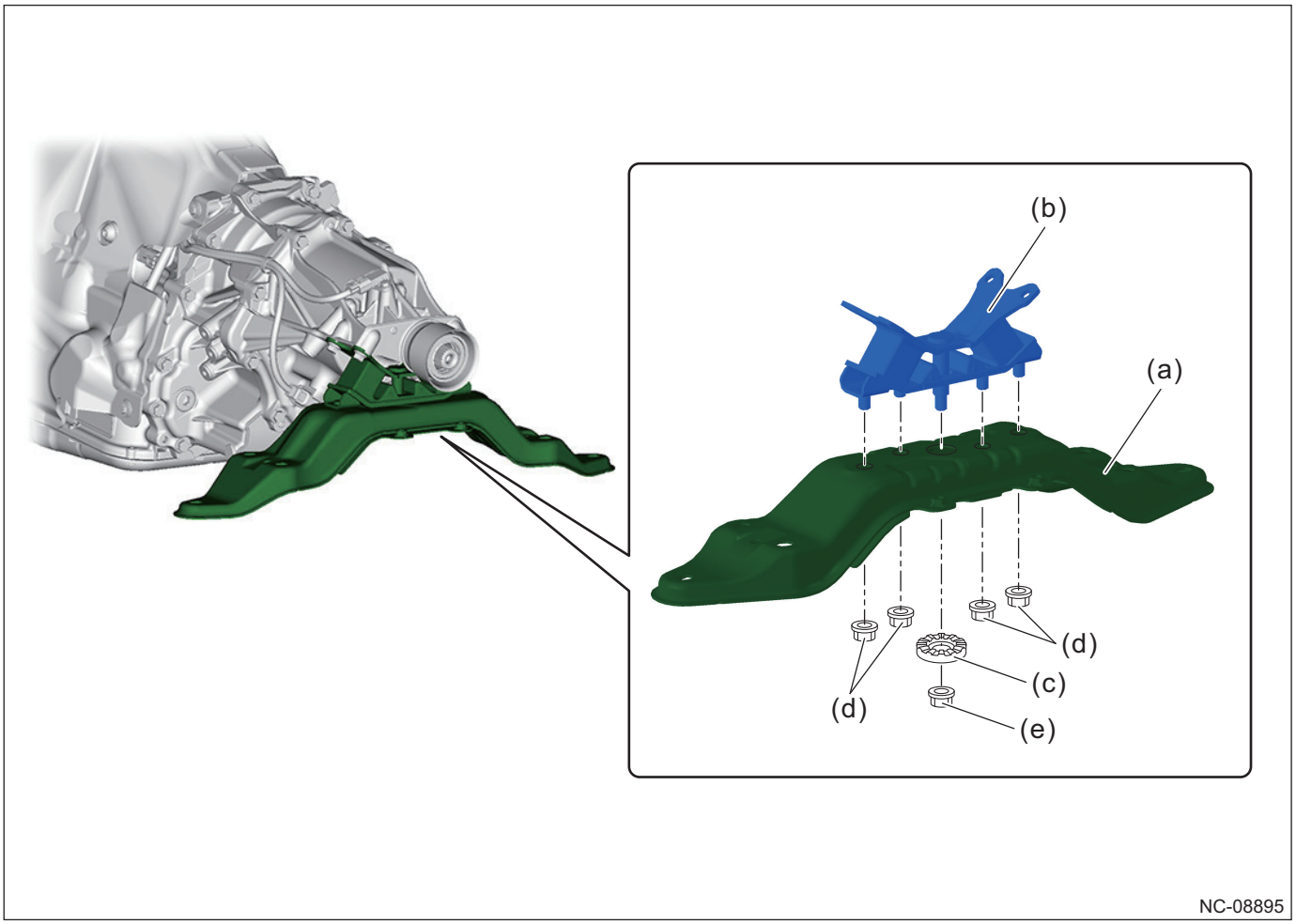
A pitching stopper type is adopted as the transmission front mount.



(a) Pitching stopper rod

■ Rear

The transmission rear cross member and rear cushion rubber are fastened at 4 points, reducing CVT chain operating vibration and noise.



(a) Transmission rear crossmember

(b) Rear cushion rubber

(c) Stopper

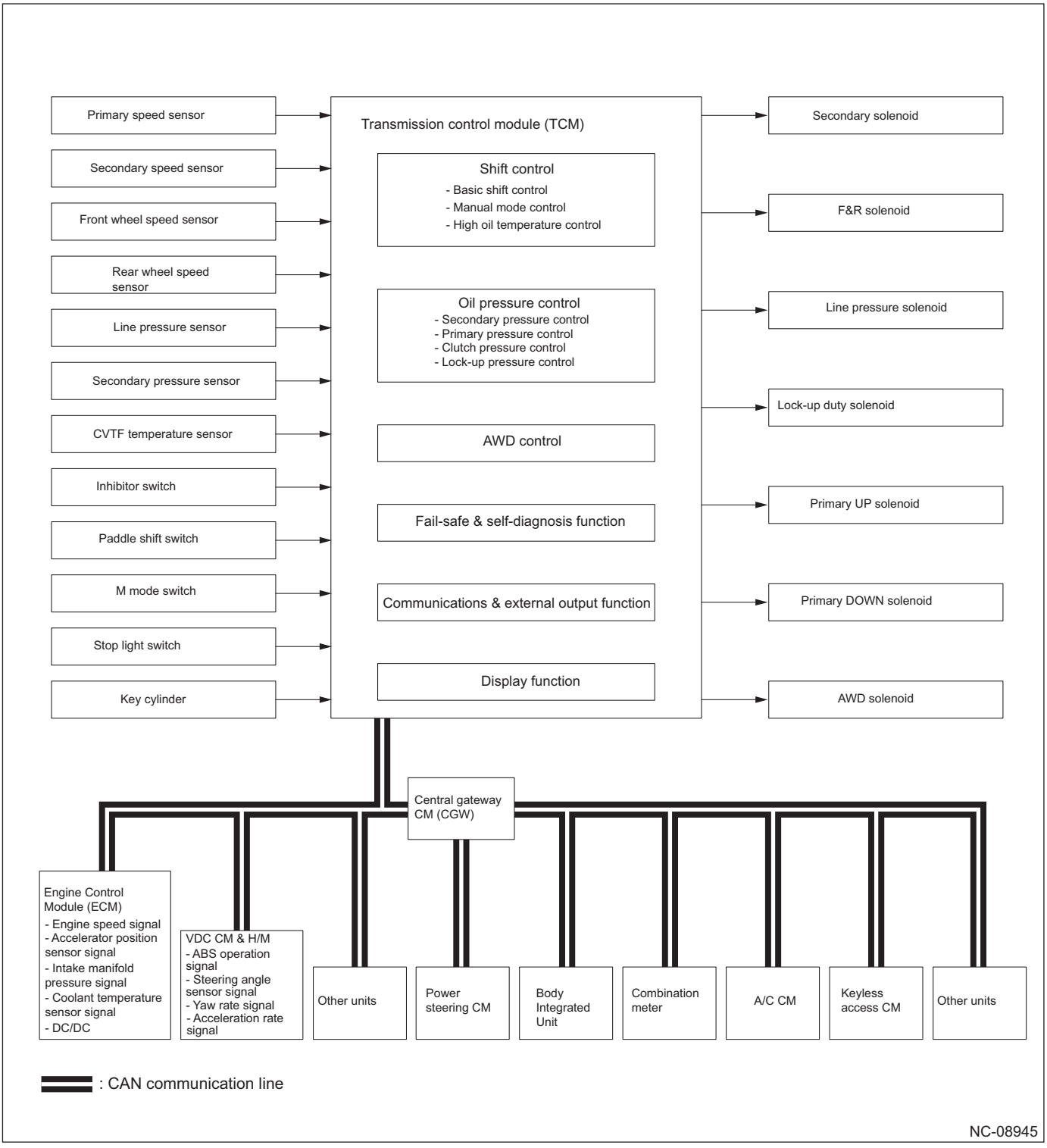
(d) Tightening nut between the transmission rear crossmember and transmission cushion rubber

(e) Stopper tightening nut

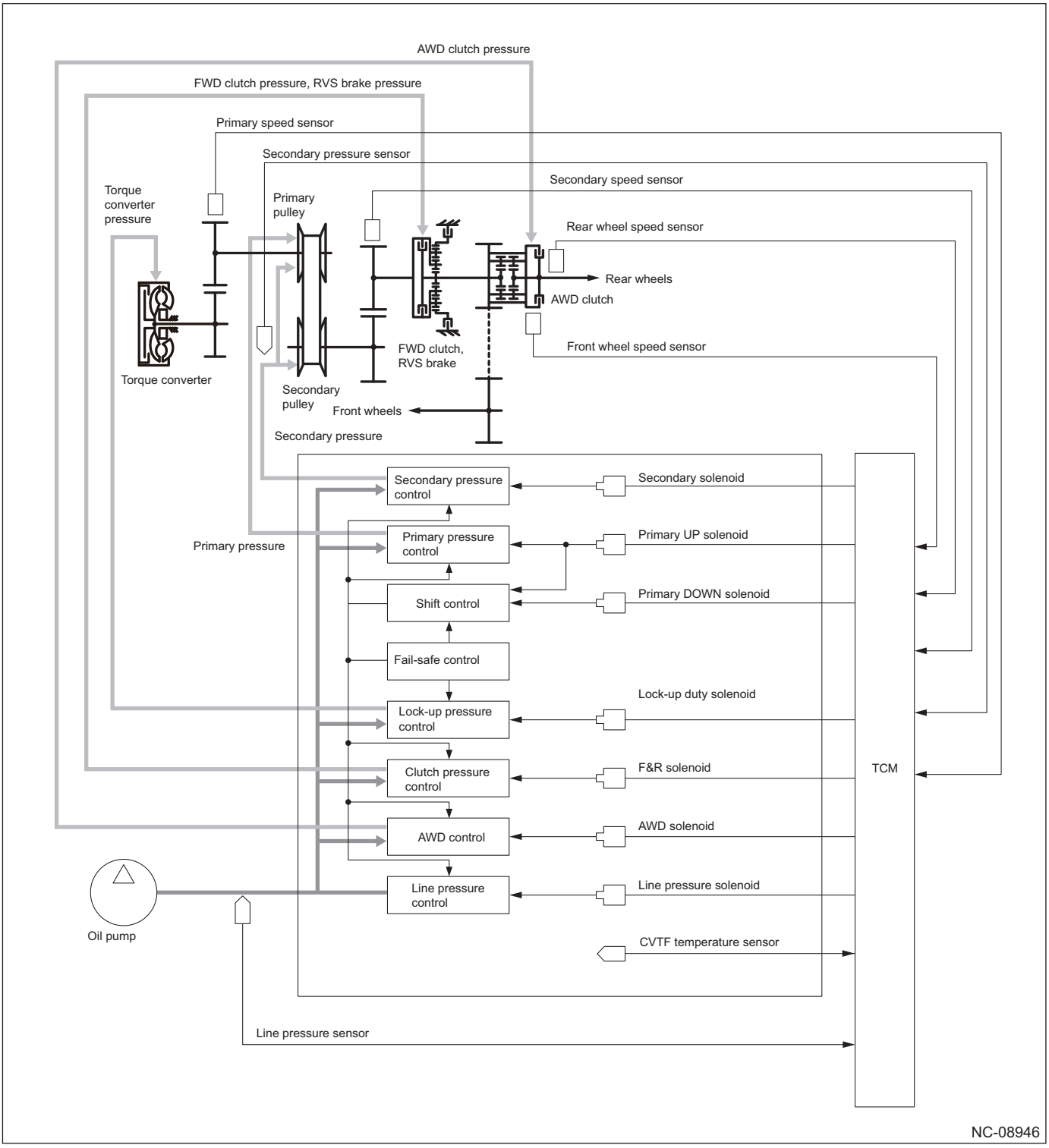
3.5.3 Construction and Operation

System diagram

CVT control system diagram



CVT control hydraulic circuit diagram



Main component functions

Component	Function
Secondary solenoid	Controls the oil pressure applied to the secondary pulley.
F&R solenoid	Controls the oil pressure applied to the forward clutch and the reverse brake.
Lock-up duty solenoid	Controls the oil pressure applied to the lock-up clutch piston in the torque converter.
Line pressure solenoid	Controls the oil pressure based on all of the required pressures within the transmission.
Primary UP solenoid	Controls the oil pressure applied to the primary pulley at up-shifting.
Primary DOWN solenoid	Controls the oil pressure applied to the primary pulley at down-shift.
AWD solenoid	Controls the oil pressure applied to the AWD clutch.
Primary speed sensor	Detects the rotating speed of the input shaft.
Secondary speed sensor	Detects the rotating speed of the output shaft.
Front wheel speed sensor	Detects the rotating speed of the front wheels.
Rear wheel speed sensor	Detects the rotating speed of the rear wheels.
Line pressure sensor	Detects the line oil pressure.
Secondary pressure sensor	Detects the oil pressure applied to the secondary pulley.
CVTF temperature sensor	Detects the oil temperature.
Inhibitor switch	Detects the shift position.
Paddle shift switch (+)	Detects the up-shifting.
Paddle shift switch (-)	Detects the down-shift.
TCM	• Controls the transmission operation by determining vehicle driving conditions based on various input signals and sending proper signals to each solenoid. • It includes a diagnosis mode and fail-safe function for serviceability when a system failure occurs.
ECM	Sends the engine control signal to TCM.
VDC CM & H/M	Sends the brake control signal to TCM.
Combination meter	Flashes the CVT oil temperature warning light when a system failure occurs.
Multi information display	• Indicates the current shift position by the shift position indicator. • Displays the warning screen when a system failure occurs.
DLC	DTC can be read by connecting the diagnosis tool.

System details

Overview

The transmission electronic oil pressure control system is composed of TCM, various sensors and switches, and oil pressure controllers including the solenoid valve. This system controls forward/reverse motion, lock-up clutch operation, line pressure, and transmission operation that includes shifting properties.

The TCM performs controls by determining the vehicle driving conditions based on various input signals from other systems and sending the appropriate signals to each solenoid (primary UP/DOWN solenoid, secondary solenoid, lock-up duty solenoid, F&R solenoid, AWD solenoid, and line pressure solenoid).

The TCM has the following major functions.

- Selects shift transmission/lock-up pattern and determines gear ratio/lock-up conditions.
- Drives mechatronic devices such as the solenoid valve based on a shift command and a control signal for working pressure.
- AWD clutch control function
- Self-diagnosis function for identifying faulty parts of the transmission and fail-safe function when a problem is detected
- Function for communication with a diagnosis tool for malfunction diagnosis and maintenance, etc.
- Hard variation correction function for a transmission by learned control
- Function for communication (CAN communication) with other control modules

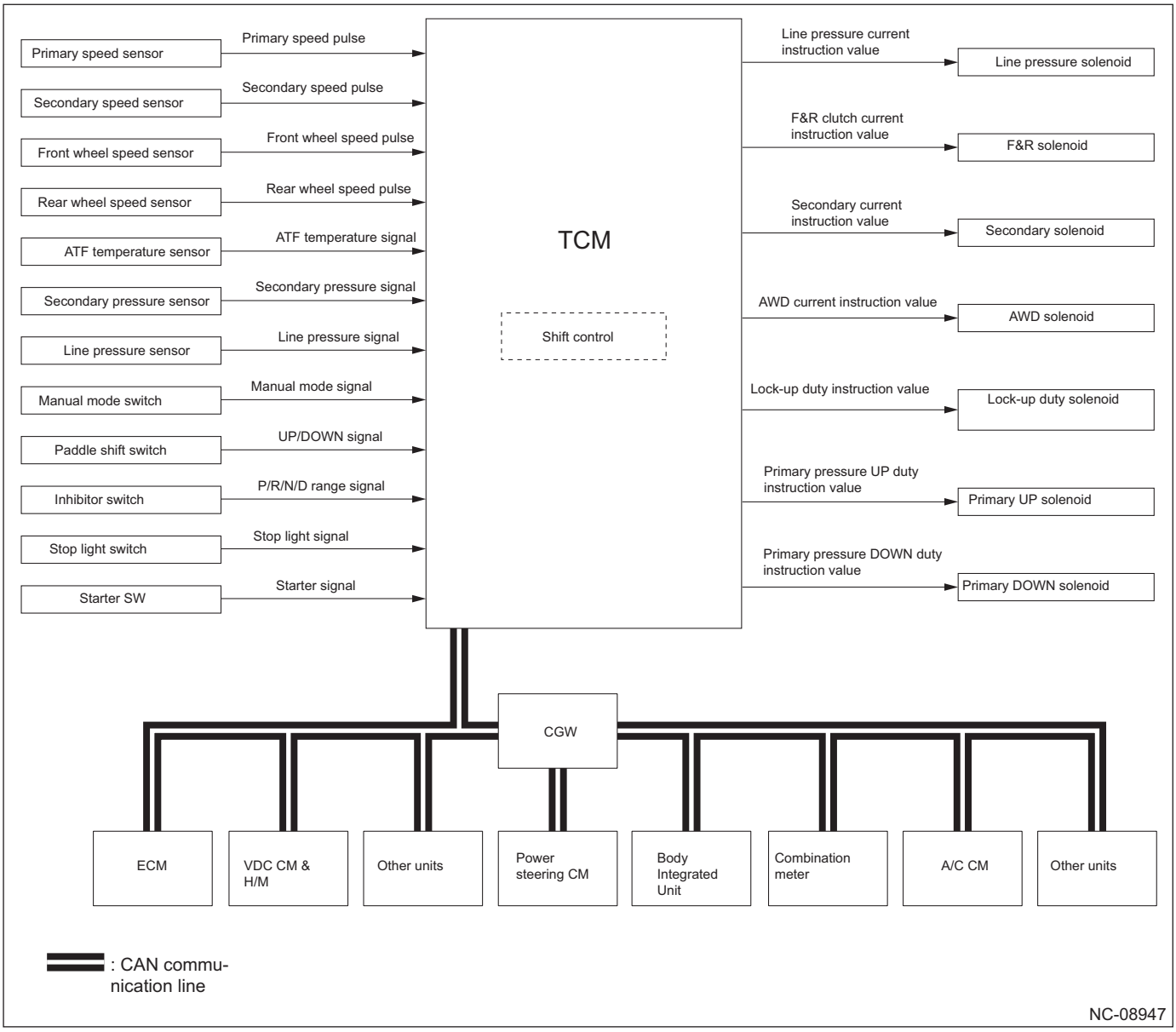
Control description

Control item	Control description		Control signal
Shift control	Basic shift control	Shifting properties are set for each range depending on the acceleration opening angle and vehicle speed.	• Accelerator position signal • Engine speed • Secondary speed sensor signal • Primary speed sensor signal • Oil pressure sensor signal • Range signal • Intake manifold pressure signal
	Manual mode control	When the M-range is selected, manual mode control is selected.	• Accelerator position signal • Range signal • Engine speed • Secondary speed sensor signal • Primary speed sensor signal • Oil pressure sensor signal • Brake switch signal
	SI-DRIVE control	Controls the shifting characteristics according to the mode of SI-DRIVE/drive mode select (for some grades).	(Same as manual mode control)
	High oil temperature control	Regulates the upper limit for transmission speed when CVTF is hot.	• Engine speed • Primary speed sensor signal • Secondary speed sensor signal • Range signal • CVTF temperature signal

Control item	Control description		Control signal
Oil pressure control	Secondary pressure control	Secondary pressures are controlled depending on the necessary oil pressures selected by each range and switch signals. Feedback control on the necessary oil pressures is performed by oil pressure sensors.	• Engine speed • Secondary speed sensor signal • Primary speed sensor signal • Oil pressure sensor signal • Range signal • Intake manifold pressure signal • CVTF temperature signal • Brake switch signal
	Primary pressure control	Primary pressure is determined from secondary pressure, ranges, and gear ratio for feedback control.	(Same as secondary pressure control)
	Forward clutch pressure and reverse brake pressure control	Controls oil pressure for the forward clutch and reverse brake according to secondary speed and acceleration opening angle.	• Acceleration opening angle signal • Engine speed • Secondary speed sensor signal • Primary speed sensor signal • Oil pressure sensor signal • Range signal • CVTF temperature signal • Brake switch signal
	Lock-up pressure control	In accordance with the shift pattern selected by ranges and switch input, the lock-up engagement/release vehicle speeds are determined based on the CVTF temperature and vehicle speed. Accordingly, the lock-up duty solenoid is controlled so that the lock-up clutch in the torque converter is engaged and released smoothly.	• Acceleration opening angle signal • Engine speed • Range signal • Primary speed sensor signal • Secondary speed sensor signal • CVTF temperature signal
AWD control	VTD-AWD (electronic control AWD with uneven and variable torque distribution) control	Torque is distributed to the front and rear by the secondary differential, and control of the clutch engagement torque is performed using hydraulic pressure and electromagnetic force, in order to shift drive torque between the front and rear and prevent slipping.	• Engine speed • Secondary speed sensor signal • Primary speed sensor signal • Front wheel speed sensor signal • Rear wheel speed sensor signal • ABS operation signal • Steering angle sensor signal • Yaw rate signal • Lateral acceleration signal • Brake switch signal • Range signal • Oil pressure sensor signal • Acceleration opening angle signal

Shift control

Shift control performs control using the primary UP solenoid and the primary DOWN solenoid. The control module calculates based on input signals such as the engine speed, throttle opening angle, inhibitor switch, and input-output rotation numbers to control gear change by changing the primary pressure applied to the primary pulley.



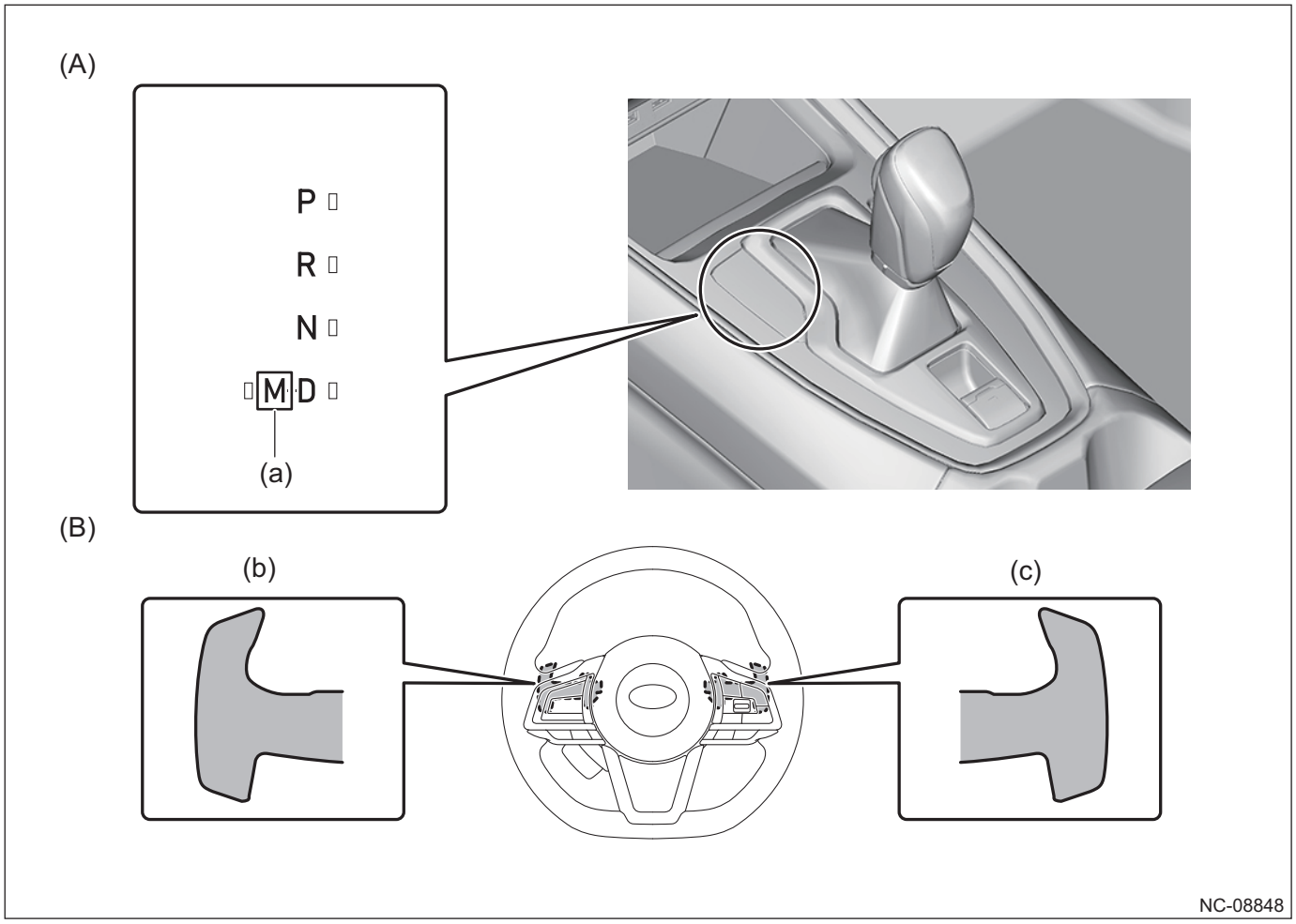
■ High oil temperature control

Protects the transmission by reducing the maximum shift allowable speed from normal operation when the CVTF temperature is high.

■ Manual mode control

▮ Normal manual shift mode

When the select lever is shifted to the M range while in the D range, the transmission enters Manual mode. The desired gear can be selected by operating the paddle shift switches located on the steering wheel.



(A) Select lever

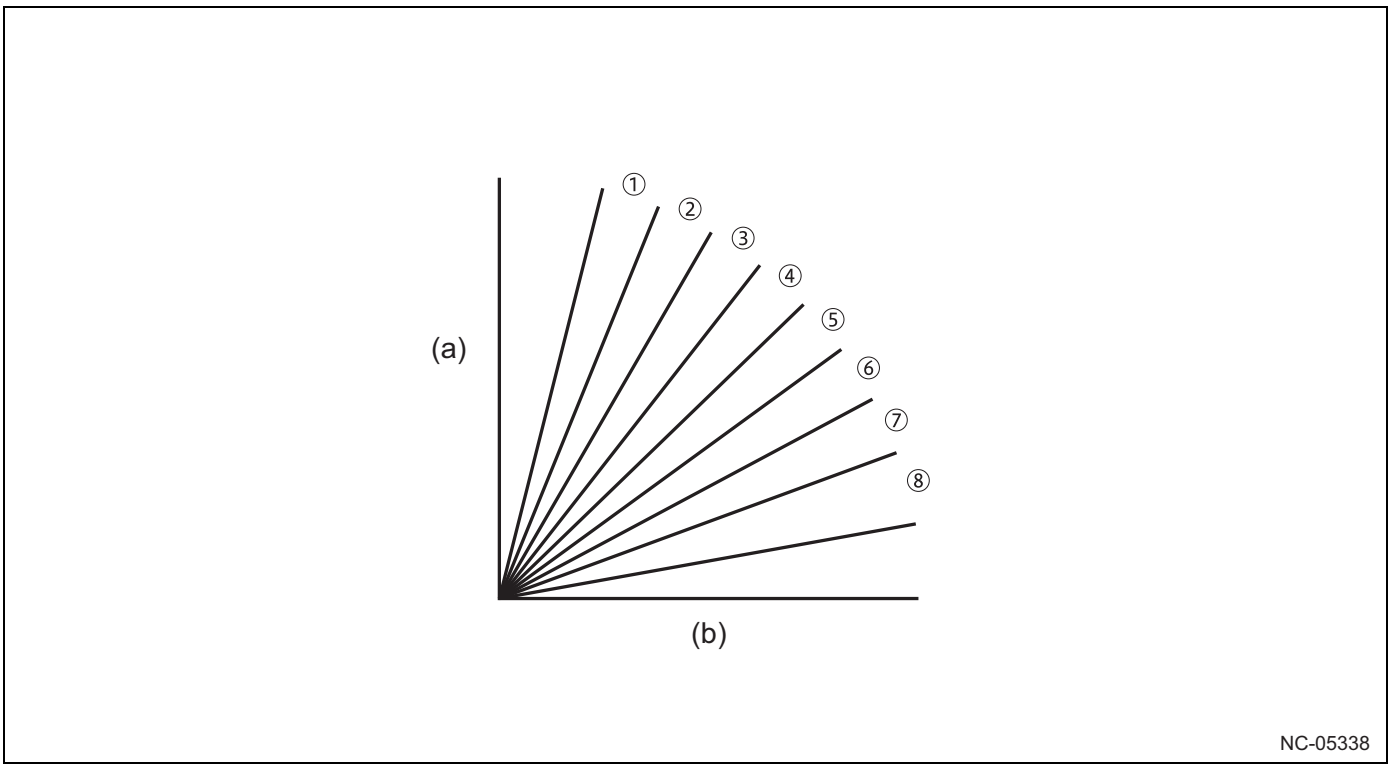
(B) Paddle shift switch

(a) M range

(b) Paddle shift switch (-)

(c) Paddle shift switch (+)

8-speed gears are adopted for the manual mode to increase the gear steps selectable by the driver and enable driver-friendly manual shifting.



(a) Engine speed (b) Vehicle speed

Caution
When the rev target is reached, up-shift occurs automatically in I/S mode, however automatic up-shift does not occur in S# mode.

▮ Temporary manual shift mode

A temporary manual mode is adopted which allows temporary switching to manual mode just by operating the paddle shifts while the shift lever remains in the D range. When constant vehicle speed driving or accelerator full open is identified, the mode automatically returns to the D range.

▮ Start from manual 2nd gear mode

Starting from a stop in 2nd gear is enabled. This reduces wheel spin in winter or otherwise slippery road surfaces.

■ SI-DRIVE control

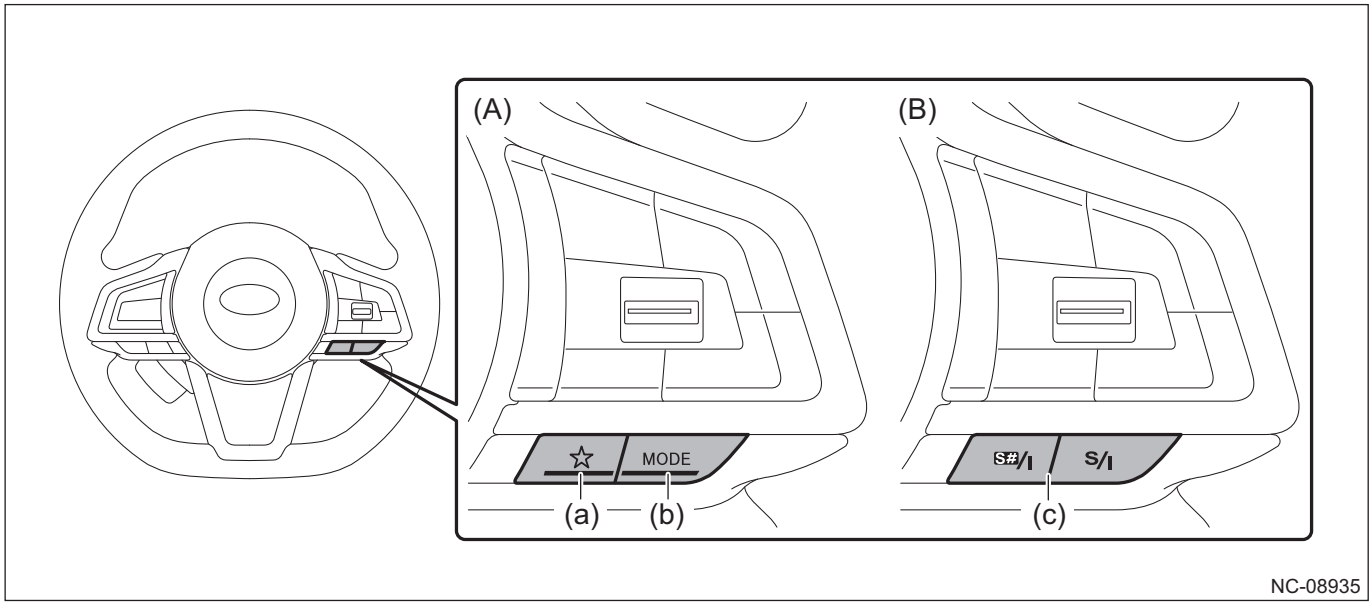
The adoption of the SI-DRIVE allows the engine property and transmission property to be selected according to the driving style, driving feel, and driving situation.

Three control modes with special output characteristics are set in the ECM. Accordingly, precise and integrated cooperative control of the electronic throttle and TCM is carried out in order to achieve driving performance with distinctive features in each control mode.

Mode	Characteristics
I (Intelligent mode)	This realizes smooth traveling performance and ecological driving by setting two power output characteristics for the accelerator operation. It also has a characteristic that enables smooth operation even on a snowy road and other slippery roads.
S (Sports mode)	This mode enables acceleration with linearity from any vehicle speed range. This all-around mode exhibits the comfortable grand touring performance.
S# (Sports sharp mode)	This mode focuses on response that draws out maximum engine performance, and produces a direct response and feeling of acceleration following accelerator operation.

For models with drive mode select, three modes of SI-DRIVE are set for drive mode select. With a single switch, drive mode select changes the control of the steering, suspension, and other systems, allowing the mode to be changed according to the driver's preferences and the driving situation.

SI-DRIVE switch	Drive mode select	Power unit
I (Intelligent mode)	COMFORT	I (Intelligent mode)
	NORMAL	
S (Sports mode)	SPORT	S (Sports mode)
S# (Sports sharp mode)	SPORT+	S# (Sports sharp mode)
-	★ (INDIVIDUAL)	I/S/S# (Can set to the mode which was selected by the driver.)



(A) Models with drive mode select

(B) Models with SI-DRIVE

(a) Individual switch

(b) MODE switch

(c) SI-DRIVE switch

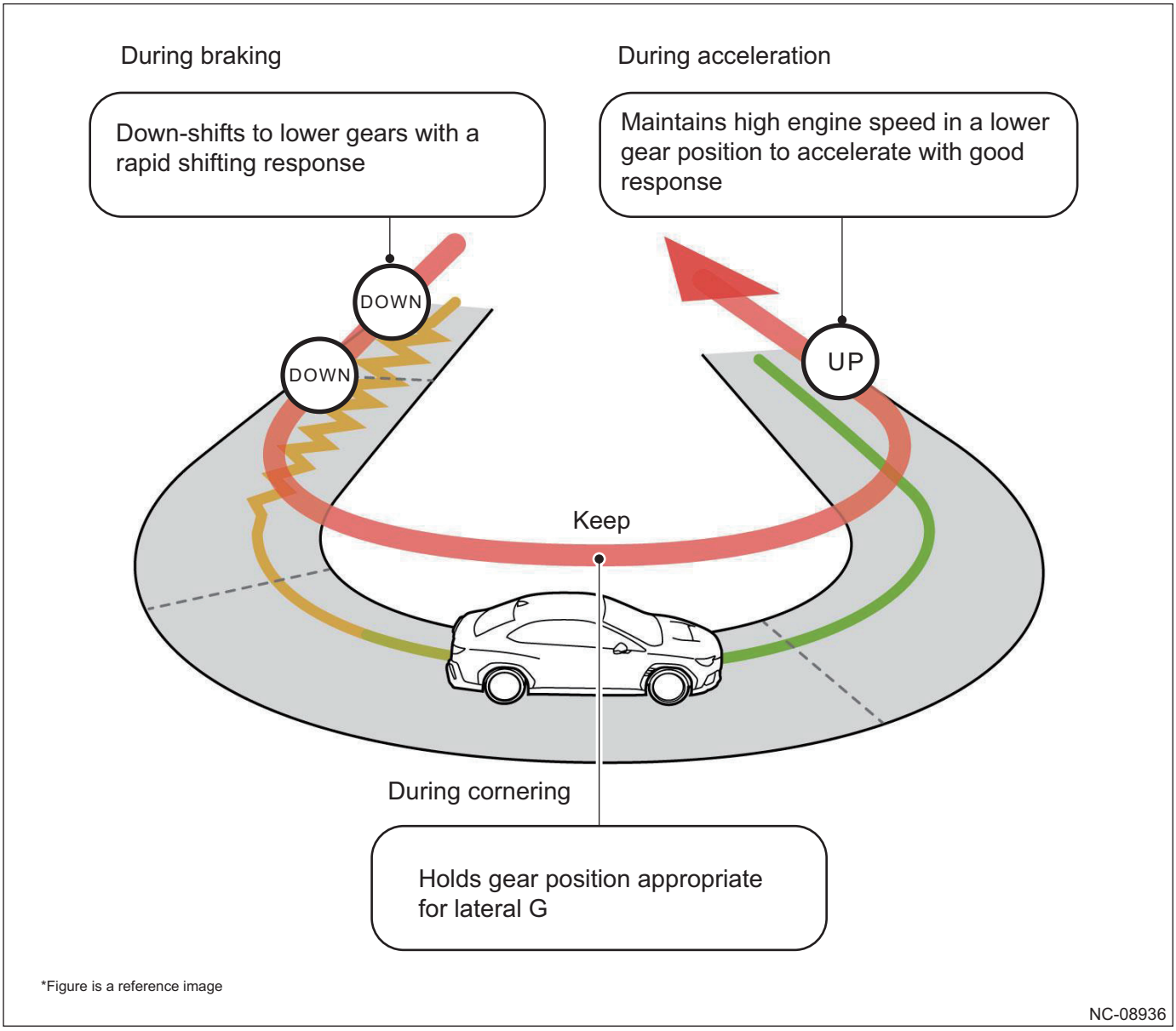
▮ Sports shifting control

Factors that are important for enjoyable driving of a car are a good response to the driver's operations, and predictability where the actual movement of the car matches the movement intended by the driver. Response and predictability are improved in order to achieve sharp, fast shifting and produce a shift feeling that directly reflects the driver’s intentions. The result is a car that provides driving enjoyment on the same level as a MT vehicle, overturning conventional wisdom about CVT cars.

When S/S# mode is selected, shifting as intended by the driver is performed according to acceleration or deceleration when driving even while remaining in the D range, which provides shifting similar to MT operation. Linear acceleration and deceleration that follows the driver's intent and links the shifting to the engine speed results in more active shifting control.

Mode	Shift control
I (Intelligent mode)	Normal
S (Sports mode)	Sports shifting control
S# (Sports sharp mode)	

- Control during braking: When braking, the system automatically down-shifts to lower gears with a rapid shifting response. Blipping control is also performed when down-shifting.
- Control during cornering: The lateral acceleration sensor detects cornering conditions and reduces unnecessary gear changes while cornering. A high engine speed is also maintained to improve acceleration response after cornering.
- Control during acceleration: Maintains high engine speed in a lower gear position in order to accelerate with good response.

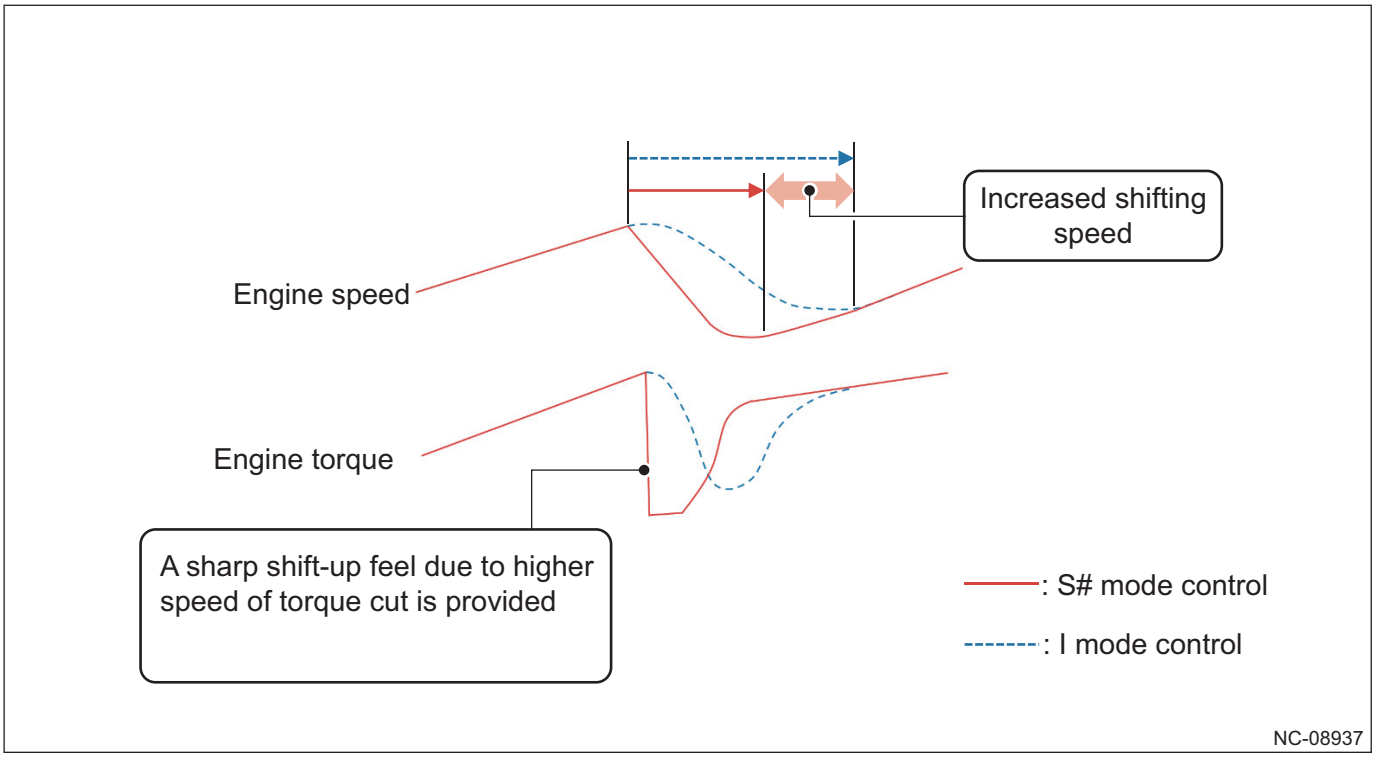

During braking
Down-shifts to lower gears with a rapid shifting response
During acceleration
Maintains high engine speed in a lower gear position to accelerate with good response
DOWN
DOWN
UP
Keep
During cornering
Holds gear position appropriate for lateral G
*Figure is a reference image
NC-08936

▮ Control for improved shifting sharpness (engine coordinated control)

Up-shifting

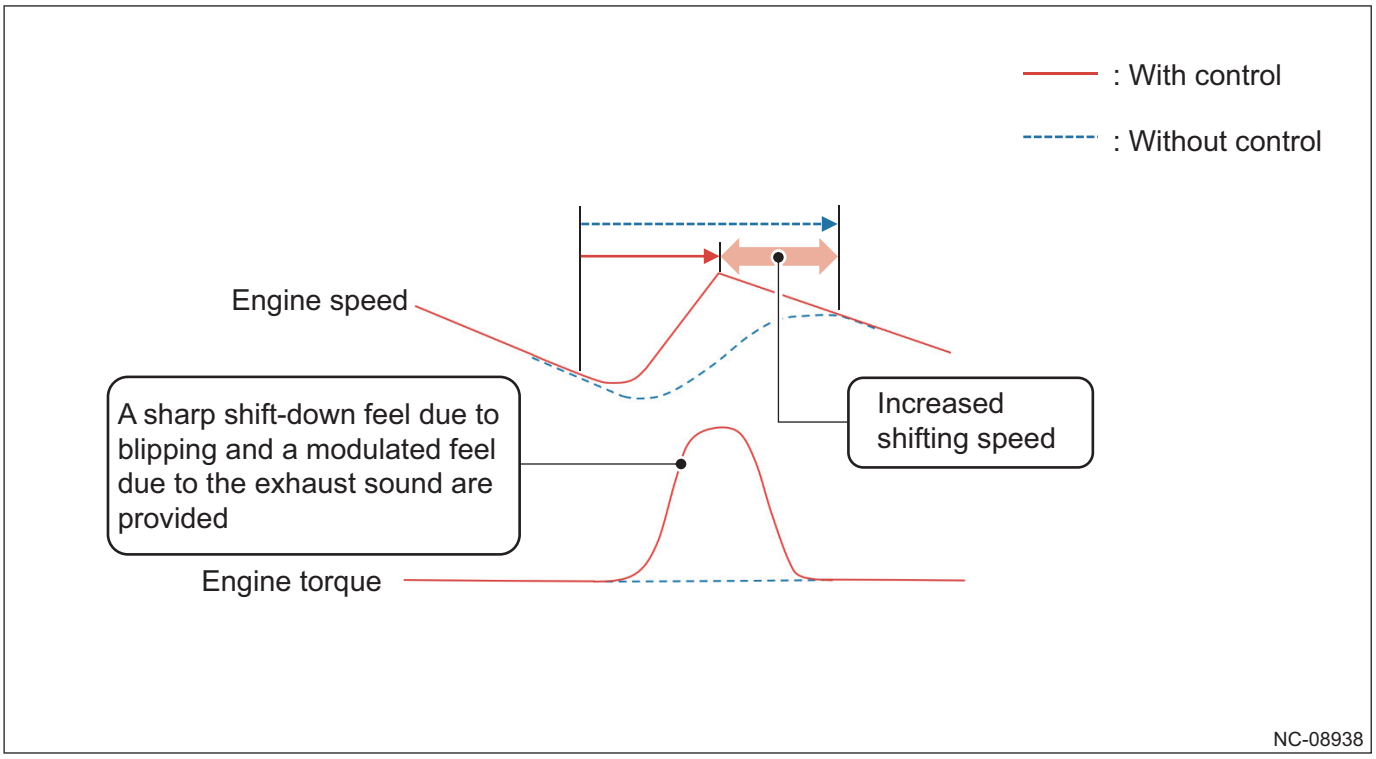
- A faster torque cut when up-shifting in S mode and S# mode produces a sharp shifting feel.

Mode	Torque cut method	Shifting sharpness
I (Intelligent mode)	Throttle convergence	Normal/high speed (Changes according to the amount of pedal depression.)
S (Sports mode)	Throttle convergence, ignition retard	High speed
S# (Sports sharp mode)	Throttle convergence, ignition retard, cylinder deactivation	Super high speed



Down-shifting

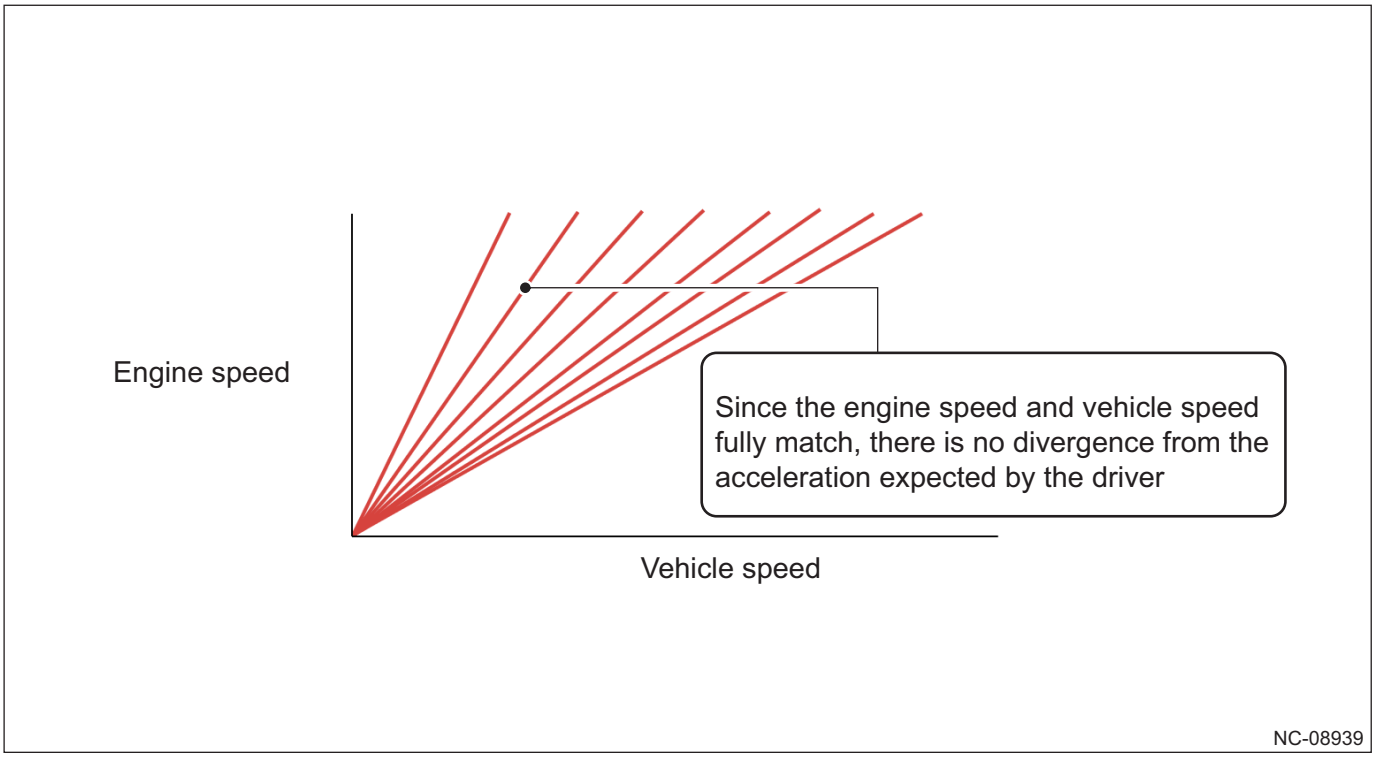
- The addition of auto-blipping control to S mode and S# mode improves shifting sharpness and produces a sharp, satisfying shifting feel that varies to match the exhaust sound.
- Because it is coordinated with engine torque control, this improves the engine speed rise rate during auto-blipping, as well as a natural deceleration feel.



All-mode fixed gear position control

Adopting fixed gear position control in all SI-DRIVE modes provides a feeling of acceleration that matches the engine and vehicle speeds.

Mode	Accelerator opening angle: Low	Accelerator opening angle: High
I (Intelligent mode)	Stepless shifting control	8-step shifting control
S (Sports mode)	8-step shifting control	
S# (Sports sharp mode)	8-step shifting control	



Torque control in each gear position (engine cooperative control)

Torque control is set for each gear position in each mode, providing both acceleration performance according to the driving situation and controllability in all speed ranges.

Low fuel consumption traveling in the intelligent mode

When intelligent mode is selected and the acceleration opening angle is large, the throttle property suitable for low fuel consumption traveling is applied according to stepless shifting control. Also, when the acceleration opening angle is small, the control can be switched to fixed gear shifting control to improve predictability and apply acceleration characteristics that match the driver's intention.

In addition, the ECO gauge supports fuel-efficient driving by providing the driver with information about low fuel consumption driving.

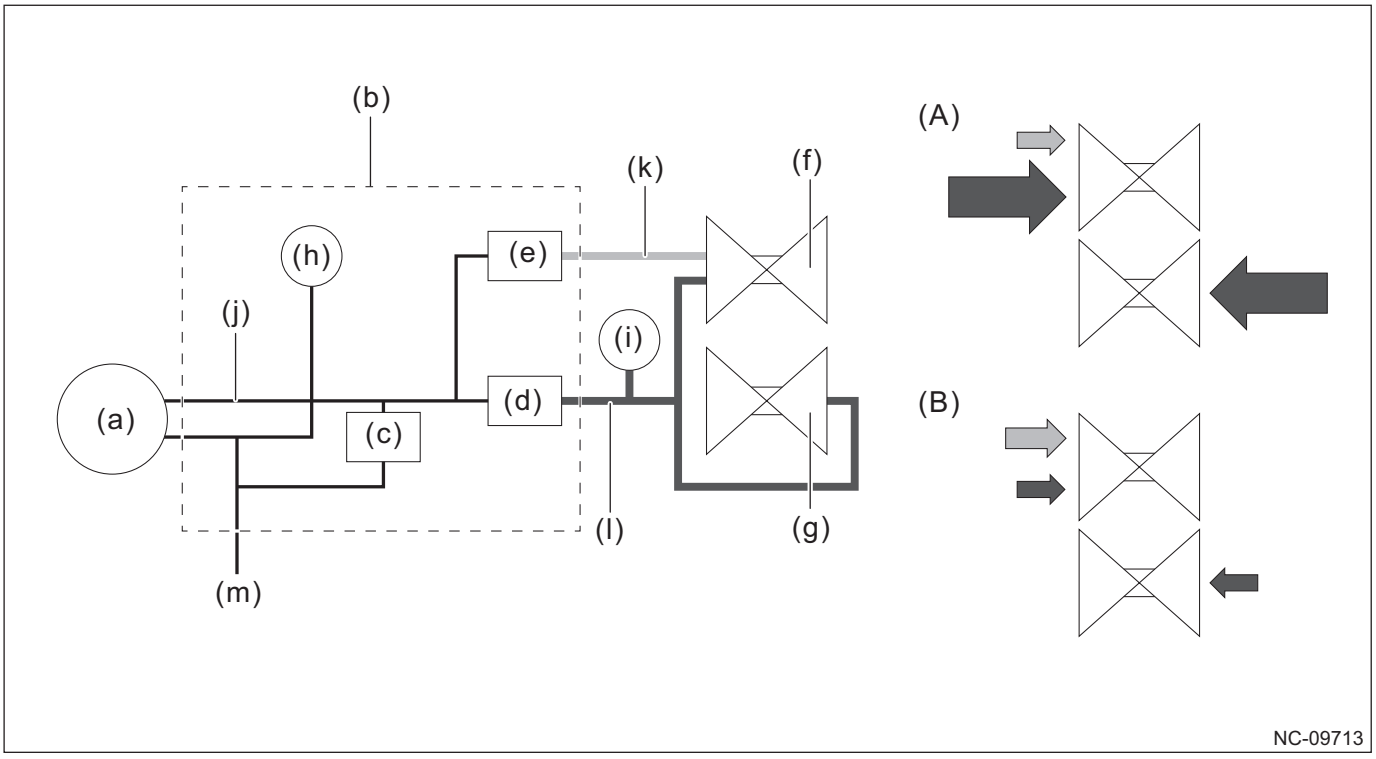
The vehicle is always in the intelligent mode at engine start. The improvement in the basic performance of the engine ensures sufficient traveling performance even in the intelligent mode while the environmental performance is maintained.

Oil pressure control

■ Secondary pressure control

This controls the optimal secondary pressure according to the driving conditions and generates the chain clamping power needed for power transmission, based on signals that include acceleration opening angle, vehicle speed, engine speed, secondary pressure sensor, brake switch, and oil temperatures.

By independently controlling the secondary pressure apart from the line pressure, the gear shift response and fuel efficiency performance are improved.

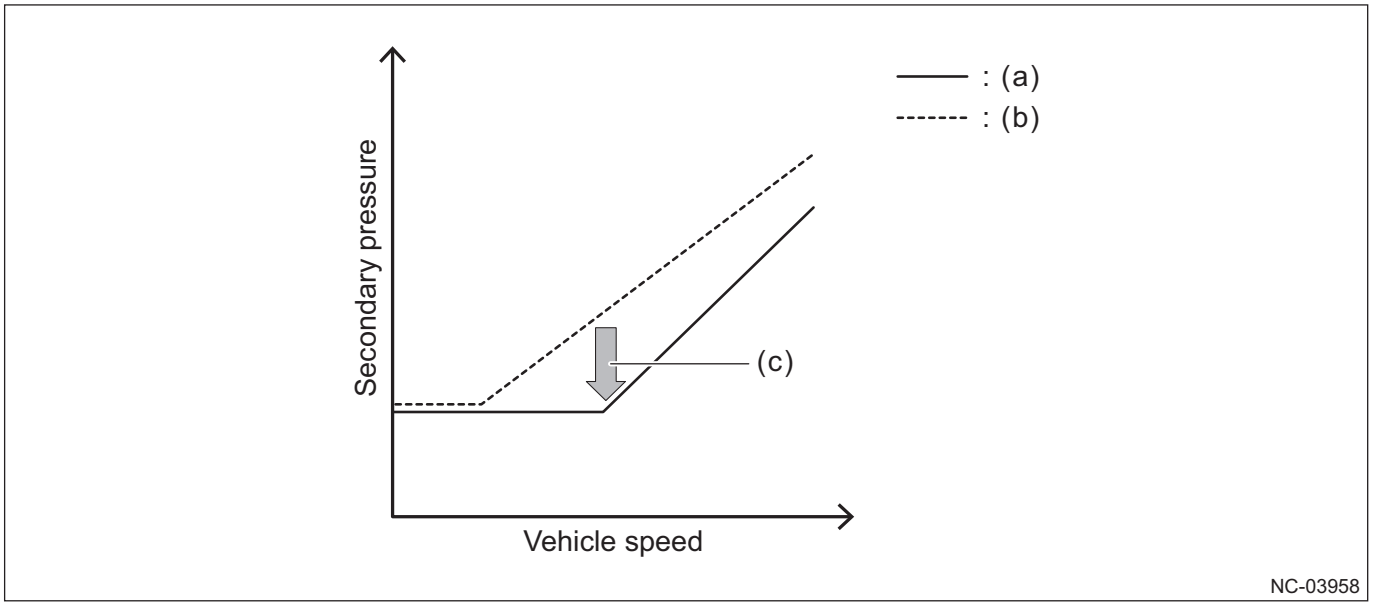


(A) Oil pressure image at low gear

(B) Oil pressure image at high gear

(a) Oil pump
(b) Control valve
(c) Pressure adjustment valve (line pressure)
(d) Pressure adjustment valve (secondary pressure)
(e) Flow rate adjustment valve (primary pressure)
(f) Primary pulley
(g) Secondary pulley
(h) Line pressure sensor
(i) Secondary pressure sensor
(j) Line pressure
(k) Primary pressure
(l) Secondary pressure
(m) Lubrication circuit

Independent secondary pressure control can reduce the oil pressure required for the variator clamp, thus allowing the torque loss of the oil pump to be controlled.



(a) With independent secondary pressure control

(b) Without independent secondary pressure control

(c) By reducing the oil pressure required for the variator clamp, the oil pressure for the overall system is reduced, resulting in the torque loss of the oil pump being controlled.

■ Primary pressure control

The primary pressure (shift control) is controlled with the primary UP solenoid and the primary DOWN solenoid. The TCM calculates based on input signals, such as the engine speed, throttle opening angle, and input-output rotation speed to control gear shift by changing the primary pressure applied to the primary pulley. The gear ratio is constantly adjusted based on the feedback of the input-output rotation numbers to achieve the target gear ratio.

■ Forward clutch pressure and reverse brake pressure control

This determines the properties for engaging the forward clutch pressure and reverse brake pressure control based on the engine input torque and electronically controls the F&R clutch solenoid with the control module to engage the clutch and brake.

▮ When engaged

When in the D, M, or R range, if the slip control valve controlled by the F&R solenoid is in the "clutch engaged" position, the clutch pressure connects to the clutch or brake actuation circuit. When in the D or M range, the forward clutch is engaged. When in the R range, the reverse brake is engaged.

▮ When released

When in the N or P range, the manual valve that is directly connected to the select lever releases the clutch or brake actuation pressure circuit. As a result, both the forward clutch and reverse brake are released.

▮ Reverse prevention control

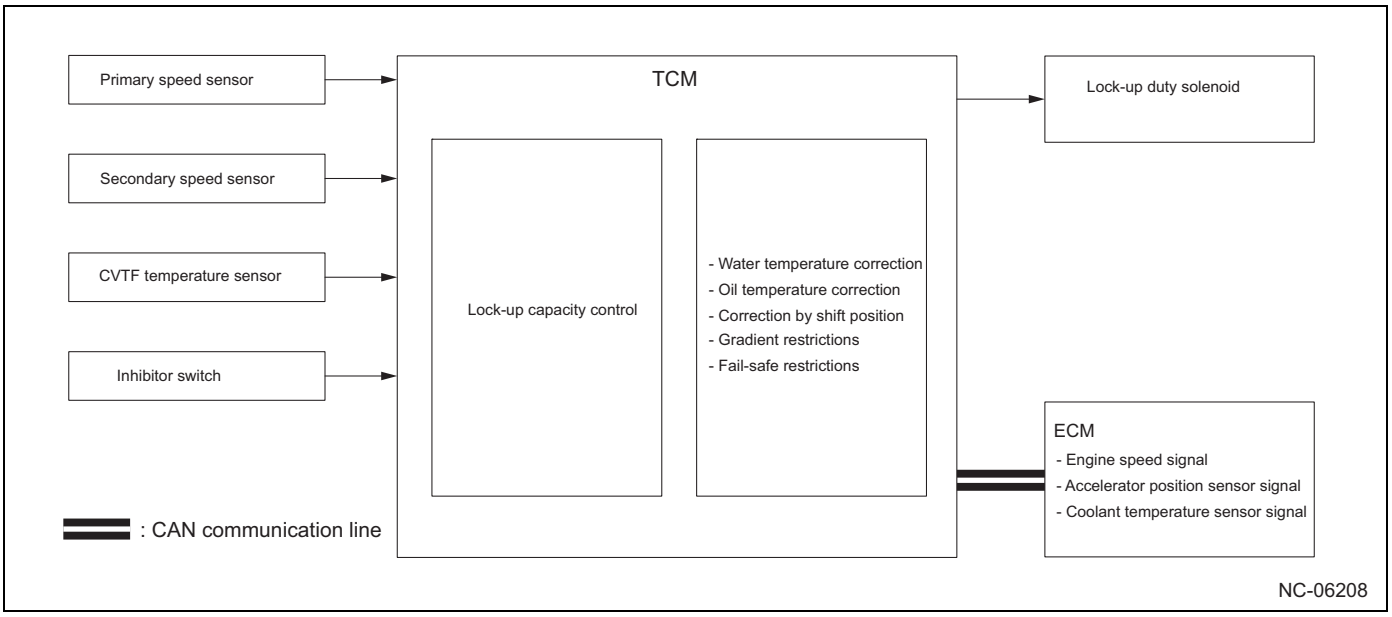
Prevents gear shifts to the R position by not generating the reverse brake control pressure when the select lever accidentally enters the R position while driving at the specified speed or faster. This is to prevent damaging parts such as the reverse brake.

Reference

Once the vehicle exceeds a specified speed, select lever N-R lock control causes the Body Integrated Unit to turn OFF the shift lock solenoid (in the solenoid unit) of the select lever, preventing a shift from the N position to the R position. This control also prevents damage to parts on the select lever side resulting from unintended operation.

■ Lock-up pressure control

TCM controls lock-up operation based on acceleration opening angle and vehicle speed.

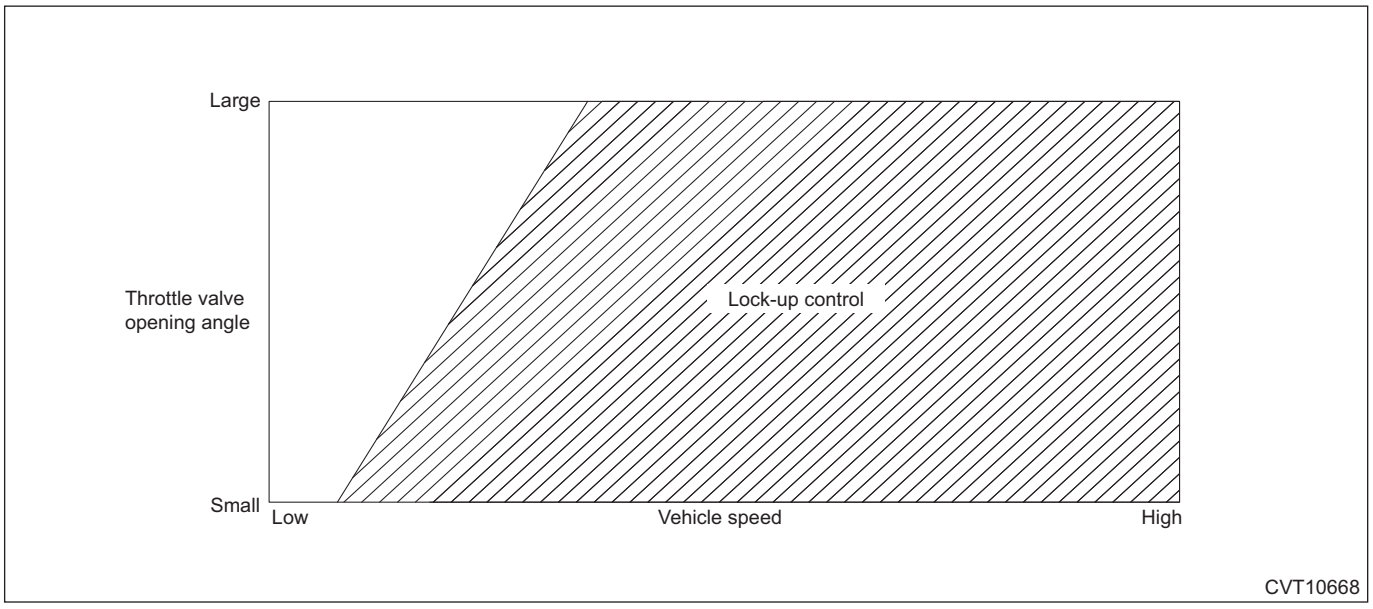


The slip in the torque converter is eliminated and the transmission efficiency is improved by engaging the lock-up clutch within the torque converter.

The lock-up duty solenoid is controlled with signals from the control module to smoothly engage or release the lock-up clutch within the torque converter.

- Lock-up clutch "ON": The lock-up oil pressure is controlled optimally to reduce shock in operation.
- Lock-up clutch "OFF": The control module is controlled to release the clutch smoothly.

The lock-up operation range is expanded to operate lock-up in the low speed range. Also, the lock-up operation range is expanded when decelerating to expand the fuel cut area and realizes superior low fuel consumption performance.



AWD control

■ VTD-AWD

VTD-AWD (electronic control AWD with uneven and variable torque distribution) is an electronic control AWD system that uses a planetary gear type center differential and an electronic control LSD (hydraulic multi-plate clutch) in the transfer mechanism that distributes torque to the rear wheels, and controls drive force distribution to the front and rear wheels according to the driving conditions.

In models with drive mode select, a SPORT mode which adds VTD-AWD control characteristics for sports driving is provided.

- NORMAL mode is the mode focused on traction performance that is the same as the current model.
- SPORT mode is the mode focused on turning performance, setting the optimal LSD torque for turning.

Drive mode select	AWD control
COMFORT	NORMAL mode
NORMAL	
SPORT	
SPORT+	SPORT mode
★ (INDIVIDUAL)	NORMAL mode/SPORT mode (Can set to the mode which was selected by the driver.)

■ Normal control

The center differential distributes torque unevenly with a front:rear ratio of 45:55. This distributes larger torque to the rear wheels for smooth handling on a curve. The torque distribution is continually varied according to the driving conditions, ensuring stability during straight driving.

■ Control when slipping occurs

When the system judges that there is a speed difference between the front and rear wheels based on the front and rear wheel speed sensors installed on the transmission or on the 4 wheel speed sensors, the engagement torque of the AWD clutch is increased compared to normal in order to absorb the speed difference.

■ Control when ABS activates

When ABS activates, the ABS controller releases the brake at the wheel where imminent locking was detected based on the changes in speed at the 4 wheels, and applies the brake at the wheels which were judged not in danger of locking. At this time, when engagement torque is produced in the clutch, the braking force also acts at the wheel where the brake was released via the clutch, and adversely affects performance of lock prevention by brake release. For this reason, clutch engagement torque during normal ABS operation is reduced in order to prevent interference with the ABS system.

■ Control during braking

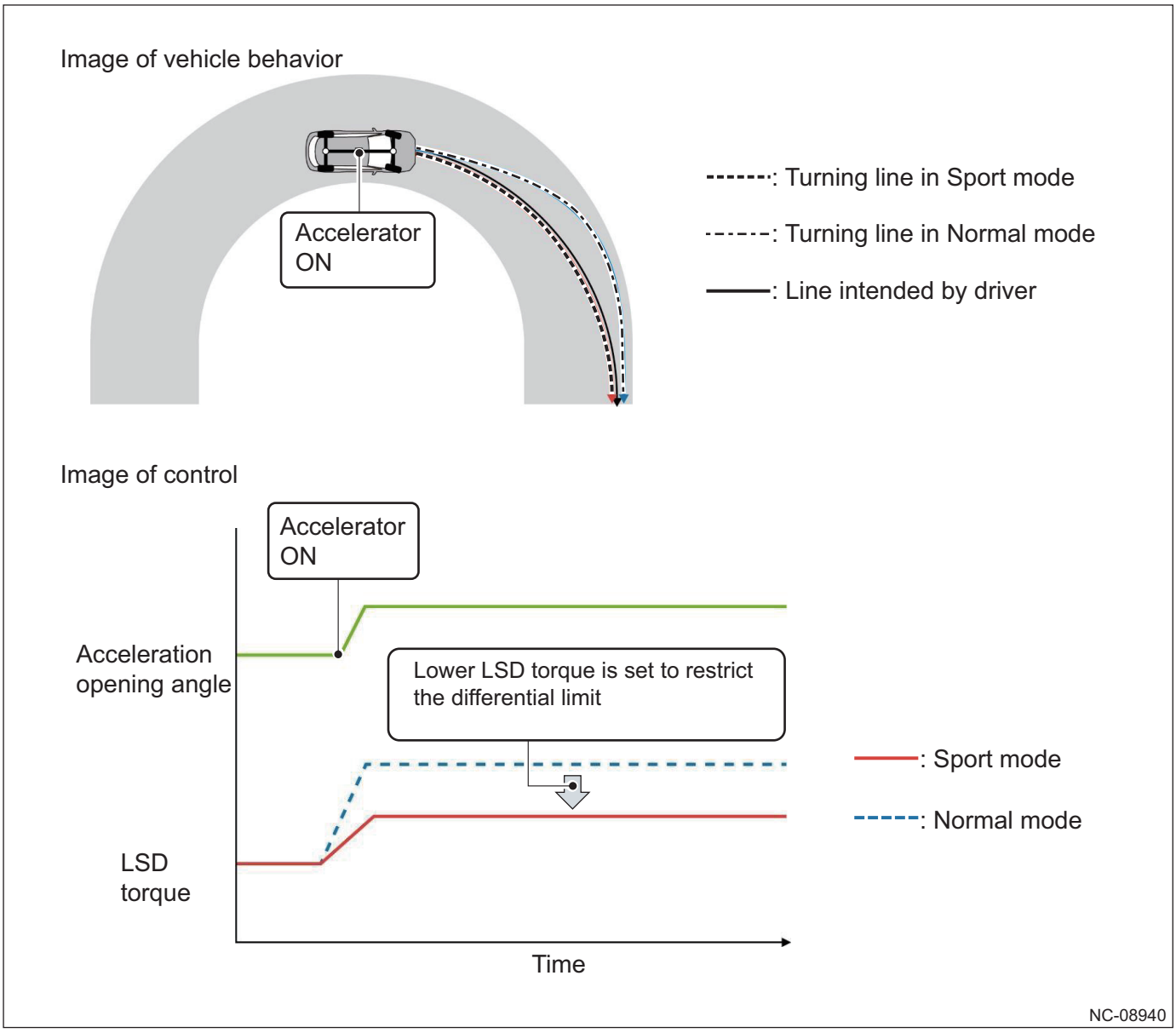
During braking, in order to prevent all 4 wheels from slipping and losing control, the balance of front and rear braking force is changed. However when the clutch engagement force is high, in the same way the brake torque affects the other wheels via the clutch when the ABS activates. Therefore during brake control, the clutch engagement torque is lowered in order to ensure vehicle stability.

■ Steering control

When steering at low speed, a difference in the wheel path occurs between the inside and outside wheels, and the turning radius on the front wheel side is larger than that on the rear wheel side. When this difference between the inside and outside wheels exists, it is necessary for the front wheels to turn faster than the rear wheels. Under these conditions, when the engagement torque of the AWD clutch is increased, a restraining force is generated between the front and rear wheels and the vehicle acts as if the brakes are applied. This phenomenon is referred to as tight corner braking. In order to avoid this, steering control estimates the amount of steering based on the steering angle sensor, speed of the 4 wheels, speed of the front/rear wheels, and other information, and reduces the clutch engagement torque according to the amount of steering.

■ SPORT mode control (models with drive mode select)

When the LSD torque is raised, allocating drive force to the front wheels during cornering when the accelerator is ON improves traction performance but reduces turning performance. When SPORT mode is selected, a lower LSD torque is set in order to restrict the differential limit of the front and rear wheels and improve turning performance. Switching the mode according to the driving situation improves turning performance and provides sporty driving enjoyment.



CVT learning

The CVT shift and the forward and reverse switching are performed by applying oil pressure through the oil passage from the control valve to the pulley, the hydraulic multi-plate clutch, and the hydraulic multi-plate brake. At that time, when oil pressure is applied suddenly, shift shock increases. When oil pressure is applied too slowly, slippage occurs.

The frictional force between the pulley slope and the variator chain, and the engaging power of the clutch or the brake, change due to oil pressure, piston stroke, and frictional force between drive plate and driven plate as well as worn drive plate and deteriorated ATF.

TCM checks gear change status, performs gear changes while learning, and stores learning value. When a transmission or TCM is replaced, it is necessary to store the learning value that is newly learned. The "CVT learning" is the learning promotion.

Fail-safe

The fail-safe control function ensures a minimum level of drivability in the event of a malfunction in a speed sensor, switch, or solenoid. It also flashes the CVT oil temperature warning light to inform the driver of the problem.

Primary speed sensor

Performs control during lock-up based on the engine speed. When the P or N position is selected when lock-up is released, the same control as during lock-up is performed. In other positions, control is performed based on the secondary speed or engine speed, whichever speed is lower.

Secondary speed sensor

Performs control based on the output speed of the output clutch.

Reference

"Output speed of the output clutch" is calculated from the front wheel speed sensor and rear wheel speed sensor.

Front wheel speed sensor

When in the P or N position, control is performed based on the vehicle speed sent by the VDC from the time when D position is selected until the F&R clutch engages. After the F&R clutch engages, control is performed based on the input speed of the output clutch.

Reference

"Input speed of the output clutch" is calculated from the secondary speed sensor.

Rear wheel speed sensor

When in the P or N position, control is performed based on the vehicle speed sent by the VDC from the time when D position is selected until the F&R clutch engages. After the F&R clutch engages, control is performed based on the input speed of the output clutch.

Reference

"Input speed of the output clutch" is calculated from the secondary speed sensor.

Lock-up duty solenoid

Power to the duty solenoid is forcibly stopped so that the lock-up clutch is always released.

Primary UP/DOWN solenoid

Power to the malfunctioning duty solenoid is forcibly stopped. Output to the other duty solenoid is controlled according to the malfunction status so as to make it difficult to enter full low or full overdrive, and the secondary pressure is increased above normal levels to prevent pulley damage.

AWD solenoid

Power to the linear solenoid is forcibly stopped, stopping the shifting of drive torque between front and rear, and stopping slip prevention.

F&R solenoid

Power to the linear solenoid is forcibly stopped, and the clutch is continually engaged when in the D or R position. The secondary pressure is increased above normal levels to prevent pulley damage.

Line pressure solenoid

Power to the linear solenoid is forcibly stopped to protect the CVT, and the line pressure is always controlled to the maximum pressure.

Secondary solenoid

Power to the linear solenoid is forcibly stopped, and the secondary pressure is always controlled to the maximum pressure in order to prevent pulley damage.

Inhibitor switch

If there is input to the control module which is not one of the specified patterns, the range is not displayed in the meter. The CVT control mode selects a range in the following order of priority: D > R > N > P.

CVTF temperature sensor

The secondary pressure is increased above normal levels to prevent pulley damage.

Line pressure sensor

Independent control of the secondary pressure separate from the line pressure is stopped.

Secondary pressure sensor

Independent control of the secondary pressure separate from the line pressure is stopped.

M mode switch

Manual mode shifting is prohibited.

Diagnosis

The system detects malfunctions related to TCM and transmission, and flashes the CVT oil temperature warning light on the combination meter to display malfunction or defect.

When the CVT oil temperature warning light flashes, a corresponding diagnostic trouble code (DTC) is stored in the TCM.

DTC stored in TCM can be read out by connecting the diagnosis tool to the data link connector (DLC).

The on-board diagnosis system detects the following electrical malfunctions and system malfunctions.

- Secondary solenoid
- F&R solenoid
- Lock-up duty solenoid
- Line pressure solenoid
- Primary UP solenoid
- Primary DOWN solenoid
- AWD solenoid
- Primary speed sensor
- Secondary speed sensor
- Front wheel speed sensor
- Rear wheel speed sensor
- Line pressure sensor
- Secondary pressure sensor
- CVTF temperature sensor
- Inhibitor switch
- CAN communication circuit
- M mode switch
- Stop light switch

Power transmission mechanism

Overview

The power transmission mechanism is composed of the torque converter, continuously variable transmission mechanism, forward and reverse switching mechanism, reduction gear mechanism, AWD mechanism, etc.

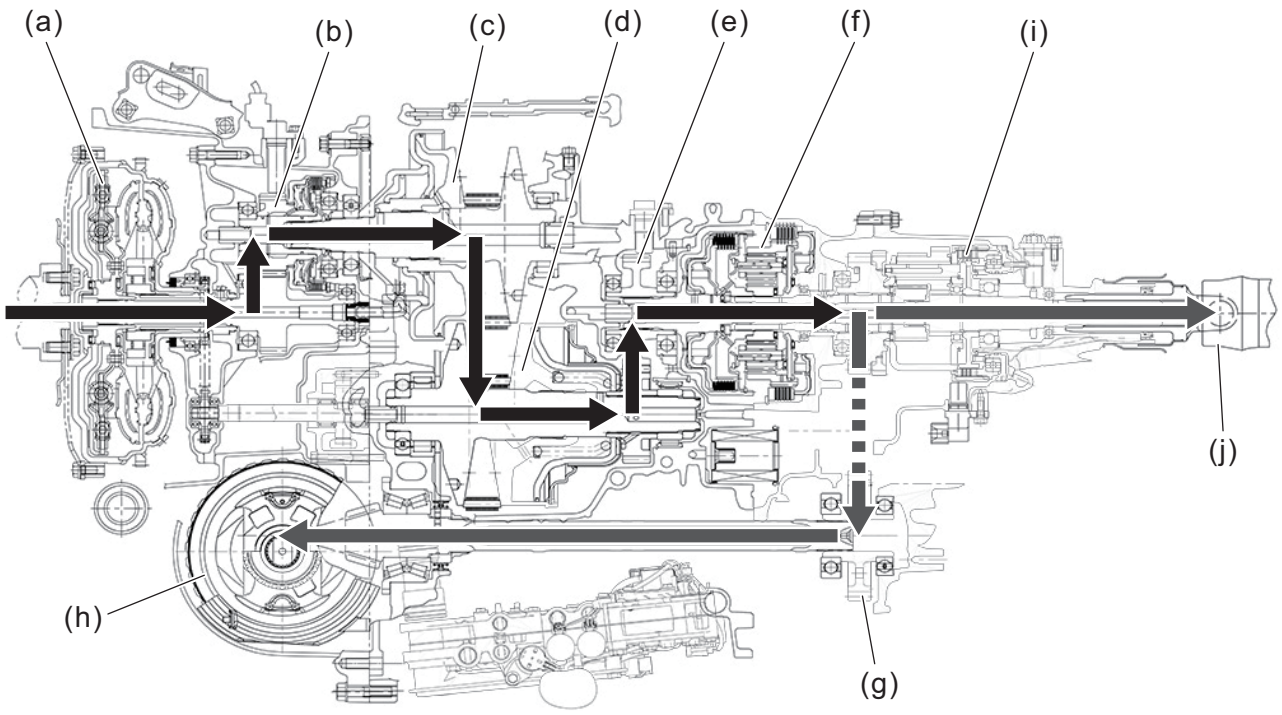
The gear change is continuously performed by changing the winding diameter of the variator chain using a pulley that changes the groove width depending on the oil pressure control.

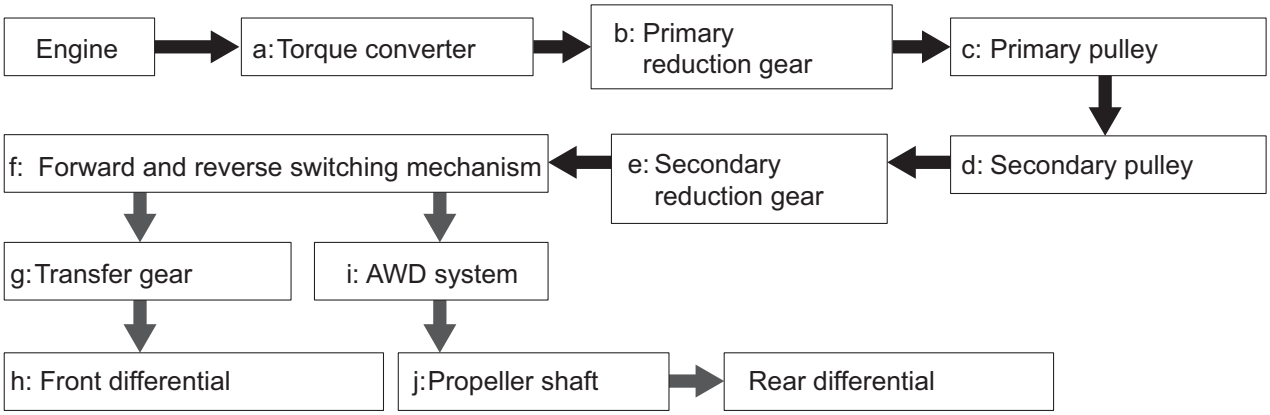
A double-pinion planetary gear and a hydraulic multi-plate clutch are combined on the forward and reverse switching mechanism.

The power transmission is transmitted in the following order.

Drive force from the engine is transmitted to the torque converter, and from there it is transmitted through the primary reduction gear, pulley, and secondary reduction gear before being transmitted to the forward and reverse switching mechanism.

The drive force that has been switched to forward or reverse by the forward and reverse switching mechanism is distributed to the front and rear by the AWD system. The front drive force is output from the transfer gear to the front axle through the front differential. The rear drive force is output to the propeller shaft.


(a)
(b)
(c)
(d)
(e)
(f)
(i)
(j)
(h)
(g)


Engine
a: Torque converter
b: Primary reduction gear
c: Primary pulley
d: Secondary pulley
e: Secondary reduction gear
f: Forward and reverse switching mechanism
g: Transfer gear
i: AWD system
h: Front differential
j: Propeller shaft
Rear differential

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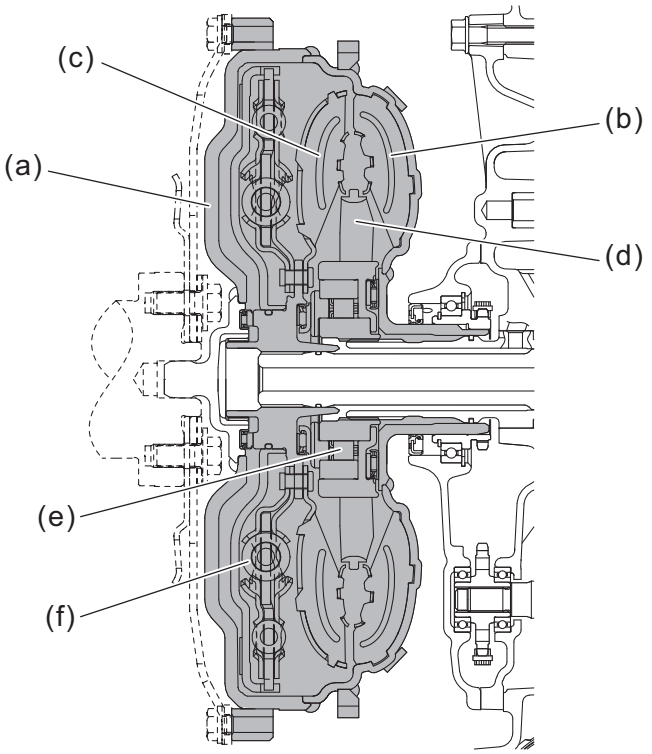
Torque converter

■ Construction

The torque converter is composed of the pump impeller that is integrated with the torque converter cover with drive plate mounted to it, turbine that is splined to the transmission-side front reduction drive gear, stator, one-way clutch that supports the stator, lock-up clutch, etc.

In the lock-up mechanism, the mechanical clutch is installed between the torque converter cover and the turbine, and the pump impeller is directly connected with the turbine. This mechanism reduces rotation difference and improves transmission efficiency.



(a) Torque converter cover
(b) Pump impeller
(c) Turbine
(d) Stator
(e) One-way clutch
(f) Damper construction

■ Operation

The torque converter transmits engine power to the transmission by oil.

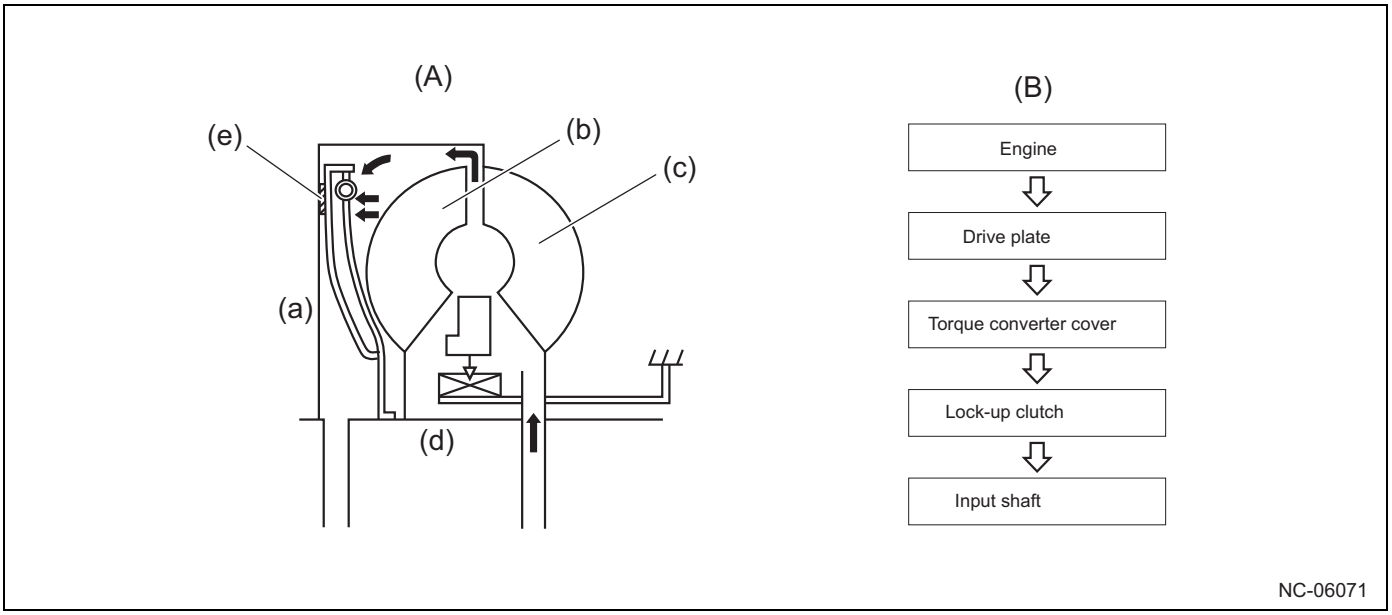
When the pump impeller rotates as a result of engine rotation, oil flows into the torque converter. When the turbine receives the flowing oil and then it rotates, the input shaft rotates.

When the engine rotates, power is directly applied to the pump impeller and it continually rotates. Even when the engine rotates at low speed (idling state), the oil in the torque converter is rotating at low speed. As a result, the turbine that receives the rotation of the oil also rotates and transfers a small amount of power to the transmission. The state is said to be creep phenomenon.

▮ When lock-up clutch is operating

When the lock-up clutch is operating, TCM controls the oil pressure control mechanism to switch the fluid flow into the lock-up clutch within the torque converter as shown below.

When the lock-up clutch is pushed against the torque converter cover due to the oil pressure difference between right and left, the lock-up clutch rotates together with the cover.



(A) Fluid flow

(B) Power transmission

(a) Torque converter cover

(b) Turbine

(c) Pump impeller

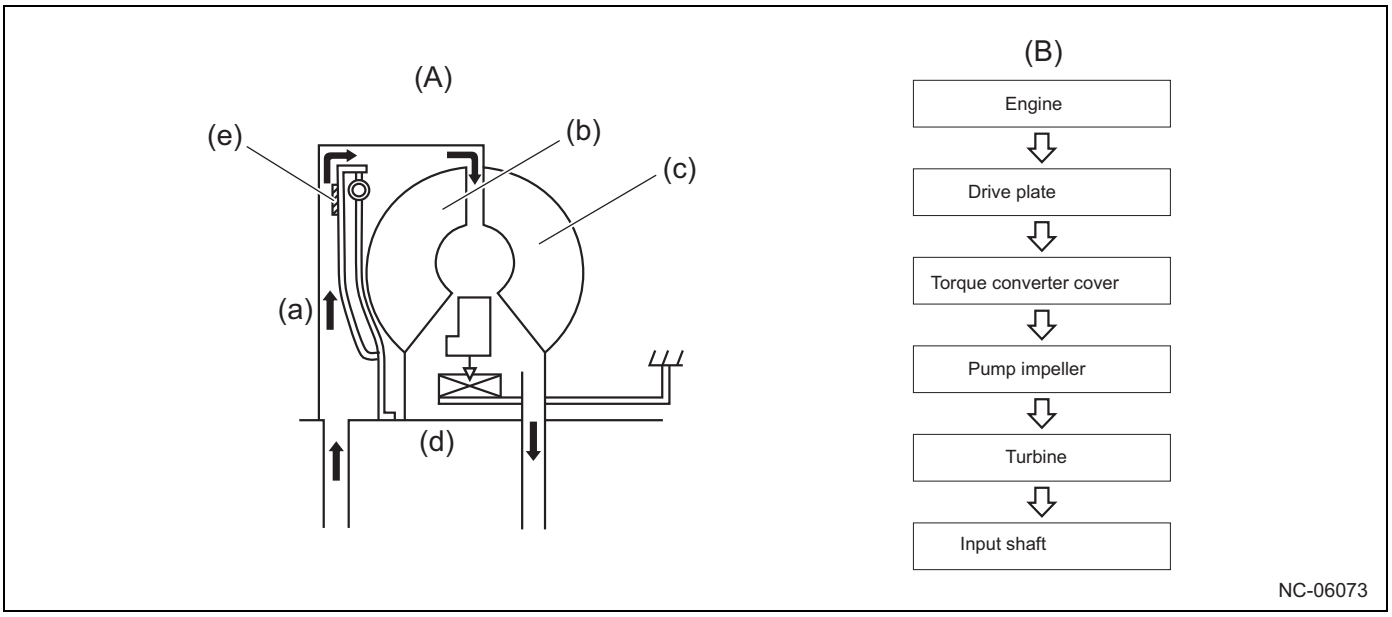
(d) Input shaft

(e) Lock-up clutch

When lock-up clutch is not operating

When the lock-up clutch is not operating, TCM controls the hydraulic pressure control mechanism to switch the fluid flow into the lock-up clutch inside the torque converter as shown below.

When the lock-up clutch moves away from the torque converter cover due to the oil pressure difference between right and left, power is transmitted as in a normal torque converter.



(A) Fluid flow
(B) Power transmission

(a) Torque converter cover
(b) Turbine
(c) Pump impeller
(d) Input shaft
(e) Lock-up clutch

Continuously variable transmission mechanism

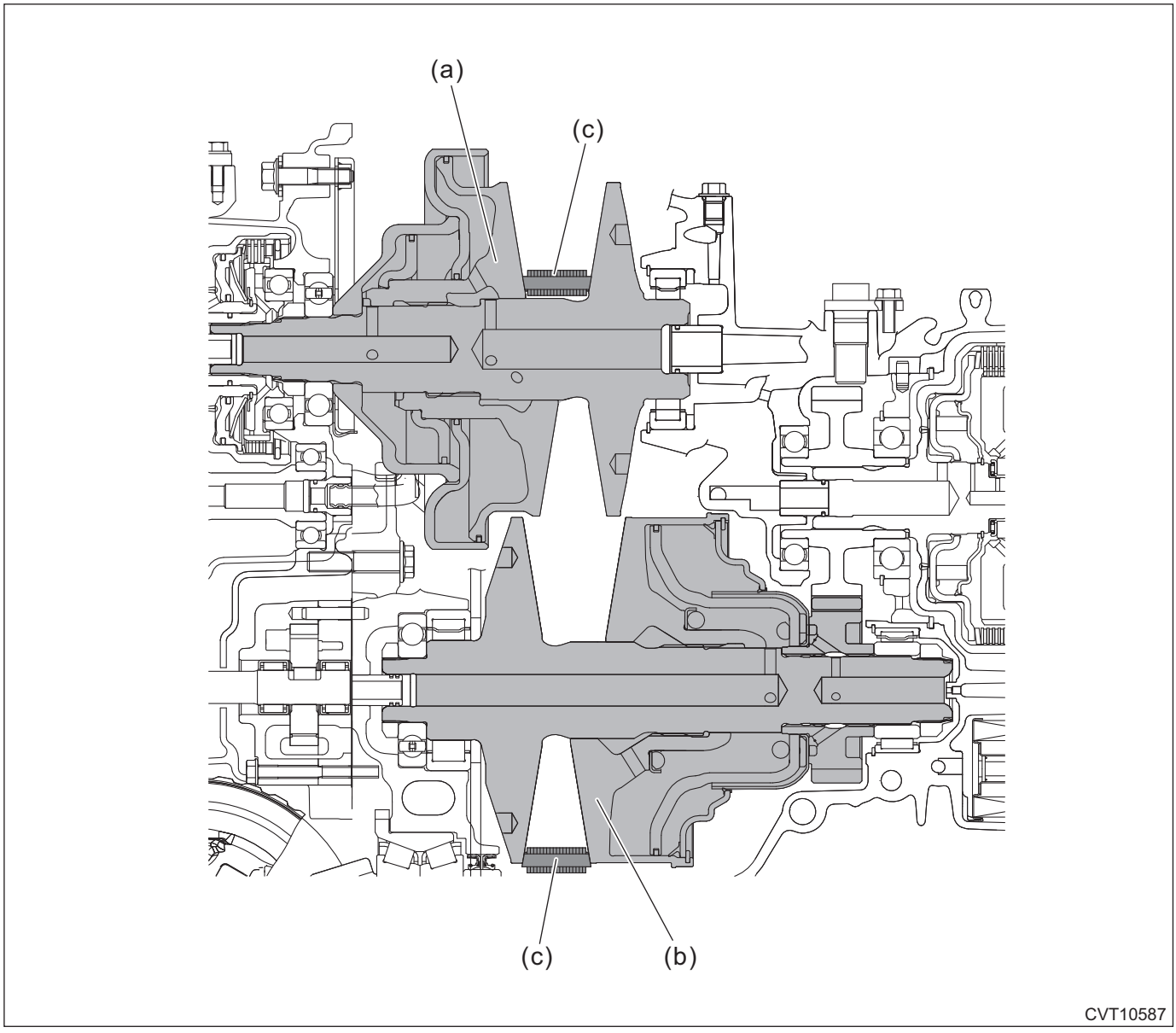
■ Construction

The continuously variable transmission mechanism is composed of a primary pulley, a secondary pulley, and variator chain.

The primary pulley and the secondary pulley is each composed of a shaft with an inclined surface (fixed conical surface), a movable sheave (a conical surface movable in the axial direction), and an oil pressure chamber on the back side of the movable sheave.

The variator chain is held on by pressure generated in the oil pressure chamber of the pulley, and power is transmitted by frictional force generated between the pulley slope and variator chain.

Continuously variable speed adjustments are made possible by controlling the primary pulley oil volume, controlling the secondary pulley oil pressure, and changing the pulley width. Gear ratios have also been widened for both drivability and fuel economy.

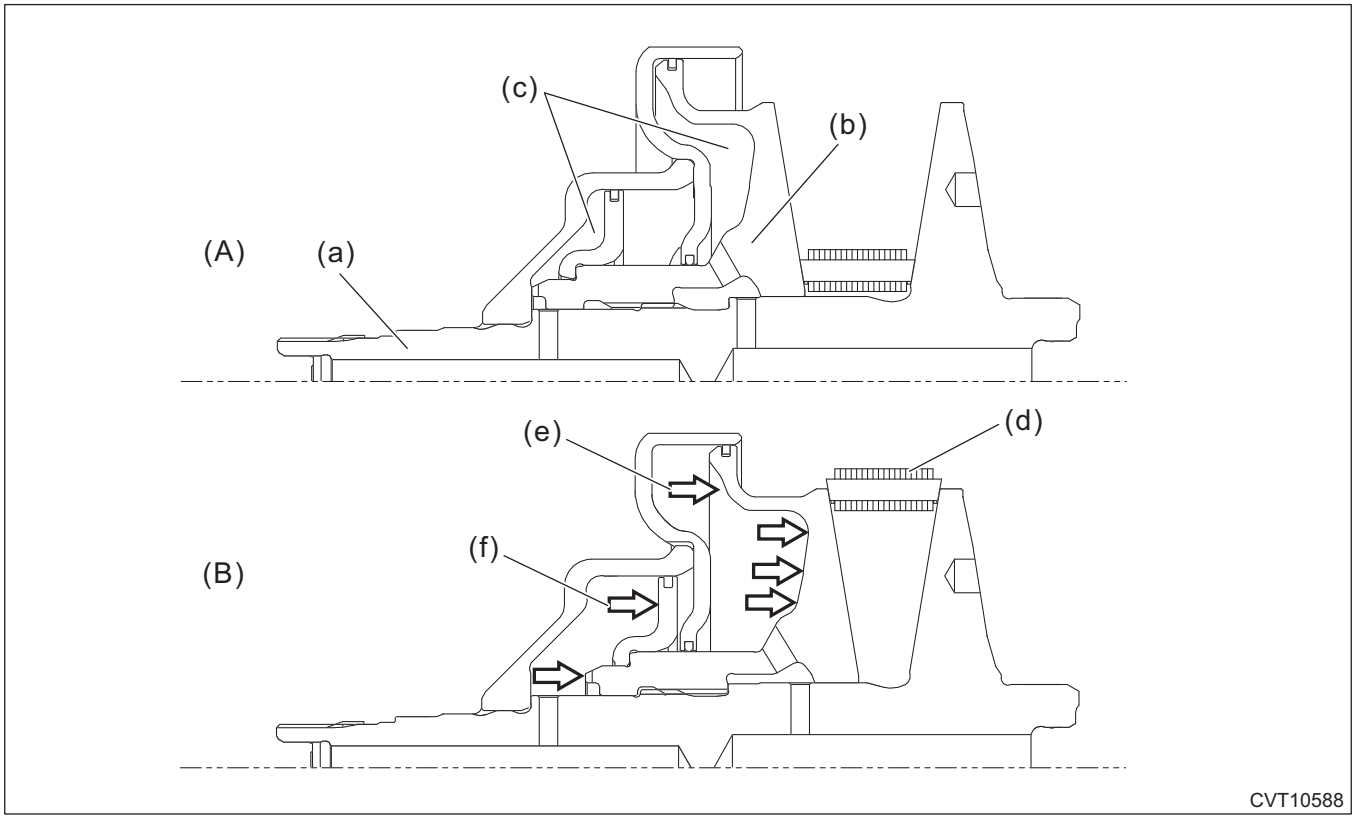


(a) Primary pulley
(b) Secondary pulley
(c) Variator chain

■ Primary pulley

The double piston construction is adopted on the primary pulley.

The variator chain is held on by the pressure generated in the two oil pressure chambers serially-arranged.



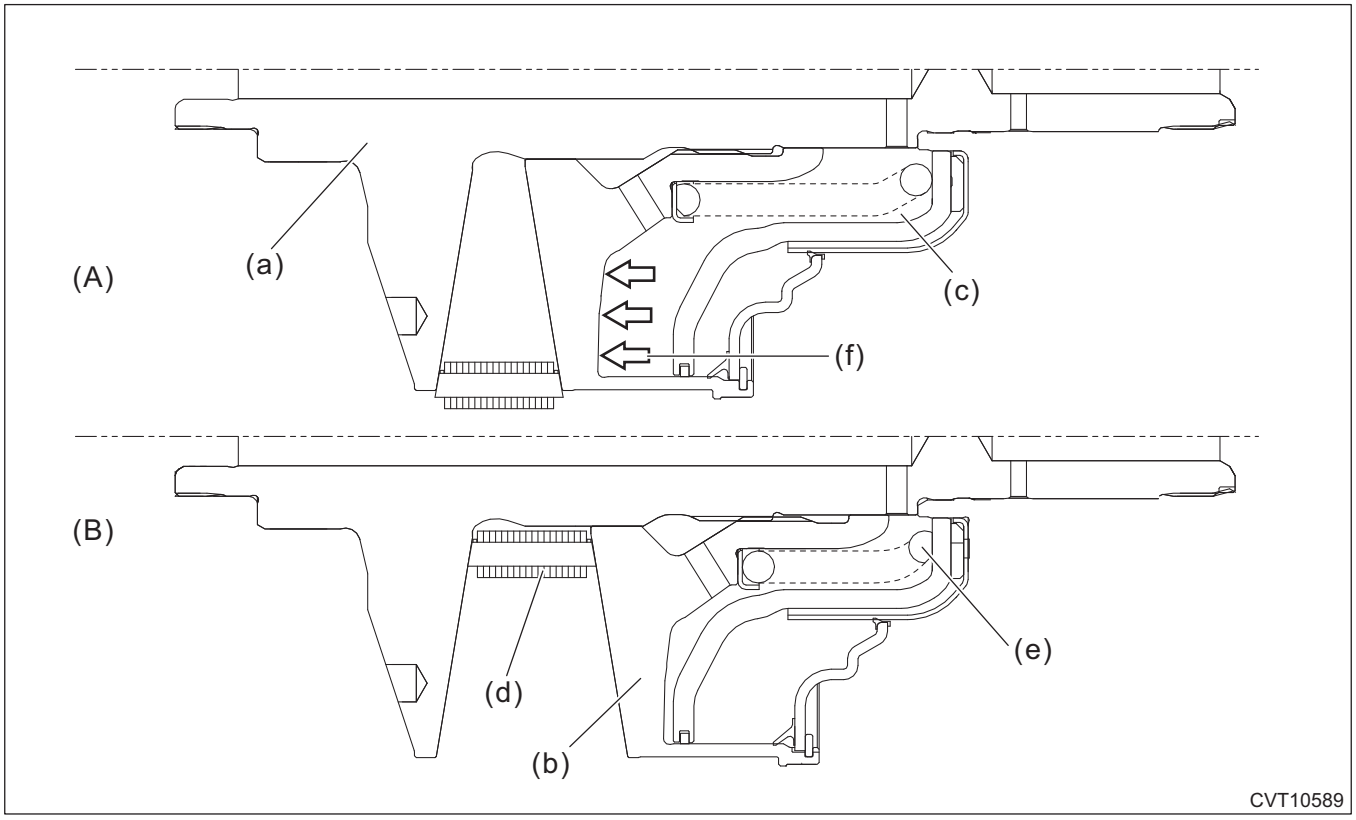
(A) At low gear
(B) At high gear

(a) Shaft
(b) Movable sheave
(c) Oil pressure chamber
(d) Variator chain
(e) Primary pressure
(f) Secondary pressure

■ Secondary pulley

The single piston construction is adopted on the secondary pulley.

The variator chain is held on by pressure generated in the secondary pulley oil pressure chambers and spring force.



(A) At low gear
(B) At high gear

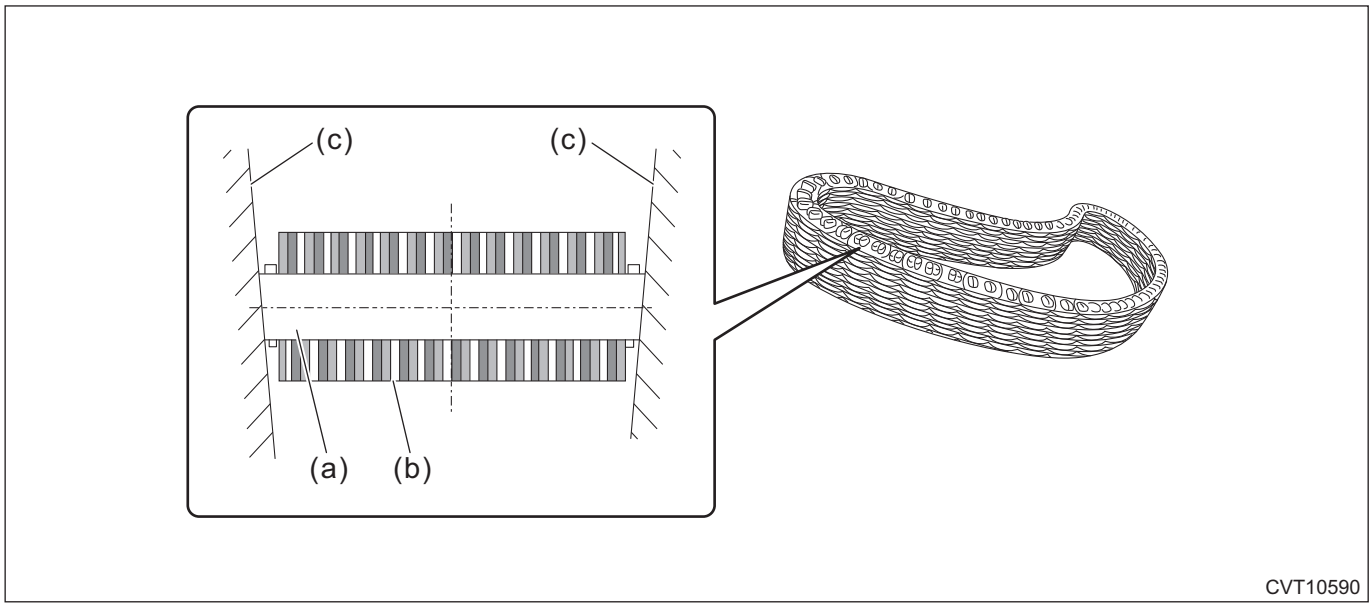
(a) Shaft
(b) Movable sheave
(c) Oil pressure chamber
(d) Variator chain
(e) Spring
(f) Secondary pressure

■ Variator chain

The variator chain is composed of a pin that contacts with a pulley to transmit torque and a link plate that connects several pins to form a chain.

Since both ends of the pin contacts with the pulley to transmit torque, the pin has the same angle as the pulley.

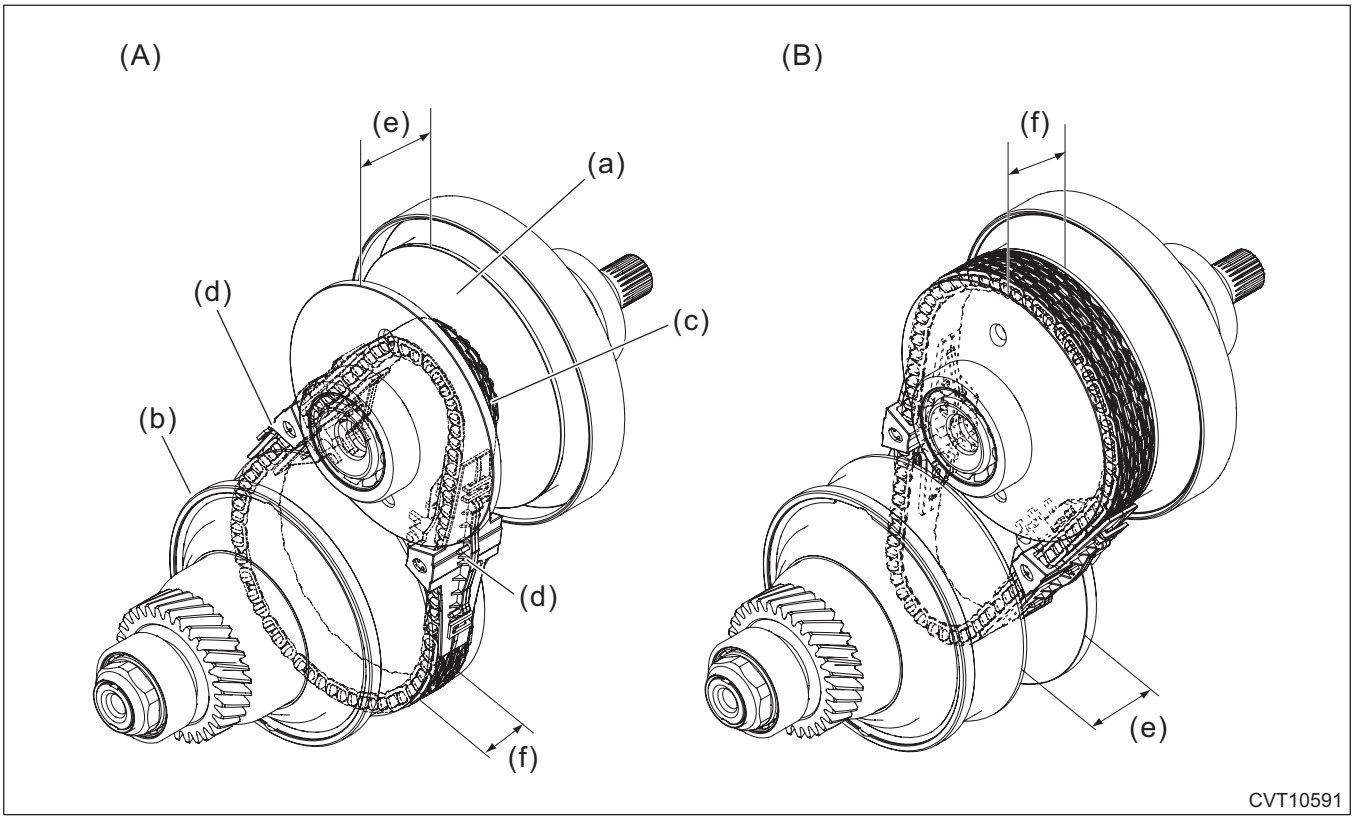
The link plate is thin steel and supports each pin at regular intervals. Strong tension force functions on the link plate.



(a) Rocker pin
(b) Link plate
(c) Pulley

■ Operation

The movable sheave slides on the spline shaft and changes the groove width of the pulley. By changing the working pressures of the primary pulley and the secondary pulley, the groove width of the pulley is controlled with input signals such as the engine load (acceleration opening angle), the engine speed, and the gear ratio (vehicle speed). As the groove width of the pulley changes, the contact radius of the variator chain also changes. The speed changes continuously and steplessly from the low state (gear ratio: 3.490) to the overdrive state (gear ratio: 0.506). The contact radius ratio of the pulleys that contact the belt is the gear ratio.



(A) At low gear

(B) At high gear

(a) Primary pulley

(b) Secondary pulley

(c) Variator chain

(d) Guide rail

(e) Large groove width

(f) Narrow groove width

The power is transmitted by frictional force generated between the pulley slope and variator chain. The mechanism of frictional force generation is as shown below.

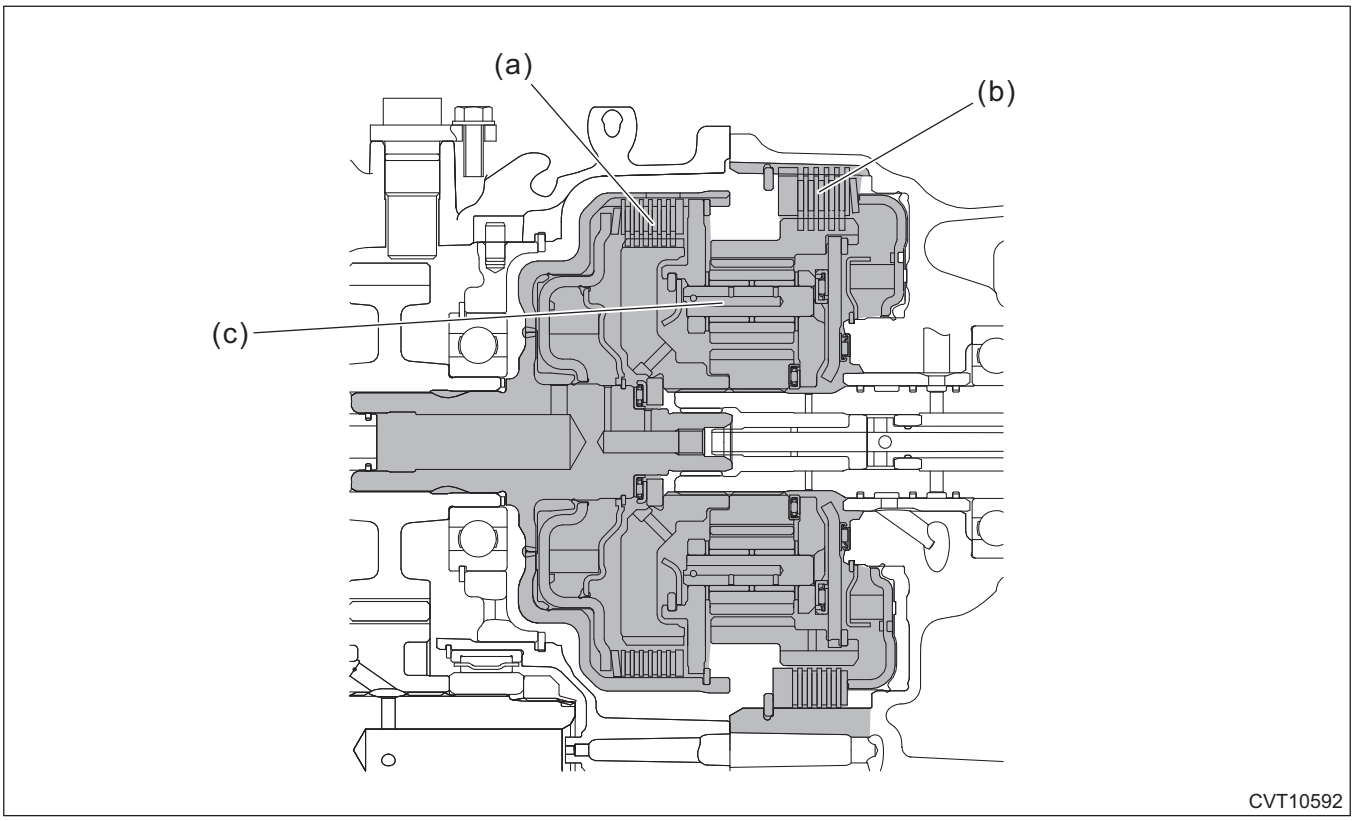
- When the oil pressure works on the secondary pulley, the secondary pulley contacts with the variator chain.
- The variator chain stretches outward in the pulley radial direction.
- Tension occurs on the variator chain.
- Frictional force occurs between the variator chain on the primary pulley and the pulley.

The frictional force generates tension on the variator chain and power is transmitted to the secondary pulley.

Forward and reverse switching mechanism

■ Construction

The forward and reverse switching mechanism is composed of one set of planetary gears (double-pinion planetary gear), one set of multi-plate clutches (forward clutch), and one set of multi-plate brakes (reverse brake).

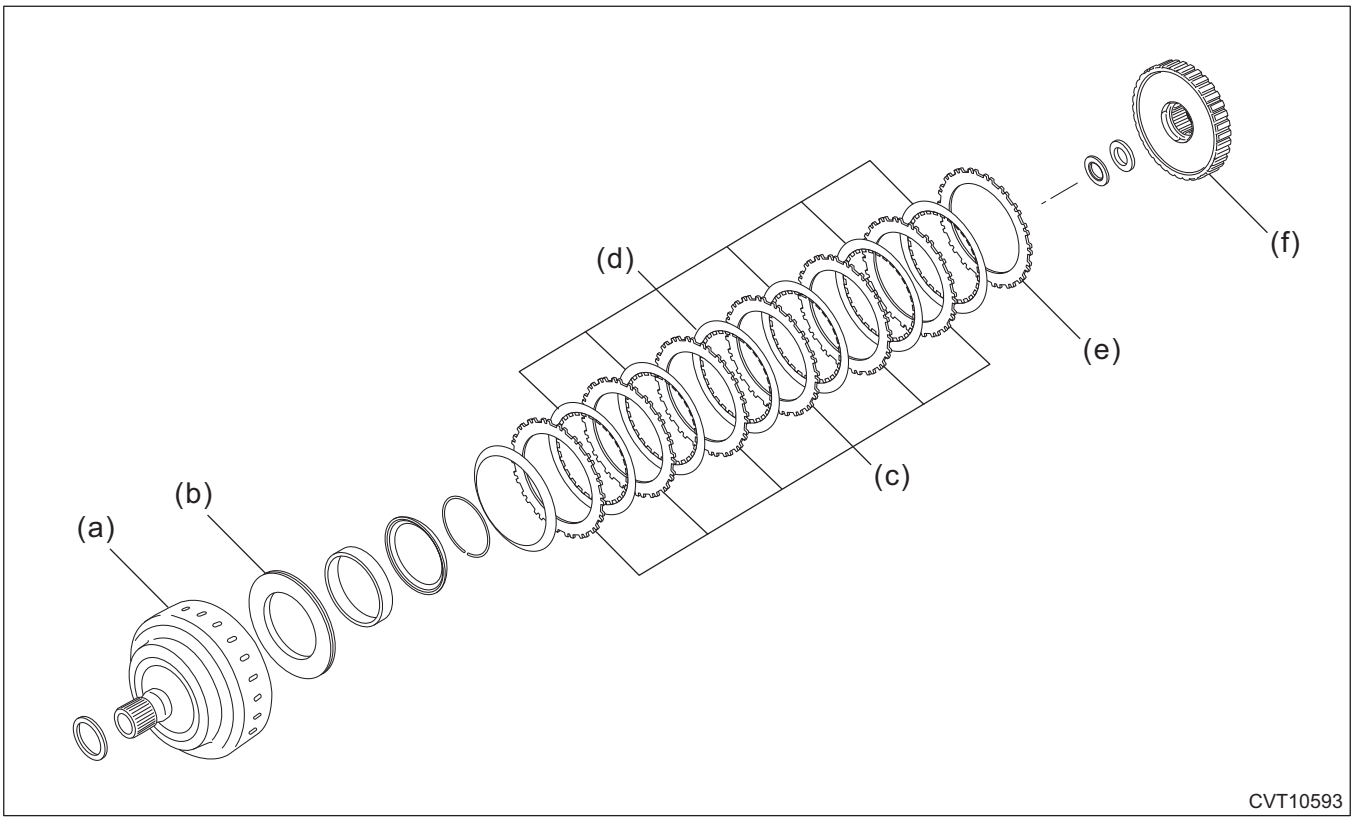


(a) Forward clutch
(b) Reverse brake
(c) Planetary gear

■ Forward clutch

The forward clutch is composed of the forward clutch drum, forward clutch piston, clutch plate, forward clutch hub, etc.

When D position is selected, movement of the manual valve forms an oil passage to the forward clutch, and the forward clutch engages. The acting oil pressure is controlled by the F&R clutch solenoid.

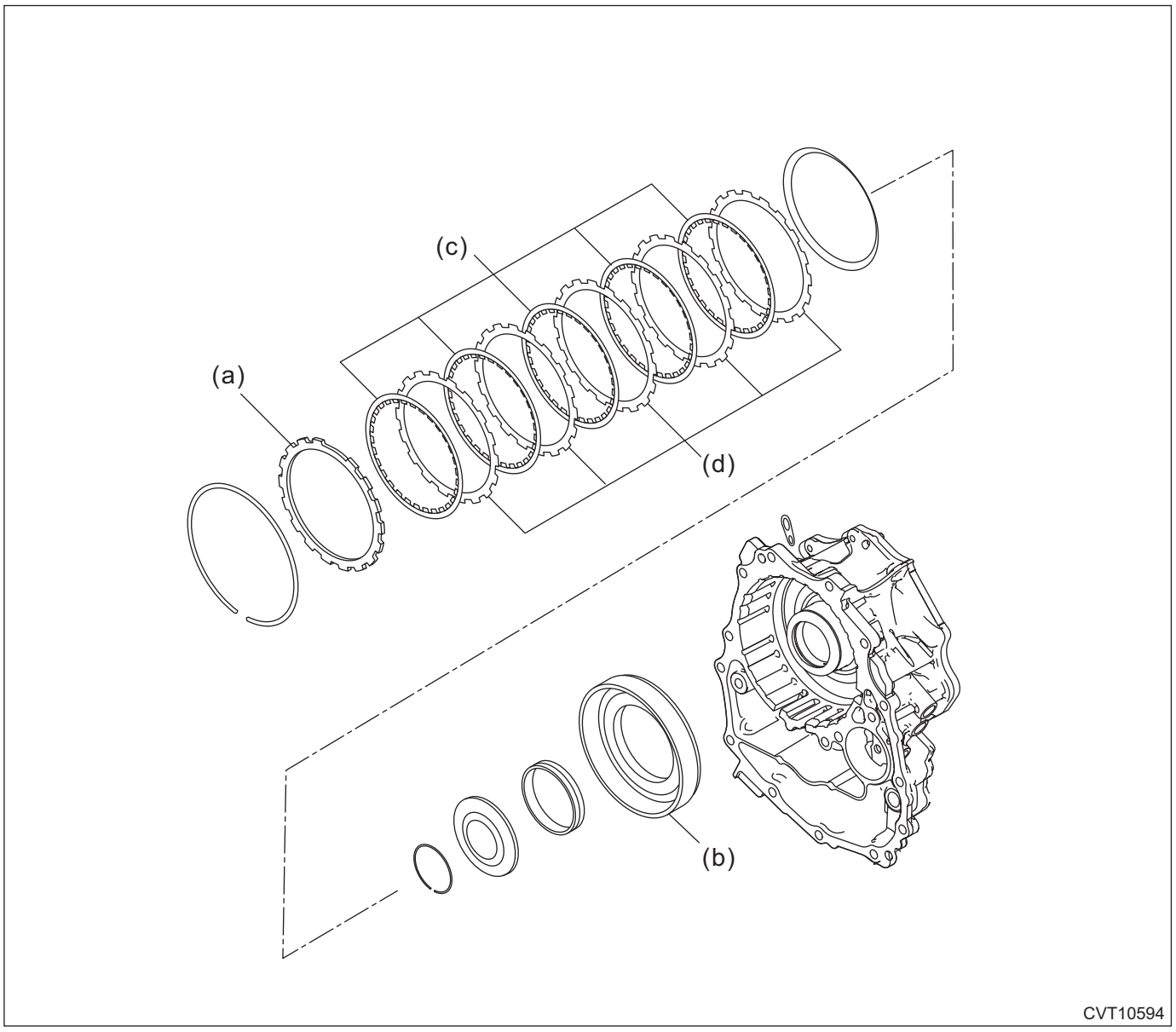


(a) Forward clutch drum
(b) Forward clutch piston
(c) Driven plate
(d) Drive plate
(e) Retaining plate
(f) Forward clutch hub

Reverse brake

The reverse brake is composed of the retaining plate, reverse brake piston, drive plate, driven plate, etc.

When the R position is selected, movement of the manual valve forms an oil passage to the reverse brake, and the reverse brake engages. The reverse brake is a hydraulic actuation brake, and the acting oil pressure is controlled by the F&R clutch solenoid.



(a) Retaining plate
(b) Reverse brake piston
(c) Drive plate
(d) Driven plate

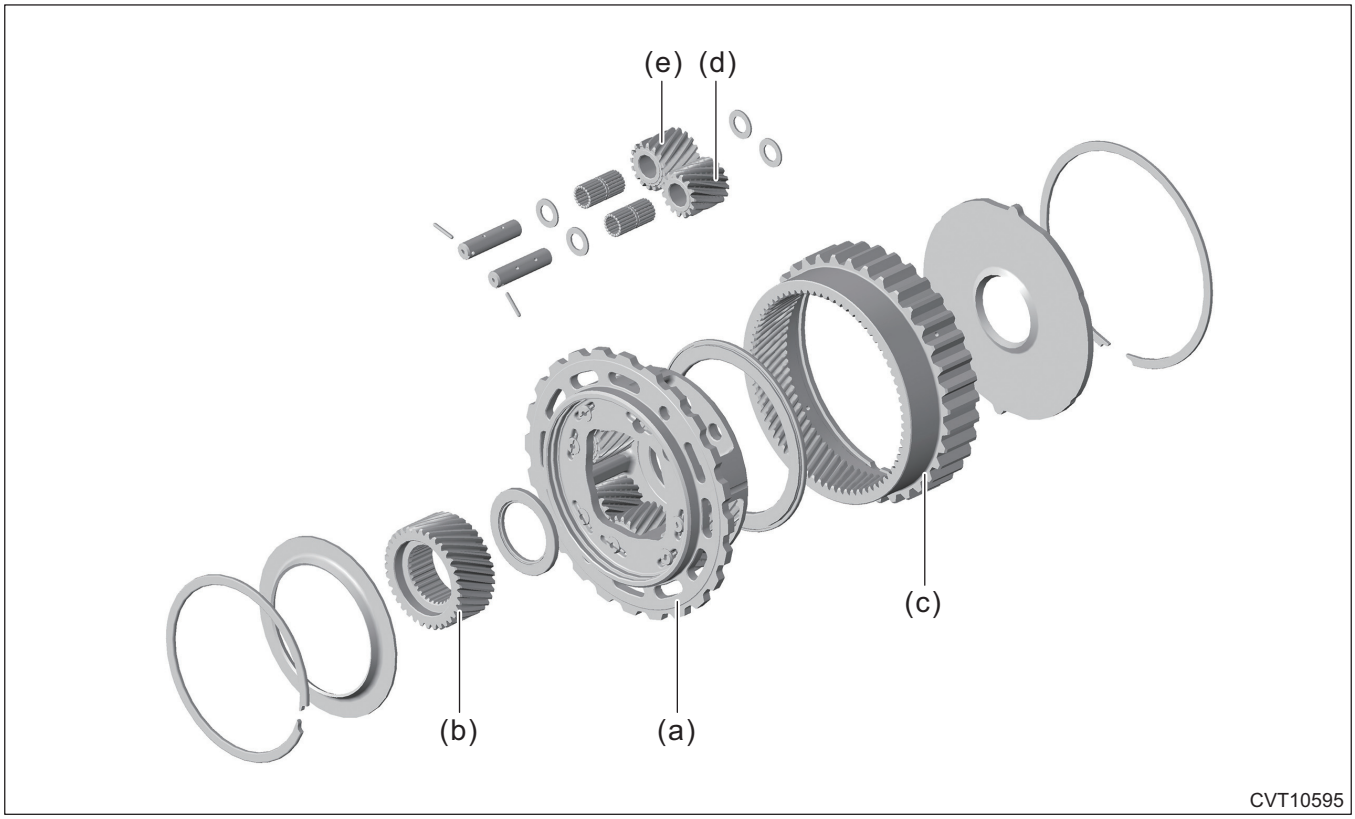
Planetary gear

The planetary gear is composed of planetary carrier, sun gear, planetary pinion gear, internal gear, etc.

The planetary gear has the sun gear at the central portion, the internal gear on the outer circumference, and the planetary pinion gear at the middle point between the sun gear and the internal gear. The outer and inner planetary pinion gears are each supported by the planetary carrier at equal distances.

The planetary carrier is connected to the forward clutch drum, and the internal gear is connected to the planetary pinion gear and reverse brake. The sun gear is splined to the reduction drive gear shaft.

When the internal gear is fixed by the reverse brake, the planetary carrier and sun gear rotate in the reverse direction.



(a) Planetary carrier
(b) Sun gear
(c) Internal gear
(d) Outer planetary pinion gear
(e) Inner planetary pinion gear

■ Operation

Switching between forward and reverse is performed by the forward and reverse switching mechanism located behind the secondary pulley.

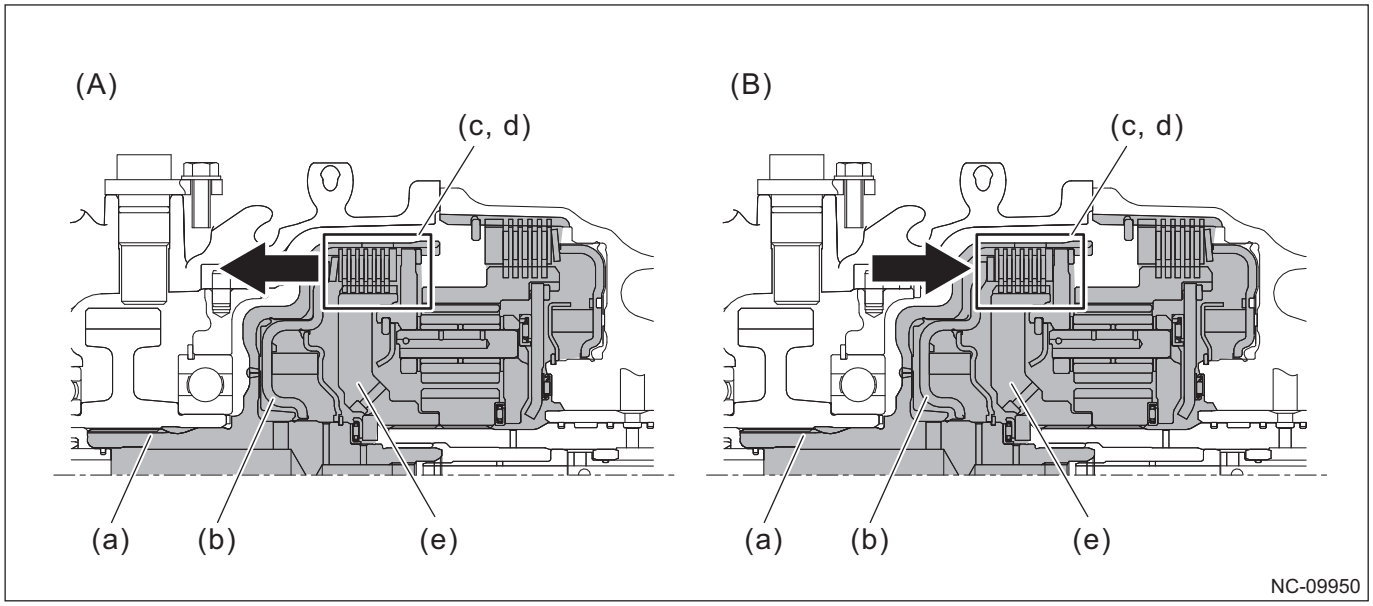
When the pulley rotates, the forward clutch drum and planetary carrier continually rotate. When the forward clutch and reverse brake are engaged and released, the switching between forward and reverse is performed.

When engaging the forward clutch and releasing the reverse brake, the vehicle moves forward. When releasing the forward clutch and engaging the reverse brake, the vehicle moves reversely.

▮ Forward clutch

When the oil pressure is applied to the forward clutch, the forward clutch piston moves and the drive plate and the driven plate are engaged. Accordingly, drive force is transmitted from the forward clutch drum to the forward clutch hub through the plate set, and drives the reduction drive gear shaft.

When the oil pressure is released from the forward clutch, the forward piston releases the engagement of the drive plate and the driven plate. Accordingly, the forward clutch drum independently rotates on the forward clutch and the drive force is not transmitted.



(A) When released

(B) When engaged

(a) Forward clutch drum

(b) Forward clutch piston

(c) Drive plate

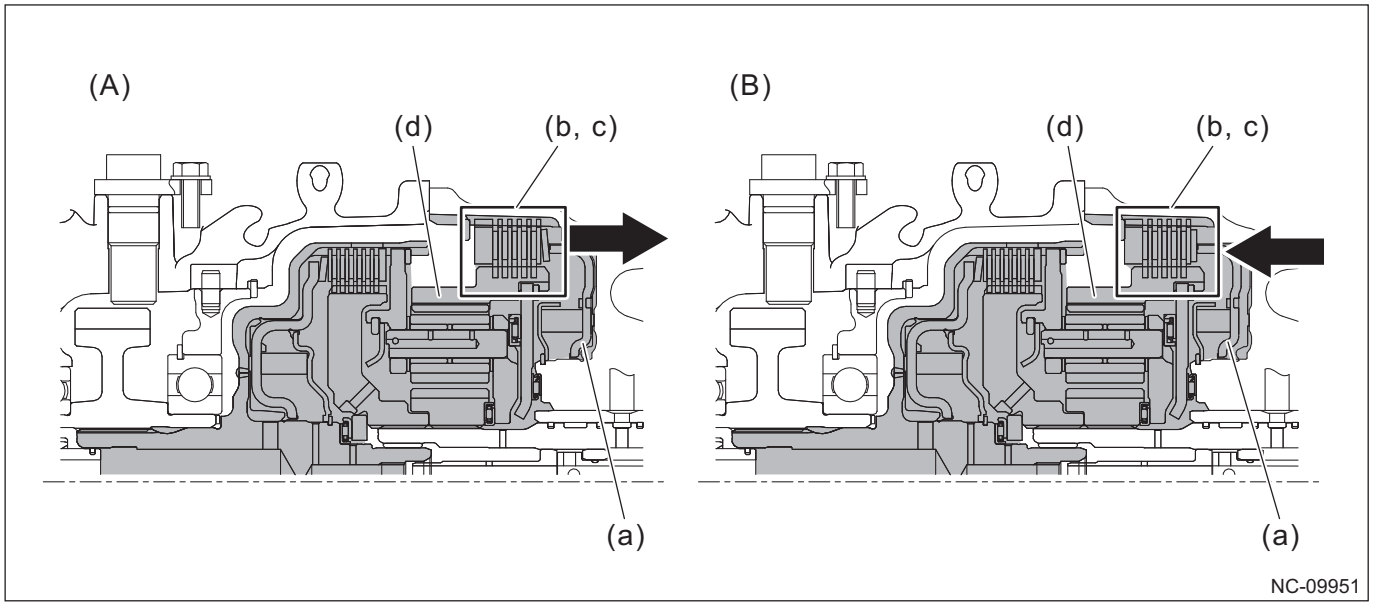
(d) Driven plate

(e) Forward clutch hub

Reverse brake

When the oil pressure is applied to the reverse brake, the reverse brake piston moves and the drive plate and the driven plate are engaged. As a result, the internal gear is fixed and drive force is transmitted from the forward clutch drum to the planetary carrier, and then from the planetary carrier to the sun gear through the planetary pinion gear, and drives the reduction drive gear shaft.

When the oil pressure is released from the reverse brake, the reverse brake piston releases the engagement of the drive plate and the driven plate. Accordingly, the fixed internal gear is released and the drive force generated by the planetary carrier is not transmitted.



(A) When released

(B) When engaged

(a) Reverse brake piston

(b) Drive plate

(c) Driven plate

(d) Internal gear

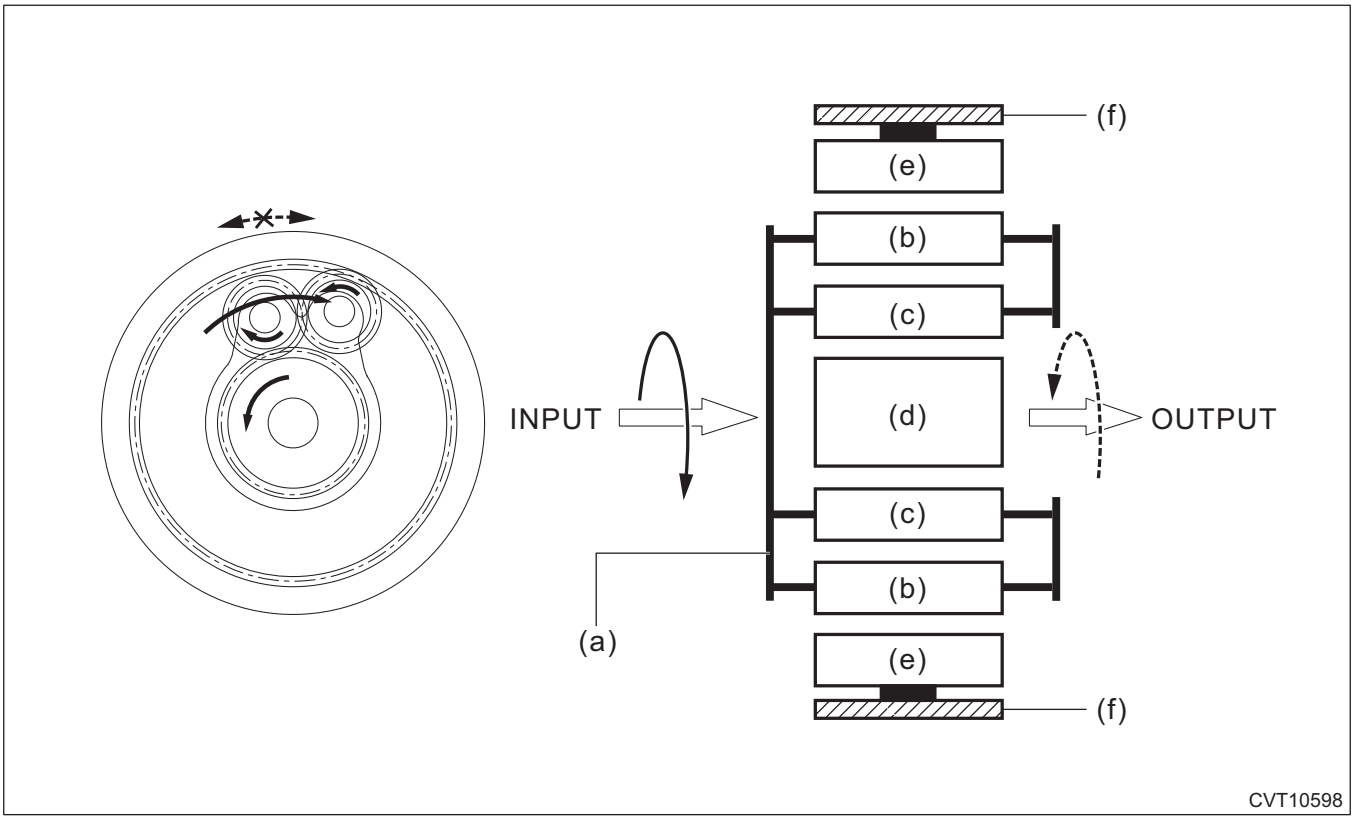
Planetary gear

When reversing, the reverse brake is engaged and the internal gear is fixed to the intermediate case.

Power from the pulley rotates the planetary carrier via the forward clutch drum. Because the internal gear is fixed by the reverse brake, the outer planetary pinion gear rotates in the opposite direction from the planetary carrier, and the inside planetary pinion gear rotates in the same direction as the planetary carrier. As a result, the sun gear rotates in the opposite direction from the planetary carrier.

As a result of this operation of the planetary gear, the drive force from the pulley is transmitted in the reverse direction to the reduction drive gear shaft.

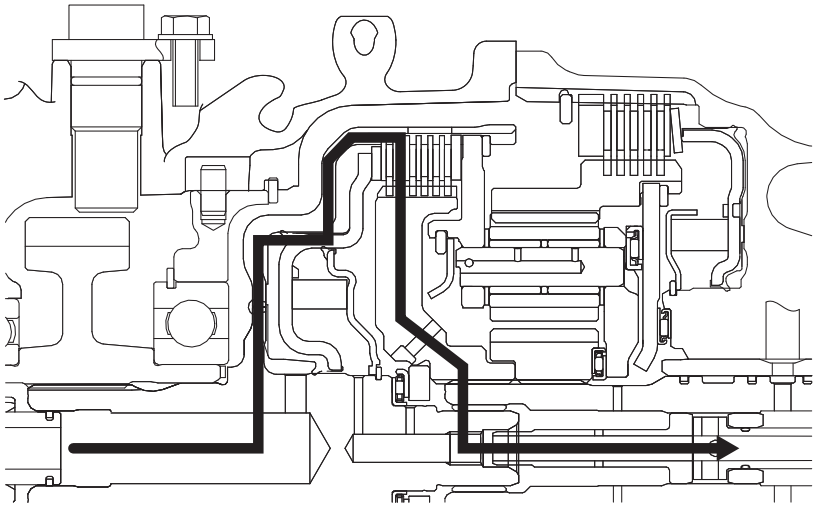
* When driving forward, the drive force from the pulley is transmitted from the forward clutch to the reduction drive gear shaft in the same direction, without going through the planetary gear.



(a) Planetary carrier
(b) Outer planetary pinion gear
(c) Inner planetary pinion gear
(d) Sun gear
(e) Internal gear
(f) Reverse brake

▮ Power transmission when in forward range

When driving forward, the forward clutch is ON and the reverse brake is OFF. The drive force from the pulley is input to the forward clutch. Accordingly, the drive force is transmitted from the forward clutch to the reduction drive gear shaft in the same rotation direction.



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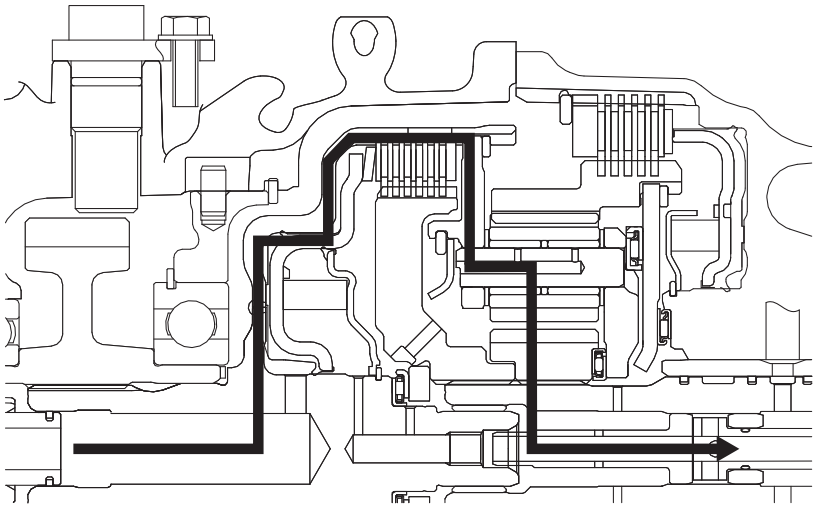
▮ Power transmission when in reverse range

When reversing, the forward clutch is OFF and the reverse brake is ON. Accordingly, the drive force from the pulley is input to the planetary carrier, and the internal gear is fixed by the reverse brake. As a result, drive force is transmitted from the planetary carrier to the reduction drive gear shaft in the reverse direction.

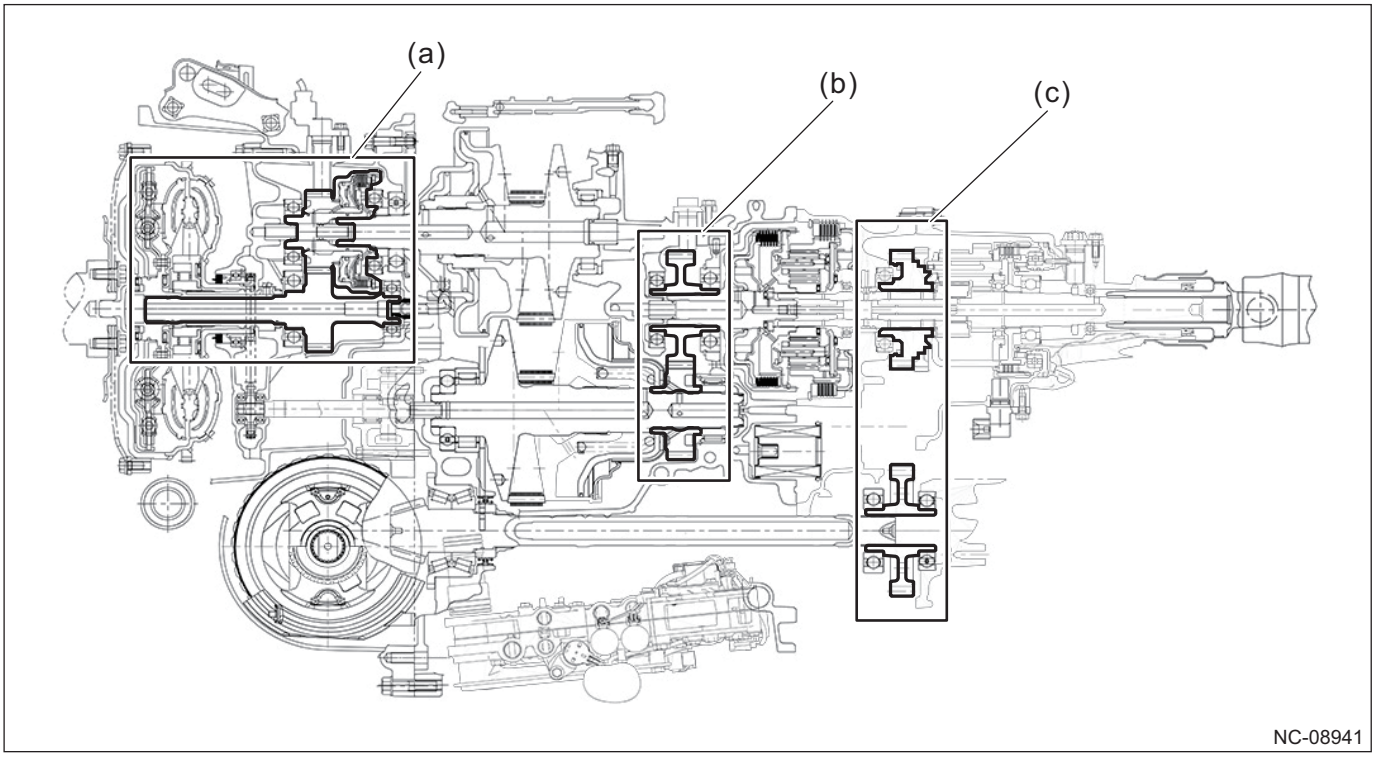


NC-09953

Reduction gear mechanism

■ Construction

The reduction gear mechanism is composed of the primary reduction gear, secondary reduction gear, and transfer gear.

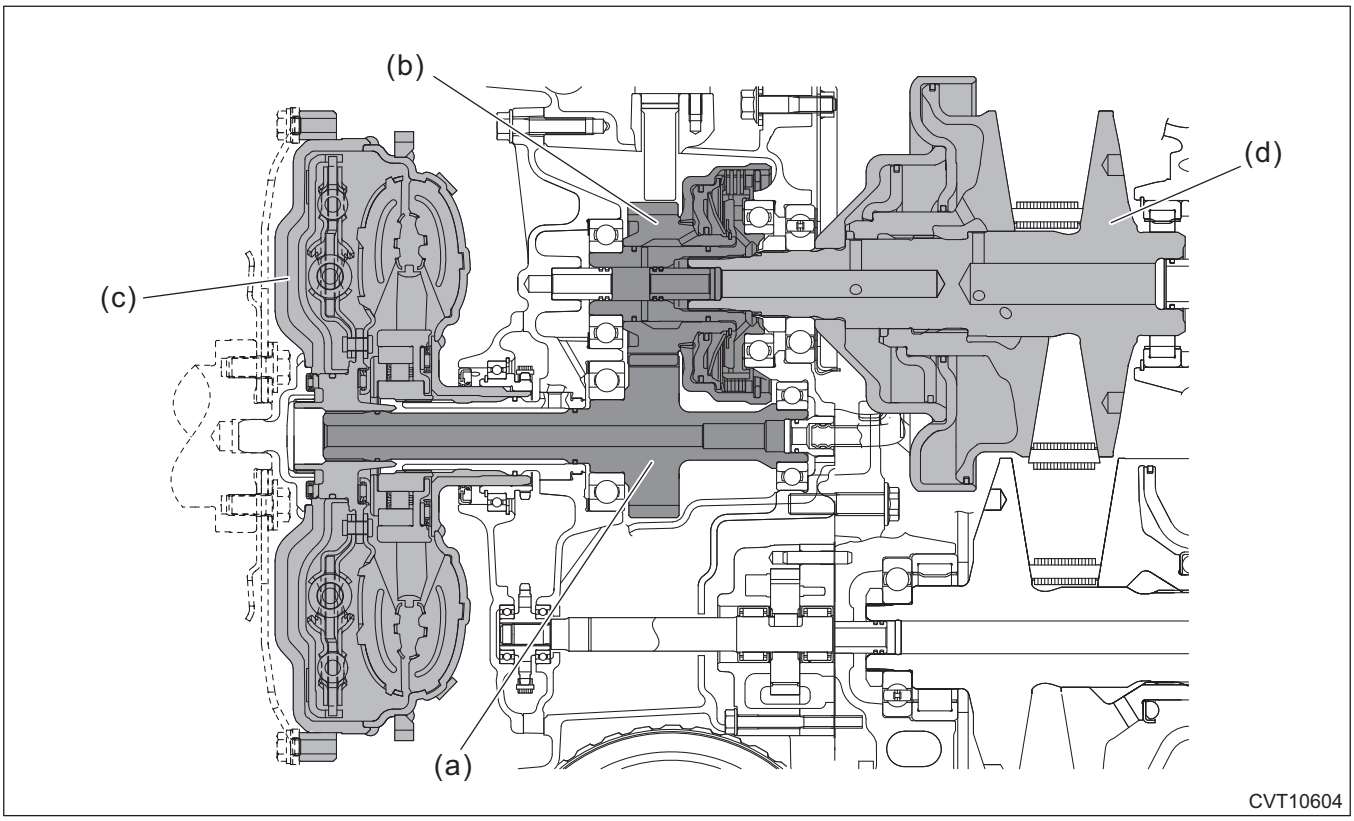


(a) Primary reduction gear
(b) Secondary reduction gear
(c) Transfer gear

■ Operation

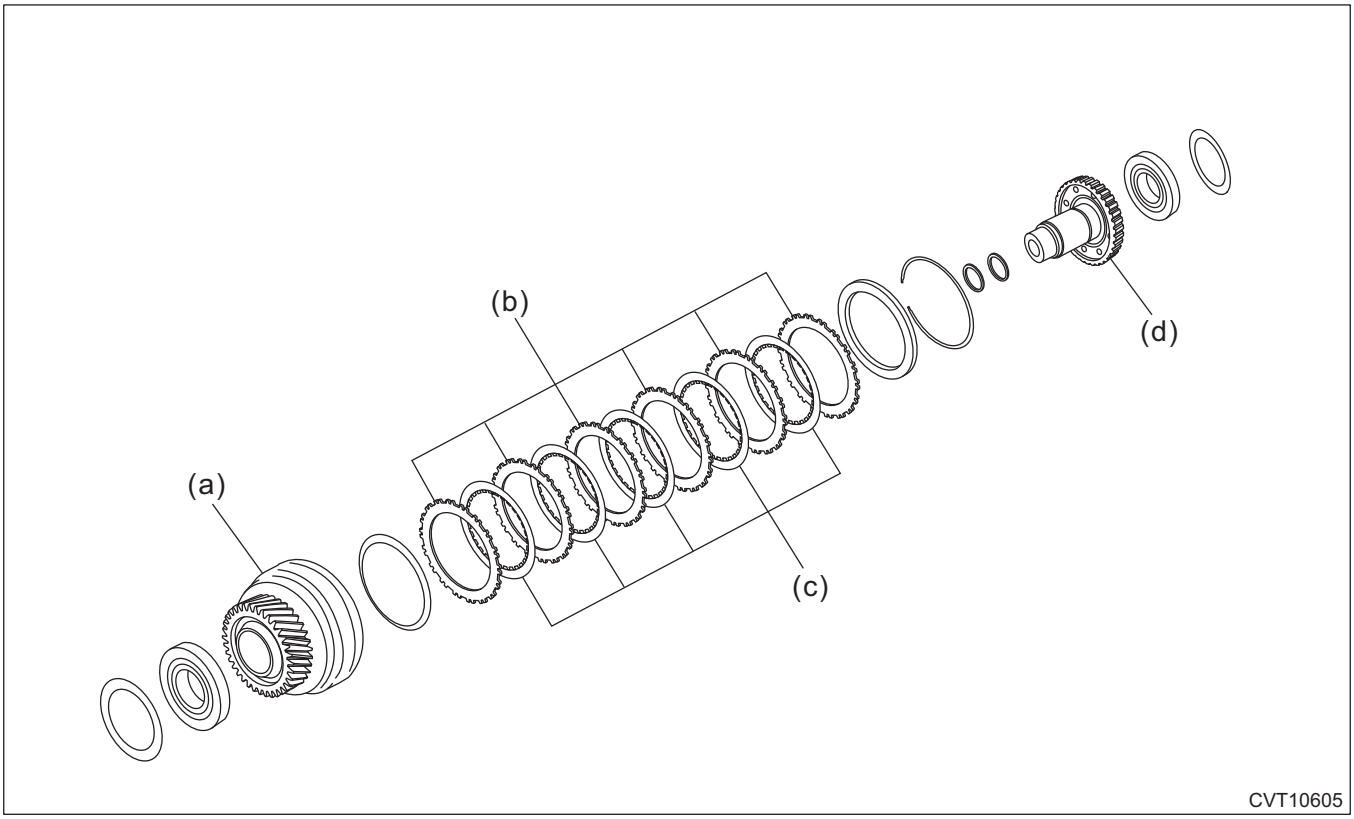
▮ Primary reduction gear

The primary reduction gear transmits the drive force output from the torque converter to the continuously variable transmission mechanism.



(a) Front reduction drive gear
(b) Front reduction driven gear
(c) Torque converter
(d) Primary pulley

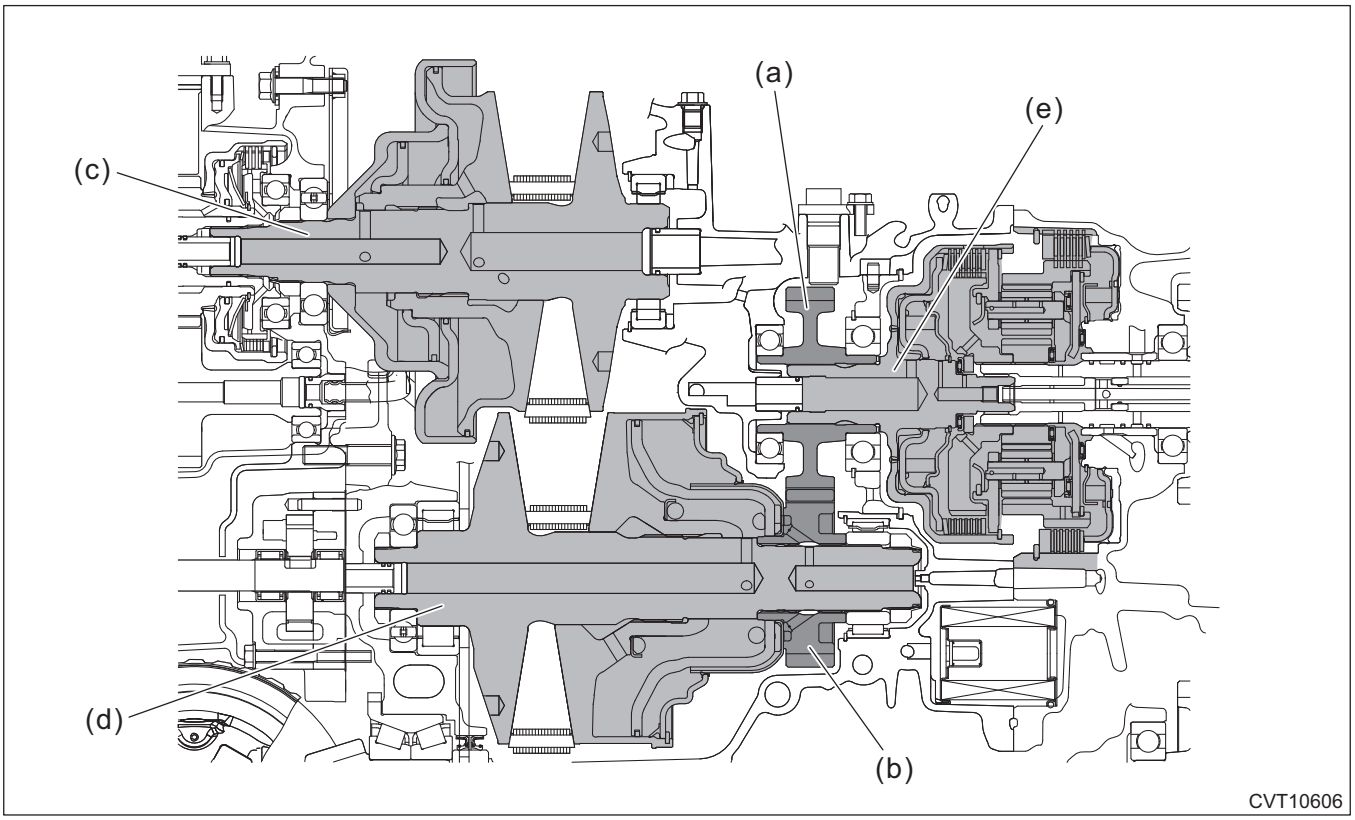
The front reduction driven gear is composed of parts including the drive plate, driven plate, and front reduction driven shaft. It includes a built-in hydraulic actuation clutch mechanism.



(a) Front reduction driven gear
(b) Driven plate
(c) Drive plate
(d) Front reduction driven shaft

▮ Secondary reduction gear

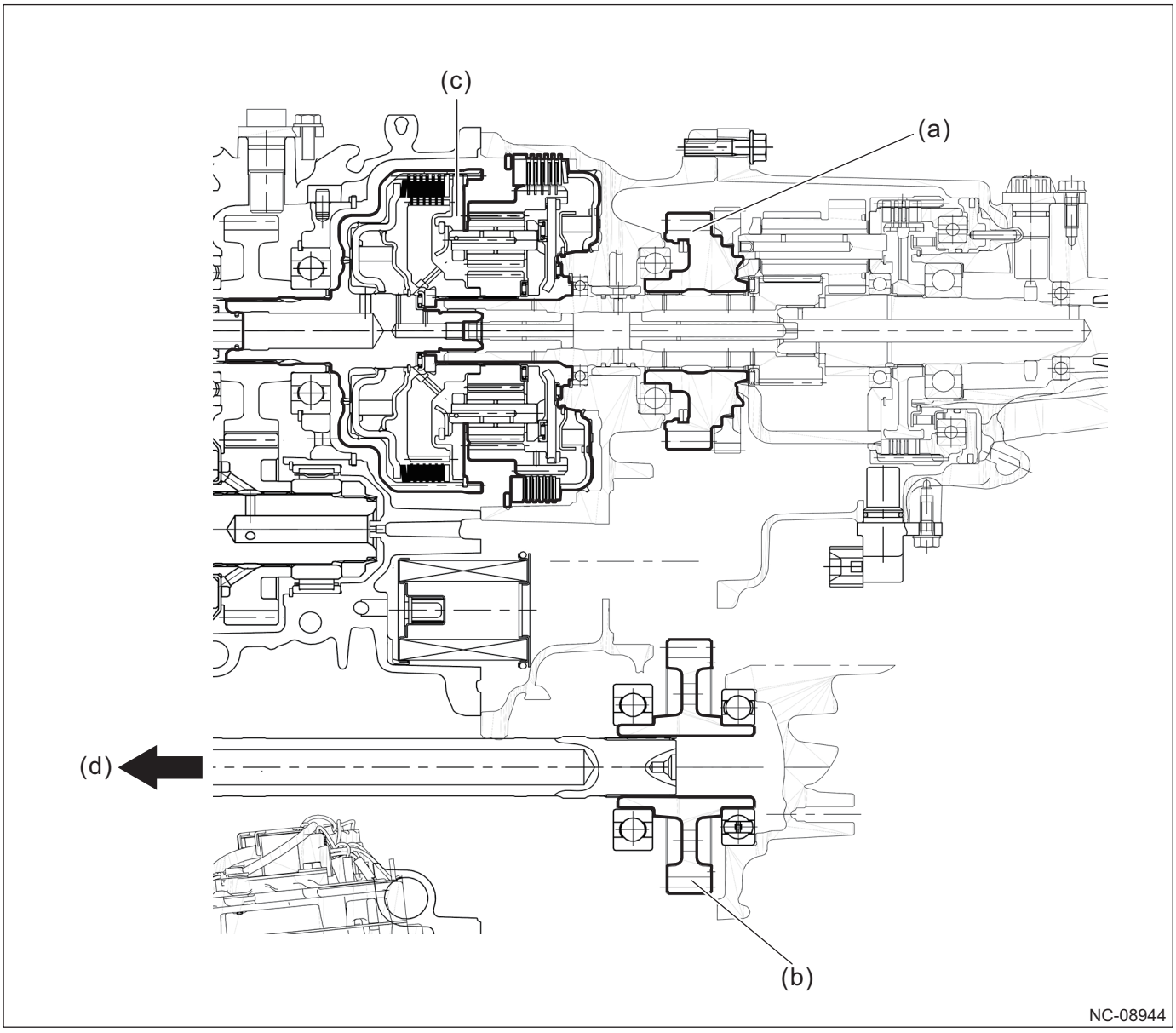
The secondary reduction gear reduces the speed of the drive force output from the continuously variable transmission mechanism and transmits it to the forward and reverse switching mechanism.



(a) Reduction driven gear
(b) Reduction drive gear
(c) Primary pulley
(d) Secondary pulley
(e) Forward clutch assembly

Transfer gear

The transfer gear reduces the speed of the drive force output from the forward and reverse switching mechanism and transmits it to the front differential.

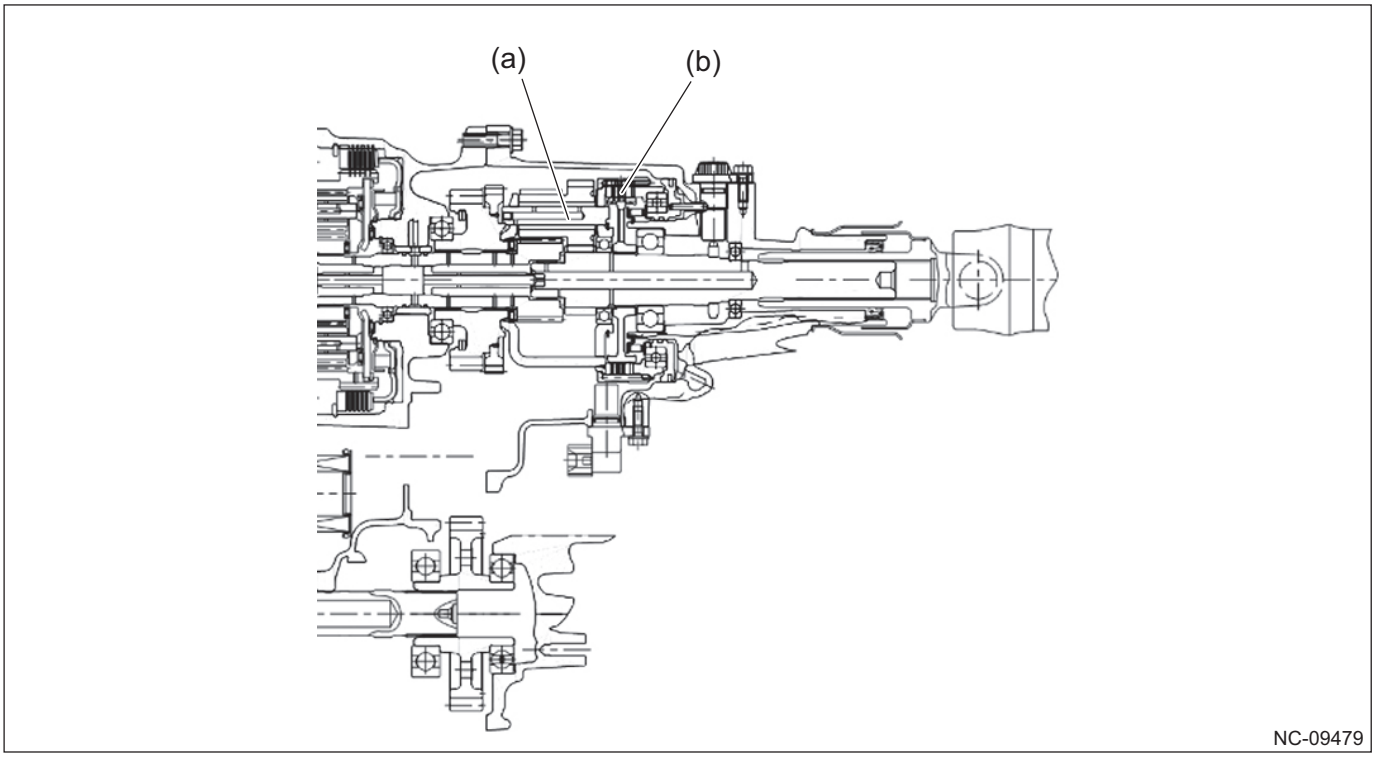


(a) Transfer drive gear
(b) Transfer reduction driven gear
(c) Forward and reverse switching mechanism
(d) Front differential

AWD mechanism

■ Construction

VTD-AWD uses a planetary gear type center differential and an electronic control LSD (hydraulic multi-plate clutch) in the transfer mechanism that distributes torque to the rear wheels. The mechanism controls electronically the oil pressure of the clutch and has the center differential function and the LSD function.



(a) Planetary gear

(b) Electronic control LSD

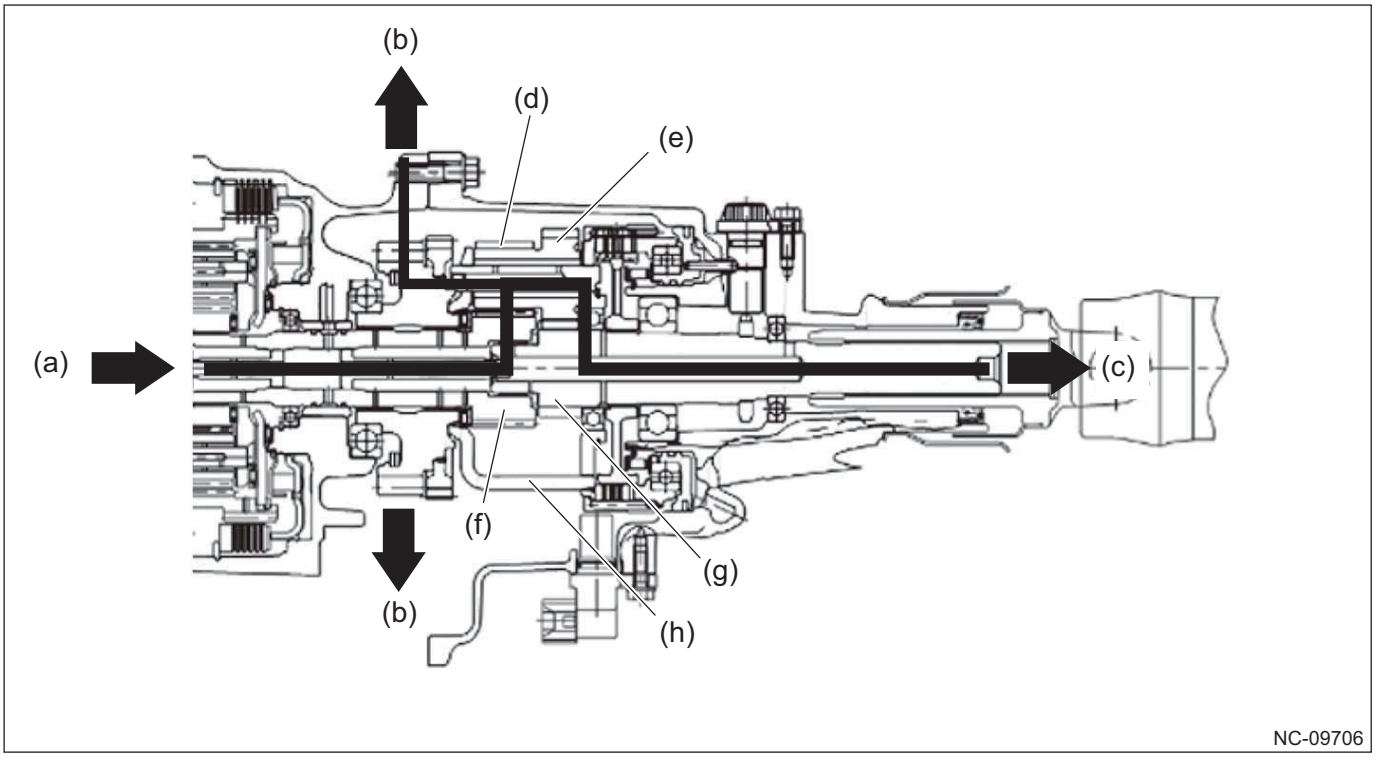
■ Operation

▮ When traveling straight forward (AWD clutch disengaged)

The basic torque distribution to the front and rear for the input torque from the forward and reverse switching mechanism is determined by the planetary gear type center differential. The front wheel torque is transmitted to the No. 1 pinion, and the rear wheel torque is transmitted to the No. 2 pinion. As a result, the torque is transmitted unequally in a front:rear ratio of 45:55.

Reference

Since the No. 1 pinion and No. 2 pinion have the same number of teeth, the unequal torque distribution results from the difference in the number of teeth on the No. 1 sun gear and No. 2 sun gear.

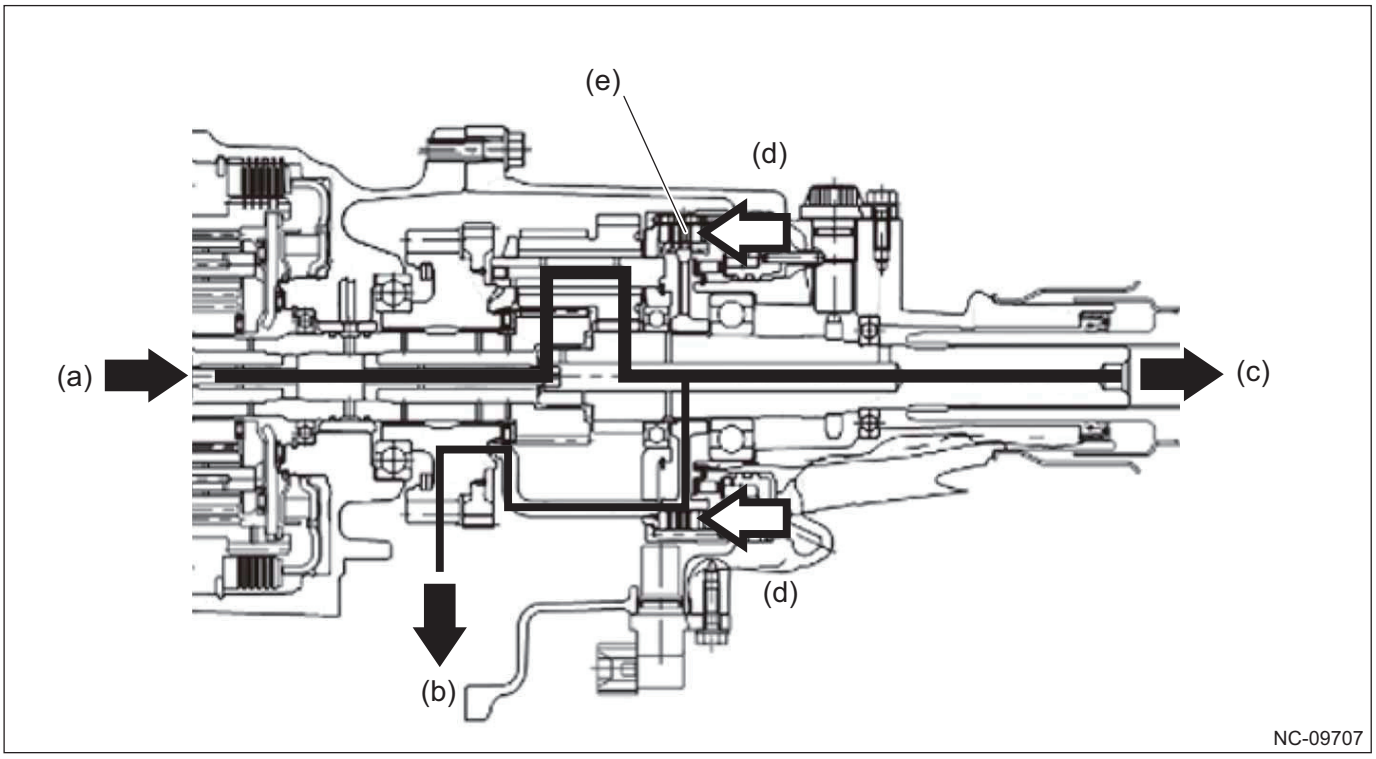


(a) From forward and reverse switching mechanism
(b) To front differential
(c) To rear differential
(d) No. 1 pinion
(e) No. 2 pinion
(f) No. 1 sun gear
(g) No. 2 sun gear
(h) Carrier

When a speed difference occurs between the front and rear wheels (such as when turning) (AWD clutch hydraulic pressure control)

When TCM detects that the front wheel slips, TCM increases the torque to the rear wheel to ensure the drive force.

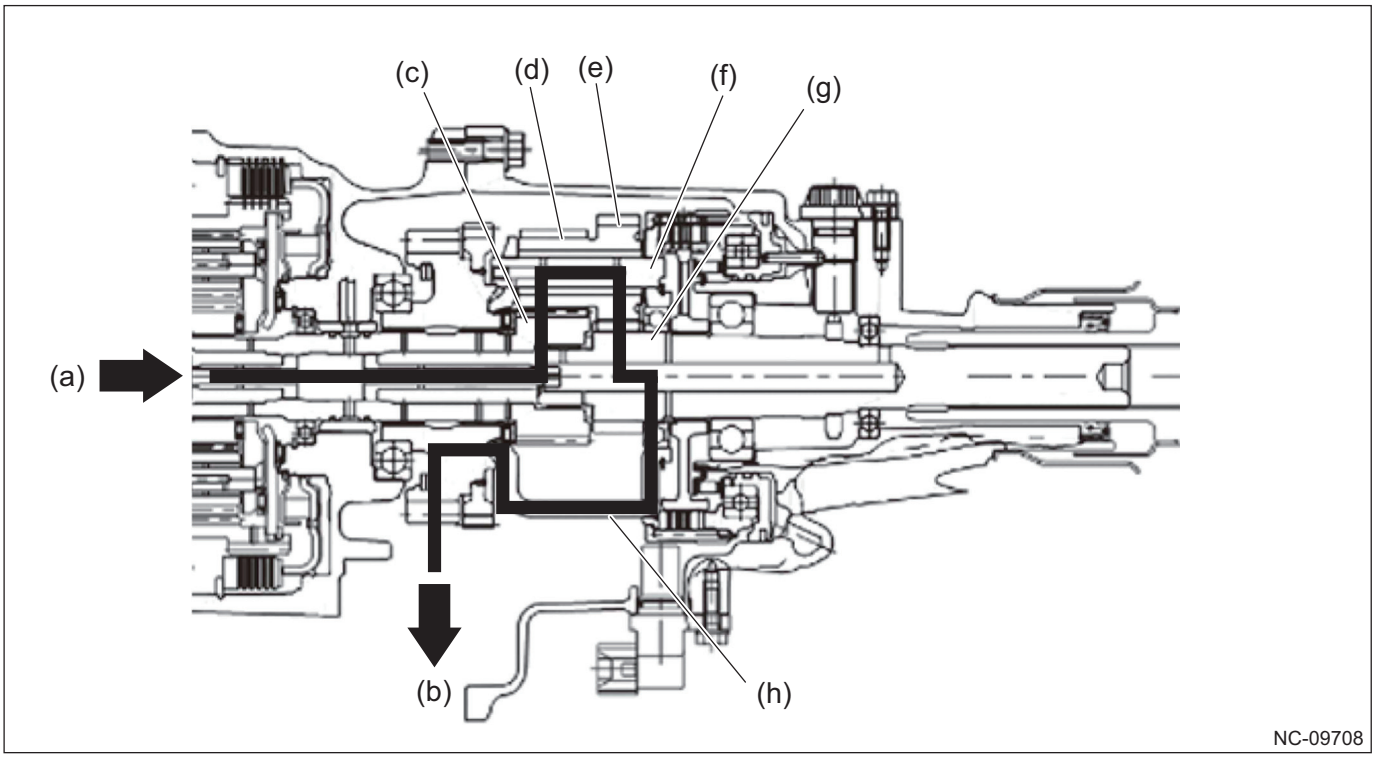
The AWD clutch pressure is controlled by the AWD solenoid based on the signal sent from TCM. TCM controls the torque distribution to the front and rear wheels in real time according to the driving conditions such as accelerating, hill climbing, and turning.



(a) From forward and reverse switching mechanism
(b) To front differential
(c) To rear differential
(d) AWD clutch hydraulic pressure control
(e) AWD clutch

When a rear wheel locks

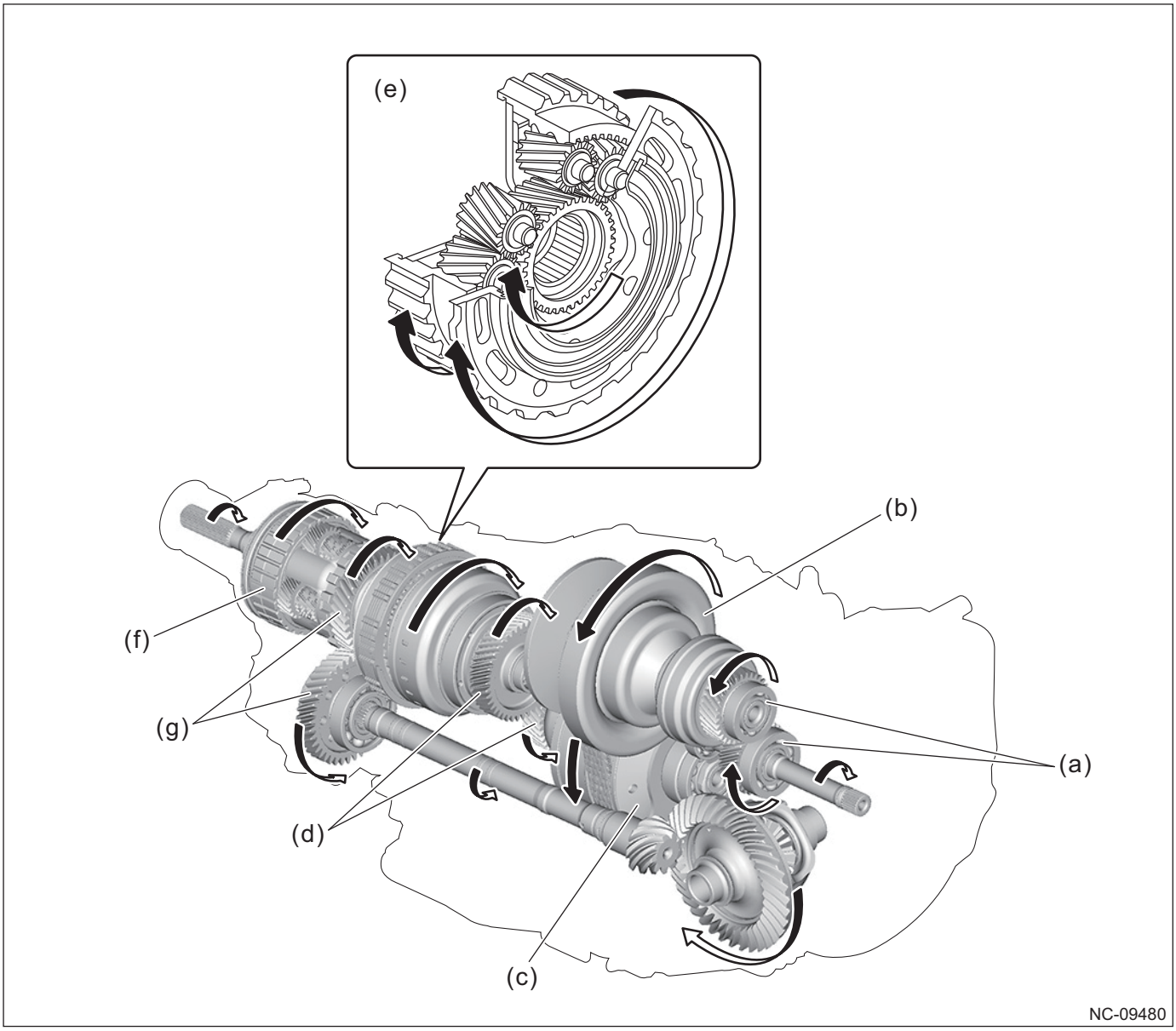
When a rear wheel locks, the pinion gear revolves the No. 2 sun gear, and the drum that is connected to the pinion shaft rotates, allocating all torque to the front wheels.



(a) From forward and reverse switching mechanism
(b) To front differential
(c) No. 1 sun gear
(d) No. 1 pinion
(e) No. 2 pinion
(f) Pinion shaft
(g) No. 2 sun gear
(h) Carrier

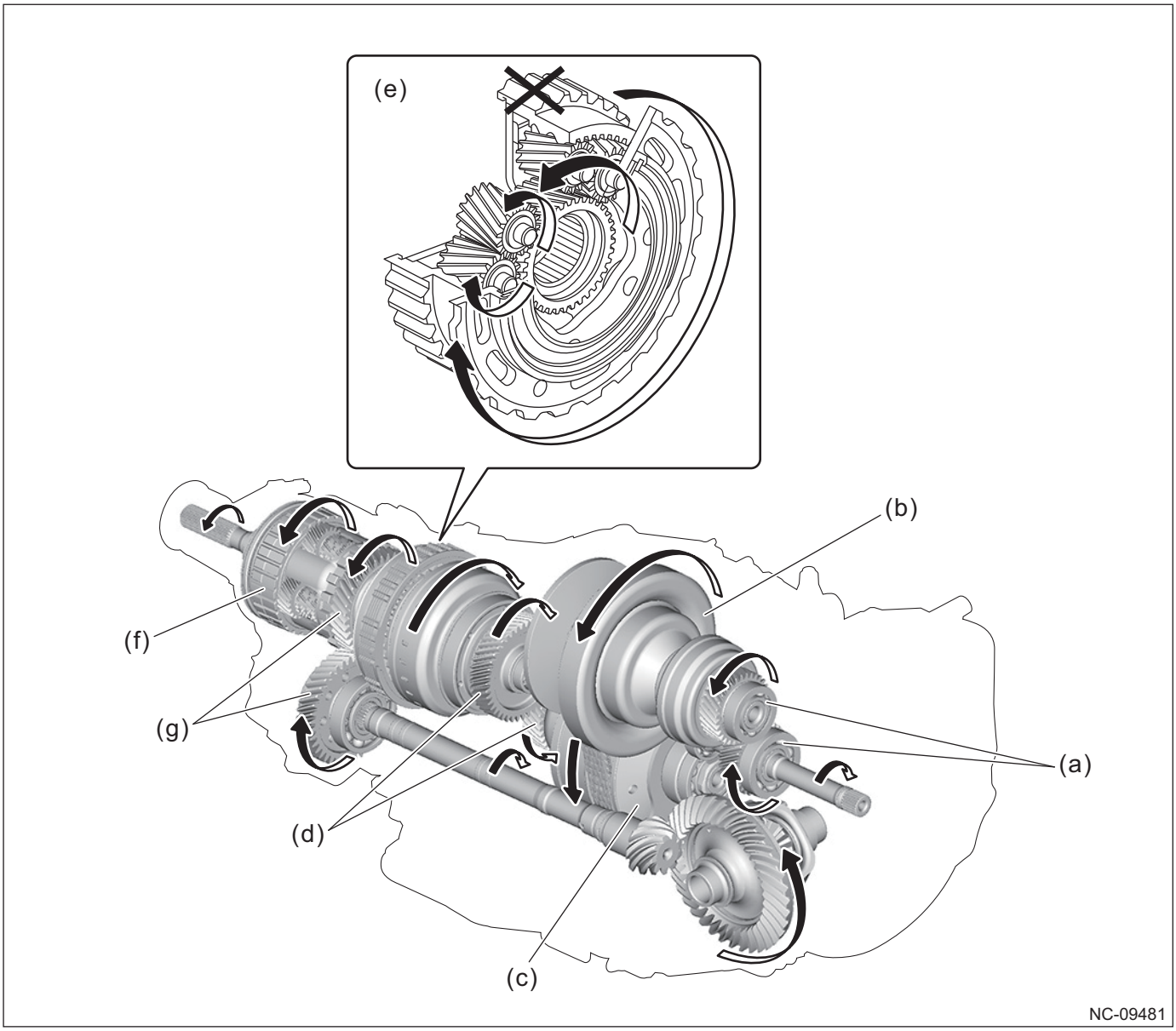
Power transmission

■ D range



(a) Primary reduction gear
(b) Primary pulley
(c) Secondary pulley
(d) Secondary reduction gear
(e) Forward and reverse switching mechanism
(f) AWD system
(g) Transfer gear

■ R range



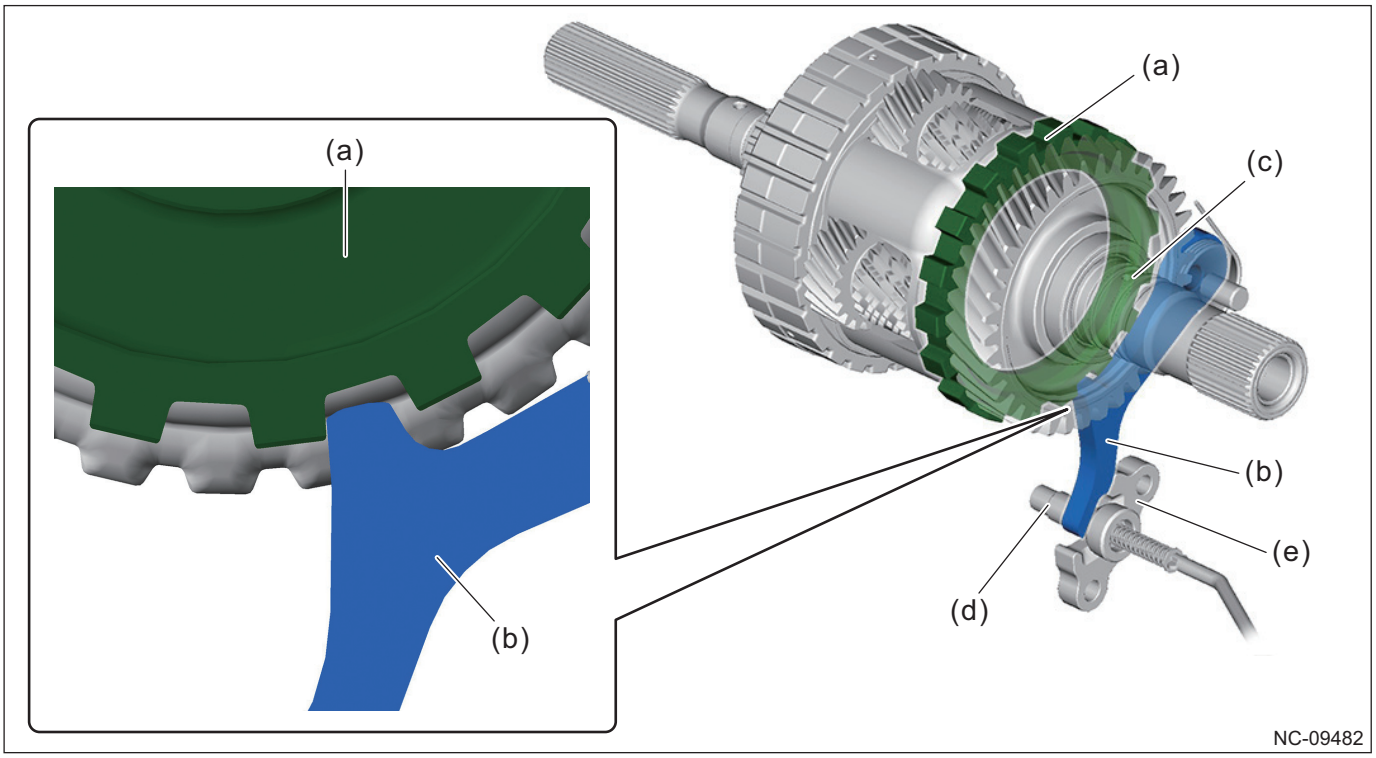
(a) Primary reduction gear
(b) Primary pulley
(c) Secondary pulley
(d) Secondary reduction gear
(e) Forward and reverse switching mechanism
(f) AWD system
(g) Transfer gear

■ N range

When the gear is shifted to the N range, the drive force from the pulley is input to the forward clutch drum and the planetary carrier. However since the forward clutch is OFF and the reverse brake is OFF, the drive force is not transmitted to the wheels.

■ P range

When the gear is shifted to the P range, drive force is not transmitted to the wheels in the same way as in the N range. Furthermore, the parking pawl engages with the parking gear to lock the rotation of the reduction drive gear shaft.



(a) Parking gear
(b) Parking pawl
(c) Reduction drive gear shaft
(d) Parking rod
(e) Parking support

Differential

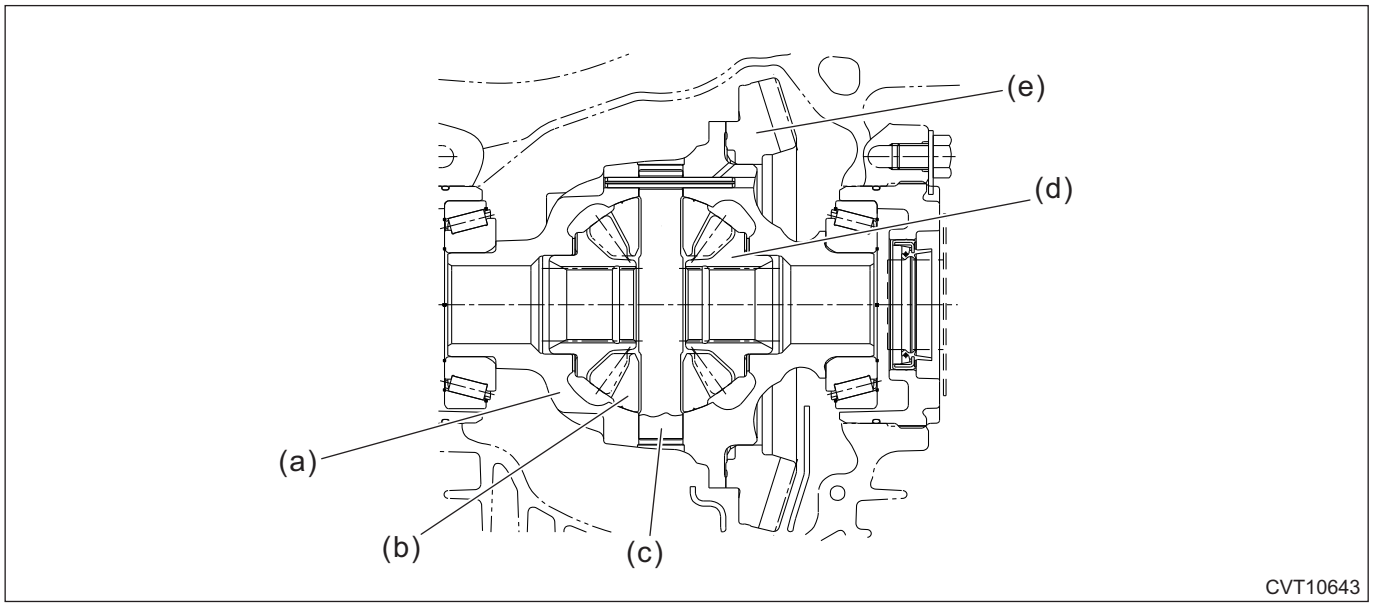
■ Construction

The front differential is composed of a differential case, a pinion gear (differential bevel pinion), a pinion shaft, and a side gear (differential bevel gear).

The pinion gear is installed in the differential case using the pinion shaft and rotates together with the differential case. Also, the pinion gear can freely rotate around the pinion shaft as an axis.

The side gear engages with the pinion gear. The center of the side gear with a spline shape is coupled with the drive shaft that is a drive axis.

The ring gear (hypoid driven gear) is installed outside the differential case.



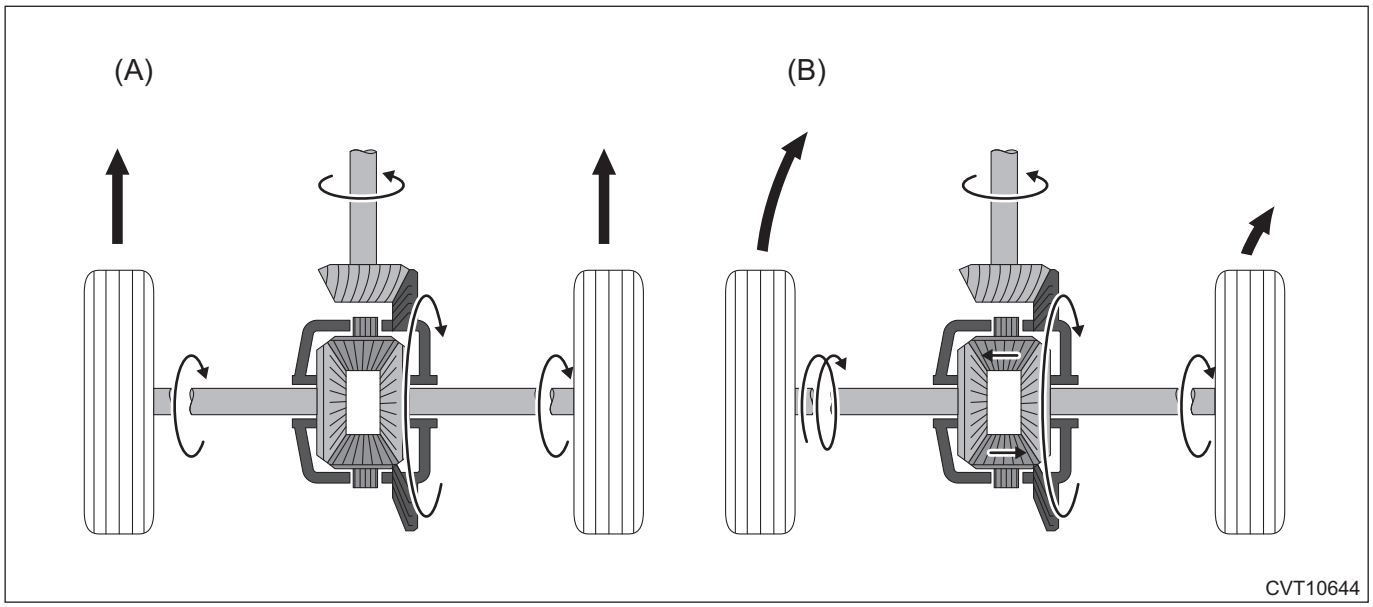
(a) Differential case
(b) Pinion gear
(c) Pinion shaft
(d) Side gear
(e) Ring gear

■ Operation

If there is no rotation difference between right and left wheels when traveling straight forward, rolling distances of the right and left wheels are the same. The pinion gear engaged with the side gear does not rotate on the pinion shaft and rotates (revolves) together with the differential case at this state. The right and left wheels rotate at the same speed.

When turning, since the rolling distances in the right and left wheels are different from each other, the inner wheel is required to decelerate and the outer wheel is required to accelerate. As a result, the pinion gear rotates on the pinion shaft by an amount equivalent to the amount of wheel speed difference, and at the same time the pinion gear revolves on the side gear that has larger resistance and drives the other side gear. This produces differential operation.

When one wheel stops, the pinion gear itself starts to rotate. The pinion gear rotates at double speed because it rotates the other side gear quickly.



(A) When traveling straight forward

(B) When turning

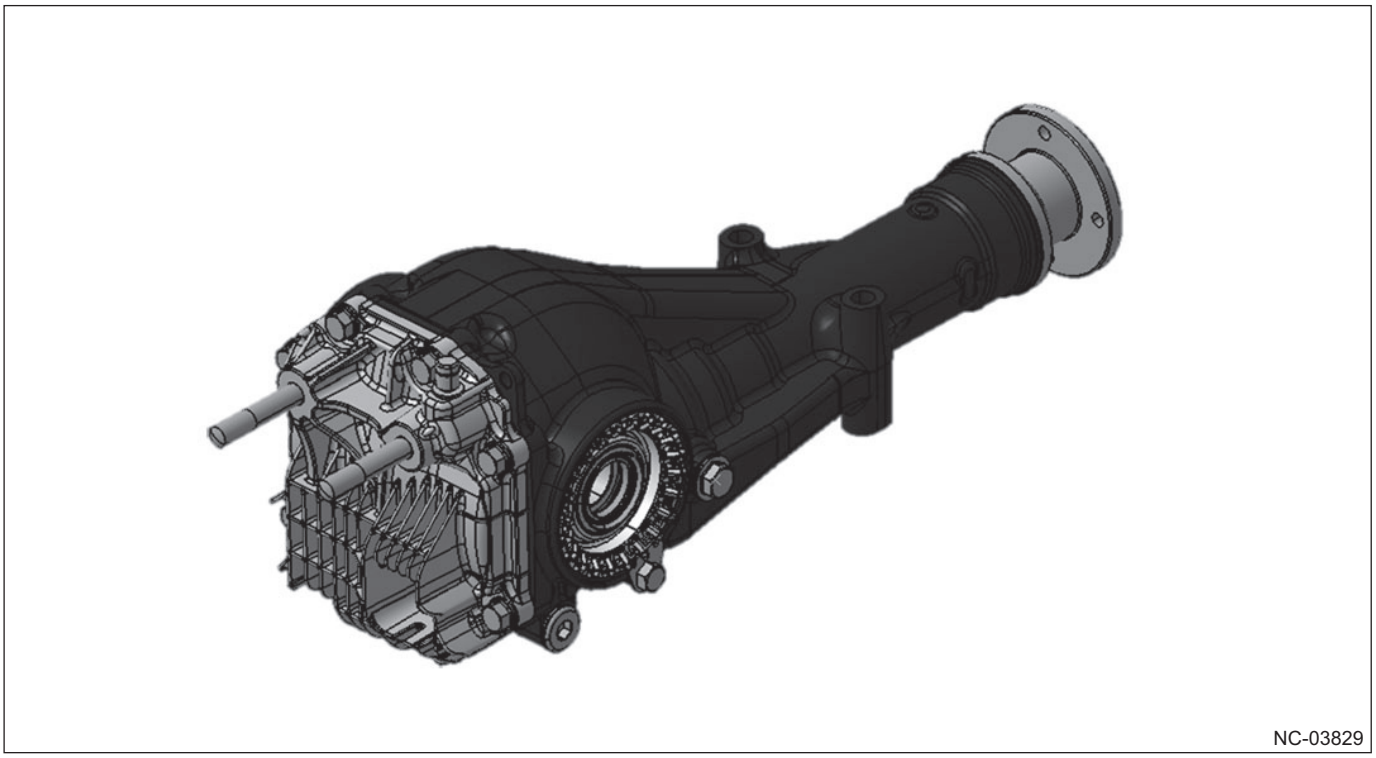
3.6 Rear differential

3.6.1 Overview

Overview

The R167 rear differential is adopted. The R167 rear differential has the following characteristics.

- The power performance is improved by enlarging the hypoid gear diameter in order to satisfy the drive force requirements (power, climbing, towing).
- Mass increase is limited by reducing the basic thickness of the differential carrier, rear cover, etc.
- Optimization of the internal structure of the differential and adoption of low viscosity oil and low-friction bearing reduce driving resistance and improve fuel efficiency.


NC-03829

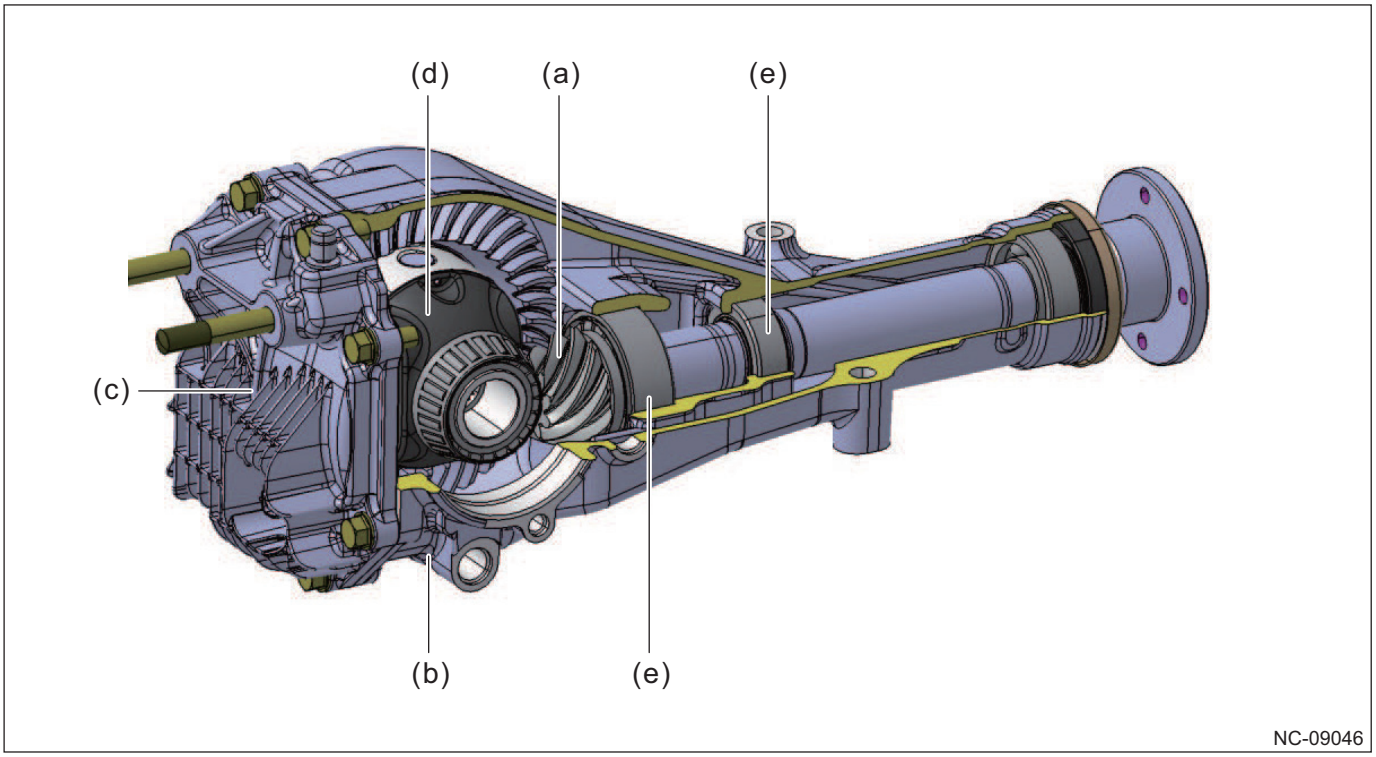
Specifications

Rear differential

Rear differential type		VB3 type
LSD type		-
Gear type		Hypoid gear
Gear ratio		4.111 (MT) 4.444 (CVT)
Differential gear oil capacity	Name	GL-5, 75W-90
	Oil amount (US qt (liter, Imp qt))	0.8 (0.8, 0.7)

3.6.2 Component

Component layout drawing

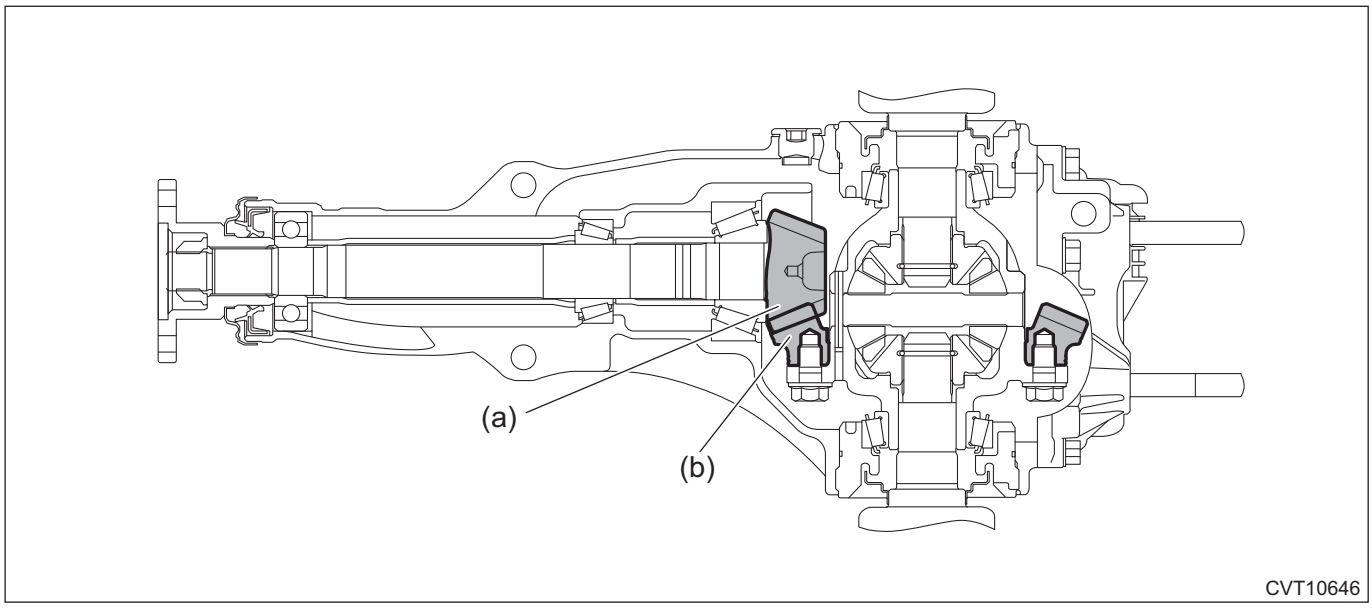


(a) Hypoid gear
(b) Differential carrier
(c) Rear cover
(d) Differential case
(e) Low-friction bearing

Component details

Hypoid gear

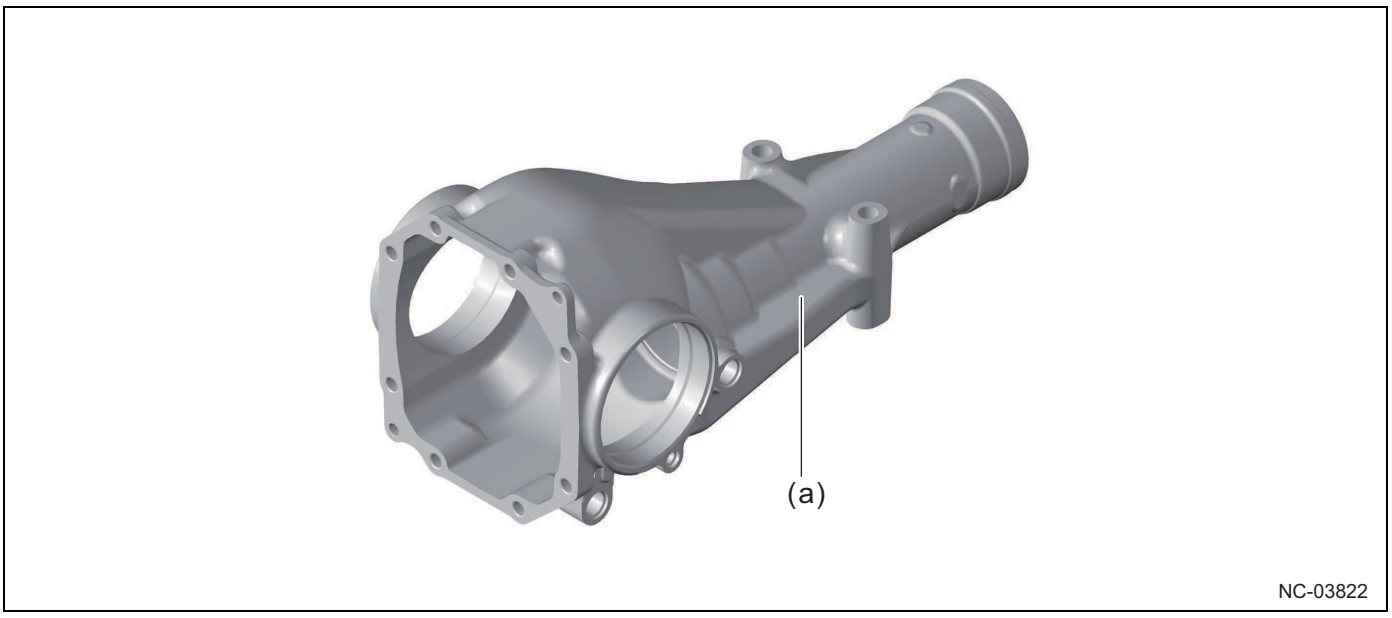
Fuel efficiency performance is improved by optimizing the gear specifications. The engagement ratio is increased to reduce vibration and noise.



(a) Drive pinion gear
(b) Hypoid driven gear

Differential carrier

By adopting the internal lubrication structure to reduce driving loss, fuel efficiency is improved. Thin basic thickness is adopted to reduce weight, and the structure is optimized.

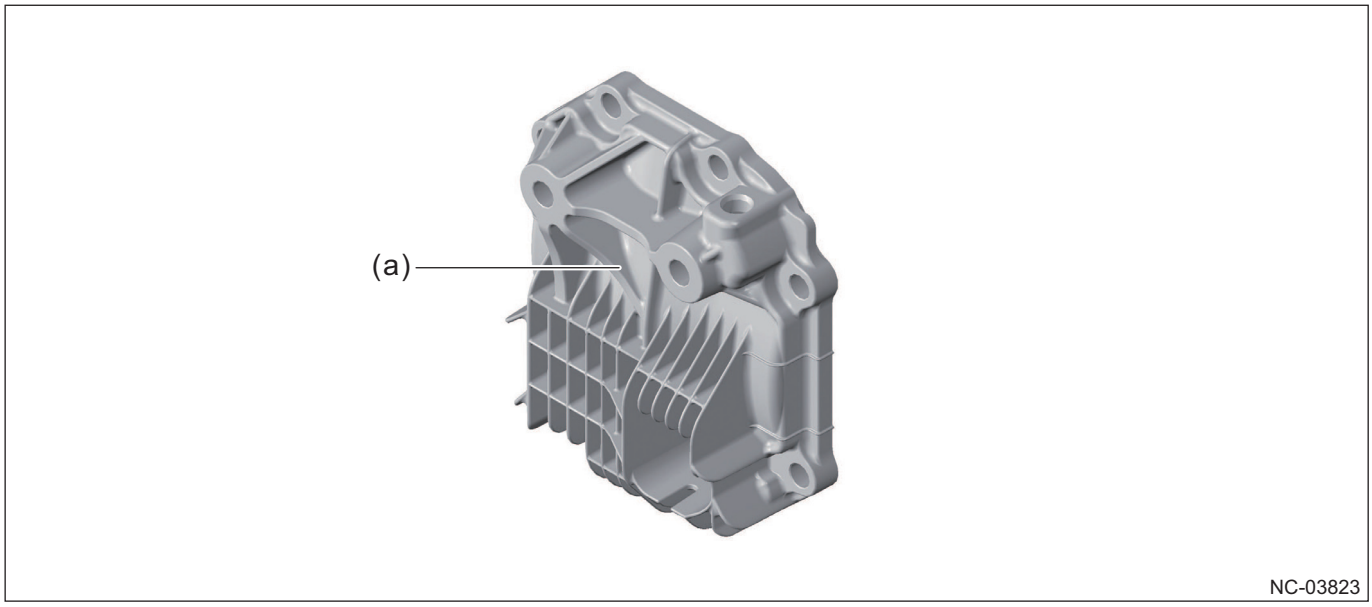


(a) Differential carrier

Rear cover

By adopting the internal lubrication structure to reduce driving loss, fuel efficiency is improved. Basic thickness is kept to the minimum, and the structure is optimized to reduce weight.

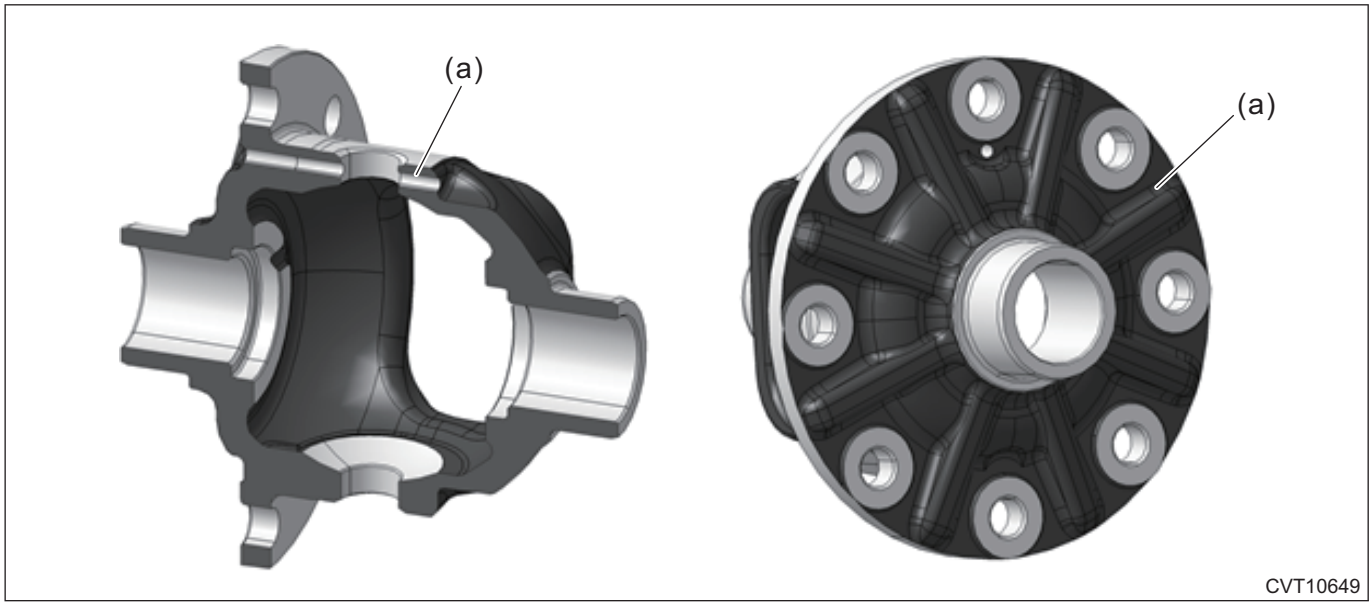
The fin shape is optimized to improve heat dissipation.



(a) Rear cover

Differential case

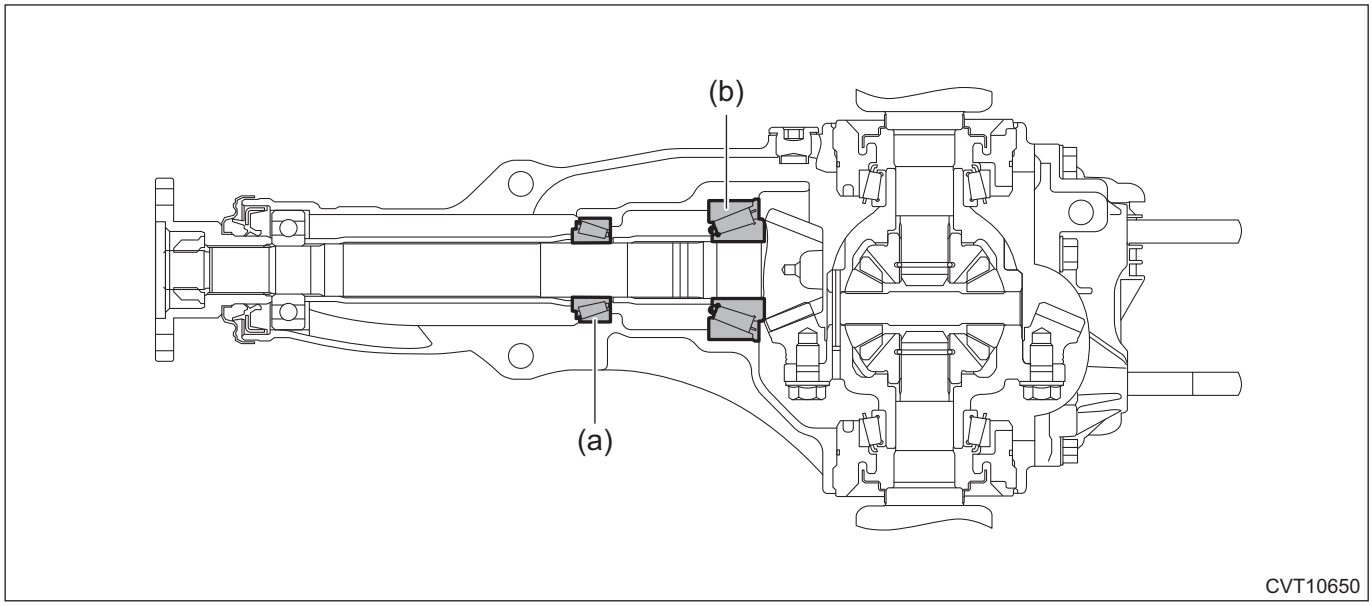
A high-strength differential case is adopted.



(a) Differential case

Low-friction bearing

Low-friction bearings are adopted for the front bearing and rear bearing of the drive pinion.

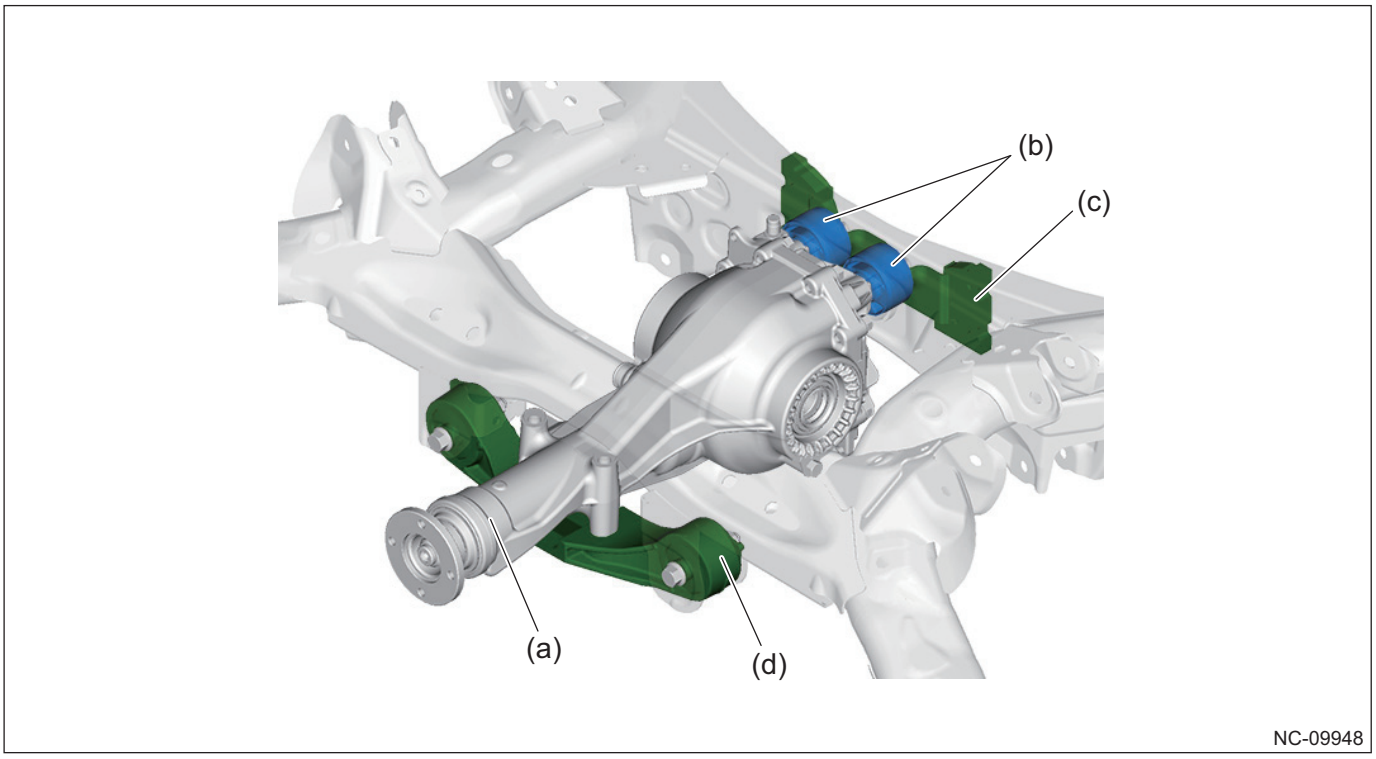


(a) Front bearing

(b) Rear bearing

Mounting system

Mass damper jointed with the rear differential mount bushing is adopted to reduce the booming noise and vibration when the rear differential is in operation. (CVT)



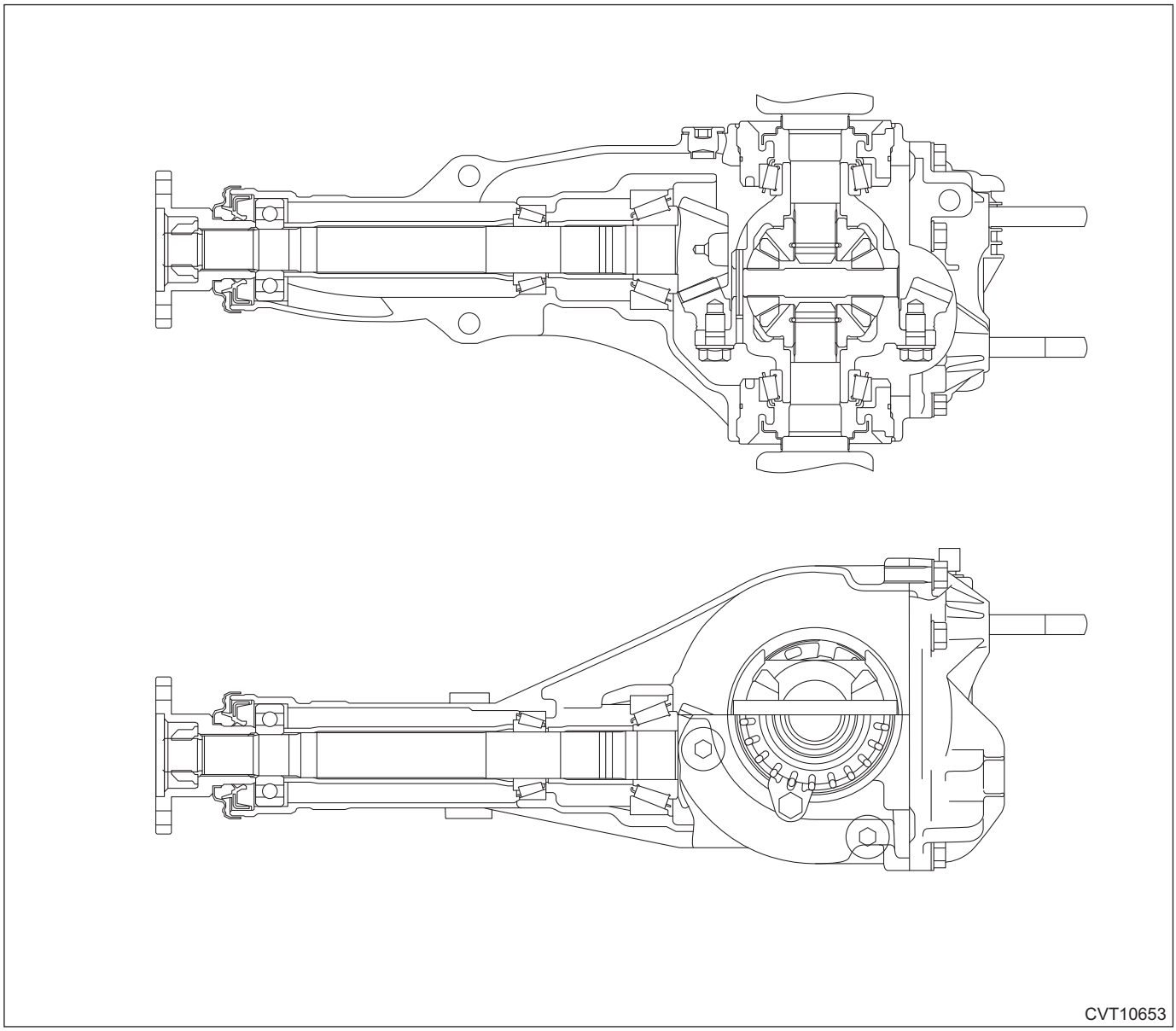
(a) Rear differential
(b) Rear differential mount bushing
(c) Mass damper*
(d) Rear differential front member

*: *CVT*

Rear differential

The drive gear is a hypoid gear with 6.57 in (167 mm) nominal diameter.

The drive pinion shaft is supported by three bearings. The preload of each bearing is adjusted by selecting a combination of spacers and washers with the correct thickness. Drive pinion height is adjusted by appropriately selecting the thickness of the washers on the drive pinion neck using a dummy shaft and gauge.



Reference

The operating principle of the rear differential is same as that of the front differential.

3.7 Drive Shaft/Propeller Shaft/Axle

3.7.1 Overview

Overview

On the front drive shaft, the Rzeppa constant velocity joint is adopted on the wheel side, and the sliding tripod constant velocity joint is adopted on the transmission side.

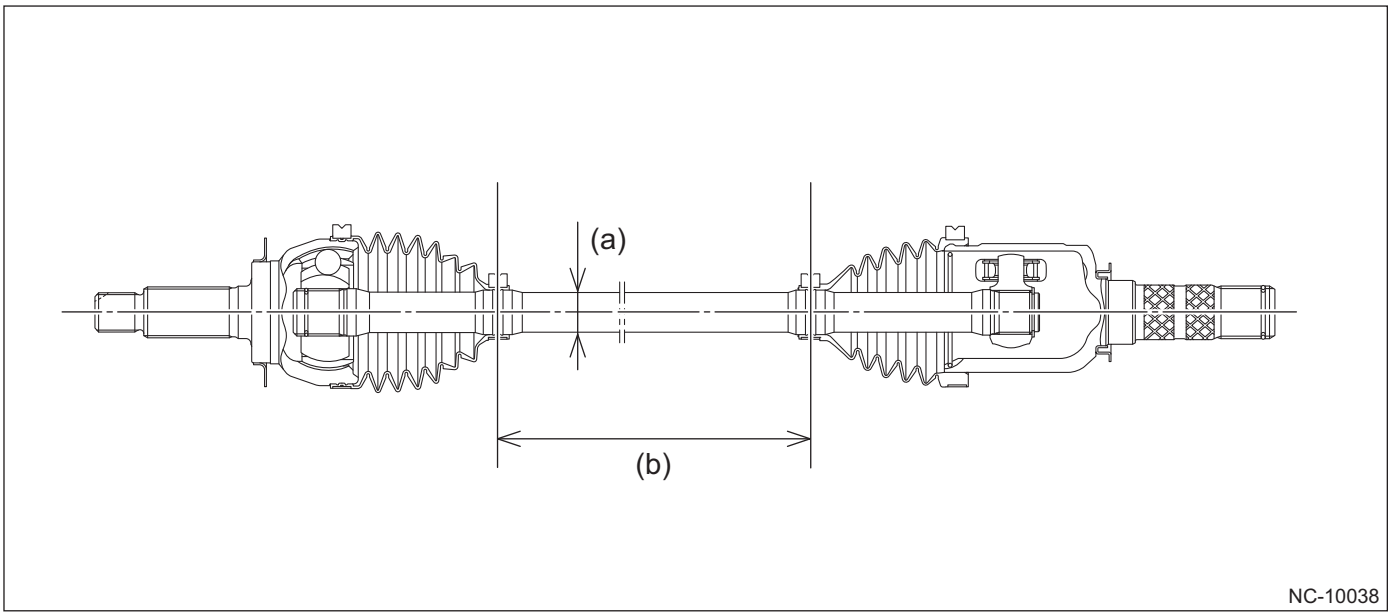
On the rear drive shaft, the Rzeppa constant velocity joint is adopted on the wheel side, and the double offset constant velocity joint is adopted on the rear differential side.

A propeller shaft with collapse mechanism is adopted for the propeller shaft.

An angular ball bearing is adopted for the hub unit bearing.

Specifications

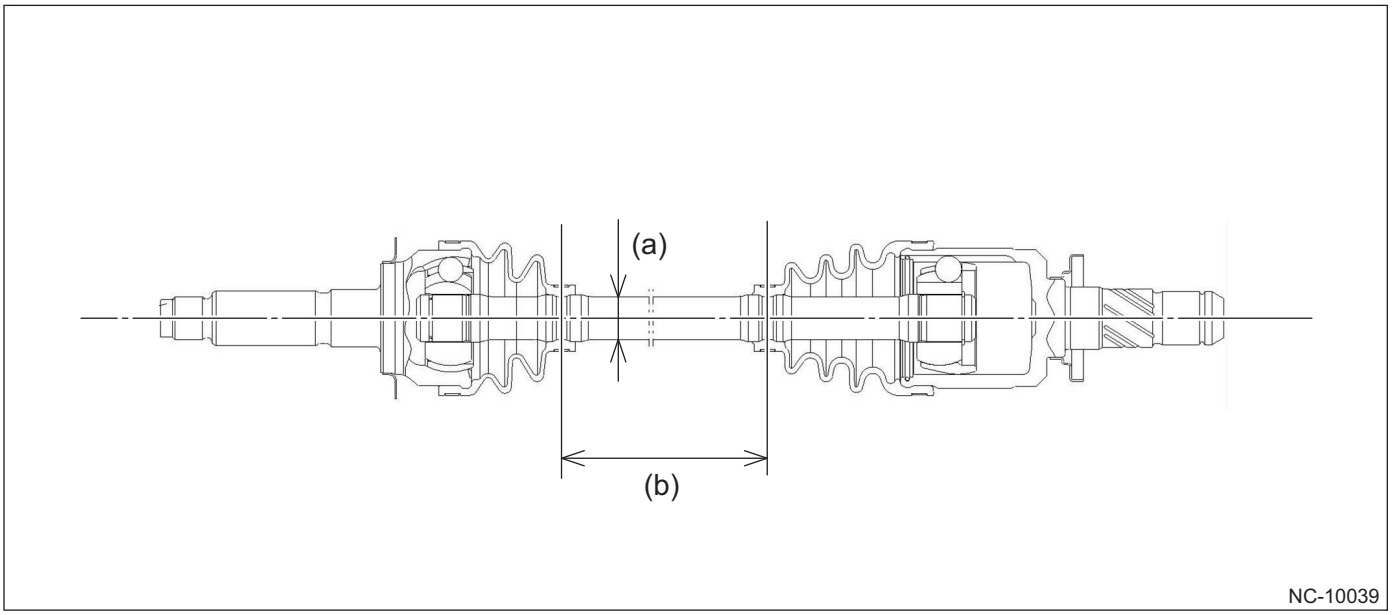
Front drive shaft



(a) Shaft diameter (b) Shaft length

Drive shaft type	Shaft diameter in (mm)	Shaft length in (mm)
Rzeppa constant velocity joint + sliding tripod constant velocity joint	0.87 (22.0)	14.20 (360.7)

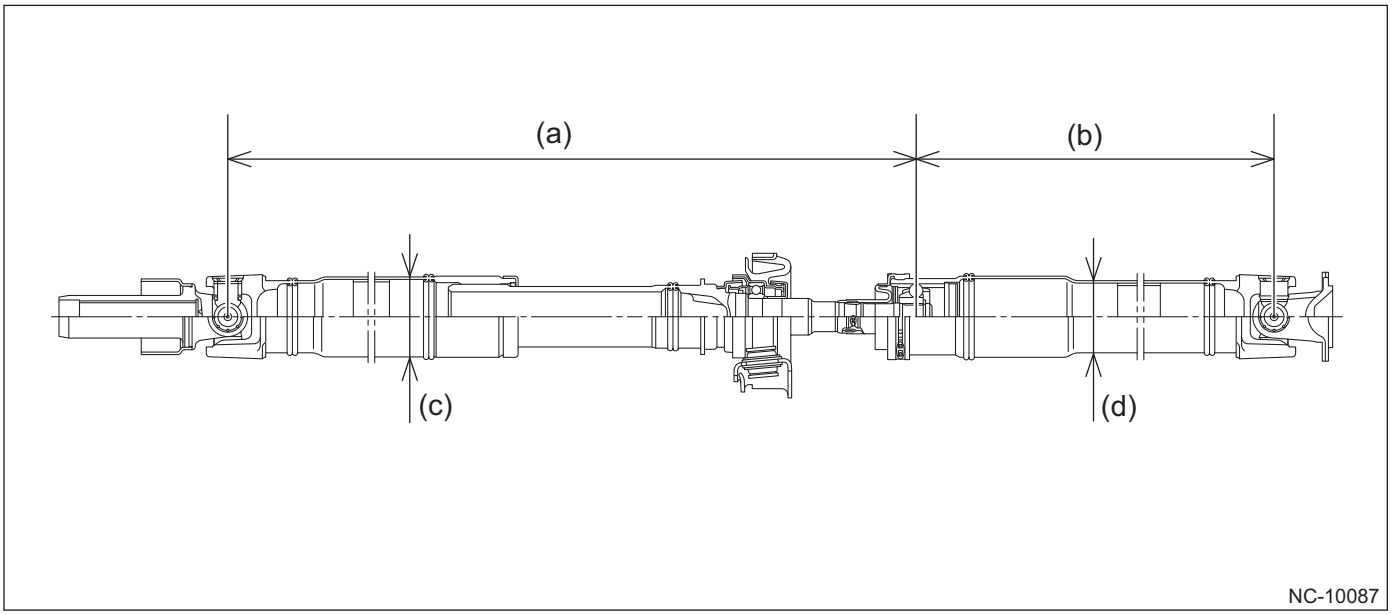
Rear drive shaft



(a) Shaft diameter (b) Shaft length

Drive shaft type	Shaft diameter in (mm)	Shaft length in (mm)
Rzeppa constant velocity joint + double offset constant velocity joint	0.87 (22.0)	15.73 (399.5)

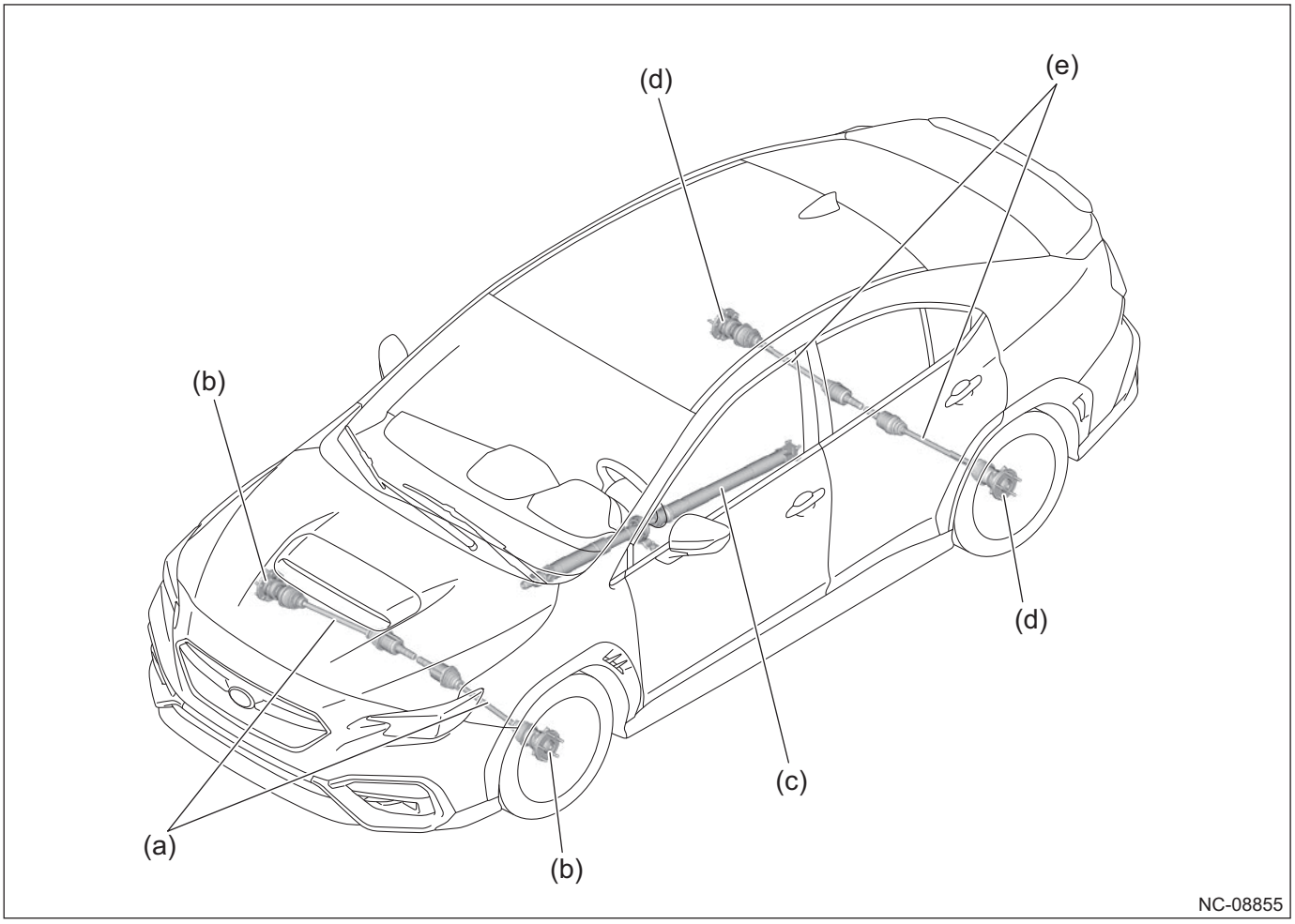
Propeller shaft



Propeller shaft type		Cardan joint + double offset constant velocity joint	
		MT	CVT
Joint-to-joint length (in (mm))	Front side	28.96 (735.5)	22.76 (578.0)
	Rear side	29.41 (747.0)	29.41 (747.0)
Outer diameter of tube (in (mm))	Outer diameter (D1)	2.50 (63.5)	2.50 (63.5)
	Outer diameter (D2)	2.26 (57.5)	2.26 (57.5)

3.7.2 Component

Component layout drawing



(a) Front drive shaft
(b) Front axle
(c) Propeller shaft
(d) Rear axle
(e) Rear drive shaft

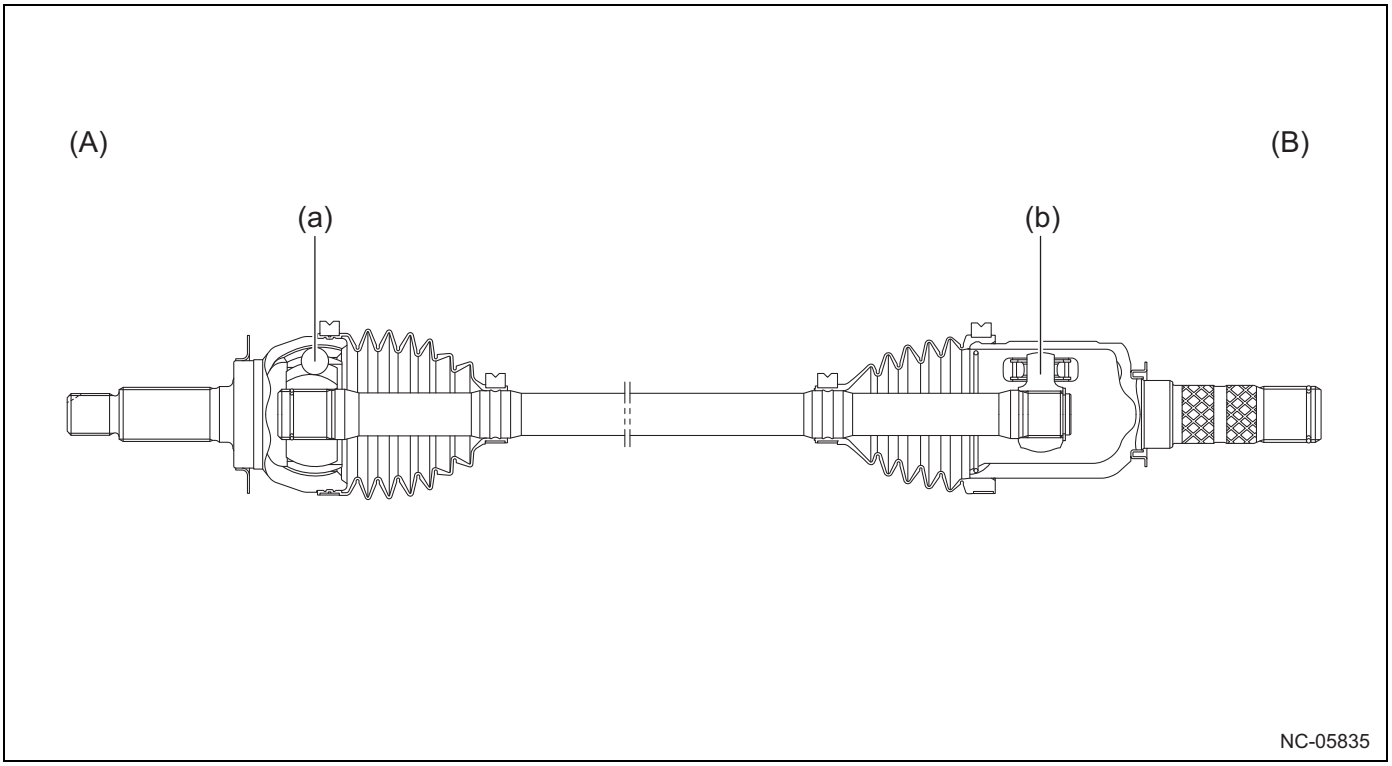
Component details

Drive shaft

■ front drive shaft

Sliding tripod constant velocity joint that corresponds to the change in the axle length when the suspension moves is adopted for the joint on the transmission side.

Rzeppa constant velocity joint that corresponds to the angle change in the steering wheel is adopted for the joint on the wheel side.



(A) Wheel side

(B) Transmission side

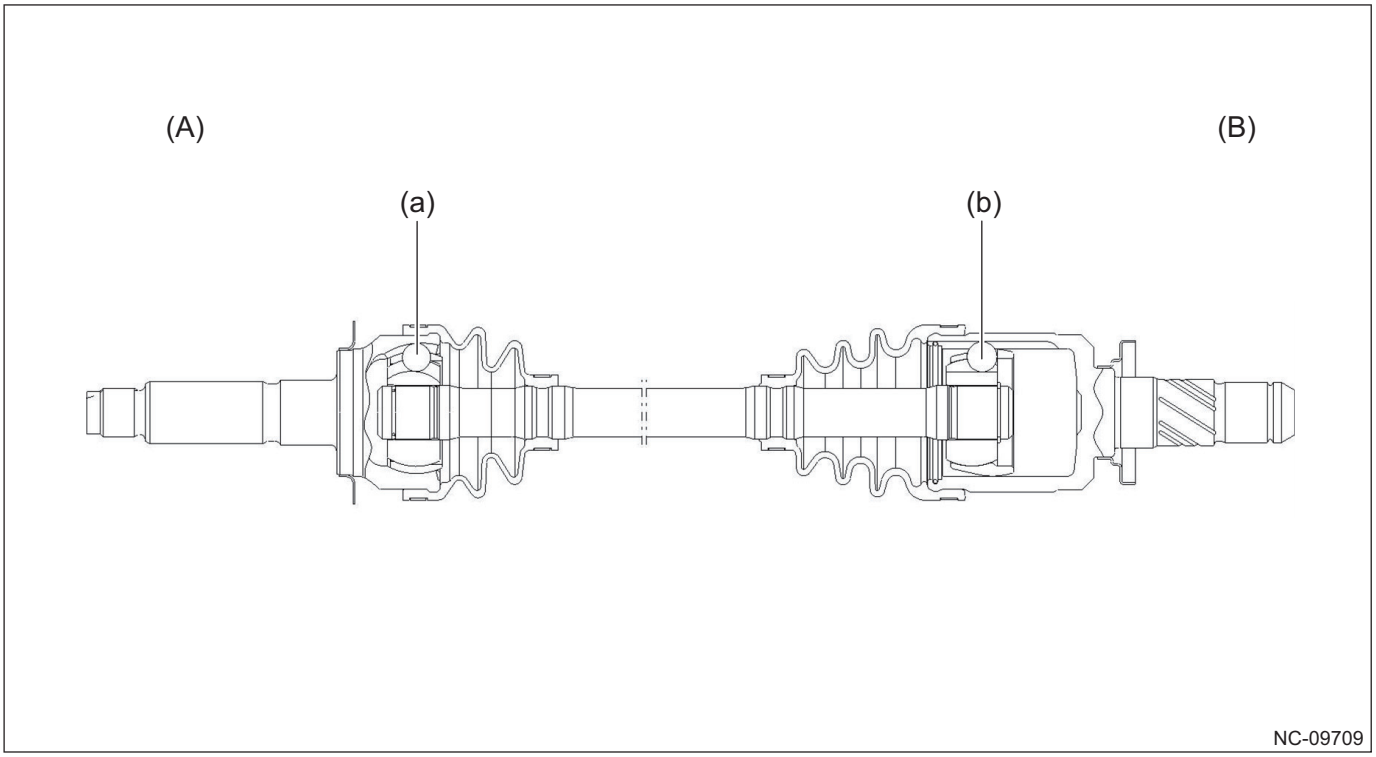
(a) Rzeppa constant velocity joint

(b) Sliding tripod constant velocity joint

■ Rear drive shaft

Double offset constant velocity joint that corresponds to the change in the axle length when the suspension moves is adopted for the joint on the rear differential side.

Rzeppa constant velocity joint that corresponds to the angle change in the rear wheels is adopted for the joint on the wheel side.



(A) Wheel side

(B) Rear differential side

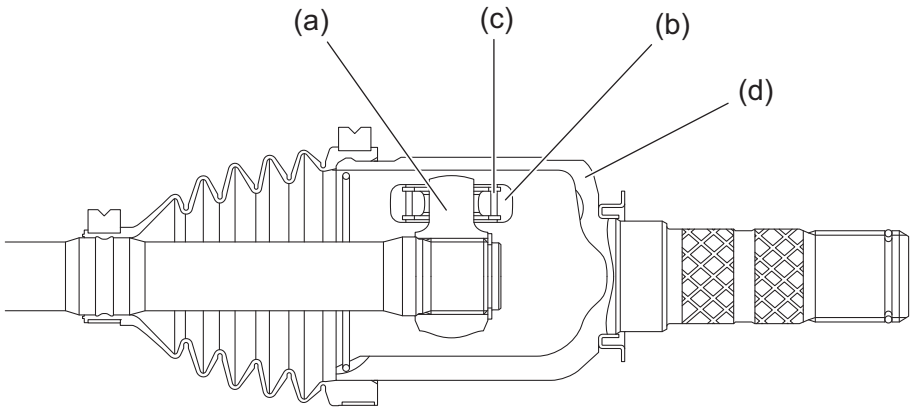
(a) Rzeppa constant velocity joint

(b) Double offset constant velocity joint

Sliding tripod constant velocity joint

Three rollers are installed in the tripod of the sliding tripod constant velocity joint through the needle bearing. Since the three rollers are inserted into three grooves of the outer race, they can move freely.

The sliding tripod constant velocity joint has the construction that slides while rolling in the axial direction, without inclination of the roller posture even when the operating angle occurs on the joint. The roller is not affected by the operating angle and moves on the inner surface smoothly in the axial direction to reduce friction.



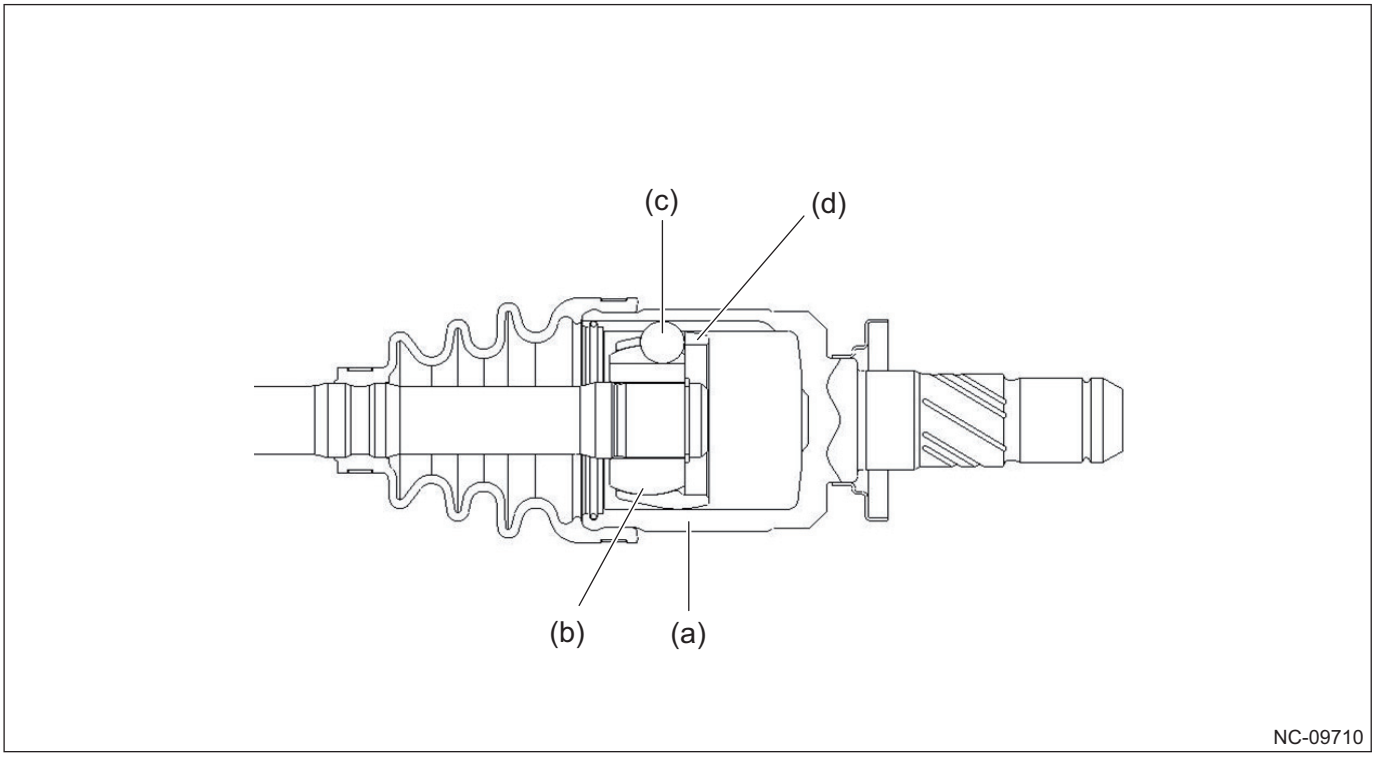
NC-05837

(a) Tripod
(b) Roller
(c) Needle bearing
(d) Outer race

Double offset constant velocity joint

In the double offset constant velocity joint, there are eight balls in the grooves of the outer race and the inner race, and the balls are held by the ball cage. Since the ball grooves of the outer race and the inner race are parallel to the axial direction, the balls can slide in the axial direction.

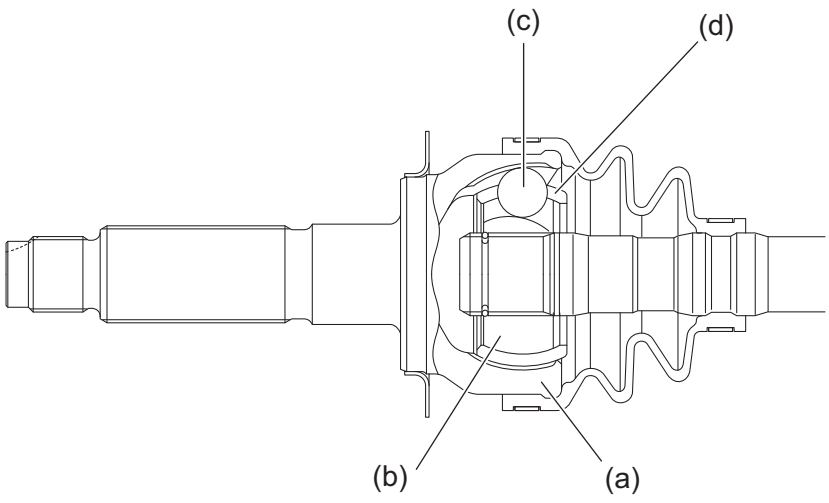
The double offset constant velocity joint can transmit drive force while corresponding to change in the length between the wheel and the differential when the vehicle body moves up and down.



(a) Outer race
(b) Inner race
(c) Ball
(d) Ball cage

Rzeppa constant velocity joint

In the Rzeppa constant velocity joint, there are eight balls in the grooves of the outer race and the inner race, and the balls are held by the ball cage. Ball grooves on the inside of the outer race and on the outside of the inner race have a spherical surface that can permit a large operating angle.



NC-05839

(a) Outer race
(b) Inner race
(c) Ball
(d) Ball cage

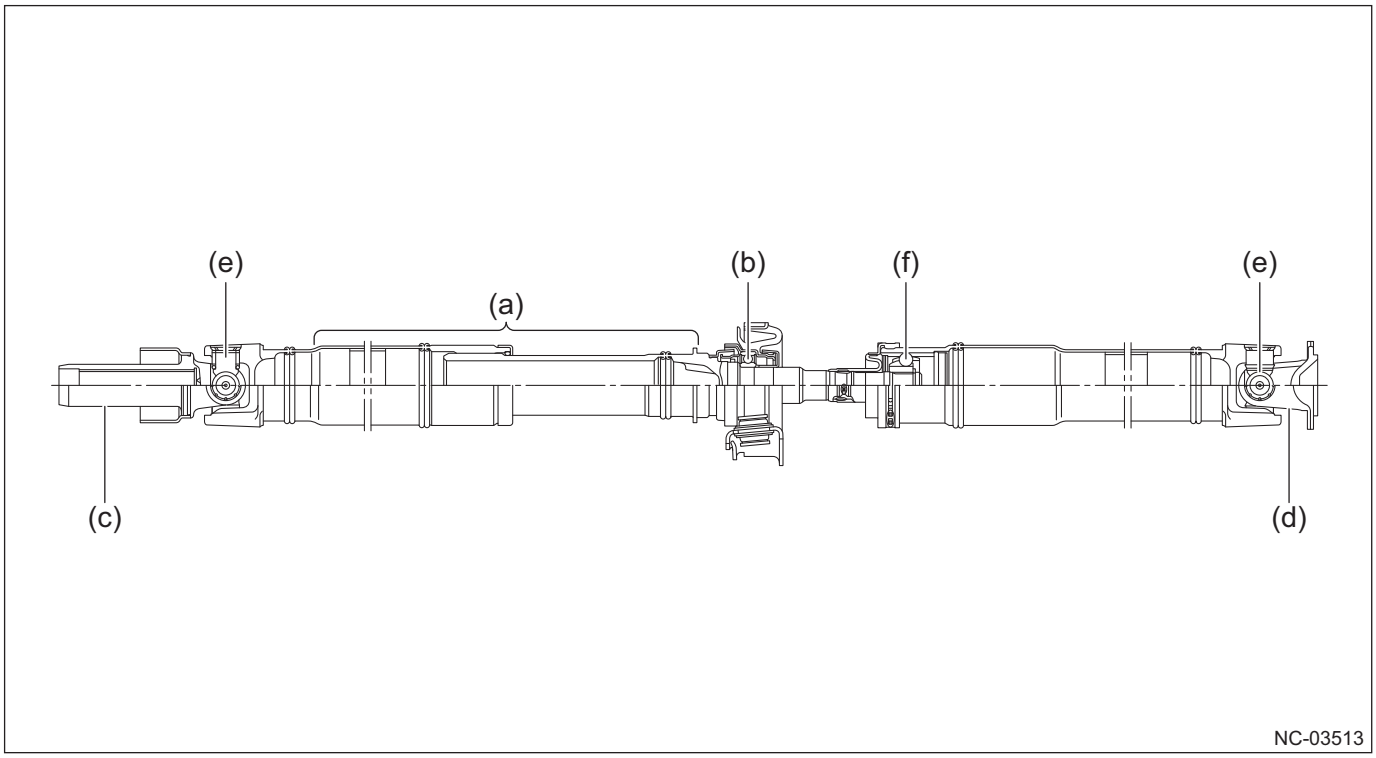
Propeller shaft

A three-joint type propeller shaft with collapse mechanism and center bearing is adopted.

A mechanism for reducing vehicle collision resistance in case of collision is created by providing a collision stroke mechanism (spline collapse mechanism).

The sleeve yoke on the transmission side and the flange yoke on the rear differential side are coupled with the cardan joint using the needle bearing to move freely.

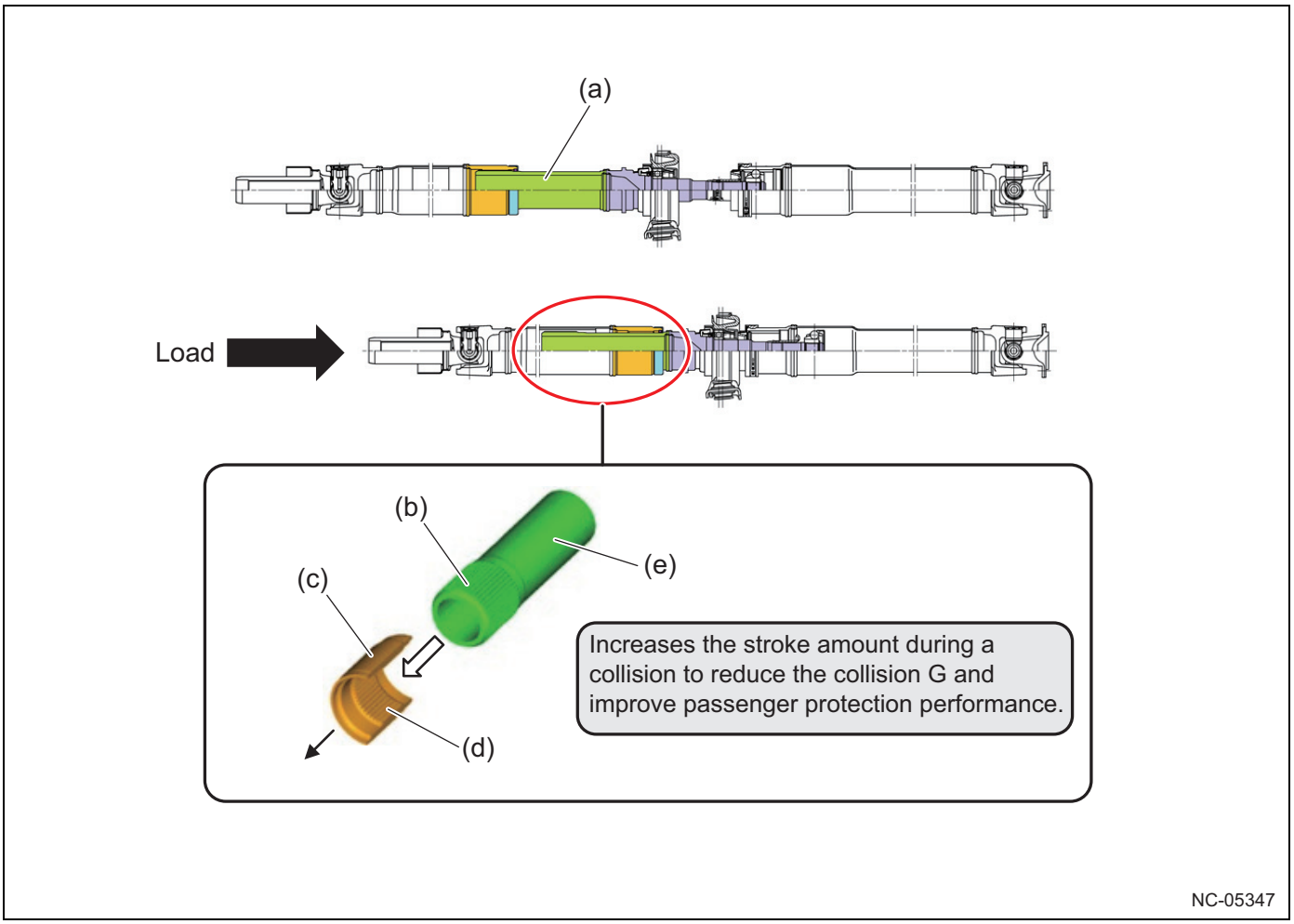
The spline of the sleeve yoke absorbs the length change and the center bearing prevents deflection of the shaft. Also, the double offset constant velocity joint absorbs changes in length and angle, and reduces more rotational vibration to improve quietness.



(a) Collapse mechanism
(b) Center bearing
(c) Sleeve yoke
(d) Flange yoke
(e) Cardan joint
(f) Double offset constant velocity joint

Collapse mechanism

The collapse mechanism strokes the propeller shaft on collision and reduces vehicular collision g-forces.



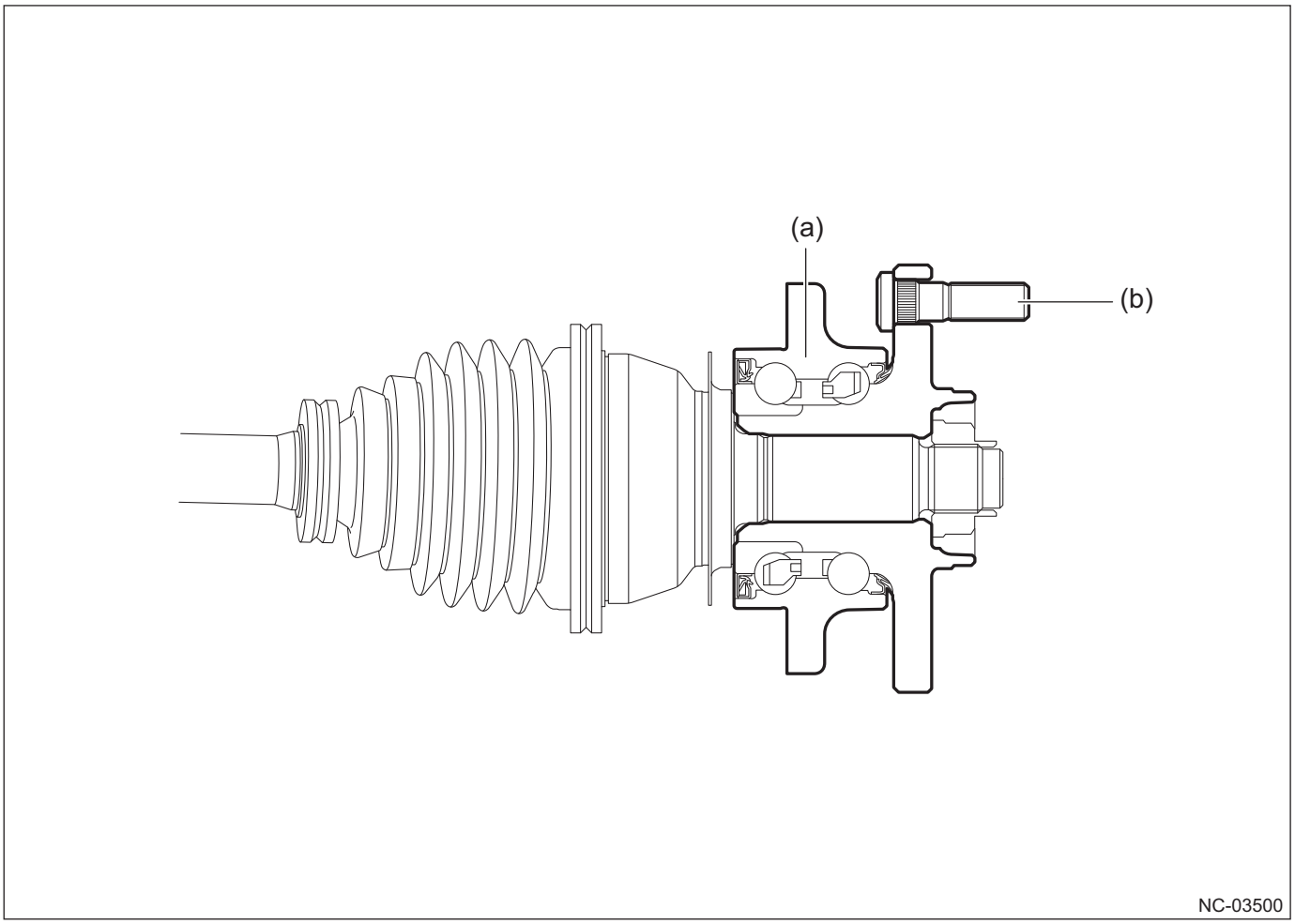
(a) Collapsible spline
(b) Helical spline
(c) Spline sleeve (cross-section model)
(d) Spline (straight)
(e) Spline shaft

Axle

■ Front axle

A double-row angular ball bearing with low rolling resistance is adopted for the front axle hub unit bearing.

At the unit type front axle hub unit bearing, one side of the bearing inner race is integrated with the axle hub and includes an integrated oil seal. This reduces weight, improves durability, and improves serviceability.



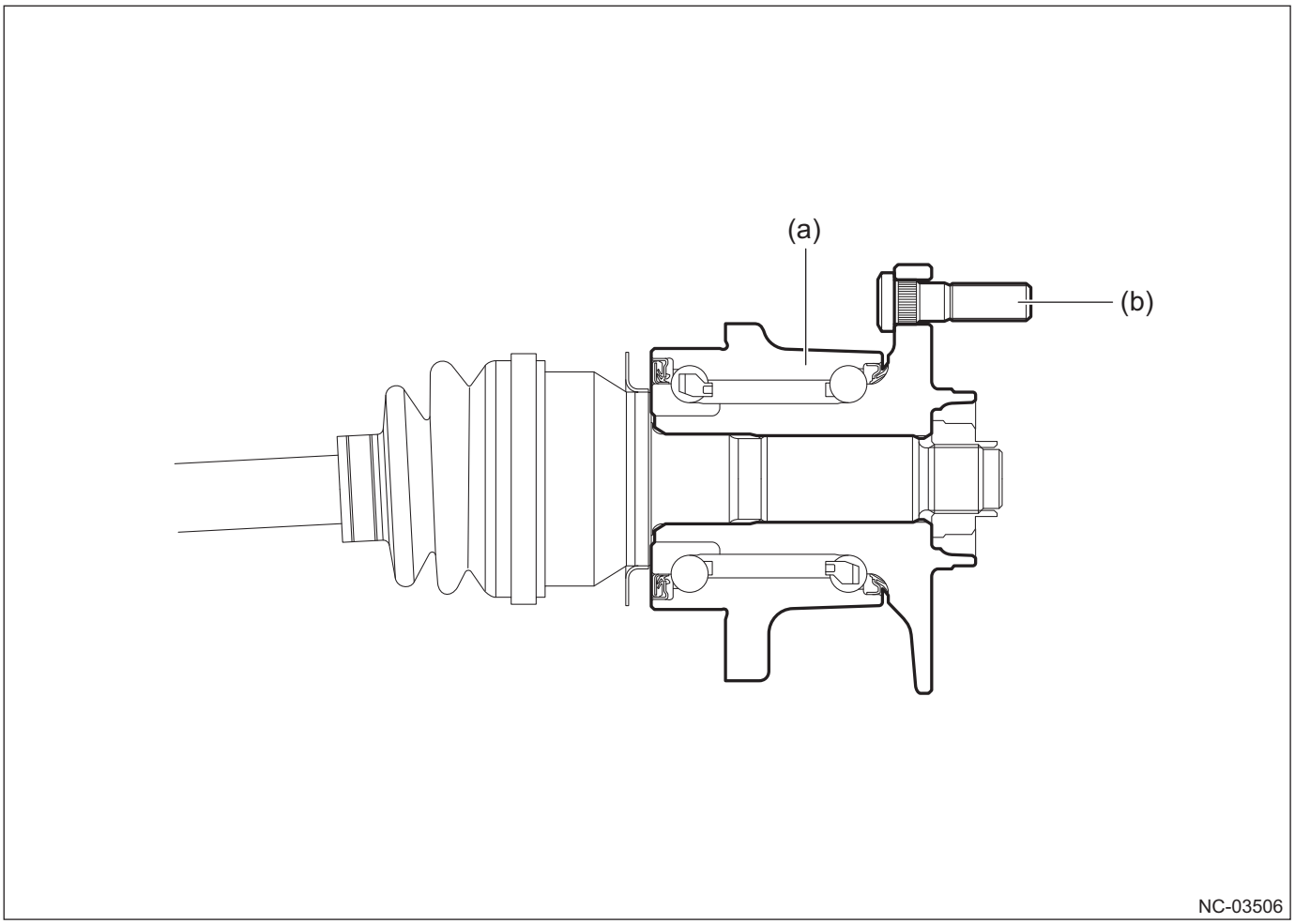
(a) Hub unit bearing

(b) Hub bolt

■ Rear axle

A double-row angular ball bearing with low rolling resistance is adopted for the rear axle hub unit bearing.

At the unit type rear axle hub unit bearing, one side of the bearing inner race is integrated with the axle hub and includes an integrated oil seal. This reduces weight, improves durability, and improves serviceability.



(a) Hub unit bearing

(b) Hub bolt

4 SUSPENSION SYSTEM

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4.1 General Overview

4.1.1 Overview

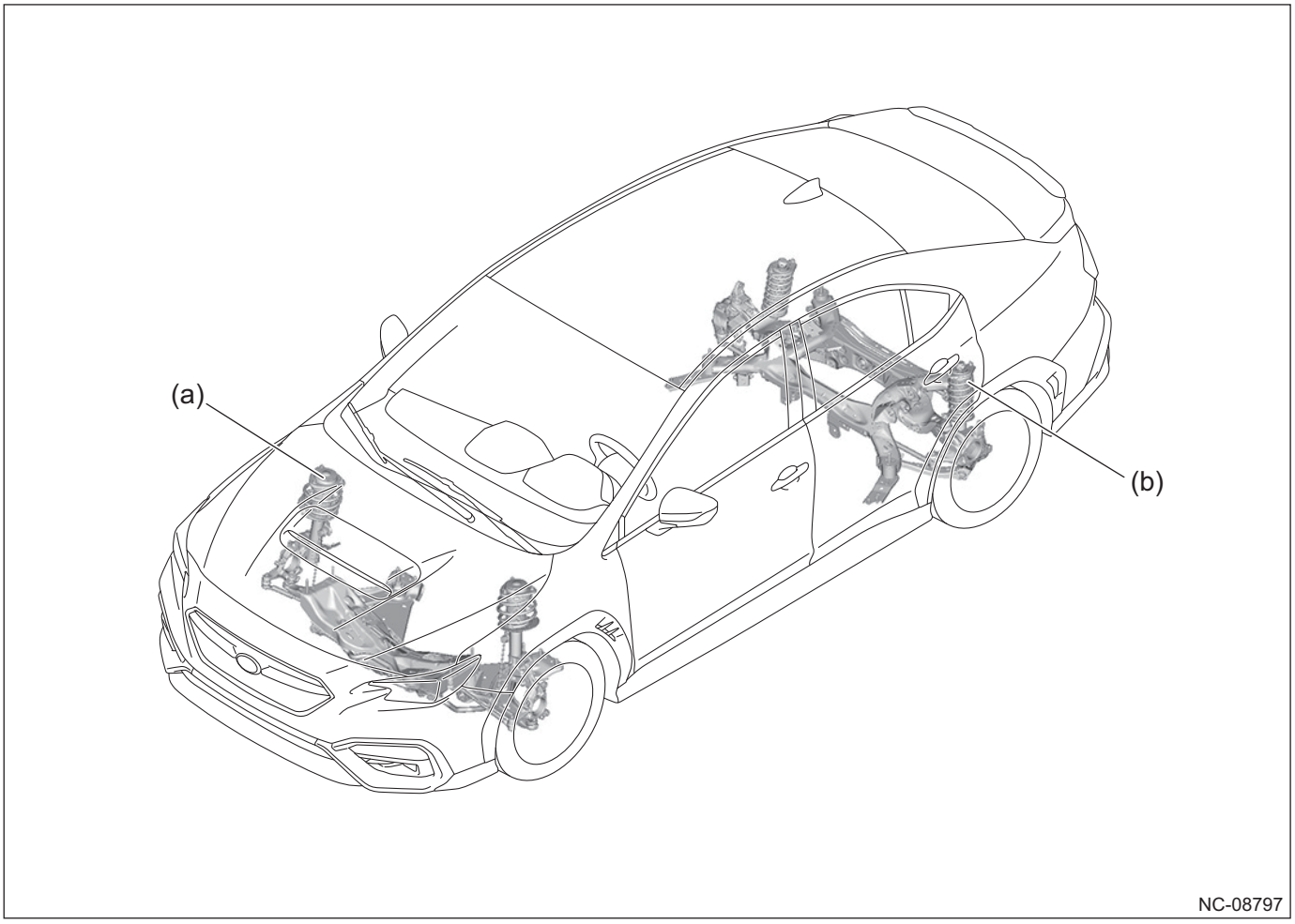
Overview

The following performances are mainly improved for the suspension system.

- The suspension geometry is optimized to achieve a high level of steering stability, ride quality, and quietness.
- The input separating type mount reduces vibration and noise and improves ride quality and steering stability
- The highly rigid front crossmember and highly rigid rear sub frame assembly increase responsiveness of the vehicle and improve the ride quality
- A new rear stabilizer layout is adopted. Direct mounting of the stabilizer on the body increases stabilizer efficiency, achieving both ride quality performance and steering stability performance.
- The adoption of an aluminum lower arm results in lower weight and higher rigidity.
- Electronic control dampers are adopted to produce a dramatic improvement in steering stability and ride quality (for some grades).
- Increasing the practical suspension stroke improves tire gripping performance and reduces unpleasant thrust-up, improving comfort in everyday driving ranges

4.1.2 Component

Component layout drawing



(a) Front suspension

(b) Rear suspension

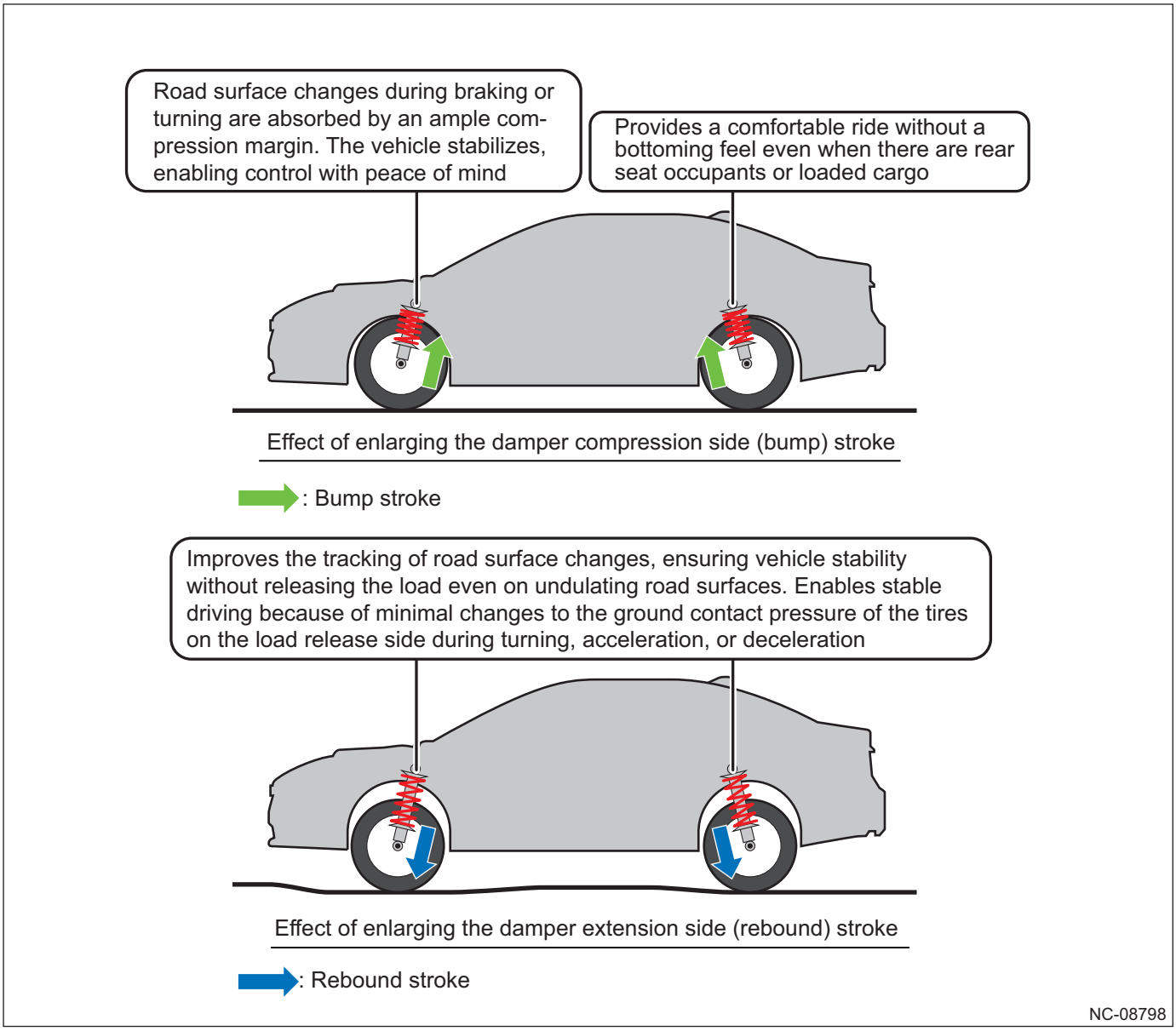
Component details

Suspension Structure

A strut type independent suspension is adopted for the front suspension and double-wishbone type independent suspension is adopted for the rear suspension.

Larger practical suspension stroke

The practical suspension stroke is increased by around 5% in the front and around 20% in the rear, improving ride quality.



4.2 Front Suspension

4.2.1 Overview

Overview

The following performances are mainly improved for the front suspension.

Improvement in accuracy and responsiveness during steering

- The adoption of a ball joint embedded in the aluminum lower arm, and the use of pinch bolts in the housing fastening, reduce mass offset, improving the steering feel.
- The adoption of a K-type brace improves lateral bending rigidity, reducing front crossmember deflection caused by the input from the lower arm when steering.
- The highly rigid front crossmember increases responsiveness of the vehicle and shuts off vibration transmission from tires and engine.
- A bushing with inter-ring is adopted for the bushing on the front crossmember side of the lower arm and a bushing with a pillow ball structure is adopted for the bushing on the vehicle body side to improve rigidity. This increases responsiveness and ensures excellent steering stability.

Lower weight and higher rigidity

The adoption of an aluminum lower arm achieves both lower weight and higher rigidity.

Improved rolling feel and roll reduction

Roll rigidity is improved by optimizing the roll center height and by mounting the stabilizer link front on the front strut.

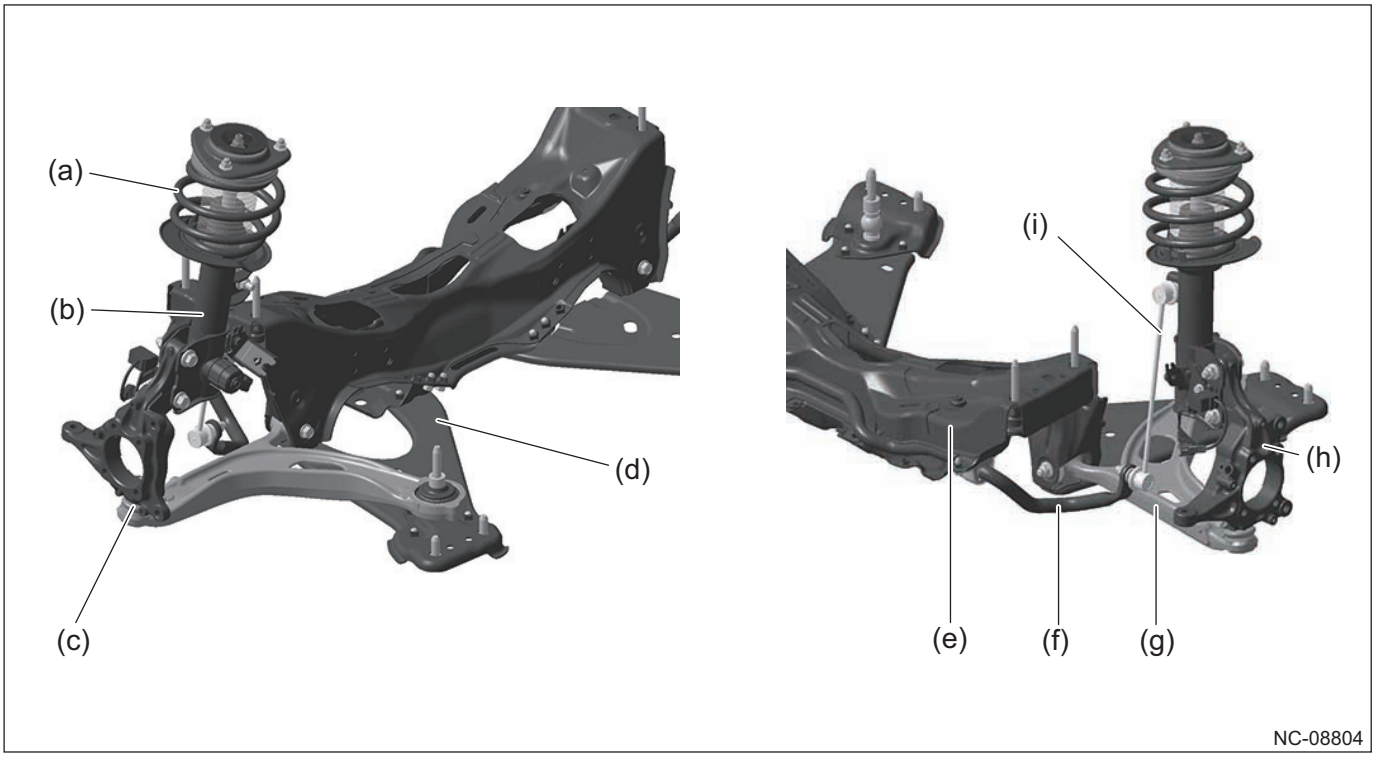
Specifications

Front wheel alignment	17-inch tires	18-inch tires
Toe-in (in (mm))	0 (0)	0 (0)
Camber (deg)	-0°40′	-0°40′
Caster (deg) (referential value)	6°00′	6°00′
Kingpin angle (deg) (referential value)	14°30′	14°35′

Refer to the service manual for the details of the adjustment method, etc.

4.2.2 Component

Component layout drawing



(A) Load axis control coil spring
(b) Front strut
(c) Ball Joint
(d) Crossmember support rear
(e) Front crossmember COMPL
(f) Stabilizer
(g) Lower arm
(h) Front axle housing
(i) Stabilizer link front

Component details

Front strut/mount

The following performances are mainly improved for the front strut and front strut mount.

■ Improvement in steering stability and ride quality

- Increases the practical suspension stroke by around 5%, improves tire gripping performance and reduces unpleasant thrust-up, improving comfort in everyday driving ranges.
- Electronic control dampers are adopted. (for some grades)

■ Achievement of both the vibration and noise restraining performance and the steering stability

- The coil spring load input separating type is adopted for the front strut mount. This reduces unpleasant vibration and the road noise that are transmitted from the tires to the vehicle floor.
- Electronic control dampers are adopted. (for some grades)

■ Improvement in accuracy and responsiveness during steering

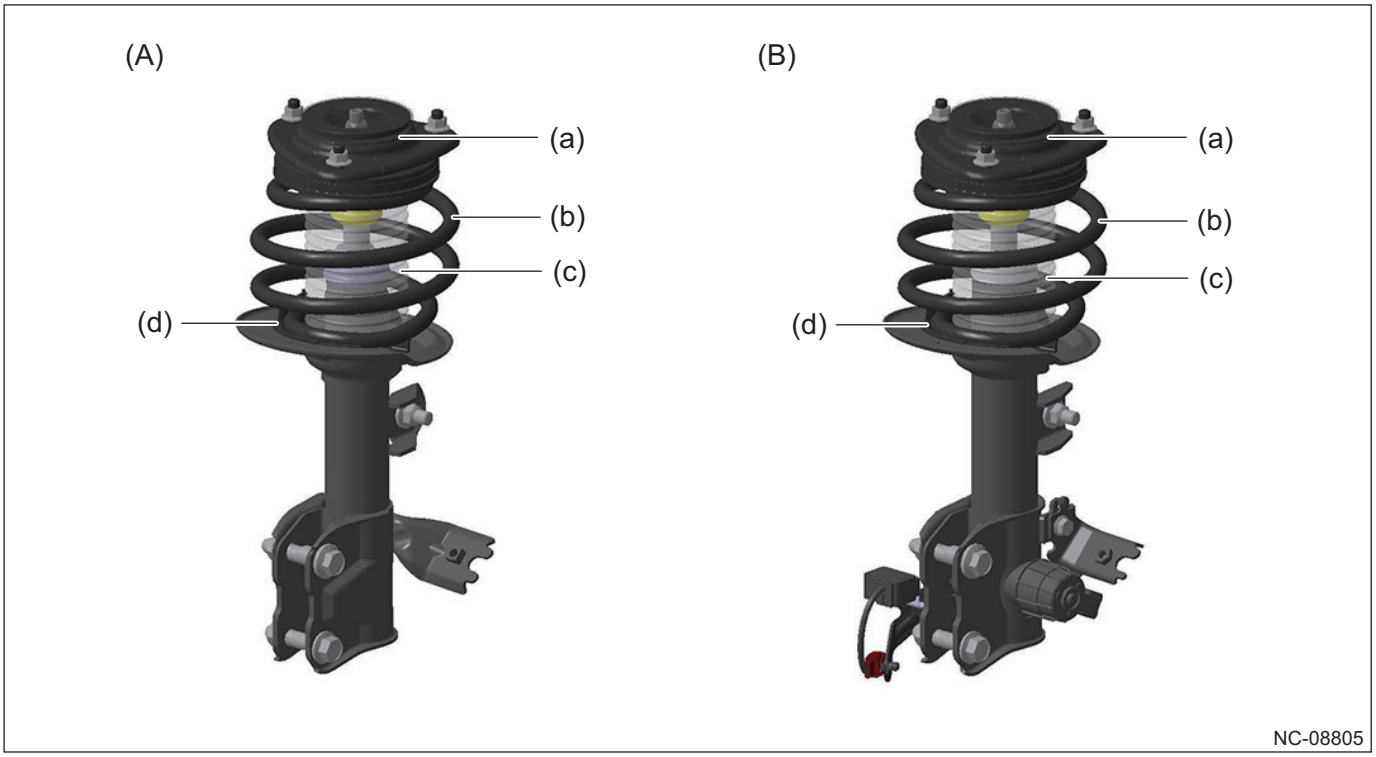
- The adoption of a load axis control coil reduces damper friction.
- A rebound spring is adopted for the standard damper.
- The diameter of the front strut outer cylinder is increased.

■ Countermeasure against dust entry into the strut

A rubber sheet and dust cover that prevent dust absorption are adopted to reduce dust entering the rod slide portion of the front strut.

■ Improvement of the feel of firmly contacting the ground

Low friction rod guide is adopted to improve the feel of firmly contacting the ground.



(A) Standard damper

(B) Electronic control damper

(a) Input separating type mount

(b) Load axis control coil spring

(c) Dust cover

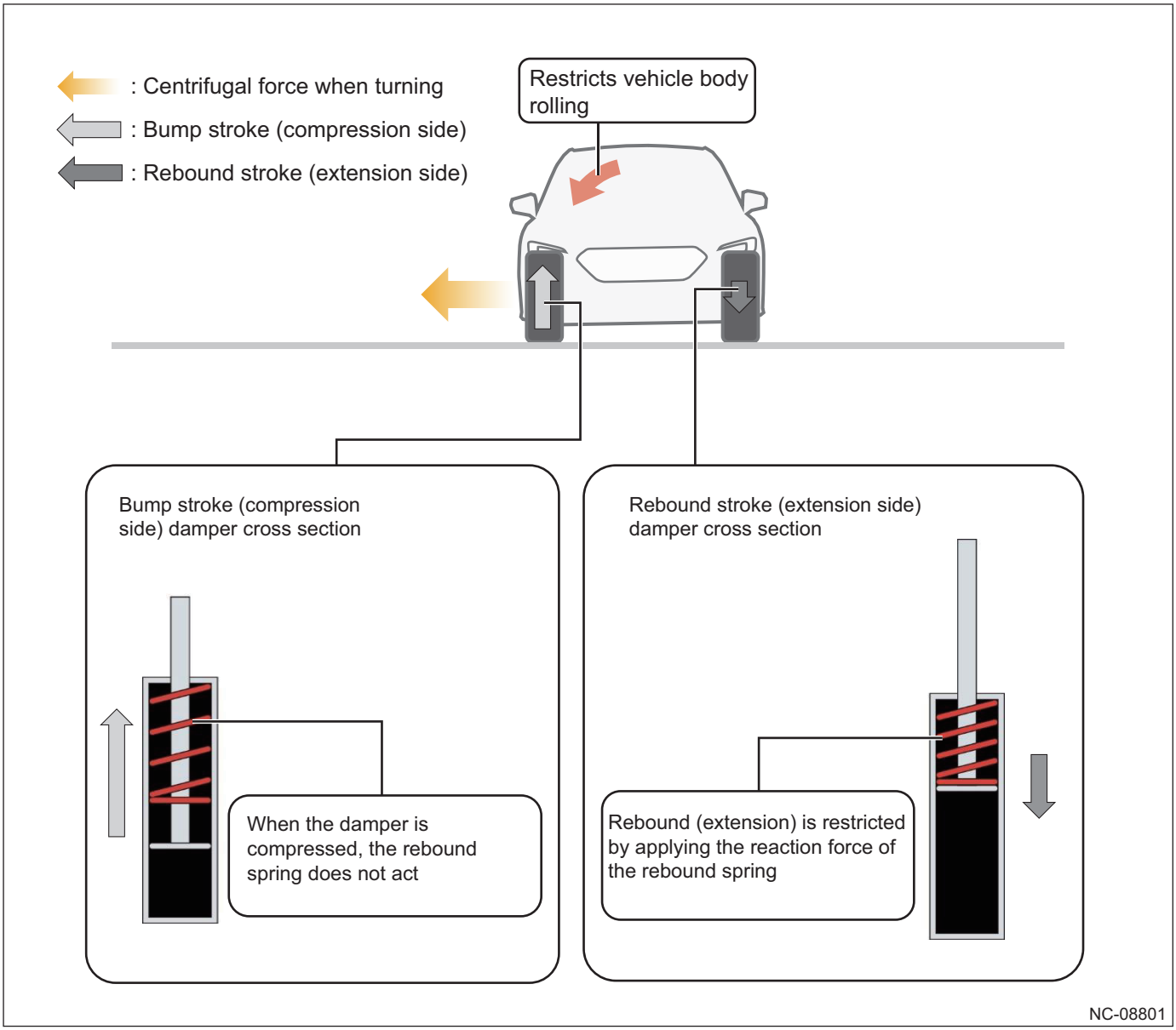
(d) Rubber sheet

Damper characteristics

The adoption of a low friction rod guide reduces rod friction resistance and enables tuning of the damping force. This produces damper characteristics which provide a comfortable feeling that allows users to truly experience the high ride quality.

Rebound spring

A rebound spring that reduces damper elongation is adopted for the standard damper. Using a spring to reduce the elongation-side stroke reduces lifting of the body and improves stability and maneuverability when turning.



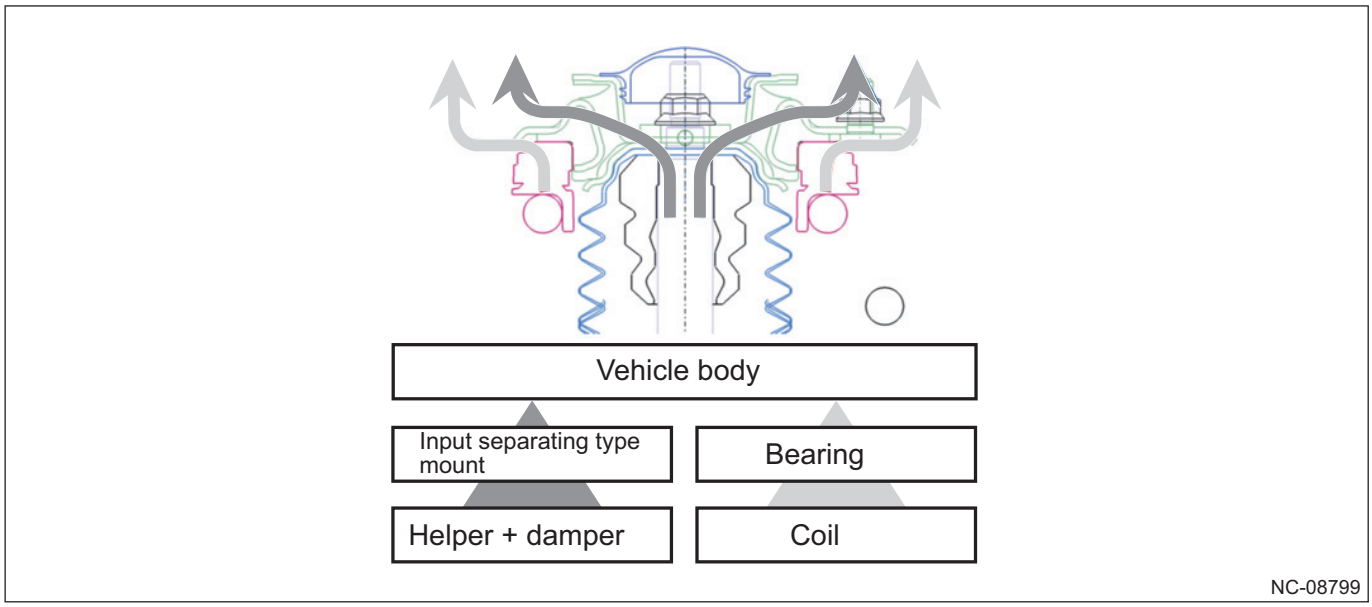
Load axis control coil

The contact shape of the coil top and mount is optimized in order to stabilize the coil reaction force direction and reduce damper friction, improving ride quality. It also reduces the effects of external disturbances and reduces body vibration.

Input separating type mount

A coil input separating structure is adopted to achieve both the vibration and noise restraining performance and the steering stability.

- The input of the coil is directly transmitted to the vehicle body without passing through the rubber of the mount.
- The input of the helper and damper is transmitted to the vehicle body through the rubber of the mount.



Lower mass offset

The structure which fastens the ball joint that connects the lower arm and housing is changed, and the joint center is moved toward the outside of the vehicle, reducing the mass offset. As a result, the center axis of rotation and wheel center are closer when steering, resulting in accurate and responsive behavior and delivering a clear and clean steering feel.

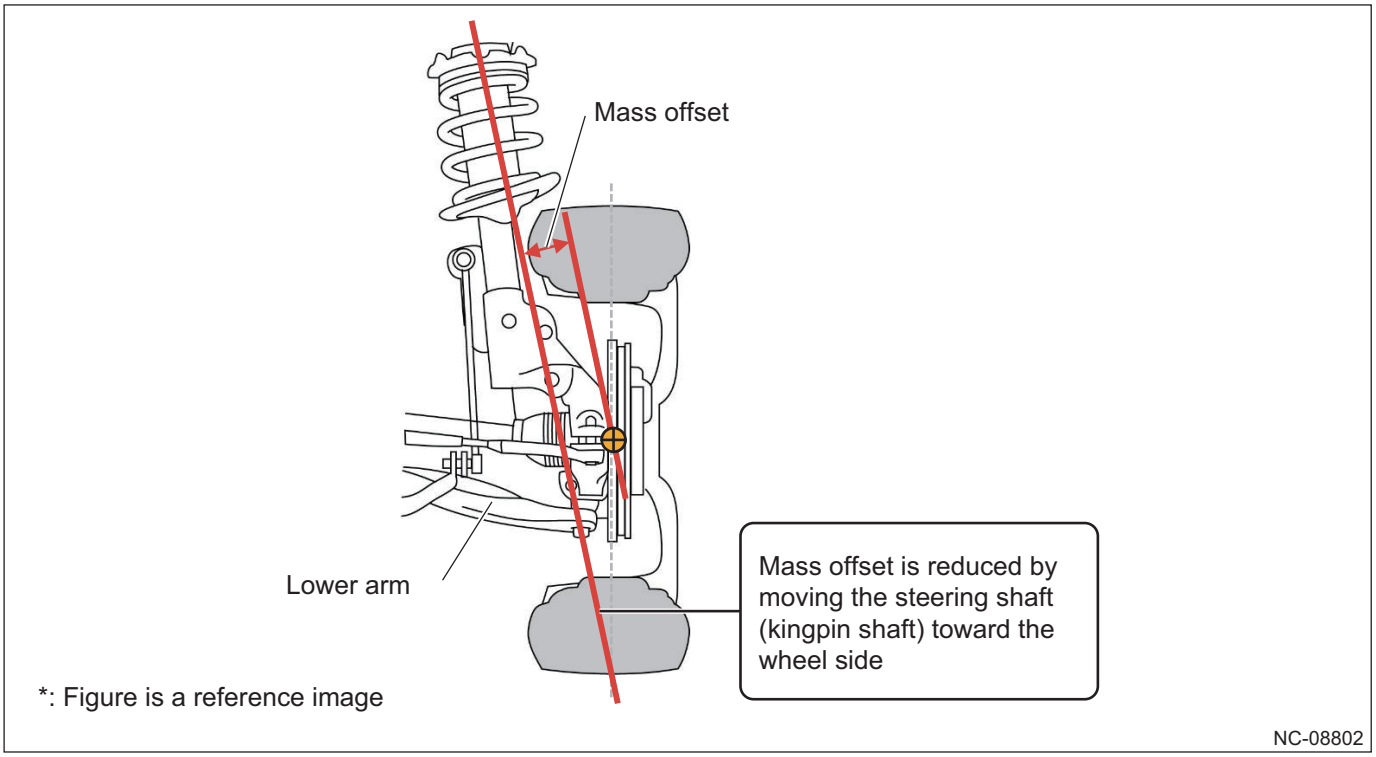
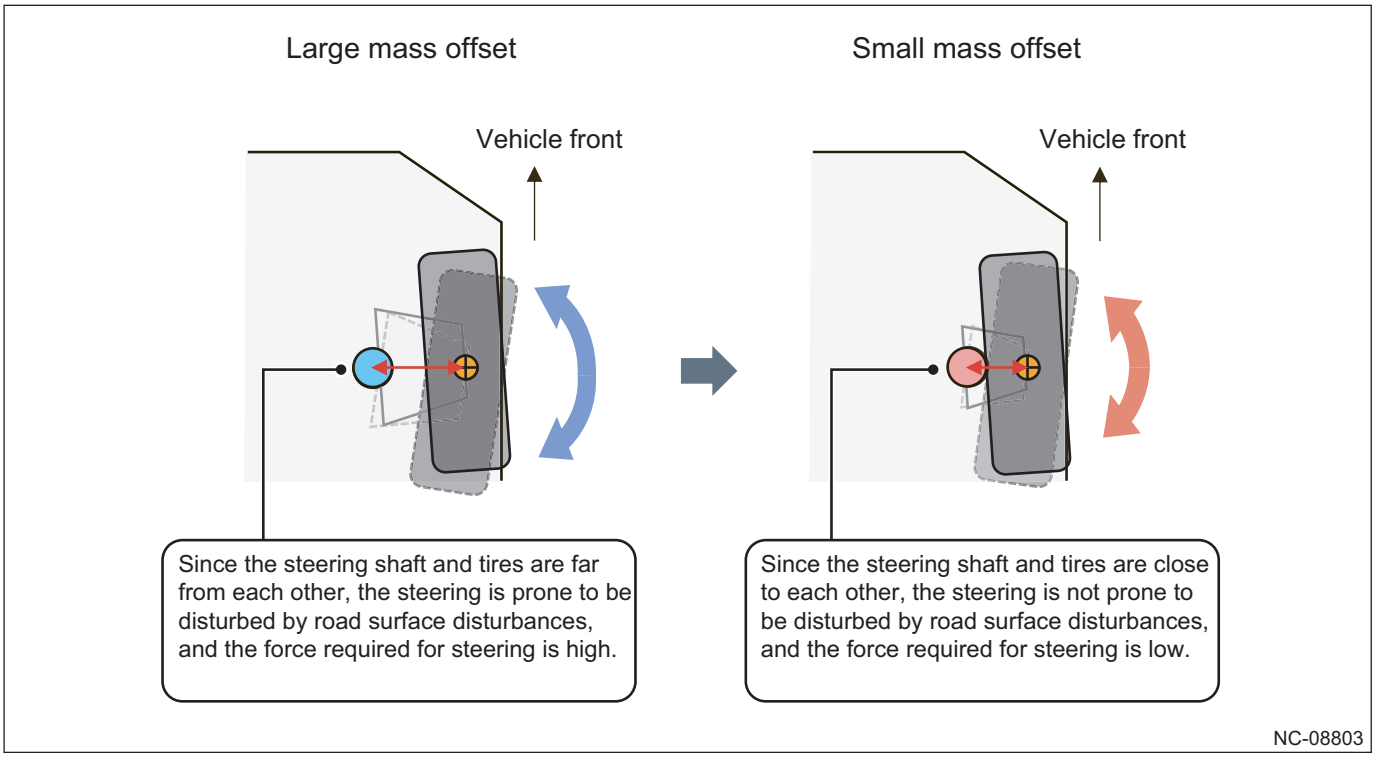


Image of change in mass offset



4.3 Rear Suspension

4.3.1 Overview

Overview

The following performances are mainly improved for the rear suspension.

Reduction of vibration and noise and security of steering stability

- Uncoupled sub frame bushing is adopted to reduce vibration and noise and achieve improved ride quality and steering stability.
- Direct mounting of the stabilizer on the body increases stabilizer efficiency.

Improvement in accuracy and responsiveness during steering

- Rigidity is increased by adopting a bushing with inter-ring for the rubber bushing trailing link on the rear axle housing side. This increases responsiveness and ensures excellent steering stability.
- The structure of the rear sub frame is changed to improve the rigidity of the rear suspension.

Improvement in ride quality

The highly rigid rear sub frame and uncoupled sub frame bushing increase responsiveness of the vehicle and shut off vibration transmission from tires and engine.

Lower weight and higher rigidity

- The adoption of an aluminum rear shock absorber mount and upper arm achieves both lower weight and higher rigidity. (for some grades)
- The housing is changed from cast iron to aluminum, reducing the unsprung weight. (for some grades)

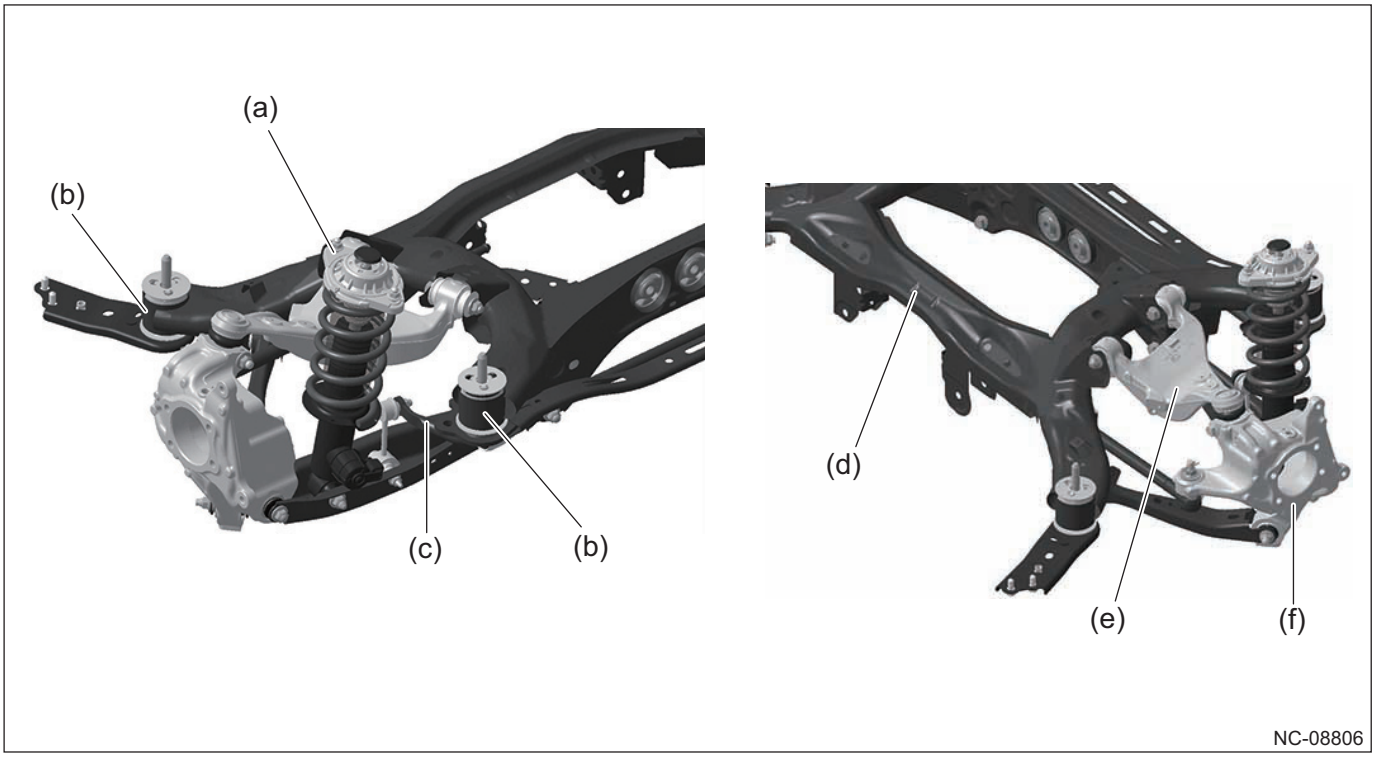
Specifications

Rear wheel alignment	17-inch tires	18-inch tires
Toe-in (in (mm))	IN 0.12 (3)	IN 0.12 (3)
Camber (deg)	-1°25′	-1°35′
Thrust angle (deg)	0°	0°

Refer to the service manual for the details of the adjustment method, etc.

4.3.2 Component

Component layout drawing



(a) Rear shock absorber mount
(b) Sub frame bushing
(c) Stabilizer
(d) Sub frame assembly
(e) Upper arm
(f) Rear axle housing

Component details

Rear shock absorber/mount

The following performances are mainly improved for the rear shock absorber and rear shock absorber mount.

■ Improvement in steering stability and ride quality

- Increasing the practical suspension stroke by around 20% improves tire gripping performance and reduces unpleasant thrust-up, improving comfort in everyday driving ranges.
- Optimization of the helper length and spring characteristics reduces the bottoming feel when large input occurs.
- Electronic control dampers are adopted. (for some grades)

■ Achievement of both the vibration and noise restraining performance and the steering stability

- An input separating type rear shock absorber mount is adopted. This reduces unpleasant vibration and the road noise that are transmitted from the tires to the vehicle floor.
- Electronic control dampers are adopted. (for some grades)
- A urethane upper mount bushing is adopted for the electronic control dampers, improving vibration and noise restraining performance.

■ Countermeasure against dust entry

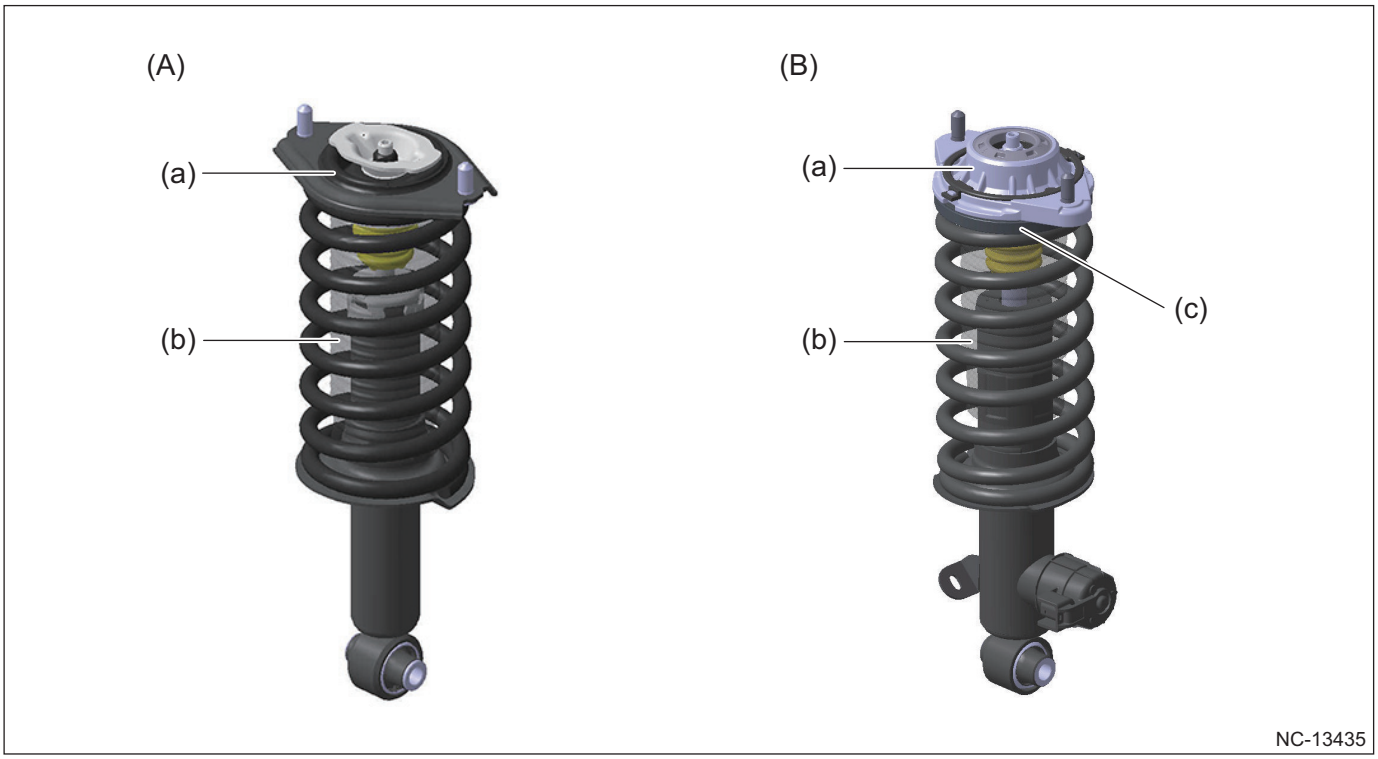
Dust cover that prevents dust intrusion is adopted to reduce dust entering the rod slide portion of the rear shock absorber.

■ Improvement of the feel of firmly contacting the ground

Low friction rod guide is adopted to improve the feel of firmly contacting the ground.

■ Lower weight and higher rigidity

The adoption of an aluminum rear shock absorber mount for the electronic control dampers achieves both lower weight and higher rigidity.



(A) Standard damper

(B) Electronic control damper

(a) Input separating type mount

(b) Dust cover

(c) Rubber sheet

Input separating type mount

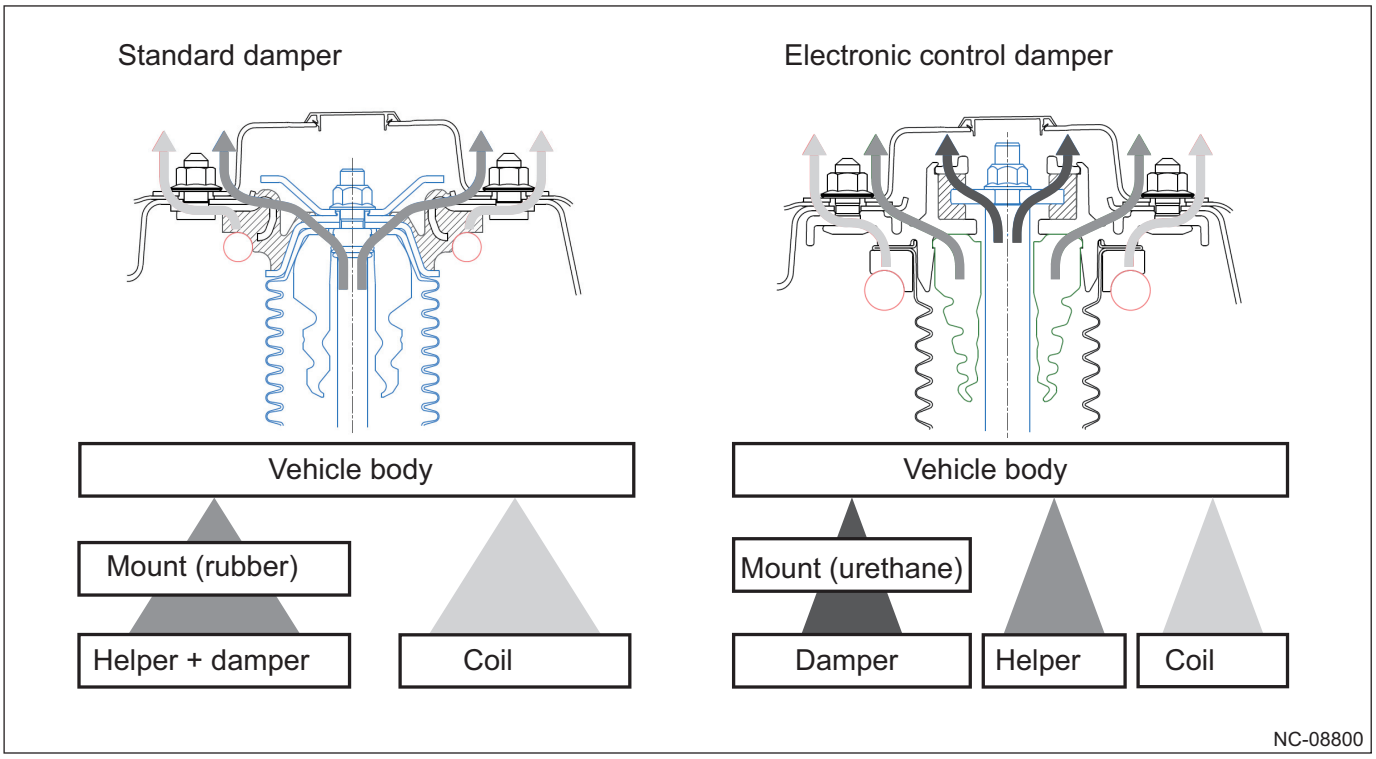
A coil input separating structure is adopted to achieve both the vibration and noise restraining performance and the steering stability.

■ Standard damper

- The input of the coil spring is directly transmitted to the vehicle body without passing through the rubber of the mount.
- The input of the helper and damper is transmitted to the vehicle body through the rubber of the mount.

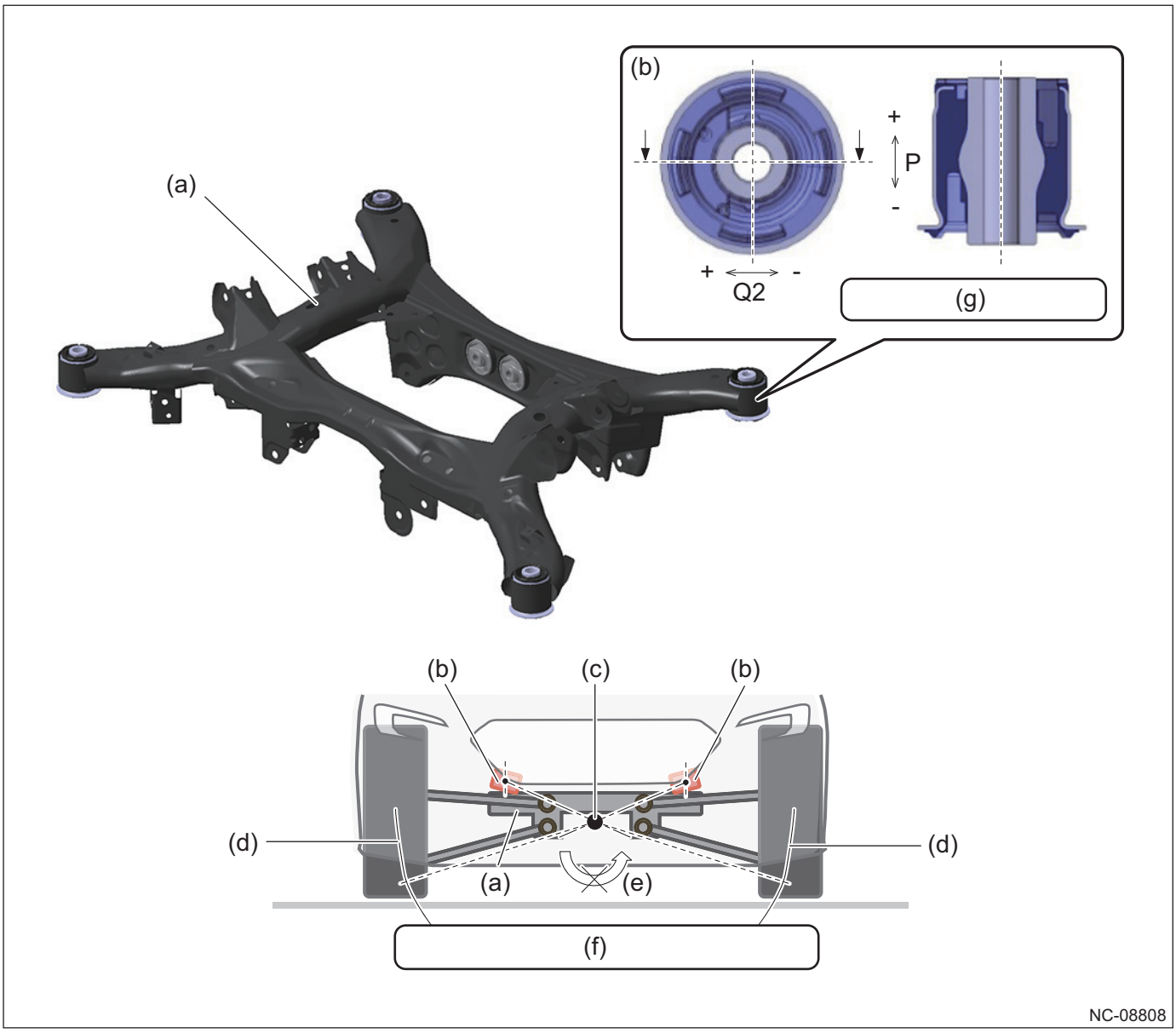
■ Electronic control damper

- The input of the coil and helper is directly transmitted to the vehicle body without passing through the urethane of the mount.
- The input of the damper is transmitted to the vehicle body through the urethane of the mount.



Uncoupled sub frame bushing

The uncoupled sub frame bushing is adopted to improve the tread rigidity and the steering stability, and the movement of the sub frame assembly relative to the vehicle is also reduced to achieve the optimal characteristics of the bushing without hardening it. This improves ride quality and reduces vibration and noise.



(a) Sub frame assembly

(b) Sub frame bushing

(c) Elastic center

(d) Grounding point track

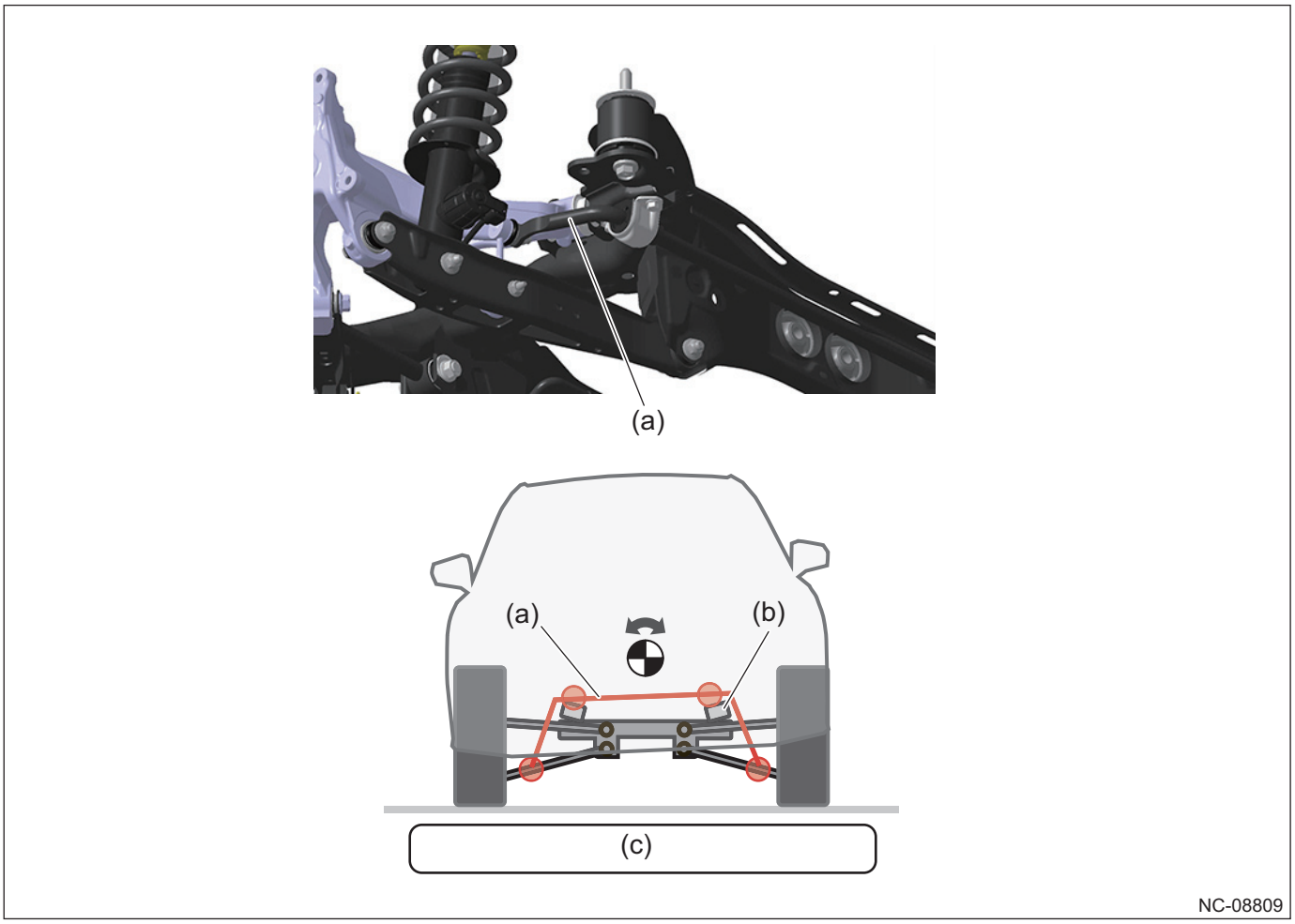
(e) Prevents rotation.

(f) The elastic center is closer to the roll center of the vehicle, reducing the moment force.

(g) Softer bushing can be used due to the reduced moment input.

Rear stabilizer

The rear stabilizer is installed directly on the vehicle body, increasing stabilizer efficiency and reducing body sway. Reducing lateral sway in the roll direction improves steering stability and ride quality.



(a) Rear stabilizer

(b) Sub frame bushing

(c) Rear stabilizer directly reduces the body sway.

4.4 Electronic Control Damper System

4.4.1 Overview

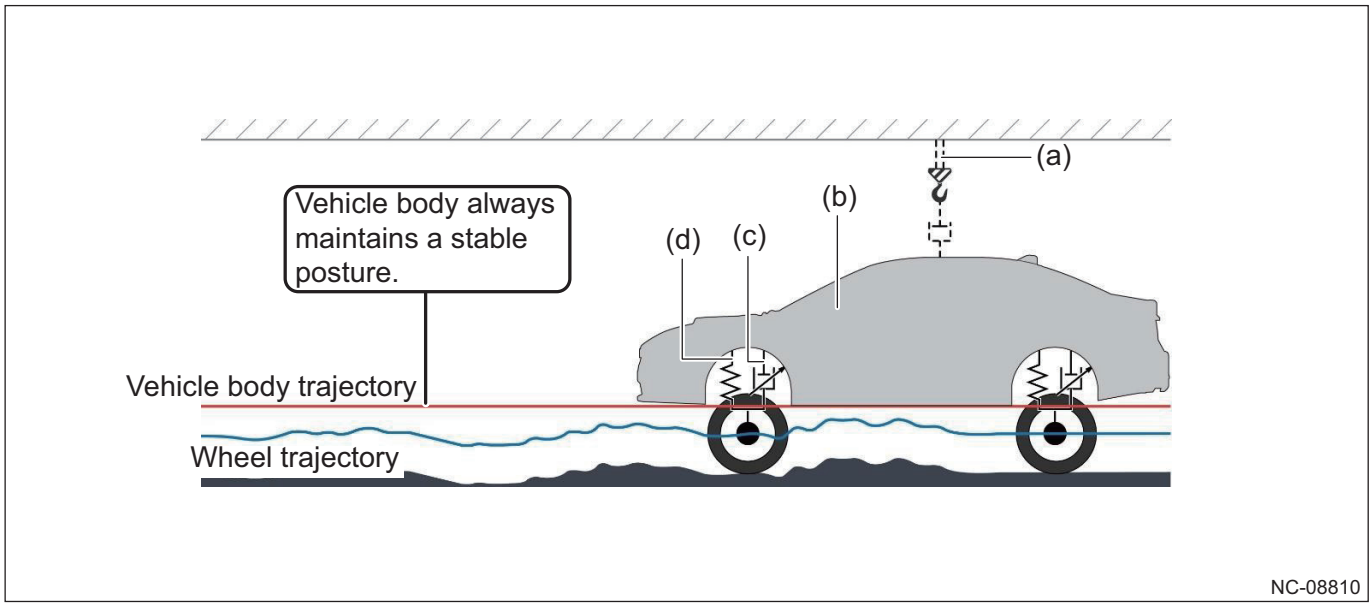
Overview

- An electronic control damper system is adopted. (for some grades)
- The damping force of the dampers can be controlled according to the road and vehicle conditions, resulting in a dramatic improvement in steering stability and ride quality.
- The damping force mode can be selected with drive mode select.

Characteristics

Skyhook theory

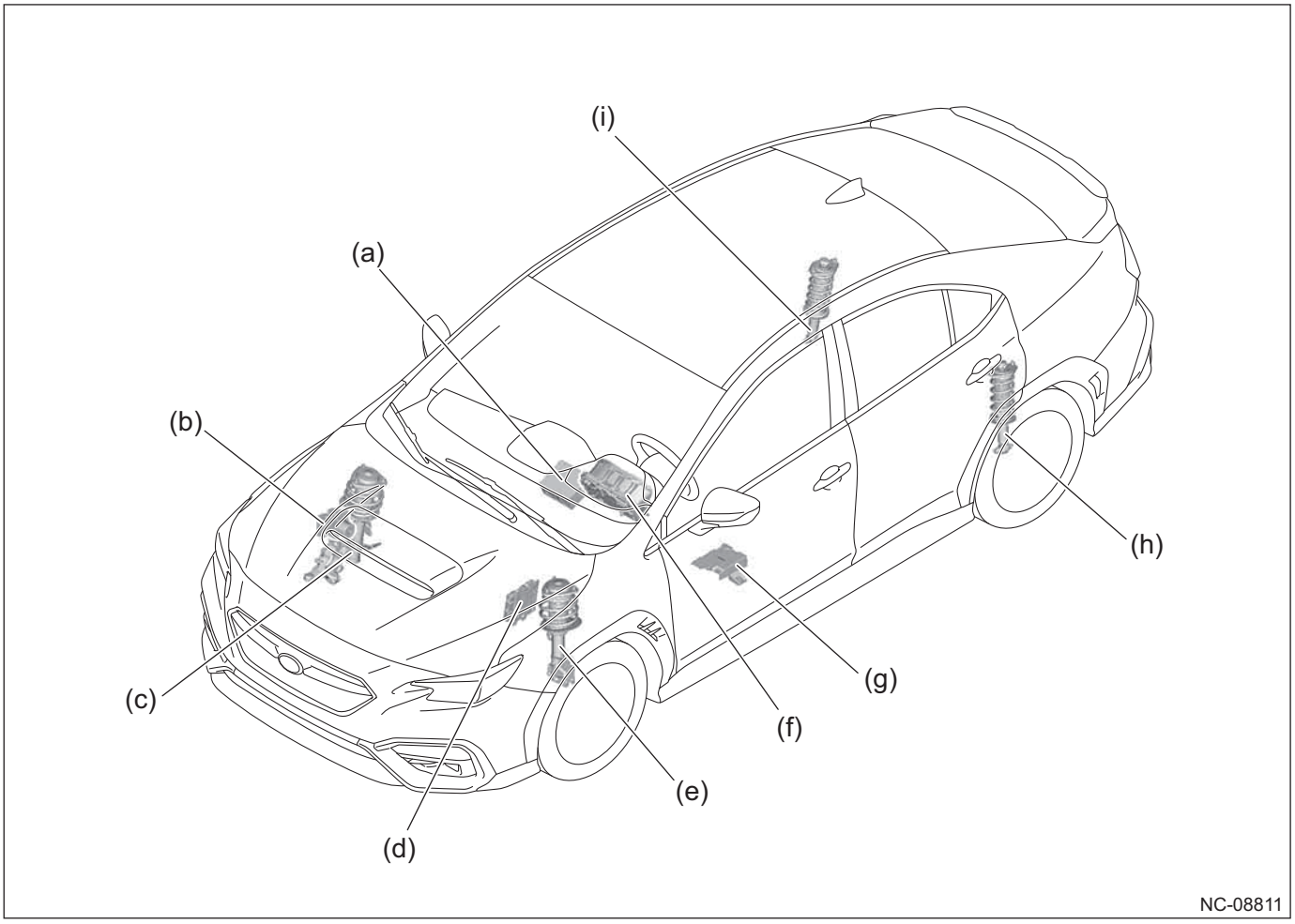
The electronic control damper system was developed based on the Skyhook theory which states that an object can maintain a stable posture if it is traveling suspended (Skyhook) by an imaginary straight line running through the air. The suspension and wheels move so as to maintain a constant vehicle posture, and the amount of this movement is controlled with electronic control dampers.



(a) Skyhook
(b) Vehicle body
(c) Electronic control damper
(d) Spring

4.4.2 Component

Component layout drawing

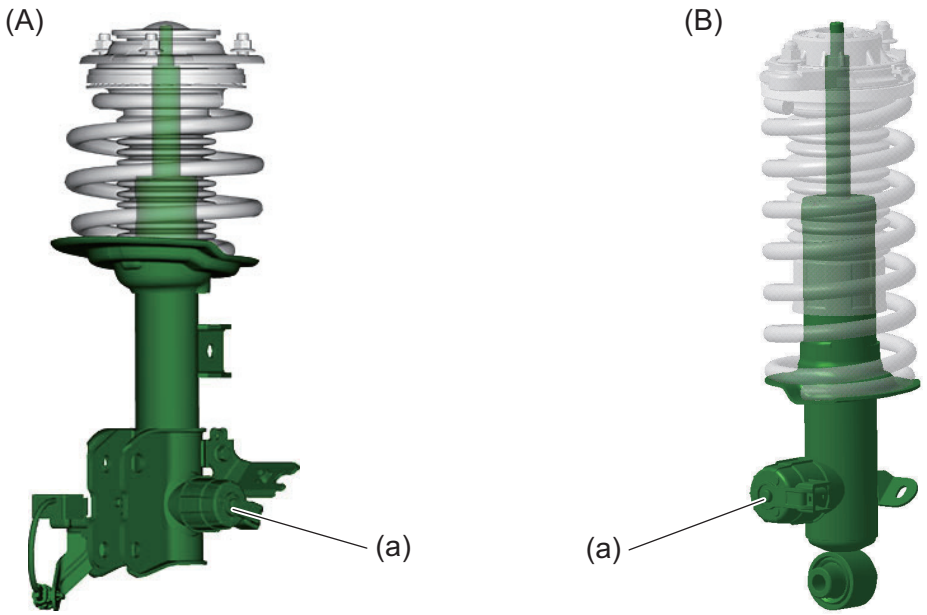


(a) Cockpit control module (CCM)
(b) VDC CM & H/M
(c) Front strut RH
(d) Engine control module (ECM)
(e) Front strut LH
(f) Combination meter
(g) Electronic control damper CM
(h) Rear shock absorber LH
(i) Rear shock absorber RH

Component details

Electronic control damper

The electronic control damper controls the damping force by means of a solenoid valve.



(A) Front

(B) Rear

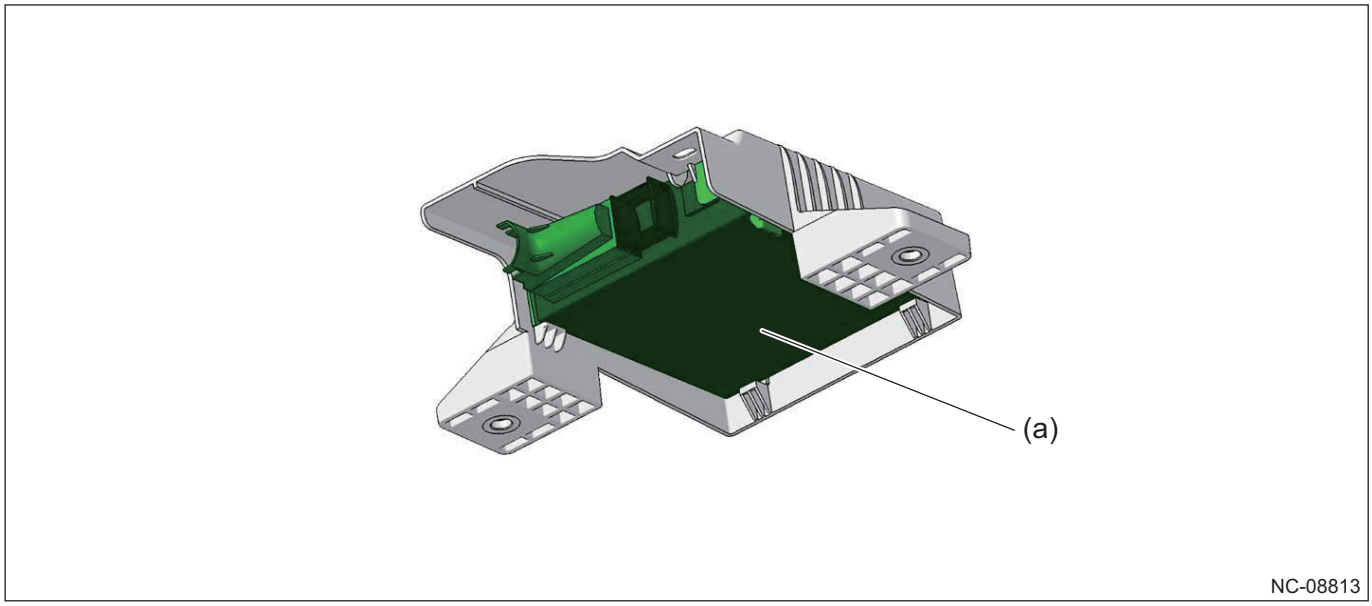
(a) Solenoid valve

Electronic control damper CM

The electronic control damper CM is installed under the front seat.

The electronic control damper CM controls the damping force of the damper at each of the 4 wheels based on the damping force mode selected with drive mode select, an acceleration sensor, and vehicle information.

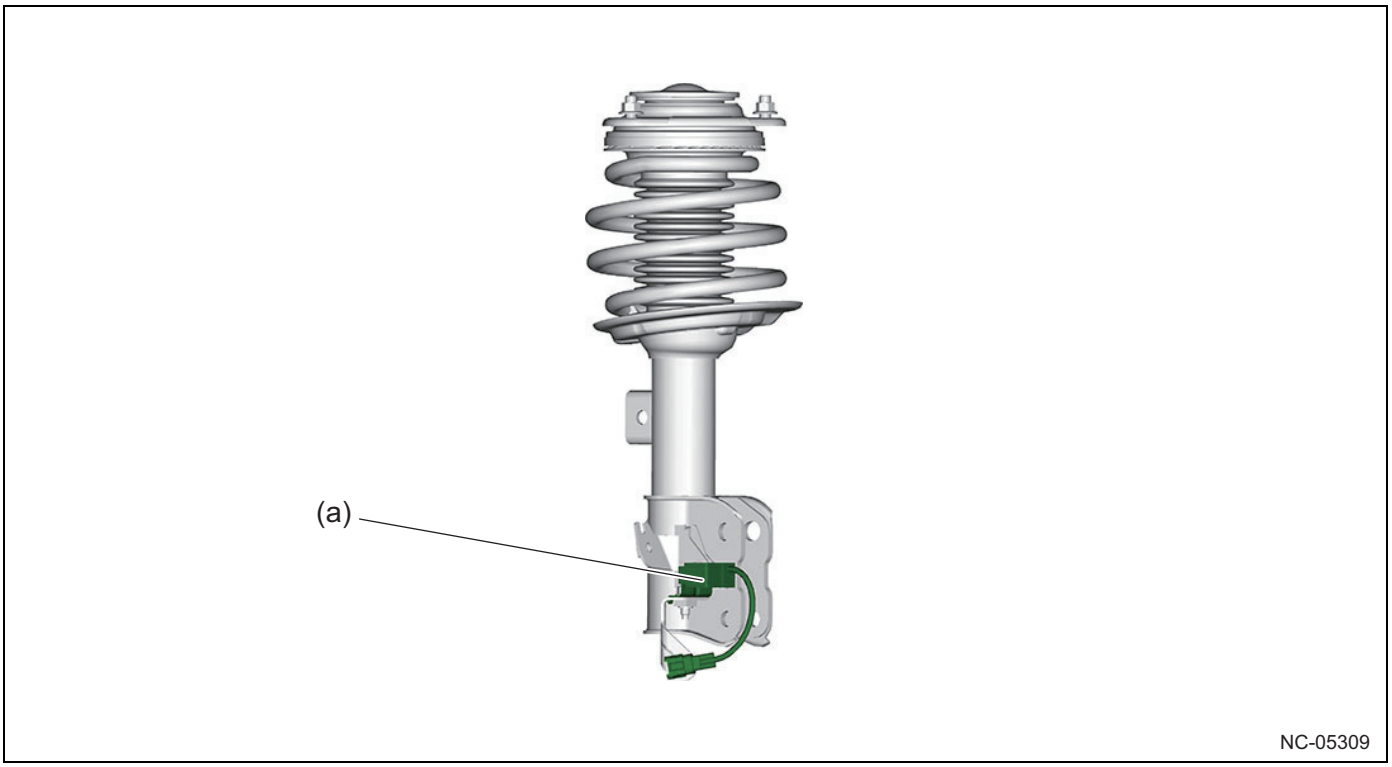
The electronic control damper CM contains an acceleration sensor that detects acceleration on the vehicle springs.



(a) Electronic control damper CM

Acceleration sensor

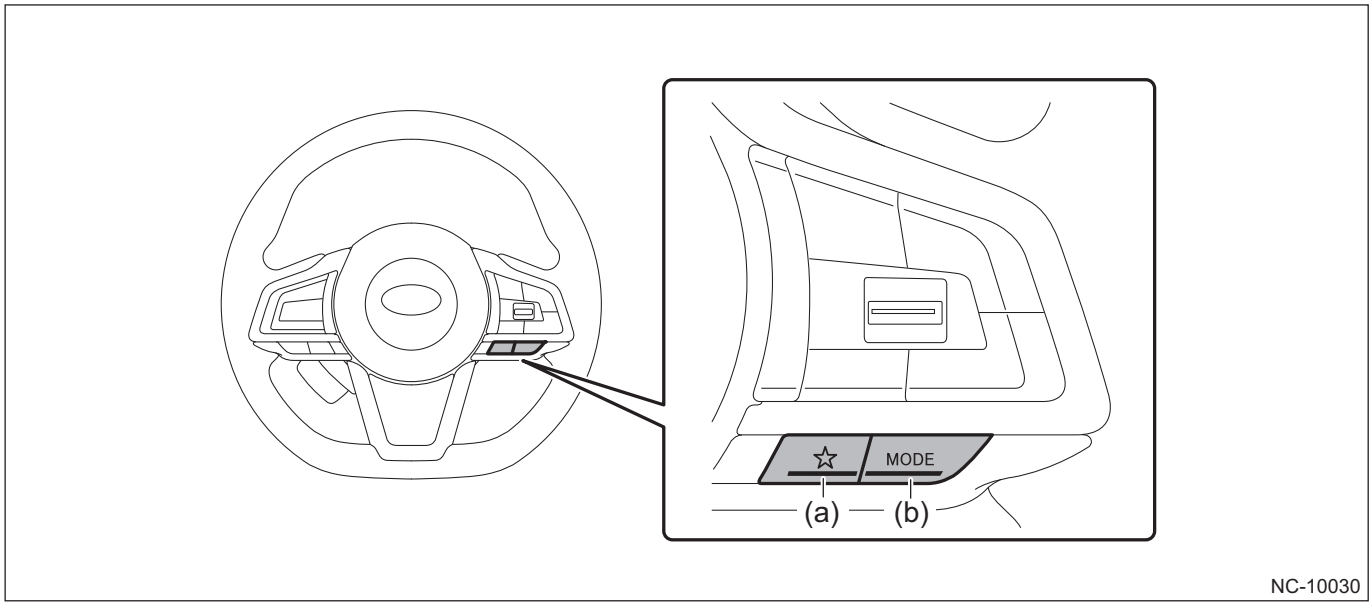
The acceleration sensor is installed on the front strut and detects vertical acceleration of the tires.



(a) Acceleration sensor

MODE switch

This switch is installed on the steering wheel, and changes the damping force mode when drive mode select is selected.

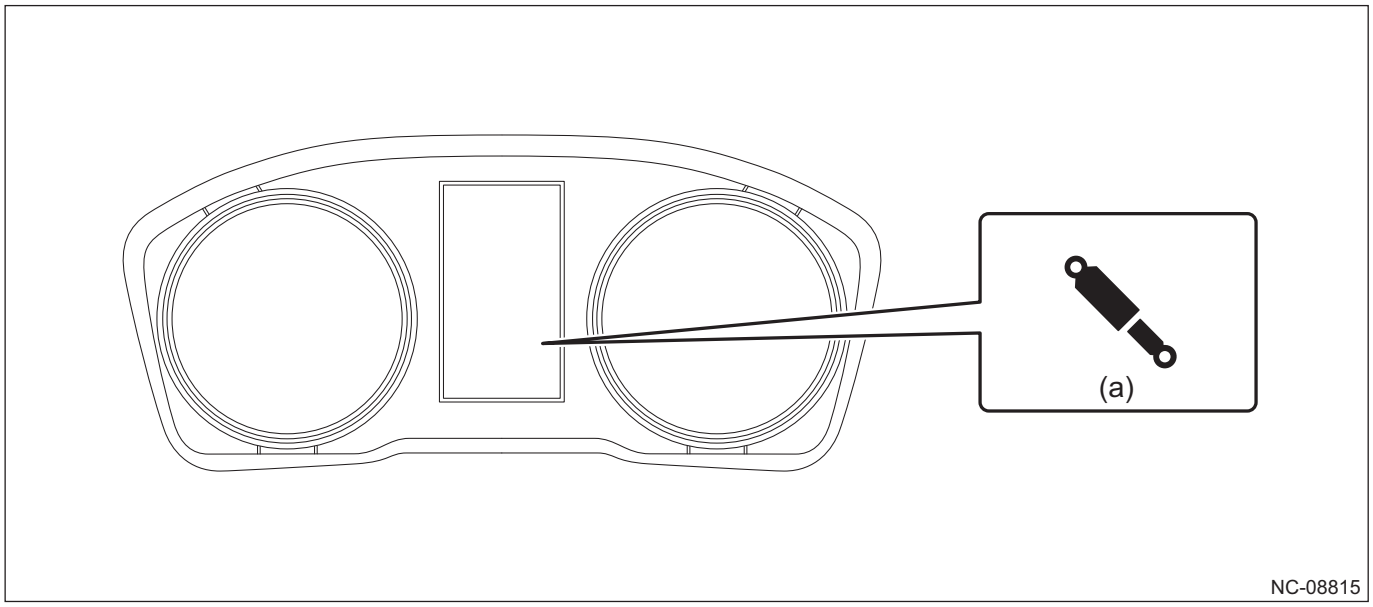


(a) Individual switch

(b) MODE switch

Electronic control damper system warning light

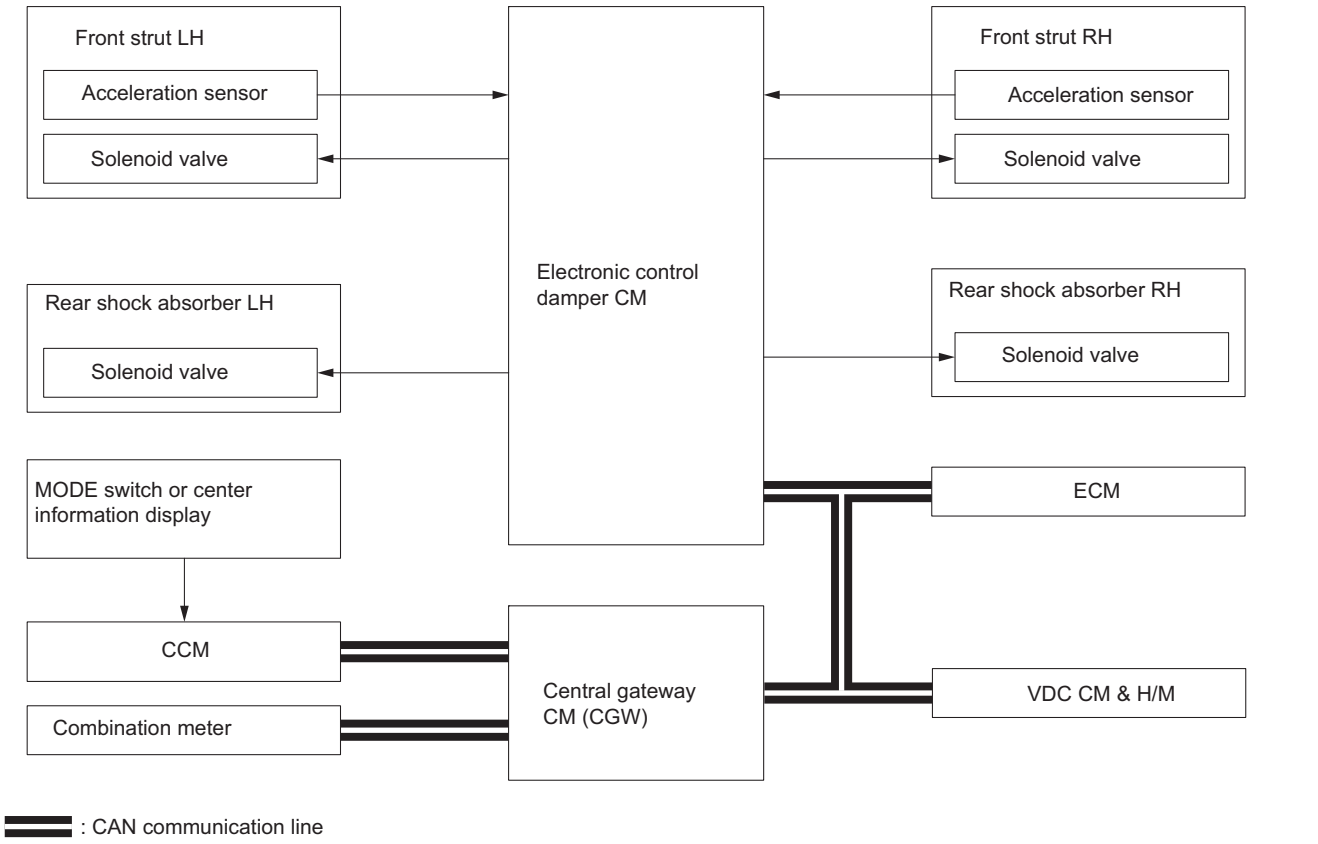
When an abnormality occurs in the electronic control damper system, the fail-safe function operates and the electronic control damper system warning light in the combination meter turns on to alert the driver of the abnormality.



(a) Electronic control damper system warning light

4.4.3 Construction and Operation

System diagram



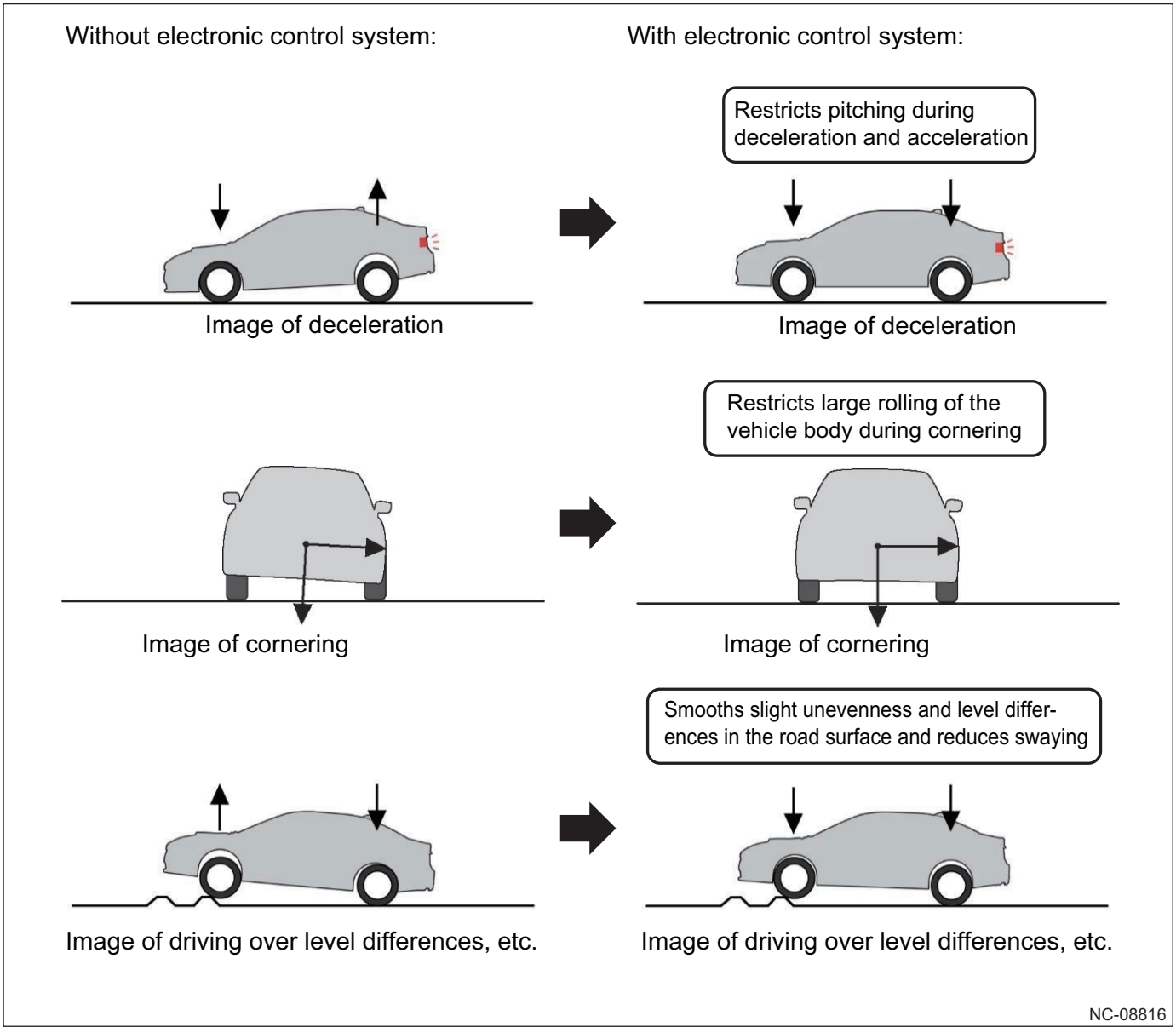
Main component functions

Part name	Function
Electronic control damper CM	• The vehicle condition is judged based on various input signals, and current is applied to each of the solenoid valves in order to appropriately control the damping force. • Damping force is controlled according to the damping force mode that was selected with drive mode select. • The internal acceleration sensor detects acceleration on the vehicle springs. • The diagnosis function (self diagnosis) and the fail-safe function are installed for serviceability in case of system failure.
Solenoid valve	The damping force of the electronic control dampers is controlled according to the electrical current commands from the control module.
Acceleration sensor	Detects vertical acceleration of the tires.
VDC CM & H/M	• Sends the brake control signal to the electronic control damper CM. • Sends the steering angle sensor signal to the electronic control damper CM.
ECM	Sends the engine control signal to the electronic control damper CM.
MODE switch	Changes drive mode select (damping force mode).
Center information display	Changes drive mode select (damping force mode).
CCM	• Sends the cockpit control module signal to the electronic control damper CM. • Sends information about the drive mode that was set with the MODE switch to the electronic control dampers.
Combination meter	• Turns on the electronic control damper system warning light when a system failure occurs. • Displays the selection status of drive mode select.

System details

The electronic control damper CM that is installed under the front seat combines the information from the body gyroscope sensor and from Vehicle Dynamics Control with information from the acceleration sensors that are installed on the front left and right dampers, and controls the dampers in real time according to the conditions of the road and vehicle. As a result, this smooths small unevenness, steps, and other variations in the road surface while properly restraining large rolling of the body. This produces a flat ride quality with minimal swaying.

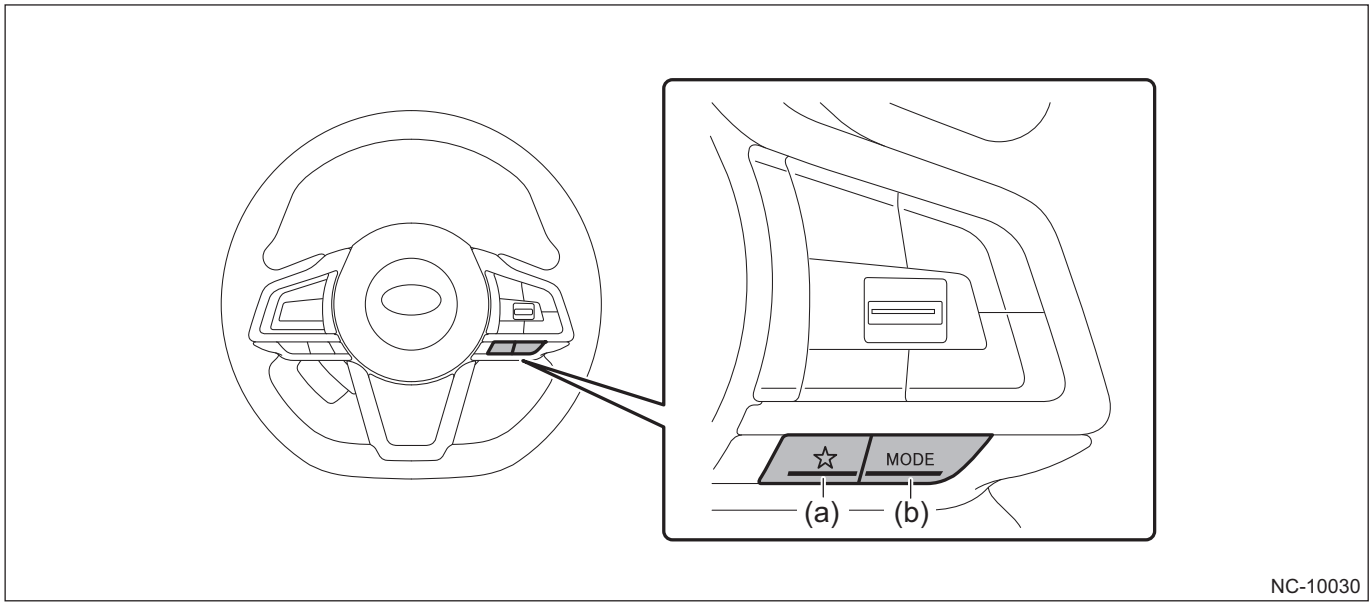
The damper damping force is controlled to the optimal value according to the driving conditions based on vehicle signals such as the body acceleration, body roll and pitch angles, steering angle, vehicle speed, brake pressure, engine torque, and Vehicle Dynamics Control information, as well as damper acceleration information.



Function

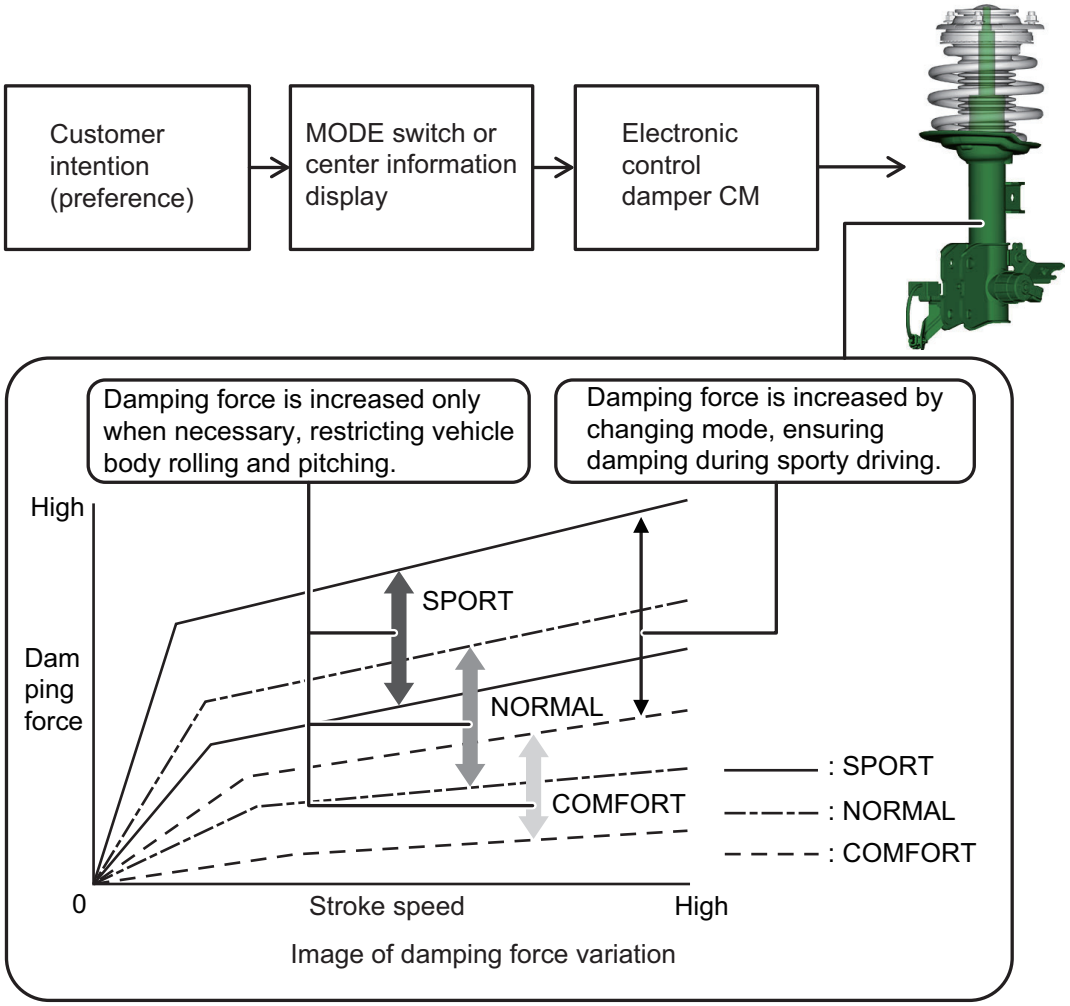
Selecting the damping force mode

3 modes are provided, each with different damping force characteristics: COMFORT, NORMAL, and SPORT. Operating drive mode select allows the driver to select damping force characteristics according to his or her intentions (preferences). The wide range of available ride quality supports a diverse range of driver tastes.



(a) Individual switch (b) MODE switch

Drive mode select	Damping force mode	Control description
COMFORT	COMFORT	A relaxed and comfortable mode
NORMAL	NORMAL	A mode that balances steering stability and ride quality
SPORT		
SPORT+	SPORT	A mode that provides sporty driving enjoyment
★ (INDIVIDUAL)	COMFORT / NORMAL / SPORT	Can set to the damping force mode which was selected by the driver.


Customer intention (preference)
MODE switch or center information display
Electronic control damper CM
Damping force is increased only when necessary, restricting vehicle body rolling and pitching.
Damping force is increased by changing mode, ensuring damping during sporty driving.
High
Damping force
SPORT
NORMAL
COMFORT
: SPORT
: NORMAL
: COMFORT
0
Stroke speed
High
Image of damping force variation

NC-05364

Fail-safe

In the event of a failure in the sensors, ECM, or control circuit, the fail-safe function performs control in 3 stages according to the degree of the failure.

Minor failure

In the case of a minor failure, the information from immediately before the failure was detected is used in order to continue control.

- Failure in the drive mode select function

Major failure

In the event of a major failure, control uses a fixed damping force.

- Acceleration sensor system failure
- Failure in the acceleration sensor inside the electronic control damper CM
- Failure in communications with ECM or VDC CM & H/M

Fatal failure

In the event of a fatal failure, damping force variable control is completely stopped. (However this does not mean that damping force completely disappears.)

- Failure of the electronic control damper CM
- Lower power supply voltage
- Solenoid valve system failure

5 WHEEL & TIRE

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5.1 WHEEL & TIRE

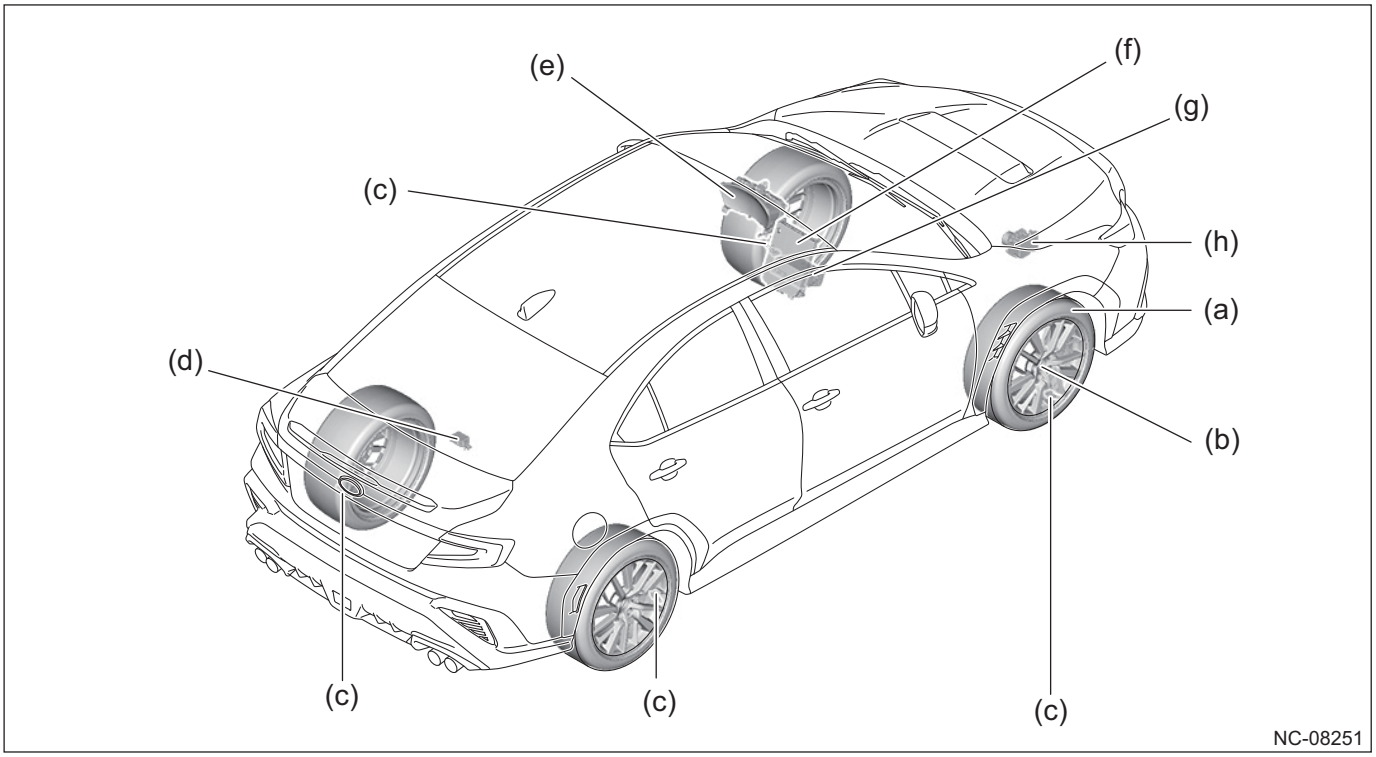
5.1.1 Overview

Overview

- Wheels are adopted that express a new design with a sense of power and functionality which heightens expectations for driving.
- With the aim of reducing vibration noise and rolling resistance and improving brake performance, steering stability, and ride quality, 2 tire types of 17 inches and 18 inches are adopted to enhance the total balance of performance.

5.1.2 Component

Component layout drawing



(a) Tire
(b) Wheel
(c) Transmitter (tire inflation pressure sensor)
(d) TPMS & keyless entry CM
(e) Combination meter
(f) Center Information Display (CID)
(g) Cockpit control module (CCM)
(h) VDC control module and hydraulic control module (VDC CM & H/M)

Component details

Tire

Tire specifications		WRX Base/ WRX Base ES	WRX Prm / WRX Prm ES	WRX Ltd/ WRX Ltd ES	WRX GT ES
17inches	235/45R17 97W	○	-	-	-
18inches	245/40R18 97Y	-	○	○	○
17 inches (spare tire)	205/50R17 89V	○ *	○	○	○

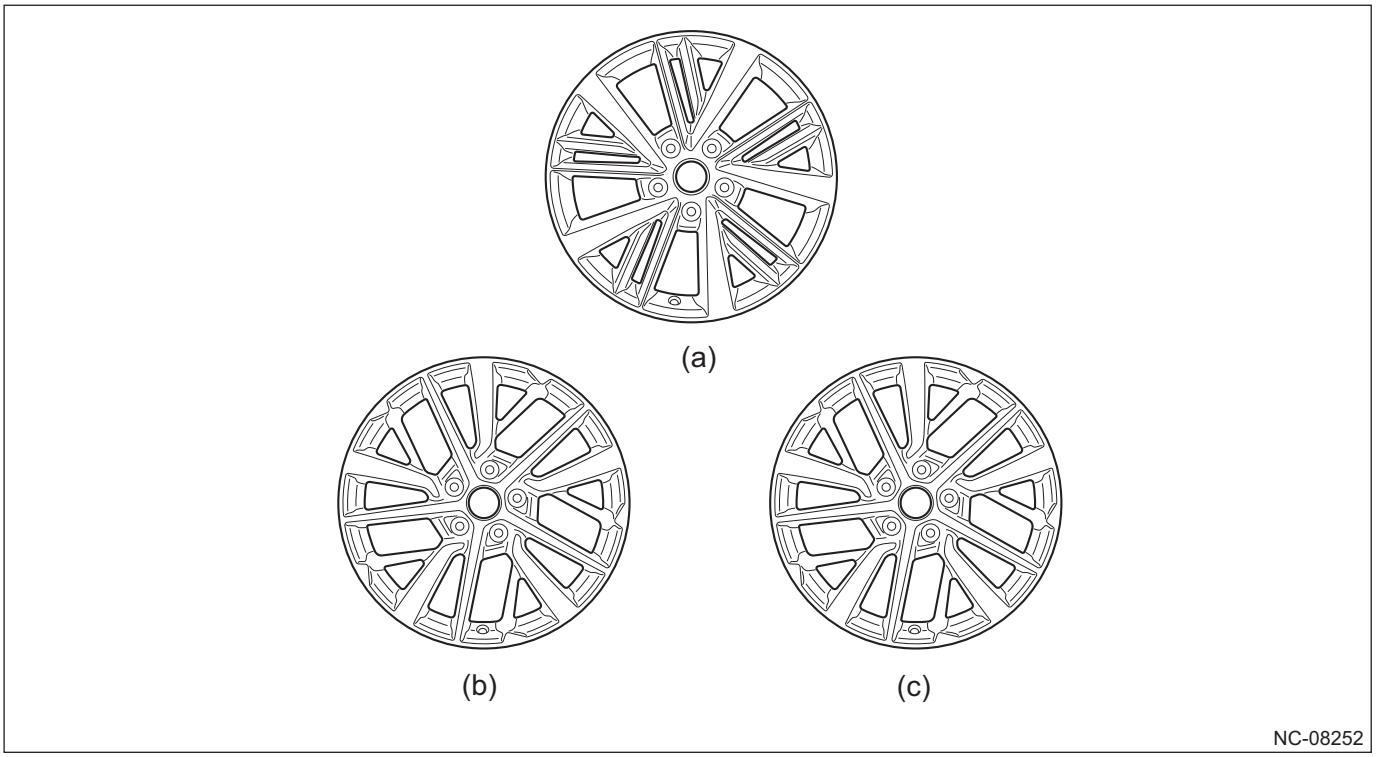
**: Except for WRX base ES*

Wheel

Wheel specifications		
Wheel	17inches	18inches
	17x8J	18x8 1/2J
Material	Aluminum	Aluminum
Color	Dark gray metallic	Dark gun metallic Matte gray metallic

■ Wheel

- Wheels of 3 specifications are adopted that express a design with a sense of power and functionality to heighten expectations for driving.
- Dark gray metallic, dark gun metallic, and matte gray metallic are provided as the colors for the aluminum wheels.



(a) 17x8J, dark gray metallic, aluminum

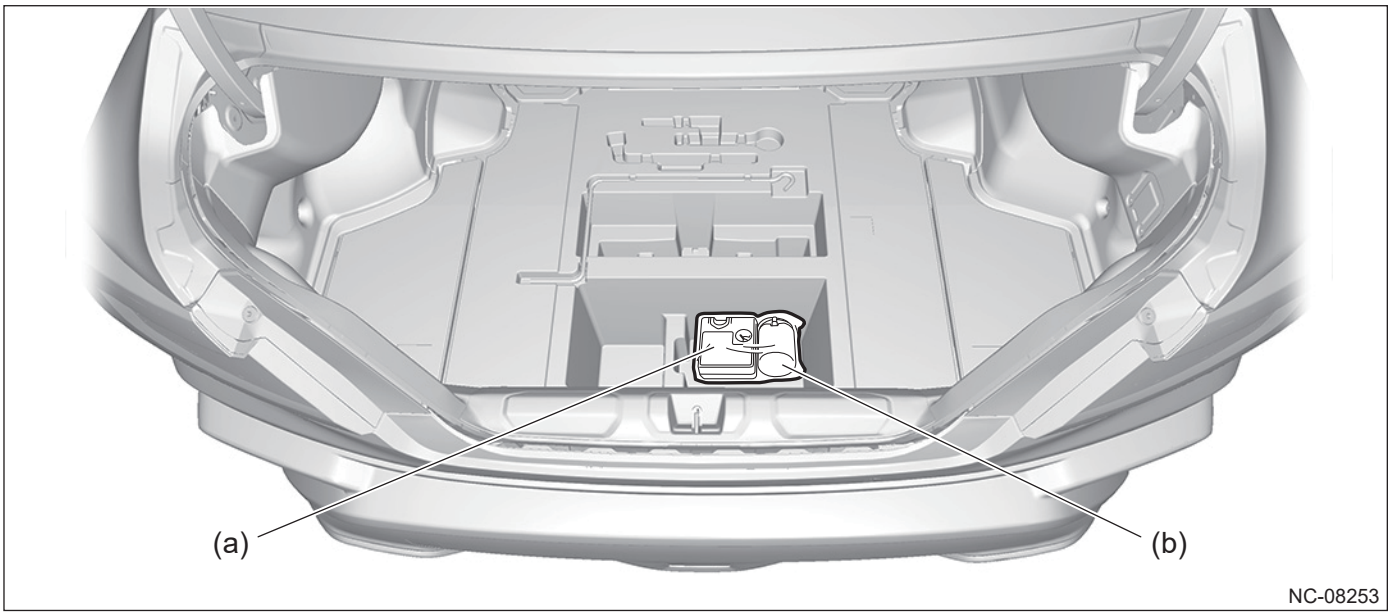
(b) 18x8 1/2J, dark gun metallic, aluminum

(c) 18x8 1/2J, matte gray metallic, aluminum

-

■ Repair kit

- A tubeless tire repair kit (puncture repair kit) is adopted depending on the specification, and the installation location is positioned under the floor mat in the trunk room.

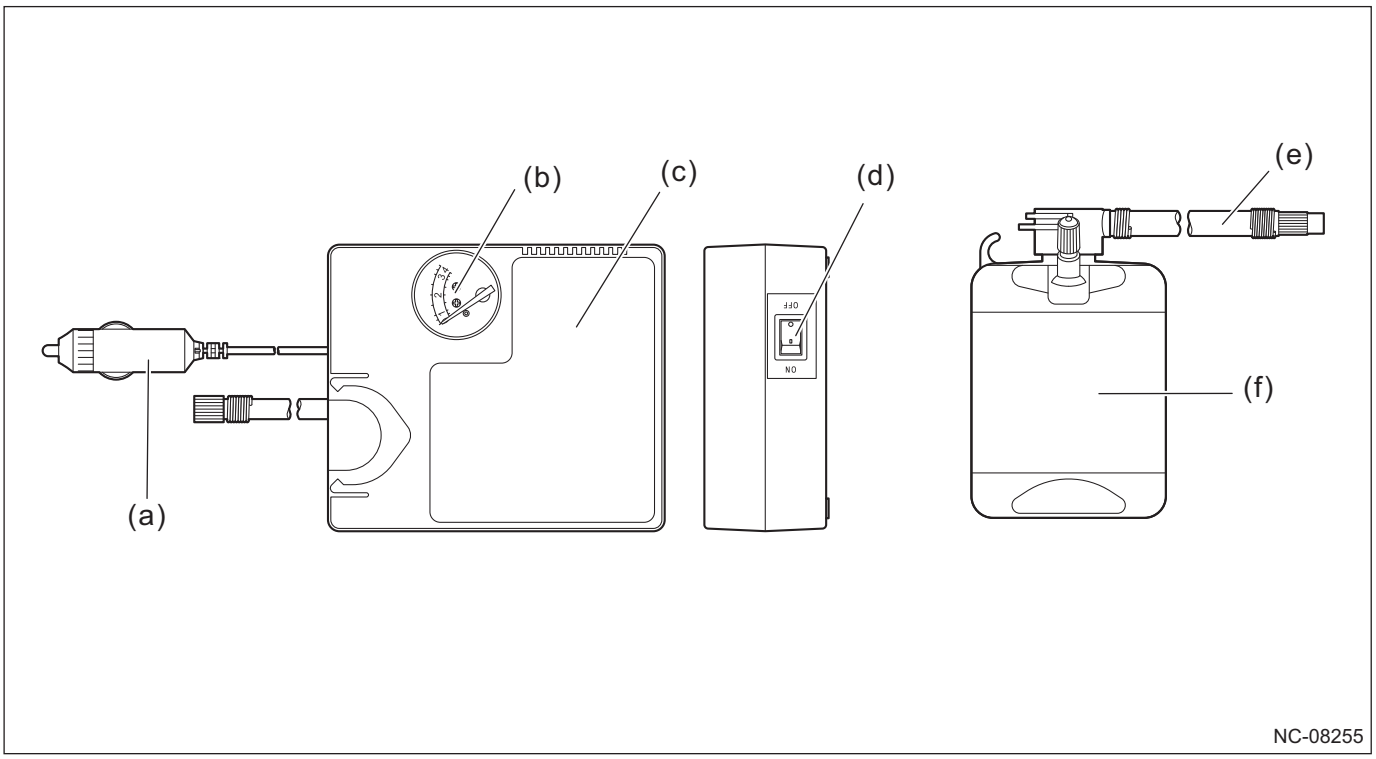


(a) Air compressor

(b) Repair agent bottle

Tubeless tire repair kit

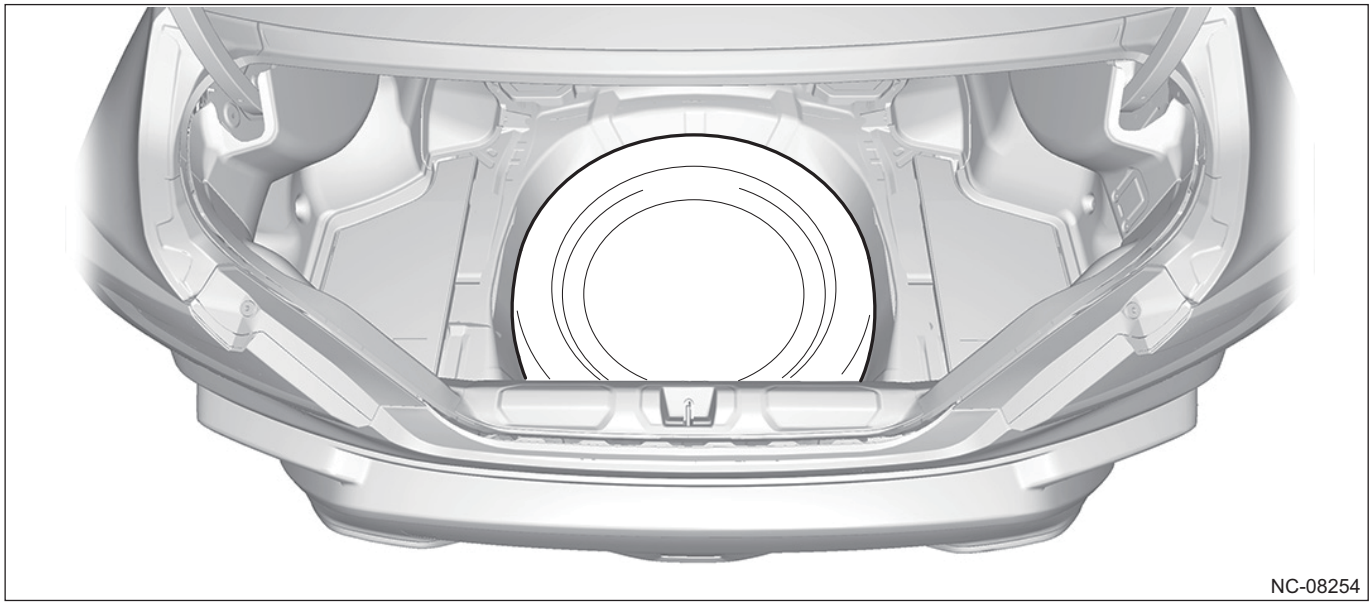
Item	Specifications	
Operating environment temperature	-22°F (-30°C) to 140°F (60°C)	
Maximum consumption current	10 A	
Locations where puncture emergency repair is possible	One hole from a nail, screw, etc., with a diameter less than 3/16 in (4 mm) located on the tread (excluding the side wall)	
Puncture repair fluid	Repair agent specifications	Propylene glycol, natural rubber latex, synthetic resin emulsion, ammonia
	Capacity	13.5 fl oz (400 ml)
	Puncture repair fluid expiration date	Displayed on repair agent bottle



(a) Power supply plug
(b) Air pressure gauge
(c) Air compressor
(d) ON/OFF switch
(e) Nozzle
(f) Repair agent bottle

■ Spare tire

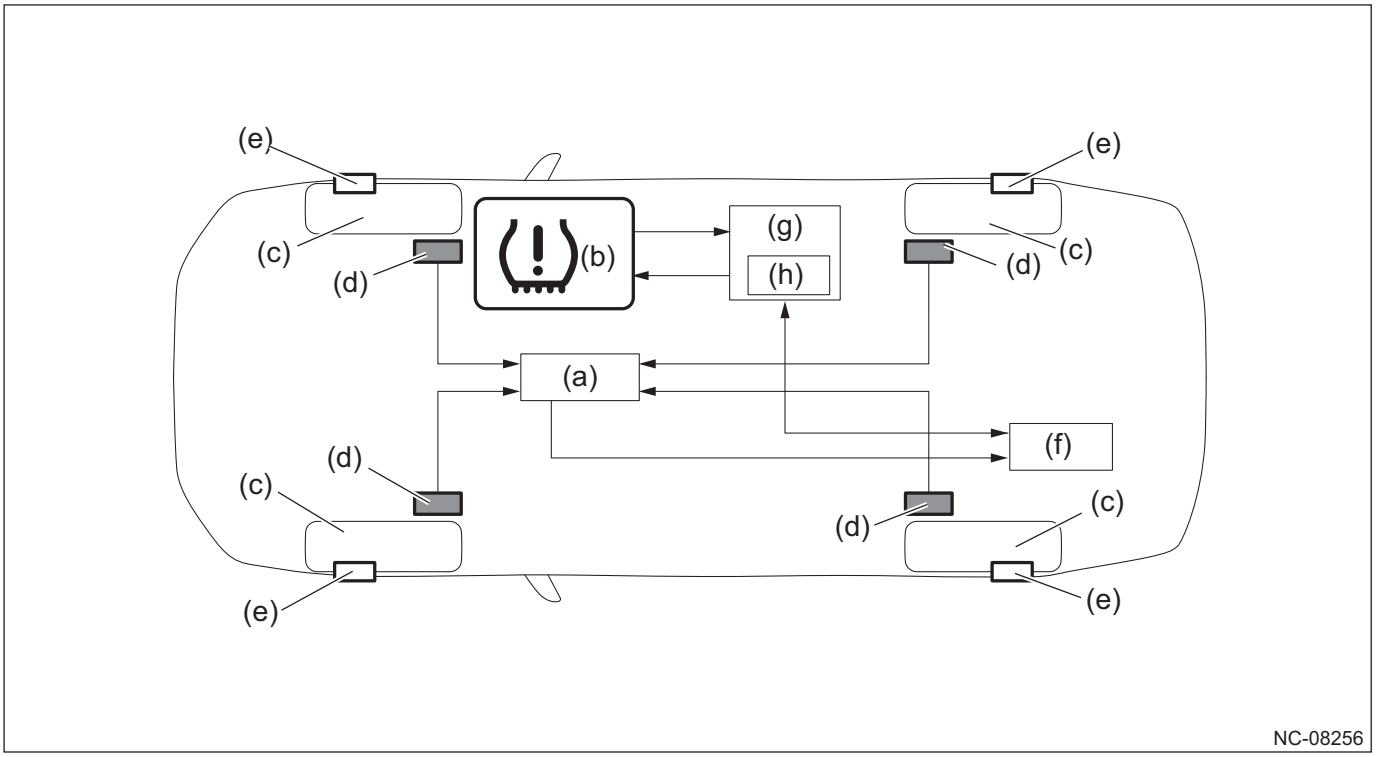
- A standard tire is adopted depending on the specification, and the installation location is positioned under the floor mat in the trunk room.



5.1.3 Construction and Operation

TPMS (Tire Pressure Monitoring System)

A system called Tire Pressure Monitoring System, TPMS is adopted. This system monitors the tire air pressure through the wheel speed counter of the ABS and the RF transmission cycle to identify the tire with low air pressure. Then it turns on the warning light in the combination meter to alert the driver of low air pressure. TPMS quickly detects tire faulty due to low air pressure when driving at high speed and alerts the driver to the fault, to allow the driver to realize it and take action appropriately. TPMS prevents decreases in roll resistance and flat tires due to low air pressure, measures the air pressure for each of the left and right-front and rear tires, and issues the warning to the driver.



(a) VDC control module and hydraulic control module (VDC CM & H/M)

(b) TPMS warning light & multi information display

(c) Tire

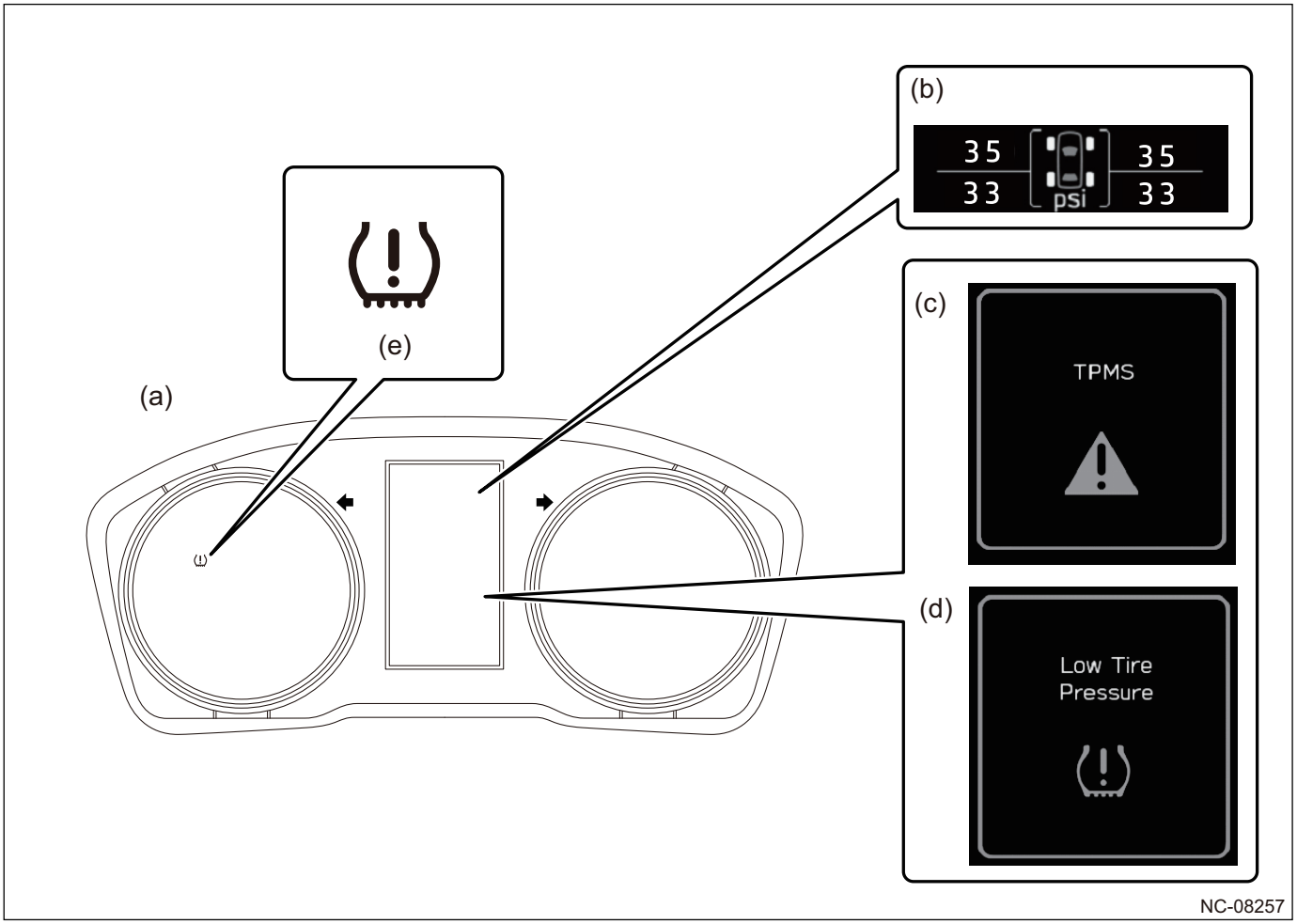
(d) Wheel speed sensor

(e) Transmitter (tire inflation pressure sensor)

(f) TPMS & keyless entry CM

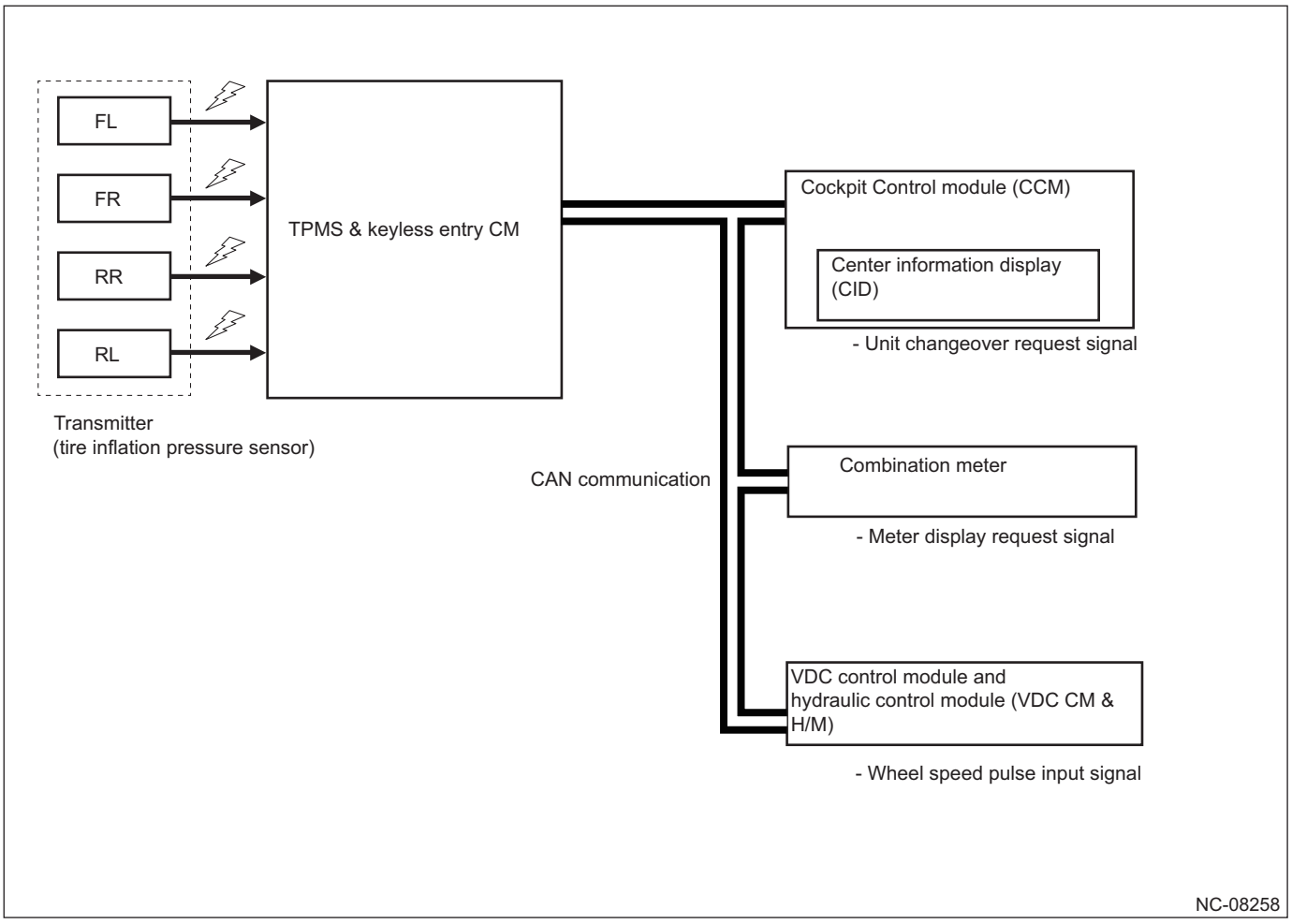
(g) Cockpit Control Module (CCM)

(h) Center Information Display (CID)



(a) Combination meter
(b) Multi information display
(c) TPMS warning display
(d) Interruption screen
(e) TPMS warning light

System diagram



Main component functions

Component	Function
TPMS & keyless entry CM	Receives the signal from the tire inflation pressure warning valve / transmitter and monitors the tire inflation pressure. When low tire pressure is detected, an initial setting request is received, or a system failure is detected, it sends a signal to the combination meter via the cockpit control module (CCM).
Transmitter (tire inflation pressure sensor)	Measures the tire inflation pressure and sends the measured value to the TPMS & keyless entry CM.
Center Information Display (CID)	Changes the units display according to operation of the touch panel.
VDC control module and hydraulic control module (VDC CM & H/M)	Sends the wheel speed to the TPMS & keyless entry CM.
Combination meter	Notifies the driver by flashing the tire inflation pressure warning light in case of low tire pressure or system failure, and displaying the inflation pressure value for each tire on the multi information display.
Cockpit Control module (CCM)	Receives the signal from the TPMS & keyless entry CM, and sends a signal to the combination meter assembly.

6 BRAKE SYSTEM

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6.1 General Overview

6.1.1 Overview

Overview

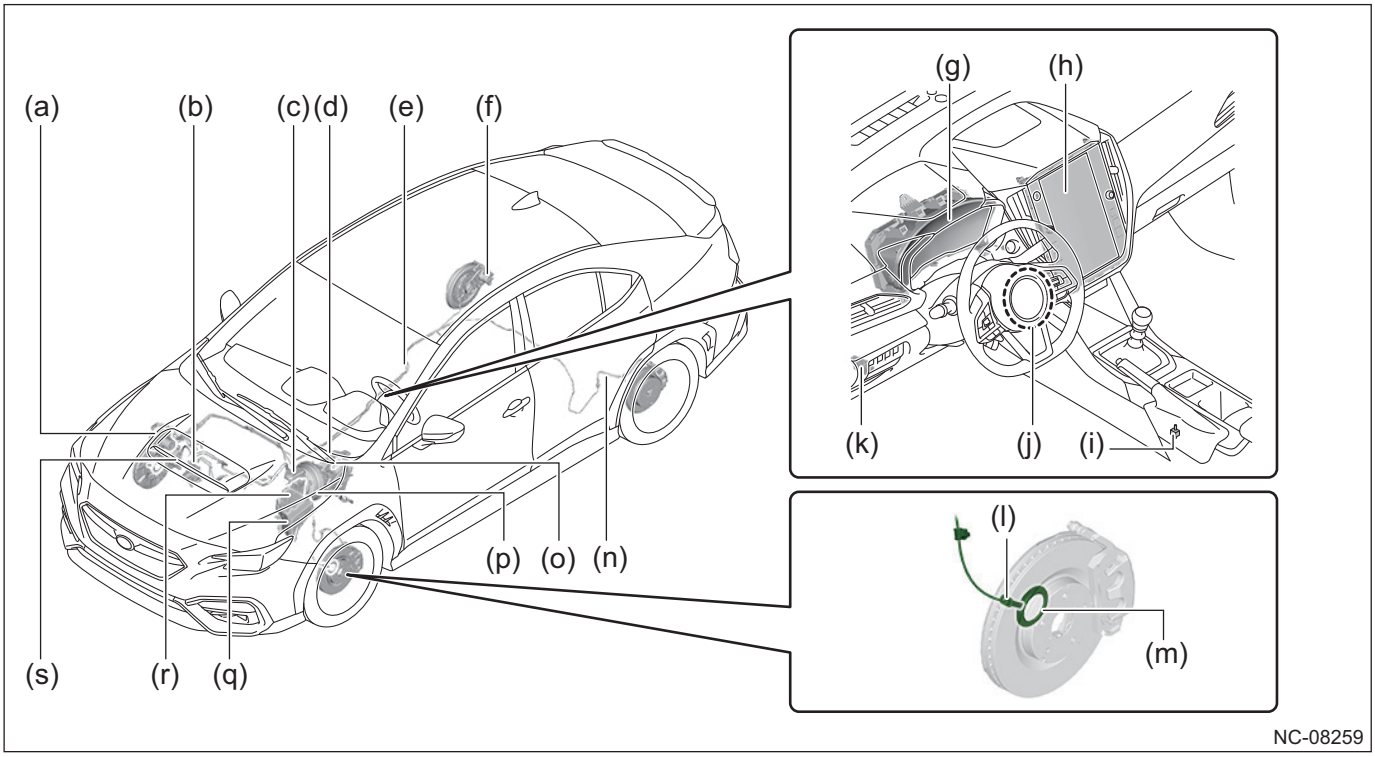
This chapter describes the following systems configuring the brake system.

- Service Brake
- Vehicle Dynamics Control (VDC)
- Electronic Parking Brake
- Hand-operated Lever Type Parking Brake

6.1.2 Component

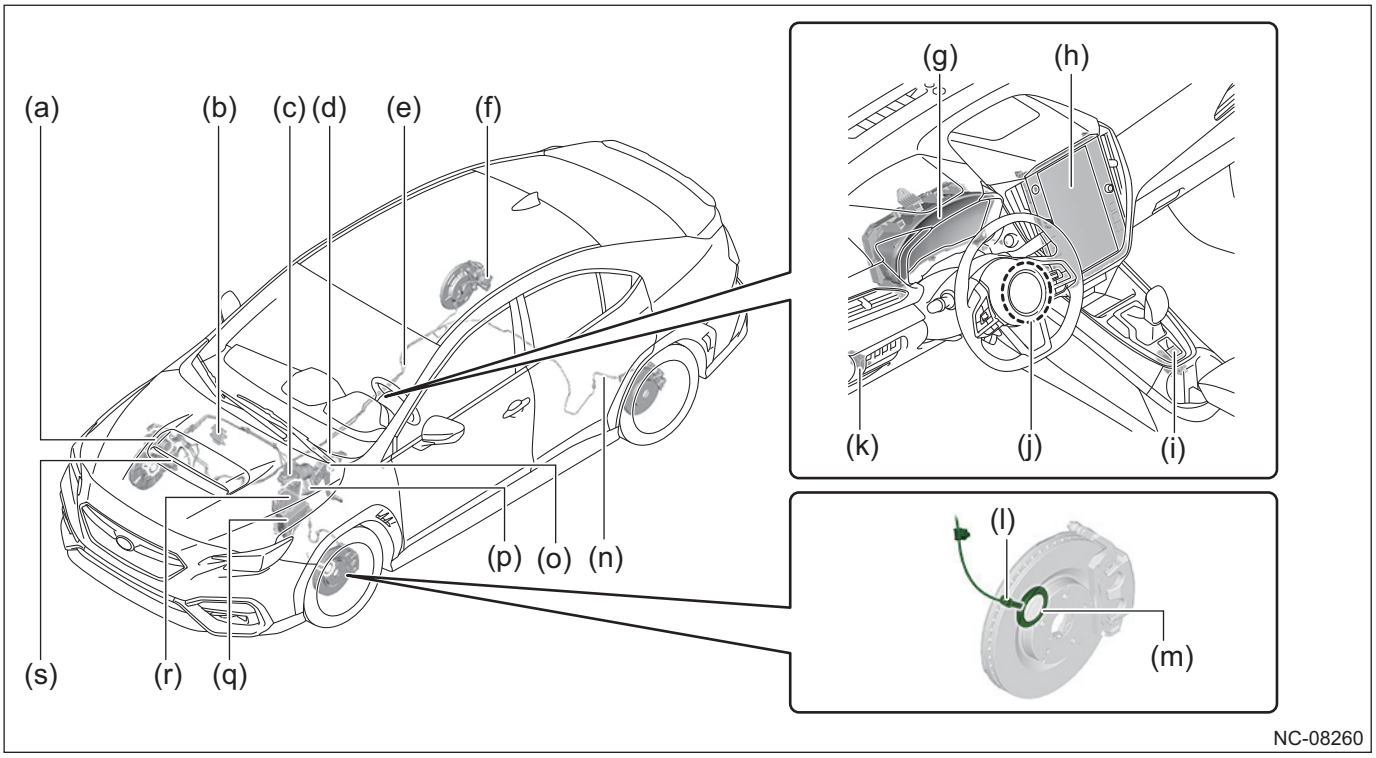
Component layout drawing

MT models



(a) VDC control module and hydraulic control module (VDC CM & H/M)
(b) Vacuum pump
(c) Master cylinder assembly
(d) Brake pedal
(e) Brake pipe
(f) Rear brake caliper
(g) Combination meter
(h) Center information display (for some grades)
(i) Hand brake switch assembly
(j) Steering angle sensor
(k) VDC OFF switch
(l) ABS wheel speed sensor
(m) Magnetic encoder
(n) Brake hose
(o) Stop light switch
(p) Vacuum booster assembly
(q) Brake light relay (in main fuse & relay box)
(r) Engine control module (ECM)
(s) Front brake caliper

CVT models



(a) VDC control module and hydraulic control module (VDC CM & H/M)
(b) Transmission control module (TCM)
(c) Master cylinder assembly
(d) Brake pedal
(e) Brake pipe
(f) Rear brake caliper
(g) Combination meter
(h) Center information display (for some grades)
(i) Parking brake switch
(j) Steering angle sensor
(k) VDC OFF switch
(l) ABS wheel speed sensor
(m) Magnetic encoder
(n) Brake hose
(o) Stop light switch
(p) Electric booster assembly
(q) Brake light relay (in main fuse & relay box)
(r) Engine control module (ECM)
(s) Front brake caliper

6.2 Service Brake

6.2.1 Overview

Overview

The following items are adopted for the service brake to realize the brake performance with a feel of safety and immediate effect when the brake pedal is depressed.

- Vacuum sensor compatible with brake assist control (MT models)
- Engine-driven vacuum pump (MT models)
- Master cylinder assembly and electric booster assembly that increase responsiveness when Pre-Collision Braking or Adaptive Cruise Control is used (CVT models)
- Environmentally friendly, copper-free brake pads
- Rear brake caliper with built-in electronic parking brake (CVT models)
- Forward pull type duo servo parking brake (MT models)

Specifications

Front brake

Cylinder size (in (mm))	φ1.591 × 2 (φ40.4 × 2)
Rotor outer diameter (in (mm))	φ12.44 (φ316)
Rotor sliding surface thickness (in (mm))	t1.1 (t28)
Pad material	FA431GG

Rear brake

■ Electronic parking brake specifications (CVT models)

Cylinder size (in (mm))	φ1.575 (φ40.0)
Rotor outer diameter (in (mm))	φ11.81 (φ300)
Rotor sliding surface thickness (in (mm))	t0.67 (t17)
Pad material	FN410FF

■ Specifications with hand-operated lever type parking brake (MT models)

Cylinder size (in (mm))	φ1.591 (φ40.4)
Rotor outer diameter (in (mm))	φ11.42 (φ290)
Rotor sliding surface thickness (in (mm))	t0.71 (t18)
Pad material	FN410FF

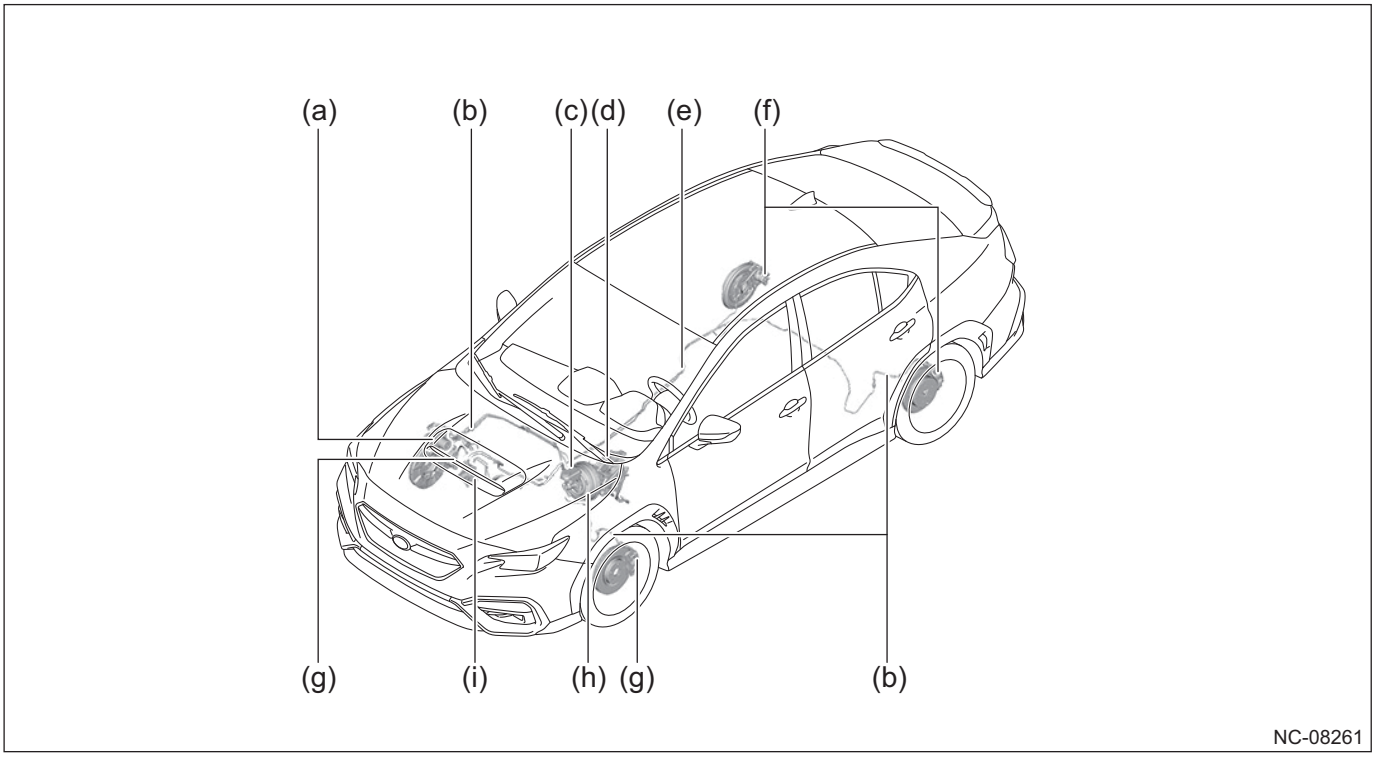
Brake master cylinder

Cylinder size (in (mm))	φ0.94 (φ23.8)

6.2.2 Component

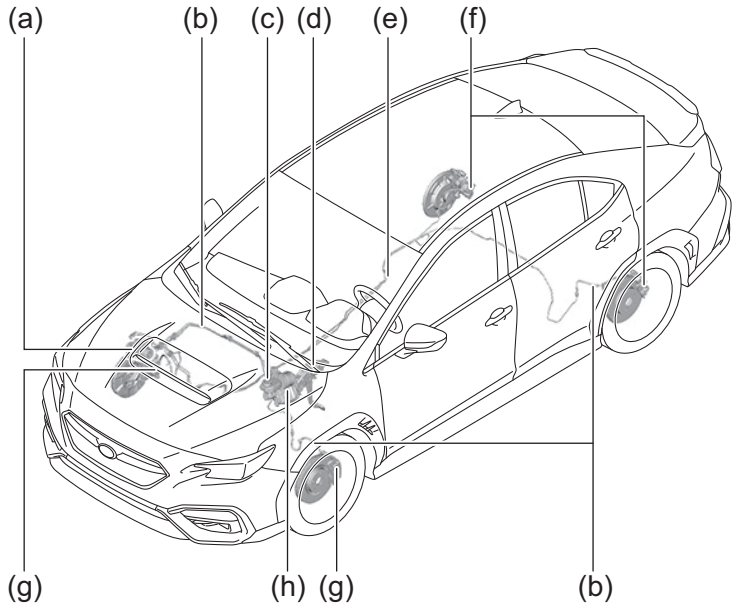
Component layout drawing

MT models



(a) VDC control module and hydraulic control module (VDC CM & H/M)
(b) Brake hose
(c) Master cylinder assembly
(d) Brake pedal
(e) Brake pipe
(f) Rear brake caliper
(g) Front brake caliper
(h) Vacuum booster assembly
(i) Vacuum pump

CVT models



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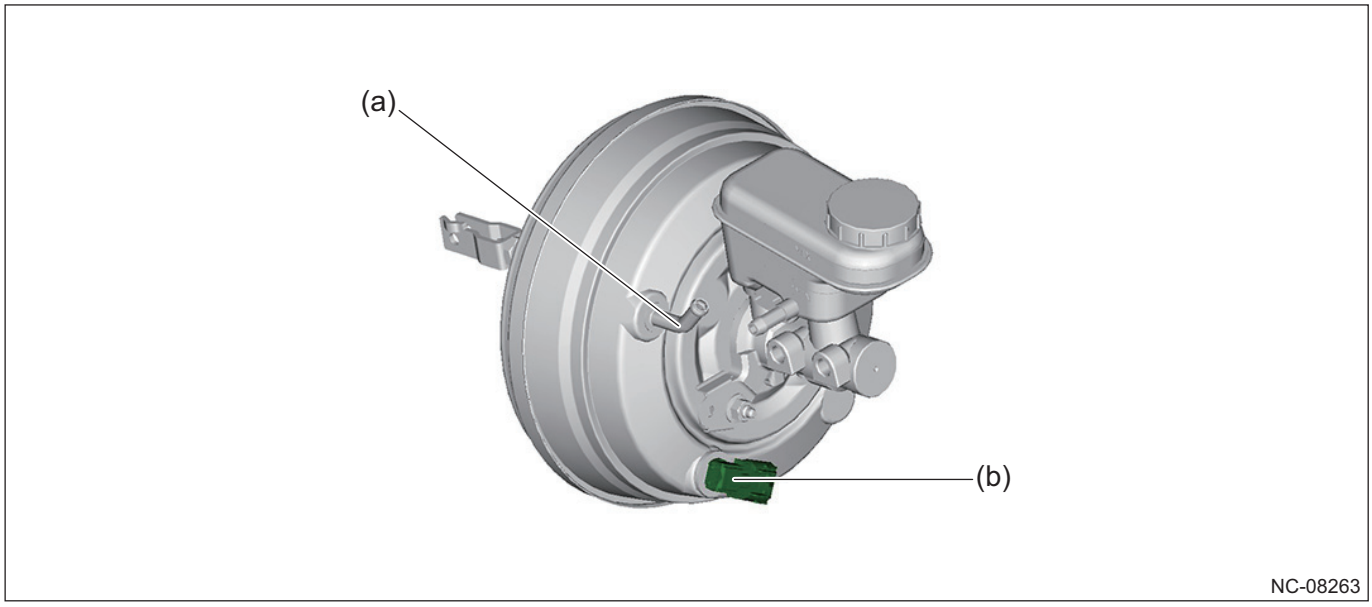
(a) VDC control module and hydraulic control module (VDC CM & H/M)
(b) Brake hose
(c) Master cylinder assembly
(d) Brake pedal
(e) Brake pipe
(f) Rear brake caliper
(g) Front brake caliper
(h) Electric booster assembly

Component details

Vacuum booster (MT models)

A vacuum booster with the following optimizations is adopted to improve brake effectiveness, ensure braking performance in emergencies, and improve operability.

- In response to the introduction of brake assist control in case of negative pressure decrease, a relative pressure/negative pressure sensor is adopted for the vacuum sensor.
- The change to the vacuum nipple installation angle improves operability when detaching and connecting the vacuum hose.



(a) Vacuum nipple

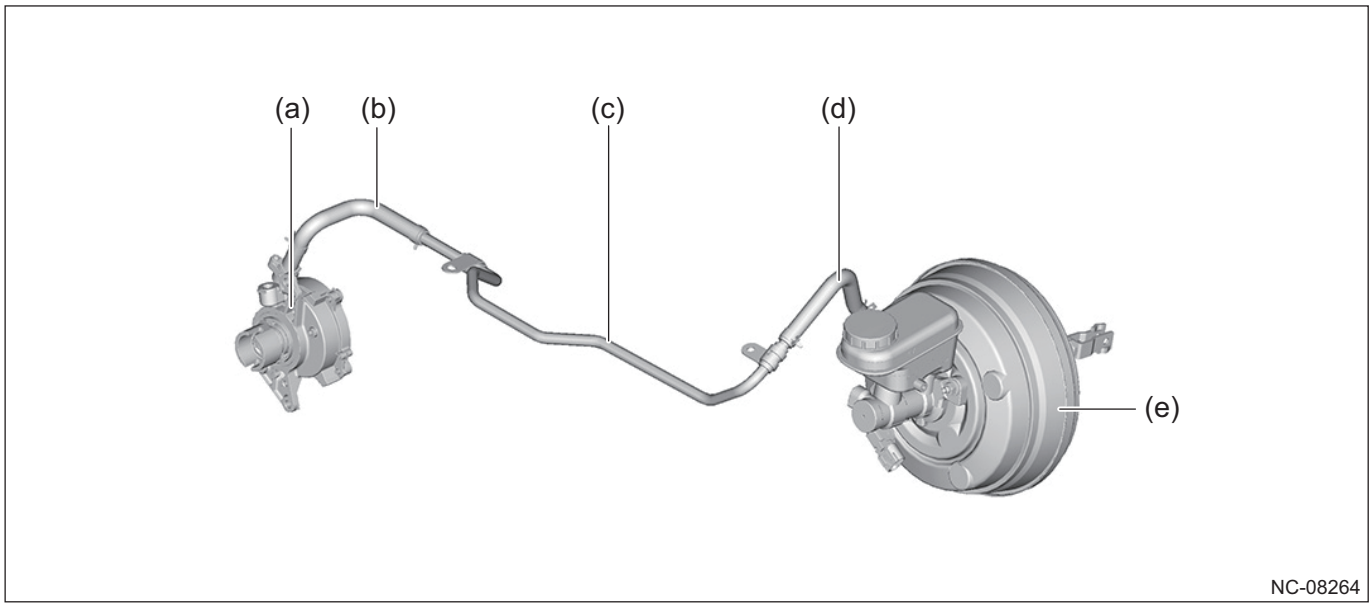
(b) Vacuum sensor (Relative pressure/negative pressure sensor)

Vacuum pump (MT models)

A vacuum pump that is driven by the engine is adopted to eliminate the problem of insufficient negative pressure supply speed.

Due to this, braking without a feeling of stepping on a stiff board is realized while ensuring the stable feeling immediately after the engine is started.

The brake assist control function in case of a negative pressure decrease in which braking force is ensured when the vacuum booster negative pressure decreases by using the pressurizing function of the VDC control module and hydraulic control module (VDC CM & H/M) is adopted.



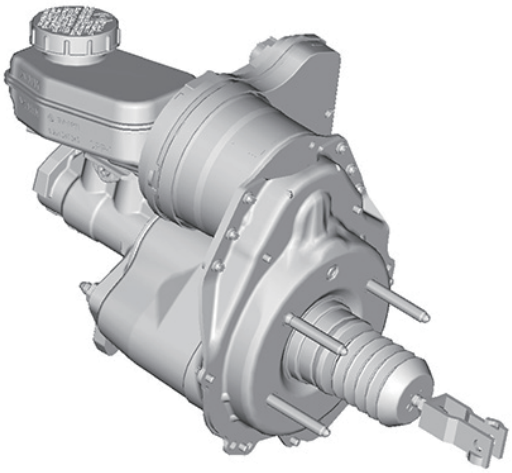
(a) Vacuum pump
(b) Vacuum hose COMPL
(c) Vacuum pipe assembly
(d) Vacuum hose COMPL
(e) Vacuum booster assembly

Master cylinder assembly and electric booster assembly (CVT models)

A master cylinder assembly and electric booster assembly are adopted.

The master cylinder assembly and electric booster assembly integrate parts such as a motor and control unit, and have a compact construction equivalent to existing negative pressure brake boosters.

Also, an electric brake booster that is more highly responsive to rising pressure is used to increase the responsiveness of Pre-Collision Braking and Adaptive Cruise Control.



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Front brake

■ Front brake caliper

The 17-inch brake caliper and brake pad, to which the following optimizations are made, are adopted for the front brake caliper. This achieves braking performance with immediate effect when the brake pedal is depressed, producing a re-assuring feeling of security.

Brake caliper

- A part with a cylinder diameter of φ1.591 in × 2 (φ40.4 mm × 2) is adopted.
- Cylinder size is optimized to reduce the ineffective stroke range.

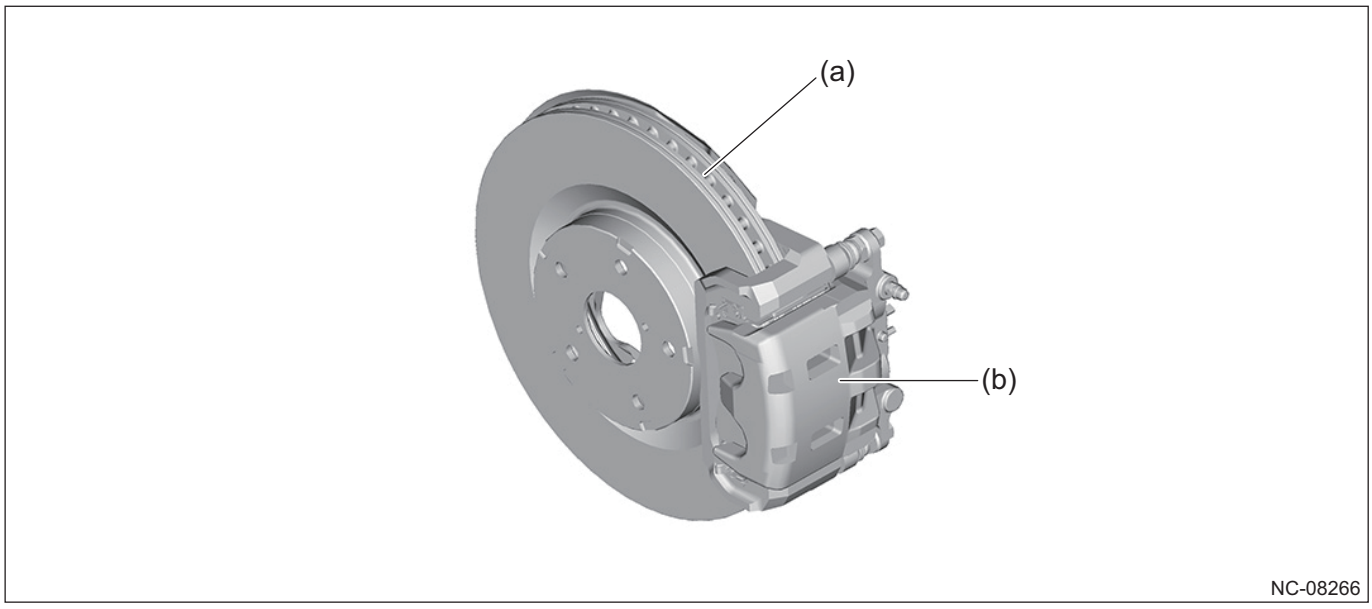
Brake pad

- Brake pads made of copper-free materials are adopted for better environmental performance.

■ Front disc rotor

17-inch disc rotor is adopted.

The change to the thickness of the front disc rotor sliding surface reduces weight.



(a) Front disc rotor

(b) Front brake caliper

Rear brake

■ Rear brake caliper

A 16-inch brake caliper and brake pad (CVT models), or a 17-inch brake caliper and brake pad (MT models), are adopted for the rear brake caliper according to the vehicle specifications. While maintaining parking performance, this achieves braking performance with immediate effect when the brake pedal is depressed, producing a reassuring feeling of security.

Brake caliper

- A part with a cylinder diameter of φ1.591 in (φ40.4 mm) (MT models), or φ1.575 in (φ40.0 mm) (CVT models), is adopted according to the vehicle specifications.

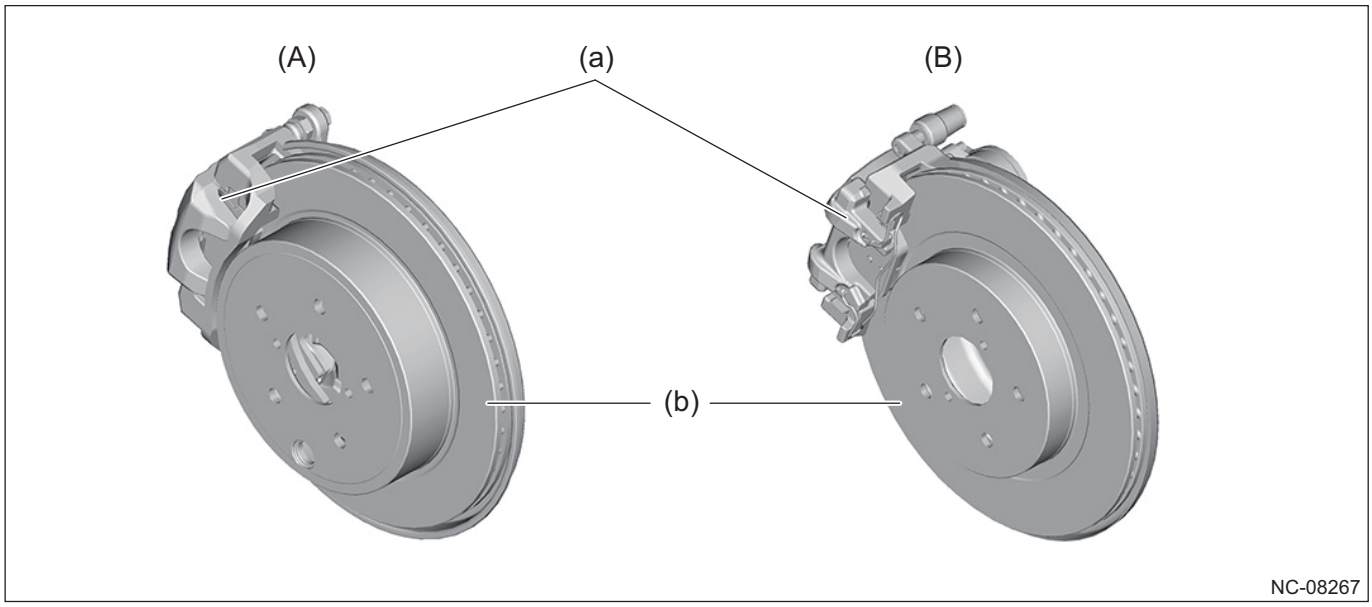
Brake pad

- The coefficient of friction of the brake pad is increased and a copper-free material is adopted to be more friendly to the environment.

■ Rear disc rotor

A 16-inch disc rotor (CVT models) or 17-inch disc rotor (MT models) is adopted according to the vehicle specifications.

Also, a part with a built-in duo servo parking brake is adopted for the 16-inch disc rotor (MT models).



(A) Rear brake with hand-operated lever type parking brake (MT models)

(B) Rear brake with electronic parking brake (CVT models)

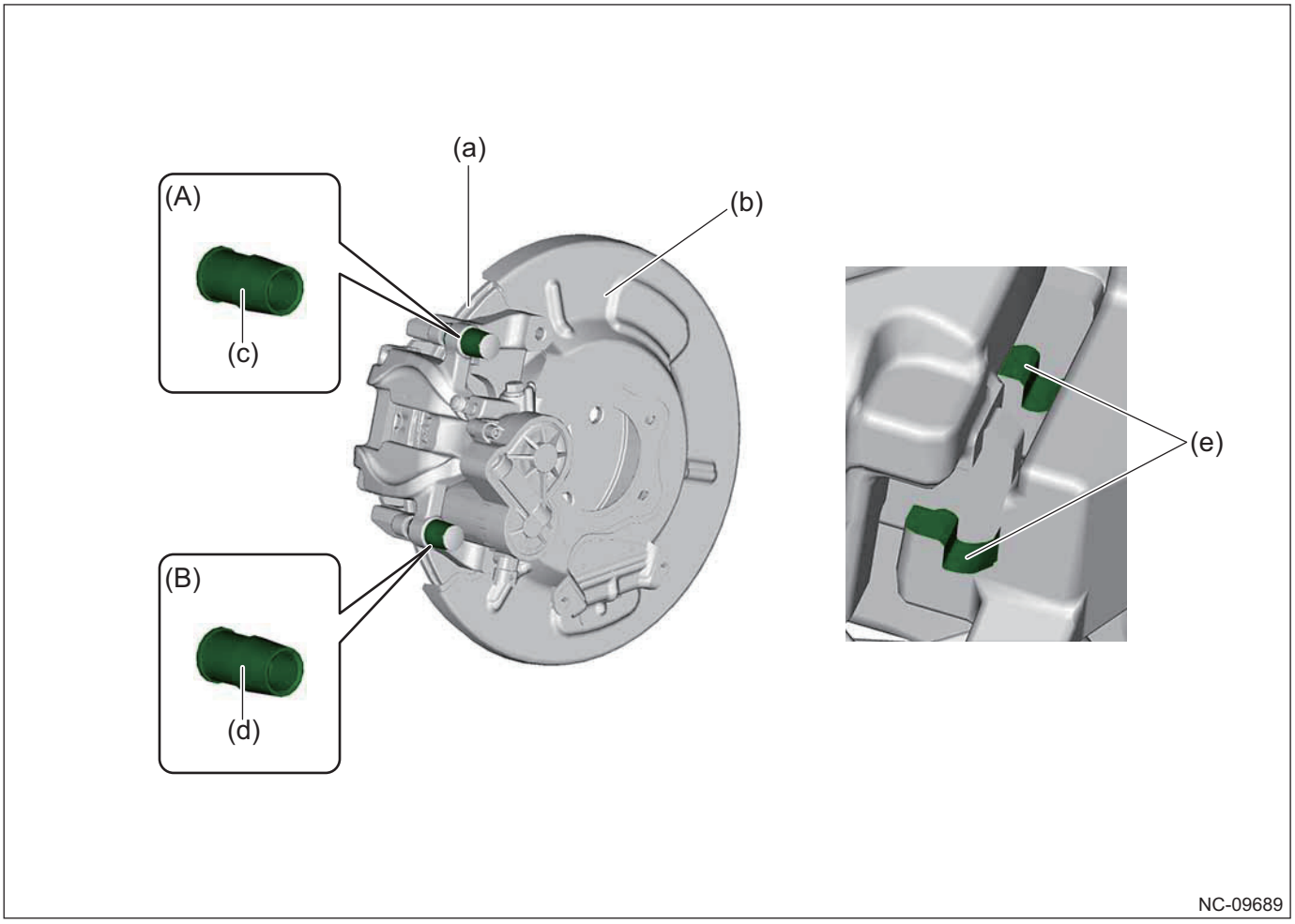
(a) Rear brake caliper

(b) Rear disc rotor

■ Rear brake with built-in 17-inch electronic parking brake (CVT models)

A rear brake caliper with built-in electric motor is adopted for CVT models. The parking brake structure uses the system to push the brake pad out with motor drive.

Adding grease to the pad sliding part, and changing the slide pin bushing on the rotate-out side of the disc caliper to one with a resin sleeve, reduce resistance caused by brake dragging.



(A) Rotate out side

(B) Rotate in side

(a) Rear disc rotor

(b) Rear disc cover

(c) Slide pin bushing (with resin sleeve)

(d) Slide pin bushing (without resin sleeve)

(e) Grease applied to pad sliding part

6.2.3 Construction and Operation

System details

Master cylinder assembly and electric booster assembly (CVT models)

The master cylinder assembly and electric booster assembly are composed of a servo mechanism, servo control mechanism, master cylinder mechanism, and brake pedal stroke sensor.

Mechanism	Construction and Operation
Servo mechanism	• The servo mechanism is composed of a motor, gear unit, and valve body. • The rotational force generated by the motor is reduced by the gear unit, and rotates the spindle nut. When the spindle nut rotates, the spindle is pushed out, which pushes out the master cylinder piston via the valve body and reaction disc.
Servo control mechanism	• The servo control mechanism is composed of parts such as an electric brake booster control unit and brake pedal stroke sensor. • The electric brake booster control unit calculates the control target differential stroke based on the signals from the brake pedal stroke sensor, and controls the motor.
Master cylinder mechanism	• The master cylinder mechanism is the same mechanism as the master cylinder used in negative pressure brake boosters.
Brake pedal stroke sensor	• The brake pedal stroke sensor is installed inside the electric booster assembly, and detects depression of the brake pedal by the driver.

■ Operation

The depression of the brake pedal by the driver is read by the brake pedal stroke sensor, and then the motor is controlled to move the master cylinder via the gear unit, which generates brake fluid pressure. However, note that the same reaction disc as a negative pressure brake booster is adopted for the pedal reaction force construction, realizing a natural brake feel.

■ Brake performance

Even with a shortish stroke, a higher depression force gradient can be set to ensure controllability and rigidity. This achieves both peace of mind by applying the brake instantaneously when it is depressed, and a sporty brake feel through the short stroke and rigidity.

■ Cooperation control with EyeSight

Adaptive Cruise Control and Pre-Collision Braking Assist using the master cylinder assembly and electric booster assembly have been enabled. In addition to increasing the pressure with the motor of the VDC unit, a more highly responsive electric brake booster is adopted to increase the responsiveness of Pre-Collision Braking and Adaptive Cruise Control.

Fail-safe

The fail-safe function operates when an abnormality occurs in the system. At this time, the driver is notified of the system anomaly by the various warnings displayed in the combination meter according to the abnormal function. For details on the various warning displays, check the owner's manual.

6.3 Vehicle Dynamics Control (VDC)

6.3.1 Overview

Overview

VDC always detects driving conditions of a vehicle with various types of sensors and assists the driver to achieve an ideal driving condition. Unstable behavior of the vehicle near the control limit such as side slipping is reduced through the braking control for each of the four wheels, engine output control, AWD torque distribution control, etc.

A VDC system is adopted that supports electronic parking brake control (CVT models), next-generation EyeSight (CVT models), brake assist function at time of negative pressure failure (MT models), and cooperation control with the newly adopted electric brake booster (CVT models).

A relative pressure/negative pressure sensor is also adopted for MT models. The control is adopted that supports the braking power by the pressurizing function of the Vehicle Dynamics Control (VDC) when the relative pressure/negative pressure sensor detects low negative pressure in the vacuum booster.

Also, for CVT models, the VDC system of existing model vehicles which have been adapted for new model vehicles has been adopted.

The Auto Vehicle Hold (AVH) is adopted for CVT models. This largely expands the usage of the brake hold function including the use on a level road as well as when starting the engine on an uphill road.

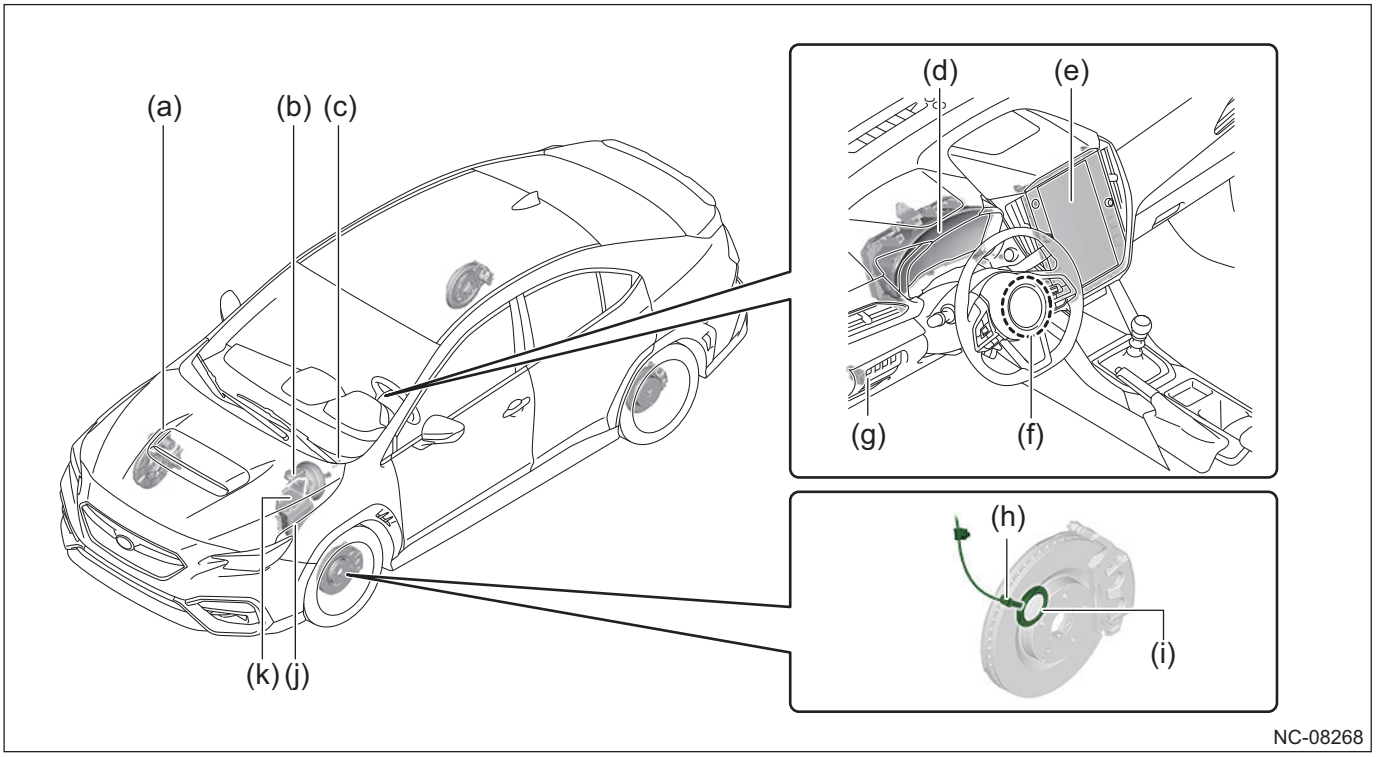
Vehicle Dynamics Control (VDC) performs the following controls.

- Active torque vectoring
- Brake assist
- Hill start assist (HSA) (MT models)
- Auto Vehicle Hold (AVH) (CVT models)
- Electronic parking brake (CVT models)
- Anti-lock brake system (ABS)
- Electronic brakeforce distribution (EBD)

6.3.2 Component

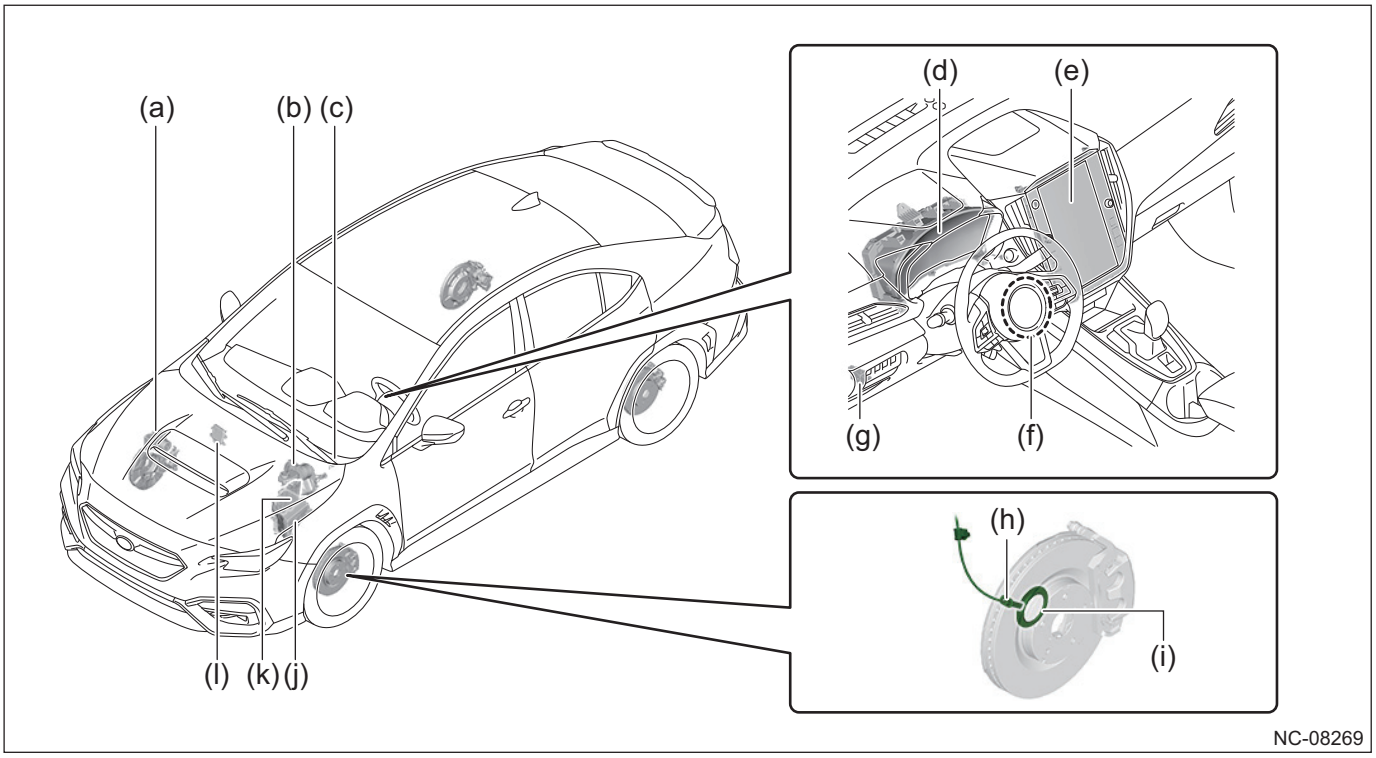
Component layout drawing

MT models



(a) VDC control module and hydraulic control module (VDC CM & H/M)
(b) Master cylinder assembly
(c) Stop light switch assembly
(d) Combination meter
(e) Center information display (for some grades)
(f) Steering angle sensor
(g) VDC OFF switch
(h) ABS wheel speed sensor
(i) Magnetic encoder
(j) Brake light relay (in main fuse & relay box)
(k) Engine control module (ECM)

CVT models

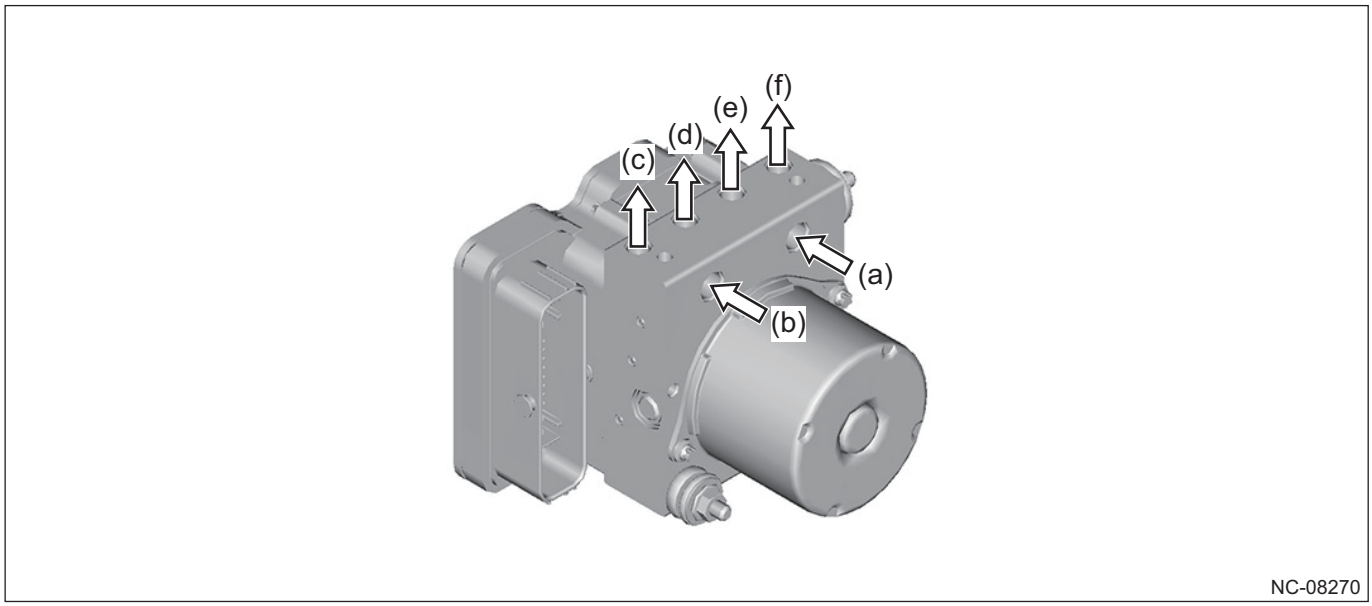


(a) VDC control module and hydraulic control module (VDC CM & H/M)
(b) Master cylinder assembly and electric booster assembly
(c) Stop light switch assembly
(d) Combination meter
(e) Center information display (for some grades)
(f) Steering angle sensor
(g) VDC OFF switch
(h) ABS wheel speed sensor
(i) Magnetic encoder
(j) Brake light relay (in main fuse & relay box)
(k) Engine control module (ECM)
(l) Transmission control module (TCM)

Component details

VDC control module and hydraulic control module (VDC CM & H/M)

The VDC control module and hydraulic control module (VDC CM & H/M) with a lightweight, compact built-in yaw rate and longitudinal G, and lateral G sensors are adopted to support the electronic parking brake control (CVT models), brake assist function at time of negative pressure failure (MT models), and cooperation control with the electric brake booster (CVT models).



(a) From primary cylinder
(b) From secondary cylinder
(c) To rear right side caliper
(d) To front left side caliper
(e) To front right side caliper
(f) To rear left side caliper

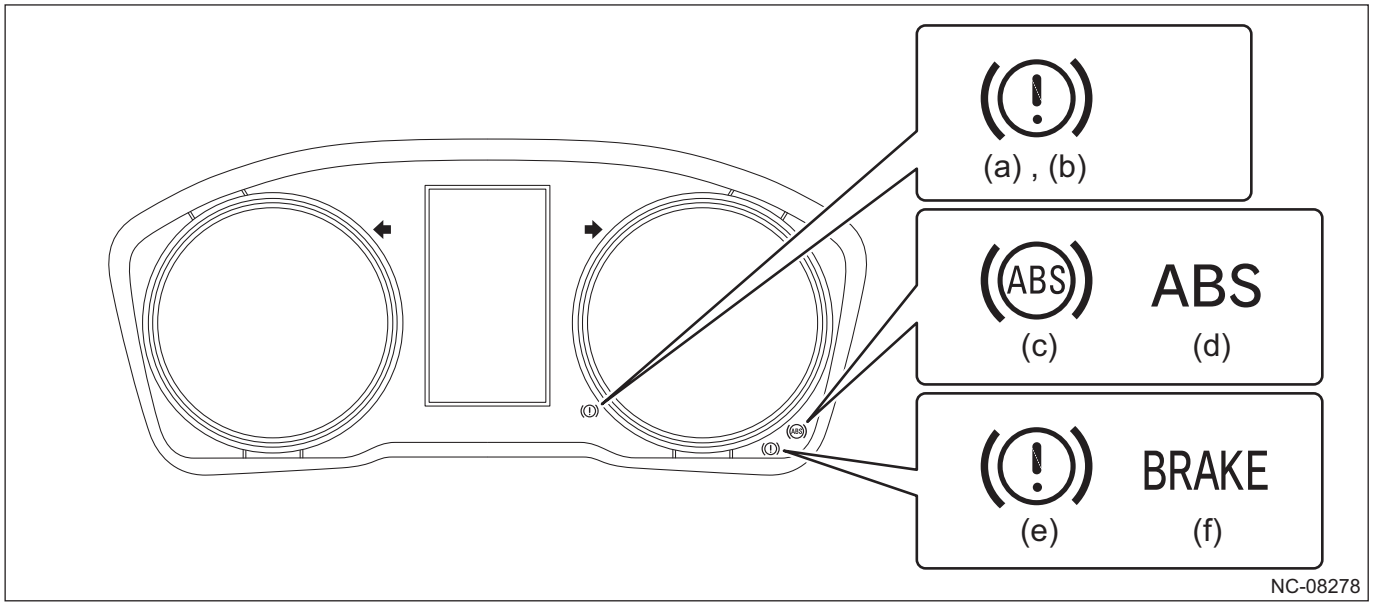
Warning light

The brake warning light (red) turns on (with the ABS warning light simultaneously) when the brake system is malfunctioning, the brake fluid level is extremely low, or the EBD electronic control system is malfunctioning.

The brake negative pressure system warning light (yellow) (MT models) turns on when there is an abnormality in the brake negative pressure system (MT models).

Also, the electronic parking brake warning light (yellow)/brake system warning light (yellow) (CVT models) turn on when the electronic parking brake system or the electric brake booster (CVT models) is malfunctioning.

The ABS warning light turns on when there is an abnormality in the ABS system.



(a) Brake negative pressure system warning light (yellow) (MT models)

(b) Electronic parking brake warning light (yellow)/brake system warning light (yellow) (CVT models)

(c) ABS warning light (other than U4, U7)

(d) ABS warning light (U4, U7)

(e) Brake warning light (red) (other than U4, U7)

(f) Brake warning light (red) (U4, U7)

Center information display (for some grades)

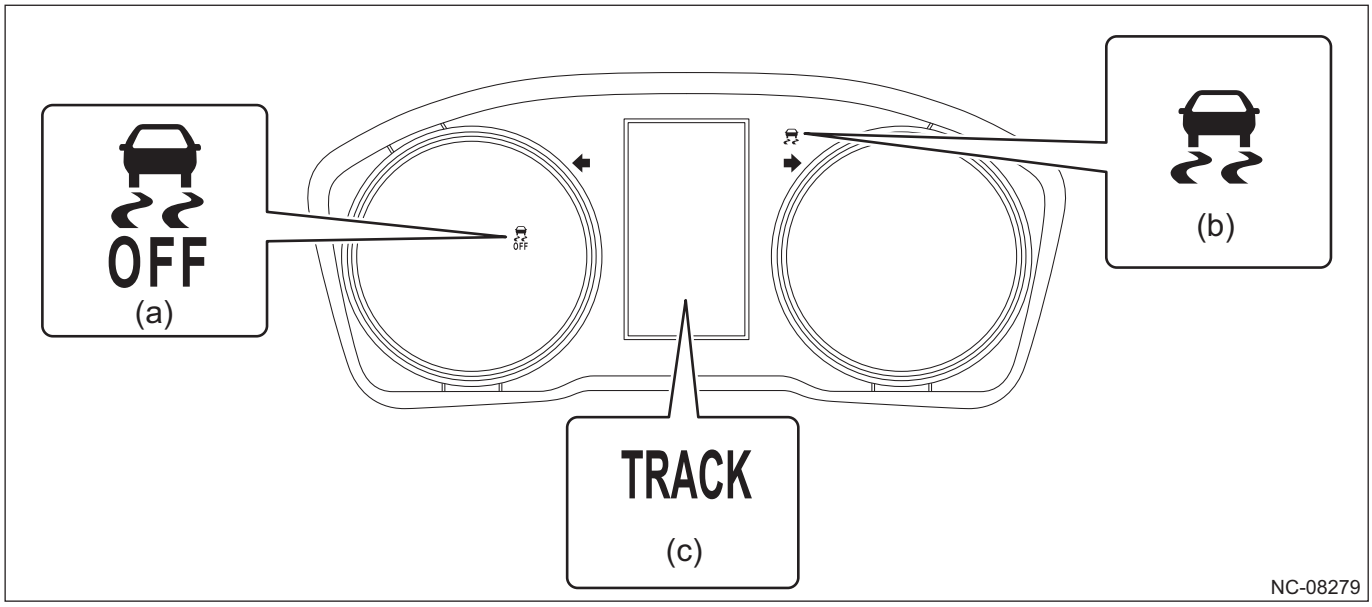
The function is added that displays the operating conditions of the Vehicle Dynamics Control (VDC) and Auto Vehicle Hold (AVH) (CVT models) on the center information display. This contributes to safe driving by notifying the driver of vehicle conditions in real time.

Vehicle Dynamics Control (VDC) warning light, VDC OFF indicator light, TRACK indicator light

The Vehicle Dynamics Control (VDC) warning light turns on when there is an abnormality in the Vehicle Dynamics Control (VDC) system.

Operating the VDC OFF switch disables the engine torque suppressing function which is effective for getting out of muddy or snowy roads, for example. When the torque suppressing function is turned off, the VDC OFF indicator light turns on in yellow in the meter so the driver can view the mode status at a glance.

The TRACK indicator light also turns on when TRACK mode is selected.



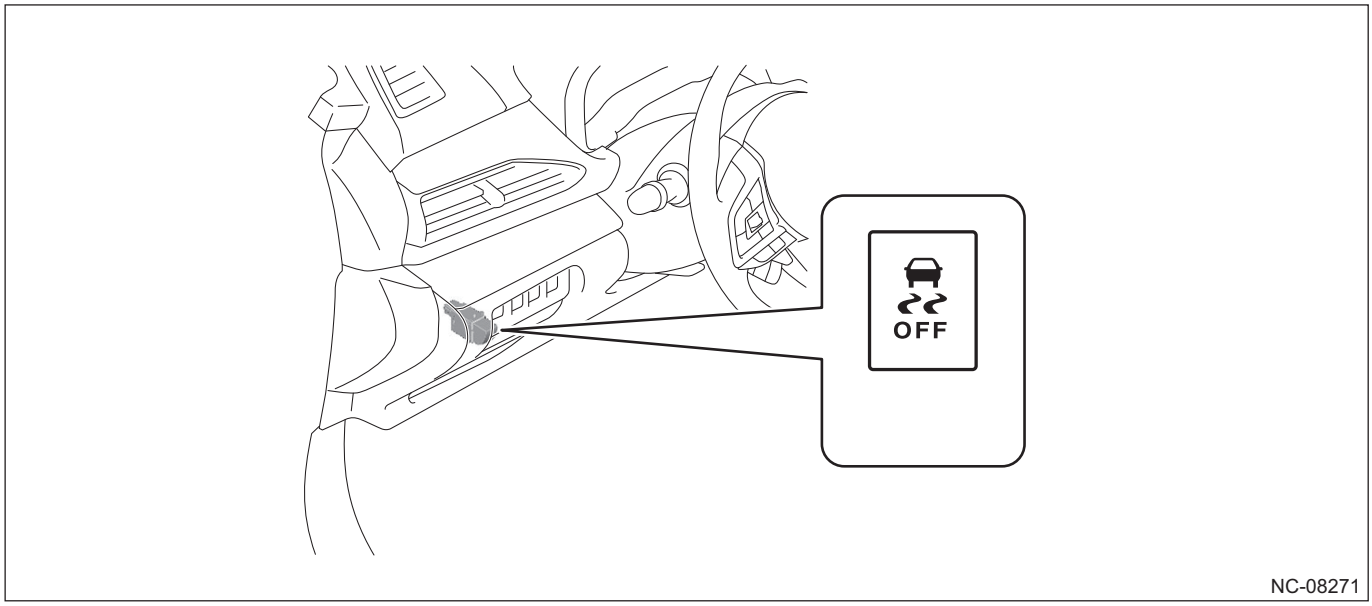
(a) VDC OFF indicator light

(b) Vehicle Dynamics Control (VDC) warning light

(c) TRACK indicator light

VDC OFF switch

The VDC OFF switch that disables the engine torque suppressing function is provided on the instrument panel.



■ Multi-mode VDC

Multi-mode VDC has been adopted. Operating the VDC OFF switch changes Vehicle Dynamics Control (VDC) and TCS control to one of three modes. When the VDC OFF switch is pressed, it switches among the 3 modes of NORMAL, TRACK, and VDC OFF.

The combination of illumination status of the VDC OFF indicator light and TRACK indicator light allows the driver to determine the mode status at a glance.

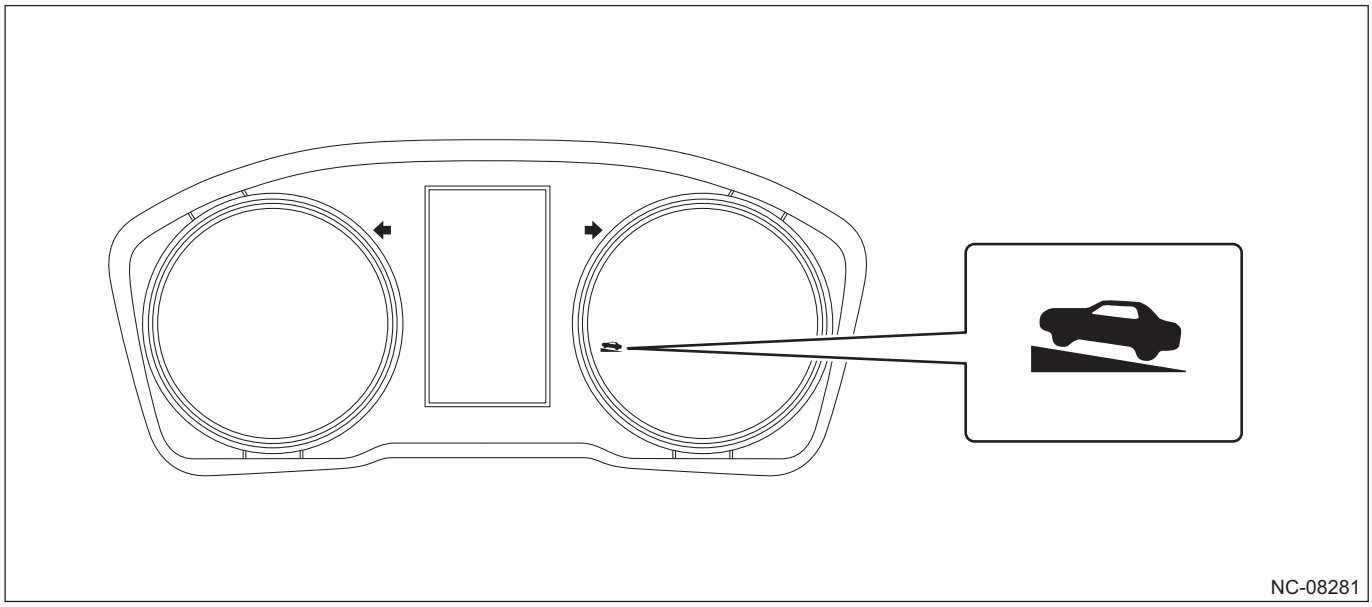
The control in each mode is as shown in the table below.

Mode	Switching method	Overview	VDC OFF indicator light	TRACK indicator light
NORMAL	At engine start	• VDC always detects the vehicle driving conditions using various types of sensors, reduces sideslip and tire spinning, and assists the driver in approaching the ideal driving conditions.	Off	Off
TRACK	Short press of VDC OFF switch	• VDC always detects the vehicle driving conditions using various types of sensors, reduces sideslip and tire spinning, and assists the driver in approaching the ideal driving conditions. • The intervention timing of Vehicle Dynamics Control (VDC) is delayed, and TCS is canceled, expanding the range of driver control over the vehicle. Also, this control can be effective when getting out after becoming stuck on muddy or snowy roads.	Turns on	Turns on
VDC OFF	Long press of VDC OFF switch when vehicle is stopped	• VDC control and TCS control can be disabled. • Because both Vehicle Dynamics Control (VDC) and TCS are disabled, the driver can control the vehicle in any way he/she wants.	Turns on	Off

Caution
The mode cannot be switched to VDC OFF while driving.

Hill start assist (HSA) indicator light (MT models)

The hill start assist (HSA) indicator light is located in the combination meter. This notifies the driver of the status of the hill start assist (HSA) system.

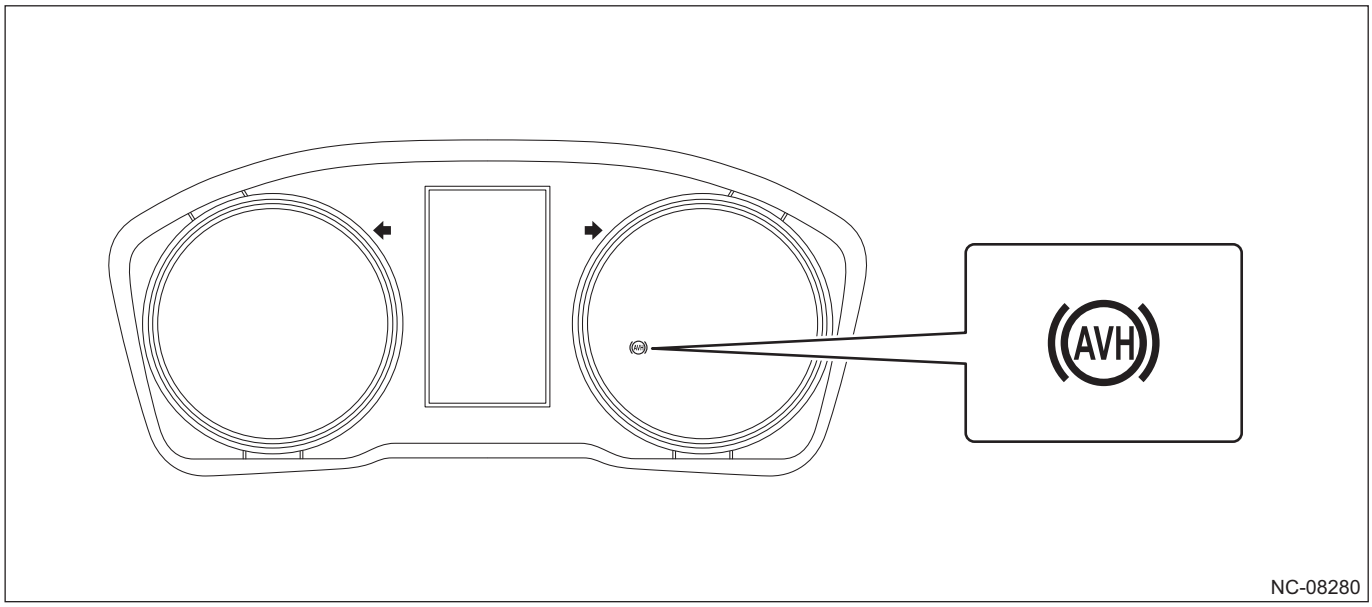


Auto Vehicle Hold switch (CVT models)

Auto Vehicle Hold switch is installed in the center information display. The display switch design may change depending on the specifications.

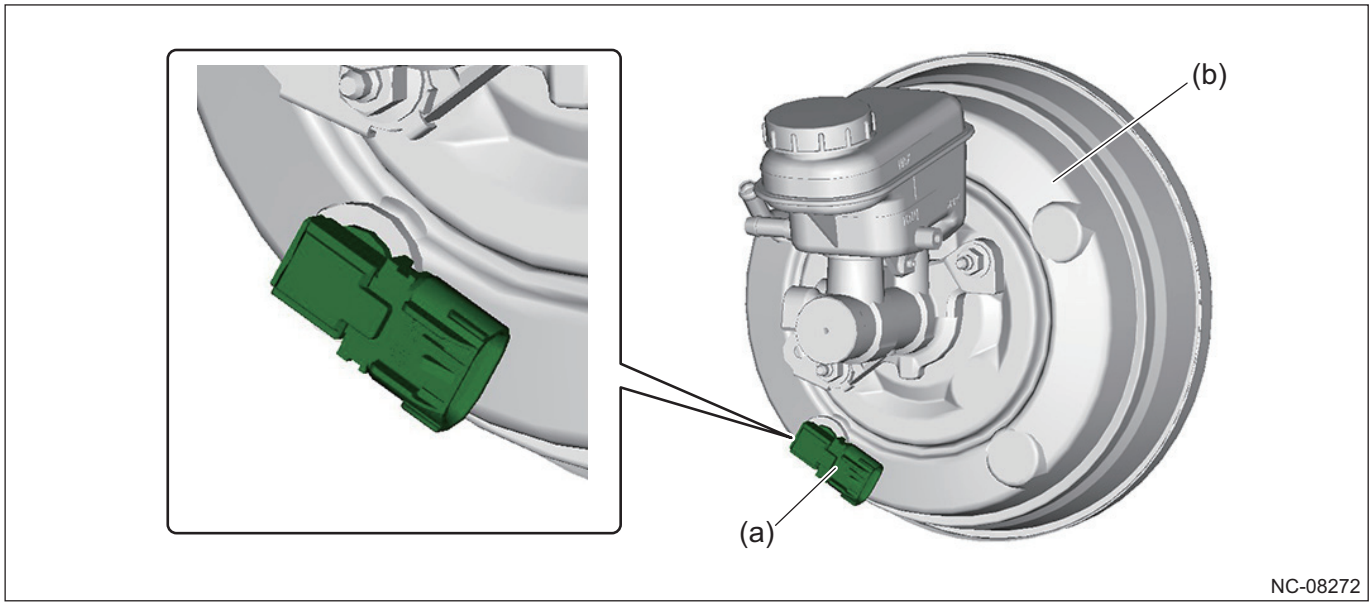
Auto Vehicle Hold (AVH) indicator light/operation light (CVT models)

The Auto Vehicle Hold (AVH) indicator light/operation light is positioned in the combination meter. This light notifies the driver of the status of the Auto Vehicle Hold (AVH) system.



Vacuum sensor (relative pressure/negative pressure sensor) (MT models)

The relative pressure/negative pressure sensor is adopted to detect the negative pressure of the vacuum booster.

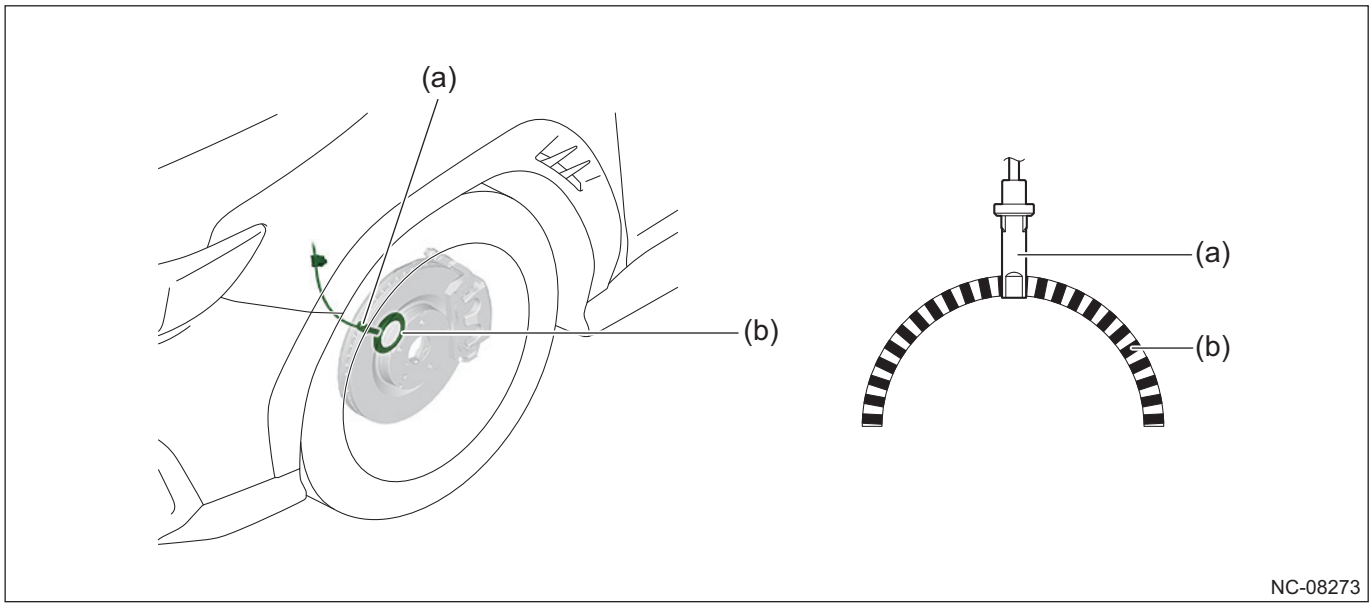


(a) Vacuum sensor (relative pressure/negative pressure sensor)

(b) Vacuum booster

ABS wheel speed sensor

A next-generation ABS wheel speed sensor is adopted. Inspection procedures for the wheel speed sensor are different from those used for existing parts due to the adoption of the next generation part. Refer to the repair manual for inspection procedures for the wheel speed sensor.



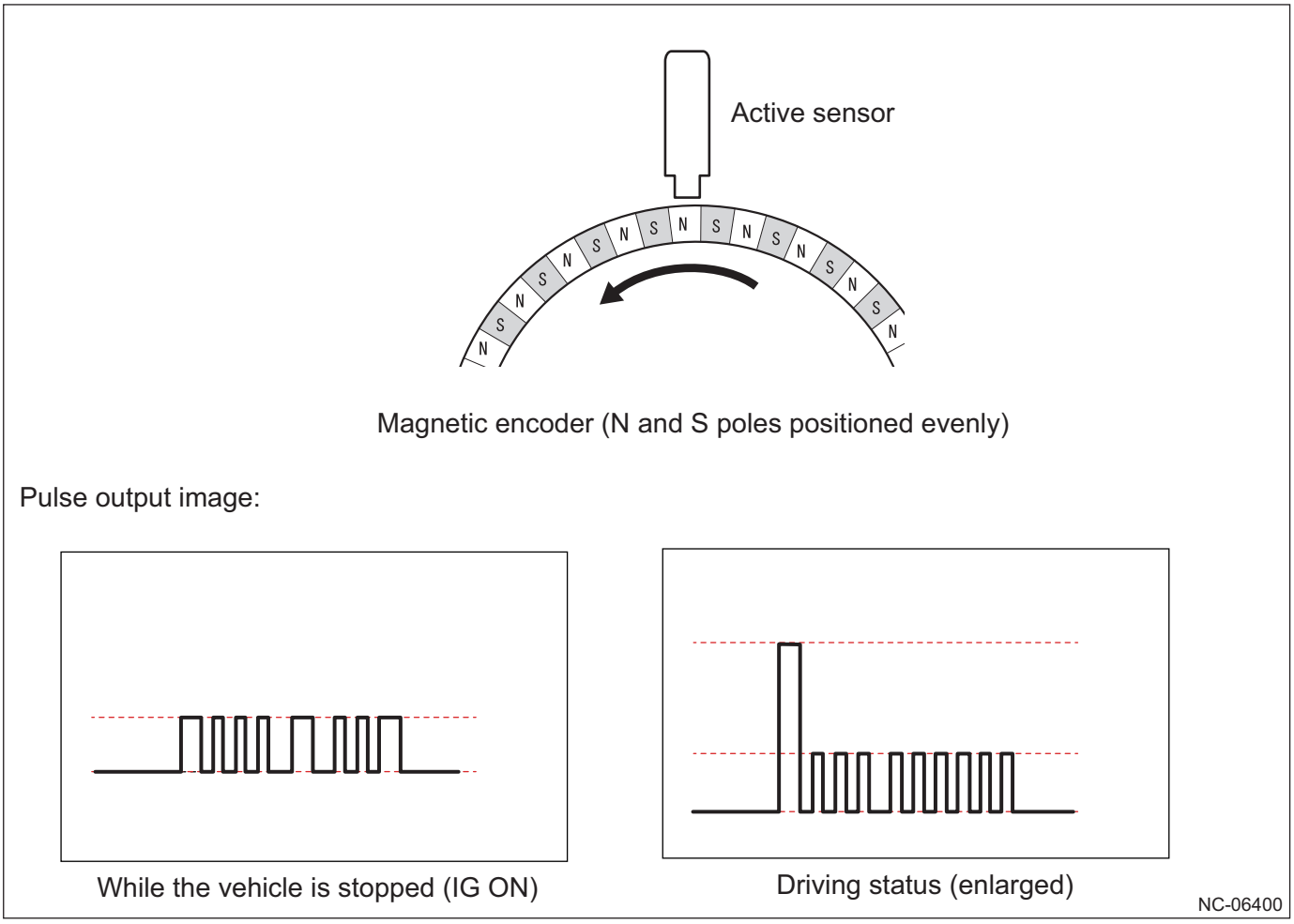
(a) ABS wheel speed sensor

(b) Magnetic encoder

■ Detection principle

The magnetic encoder is installed within the axle hub, and the N-pole and S-pole are arranged evenly in the circumferential direction.

When the magnetic rotor rotates along with the wheel, the magnetic field changes. The semiconductor sensor (active sensor) detects this and outputs the vehicle speed as a pulse signal.



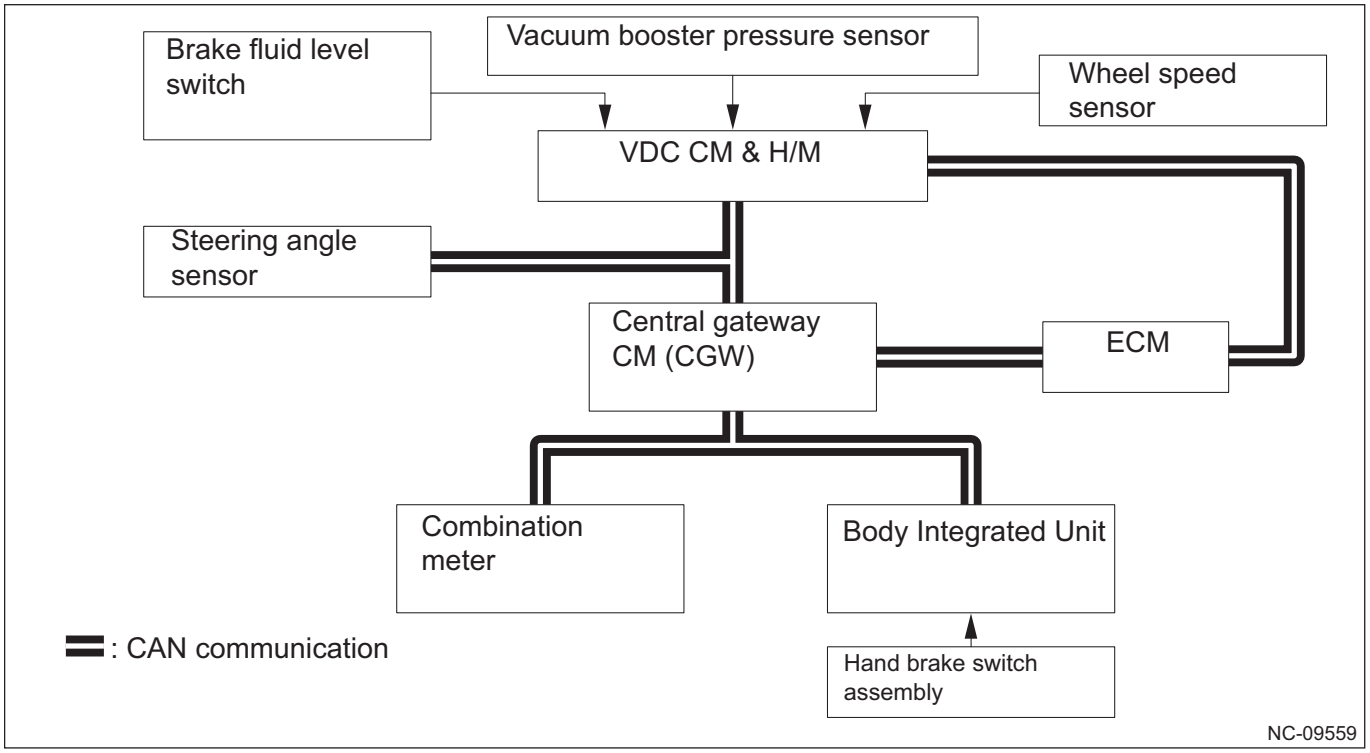
Reference

The wheel speed sensor pulse output continues to output periodically when both the vehicle has stopped and when the vehicle is traveling.

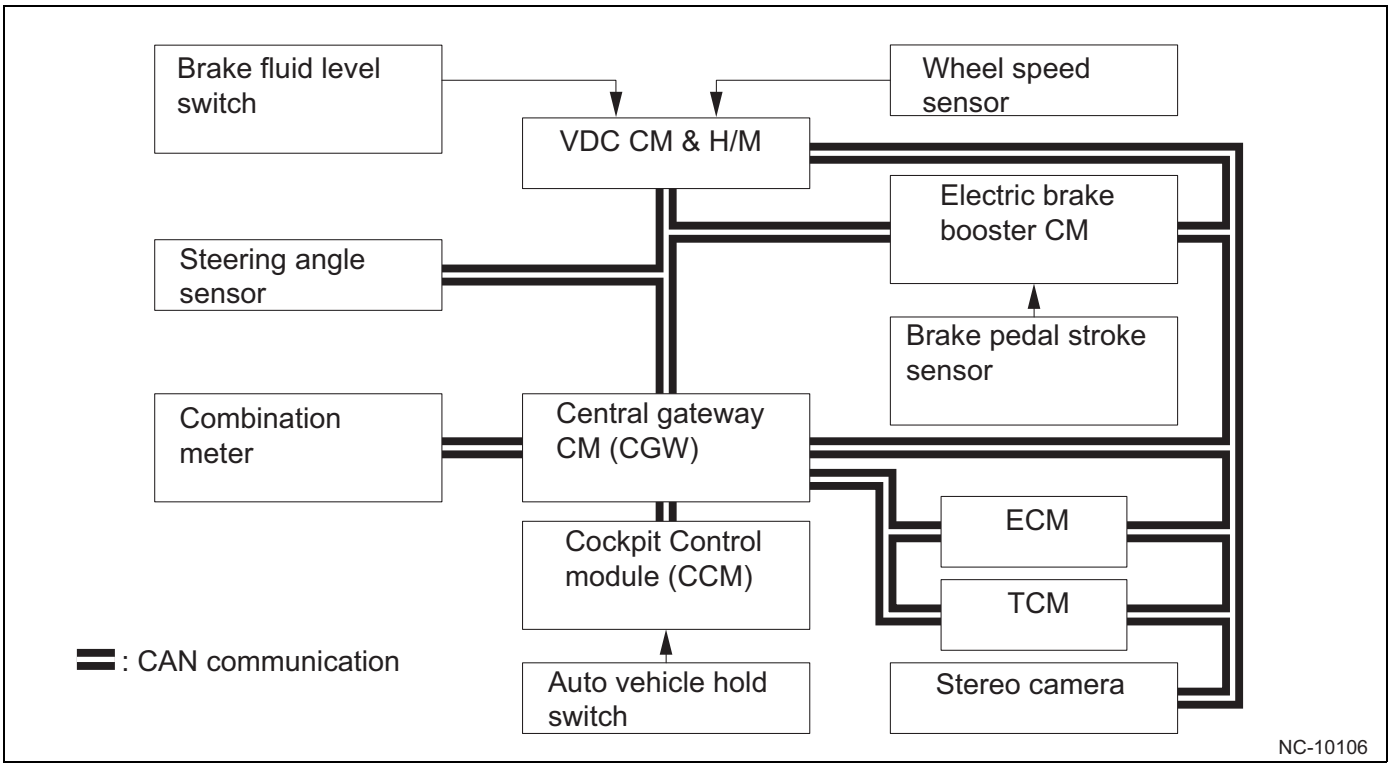
6.3.3 Construction and Operation

System diagram

MT models



CVT models



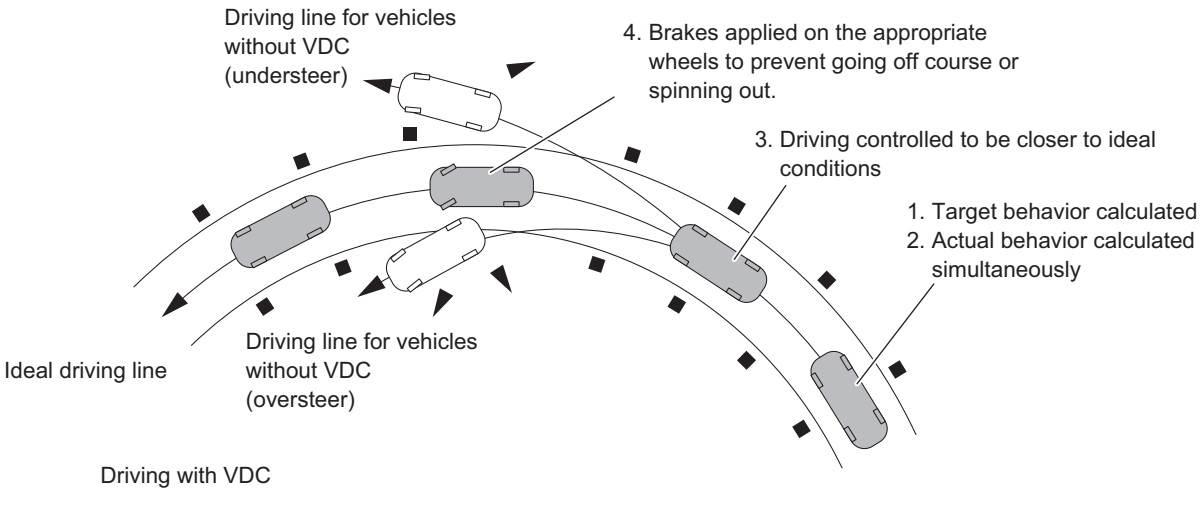
Main component functions

Component		Function
VDC control module and hydraulic control module (VDC CM & H/M)	• Yaw rate and longitudinal sensor • Lateral G sensor	• Performs VDC control based on the signals from the sensors, CM, etc. • Cooperative control is performed by EyeSight and by the master cylinder assembly and electric booster assembly. *1
Transmission control module (TCM)*1		Sends the shift position information to the VDC CM & H/M.
Stop light switch assembly		Detects the status of brake pedal operations by the driver.
Combination meter		• Notifies the driver of the VDC control status or system anomalies by turning on or flashing the various indicators in the combination meter. • Notifies the driver of the vehicle status by displaying an interruption on the multi information display.
Center information display		Notifies the driver of TCS, AVH*1, and other VDC control status.
Center information display	Auto Vehicle Hold switch*1	The Auto Vehicle Hold switch is placed on the center information display, and is used to turn the Auto Vehicle Hold function ON/OFF.
VDC OFF switch		This switch is placed on the instrument panel, and is used to turn the engine torque suppressing function ON/OFF. Switches among the 3 modes of NORMAL, TRACK, and VDC OFF according to the switch operation.
Steering angle sensor		Detects the steering direction and steering angle of the steering.
ABS wheel speed sensor		Detects the wheel speed of the 4 wheels.
Magnetic encoder		
Brake light relay (in main fuse & relay box)		Turns on the stop light.
Engine Control Module (ECM)		Controls the engine torque during VDC control based on the signals from the VDC CM & H/M.
Master cylinder assembly and electric booster assembly*1		• These assemblies are composed of the motor, CM, and other parts. They calculate the required hydraulic pressure based on the depression of the brake pedal by the driver that was read by the brake pedal stroke sensor, and generate brake fluid pressure. • Cooperative control is performed by the VDC CM & H/M and by EyeSight.
Vacuum booster pressure sensor*2		Detects the negative pressure inside the vacuum booster.

**1: CVT models*
**2: MT models*

System details

The yaw rate and longitudinal G sensors, and lateral G sensors are integrated into the VDC control module and hydraulic control module (VDC CM & H/M). They constantly monitor the vehicle status to optimize the timing at which the ABS (anti-lock control), TCS (engine control and brake LSD control), and VDC (engine and brake control to prevent sideslip) are activated. Thus, high driving safety is ensured with these controls.



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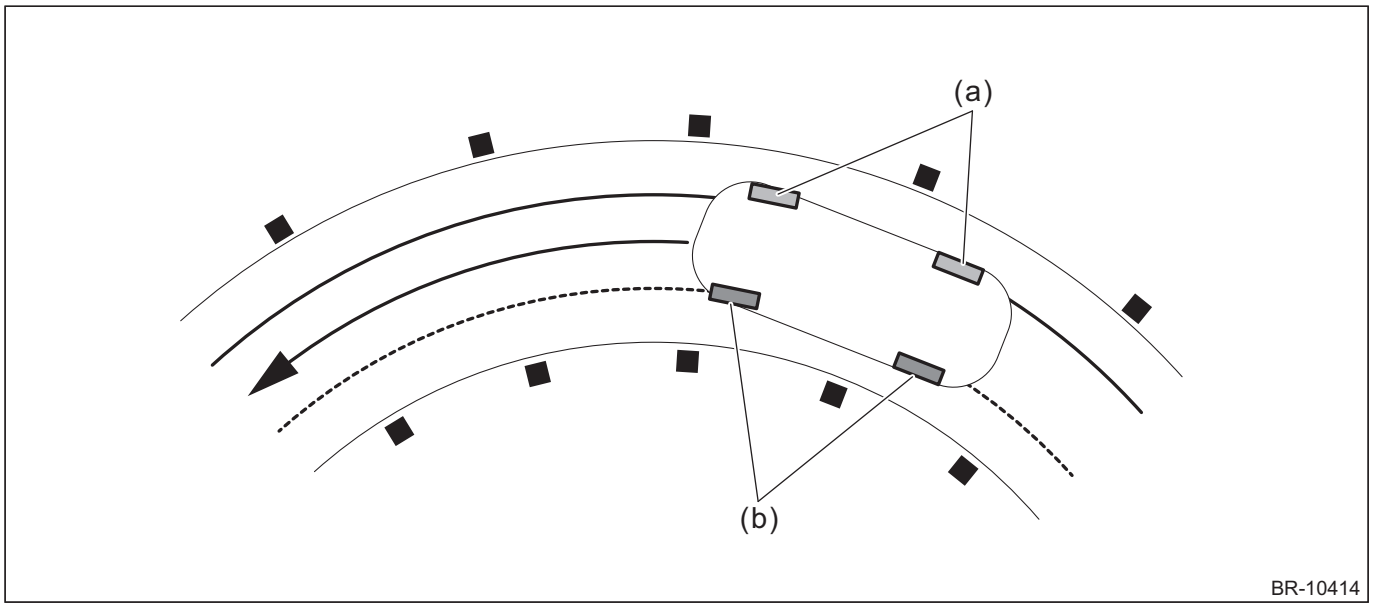
Active torque vectoring

■ When understeering

Brake pressure is applied to the inside wheel, and more torque is distributed to the outer wheel when the vehicle is cornering to improve the maximum turning performance of the vehicle

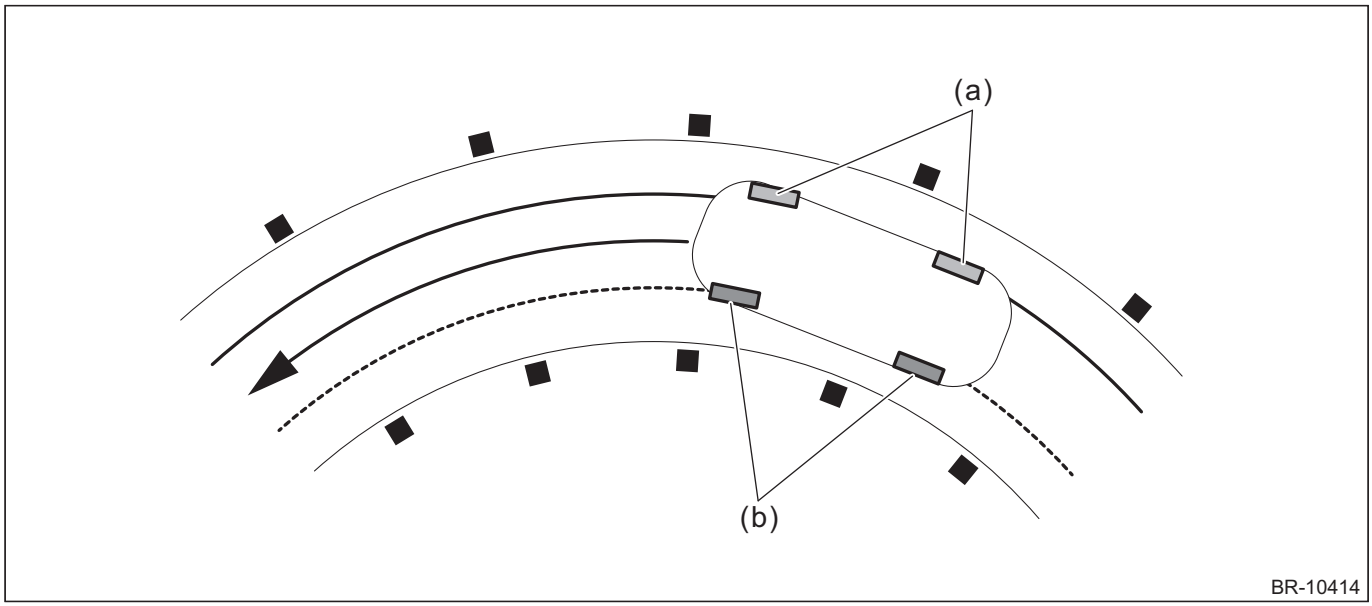


(a) Driving force

(b) Brake

■ When oversteering

Brake pressure is applied to the outer wheel, and more torque is distributed to the inside wheel when the vehicle is cornering to improve the maximum turning performance of the vehicle.



(a) Brake

(b) Driving force

Brake assist

A control system is installed that determines whether brake assist is required based not only to the force applied to the brake pedal but also to the speed at which the brake pedal is depressed, and applies brake assist accordingly to improve safety.

Hill start assist (MT models)

Hill start assist (HSA) is adopted that helps the driver start off the vehicle on a slope.

Even when the driver's foot is released from the brake pedal while the vehicle is stopped on a hill, the brake is held for several seconds for a smooth start off on the hill, bringing peace of mind to the driver.

■ Operating conditions

The hill start assist (HSA) function activates in the following conditions.

- Hill start assist (HSA) function is ON
- While the vehicle is stopped
- When the parking brake is released
- When traveling uphill and the shift lever is set to a position other than R
- When traveling downhill and the shift lever is set to R
- When the accelerator pedal is not depressed

Auto Vehicle Hold (AVH) (CVT models)

When the foot is released from the brake pedal after the vehicle is completely stopped by depressing the brake pedal, the VDC control module and hydraulic control module (VDC CM & H/M) keep the brake fluid pressure. This function detects start operations by the driver (accelerator pedal operation, etc.) to cancel the vehicle hold state.

■ Operation

When the Auto Vehicle Hold switch is turned on while the Auto Vehicle Hold (AVH) indicator light/operation light is off, the function is activated, and the Auto Vehicle Hold (AVH) indicator light/operation light turns on (standby state). When the Auto Vehicle Hold switch is pressed while the Auto Vehicle Hold (AVH) indicator light/operation light is on, the function is disabled, and the Auto Vehicle Hold (AVH) indicator light turns off. When the Auto Vehicle Hold (AVH) function activates while the Auto Vehicle Hold (AVH) indicator light/operation light is on (standby state), the Auto Vehicle Hold (AVH) operation light/operation light flashes in the combination meter and on the center information display. When the ignition switch is turned off, the Auto Vehicle Hold (AVH) is deactivated.

■ Activation and cancelation operations

The Auto Vehicle Hold (AVH) function activates in the following conditions.

- The system is in the standby state by pressing the Auto Vehicle Hold switch.
- The brake pedal is depressed to stop the vehicle.
- The door is closed.
- The driver is wearing the seat belt.
- The shift position is set to a position other than the P position.

The Auto Vehicle Hold (AVH) function is canceled in the following conditions.

- The accelerator pedal is depressed or the brake pedal is depressed again.
- The shift position is set to the P position while the brake pedal is depressed.
- The Auto Vehicle Hold switch is pressed while the brake pedal is depressed.
- ACC is set while the brake pedal is depressed deeply.
- The parking brake switch is pulled.

The Auto Vehicle Hold (AVH) indicator light/operation light turns on (standby state) or off when the function is canceled.

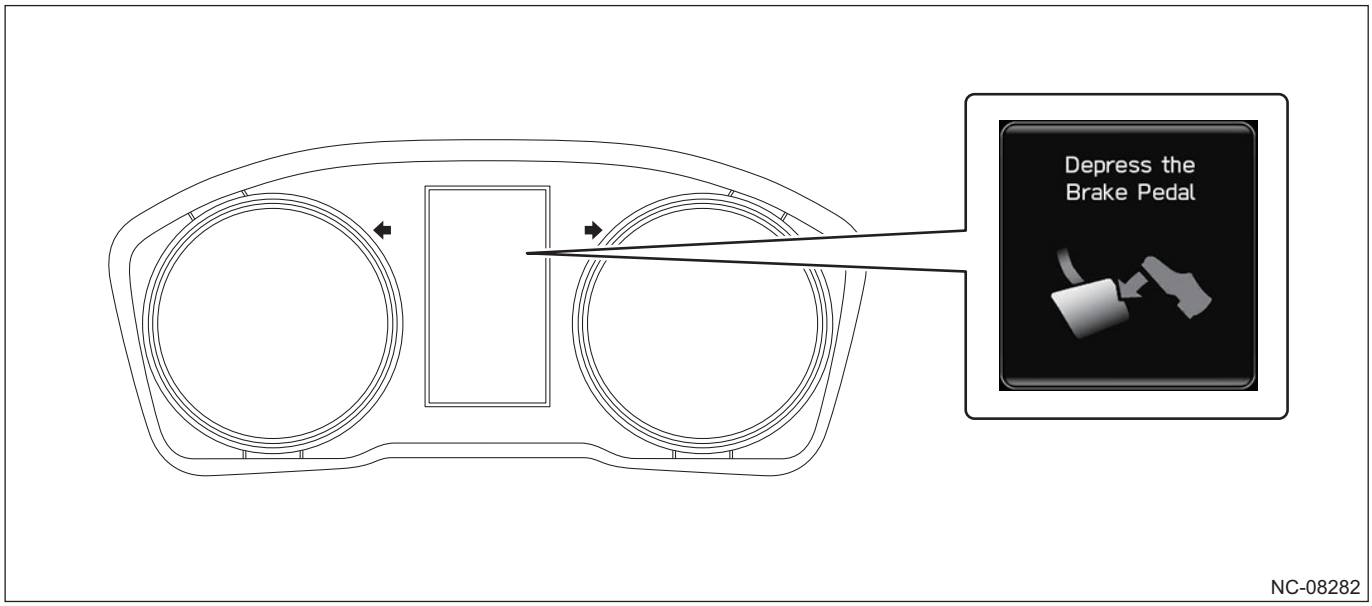
In the following conditions where the Auto Vehicle Hold (AVH) function is operating, the Auto Vehicle Hold (AVH) function is canceled, and then the brake setting shifts automatically to the electronic parking brake (EPB).

- Brake continues to be held for 10 minutes or longer.
- The driver's seat belt is unfastened.
- The driver's seat side door is opened.
- The ignition is set to OFF.
- A problem occurs in the Auto Vehicle Hold (AVH) system.
- The vehicle stops on a sharp upslope.

The Auto Vehicle Hold (AVH) indicator light/operation light turns on (standby state) or off when the function is canceled.

■ Brake-pressing instruction interruption screen

If the AVH switch is turned off without depressing the brake pedal while the AVH is operating, the warning message is displayed in the combination meter to give an instruction to depress the brake pedal.



**The illustration shows a typical example that may differ from the actual display.*

■ Warnings and cautions

Warning

Do not use the AVH function for the purpose of parking. The vehicle may begin to move suddenly and may cause serious injuries.

Make sure to set the AVH function to OFF when using a car washer or when the vehicle is towed by another vehicle.

Do not use the AVH function on a sharp upslope or a slippery road.

Caution

If the vehicle stops on a sharp upslope while the AVH function is activated, the electronic parking brake (EPB) may be activated and the electronic parking brake operation indicator may flash after the vehicle is stopped. In this case, since the vehicle may begin to move, keep the brake pedal depressed while the vehicle is stopped. When leaving the vehicle, move it to a level ground and activate the electronic parking brake (EPB) to park the vehicle.

When using the Auto Vehicle Hold (AVH) function, do not release the brake pedal until the Auto Vehicle Hold (AVH) indicator light/operation light flashes. Doing so may cause the vehicle to move suddenly.

Depending on road surface conditions or how much the brake pedal is depressed, the vehicle may be temporarily held or the brake pedal may become hard, causing unusual operational feeling. This is not a malfunction.

Fail-safe

The fail-safe function operates when an abnormality occurs in the system. At this time, the driver is notified of the system anomaly by the various warnings displayed in the combination meter according to the abnormal function. For details on the various warning displays, check the owner's manual.

6.4 Electronic parking brake (EPB)

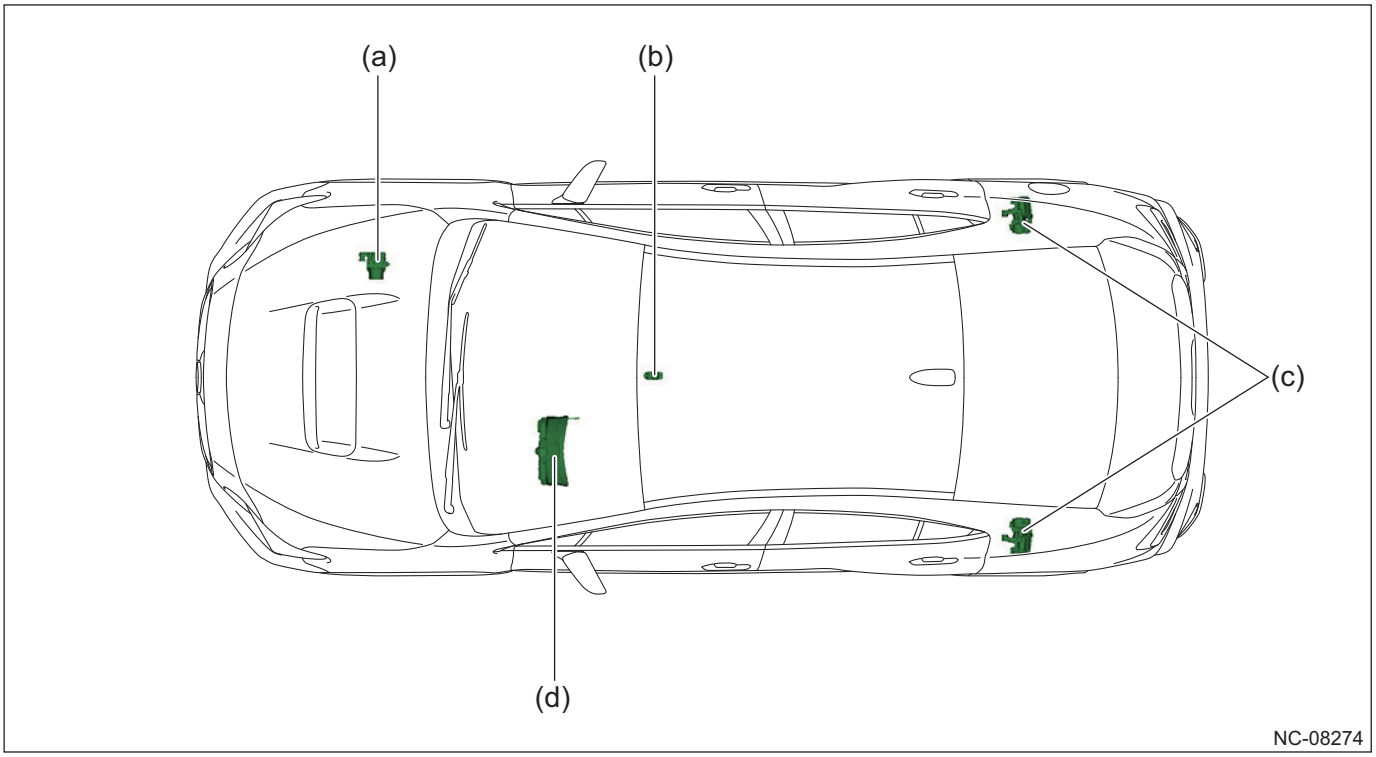
6.4.1 Overview

Overview

An electronic parking brake (EPB) is adopted. The parking brake lever is removed to realize comfortable indoor space. This also ensures the stable braking force of the parking brake while the parking brake lever operation is not required.

6.4.2 Component

Component layout drawing



(a) VDC control module and hydraulic control module (VDC CM & H/M)

(b) Parking brake switch

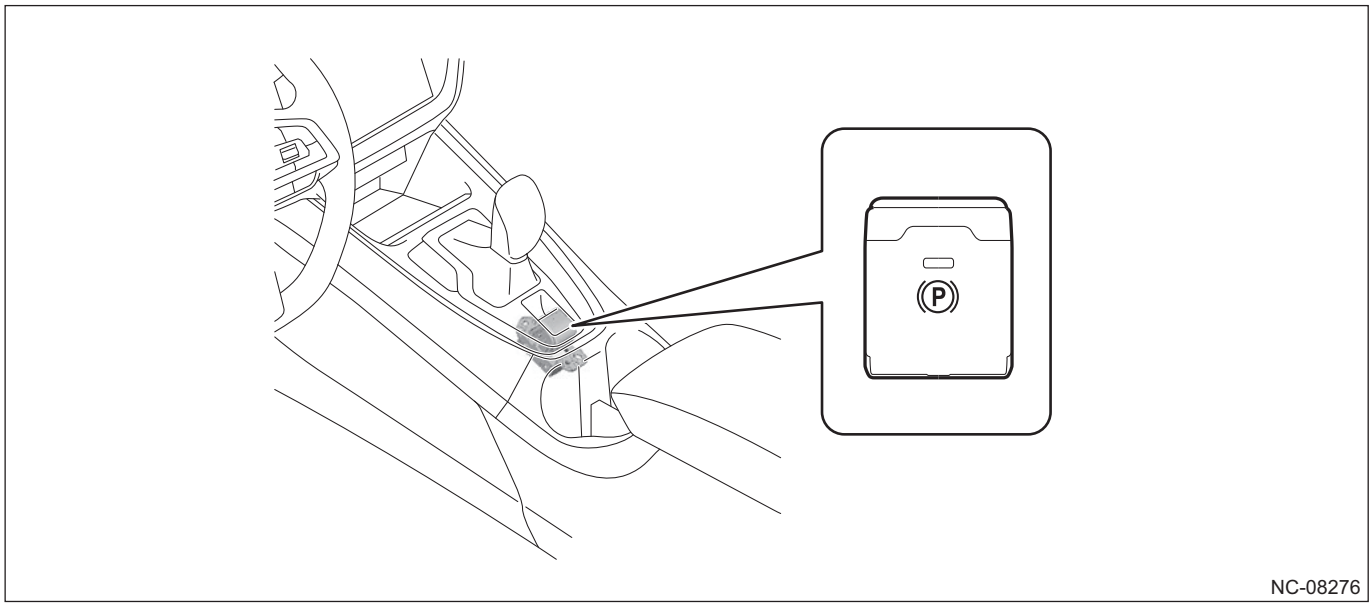
(c) Electronic parking brake actuator (built into caliper)

(d) Electronic parking brake operation indicator (in the combination meter)

Component details

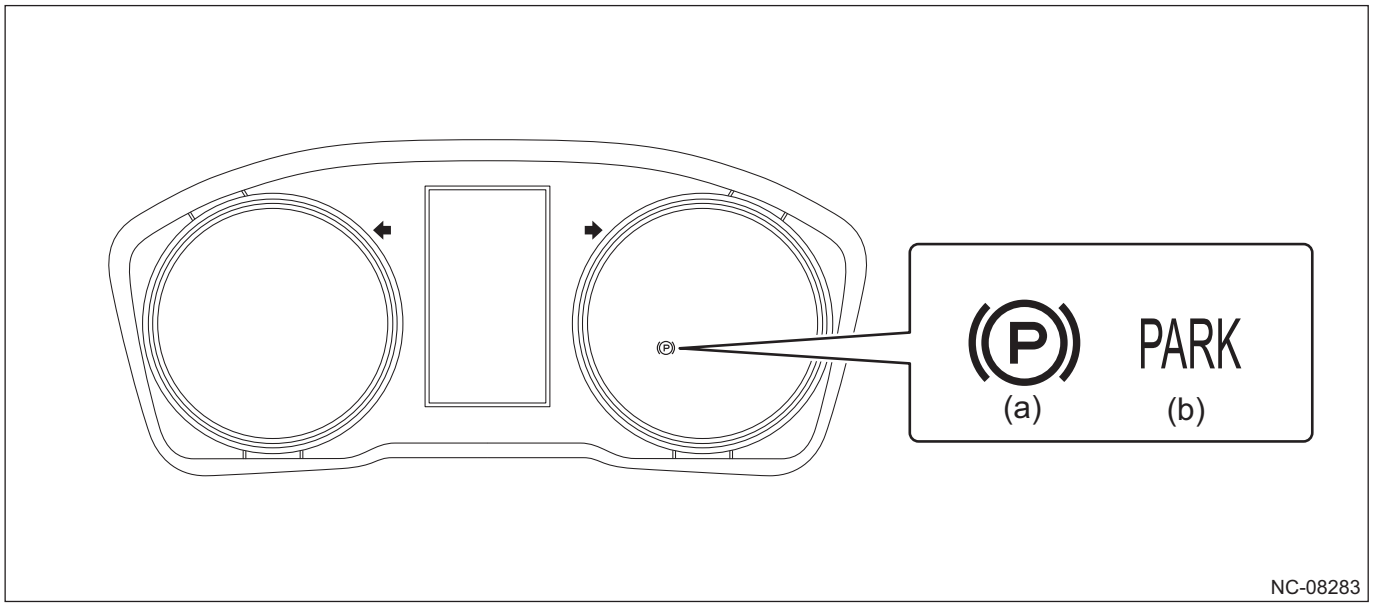
Parking brake switch

A switch is installed on the center console so that the driver can operate it easily.



Electronic parking brake operation indicator

When the electronic parking brake activates, the electronic parking brake operation indicator light in the combination meter turns on.

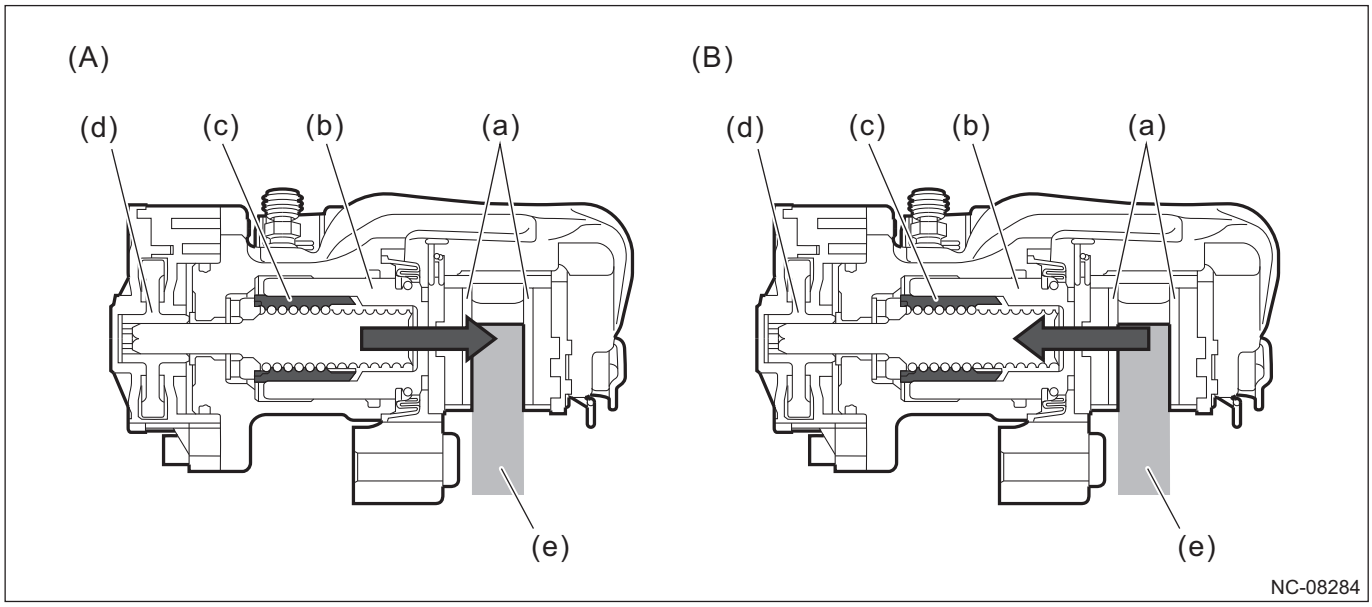


(a) Electronic parking brake operation indicator light (other than U4, U7)

(b) Electronic parking brake operation indicator light (U4, U7)

Electronic Parking Brake

An actuator is mounted inside the rear brake caliper. The motor is driven to push out the brake pad by the parking brake switch operation and the parking brake is applied.



(A) When operated

(B) When released

(a) Brake pad

(b) Piston

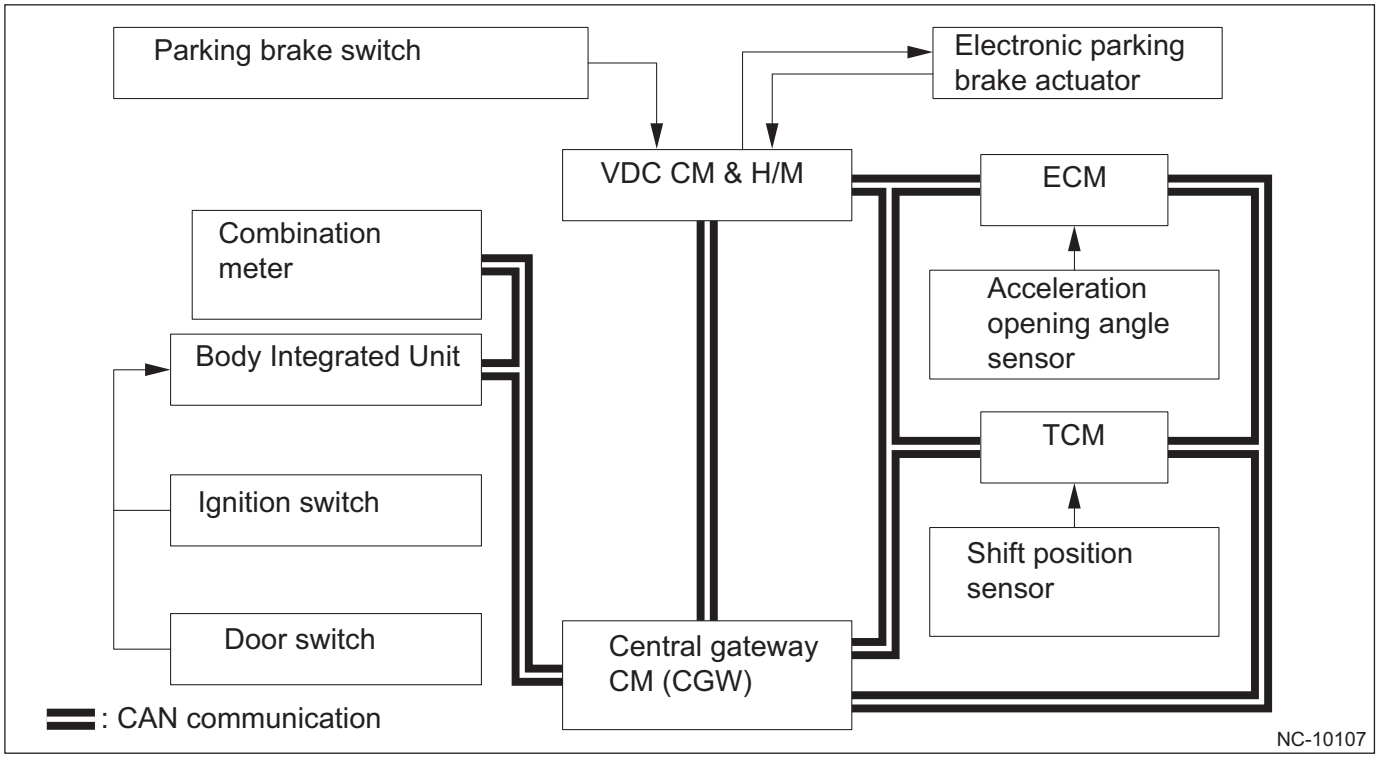
(c) Nut

(d) Motor section

(e) Disc rotor

6.4.3 Construction and Operation

System diagram



Main component functions

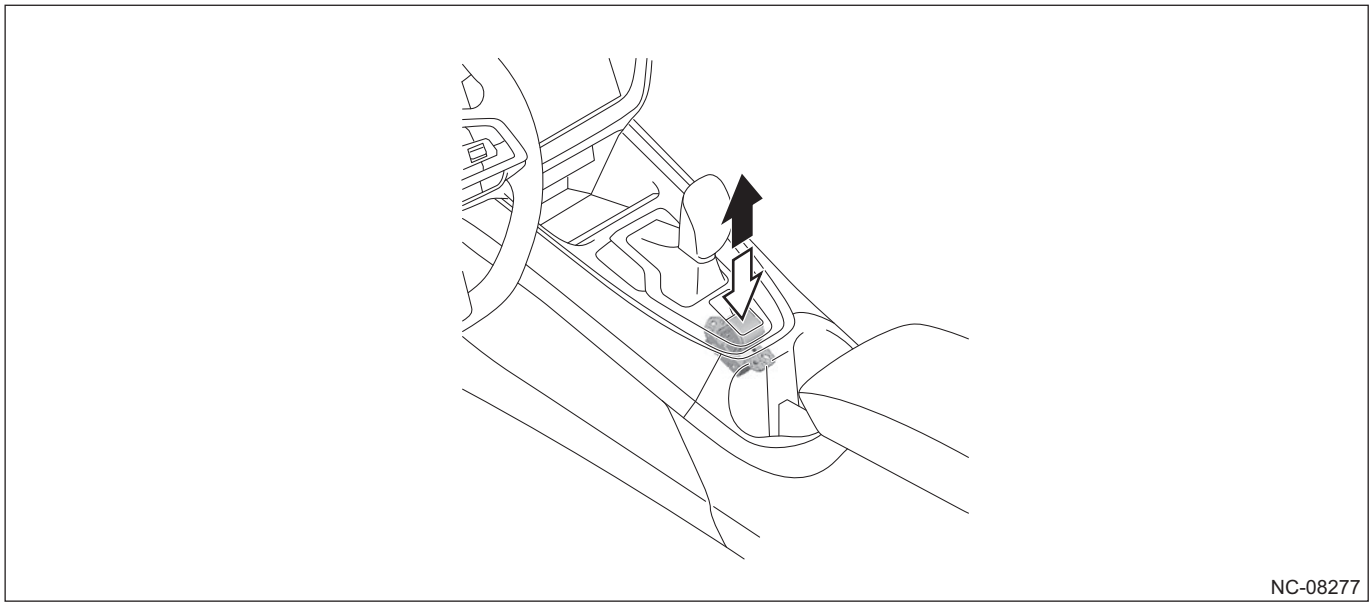
Component	Function
VDC control module and hydraulic control module (VDC CM & H/M)	Contains a built-in electronic parking brake control circuit, and sends the control signal to the electronic parking brake actuator according to operation of the parking brake switch.
Parking brake switch	• Switches between activation and deactivation of the electronic parking brake. • The illumination status of the switch LED notifies the driver of the electronic parking brake activation status.
Electronic parking brake actuator (built into caliper)	This is built into the rear brake caliper, and controls the electronic parking brake based on the signal from the VDC CM & H/M.
Electronic parking brake operation indicator (in the combination meter)	This is provided in the combination meter, and the illumination status notifies the driver of the electronic parking brake activation status.

System details

Electronic parking brake (EPB) function

The electronic parking brake operates (EPB) by pulling up the parking brake switch (toward the black arrow) when the ignition is ON, and then the electronic parking brake operation indicator in the combination meter and LED of the parking brake switch unit turn on. The electronic parking brake (EPB) is released by pushing down the parking brake switch (toward the white arrow) while depressing the brake pedal, and then the electronic parking brake operation indicator in the combination meter and LED of the parking brake switch unit turn off. Also, the electronic parking brake (EPB) can operate when the ignition is OFF.

If there is an abnormality in the electronic parking brake (EPB) system, the electronic parking brake warning light (yellow) turns on.



■ Accelerator interlocking function

This function detects start operations by the driver (accelerator pedal operation, etc.) to automatically release the electronic parking brake (EPB). If the driver is not wearing a seat belt when opening the door, the automatic cancelation is prohibited to prevent erroneous cancelation. (Manual cancelation is possible.)

Caution
In cases where the auto vehicle hold (AVH) function is activated, the driver's door is open, or the driver's seat belt is unfastened, the parking brake is not released even if operating the accelerator pedal.

Fail-safe

The fail-safe function operates when an abnormality occurs in the system. At this time, the driver is notified of the system anomaly by the various warnings displayed in the combination meter assembly according to the abnormal function. For details on the various warning displays, check the owner's manual.

6.5 Parking Brake

6.5.1 Overview

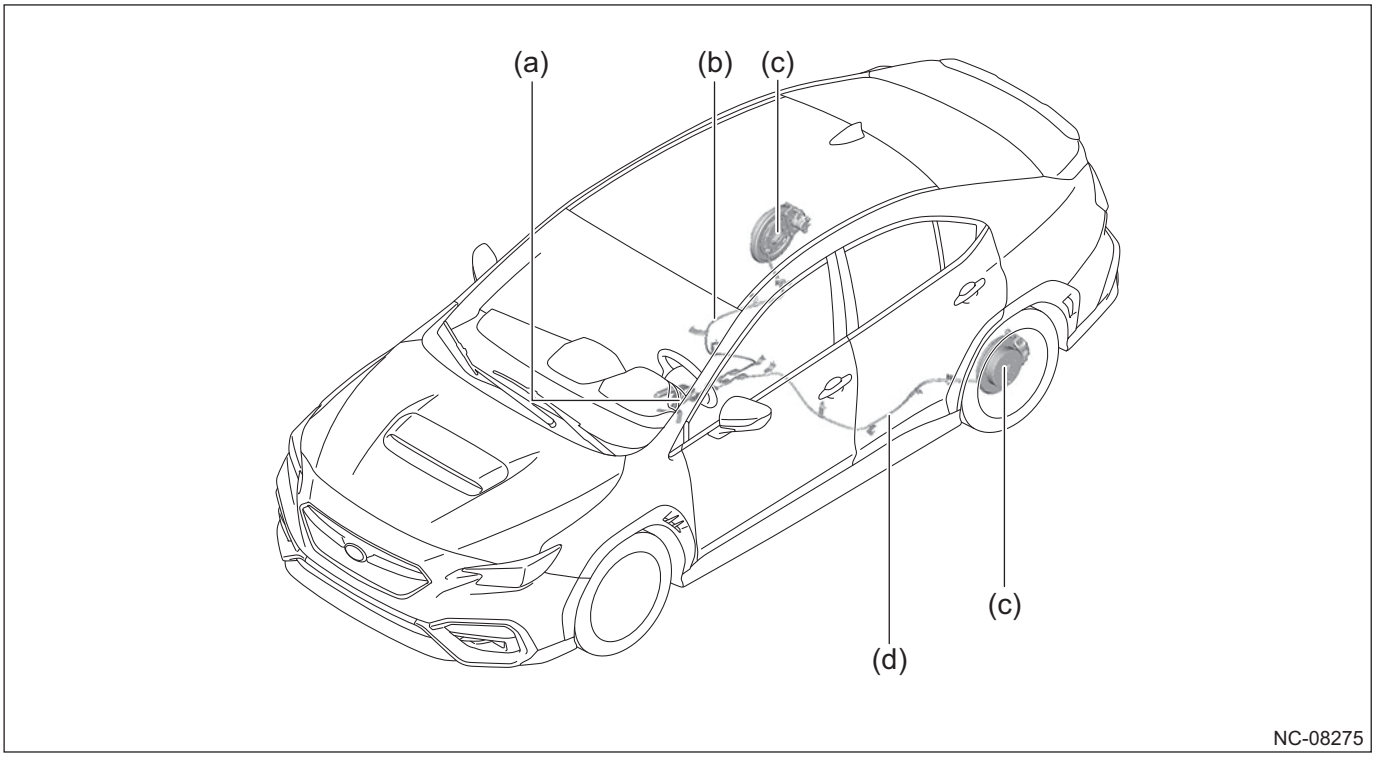
Overview

The following type of parking brake is adopted.

- Hand-operated Lever Type Parking Brake
- Light and high-performance forward pull type duo servo parking brake
- Parking brake lever with optimized lever ratio

6.5.2 Component

Component layout drawing

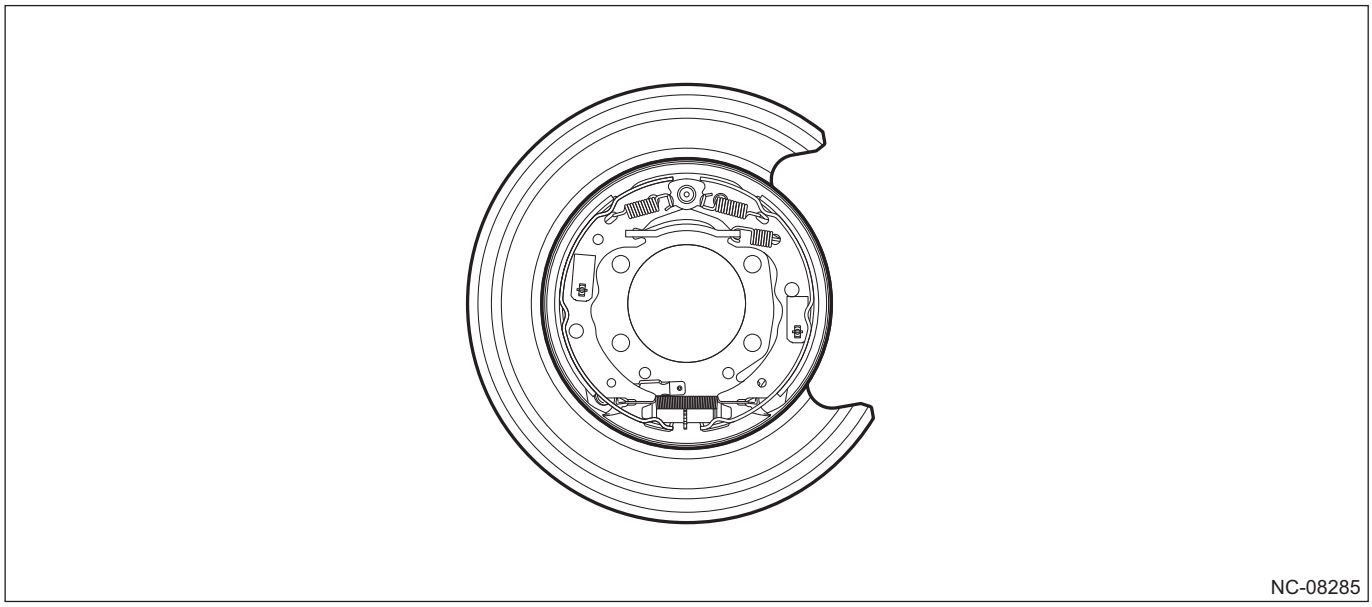


(a) Hand brake lever assembly
(b) Hand brake cable assembly RH
(c) Parking brake assembly
(d) Hand brake cable assembly LH

Component details

Parking Brake

A light and high-performance forward pull type of duo servo parking brake is adopted.



Parking brake lever

A resin parking brake lever is adopted. The lever ratio is also optimized for an excellent operation feeling

7 STEERING

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7.1 General Overview

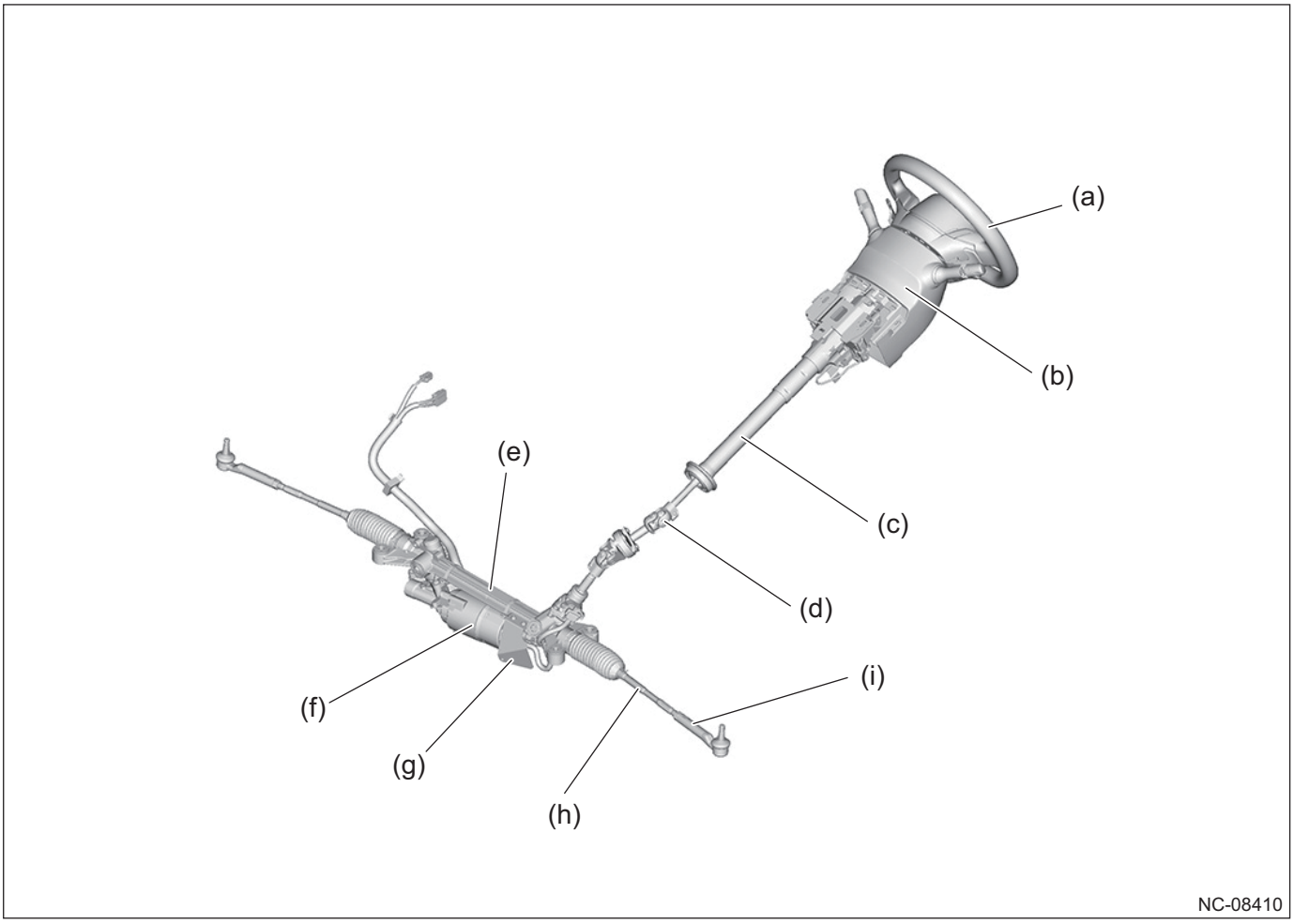
7.1.1 Overview

Overview

In this chapter, steering mechanisms such as a steering wheel and a steering column, and power assisted system that assists steering force are described.

7.1.2 Component

Component



(a) Steering wheel
(b) Column cover
(c) Steering column
(d) Universal joint
(e) Steering gearbox
(f) Control module-integrated motor
(g) EPS cover
(h) Tie-rod
(i) Tie-rod end

7.2 Steering

7.2.1 Overview

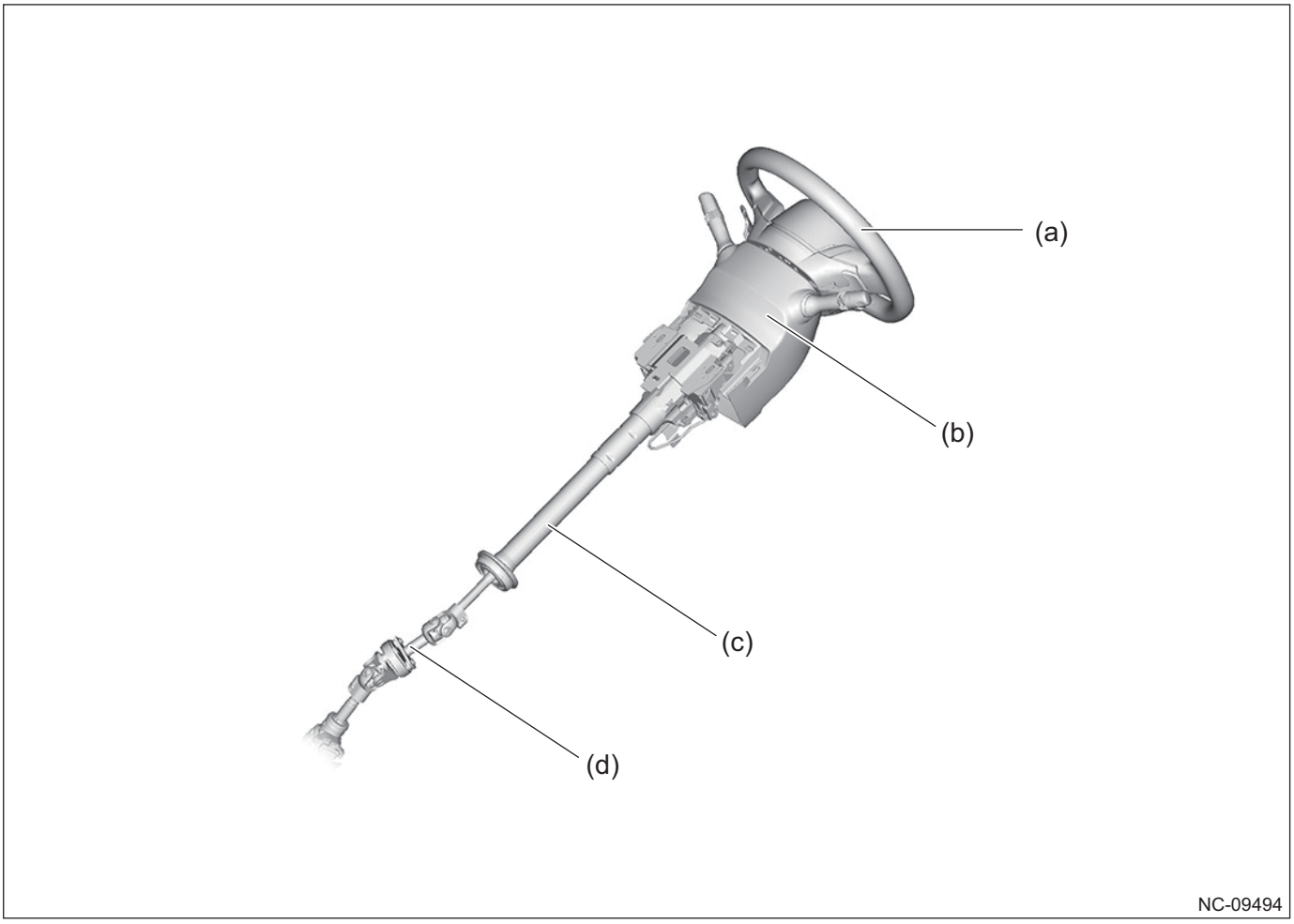
Overview

The following items are adopted for the steering wheel to improve safety and operability.

- Small diameter steering wheel
- Steering column with sufficient collapse stroke amount and increased tilt/telescopic adjustment amount

7.2.2 Component

Component layout drawing

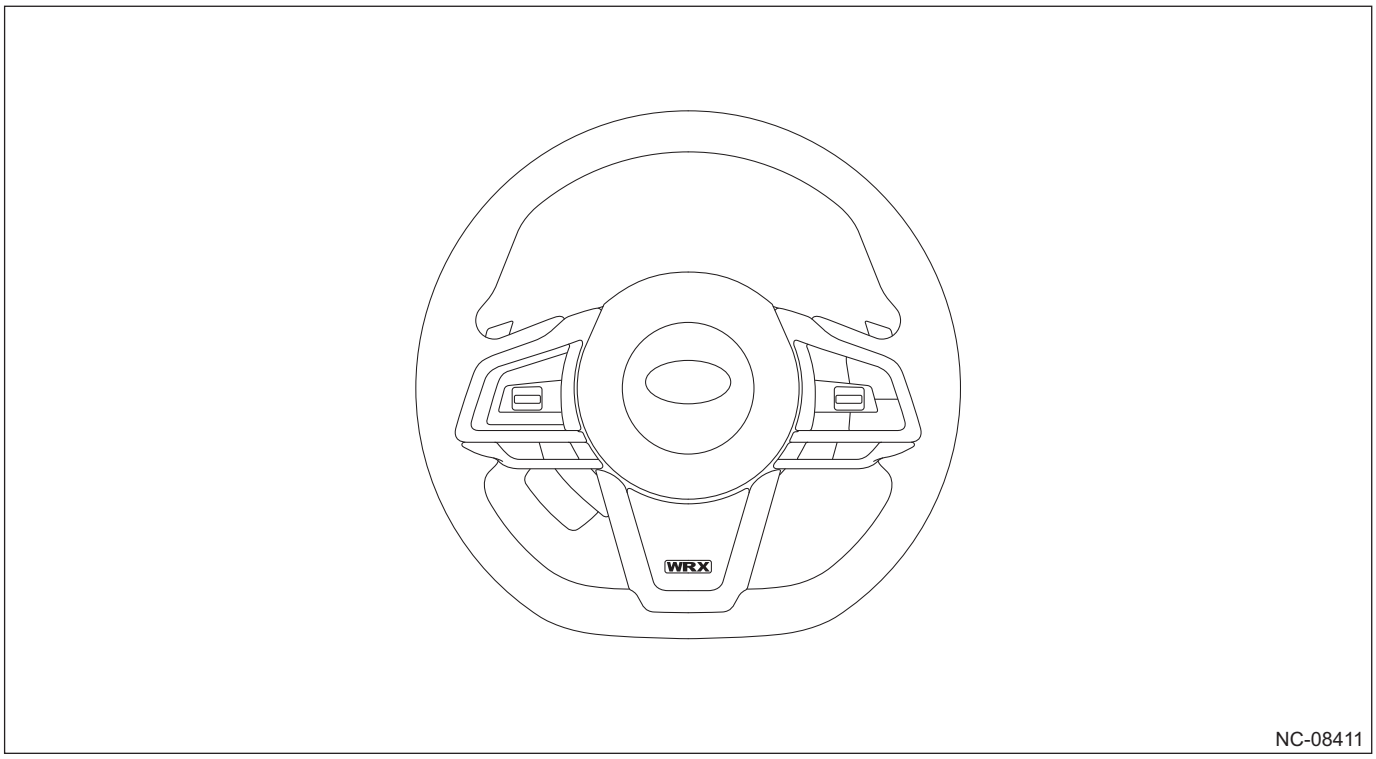


(a) Steering wheel
(b) Column cover
(c) Steering column
(d) Universal joint

Component details

Steering wheel

Steering wheel with a small diameter of φ14.6 in (370 mm) is adopted for handleability and quick steering feel. The WRX logo is adopted on the steering wheel center bezel. Real leather is adopted for the surface of the steering.



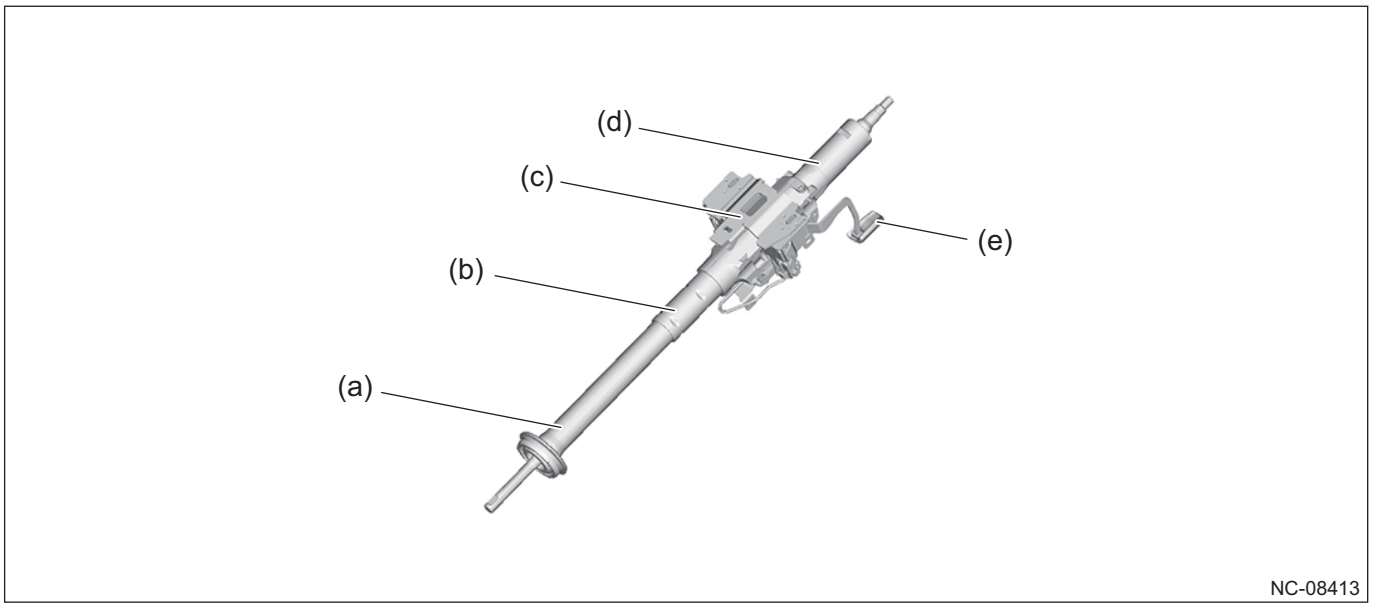
Steering column

The increased tilt/telescopic adjustment amount realizes a natural driving posture, regardless of the driver's body shape.

- Tilt adjustment amount: 2.1 in (54 mm)
- Telescopic adjustment amount: 2.2 in (55 mm)

The collapse stroke amount for the steering column is changed to improve the passenger protection performance on collision.

- Collapse stroke amount: 7.3 in (186.5 mm) or more



(a) Lower jacket
(b) Middle jacket
(c) Tilt bracket
(d) Upper jacket
(e) Tilt lever

7.3 Power Assisted System

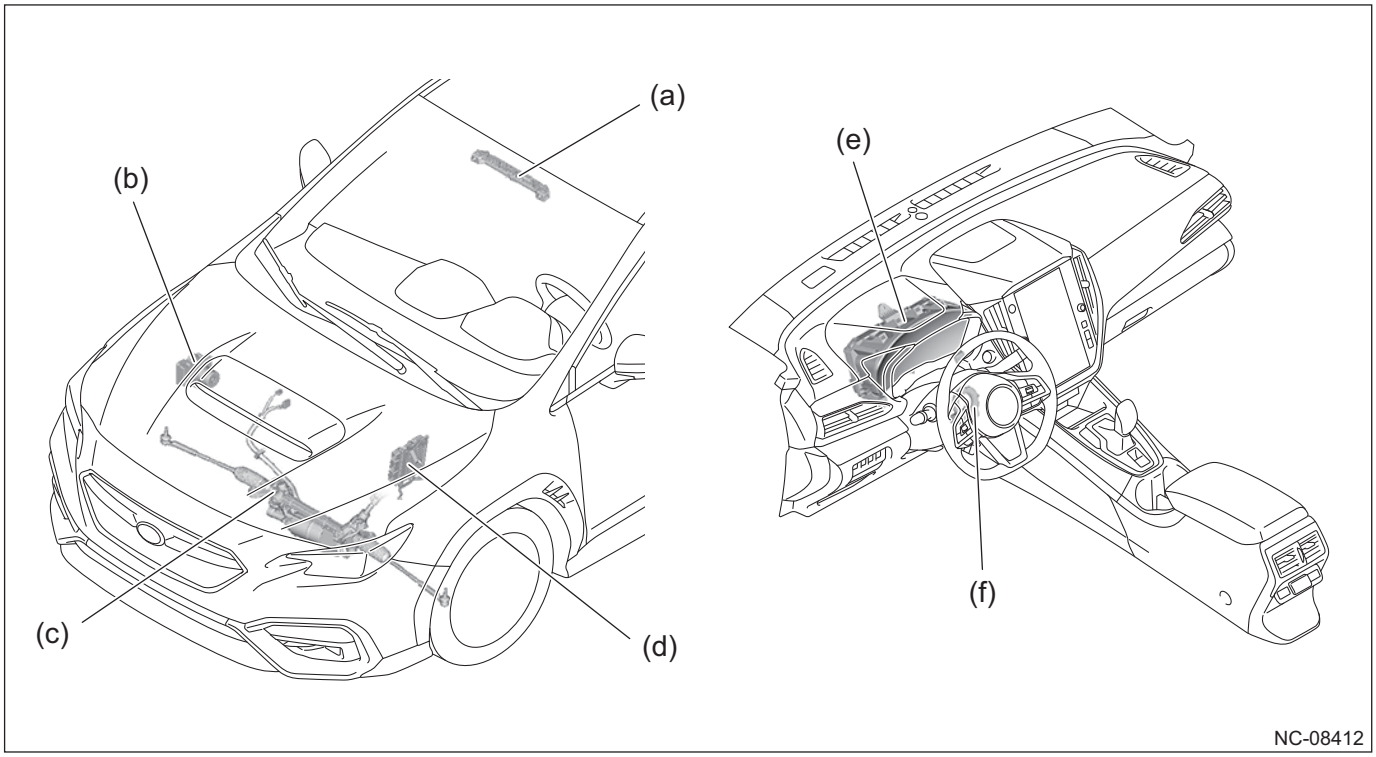
7.3.1 Overview

Overview

A 2 pinion type is adopted with separate shafts for the electric power steering motor and the driver steering operation. The reduced friction allows smooth and linear torque transmission, producing a direct and natural steering feel and achieving sporty steering with no response delay.

7.3.2 Component

Component layout drawing



(a) Stereo camera
(b) VDC CM & H/M
(c) Steering gearbox
(d) Engine control module (ECM)
(e) Combination meter
(f) Steering angle sensor

Component details

Electric power steering

As a result of the change to 2 pinions, there are now 2 shafts: a steering wheel shaft and an assist shaft. The steering wheel shaft is composed of a torque sensor that detects the input torque from the driver, and a rack-and-pinion that transmits steering force. The assist shaft is composed of a power steering control module that receives transmitted signals and torque, a worm reduction gear that reduces the speed of the power steering motor, and rack-and-pinion that transmits assist force.

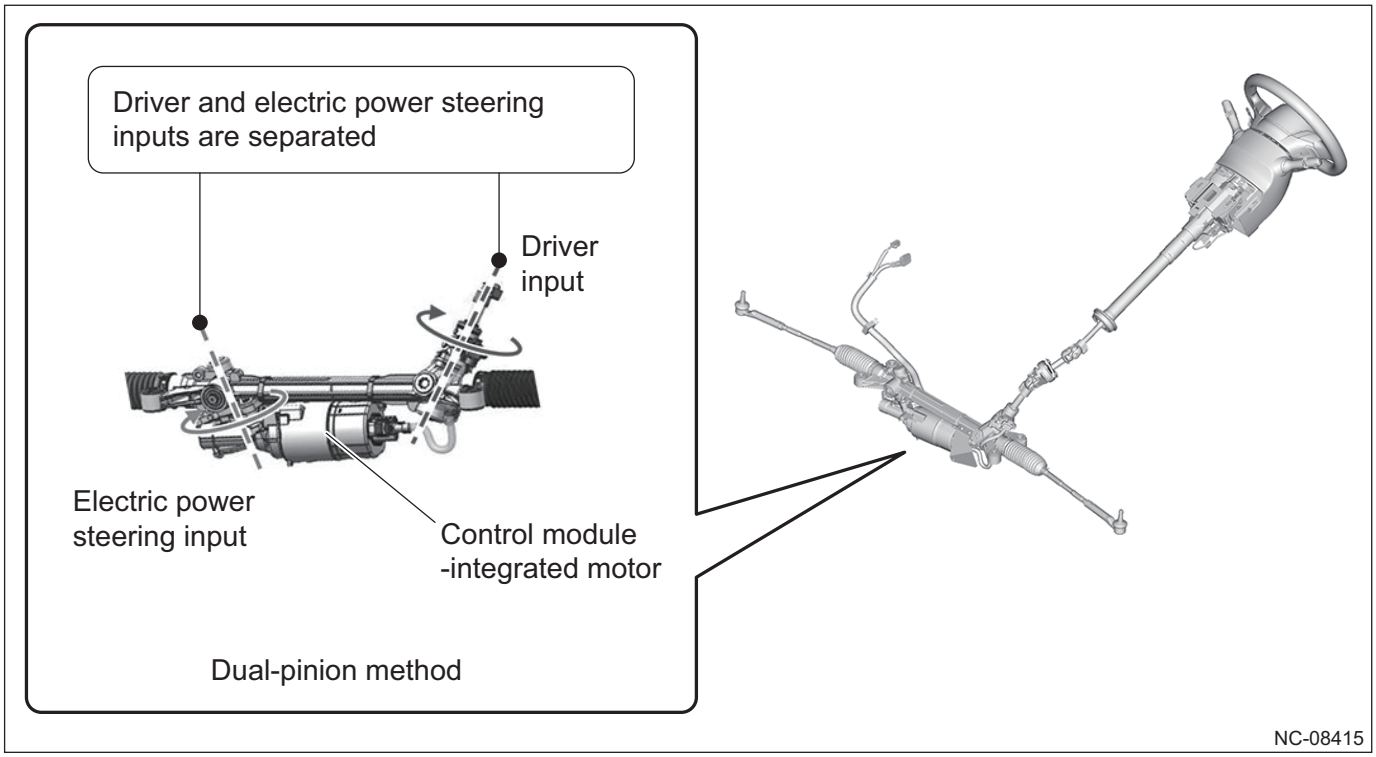
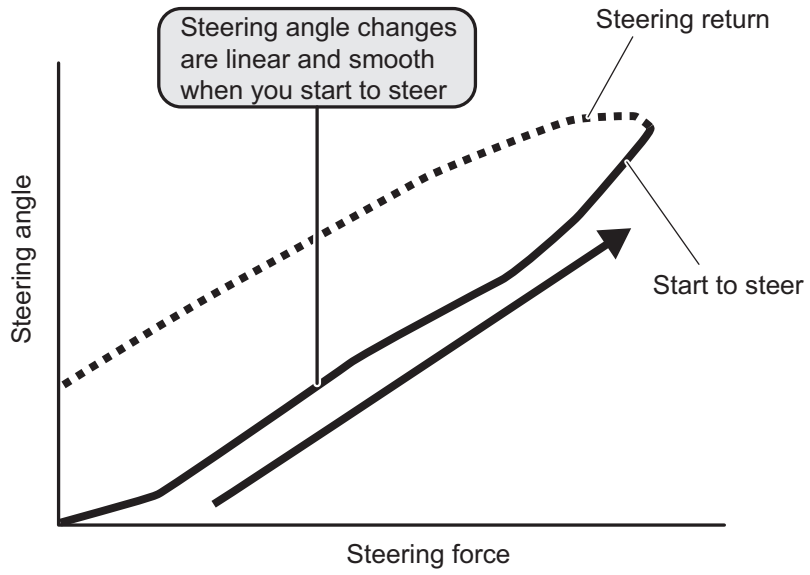


Image of steering force and steering angle



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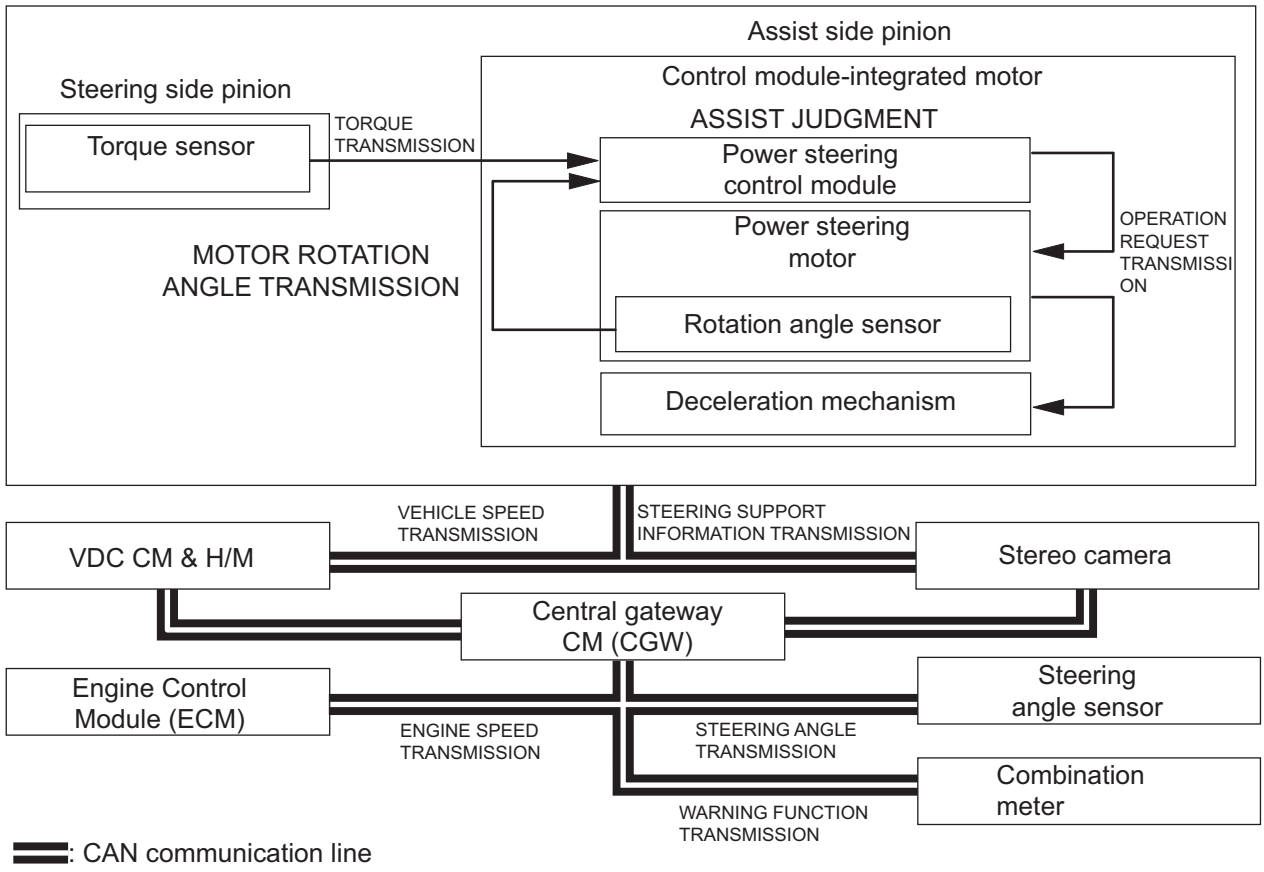
7.3.3 Construction and Operation

System diagram



Main component functions

Component			Function
Stereo camera			Sends requests for steering operation assist to the power steering control module.
VDC CM & H/M			Sends the vehicle speed signal to the power steering control module.
Steering gearbox	Torque sensor		Detects the steering torque of the steering wheel.
	Control module-integrated motor	Power steering control module	Calculates the assist current from the torque sensor signal and vehicle speed signal, and outputs the information to the power steering motor.
		Rotation angle sensor	Detects the rotation angle of the power steering motor.
		Power steering motor	Generates assist torque according to the assist current from the power steering control module.
	Deceleration mechanism		Reduces the power steering motor rotation speed and transmits it to the rack shaft.
Engine Control Module (ECM)			Sends the engine speed signal to the power steering control module.
Combination meter			Turns on the power steering warning light when a failure occurs in the power steering system.
Steering angle sensor			Detects the steering angle and steering direction of the steering wheel.

System details

Steering force and steering angle

The power steering control module calculates the steering assist based on steering torque information from the torque sensor, vehicle speed information from the VCD CM, and information from various computers. It then controls the power steering motor in order to generate the required assist torque.

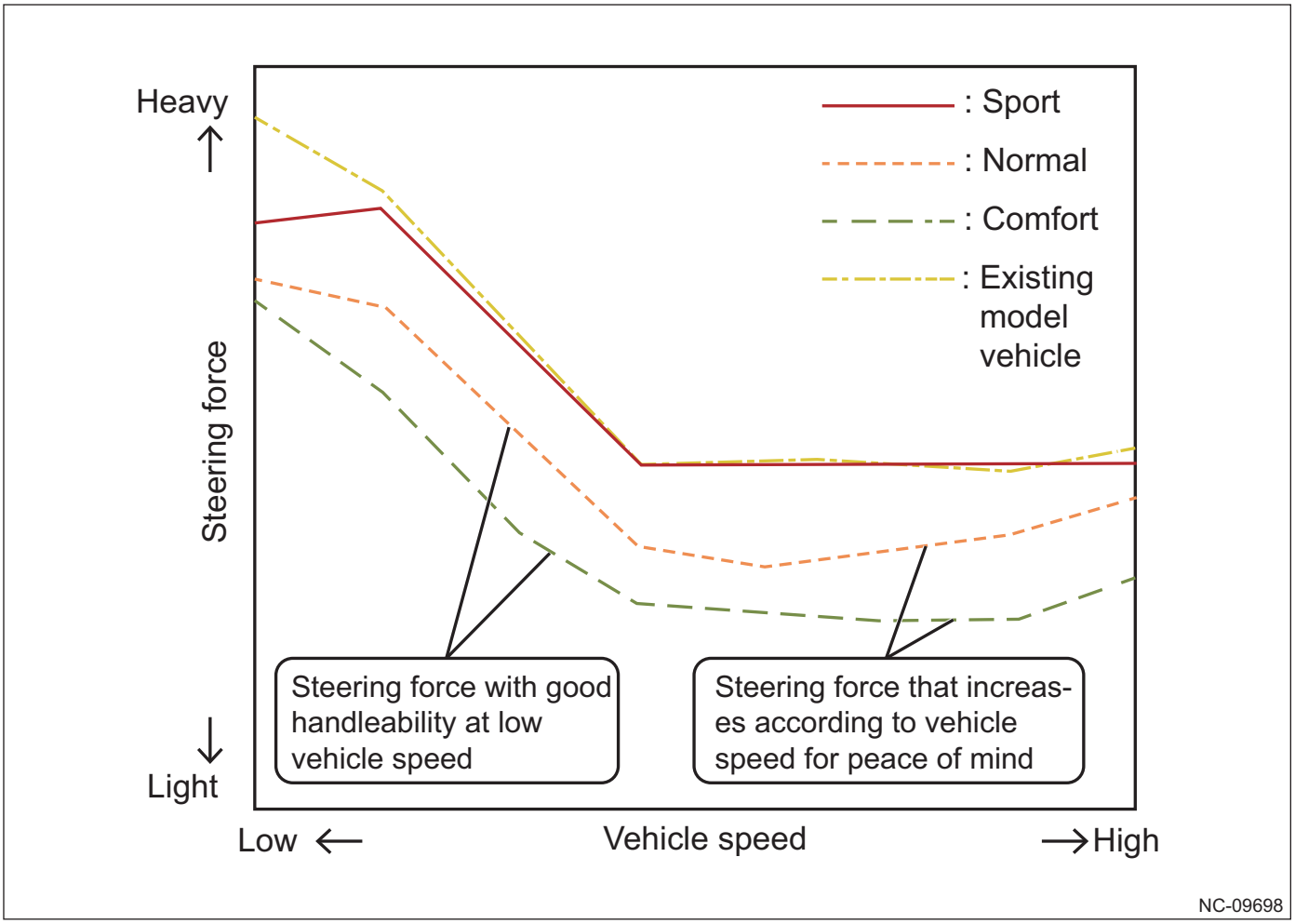
Steering control description
Based on steering torque information and vehicle speed information, the power steering motor drive current is controlled, and assist torque is generated according to the vehicle speed information in order to reduce the steering force.
Assist torque is provided according to operation of the steering wheel, improving the steering feel.
The power steering control module receives the vehicle speed signal from the VDC CM and controls the steering torque according to the control status of the brake control system.
The power steering control module assists steering operations according to the activation status of the advanced safety system and based on the request signals from the stereo camera. For details, refer to "ADVANCED SAFETY SYSTEM".
Vehicles equipped with variable effort power steering can change the assist characteristics to produce a steering feel that matches each drive mode.

Variable effort power steering

In vehicles equipped with drive mode select, variable effort power steering is provided depending on the specifications. 3 modes (Comfort, Normal, Sport) with different steering force characteristics are set, and can be selected to match the customer preference by using drive mode select.

Drive mode	Description
Sport	A mode that provides sporty driving enjoyment
Normal	A mode that balances steering stability and ride quality
Comfort	A relaxed and comfortable mode

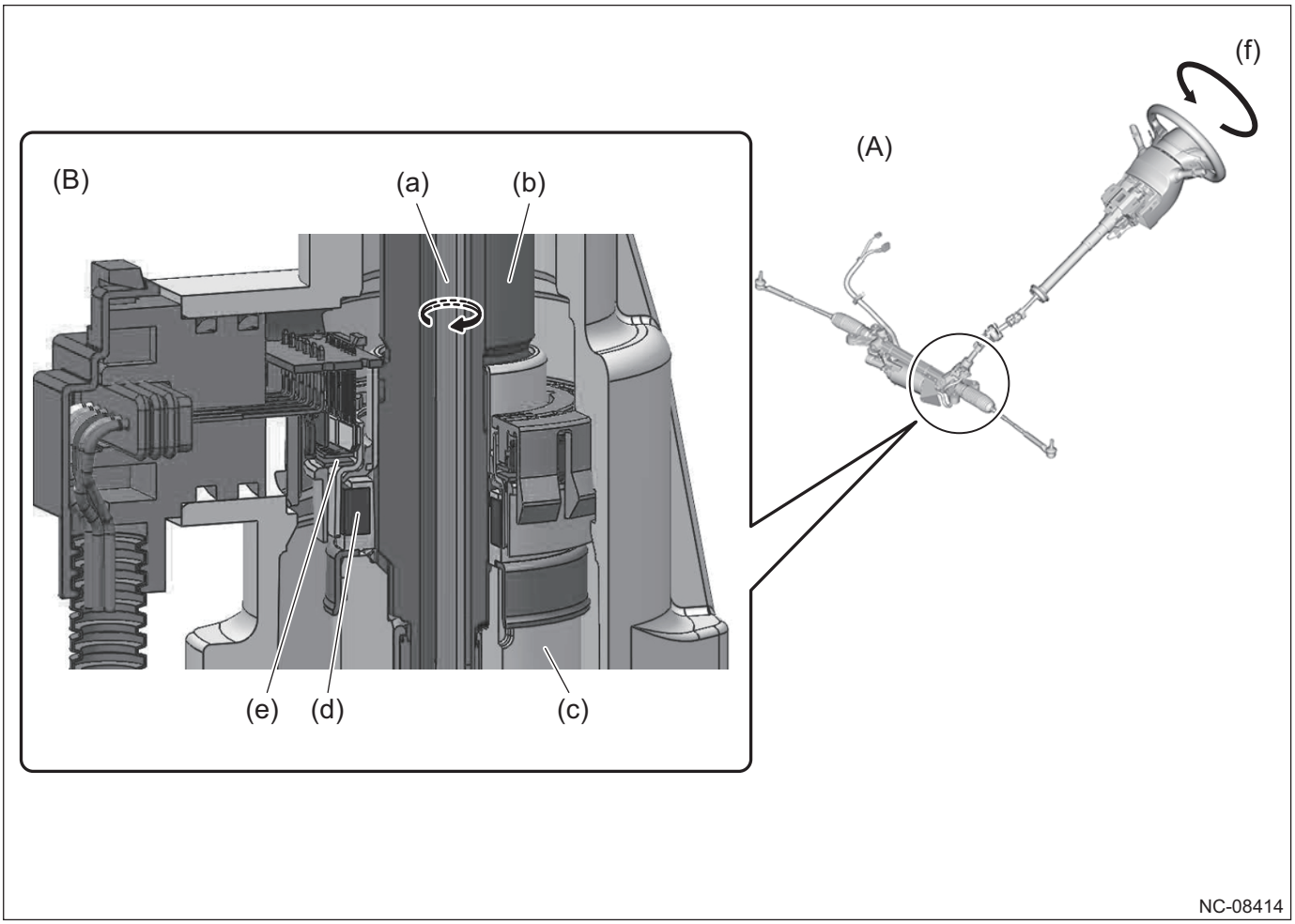
Image of variable effort power steering



Function

Torque sensor

The input shaft is coupled with the pinion shaft through the torsion bar. The relative angle change occurs between the input shaft and the pinion shaft when operating the steering due to a twist of the torsion bar caused by the steering torque. The torque sensor detects a change in magnetic force caused by angle change using the Hall IC and outputs the value of the change as the steering torque value to the power steering control module.

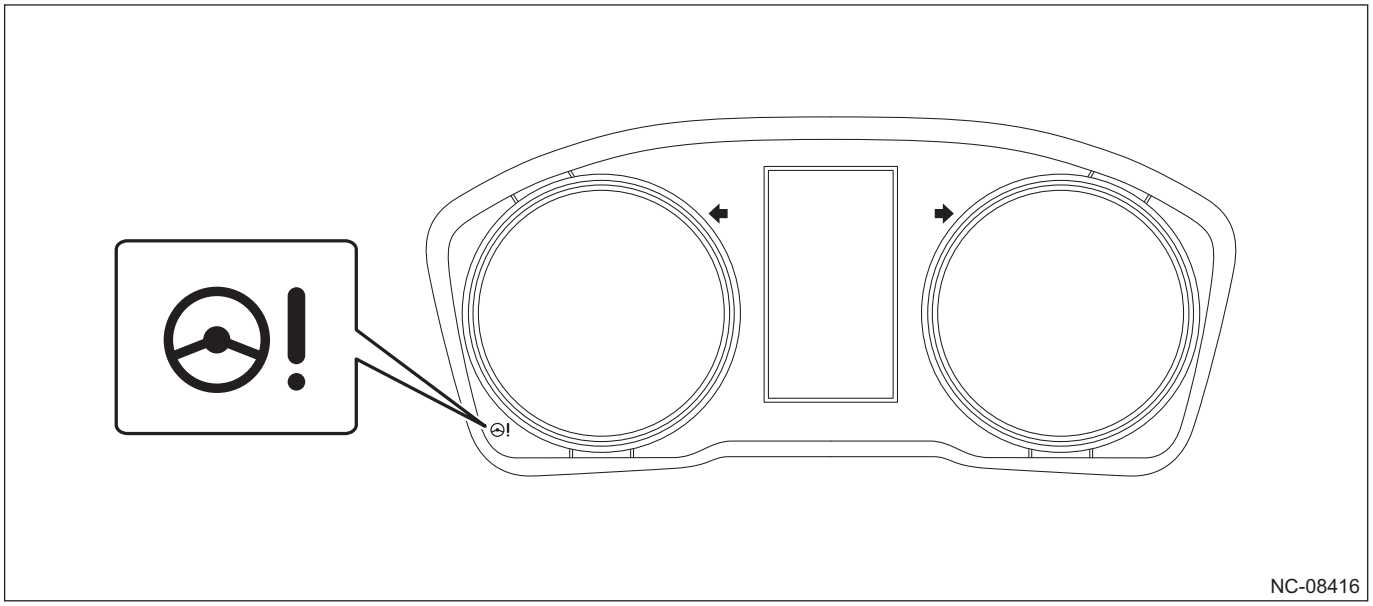


(A) Overall steering system view
(a) Torsion bar
(b) Input shaft
(c) Pinion shaft
(B) Enlarged cross-section
(d) Magnet
(e) Hall IC
(f) Steering torque

Fail-safe

Power steering warning light

When an abnormality occurs in the system, the fail-safe function operates, and the power steering warning light in the combination meter turns on to alert the driver to the abnormality. When the fail-safe function operates, the steering functions as manual steering (without assist).



**The illustration shows a typical example that may differ from the actual display.*

8 BODY STRUCTURE

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8.2.1 Overview 8-3
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8.1 General Overview

8.1.1 Overview

Overview

Subaru Global Platform is adopted, and the following main measures are taken.

Improvement of body rigidity and steering stability

- Adoption of full inner frame structure
- Reinforcement of coupling around the front frame
- Stronger suspension crossmember, sub frame connection
- Rigidity enhancement of the rear part of the vehicle
- Expanded application of the structural adhesive agent
- Weight reduction with expanded use of high-tensile strength steel and aluminum material
- Aerodynamic body shape and appropriate placement of aerodynamic parts

Reduction of vibration and noise

- Improvement of rear seat maintenance rigidity
- Appropriate placement of soundproofing materials

Reinforcement of collision safety body

- Addition of load-transmission framework, control of cabin deformation with added framework
- Appropriate placement of high-tensile strength steel and super high-tensile strength steel
- Optimization of shock absorption structural parts

8.2 Subaru Global Platform (SGP)

8.2.1 Overview

Subaru Global Platform (SGP)

SGP is a next generation platform developed to be compatible with future electrification of vehicles and to realize development of all car lines with a single platform design concept.

While planning the major specification for all car lines at once, the platform is flexibly changed for each model. This approach raises the base competitiveness of the entire SUBARU lineup and allows for development that takes advantage of the characteristics of each model. SGP aims to improve safety performance as well as steering stability and response, reduce vibration and noise, and improve "dynamic quality feel" which will enhance safety and comfort of the driver and passengers.

In addition to gasoline engines, this single design concept is compatible with various power units that will be required in the future such as hybrid, plug-in hybrid, and electric vehicles.

Main characteristics of Subaru Global Platform (SGP)

Improvement in steering stability and response

Quick response to steering operation and stable driving are made possible by significant improvement of rigidity of the body and chassis components, advancement in undercarriage mechanisms including suspensions, and lower center of gravity. Also, drivability which is realized with steering that has no unnecessary motion, providing a feel of firmly contacting the ground just like sticking to the road, and with straight-line stability that will be required for autonomous driving in the future.

Reduction of vibration and noise

The frame structure is optimized and component joints are strengthened to improve body torsional rigidity. In addition, body resonance and distortions are dispersed to greatly reduce steering, floor, and seat vibrations.

Improvement in comfort

Rigidity of the suspension installation sections is improved to allow the suspension to sufficiently cushion passengers from rough road conditions without any warp in vehicle body for a comfortable ride.

Improvement of collision safety performance

More stable ride is realized by further lowering the center of gravity, greatly improving the rigidity, and by making advancement in the undercarriage mechanism to realize hazard avoidance performance similar to a high performance sports model.

Collision energy absorption rate is improved by adopting frame structure that enables efficient energy absorption on collision and improving body strength by expanding the use of hot press molded material and other high-tensile strength steel.

Overview of Dedicated Design for New Model Vehicle

The following dedicated designs are adopted to further enhance "enjoyable driving" by balancing the maintenance of class-leading collision safety performance with the high dynamic quality feel.

- Framework: Efficient design of framework appropriate for the vehicle weight

8.3 Body Structure Details

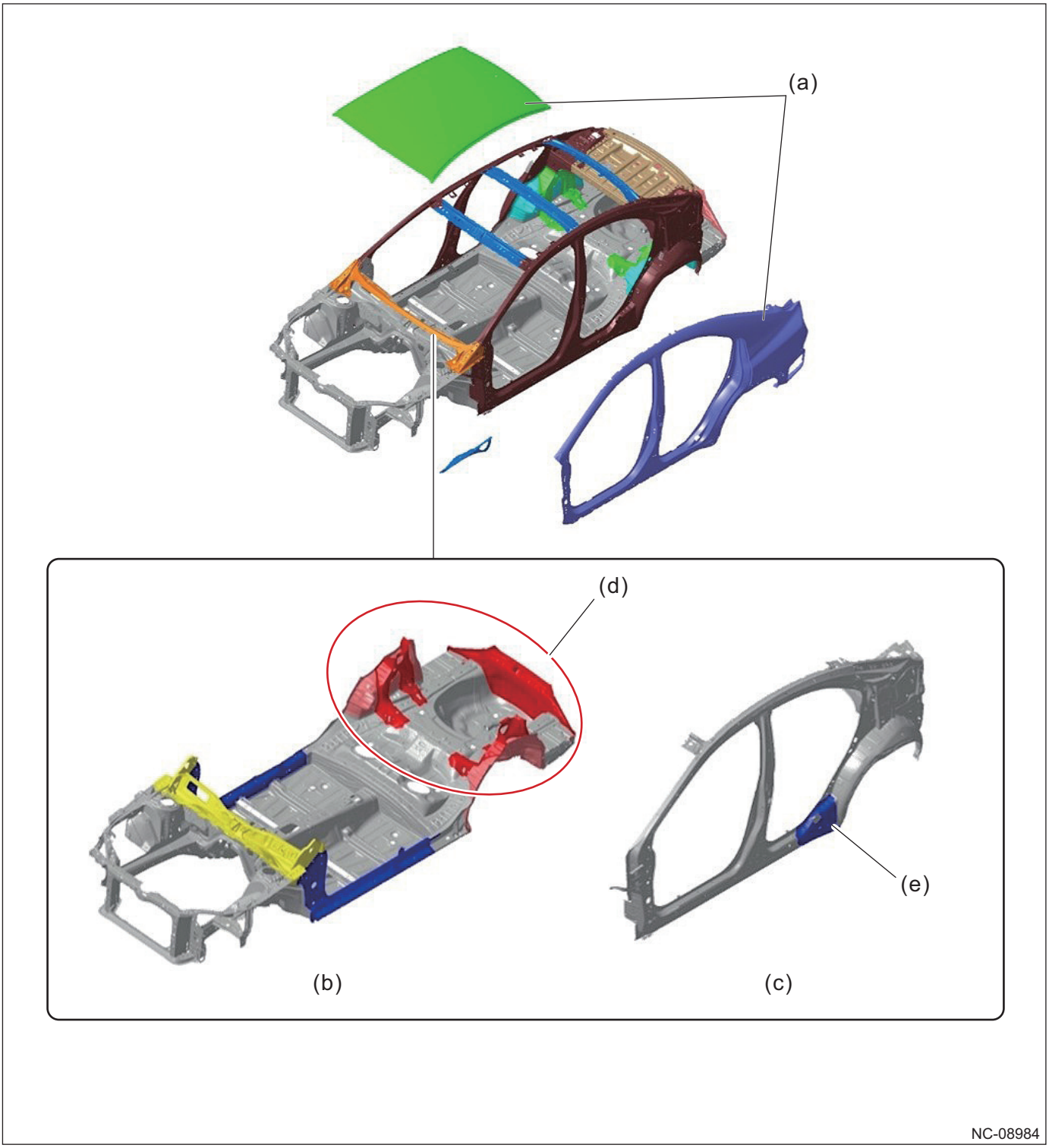
8.3.1 Construction and Operation

Body Structure that Achieves "Dynamic Quality Feel"

Full inner frame structure

In the full inner frame structure, the framework of the overall body is firmly assembled first, and only the outer panel is coupled in the final process.

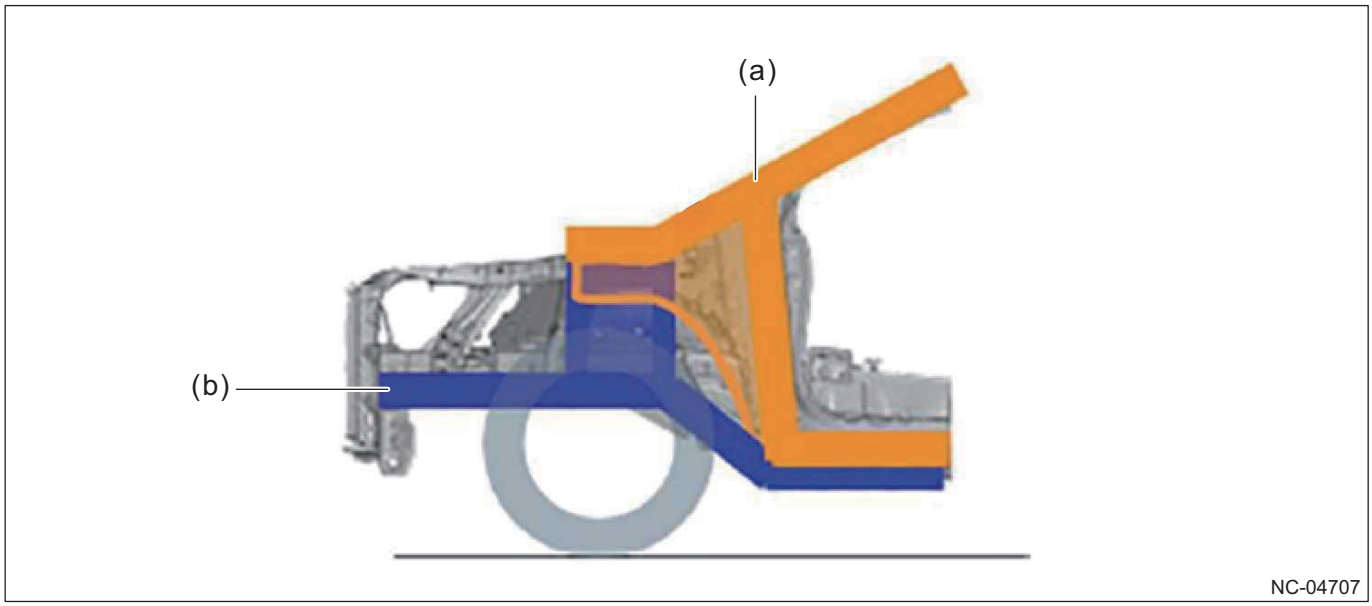
The framework to reinforce the coupling with the upper body structure is moved to the platform, and the outer panel is separated from the framework in the upper body structure. This enhances continuity, realizing further rigidity and weight reduction.



(a) Only the outer panel is welded in the final process
(b) Adoption of inner frame for platform
(c) Upper body framework
(d) Adoption of inner frame
(e) Reinforcement of framework continuity

■ Reinforcement of coupling around the front bulk

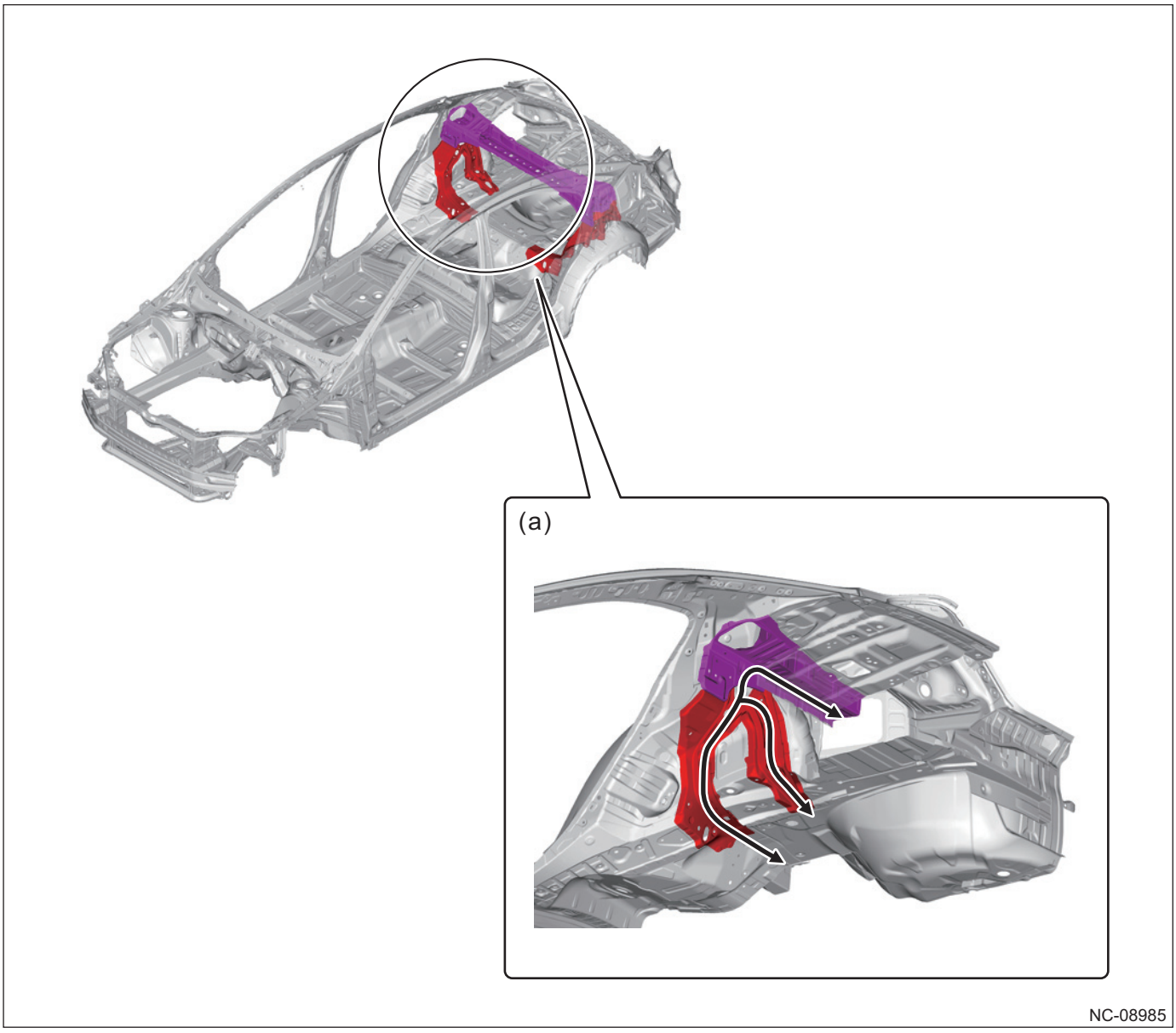
The platform and upper body framework are firmly coupled with the inner panel to enhance the coupling rigidity between the platform and upper body frame.



(a) Upper body framework (firmly coupled with the platform through the inner panel)
(b) Platform

■ Reinforcement of the framework coupling part

- The rigging gusset is discontinued to reinforce the coupling with the upper body framework.
- The upper body framework and platform load paths are formed by adopting a circular framework.



(a) Load path

Stronger suspension crossmember, sub frame connection

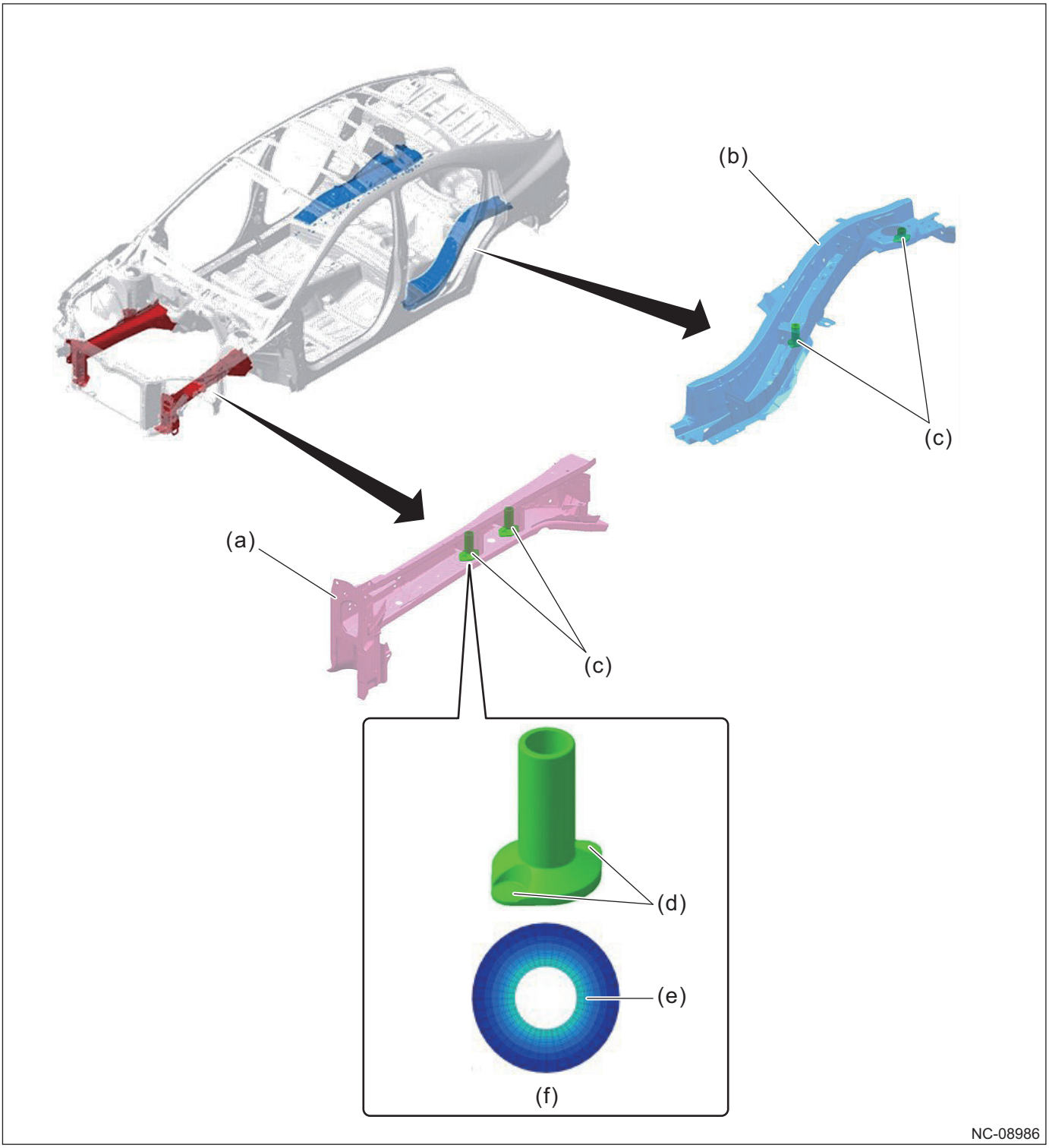
Front suspension crossmember and rear suspension crossmember are used, and the sub frame structure with great torsional rigidity is adopted.

By firmly coupling the front and rear crossmembers and the frame, great rigidity is ensured around the feet in the front and rear.

The connection structure is revised to increase the rigidity of installation sections around the suspension, reducing seat vibration and improving steering stability.

The following measures reduce seat vibration and improve steering stability.

- Spot welding is used as the welding method for the installation section weld nuts.
- Rigidity of the installation section is improved by making the stress concentration on the connection surface even and limiting local deformation.

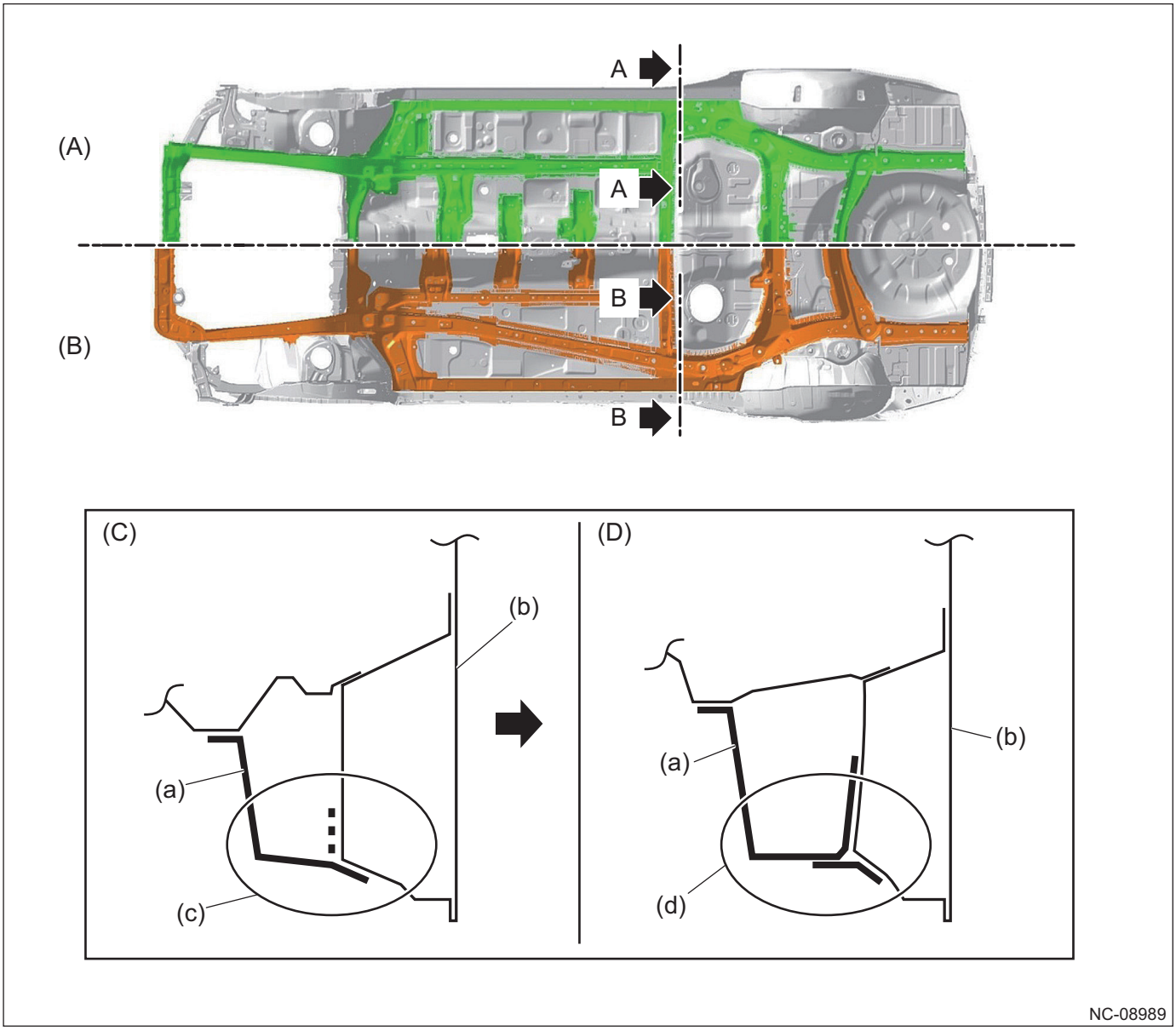


(a) Front frame
(b) Rear frame
(c) Weld nut
(d) Spot welding point
(e) Stress made even
(f) Weld nut seat (no projection welding protrusion)

Rear frame

The coupling structure between the side sill and rear frame is strengthened to ensure the continuity of rigidity.

The continuity is ensured by avoiding ridge line gap due to the bent back portion of the flange.



(A) Vehicles that have not adopted the Subaru Global Platform

(B) Vehicles that have adopted the Subaru Global Platform

(C) A-A cross section

(D) B-B cross section

(a) Rear frame

(b) Side sill

(c) Ridge line gap

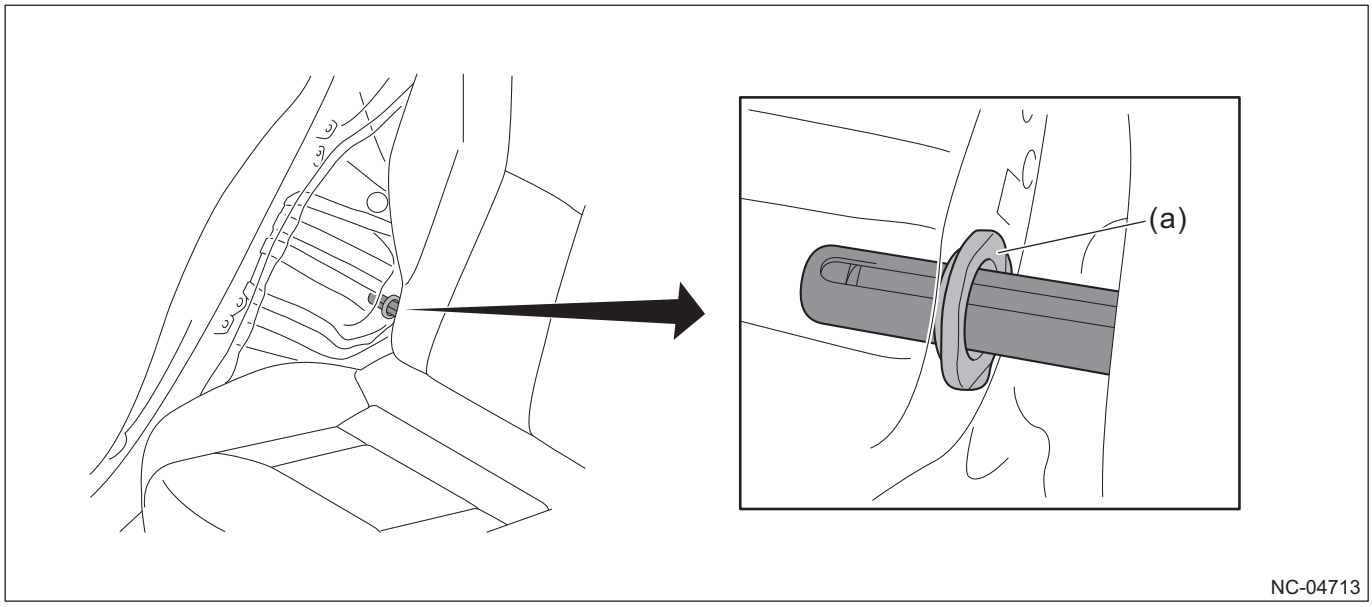
(d) No ridge line gap

Around rear

■ Improvement of rear seat maintenance rigidity

Weld pipe washer is adopted for the rear seat bearing.

Reinforcement with a weld pipe washer for bearing rigidity controls rear seat vibration.



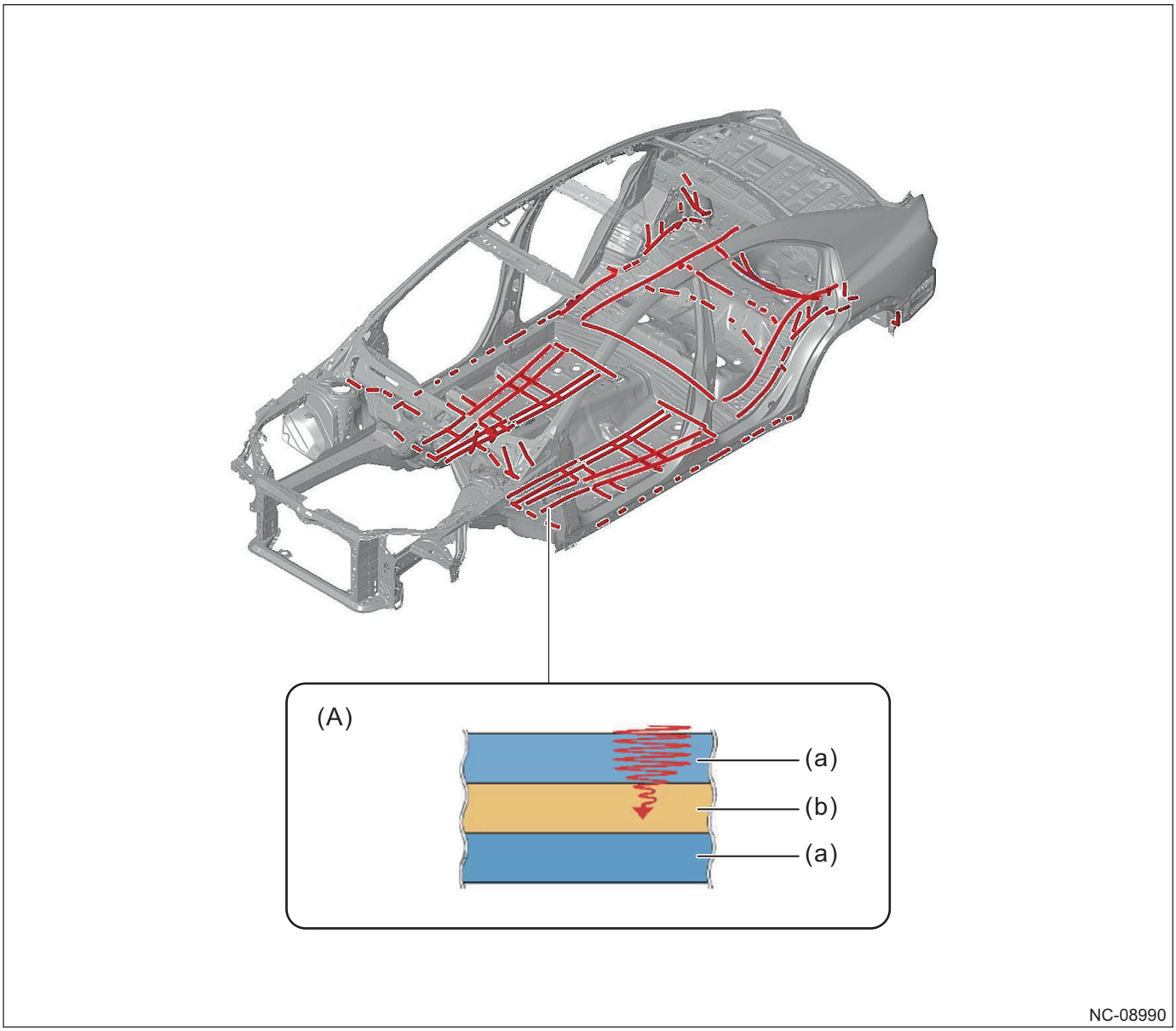
(a) Weld pipe washer

Structural adhesive agent

The structural adhesive agent is adopted to improve the body rigidity and vibration and noise restraining performance.

High viscosity adhesive is used, structures such as crossmembers and upper body framework are adopted for the vertical wall surface, and an application range of 85.31 ft (26 m) is set for the adhesive.

- By using it in joints between sheet metal parts of the body, gaps between spot welding parts are continually jointed, reducing minor deformation and increasing the overall body rigidity.
- Increased rigidity around the feet and the power unit installation point made effective utilization of bushing and mounting possible, improving the convergence of vertical vibration of the rear differential and power unit. As a result, floor vibration is controlled, realizing excellent ride quality.
- Reinforced connection between the rear edge of the front frame and the floor allows the floor to support the front frame, which supports the engine, improving the responsiveness when operating the steering wheel.
- The adhesive agent itself dampens fine vibration, improving dynamic rigidity.



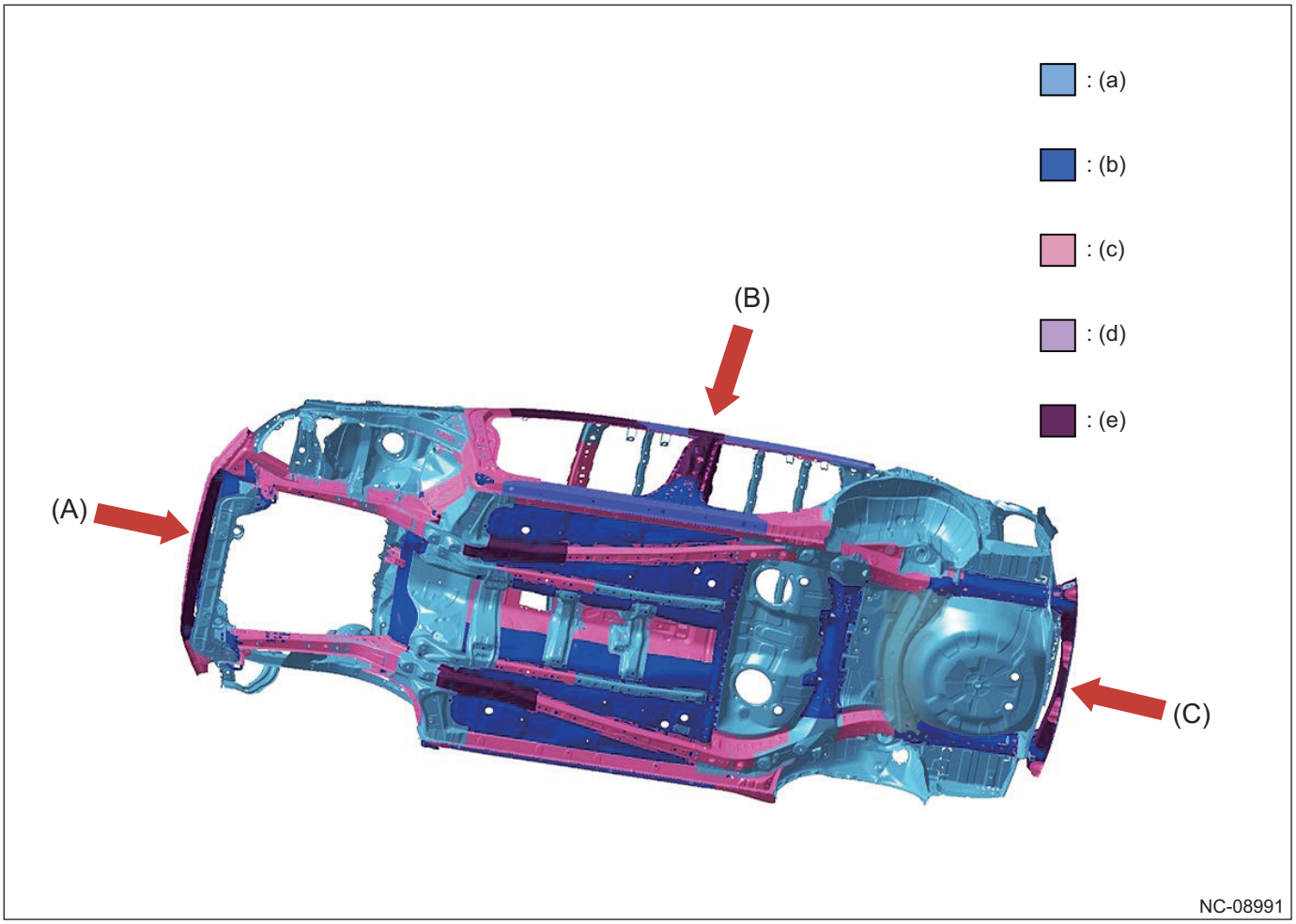
(A) Adhesive image

(a) Body panel

(b) Structural adhesive agent (dampens fine vibration)

Safety Performance

- The body pillar shape, etc. are optimized to ensure excellent visibility from the driver's seat.
- Optimization of the body structure and appropriate positioning of high-tensile strength steel limits mass increase and ensures collision safety performance in all of the front, sides, and rear.



(A) Front collision

(B) Side collision

(C) Rear collision

(a) 39,150 psi (270 MPa, 2,753 kgf/cm2)

(b) 57,999 to 72,499 psi (400 to 500 MPa, 4,079 to 5,098 kgf/cm2)

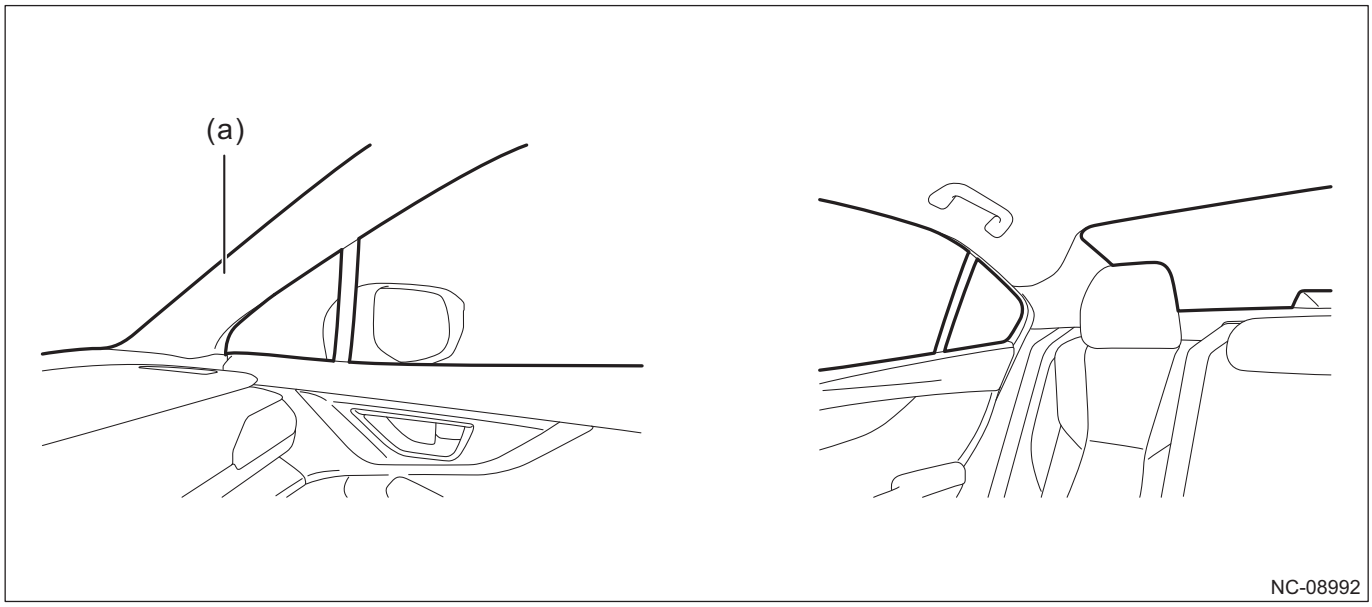
(c) 85,549 psi (590 MPa, 6,016 kgf/cm2)

(d) 140,299 psi (980 MPa, 9,993 kgf/cm2)

(e) Hot press

Visibility performance

Superior visibility from the driver's seat is secured so the driver can quickly detect danger and drive with a sense of security when cornering, turning left or right, and backing up.

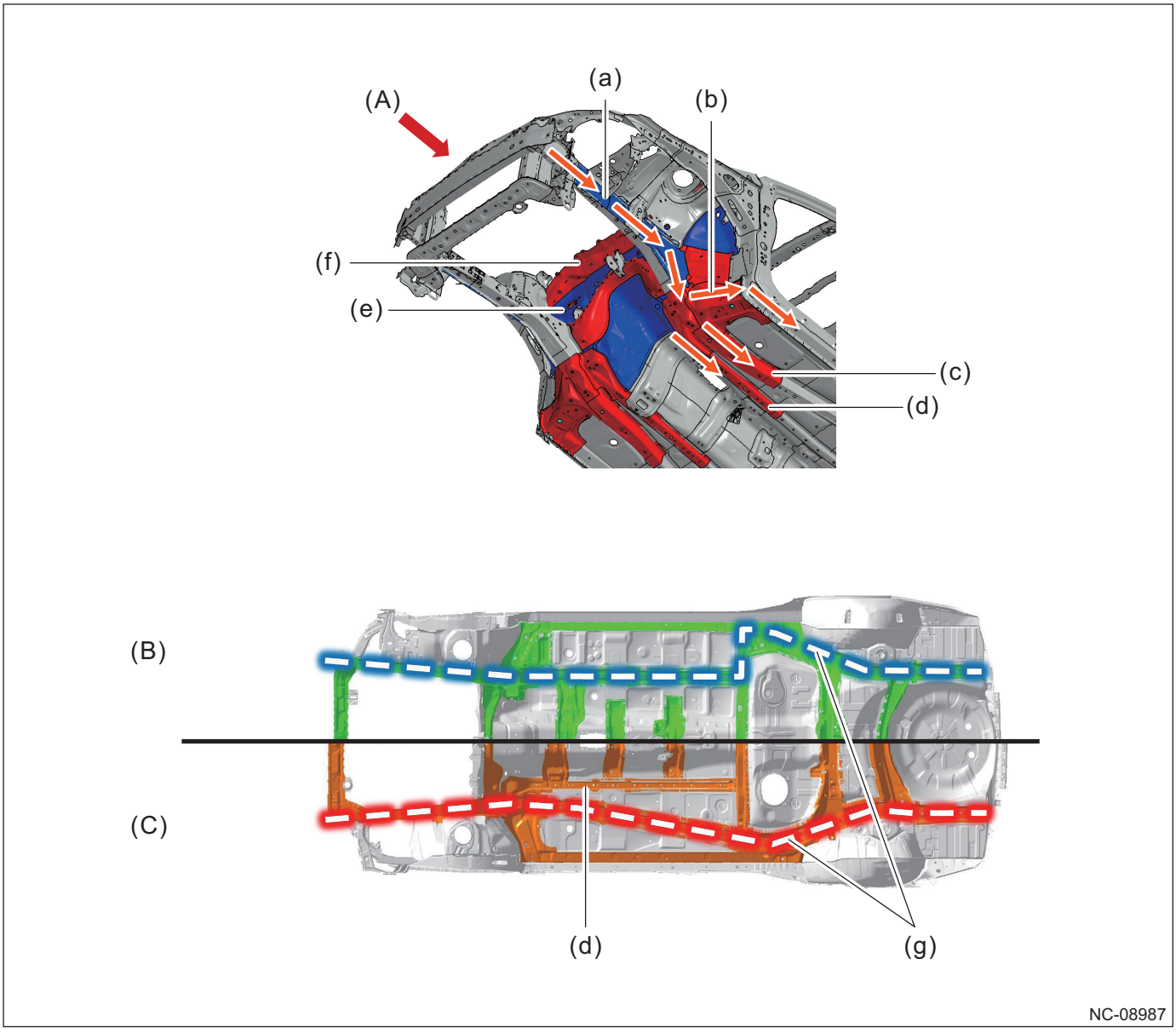


(a) Front body pillar

Collision safety body (against front collision)

The following measures are taken to protect against full-lap collisions, small overlap collisions, and offset collisions.

- A thicker closing plate is provided to support the increased vehicle weight.
- Framework is added to the side of the floor tunnel to form a structure that transmits the collision energy on front collision to the rear to disperse and absorb the energy.
- Hot press material is used in the front side frame, which is the main framework for the floor, to increase strength.
- The efficiency of load transmission to the side sill is improved.
- A thicker toe board is provided to restrict cabin deformation (occupant leg injury). The thicker toe board also improves vibration and noise restraining performance.
- An intercooler avoidance shape is adopted for the bulkhead to form a structure that restricts fuel leaks caused by the rearward movement of the intercooler in a collision.



(A) Front collision

(B) Vehicles that have not adopted the Subaru Global Platform

(C) Vehicles that have adopted the Subaru Global Platform

(a) Closing plate (increased thickness)

(b) Load transmission to side sill

(c) Front side frame (hot press material)

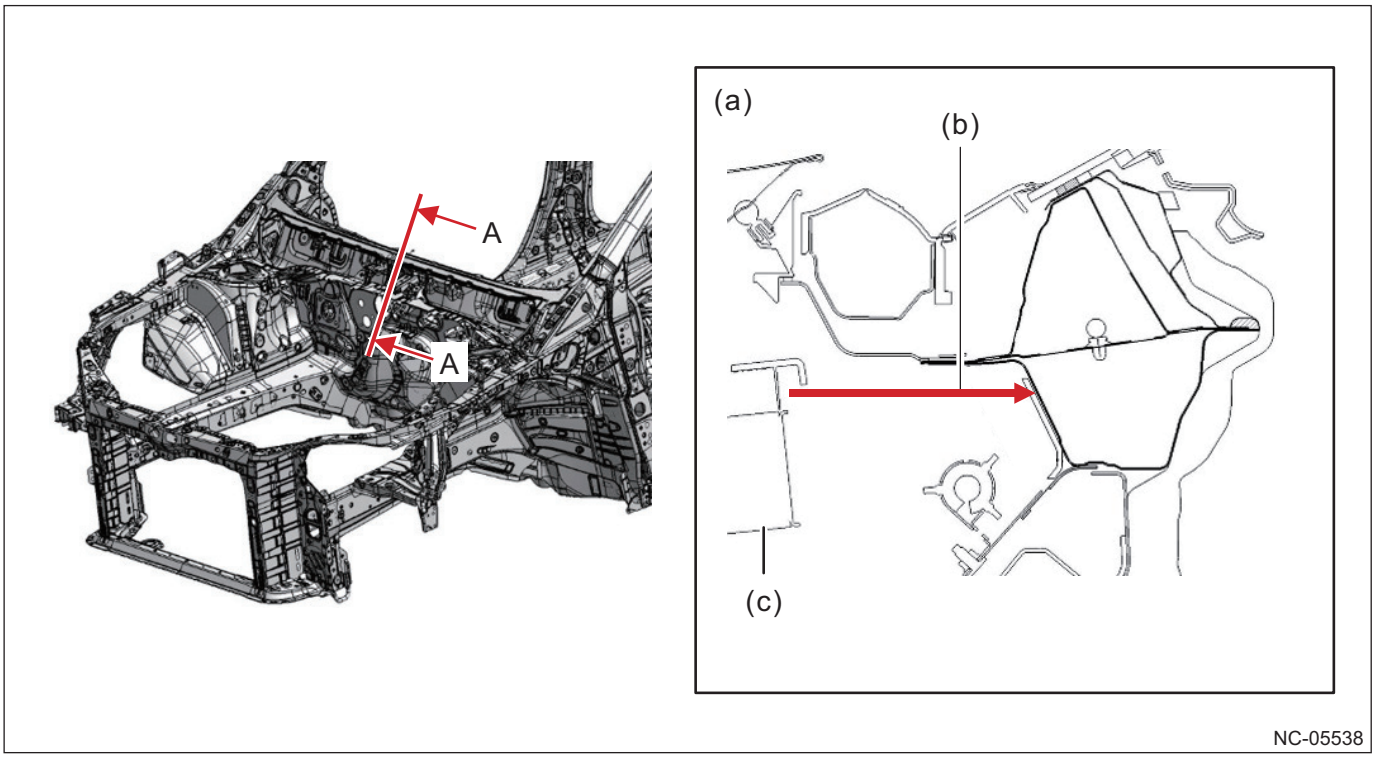
(d) Floor framework added

(e) Toe board (increased thickness)

(f) Bulkhead

(g) Frame shape

Intercooler avoidance shape



(a) A-A cross section

(b) Space between intercooler secured

(c) Intercooler

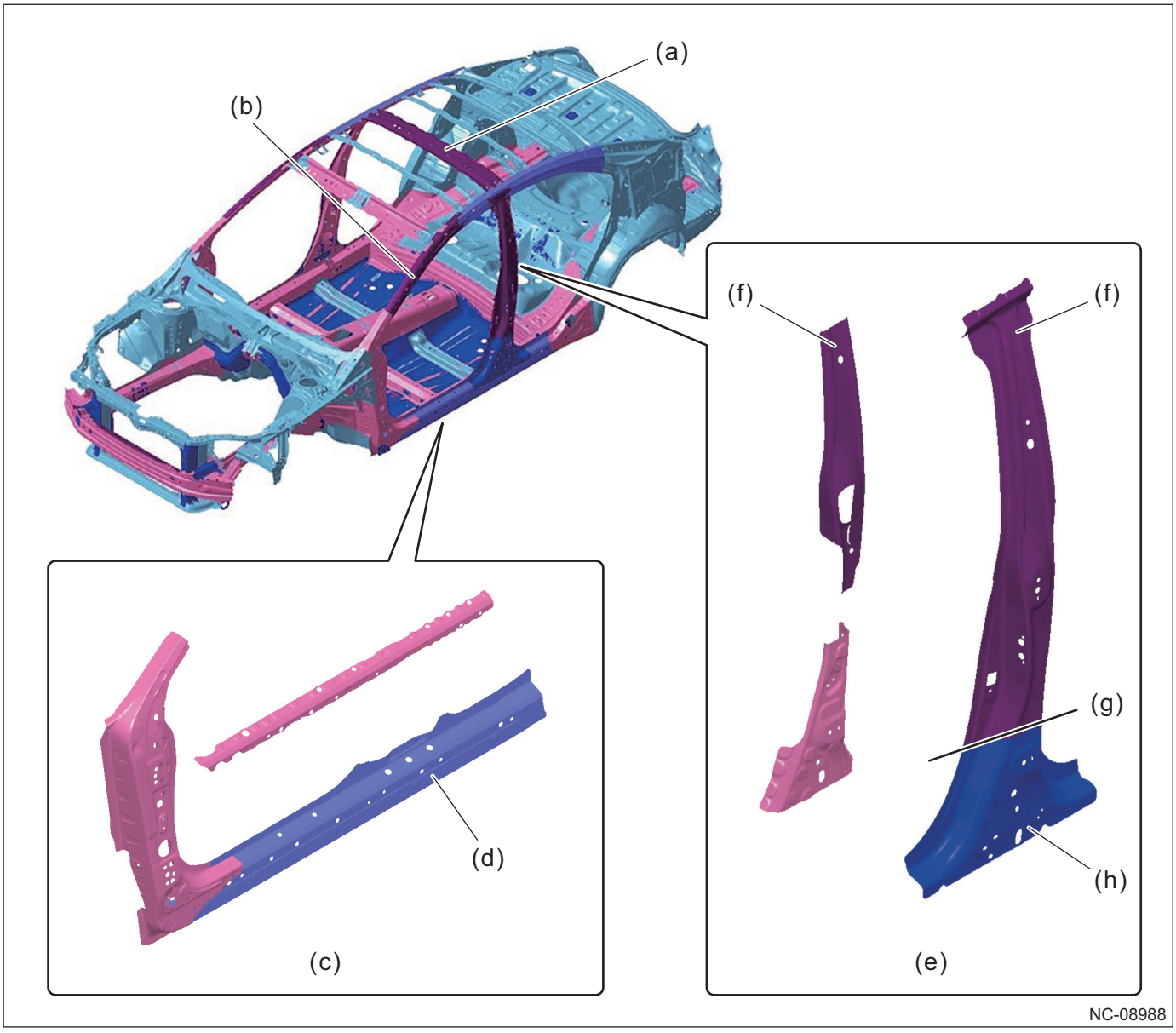
Collision safety body (against side collision)

The body framework is reinforced to control body deformation on side collision.

High strength framework is arranged in appropriate positions, and cabin room is ensured, considering body deformation on side collision. This reduces passenger injury and responds to the latest collision tests.

■ Reinforcement around the side structure

- Hot press materials are adopted for the brace center and front pillar.
- 140,299 psi (980 MPa, 9,993 kgf/cm2) materials are adopted for the underfloor framework to reinforce the cabin.
- Composite material, in which steel plates with different strength levels are jointed at the time of baking as a hot press material, is used for the center pillar.
- Controlling the center pillar deformation position (break position) reduces the passenger injury value.



(a) Brace center (hot press)

(b) Front pillar (hot press)

(c) Side sill

(d) Material strength: 140,299 psi (980 MPa, 9,993 kgf/cm2)

(e) Center pillar

(f) Material strength: 217,497 psi (1500 MPa, 15,295 kgf/cm2), hot press

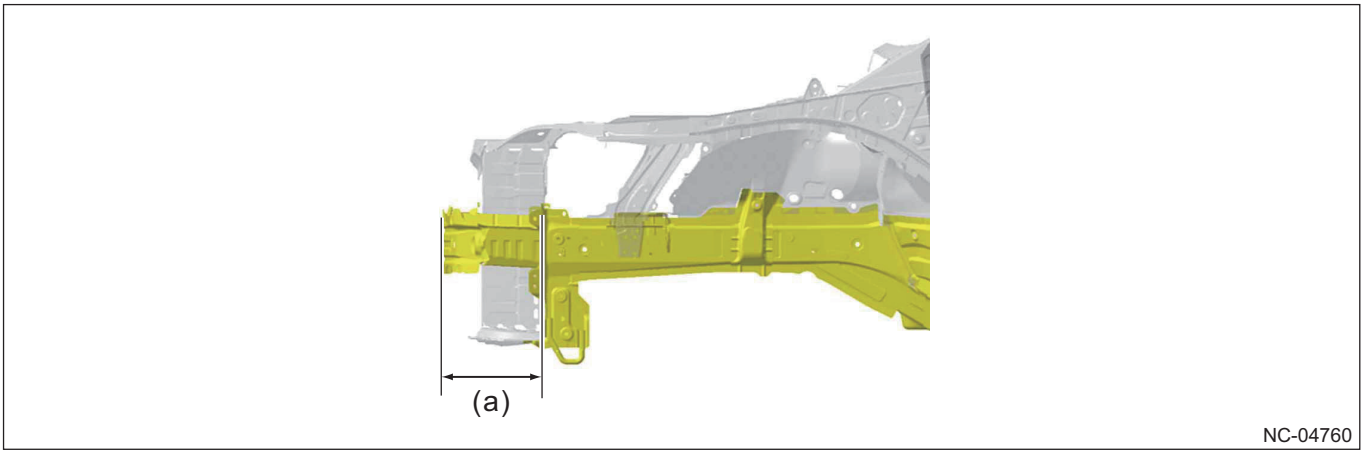
(g) Deformation position (break position)

(h) Material strength: 72,499 psi (500 MPa, 5,098 kgf/cm2), hot press

Collision safety body (against low speed collision)

The crushable zone at the frame front end is enlarged to improve the impact absorbing performance.

This also helps reduce frame damage and repair costs.

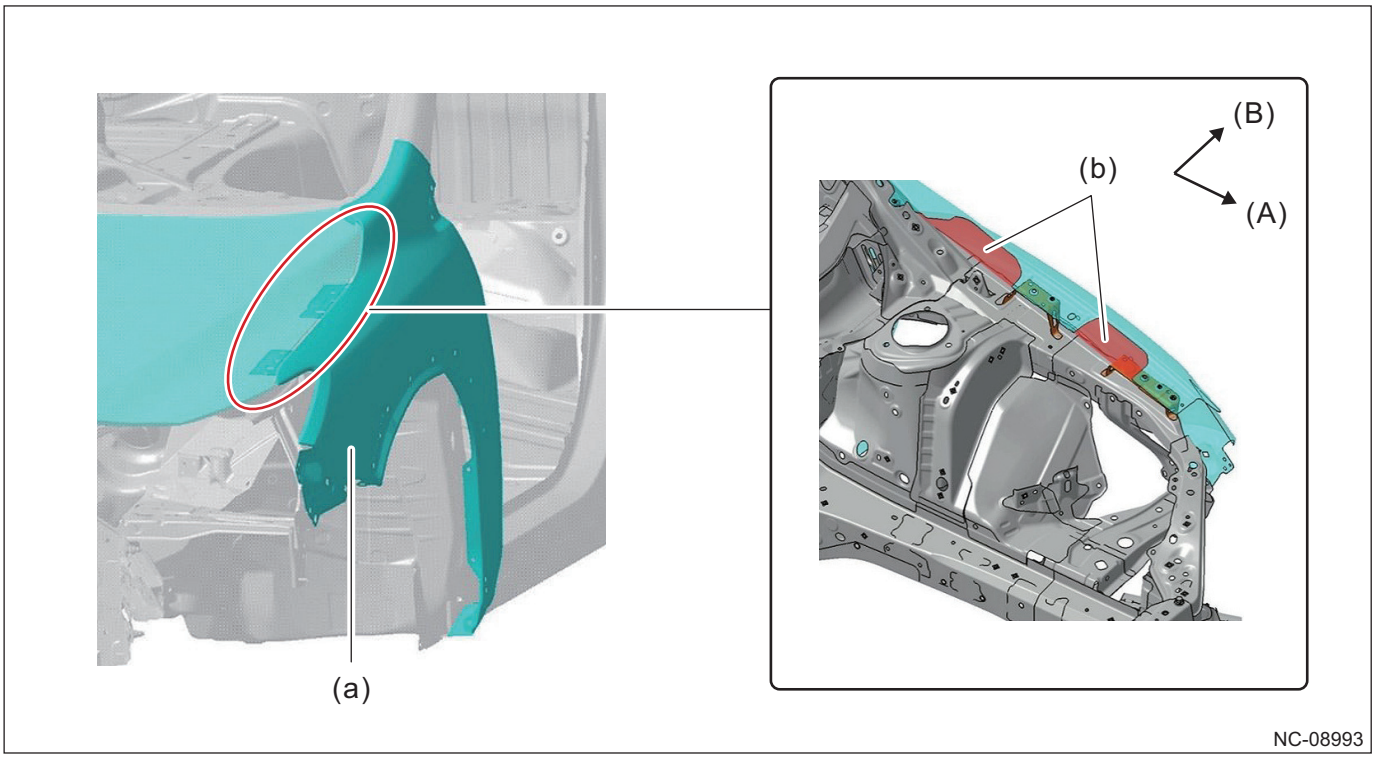


(a) Crushable zone

Pedestrian protection

The vehicle body installation structure is optimized by cutting out the fender shape and fender flanges to reduce the head injury value, resulting in high pedestrian protection performance.

Consideration is also given to practicality, ensuring sufficient rigidity if someone presses it by hand when washing the vehicle.



(A) Front of vehicle

(B) Left side of vehicle

(a) Fender

(b) Flange

Soundproof Performance

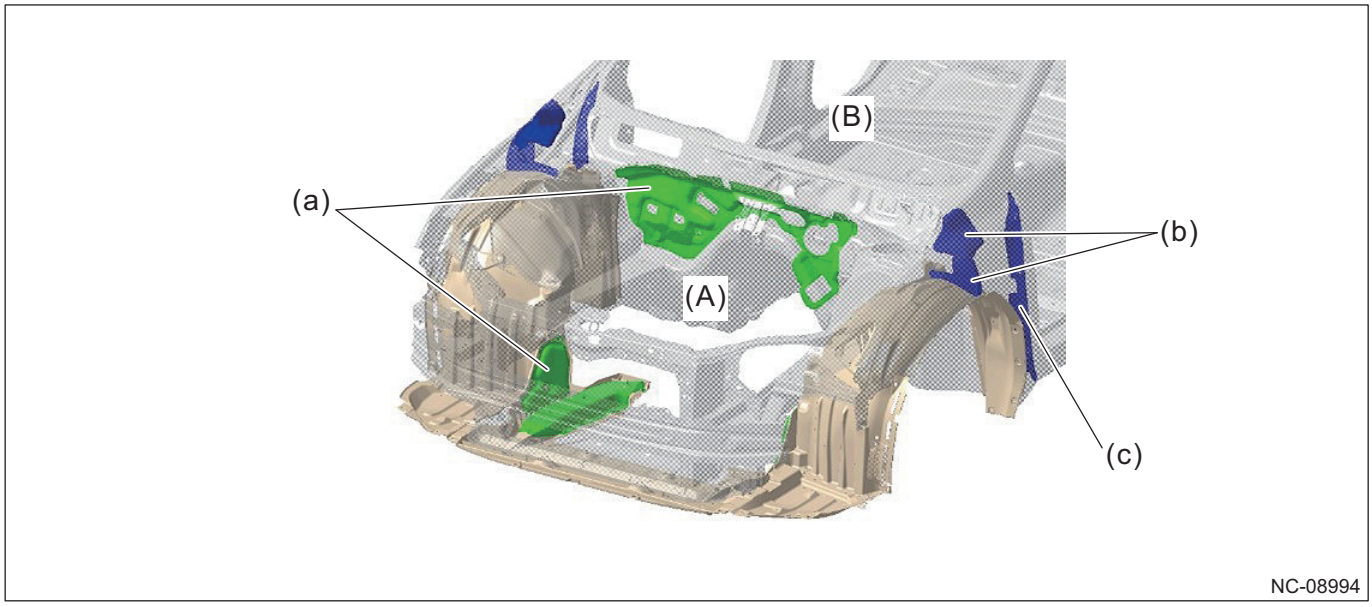
The following measures are taken to realize comfortable indoor space excellent in quietness.

Vehicle interior noise

■ Around the engine compartment

The undercover insulator is enlarged to improve the sound absorption performance in the engine compartment.

In addition, enlargement of the upper cover and lower cover in the fender shuts out sound paths, improving the quietness in the cabin.



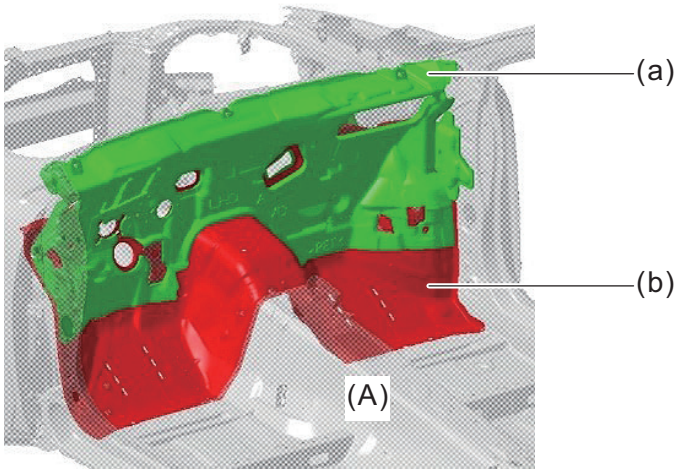
(A) Engine compartment

(B) Inside of the cabin

(a) Enlargement of insulator (improved sound absorption performance)

(b) Addition of insulator (improvement of soundproof and sound absorption performance)

(c) Enlargement of lower fender cover (improvement of soundproof performance)



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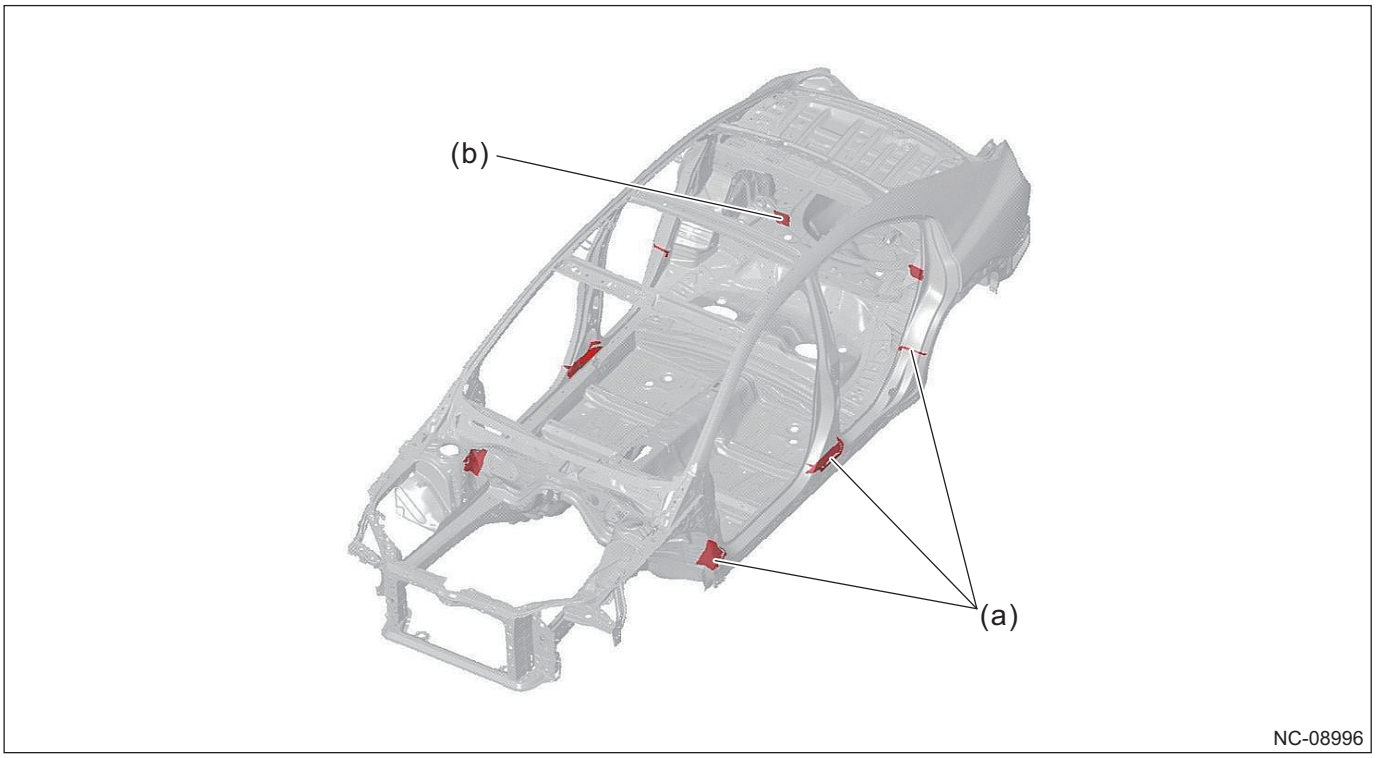
(A) Inside of the cabin

(a) Enlargement of side coating (improvement of soundproof and sound absorption performance)

(b) Thicker toe board (improvement of soundproof and collision performance)

■ Body framework (cross-section foam)

Cross-section foam is used in the body framework to reduce gaps in the body, enhancing the sealability and airtightness of the cabin.



(a) Shutting off the noise transmission paths to upper body framework

(b) Shutting off the noise transmission paths to the cabin

■ Around the floor

Sound absorption material is adopted for the under cover rear and mud guard rear, and the coated section of sheet metal parts is enlarged, thus improving quietness and aerodynamic performance. Noise generated by seams on roads, stone chips, water splashes, etc. around the rear wheel house and at the bottom surface of the body is reduced.

A tunnel insulator with an enlarged range up to near the vehicle center is also adopted to improve quietness.

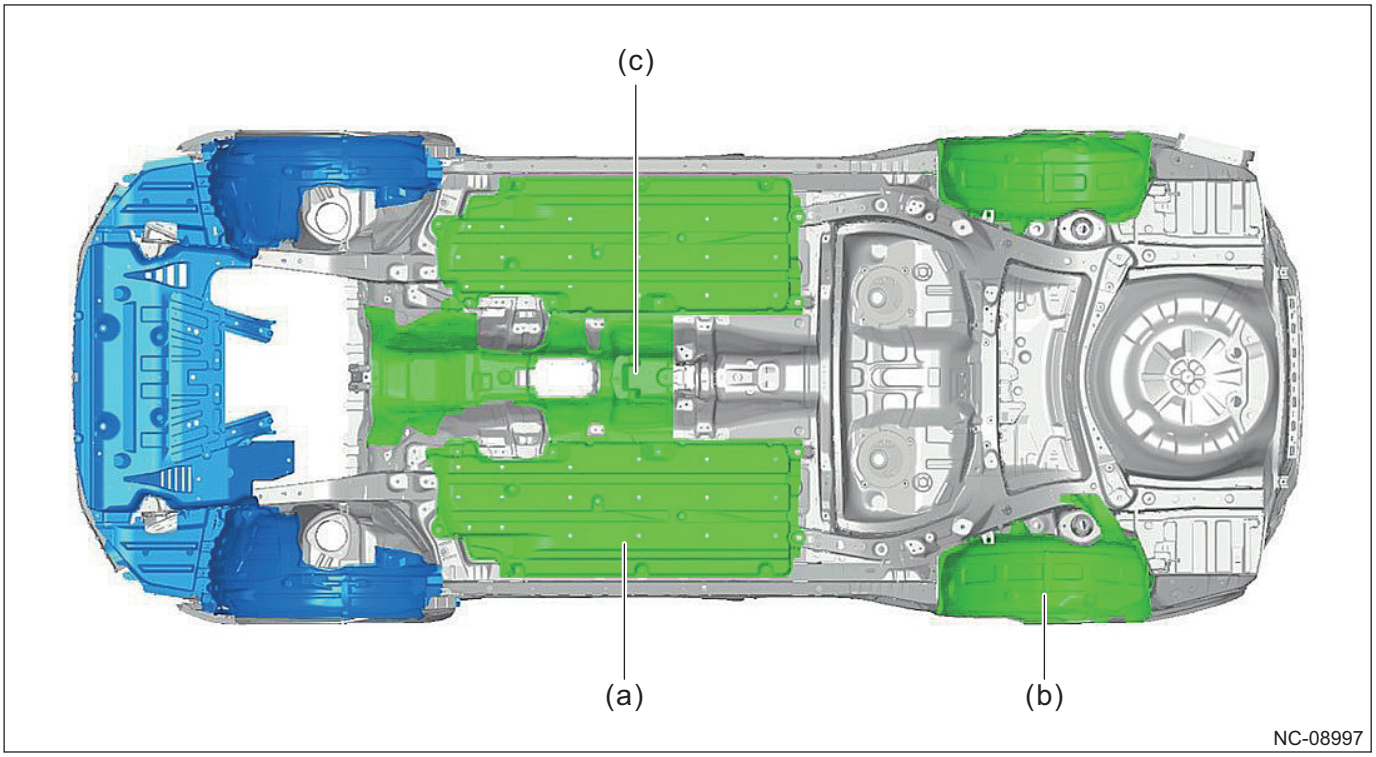
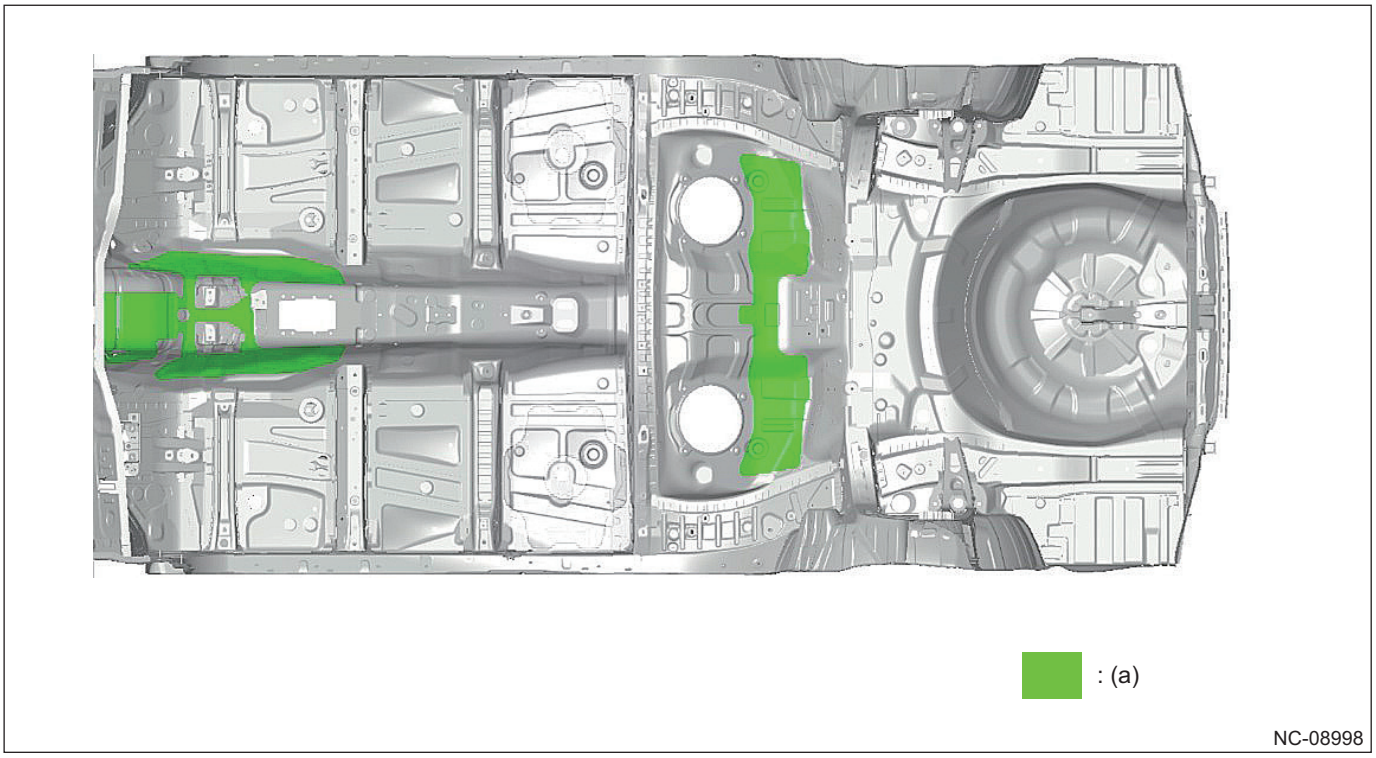


**Illustration shows CVT models*

(a) Under cover rear
(b) Mud guard rear
(c) Tunnel insulator

Vibration sound

The thickness and positioning of damping materials are revised using panel vibration analysis for the Subaru Global Platform framework. Optimization of the thickness and positioning of damping materials reduces road noise and weight.



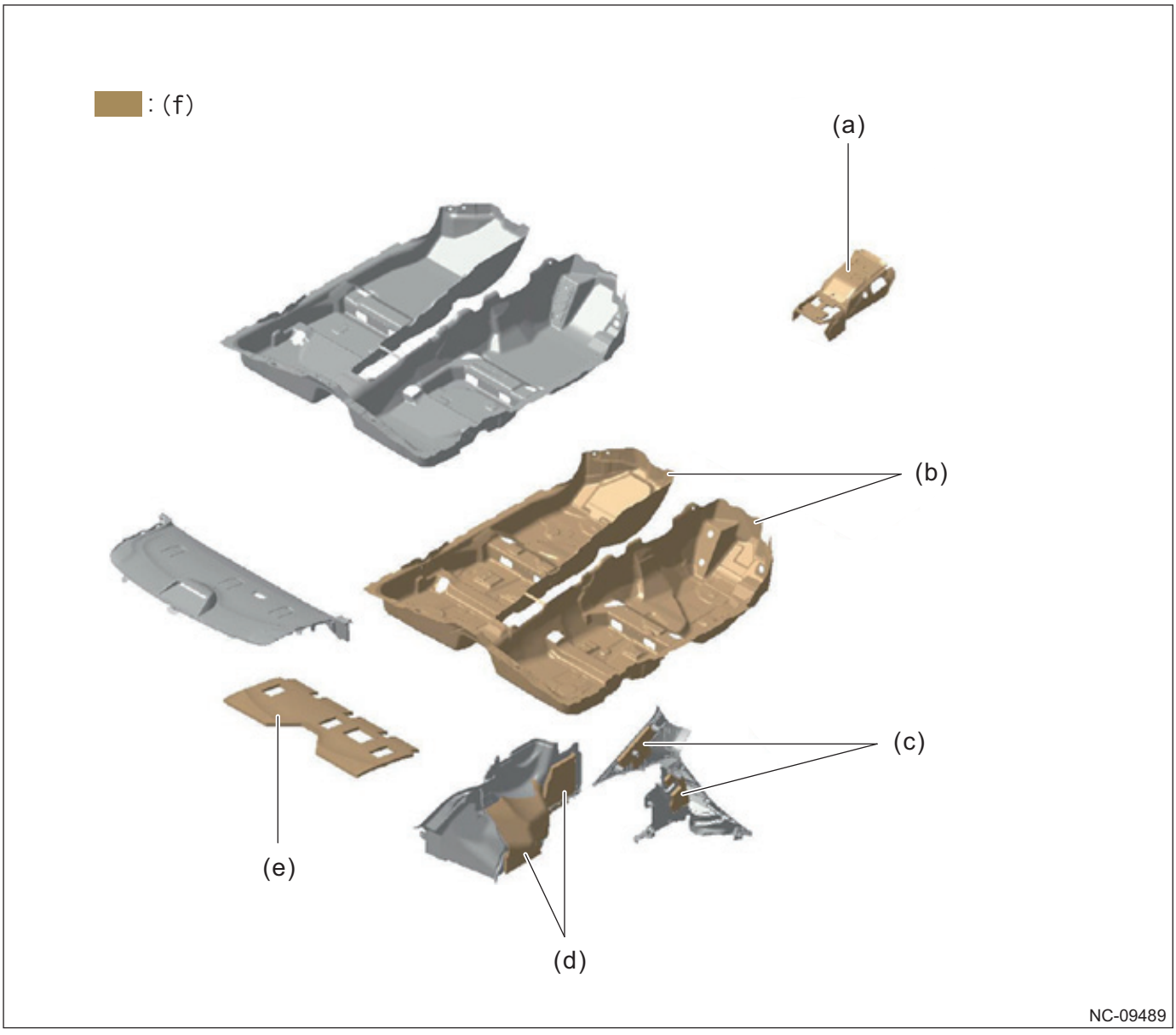
(a) Damping material (thickness 0.118 in (3 mm))

Soundproofing material

Sound-absorbing materials are provided in various interior parts in order to absorb road noise generated under the body, etc. so that the noise does not enter the cabin, thus realizing excellent cabin quietness.

A floor mat is adopted whose entire back surface is lined with felt that has excellent sound-absorbing effectiveness, improving the vibration and noise restraining performance.

Sound-absorbing material	Tunnel insulator, floor mat back silencer, trunk side trim back silencer, C pillar trim back silencer, rear shelf trim back silencer

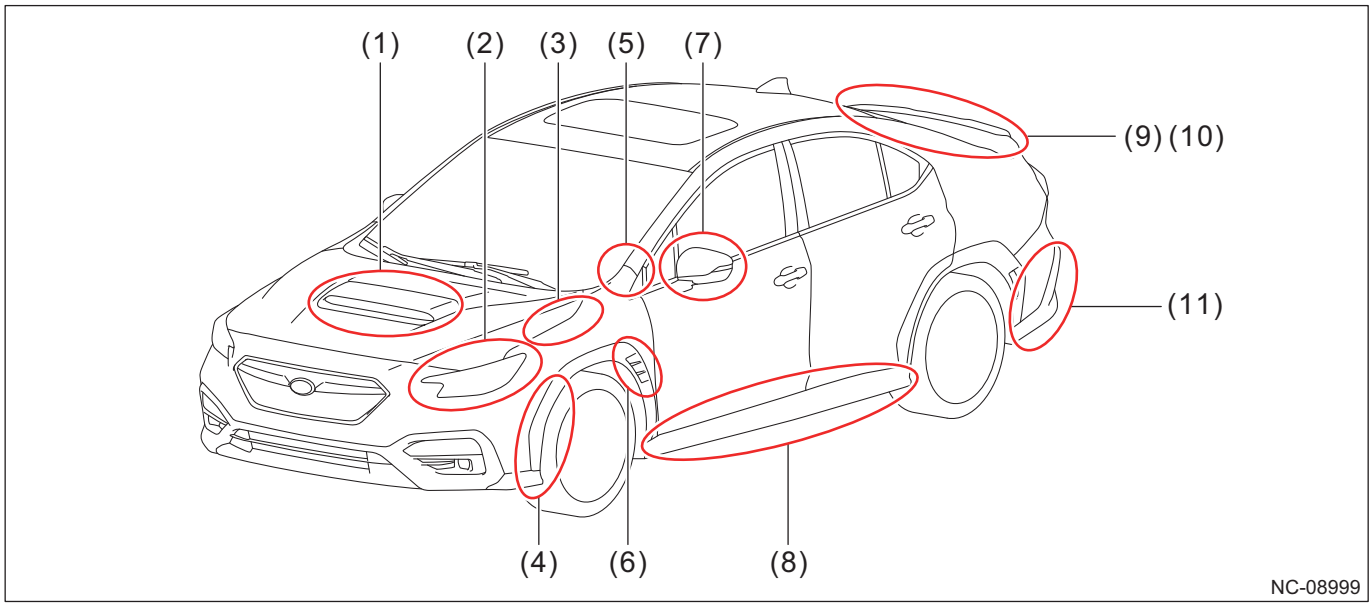


(a) Tunnel insulator
(b) Floor mat back silencer (felt)
(c) C pillar trim back silencer
(d) Trunk side trim back silencer
(e) Rear shelf time back silencer
(f) Sound-absorbing material

Aerodynamic performance

Upper body

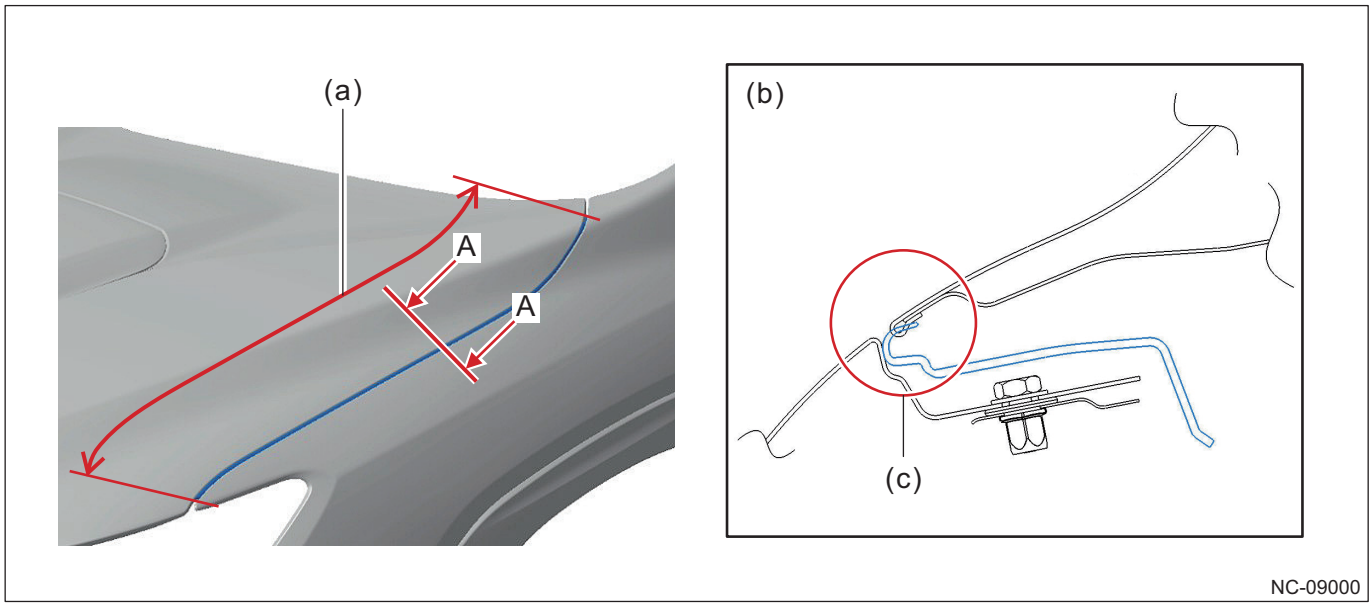
Aerodynamic parts are adopted in various sections of the upper body, improving fuel efficiency and steering stability.



No.	Parts	Description	Fuel efficiency	Steering stability
(1)	Hood grille	Opening height of resin hood grille is reduced	○	-
(2)	Headlight	Enclosing lip is adopted for the gap between the hood and the headlight	○	-
(3)	Fender upper cover	Seal is adopted for the division between the hood and fender	○	-
(4)	Mud guard	Air slit is adopted for the mud guard	○	-
(5)	A pillar	Level difference between the pillar and A pillar cover is reduced	○	-
(6)	Front fender garnish	Air outlet is adopted	-	○
(7)	Door mirror	Door mirror shape is optimized	○	-
(8)	Side sill spoiler	Bottom surface width of side sill spoiler is secured	○	-
(9)	Rear Spoiler	Small resin spoiler is adopted	○	-
(10)	Trunk lid	Kick-up shape is adopted for trunk rear end	○	-
(11)	Rear bumper	Air outlet is adopted	-	○

■ Fender upper cover

A seal is adopted for the division between the hood and fender to seal the air at the division that leaks from the chamber, reducing disturbances in the airflow over the body surface.



(a) Seal range

(b) A-A cross section

(c) Seal structure

■ Air outlet

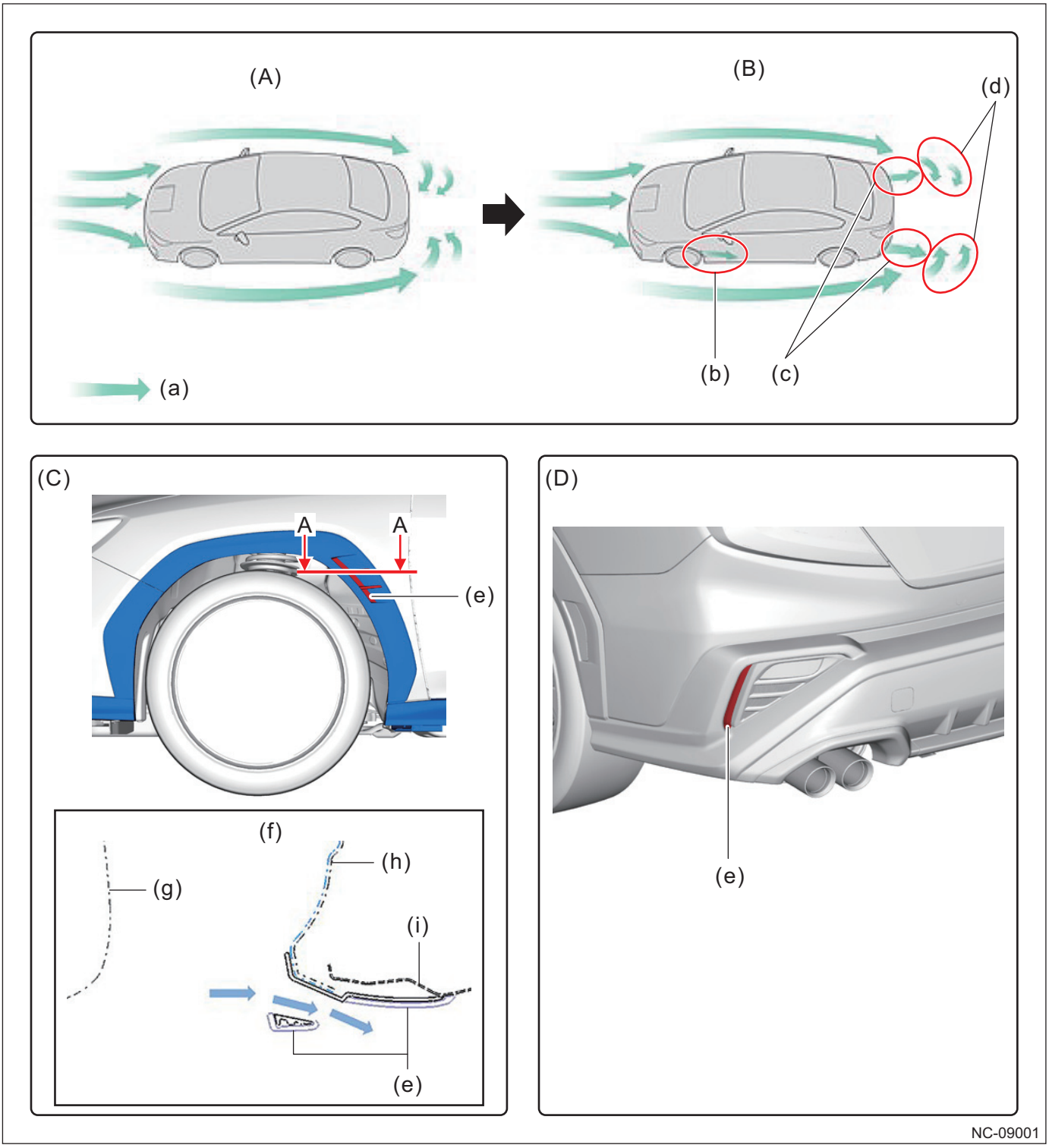
An air outlet is adopted for the front fender garnish and rear bumper.

Front side air outlet

The air accumulated in the wheel house is discharged, contributing to a smooth steering feel that restricts turbulence. Also, the air discharged from the air outlet is made to flow smoother toward the vehicle rear.

Rear side air outlet

The air accumulated in the rear bumper is discharged outside the vehicle to move the air spirals generated at the vehicle body rear further away. This restricts body sway and imbalances caused by disturbed airflow, resulting in driving with peace of mind even at high speed.


(A)
(B)
(d)
(a)
(b)
(c)
(C)
A
A
(e)
(f)
(g)
(h)
(i)
(e)
(D)
(e)
NC-09001

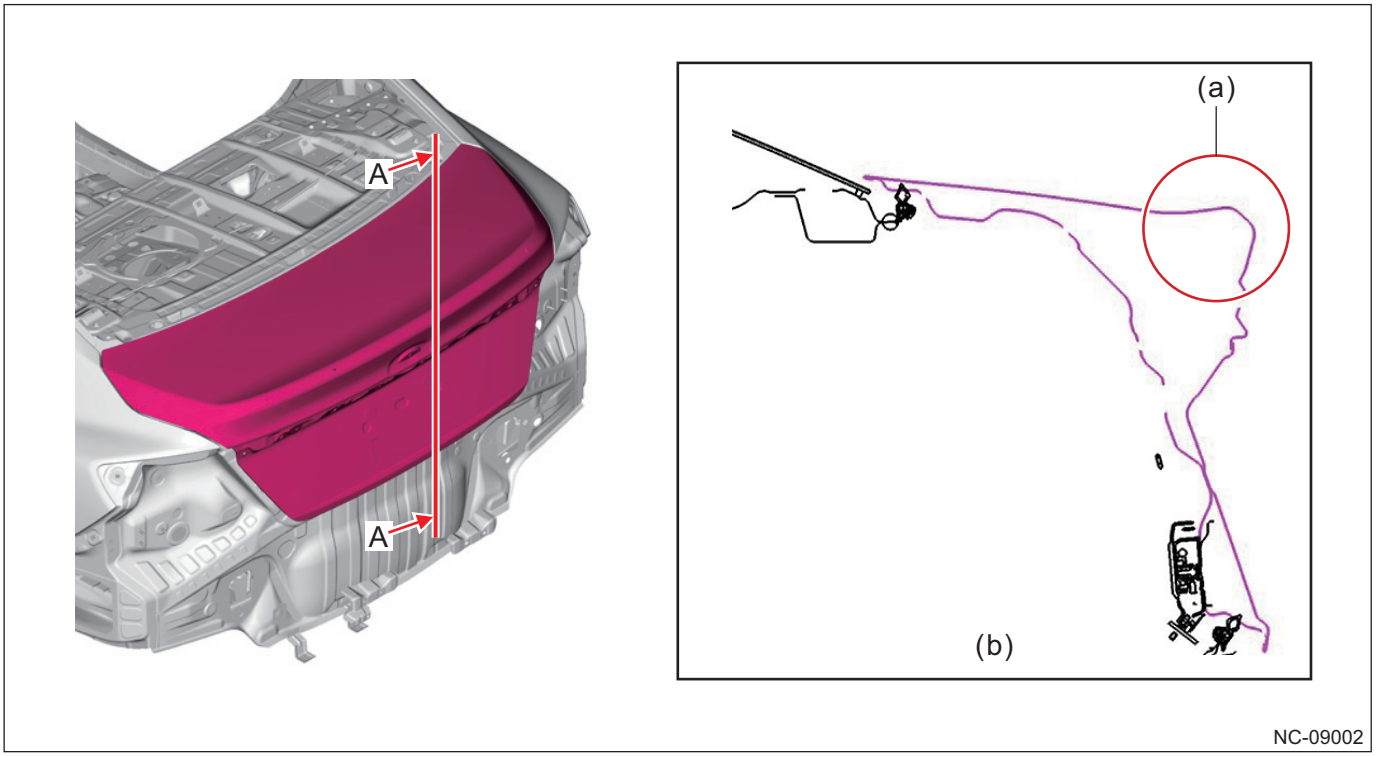
(A) Without air outlet
(B) With air outlet
(C) Front side outlet
(D) Rear side air outlet

(a) Airflow
(b) Flow from front side air outlet
(c) Flow from rear side air outlet
(d) Air spirals separated from vehicle
(e) Air outlet
(f) A-A cross section
(g) Tire
(h) Mud guard
(i) Fender

■ Trunk lid

A kick-up shape is adopted for the trunk lid rear end to achieve excellent aerodynamic performance.

- The adoption of the kick-up shape separates the airflow that rises up from the vehicle under floor and the airflow from the trunk, reducing the negative pressure caused by air spirals generated at the vehicle rear.

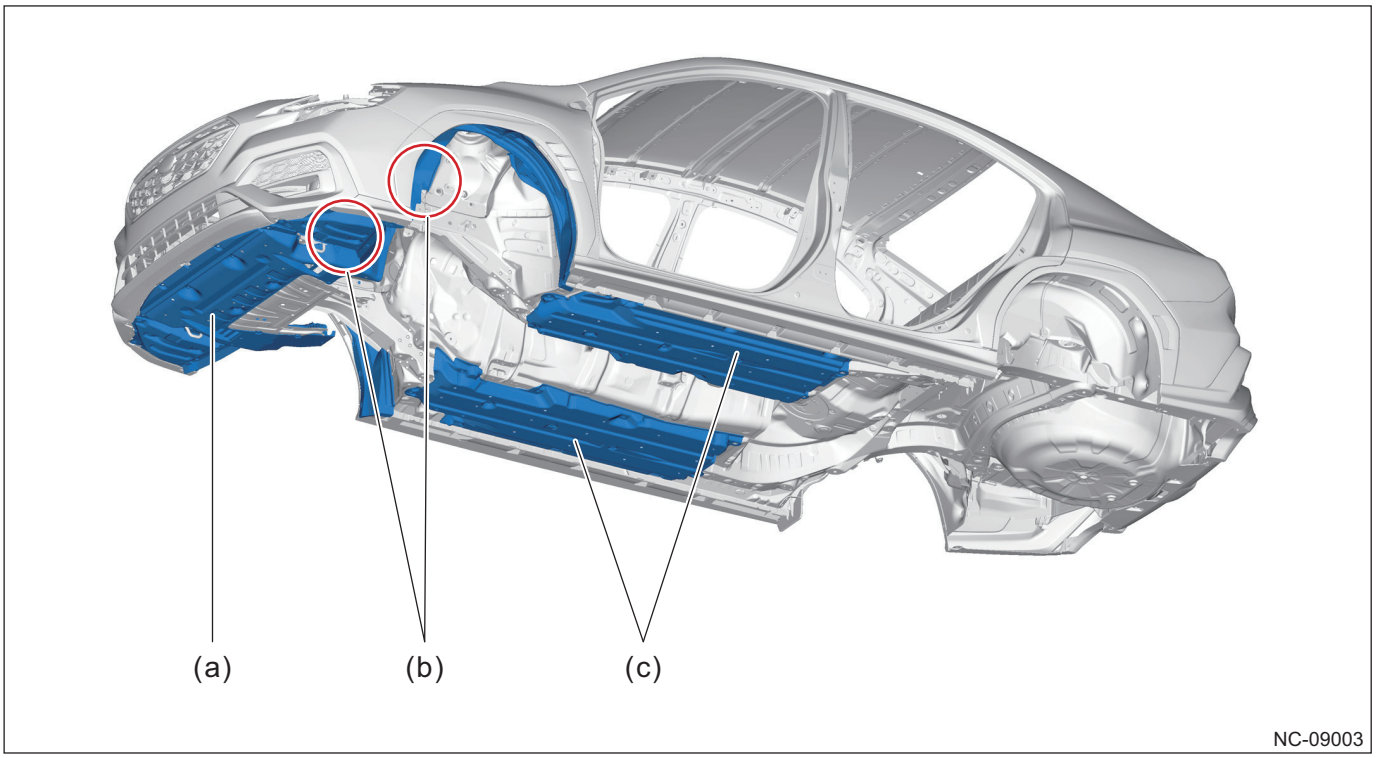


(a) Kick-up shape
(b) A-A cross section

Under body

The following under floor aerodynamic parts are adopted to improve the steering stability and fuel efficiency.

- Under cover front: Shape optimized
- Mud guard front: Air slits provided, shape optimized
- Under cover rear: Size enlarged, shape optimized

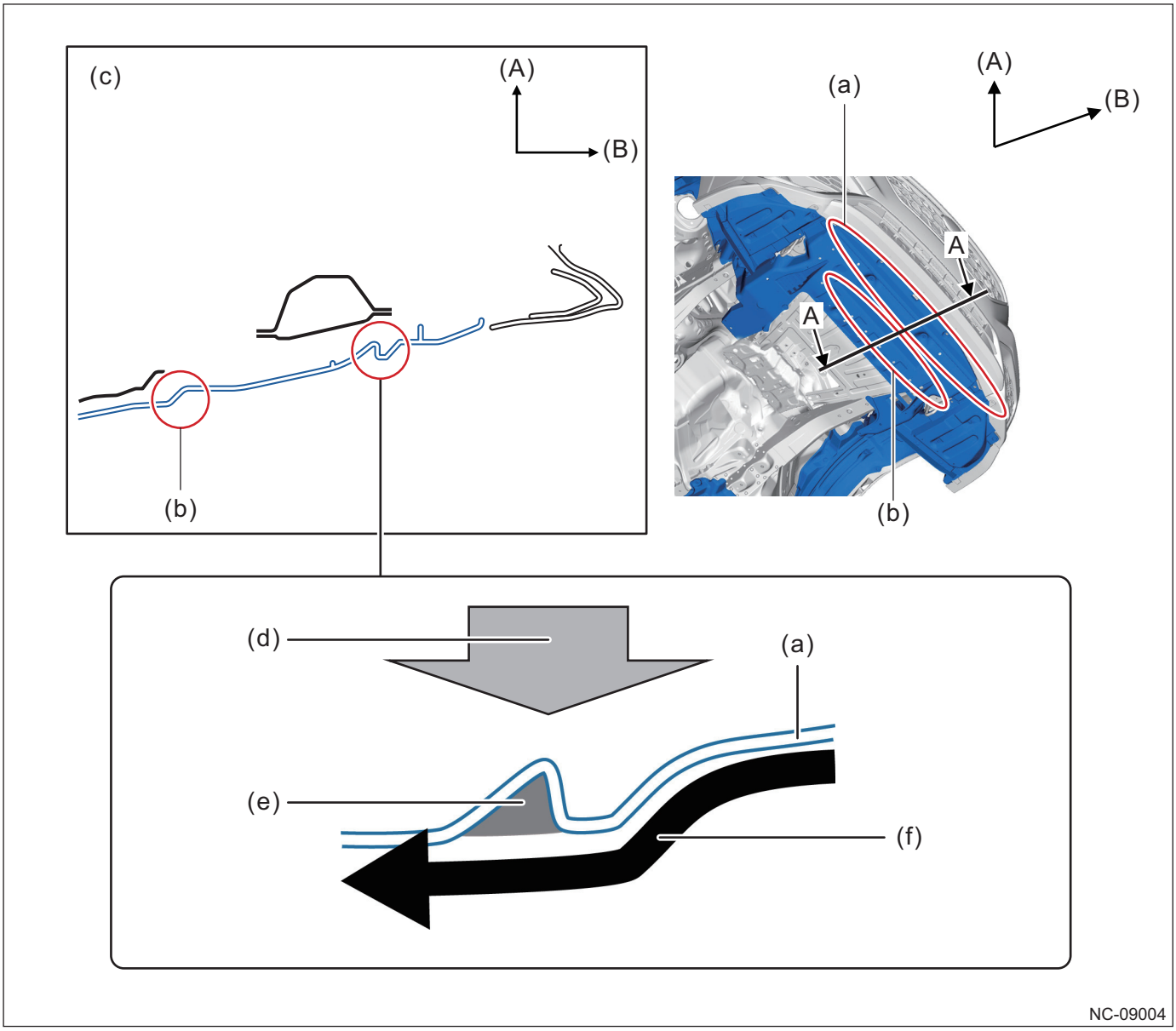


(a) Under cover front
(b) Mud guard front
(c) Under cover rear

■ Engine under cover

Bead shapes are adopted on the engine under cover to improve steering stability and aerodynamic performance.

- A bead for steering stability is adopted to generate downforce and improve straight-line performance and the feel of firmly contacting the ground.
- A bead for aerodynamics is added to improve aerodynamic performance.



(A) Top of vehicle

(B) Front of vehicle

(a) Bead for steering stability

(d) Downforce generated on vehicle body by negative pressure

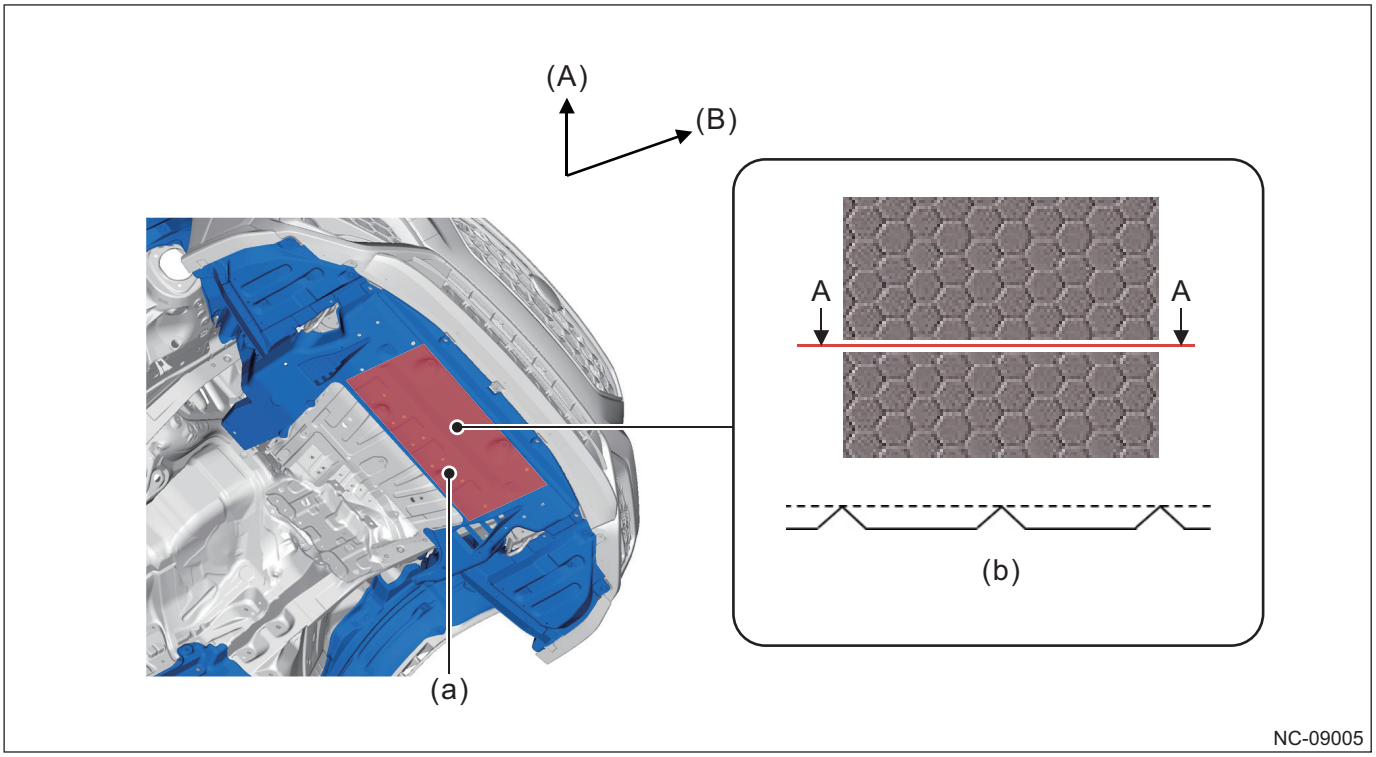
(b) Bead for aerodynamics

(e) Negative pressure is generated

(c) A-A cross section

(f) Airflow

A hexagonal dimpled pattern texture that rectifies the airflow is adopted for the engine under cover. The uneven surface shape restricts the generation of large air swirls, reducing air resistance and contributing to fuel efficiency.



(A) Top of vehicle

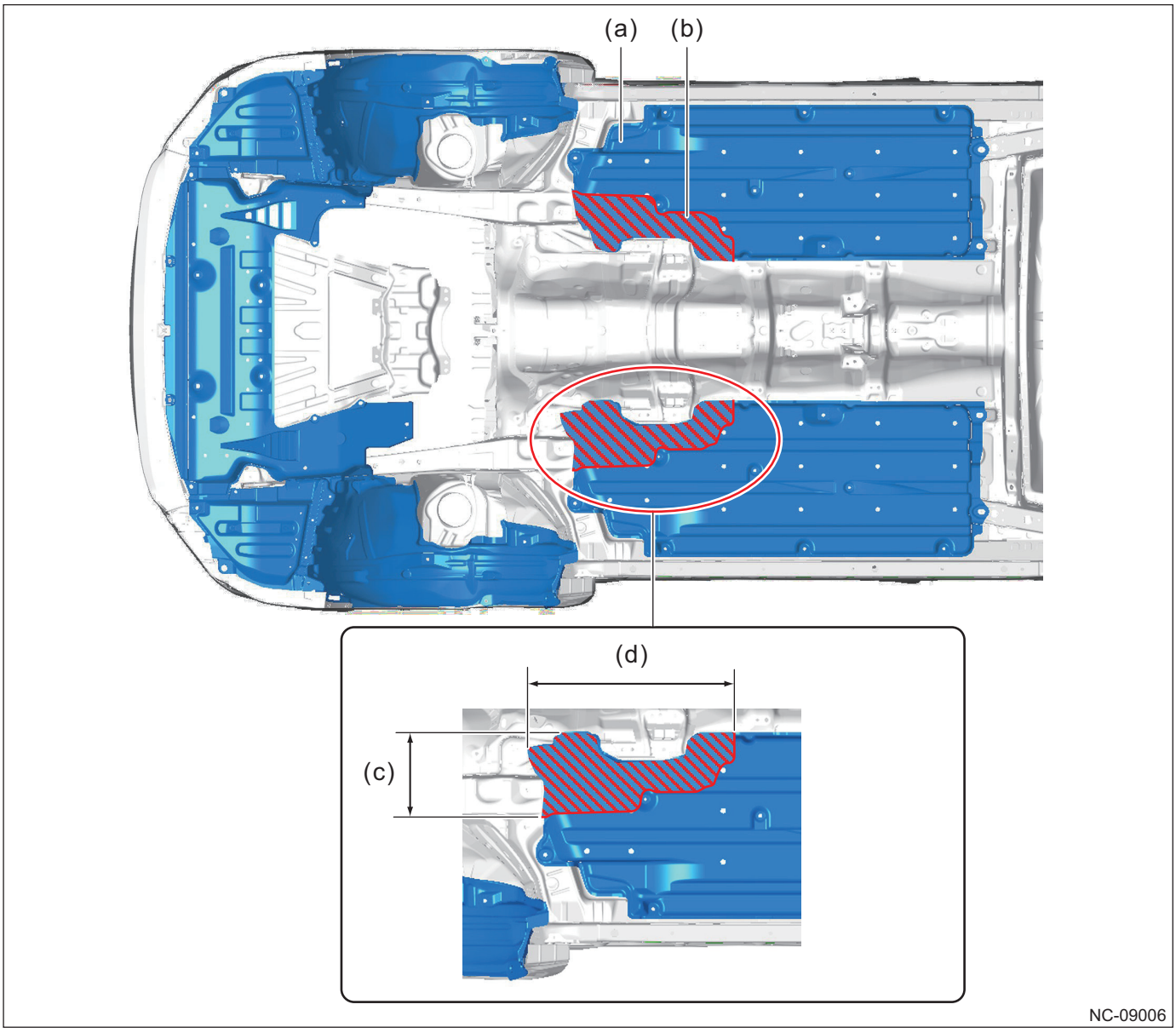
(B) Front of vehicle

(a) Area where hexagonal dimpled pattern texture is adopted

(b) A-A cross section

■ Under cover under the floor

The size of the under cover rear is enlarged and optimized to improve aerodynamic performance. Sound-absorbing materials are also adopted to reduce weight while enlarging the size.

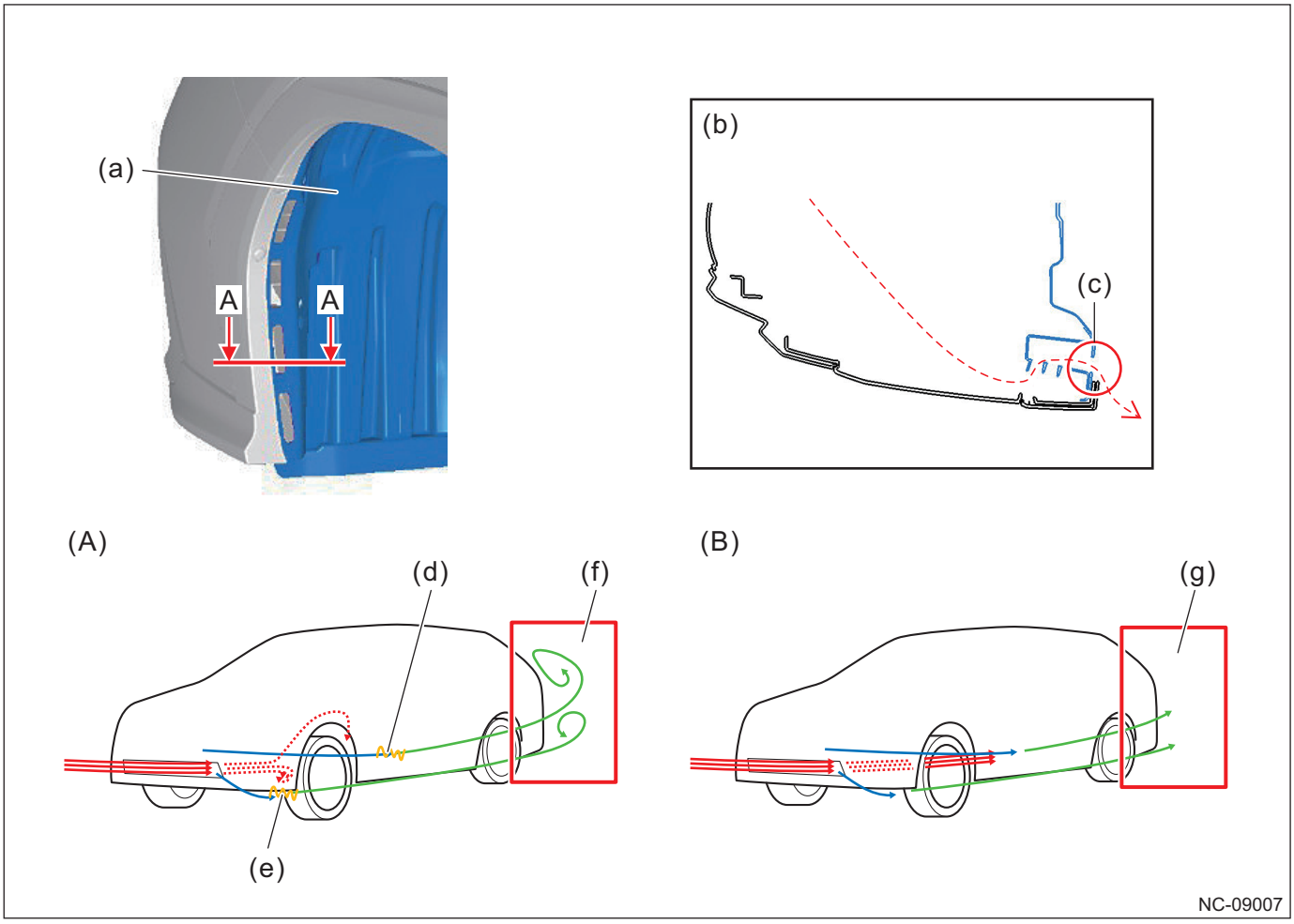


(a) Under cover rear
(b) Enlarged range
(c) 8.661 in (220 mm)
(d) 19.69 in (500 mm)

■ Front mud guard (air slits)

Air slits are adopted on the front wall of the front mud guard on the outside of the vehicle.

Reduction of the internal pressure within the engine compartment with air slits reduces interference from the airflow blown out from the wheel house and airflow passing on the sides of the vehicle, thus restricting the occurrence of back pressure behind the vehicle.



(A) Without air slits

(a) Mud guard front

(b) A-A cross section

(c) Air slits

(d) Airflow blown out from the wheel house and airflow on the sides of the vehicle interfere

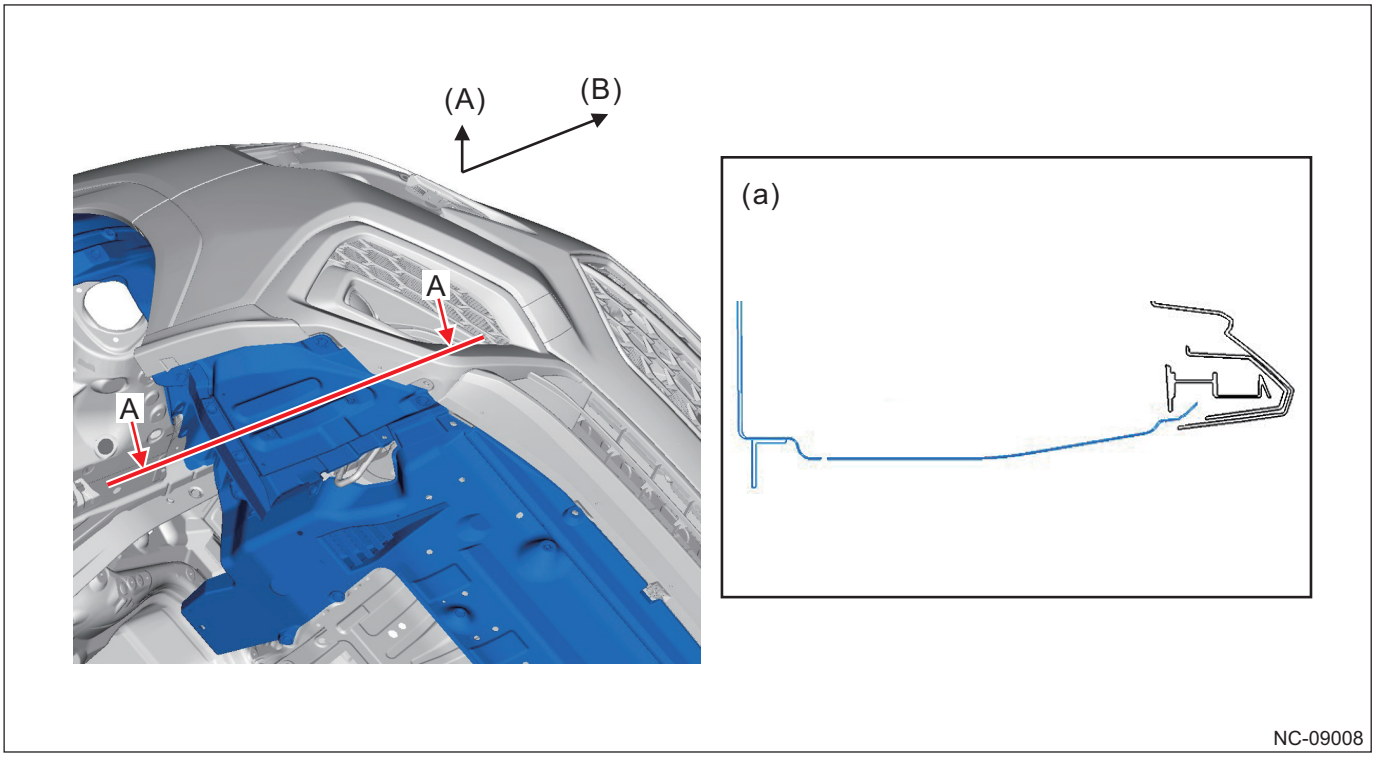
(B) With air slits

(e) Airflow blown out from inside the engine compartment and airflow under the floor interfere

(f) Back pressure: Great

(g) Back pressure: Small

The adoption of a protruding shape for the front lower surface of the front mud guard restricts the accumulation of air that flows onto the lower surface of the front mud guard to reduce air resistance.



(A) Top of vehicle

(B) Front of vehicle

(a) A-A cross section

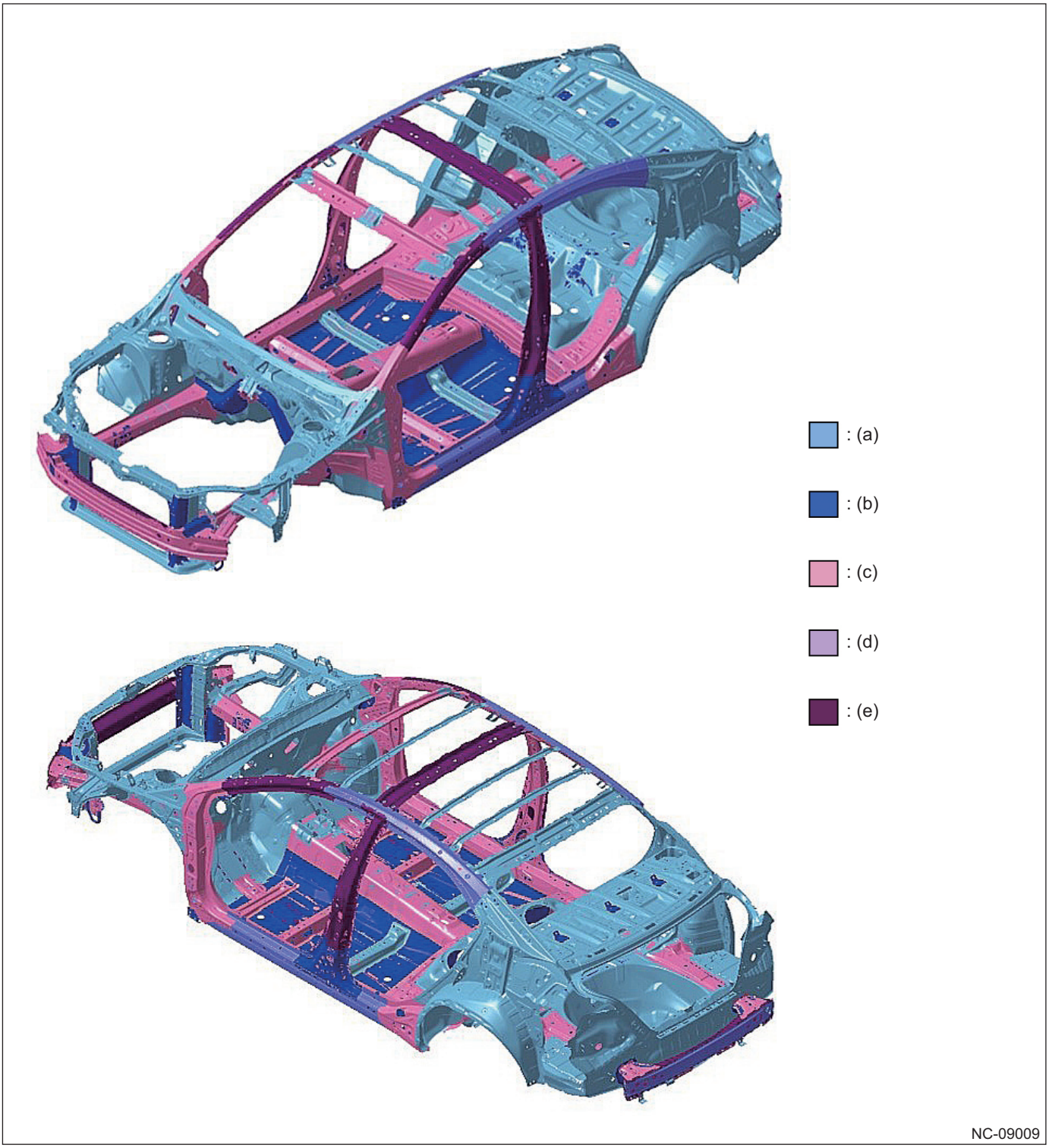
Other

Weight reduction

■ Sections with high-tensile strength steel and hot press material

In addition to adopting hot press materials, the usage ratio of super high-tensile strength steel of 140,299 psi (980 MPa, 9,993 kgf/cm2) or more is increased to reduce the vehicle weight.

The weight reduction also contributes to fuel efficiency improvement.



(a) 39,150 psi (270 MPa, 2,753 kgf/cm2)

(b) 57,999 to 72,499 psi (400 to 500 MPa, 4,079 to 5,098 kgf/cm2)

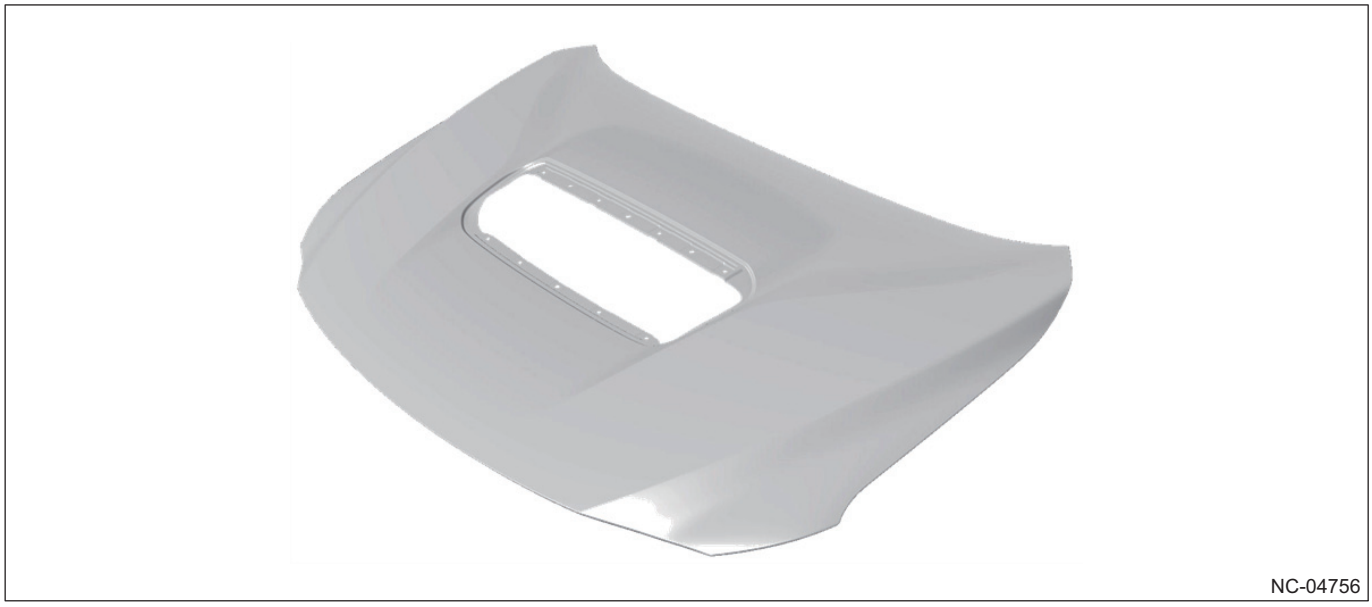
(c) 85,549 psi (590 MPa, 6,016 kgf/cm2)

(d) 140,299 psi (980 MPa, 9,993 kgf/cm2)

(e) Hot press

■ Aluminum hood

Aluminum material is adopted for the front hood to reduce the weight.

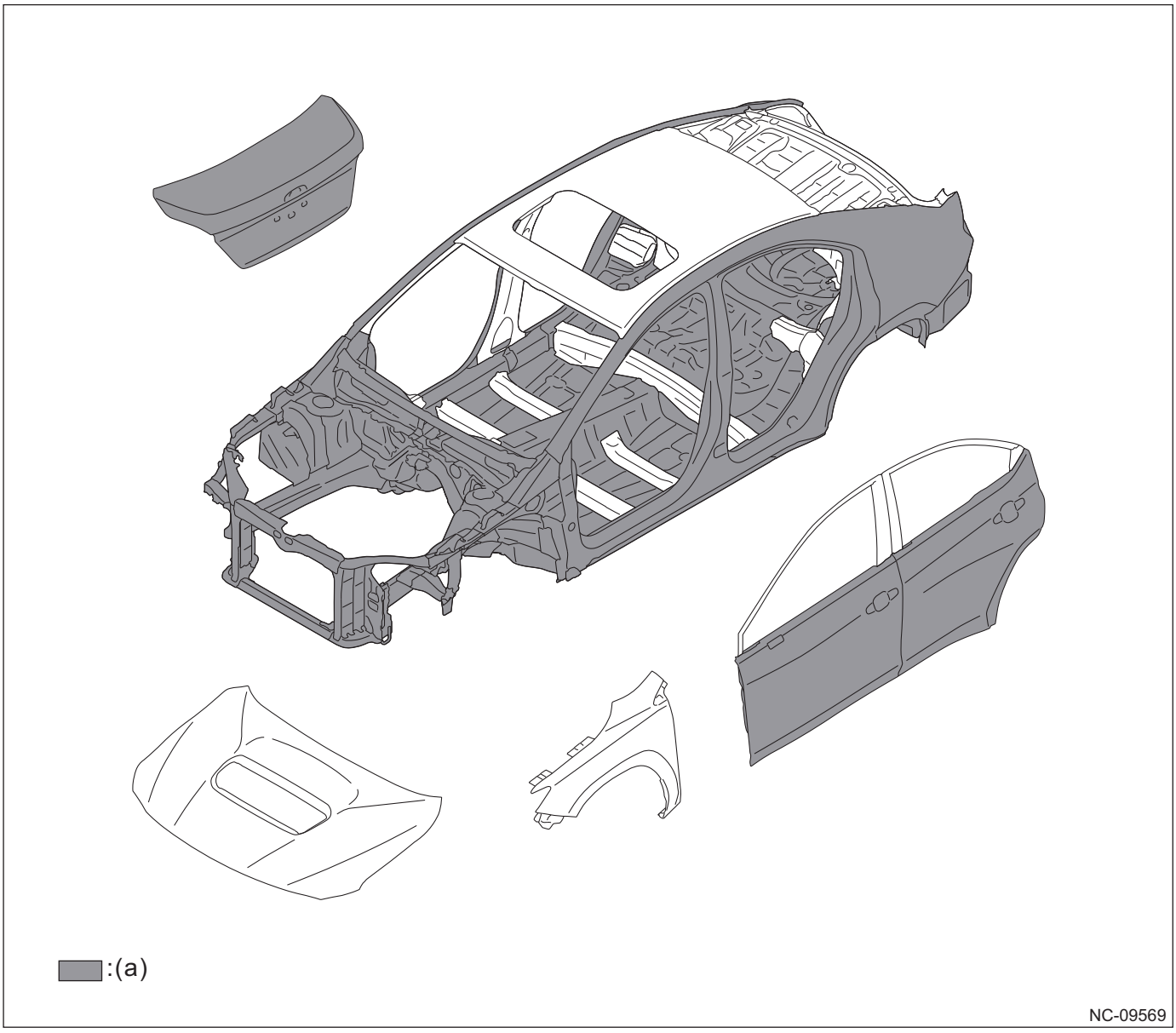


■ Aluminum fender

Aluminum material is adopted for the front fender to reduce the weight.

Portions with anti-corrosion strength steel

The anti-corrosion strength steel (galvanized steel) is adopted for portions with stringent corrosion-generation conditions to improve anti-corrosion performance.



(a) Galvanized steel (both sides)

9 EXTERIOR

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9.1 General Overview

9.1.1 Overview

Overview

In this chapter, the following components configuring the body exterior are described.

- Front Bumper/Front Grille/Horn/Cowl Panel
- Lighting System
- Fender Garnish
- Side sill spoiler
- Wiper and Washer System
- Glass/Windows/Mirrors
- Roof Molding
- Door and Fuel Flap
- Moonroof (For Some Grades)
- Rear Bumper/Letter Mark/Muffler Cutter
- Trunk/Trunk Garnish
- Rear Spoiler

9.2 Front Bumper/Front Grille/Horn/Cowl Panel

9.2.1 Overview

Overview

A sporty front bumper with a solid structure is adopted.

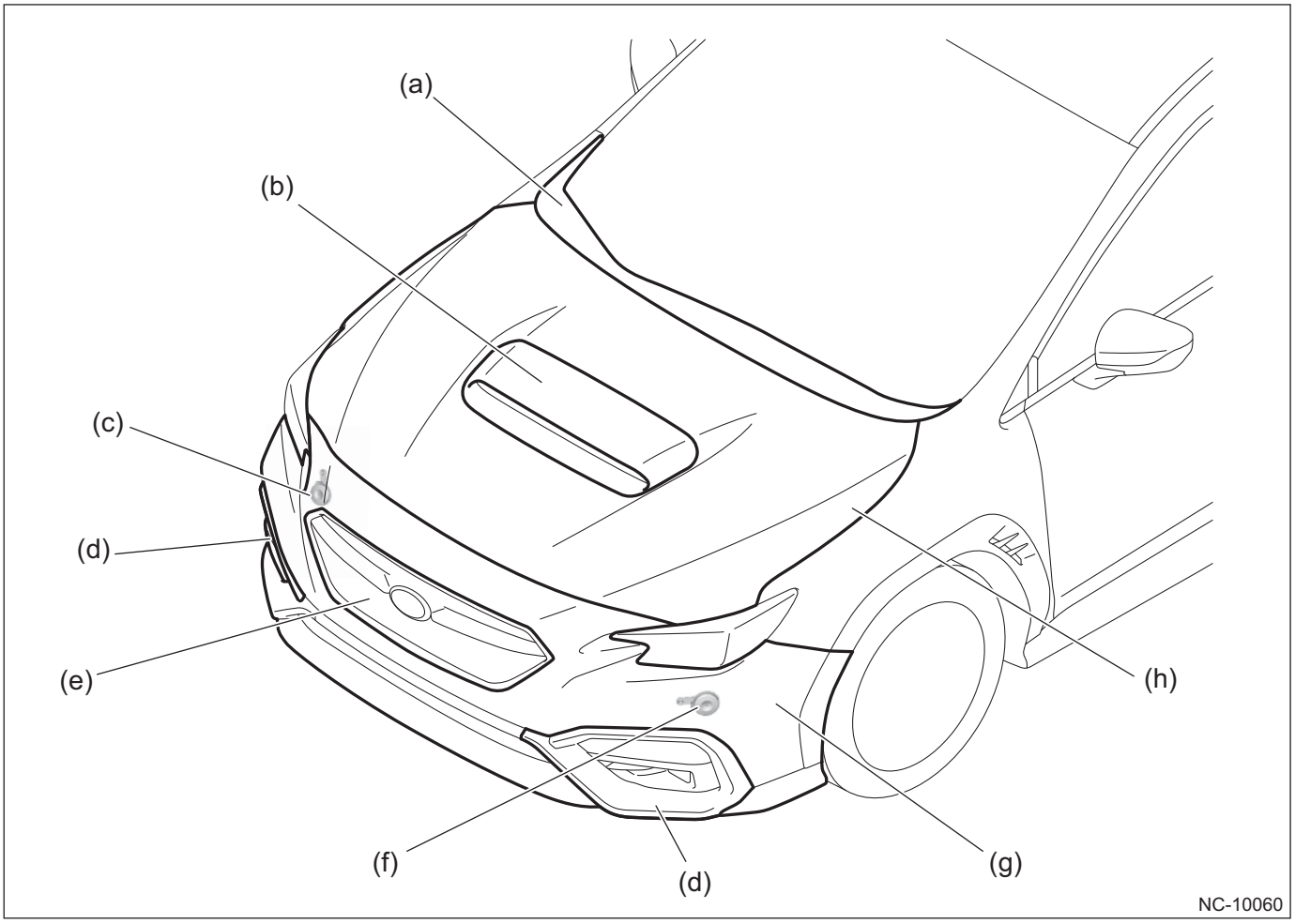
The lateral width of the front grille is enlarged to express a wide feel.

A cowl panel is adopted in consideration of wind noise and appearance.

The double horn with high pitch and low pitch is adopted.

9.2.2 Component

Component layout drawing



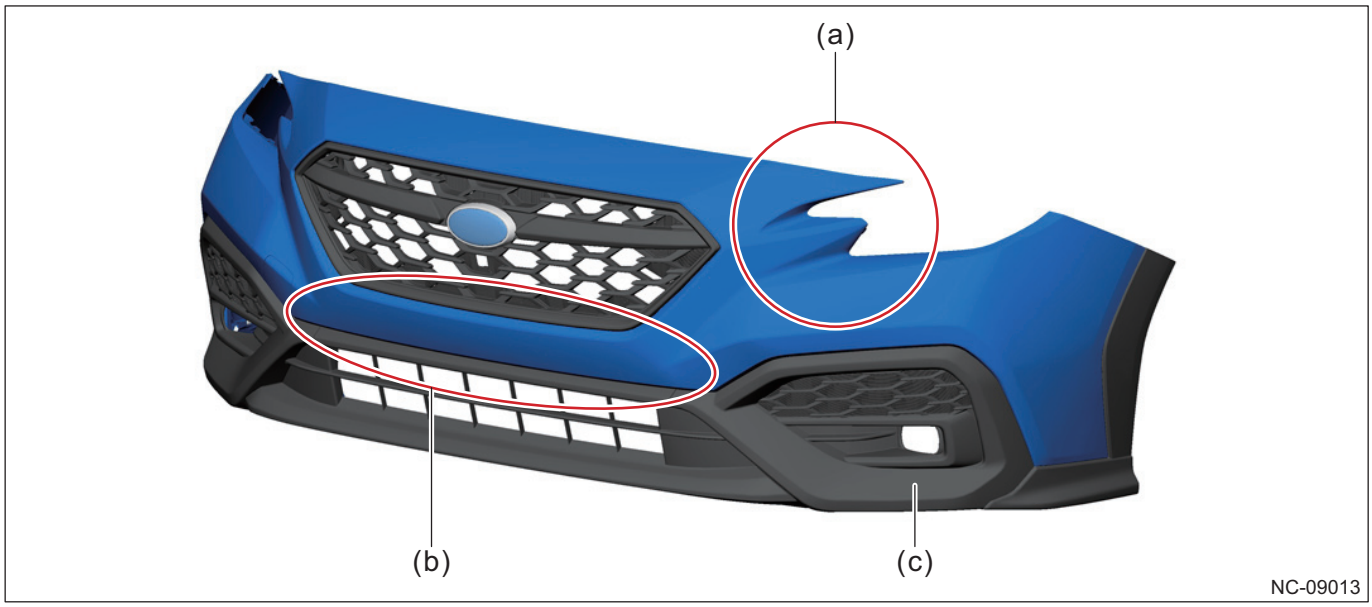
(a) Cowl panel
(b) Grille hood front assembly
(c) Horn assembly Lo
(d) Cover fog front
(e) Front grille assembly
(f) Horn assembly Hi
(g) Bumper face front
(h) Front hood

Component details

Front bumper

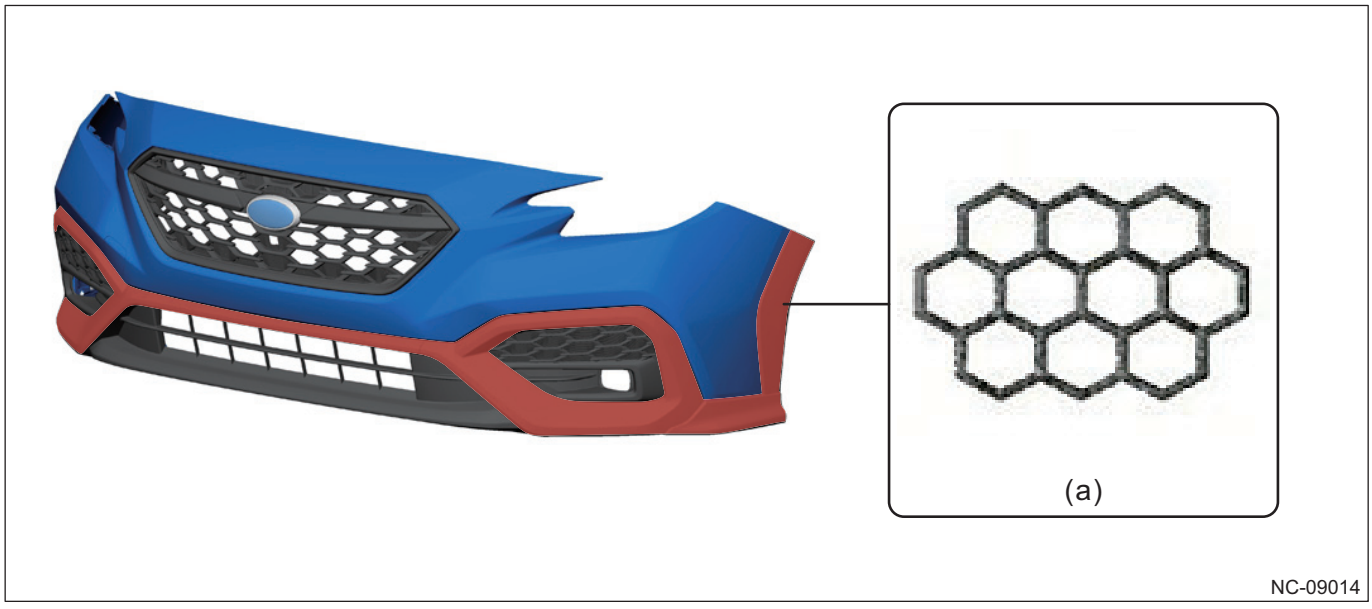
A concave surface is used for the front bumper middle section and a separate structure is used for the black outs at the front bumper lower part to provide a solid bumper shape.

The shape is aligned with the contours of the headlights to emphasize the sportiness.



(a) Headlight contour
(b) Concave surface
(c) Black out

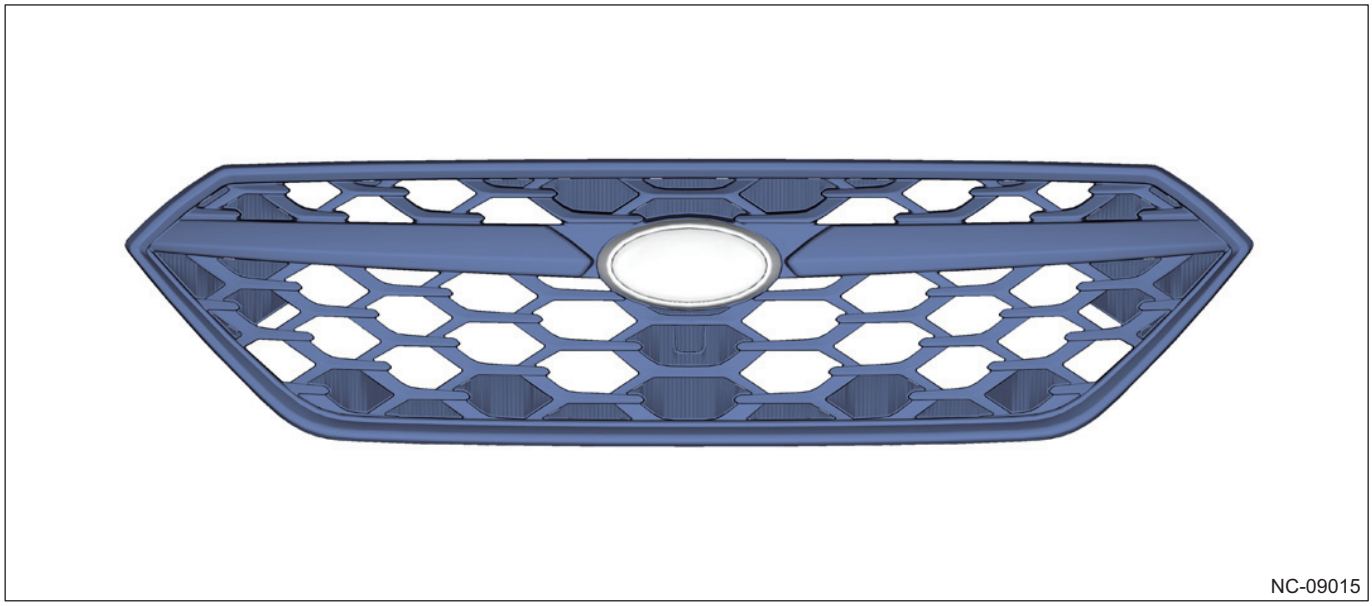
A hexagonal dimpled pattern texture that expresses a feel of functionality is adopted for the black outs at the front bumper lower part.



(a) Hexagonal dimpled pattern

Front grille

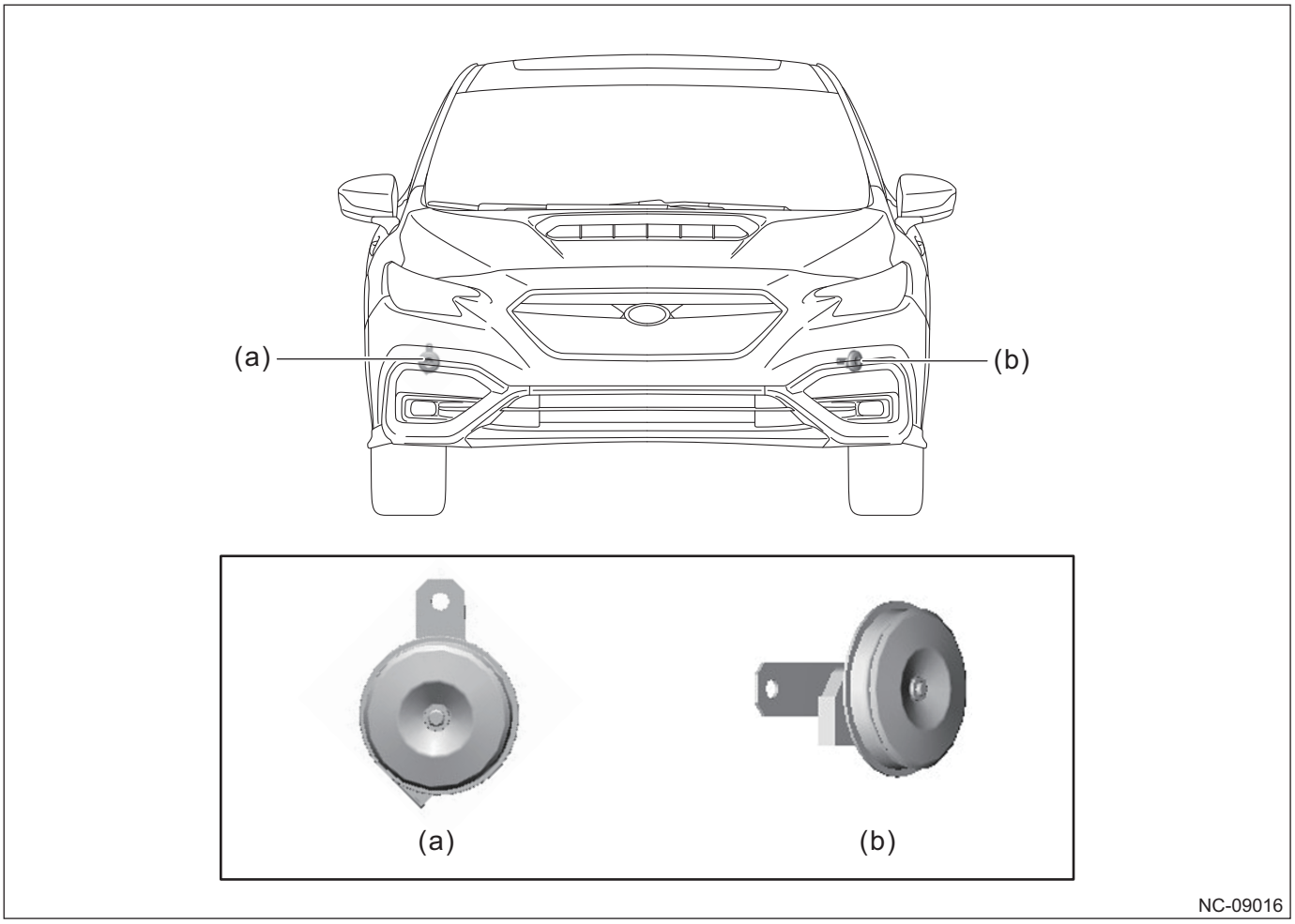
A front grille painted in dark metallic is adopted.



Horn

Two flat horns with different frequencies are adopted.

Each horn is positioned to the rear of the left and right fog lights because in the event of a light collision, the horn may be pressed and damage the radiator.



(a) Horn assembly Lo

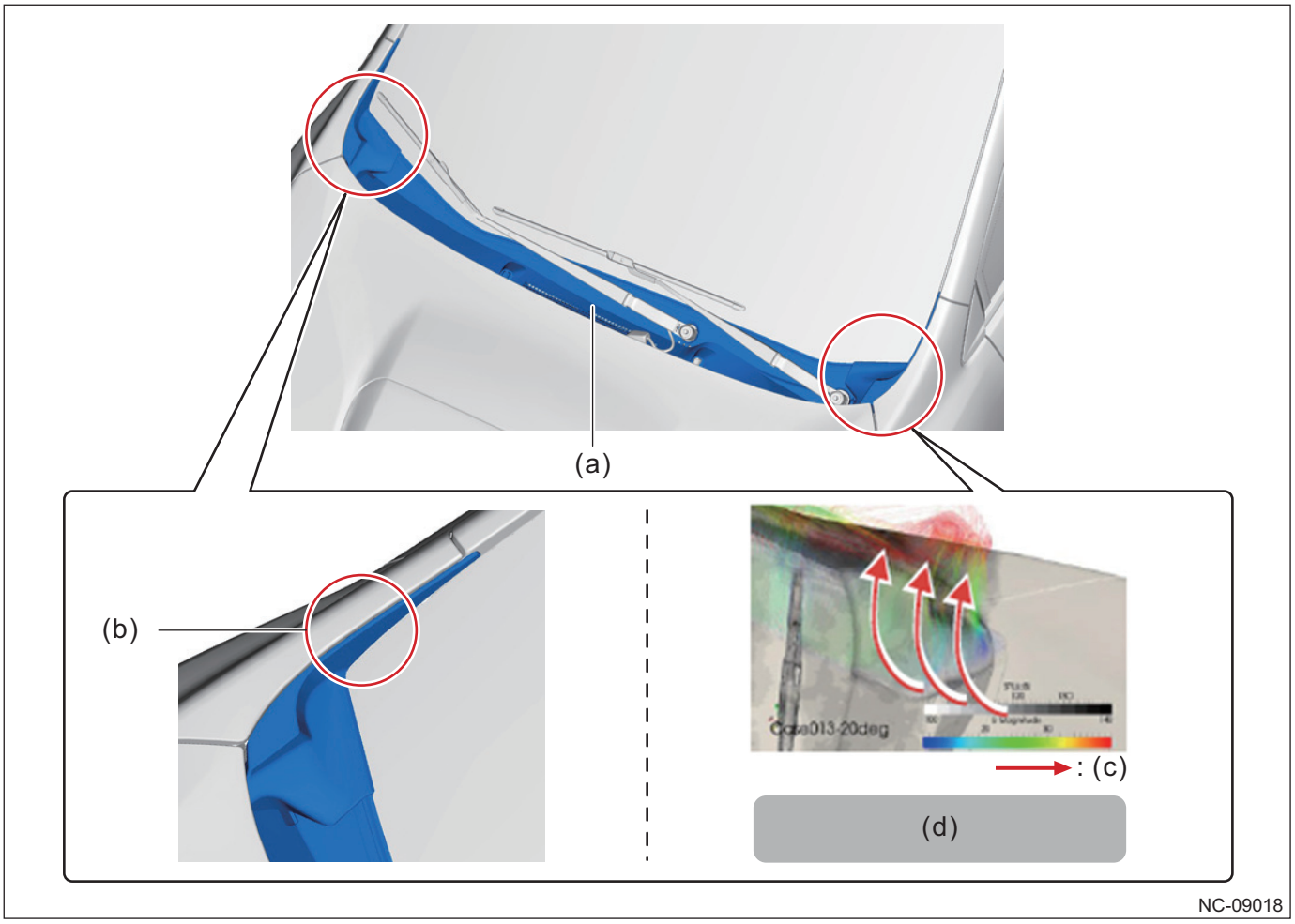
(b) Horn assembly Hi

Item	High pitch	Low pitch
Fundamental frequency [Hz]	420±20	365±20
Sound pressure level [dB]	113±5	113±5

Cowl panel

The shape of the cowl sides is revised to smooth the airflow near the base of the A pillar, reducing wind noise caused by airflow disturbances.

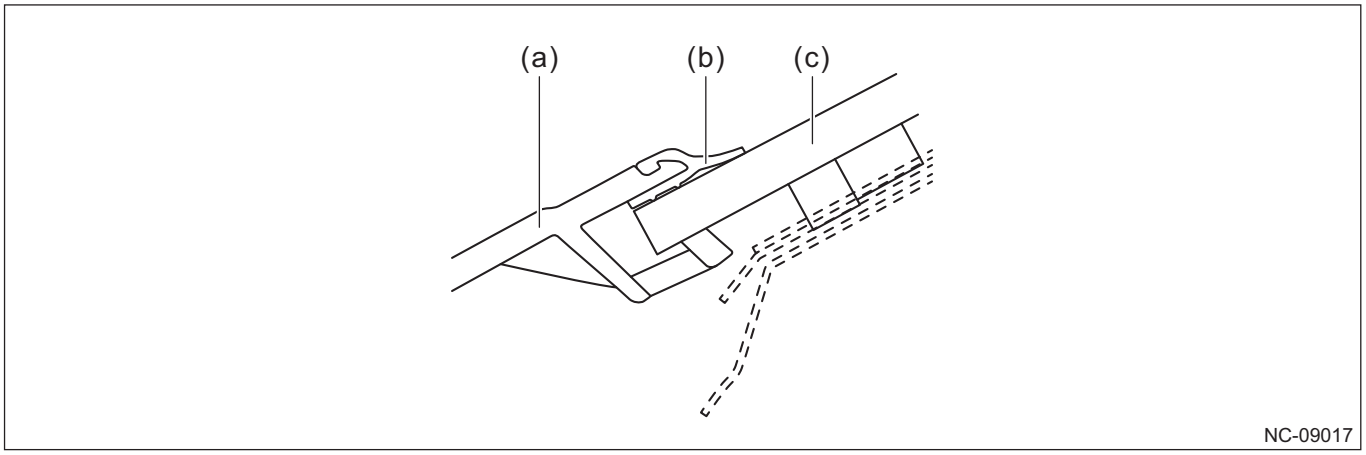
The externally installed clip is discontinued to improve appearance.



The illustration shows the left side of the vehicle.

(a) Cowl panel
(b) Position of discontinued externally installed clip
(c) Air flow
(d) Wind flow is smoothed along slanted surface

A lip is adopted at the division between the cowl panel and windshield glass to improve the appearance by following the glass with no gaps.



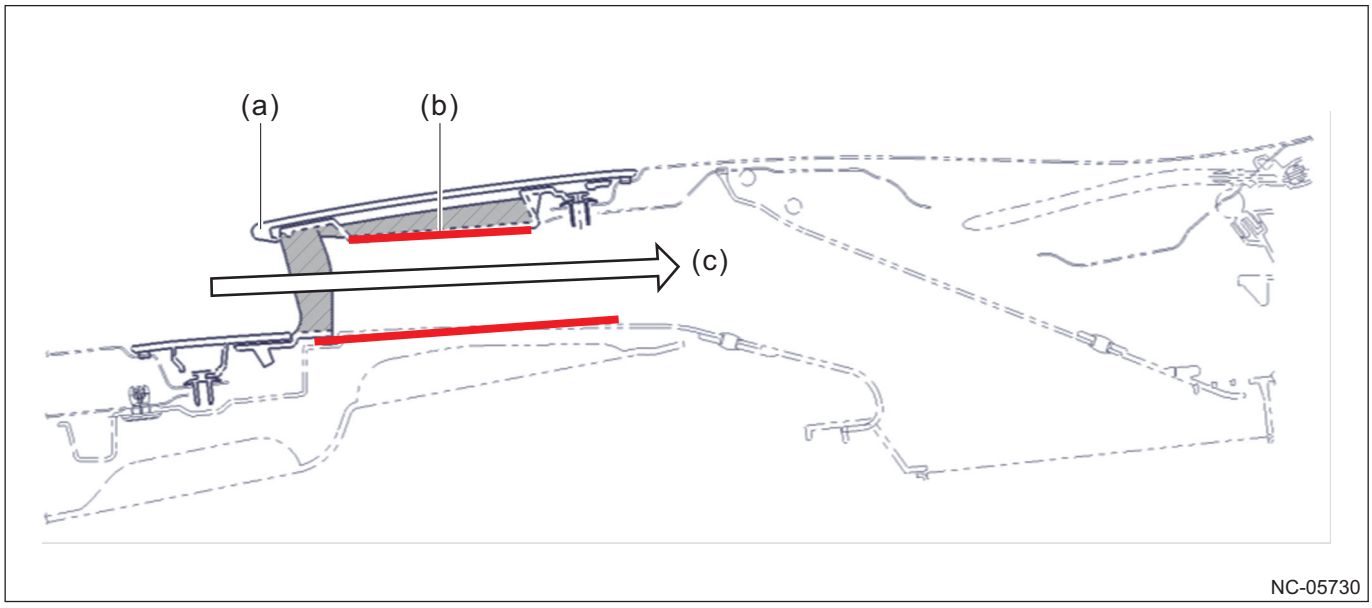
(a) Cowl panel
(b) Lip
(c) Windshield glass

Hood grille

A resin hood grille is adopted.

An outer and inner double structure is adopted to flatten the intake passages. This eliminates air turbulence and smooths the airflow for excellent cooling performance.

The opening height is lowered in consideration of visibility performance from the driver's seat and for excellent aerodynamic performance.



(a) Outer
(b) Inner
(c) Air flow

9.3 Lighting System

9.3.1 Overview

Overview

General

A newly designed headlight that creates a strong appearance across the entire front face is adopted for the headlight.

A LED light guide composed of the tail light illuminating in the shape of the SUBARU common motif (C shape) is adopted for the rear combination light.

A front fog light is adopted. (for some grades)

A daytime running light (DRL) function is adopted to ensure conspicuousness from the surroundings when driving in daytime.

A welcome lighting function is adopted to ensure the visibility of the vehicle surroundings when entering or exiting the vehicle.

The following functions are adopted to ensure visibility in the travel direction during nighttime driving.

- Auto light
- Headlight beam leveler
- High Beam Assist (HBA)
- Steering responsive headlight (SRH) (for some grades)

The following functions are adopted to ensure usability.

- Light reminder warning
- Direction indicator one-touch function

Handling precautions

■ Precautions for using High Beam Assist (HBA)

The high beam may not switch automatically to low beam in the following conditions.

- When an oncoming vehicle passes by suddenly on a curve with poor visibility
- When another vehicle cuts across in front
- When there is no oncoming vehicle or preceding vehicle in front on a slope with a large height difference
- When an oncoming vehicle or preceding vehicle appears and disappears on a continuous curve, or due to objects such as a median strip or roadside trees

High beam may switch to low beam due to the fog lights of oncoming vehicles.

High beam may switch to low beam or the low beam mode may continue due to the illumination of street lights, traffic signals, or advertisements, or reflective objects such as signs or signpost.

The timing of switching between high beam and low beam may change due to the following causes.

- Brightness or color of lights from oncoming vehicles or preceding vehicles
- When the lights of oncoming vehicles or preceding vehicles are dirty with substances such as mud or snow and cannot be seen
- Movement or direction of oncoming vehicles or preceding vehicles
- When the lights of an oncoming vehicle or preceding vehicle are turned on only on one side
- When the oncoming vehicle or preceding vehicle is a two-wheeled vehicle
- Road conditions (such as gradient, curve, or road surface conditions)
- Number of occupants and luggage weight
- Response delay due to restricted recognition range for High Beam Assist (HBA) control camera

In High Beam Assist (HBA), light sources such as the headlights of oncoming vehicles or the tail lights of preceding vehicles, and the brightness of illumination such as street lights, are recognized by the High Beam Assist (HBA) control camera. Therefore, the switching of the beam blocking range may be out of alignment with the senses of the driver.

The lights of light vehicles such as a bicycle may not be detected.

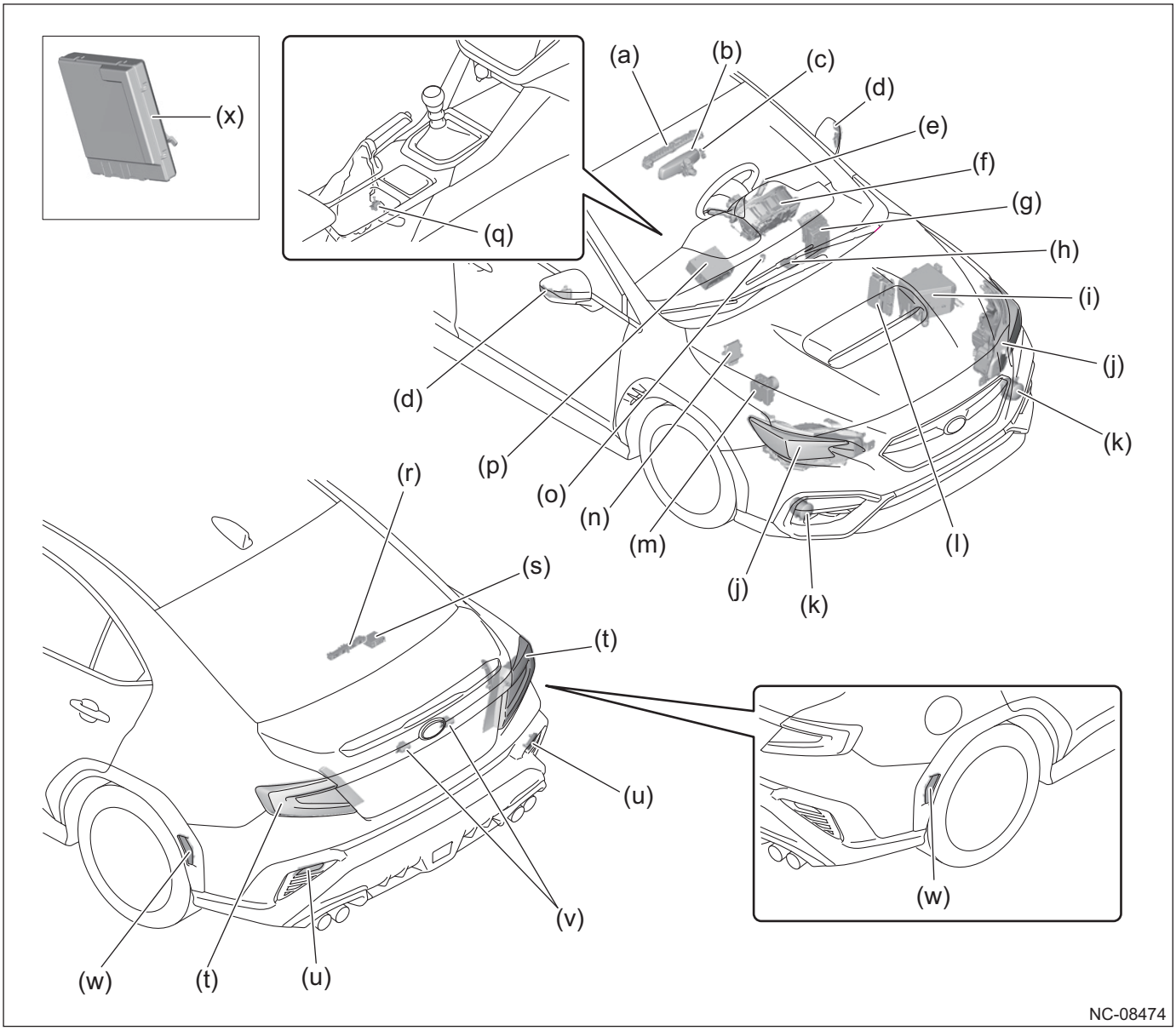
In the following situations, the surrounding brightness may not be detected accurately and the high beam may bother oncoming vehicles or preceding vehicles, or the low beam mode may continue. In such cases, switch between the high beam and low beam manually.

- In adverse weather (such as fog, snow, sand storm, or heavy rain)
- When the windshield glass is dirty or fogged
- When the windshield glass is cracked or broken
- When there is surrounding light that is similar to headlights or tail lights, etc.
- When the lights of the oncoming vehicle or preceding vehicle are not turned on (broken bulb, etc.), the light is dirty or discolored, or the beam is misaligned
- When there are sudden and continuous brightness fluctuations
- When driving on a road with many undulations or bumps
- When driving on a road with many curves
- When light is reflected strongly in front of the vehicle, like from a sign or mirror
- When light reflects strongly off the rear of the preceding vehicle, such as from a container

- When own vehicle's headlights are broken or dirty
- When the vehicle is tilted due to a puncture, towed vehicle, etc.
- Immediately after engine start

9.3.2 Component

Component layout drawing



(a) Stereo camera (models with EyeSight)

(b) Inner mirror HBA unit assembly (models without EyeSight)

(c) Front door switch assembly (driver's seat side)

(d) Side turn signal light

(e) Lighting switch

(f) Combination meter

(g) Body Integrated Unit (in joint box)

(h) Auto headlight beam leveler CM

(i) Front relay control module (in main fuse & relay box)

(j) Headlight

(k) Front fog light (for some grades)

(l) Engine control module (ECM)

(m) VDC control module and hydraulic control module (VDC CM & H/M)

(n) Transmission control module (TCM) (CVT)

(o) Auto light sensor

(p) Cockpit Control Module (CCM)

(q) Parking brake switch (models without electronic parking brake (EPB))

(r) High-mounted stop light

(s) TPMS & keyless entry CM (models with keyless entry system)

(t) Rear combination light

(u) Rear reflex reflector

(v) License plate light

(w) Rear side reflex reflector

(x) Keyless access CM (models with keyless access & push button start system)

Component details

Headlight

A small and sharp shape based on the design of the SUBARU common motif (C shape) is adopted for the headlights.

Two types of headlight are provided, depending on the grade.

■ Models with steering responsive headlight (SRH) function (for some grades)

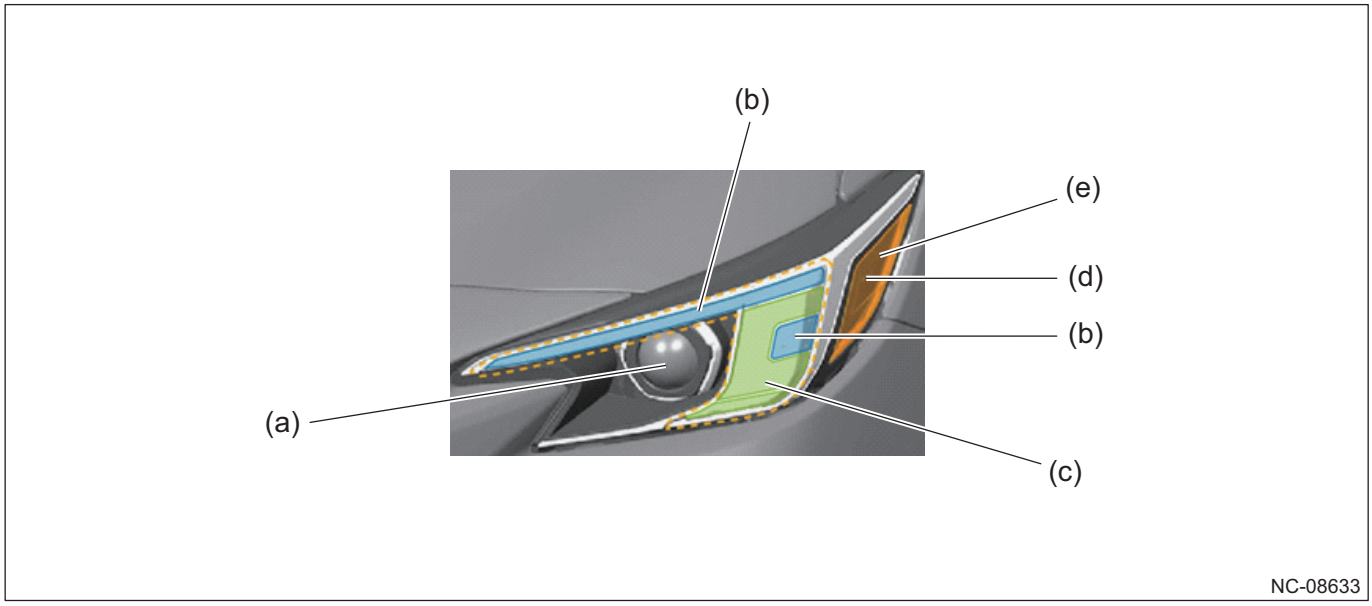
The bi-functional projector LED lights that switch between high beam and low beam are adopted for the main beam.

The daytime running light (DRL), accessory light, parking light, and front turn signal light are consolidated in the C shape to realize a design that feels advanced when the lights are on* and also help make the headlights more compact.

LED is adopted for all the light sources of the headlights to reduce power consumption.

The steering responsive headlight (SRH) function and High Beam Assist (HBA) function are adopted to improve light distribution performance.

**: A C-shaped light guide is formed by turning on the accessory light while the daytime running light (DRL) or parking light is on. While a front turn signal light is flashing, the accessory light turns off on the side with the flashing front turn signal light.*

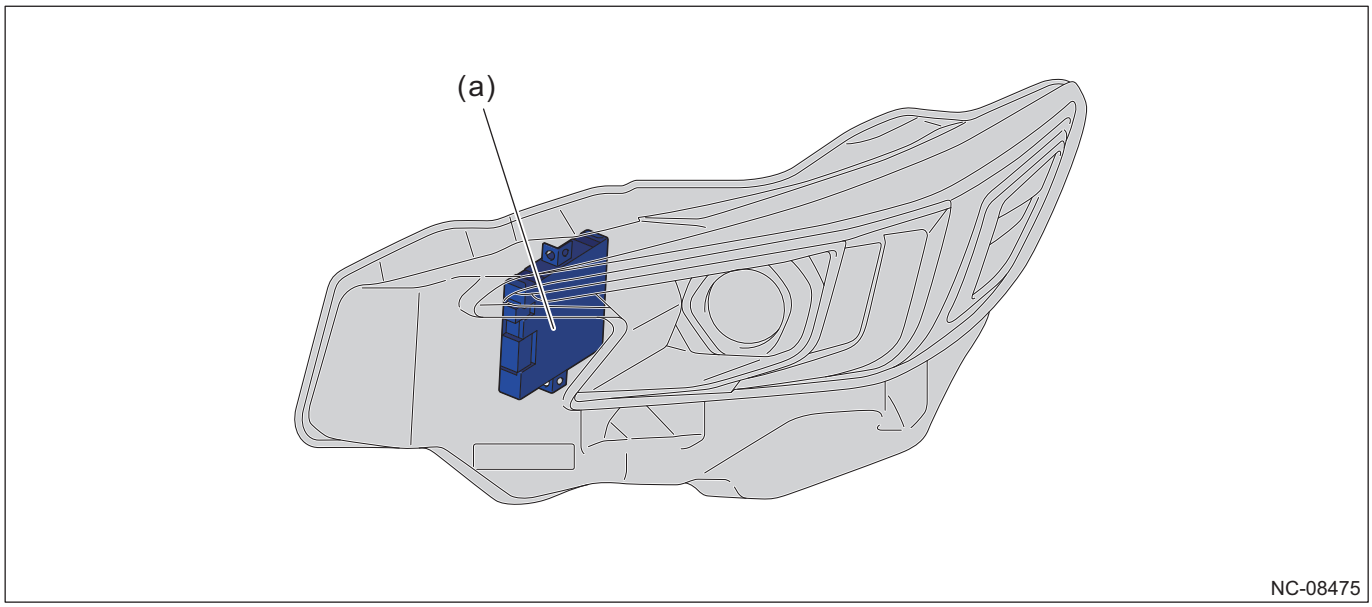


Item	Name	Specifications
(a)	Main beam (low beam/high beam)	LED
(b)	Parking light/daytime running light (DRL)/front turn signal light	LED
(c)	Accessory light/daytime running light (DRL)/front turn signal light	LED
(d)	Front side marker light	LED
(e)	Front side reflex reflector	-

Integrated LED driver module (LDM)

The integrated LED driver module (LDM) is installed in the headlight.

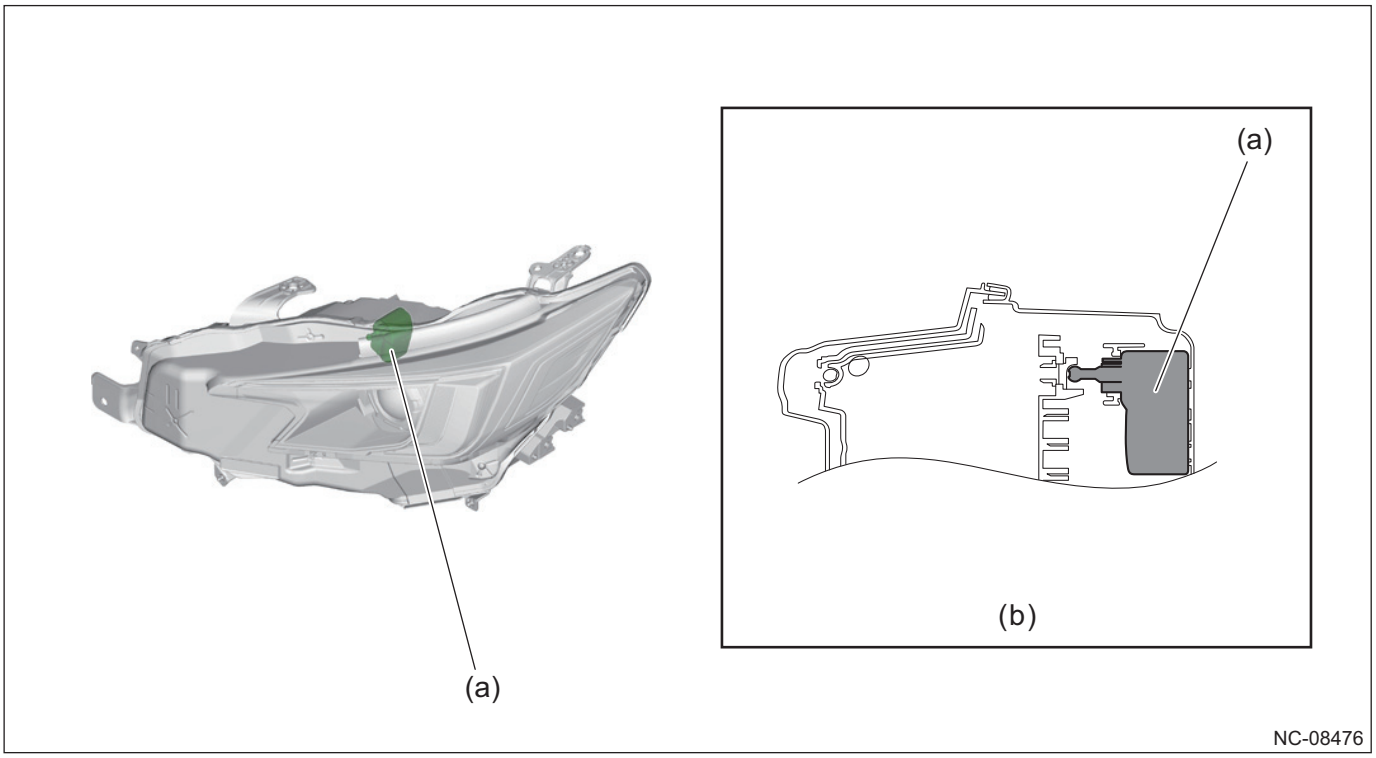
The integrated LED driver module (LDM) performs on/off control and malfunction detection for the main beam (low beam/high beam), daytime running light (DRL), parking light, accessory light, and front turn signal light.



(a) Integrated LED driver module (LDM)

Leveling actuator

The leveling actuator is installed in the headlight. Headlight beam leveler control is performed by expanding and contracting the shaft of the leveling actuator to move the headlight beams up and down.

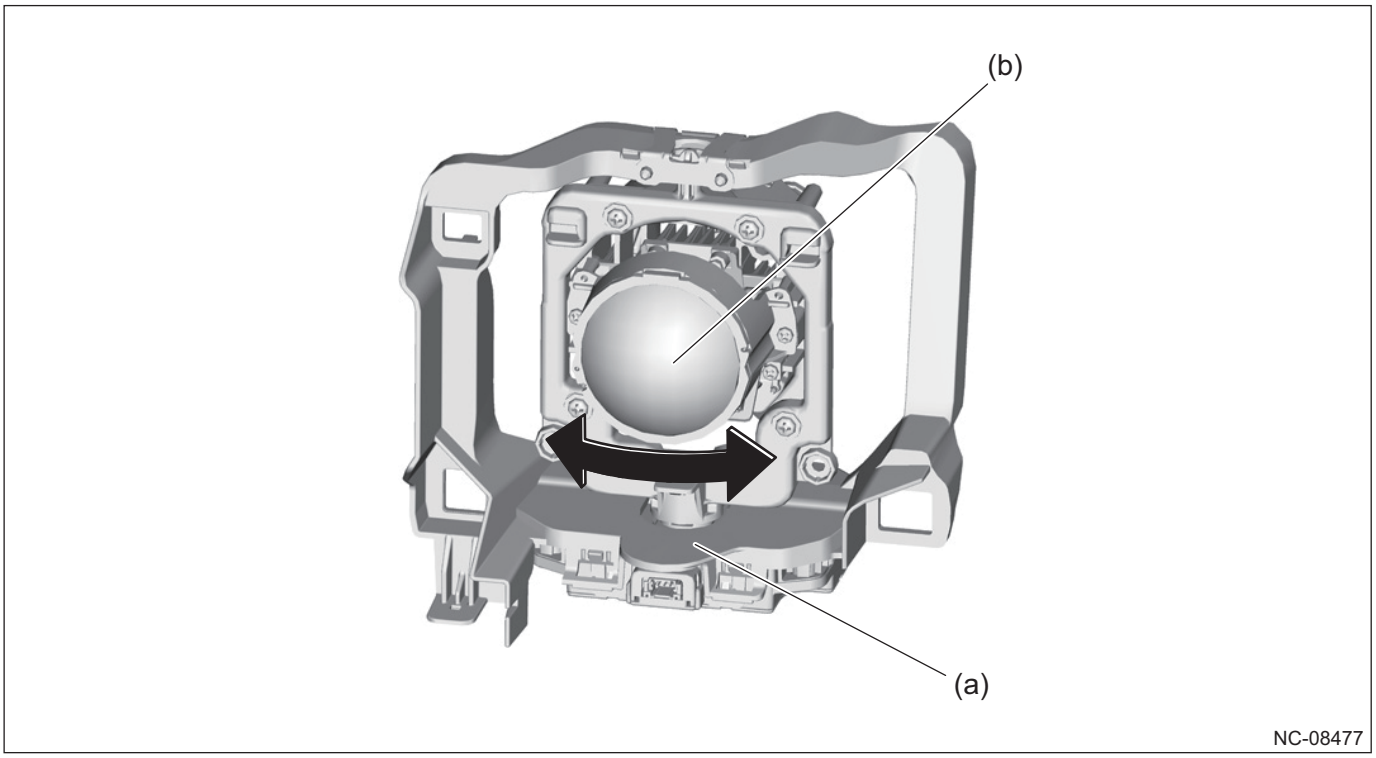


(a) Leveling actuator

(a) Headlight cross section

Swivel actuator

The swivel actuator is installed in the headlight. Steering responsive headlight (SRH) control is performed by moving the headlight beams left and right via the internal motor.



(a) Swivel actuator

(b) Main beam

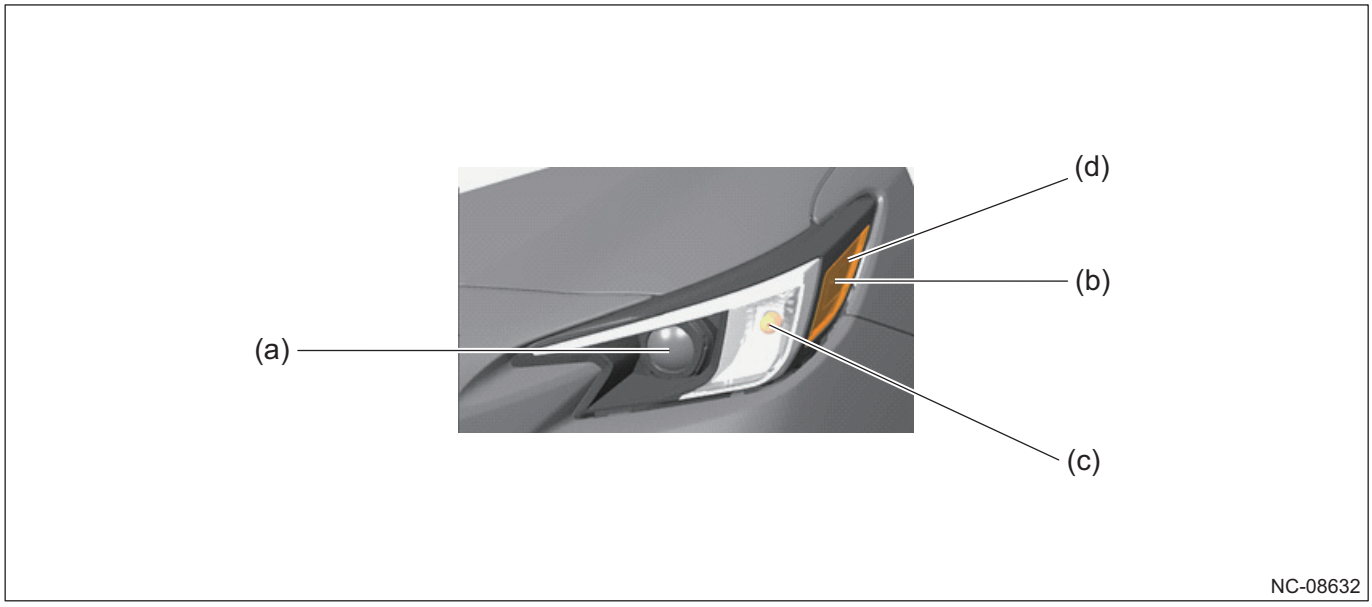
■ Models without steering responsive headlight (SRH) function (for some grades)

The bi-functional projector LED lights that switch between high beam and low beam are adopted for the main beam.

A daytime running light (DRL) function based on dimming the low beam is adopted.

The headlight size is reduced by consolidating the parking light and front turn signal light into the same bulb.

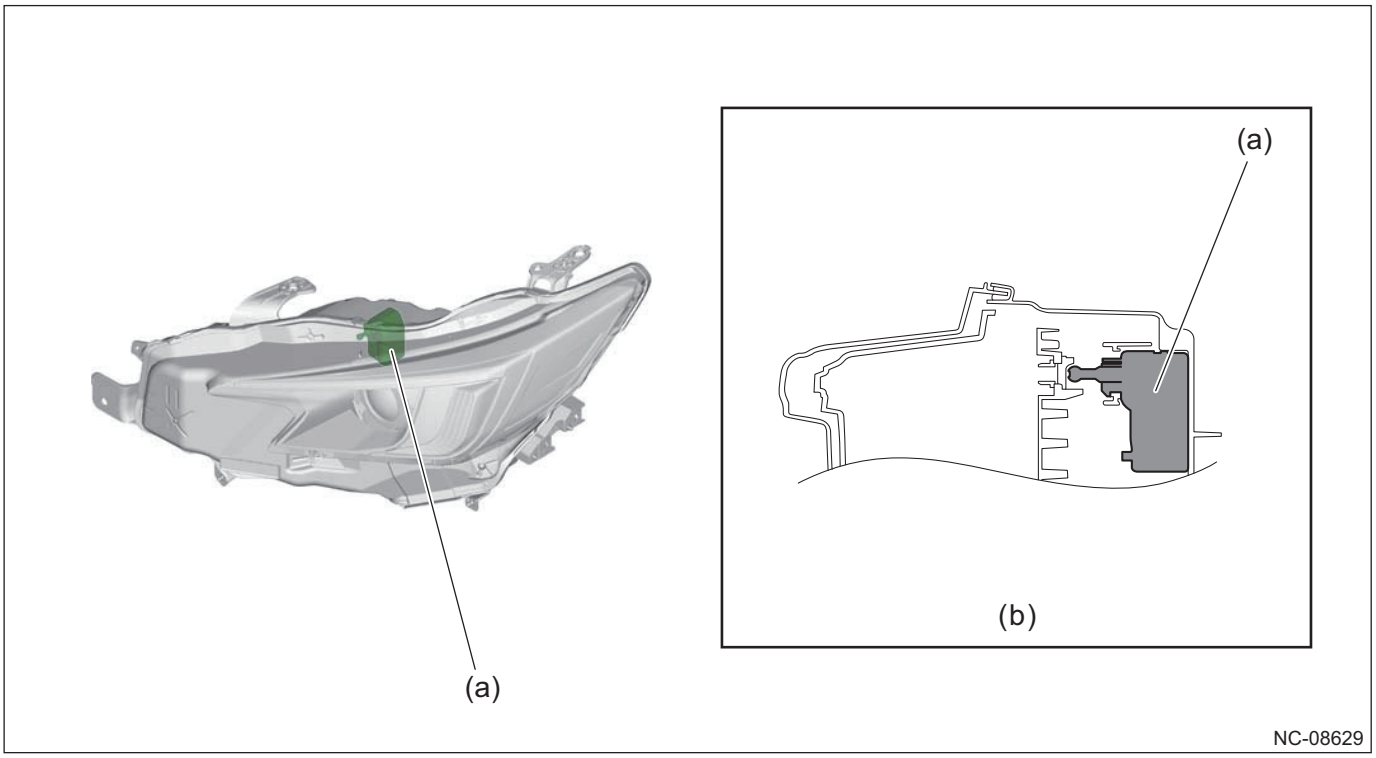
The High Beam Assist (HBA) function is adopted to improve light distribution performance.



Item	Name	Specifications
(a)	Main beam (low beam/high beam/daytime running light (DRL))	LED
(b)	Front side marker light	W5W (12 V 5 W)
(c)	Parking light/front turn signal light	7444NA (12 V 28 W/8 W)
(d)	Front side reflex reflector	-

Leveling actuator

The leveling actuator is installed in the headlight. Headlight beam leveler control is performed by expanding and contracting the shaft of the leveling actuator to move the headlight beams up and down.

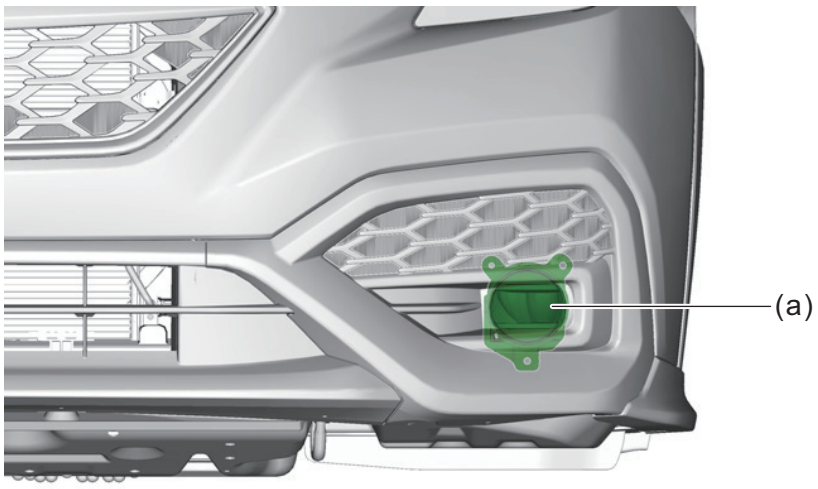


(a) Leveling actuator

(a) Headlight cross section

Front fog light (for some grades)

A front fog light is positioned on both ends of the front bumper.

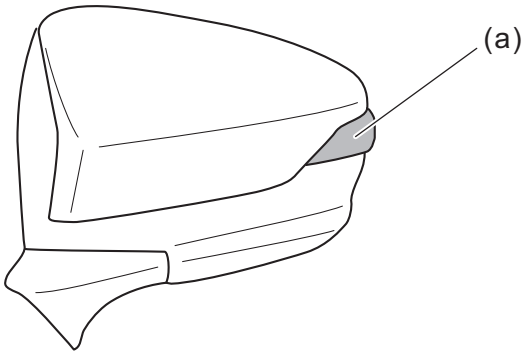


NC-08631

Item	Name	Specifications
(a)	Fog lights	LED

Side turn signal light

The side turn signal light is positioned on the door mirror. The optical guiding type of LED whose entire light body illuminates is adopted to ensure conspicuousness from the surroundings.



NC-04096

Item	Name	Specifications
(a)	Side turn signal light	LED

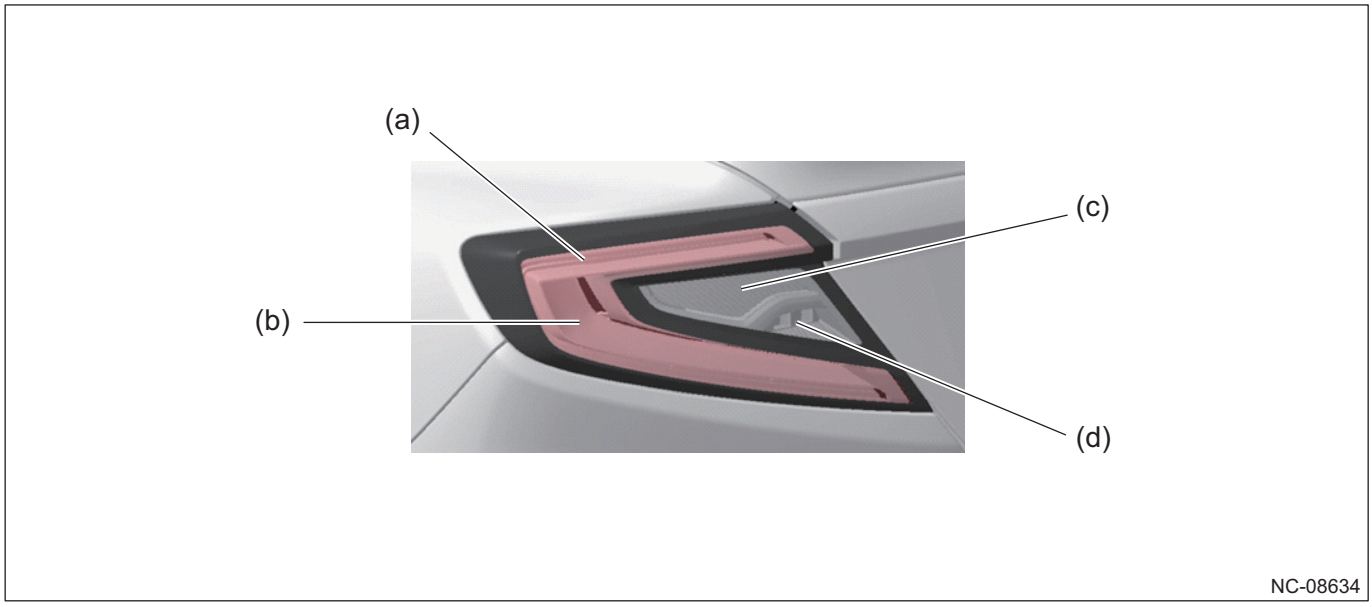
Rear combination light

The SUBARU common motif (C shape) light guide is adopted for the tail light for a sharp expression when the lights turn on.

The 3-color molded outer lens (red/clear color/black) is adopted for a design that feels integrated.

LED is adopted for the following lights to reduce power consumption.

- Stop light
- Tail light/rear side marker light
- Back-up light

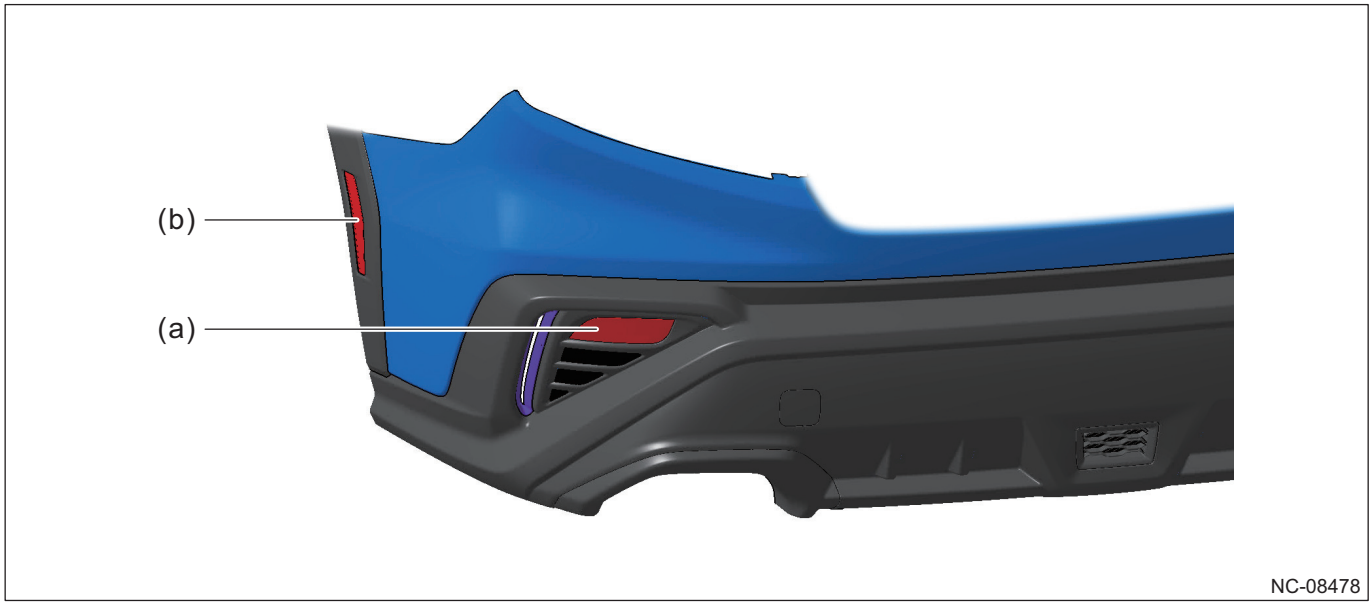


Item	Name	Specifications
(a)	Tail light/rear side marker light	LED
(b)	Tail light/stop light	LED
(c)	Turn signal light	WY21W (12 V 21 W)
(d)	Back-up light	LED

Rear reflex reflector/rear side reflex reflector

The rear reflex reflector is positioned at both ends of the rear bumper.

The side reflex reflector is positioned at both ends of the rear quarter garnish.

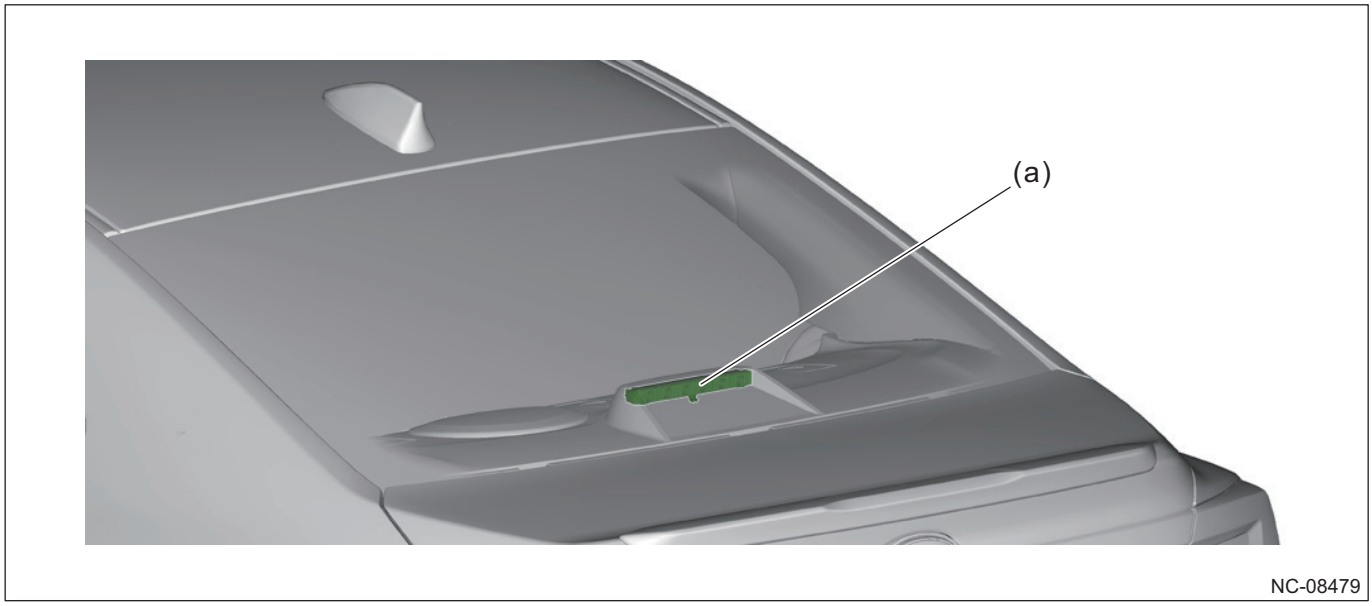


(a) Rear reflex reflector

(b) Rear side reflex reflector

High-mounted stop light

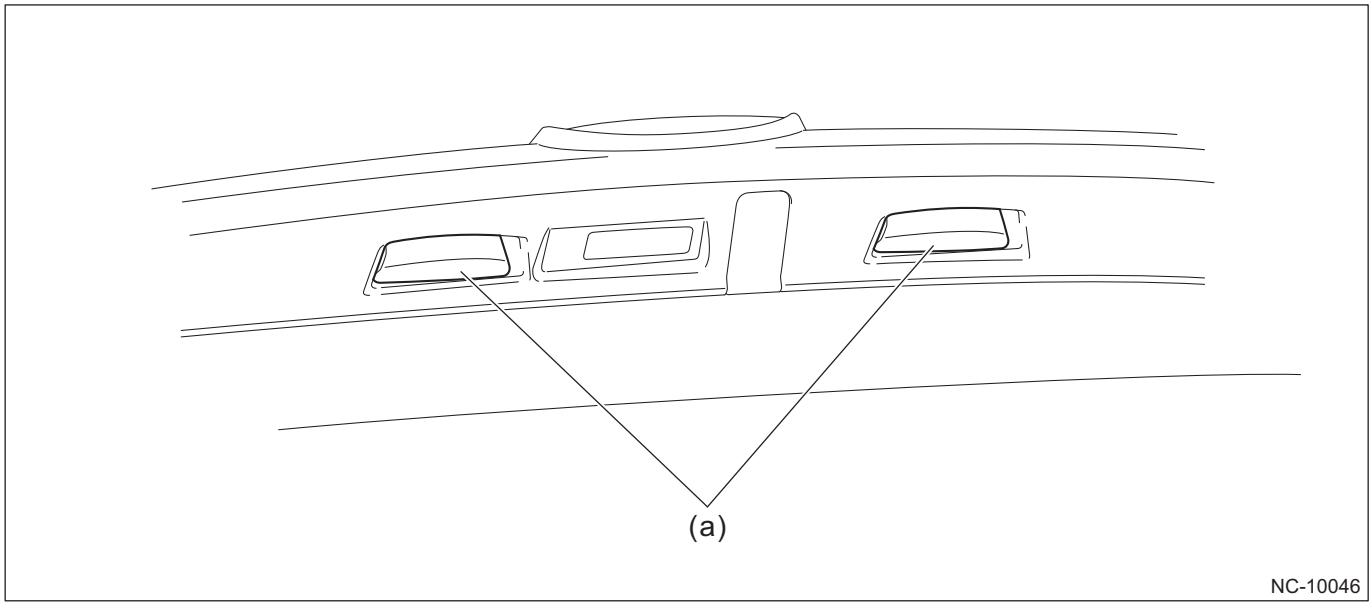
The high-mounted stop light is positioned at the rear glass lower part. The light distribution of the LED light source is optimized and its structure is thinned to enable its positioning on the slanted rear glass, creating a sharp appearance.



Item	Name	Specifications
(a)	High-mounted stop light	LED

License plate light

The license plate light is positioned in the rear garnish.



Item	Name	Type
(a)	License plate light	W5W (12 V 5 W)

Lighting switch

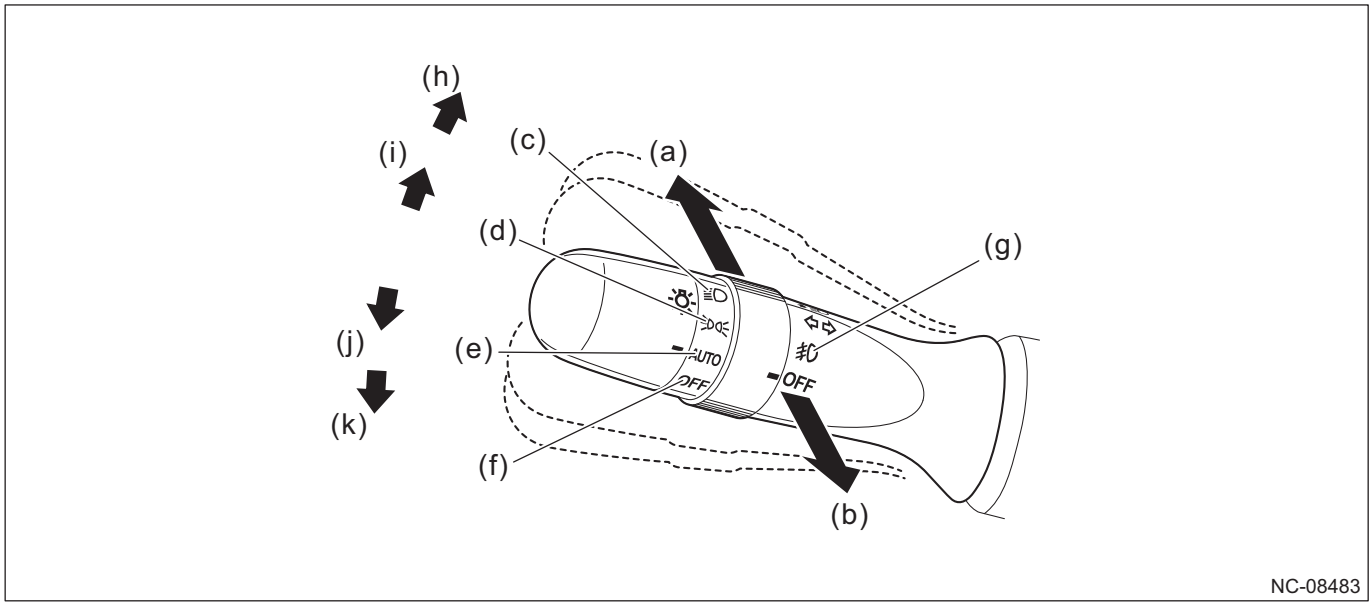
A momentary type switch is adopted for the light switch (between OFF and AUTO positions)*1, high beam switch, passing switch, and turn signal switch. *2

In the lighting switches for C0, the default position of the light switch is set to the AUTO position, creating a design that requires operation of the auto light function while driving. This prevents the driver from forgetting to turn the lights on or off. *3

2-level operation is adopted for the turn signal switch. The function is designed so that in the level 1 operation, the direction indicator one-touch function operates, and in the level 2 operation, the normal turn signal light flashing function operates. *4

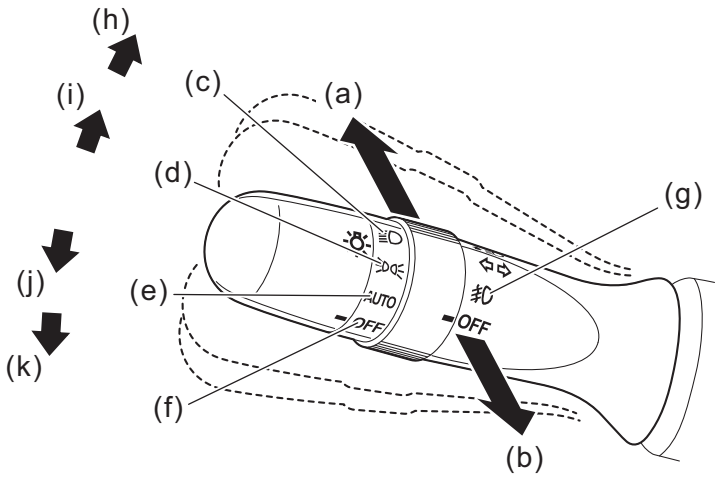
**1: The momentary switch is adopted for the light switch in models for C0 only.*
**2: A momentary type is an operation method that returns the switch to the default position automatically after the switch is operated.*
**3: The lights can be fully turned off by operating the switch to the OFF position while the vehicle is stopped. However, the auto light function operates when driving.*
**4: After the turn signal switch is operated, the flashing of the turn signal light is canceled by operating the steering to turn right or left, or by operating the switch in the opposite direction.*

For C0



(a) High beam switch
(b) Passing switch
(c) Light switch (HEAD)
(d) Light switch (TAIL)
(e) Light switch (AUTO)
(f) Light switch (OFF)
(g) Front fog switch (for some grades)
(h) Turn signal switch (right side level 2)
(i) Turn signal switch (right side level 1)
(j) Turn signal switch (left side level 1)
(k) Turn signal switch (left side level 2)

Other than C0



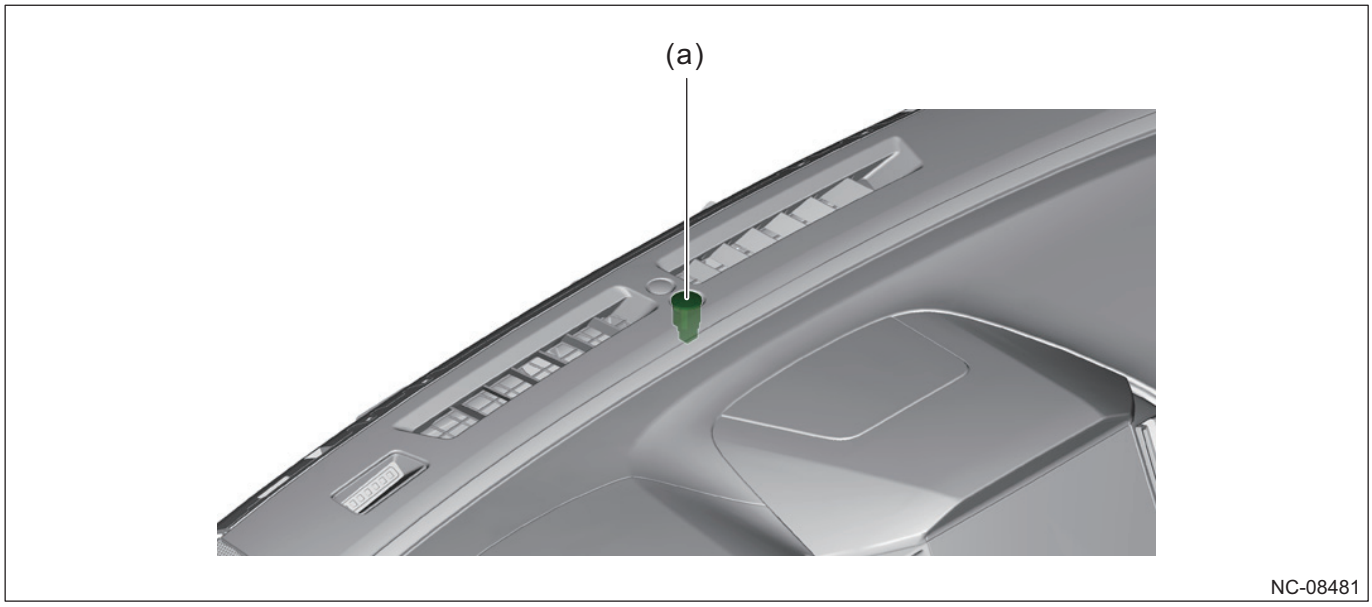
NC-08482

(a) High beam switch
(b) Passing switch
(c) Light switch (HEAD)
(d) Light switch (TAIL)
(e) Light switch (AUTO)
(f) Light switch (OFF)
(g) Front fog switch (for some grades)
(h) Turn signal switch (right side level 2)
(i) Turn signal switch (right side level 1)
(j) Turn signal switch (left side level 1)
(k) Turn signal switch (left side level 2)

Auto light sensor

The auto light sensor is positioned in the center of the front defroster at the top of the instrument panel.

The auto light function is controlled according to the illuminance based on the information detected by the visible light sensor (photodiode).



(a) Auto light sensor

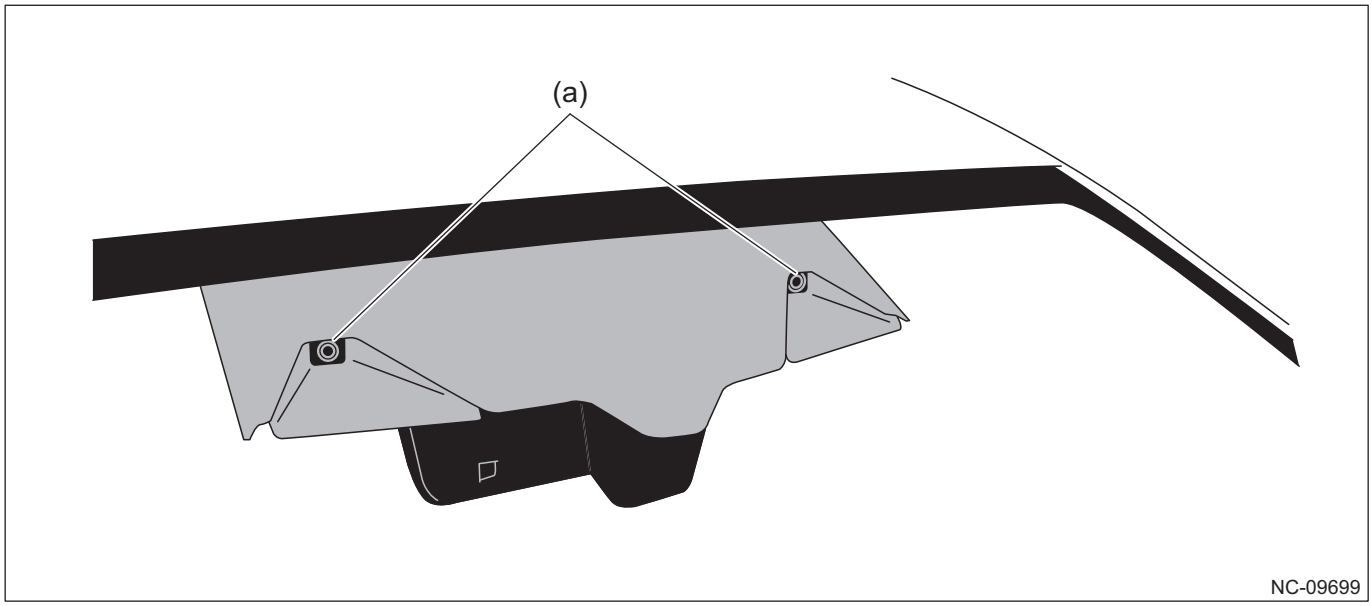
High Beam Assist (HBA) control camera

Two types of camera for High Beam Assist (HBA) control are provided, depending on the specification.

Turning on/off the high beam is automatically controlled according to the conditions in front of the vehicle based on image information from the camera.

■ Stereo camera (models with EyeSight)

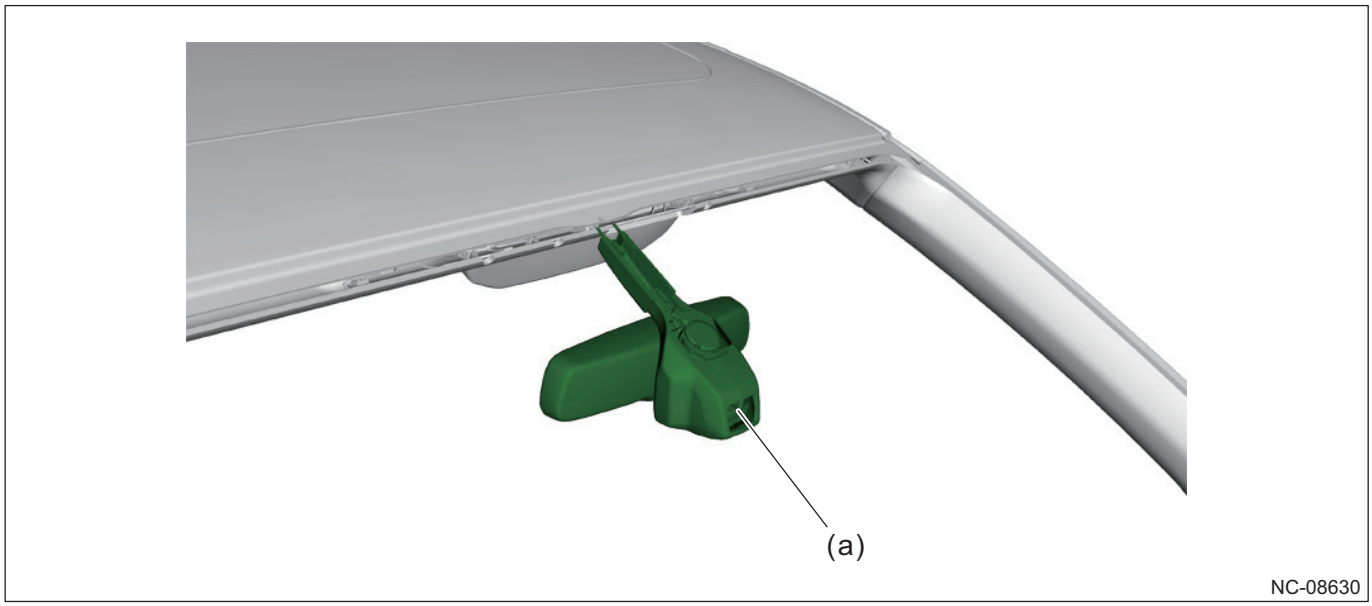
The light sources emitted by preceding vehicles, oncoming vehicles, and street lights, etc. are detected by the stereo camera for EyeSight.



(a) Camera

■ Inner mirror HBA unit assembly (models without EyeSight)

The light sources emitted by preceding vehicles, oncoming vehicles, and street lights, etc. are detected by the camera built into the inner mirror HBA unit assembly.



(a) Camera

9.3.3 Construction and Operation

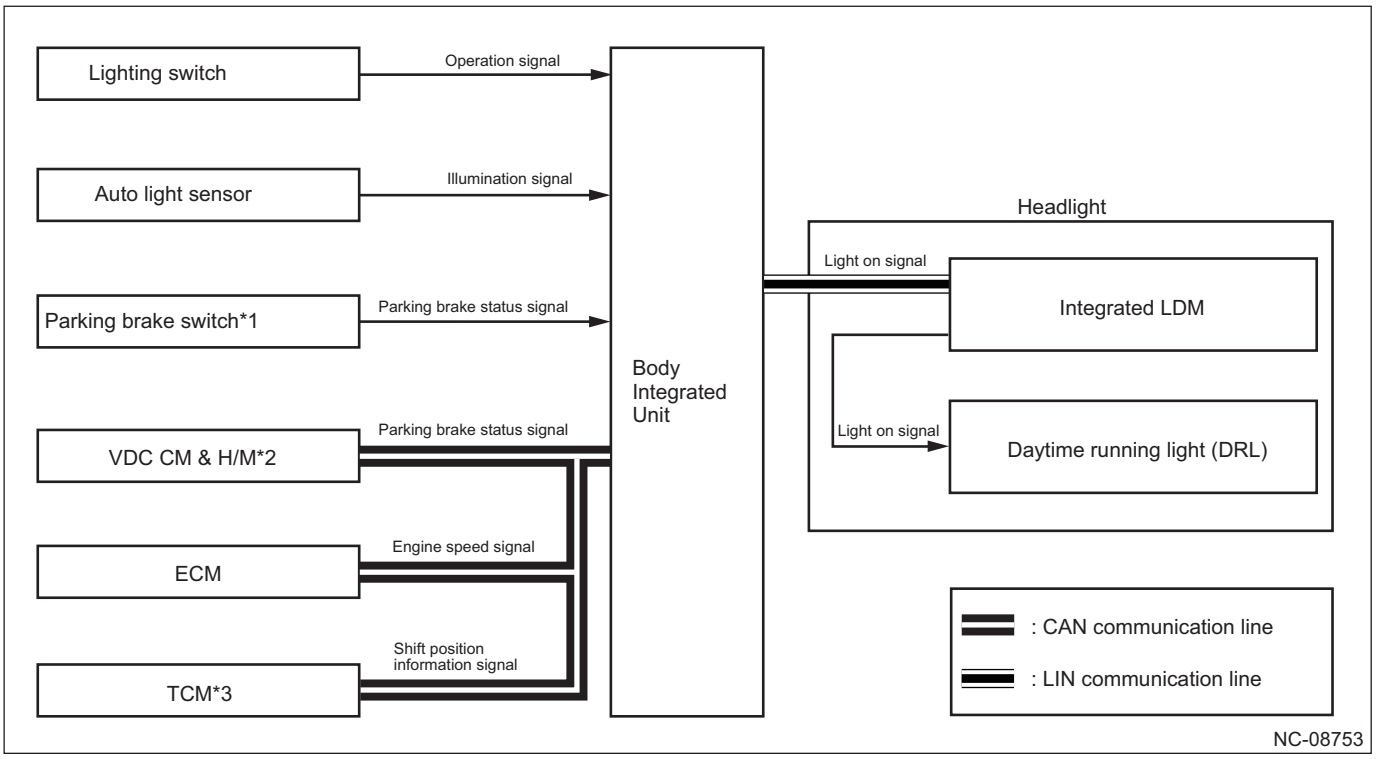
Daytime running light (DRL)

The daytime running light (DRL) is turned on* when driving in daytime. This ensures conspicuousness from oncoming vehicles and pedestrians.

**: While a front turn signal light is flashing, the daytime running light (DRL) turns off on the side with the flashing front turn signal light.*

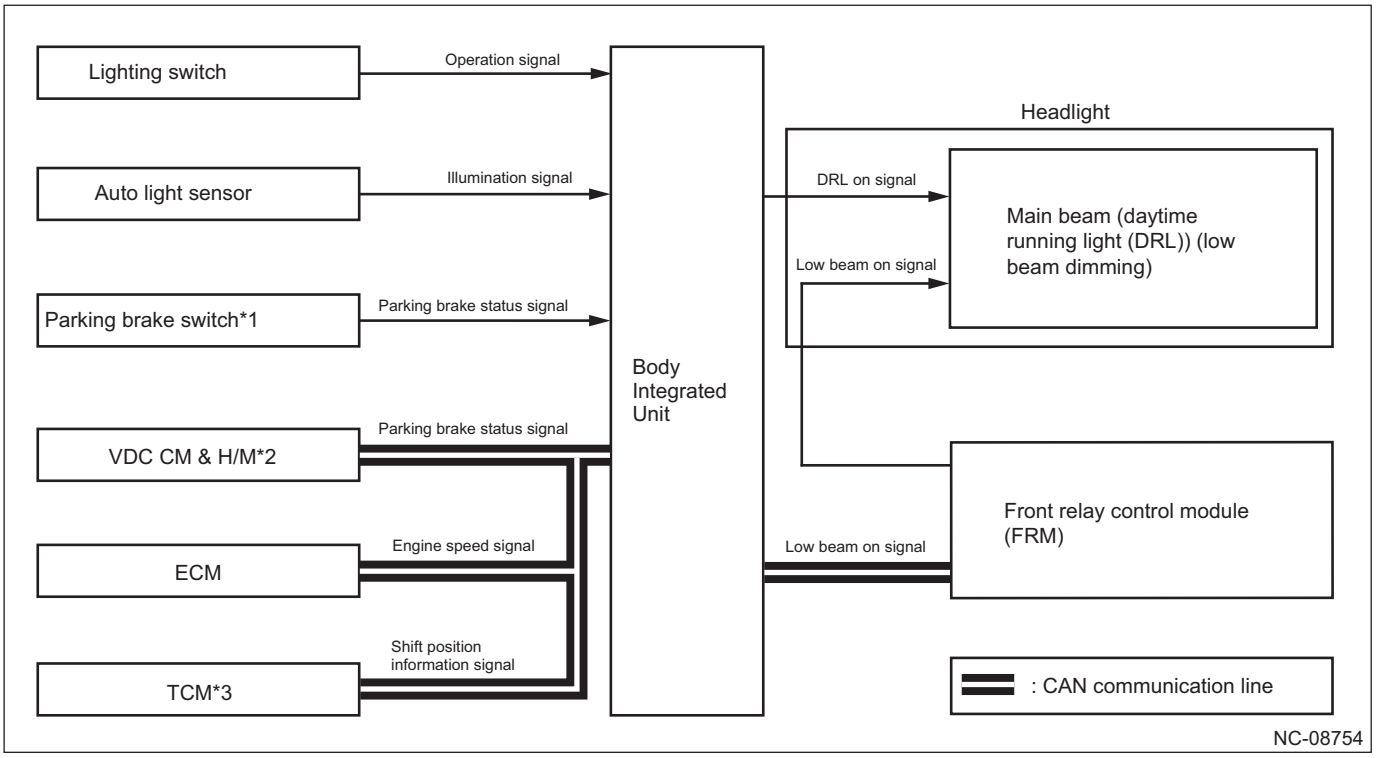
System diagram

Models with steering responsive headlight (SRH) function



**1: Models without electronic parking brake (EPB)*
**2: Models with electronic parking brake (EPB)*
**3: CVT*

Models without steering responsive headlight (SRH) function



**1: Models without electronic parking brake (EPB)*
**2: Models with electronic parking brake (EPB)*
**3: CVT*

Main component functions

Component	Function
Body Integrated Unit	• Receives signals from the units, sensors, and switches, and sends the DRL on signal to the integrated LED driver module (LDM) via LIN communication. *4 • Receives signals from the units, sensors, and switches, and controls the on/off of the daytime running light (DRL). • Receives signals from the units, sensors, and switches, and sends the low beam on signal to the front relay control module (FRM) via CAN communication. *5
Lighting switch	Sends the switch operation signal to the Body Integrated Unit.
Auto light sensor	Detects the brightness surrounding the vehicle and sends the calculated illumination signal to the Body Integrated Unit.
Parking brake switch*1	Sends the parking brake status signal to the Body Integrated Unit.
VDC control module and hydraulic control module (VDC CM & H/M)*2	Sends the parking brake status signal to the Body Integrated Unit via CAN communication.
Engine Control Module (ECM)	Sends the engine speed signal to the Body Integrated Unit via CAN communication.
Transmission control module (TCM)*3	Sends the shift position information signal to the Body Integrated Unit via CAN communication.
Integrated LED driver module (LDM)*4	Receives the DRL on signal from the Body Integrated Unit and controls the on/off of the daytime running light (DRL).
Front relay control module (FRM)*5	Receives the light on signal from the Body Integrated Unit and controls the on/off of the low beam.
Daytime running light (DRL)	Turns on during operation of daytime running light (DRL) function.

**1: Models without electronic parking brake (EPB)*
**2: Models with electronic parking brake (EPB)*
**3: CVT*
**4: Models with steering responsive headlight (SRH) function*
**5: Models without steering responsive headlight (SRH) function*

Operating conditions

The daytime running light (DRL) turns on*1 when all the following conditions are satisfied.

- Ignition switch*2 or engine switch*3 is ON
- Lighting switch is in a position other than HEAD
- Surroundings are bright (when the illuminance detection of the auto light sensor determines that the headlights should be turned off)
- Parking brake is released
- Shift position in other than P*4
- Driving is possible (engine speed is 400 rpm or higher)

**1: While a front turn signal light is flashing, the daytime running light (DRL) turns off on the side with the flashing front turn signal light.*
**2: Models with keyless entry system*
**3: Models with keyless access & push button start system*
**4: CVT*

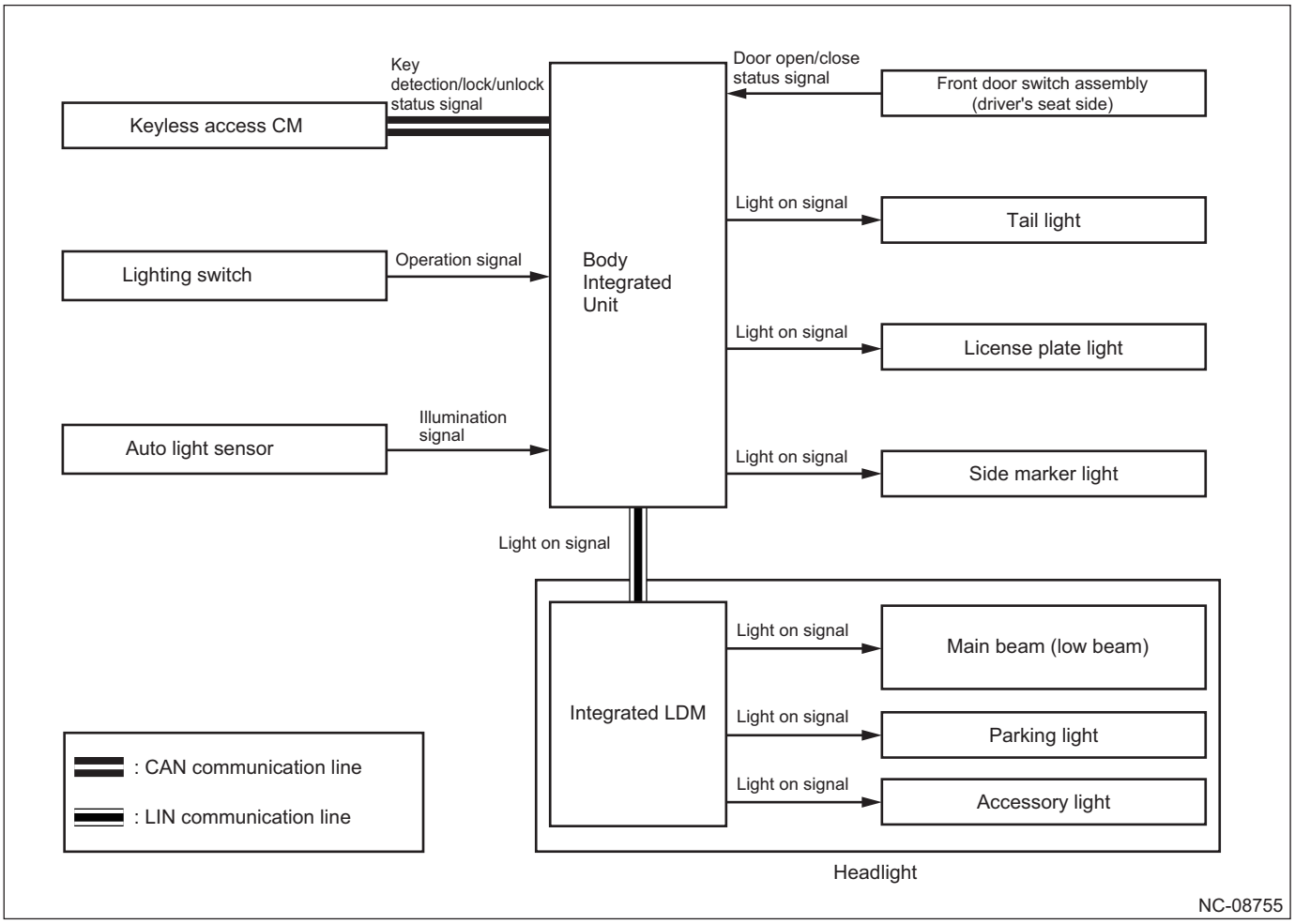
Welcome lighting

The main beam (low beam), side marker light, parking light, accessory light*, tail light, and license plate light are turned on when entering or exiting the vehicle.

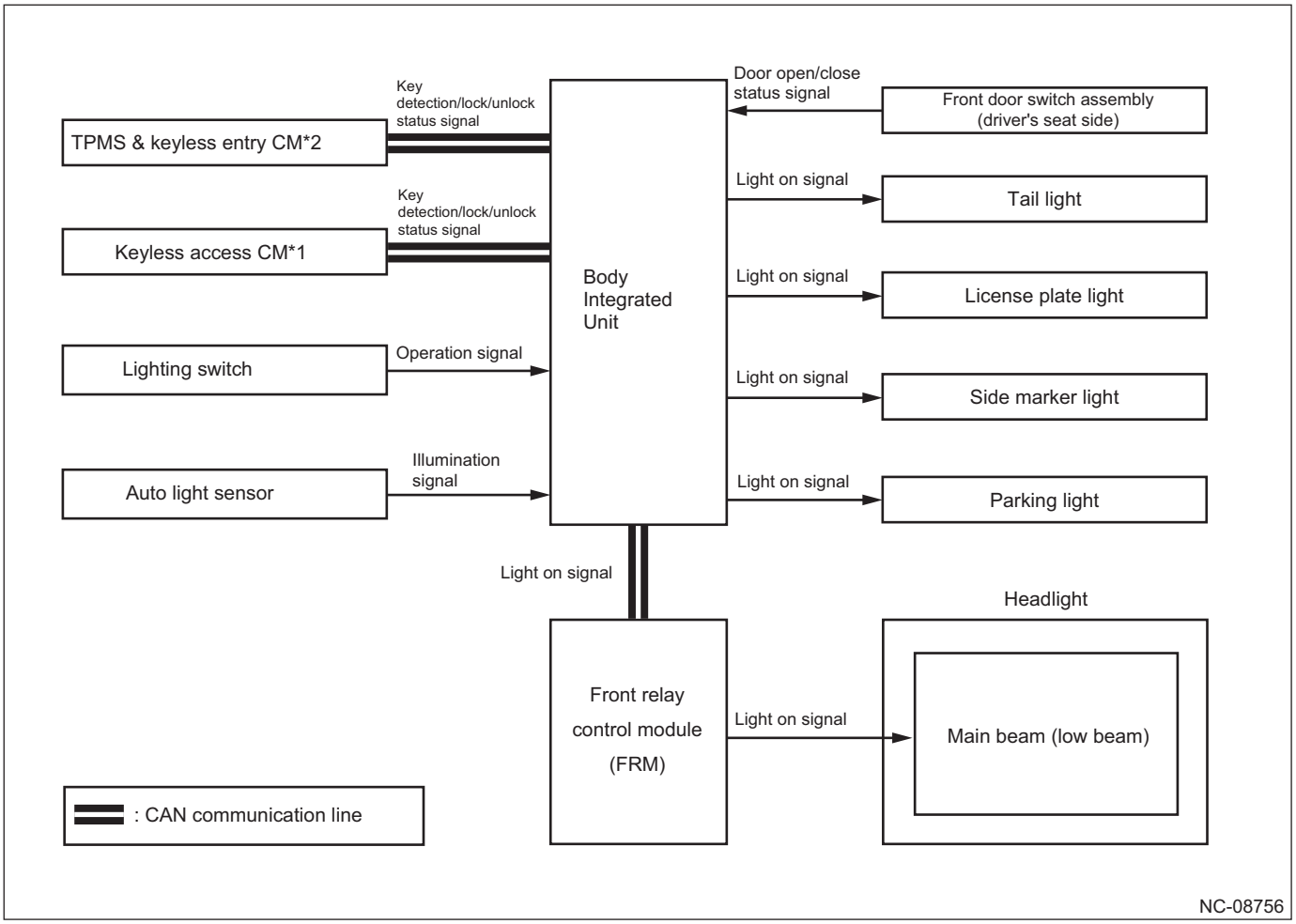
**: Models with steering responsive headlight (SRH) function*

System diagram

Models with steering responsive headlight (SRH) function



Models without steering responsive headlight (SRH) function



**1: Models with keyless entry system*
**2: Models with keyless access & push button start system*

Main component functions

Component	Function
Body Integrated Unit	• Receives signals from the units, sensors, and switches, and controls the on/off of the various lights. • Receives signals from the units, sensors, and switches, and sends the light on signal to the front relay control module (FRM) via CAN communication. *3 • Receives signals from the units, sensors, and switches, and sends the light on signal to the integrated LED driver module (LDM) via LIN communication. *4
TPMS & keyless entry CM*1	Sends the door lock/unlock signal based on the keyless transmitter locking operation to the Body Integrated Unit via CAN communication.
Keyless access CM*2	Sends the detection signal based on carrying the access key and the door lock/unlock signal based on the locking operation to the Body Integrated Unit via CAN communication.
Lighting switch	Sends the switch operation signal to the Body Integrated Unit.
Auto light sensor	Detects the brightness surrounding the vehicle and sends the calculated illumination signal to the Body Integrated Unit.
Front door switch assembly (driver's seat side)	Sends the open/close status signal for the driver's door to the Body Integrated Unit.
Front relay control module (FRM)*3	Receives the light on signal from the Body Integrated Unit and controls the on/off of the main beam (low beam).
Integrated LED driver module (LDM)*4	Receives the light on signal from the Body Integrated Unit and controls the on/off of the main beam (low beam), parking light, and accessory light.
Main beam (low beam)	Turns on when the welcome lighting is activated.
Parking light	
Accessory light*4	
Tail light	
Side marker light	
License plate light	

**1: Models with keyless entry system*
**2: Models with keyless access & push button start system*
**3: Models without steering responsive headlight (SRH) function*
**4: Models with steering responsive headlight (SRH) function*

Operation when entering

Lighting condition	When all the following conditions are satisfied and the doors are unlocked with the keyless transmitter*1, access key*2, or Remote Service*3, the main beam (low beam), parking light, accessory light*4, side marker light, tail light, and license plate light turn on for approximately 30 seconds. • Ignition switch*1 or engine switch*2 is OFF • Lighting switch is in AUTO position • Surroundings are dark (when the illuminance detection of the auto light sensor determines that the headlights should be turned on)
Lighting-off conditions after turned on	When approximately 30 seconds have elapsed after turning on
	When the lighting switch is in a position other than AUTO
	When the doors are locked using the keyless transmitter*1, access key*2, touch sensor*2, Remote Service*3, or central door lock switch
	When the ignition switch*1 or engine switch*2 is turned ON

**1: Models with keyless entry system*
**2: Models with keyless access & push button start system*
**3: For details on Remote Service, refer to the telematics system.*
**4: Models with steering responsive headlight (SRH) function*

Operation when exiting

Lighting condition	When the ignition switch*1 or engine switch*2 is turned OFF while the lighting switch is in the AUTO position and the headlight is turned on, the main beam (low beam), parking light, accessory light*3, side marker light, tail light, and license plate light turn on for approximately 30 seconds.
Lighting-off conditions after turned on	When 30 seconds have passed since the driver's door has been opened and closed while the light is on
	When the lighting switch is in a position other than AUTO
	When the doors are locked twice using the keyless transmitter*1, access key*2, touch sensor*2, or central door lock switch
	When the doors are locked using Remote Service*4
	When 180 seconds have elapsed after turning on

**1: Models with keyless entry system*
**2: Models with keyless access & push button start system*
**3: Models with steering responsive headlight (SRH) function*
**4: For details on Remote Service, refer to the telematics system.*

Customization function

It is possible to customize the time until the light turns off by selecting from four patterns of OFF (0 seconds), 30 seconds, 60 seconds, and 90 seconds at the dealer using the Subaru Select Monitor 4 or on the center information display. (The factory setting is 30 seconds.)

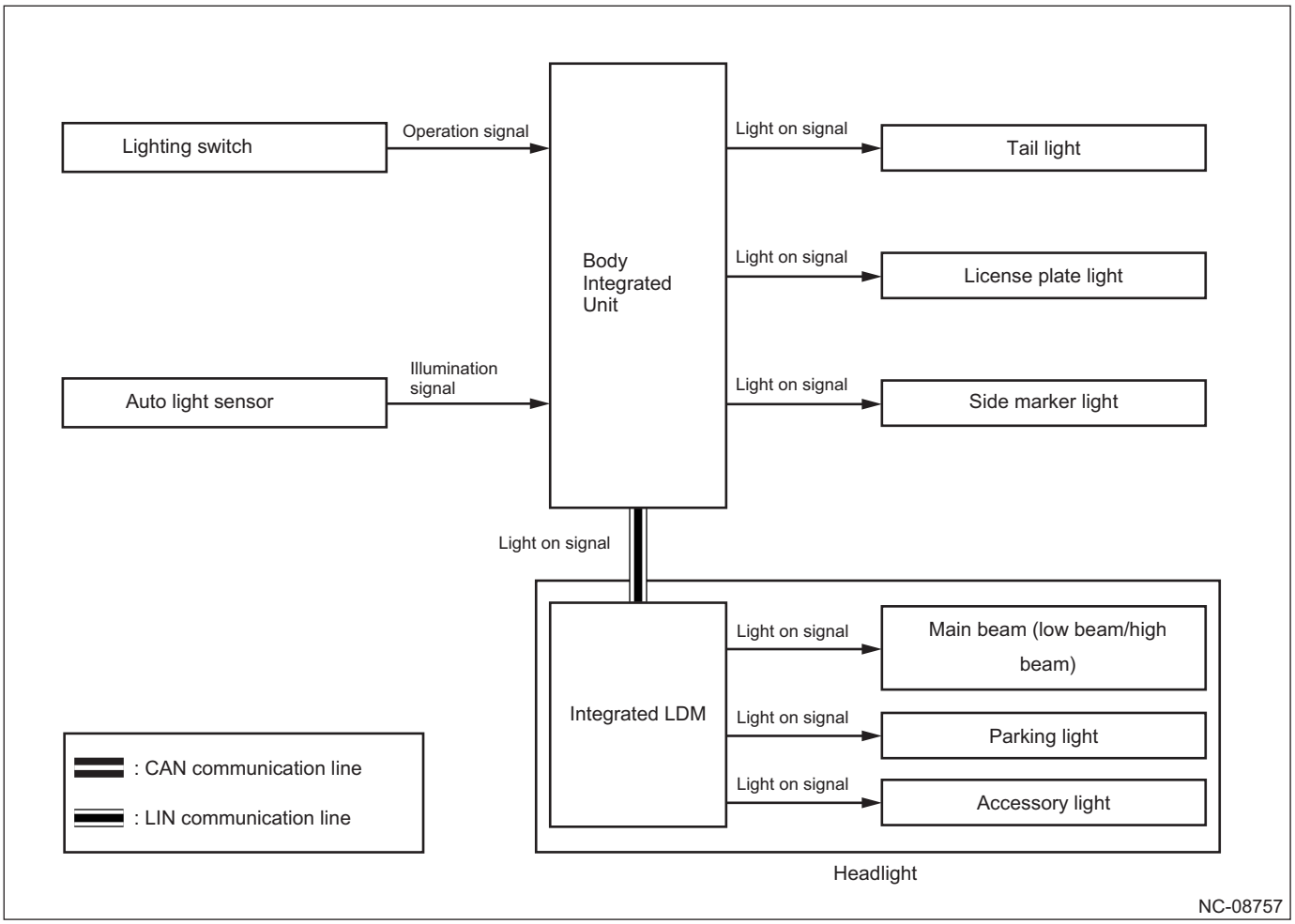
Auto light

The surrounding brightness is determined by the auto light sensor installed on the instrument panel. When the surroundings darken, the main beam (low beam/high beam), side marker light, parking light, accessory light*, tail light, and license plate light automatically turn on.

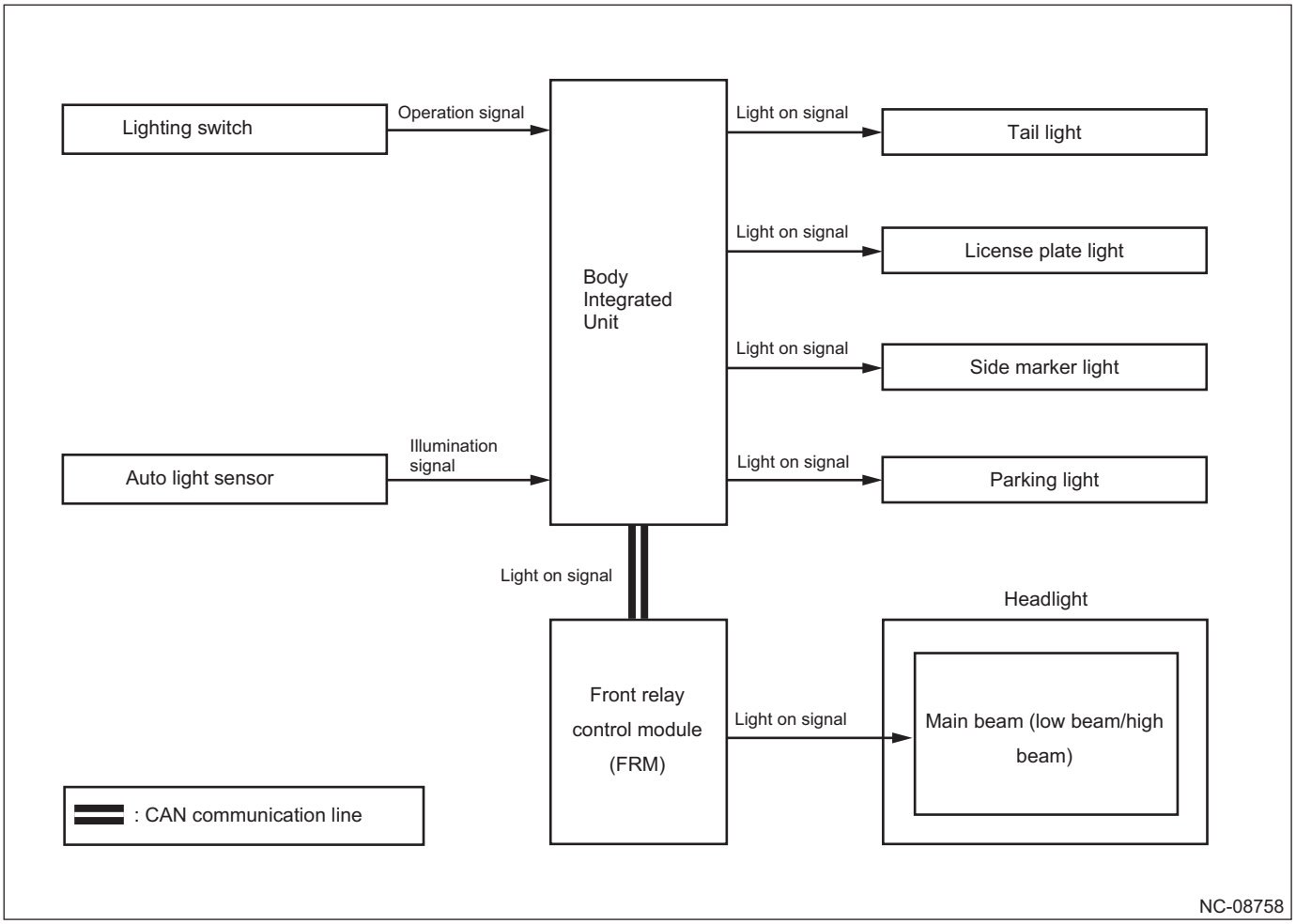
**: Models with steering responsive headlight (SRH) function*

System diagram

Models with steering responsive headlight (SRH) function



Models without steering responsive headlight (SRH) function



Main component functions

Component	Function
Body Integrated Unit	• Receives signals from the units, sensors, and switches, and controls the on/off of the various lights. • Receives signals from the units, sensors, and switches, and sends the light on signal to the integrated LED driver module (LDM) via LIN communication. *1 • Receives signals from the units, sensors, and switches, and sends the light on signal to the front relay control module (FRM) via CAN communication. *2
Lighting switch	Sends the switch operation signal to the Body Integrated Unit.
Auto light sensor	Detects the brightness surrounding the vehicle and sends the calculated illumination signal to the Body Integrated Unit.
Integrated LED driver module (LDM)*1	Receives the light on signal from the Body Integrated Unit and controls the on/off of the main beam (low beam/high beam), parking light, and accessory light.
Front relay control module (FRM)*2	Receives the light on signal from the Body Integrated Unit and controls the on/off of the main beam (low beam/high beam).
Main beam (low beam/high beam)	Turns on during the auto light operation.
Parking light	
Accessory light*1	
Tail light	
Side marker light	
License plate light	

**1: Models with steering responsive headlight (SRH) function*
**2: Models without steering responsive headlight (SRH) function*

Basic operations and operating conditions

When the light control switch is in the AUTO position with the engine switch turned ON, each light is automatically turned ON and OFF according to the brightness of the surroundings and the status of the vehicle.

When the vehicle exterior darkens, the main beam (low beam/high beam), parking light, accessory light*, tail light, side marker light, and license plate light automatically turn on. When the vehicle exterior brightens, the various lights automatically turn off.

If the surroundings become momentarily bright due to street lights, etc. while the various lights are turned on, the lights do not turn off.

**: Models with steering responsive headlight (SRH) function*

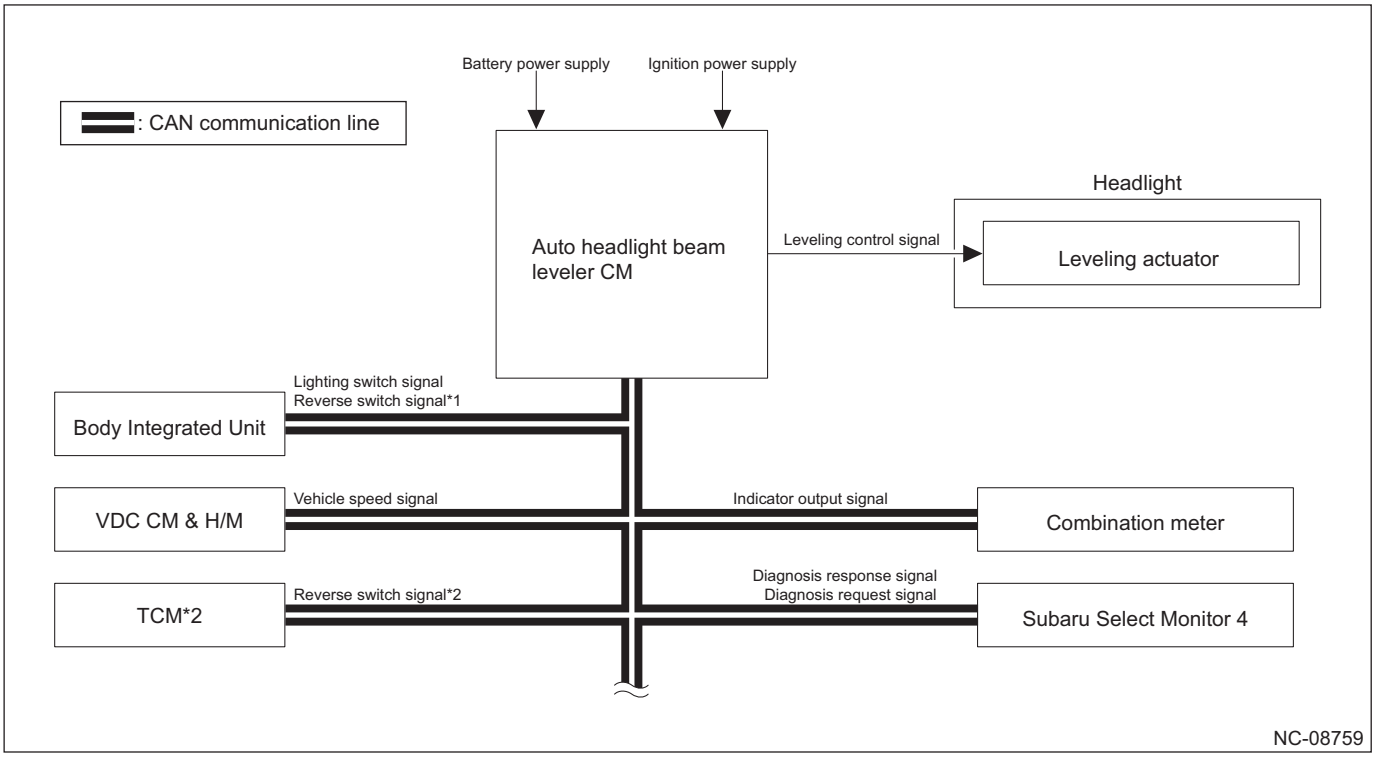
Customization function

It is possible to customize the turn on timing of the auto light by selecting from among four stages at the dealer using the Subaru Select Monitor 4 or via the vehicle settings in the center information display. (The factory setting is three stages.)

Headlight beam leveler

This automatically maintains the headlight beams at constant angles when the vehicle is stopped or steadily traveling to prevent the glare light to oncoming vehicles, depending on changes in the vehicle attitude due to the luggage being loaded, etc. This system detects changes in the static load with the acceleration sensor while stopping to calculate the pitch angle to the basic attitude. The system also detects the vehicle attitude angle with the acceleration sensor while traveling to correct the error of the pitch angle while stopping.

System diagram



*1: MT
*2: CVT

Main component functions

Component	Function
Auto headlight beam leveler CM	• Calculates the vehicle status according to the signals from the units and sensors, and sends the drive control signal to the leveling actuator in the headlight. • Calculates the vehicle attitude according to the built-in acceleration sensor and sends the drive control signal to the leveling actuator in the headlight. • Supplies power to the leveling actuator in the headlight.
Body Integrated Unit	• Sends the lighting switch signal to the auto headlight beam leveler CM via CAN communication. • Sends the reverse switch signal to the auto headlight beam leveler CM via CAN communication. *1
VDC control module and hydraulic control module (VDC CM & H/M)	Sends the vehicle speed signal and vehicle height signal to the auto headlight beam leveler CM via CAN communication.
Transmission control module (TCM)*2	Sends the reverse switch signal to the auto headlight beam leveler CM via CAN communication.
Leveling actuator	This is built into the headlight, and it receives the drive control signal from the auto headlight beam leveler CM and adjusts the headlight beams.
Combination meter	Receives the indicator display output signal from the auto headlight beam leveler CM and displays the headlight beam leveler warning in the combination meter.
Subaru Select Monitor 4	The diagnosis information can be read.

**1: MT*
**2: CVT*

Control while vehicle stops

After a change in the vehicle attitude is detected when the headlights turn on and the changed attitude continues in a stabilized state for about 3 seconds, the leveling actuator is driven depending on the average value of the pitch angle change in the last 1 second or so.

Control while traveling

The auto headlight beam leveler CM obtains the data of acceleration change while traveling for 100 seconds, and calculates the vehicle posture.

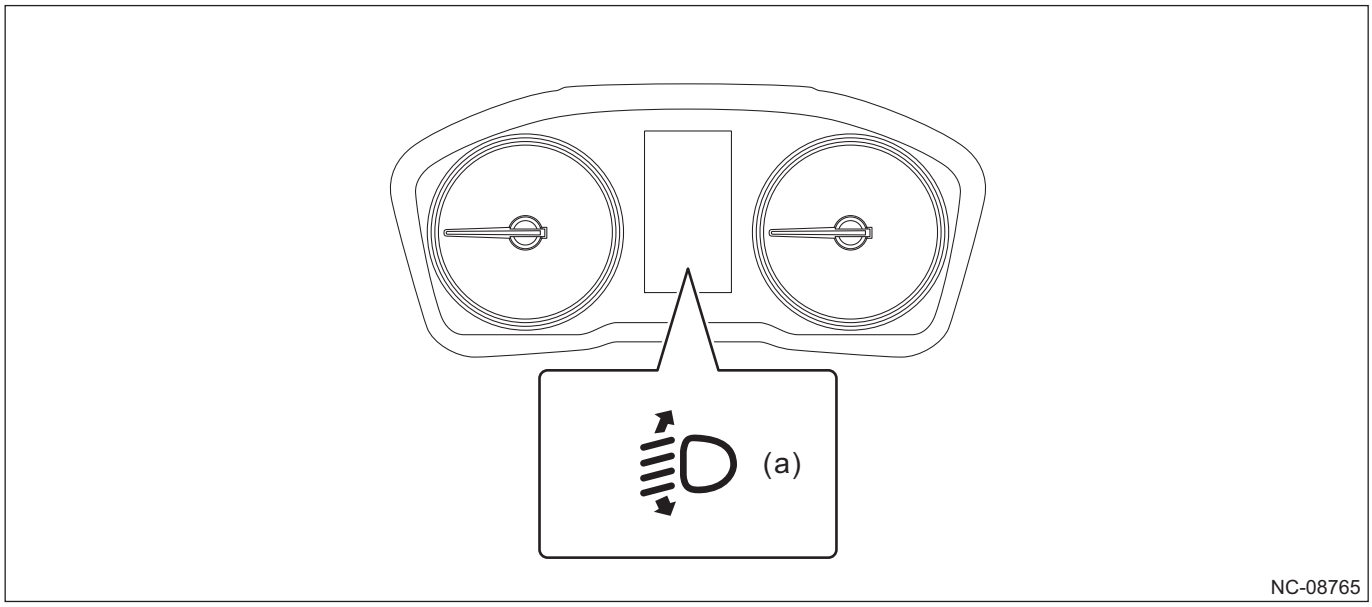
If there is a threshold value or more of difference from the currently recognized vehicle posture, the leveling actuator is driven.

In the following condition, the auto headlight beam leveler CM may misrecognize the vehicle posture, and the optical axis of headlight may be misaligned.

- When the road angle has changed while the engine is OFF or vehicle is stopped (vehicle speed 0 mph (0 km/h)). (e.g. when the vehicle being stopped on a slope is moved to a level land by a wrecker truck)

System malfunction warning function

The auto headlight beam leveler CM displays the headlight beam leveler warning in the combination meter when an anomaly is detected in the system.



(a) Headlight beam leveler warning display

High Beam Assist (HBA)

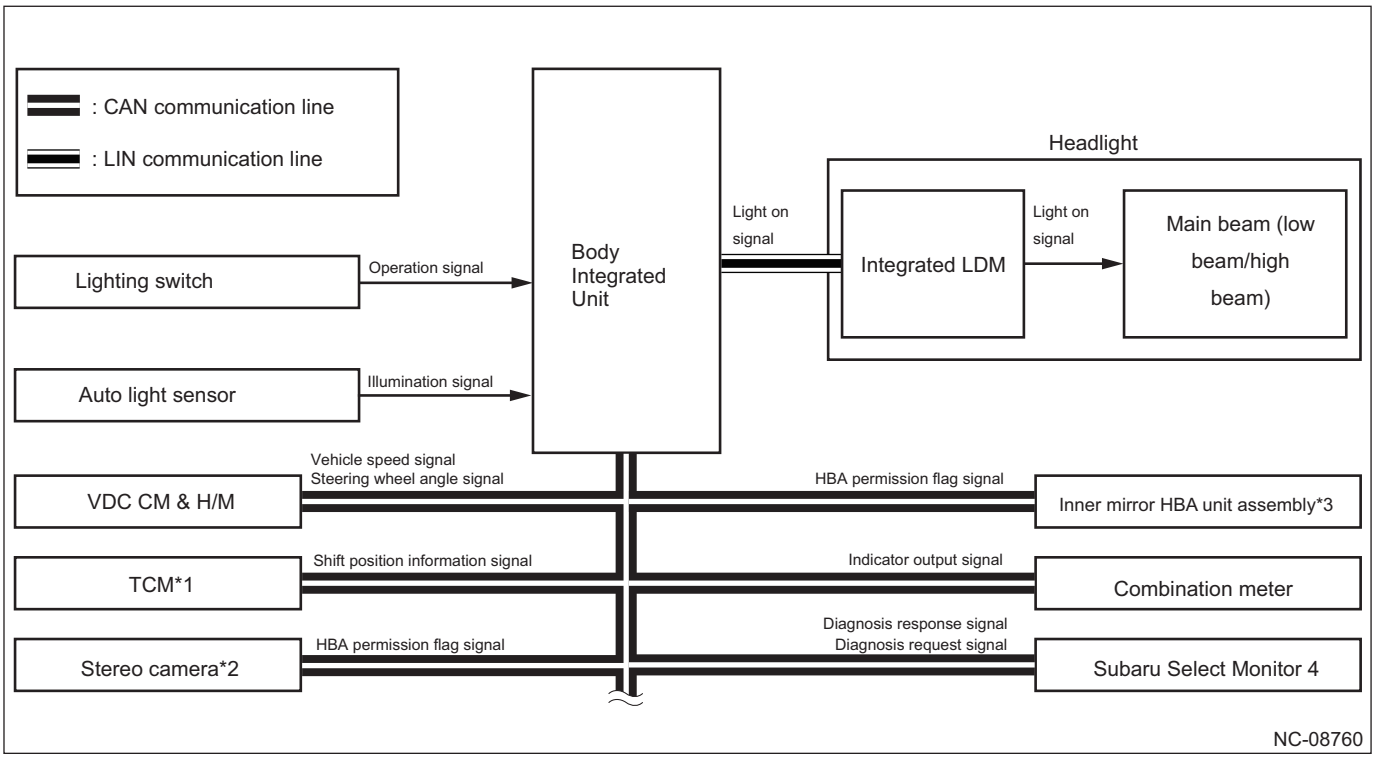
Light sources of a preceding vehicle in front of the vehicle, oncoming vehicles, street lights, etc. are detected by the EyeSight stereo camera*1 or camera built into the inner mirror HBA unit assembly*2, and the headlight is switched automatically between low beam and high beam depending on conditions. High Beam Assist (HBA) is also expected to have the following effects while driving.

- Reduces burden of lighting switch operations
- Prevents the driver from forgetting to turn off the high beam
- EyeSight improves recognition of pedestrians and obstacles*1

**1: Models with EyeSight*
**2: Models without EyeSight*

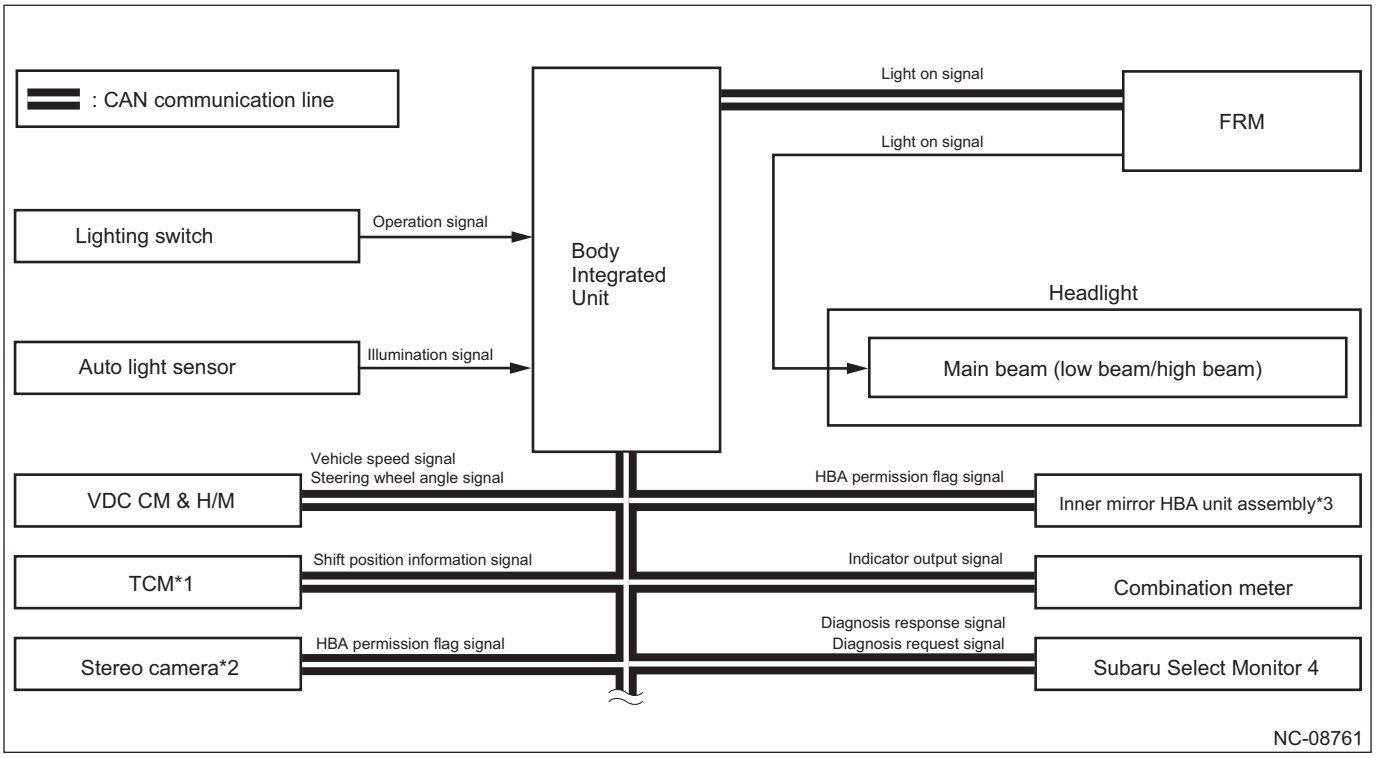
System diagram

Models with steering responsive headlight (SRH) function



**1: CVT*
**2: Models with EyeSight*
**3: Models without EyeSight*

Models without steering responsive headlight (SRH) function



*1: CVT
*2: Models with EyeSight
*3: Models without EyeSight

Main component functions

Component	Function
Body Integrated Unit	• Calculates the vehicle surrounding information and driving conditions according to the signals from the units and sensors, and controls the High Beam Assist (HBA) function. • When High Beam Assist (HBA) is ready for operation or there is a system anomaly, sends the indicator display output signal to the combination meter via CAN communication. • Receives signals from the units, sensors, and switches, and sends the light on signal to the integrated LED driver module (LDM) via LIN communication. *1 • Receives signals from the units, sensors, and switches, and sends the light on signal to the front relay control module (FRM) via CAN communication. *2
VDC control module and hydraulic control module (VDC CM & H/M)	Sends the vehicle speed signal and steering wheel angle signal to the Body Integrated Unit via CAN communication.
Transmission control module (TCM)*3	Sends the shift position information signal to the Body Integrated Unit via CAN communication.
Stereo camera*4	Sends identification signals for preceding vehicles, oncoming vehicles, street lights, etc., based on image processing information and the High Beam Assist (HBA) permission signals to the Body Integrated Unit via CAN communication.
Inner mirror HBA unit assembly*5	
Integrated LED driver module (LDM)*1	Receives the light on signal from the Body Integrated Unit and controls the on/off of the main beam (low beam/high beam).
Front relay control module (FRM)*2	Receives the light on signal from the Body Integrated Unit and controls the on/off of the main beam (low beam/high beam).
Main beam (low beam/high beam)	Switches between low beam and high beam.
Combination meter	Receives the indicator display output signal from the Body Integrated Unit and displays the operation indicator and warning for High Beam Assist (HBA) in the combination meter.
Lighting switch	Sends the switch operation signal to the Body Integrated Unit.
Auto light sensor	Detects the brightness surrounding the vehicle and sends the calculated illumination signal to the Body Integrated Unit.
Subaru Select Monitor 4	The diagnosis information can be read.

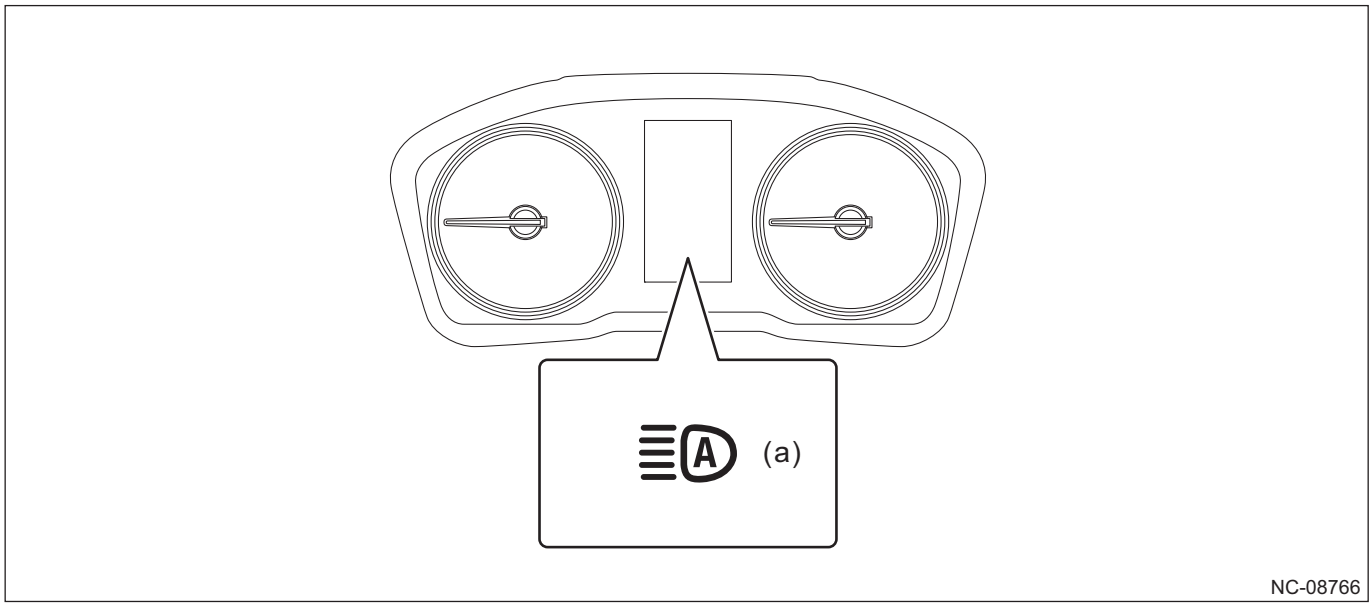
**1: Models with steering responsive headlight (SRH) function*
**2: Models without steering responsive headlight (SRH) function*
**3: CVT*
**4: Models with EyeSight*
**5: Models without EyeSight*

Operating conditions and basic operations

■ Operability conditions

When the following conditions are satisfied, High Beam Assist (HBA) becomes ready for operation, and the operation indicator is displayed in the combination meter.

- When the lighting switch is AUTO and the headlight turns on
- When the lever of the lighting switch is pushed forward to set the high beam



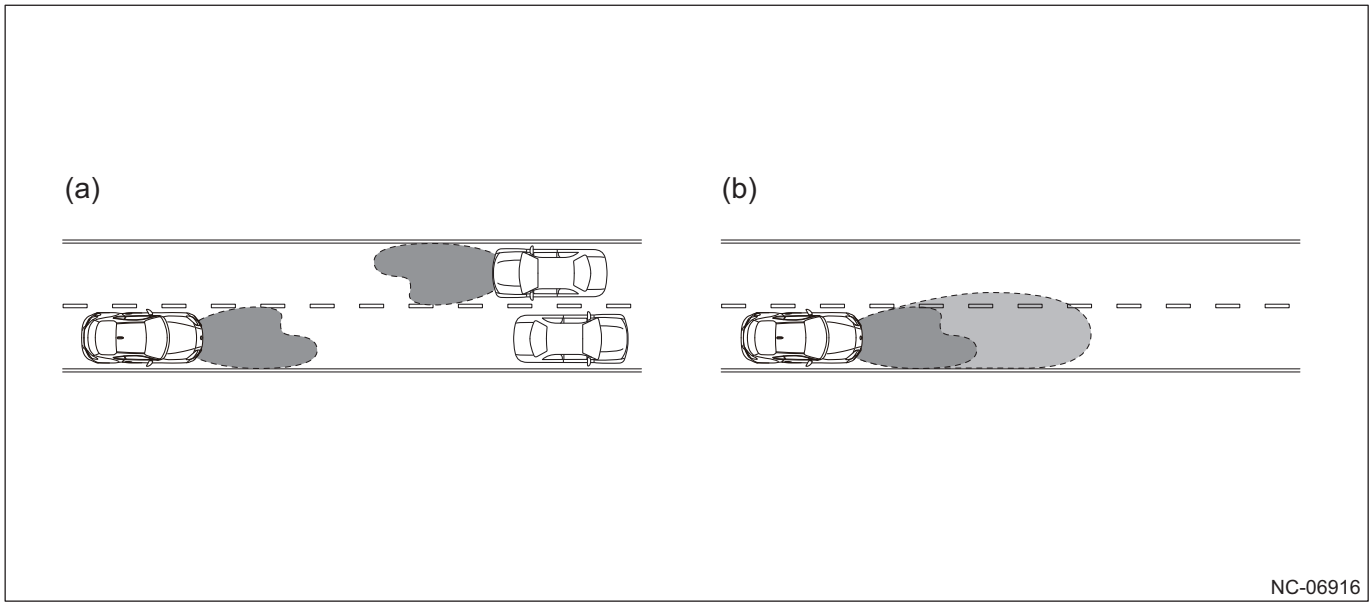
(a) Operation indicator (green)

■ Basic operation

The EyeSight stereo camera*1 or camera built into the inner mirror HBA unit assembly*2 recognizes the surrounding brightness and the light sources of preceding vehicles in front of the vehicle and oncoming vehicles; determines whether or not to permit high beam using the recognized brightness, light source information, own vehicle speed information, and gear position information; and outputs this permission signal to the Body Integrated Unit. Based on this signal and the auto light sensor and lighting switch information, the Body Integrated Unit selects and outputs the headlight high beam or low beam drive signal to perform control that automatically switches between high beam and low beam.

**1: Models with EyeSight*
**2: Models without EyeSight*

Operation image



(a) When a preceding vehicle or oncoming vehicle is present: High beam off (fixed to low beam)

(b) When a preceding vehicle or oncoming vehicle is not present: High beam on

■ Operating conditions

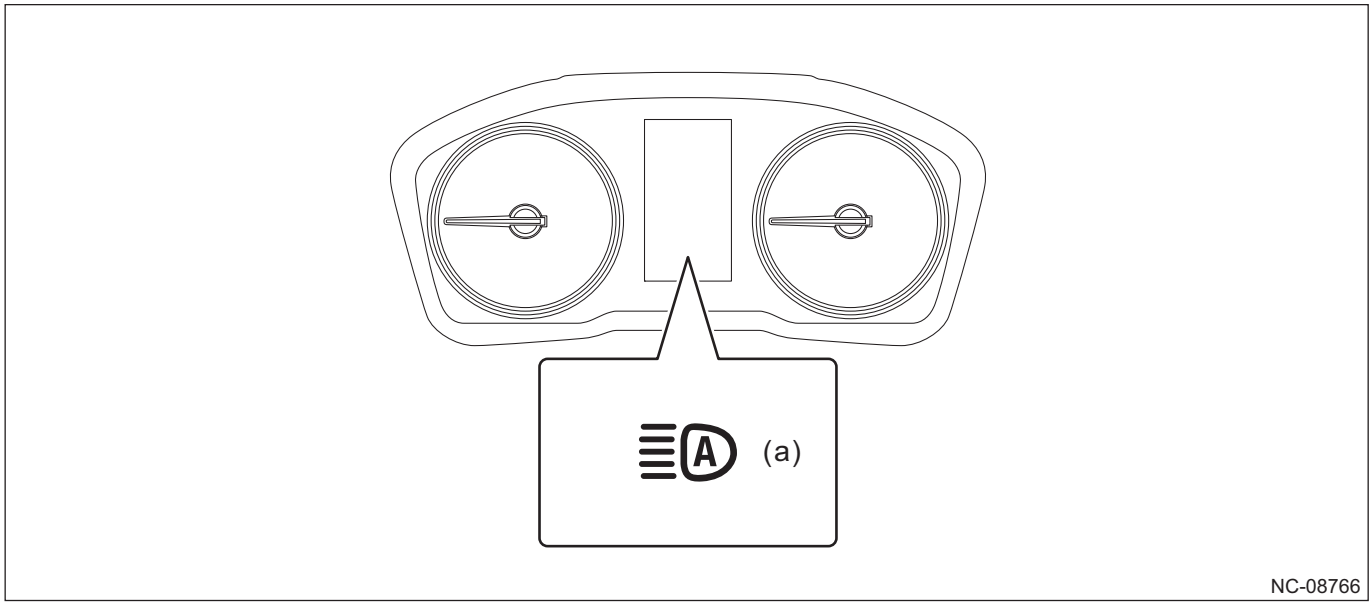
When High Beam Assist (HBA) is ready for operation, control is performed that automatically switches between high beam and low beam according to the following conditions.

Turning on pattern	Condition
High beam off (fixed to low beam)	• When vehicle speed is approximately 10 mph (16 km/h) or lower*1 • When vehicle speed is approximately 17 mph (27 km/h) or lower*2 • When the lights of a preceding vehicle or oncoming vehicle are turned on • When the vehicle front is bright, such as when street lights are lined up to the front of own vehicle or while driving through a town • When the EyeSight stereo camera*1 or camera built into the inner mirror HBA unit assembly*2 is paused
High beam on	• When vehicle speed is approximately 20 mph (32 km/h) or more*1 • When vehicle speed is approximately 22 mph (35 km/h) or more*2 • When the vehicle front is dark, such as when there is no preceding vehicle or oncoming vehicle, or the lights of the preceding vehicle or oncoming vehicle are not turned on • When there is no sharp curve

**1: Models with EyeSight*
**2: Models without EyeSight*

System malfunction warning function

When an anomaly is detected in the system, the High Beam Assist (HBA) warning is displayed in the combination meter.

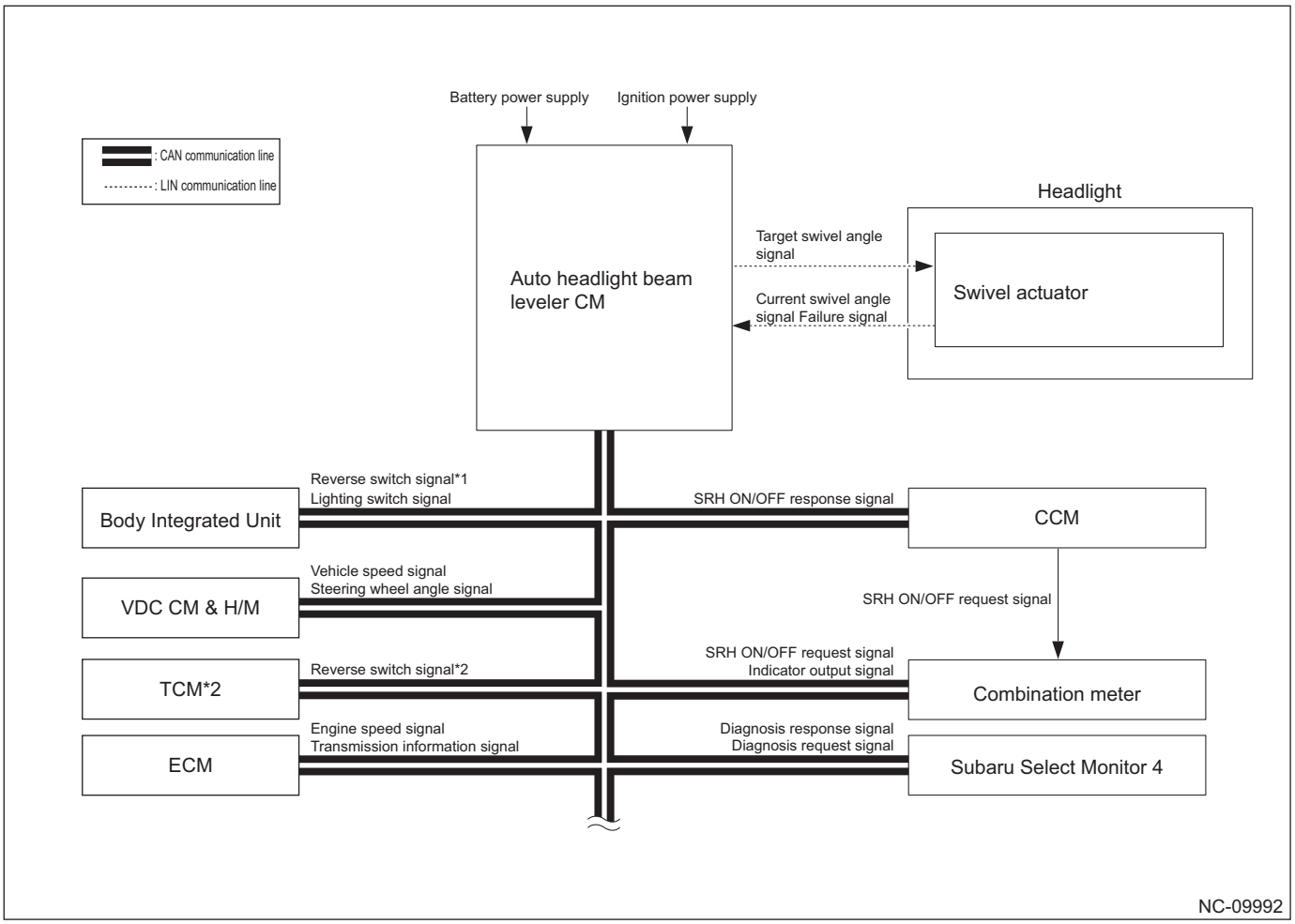


(a) Headlight beam leveler warning display (yellow)

Steering responsive headlight (SRH) (for some grades)

The steering responsive headlight (SRH) is installed to improve visibility beyond a curve. The steering responsive headlight (SRH) has a function that moves the headlight beam horizontally according to the steering operation and the vehicle speed when the headlight turns on. The illumination direction of the low beam and high beam of the headlight at curves and intersections are changed according to the curve to improve the visibility of the traveling direction.

System diagram



**1: MT*
**2: CVT*

Main component functions

Component	Function
Auto headlight beam leveler CM	• Calculates the vehicle surrounding information and driving conditions according to the signals from the units and sensors, and sends the drive control signal to the swivel actuator in the headlight. • When a fuel signal from the swivel actuator is detected, sends the indicator display output signal to the combination meter via CAN communication.
Body Integrated Unit	• Sends the lighting switch signal to the auto headlight beam leveler CM via CAN communication. • Sends the reverse switch signal to the auto headlight beam leveler CM via CAN communication. *1
VDC control module and hydraulic control module (VDC CM & H/M)	Sends the vehicle speed signal and steering wheel angle signal to the auto headlight beam leveler CM via CAN communication.
Transmission control module (TCM)*2	Sends the reverse switch signal to the auto headlight beam leveler CM via CAN communication.
Engine Control Module (ECM)	Sends the engine speed signal and transmission information signal to the auto headlight beam leveler CM via CAN communication.
Cockpit control module (CCM)	• Sends the SRH ON/OFF request signal based on the setting screen operation in the center information display to the combination meter via LVDS. • Receives the SRH control status from the auto headlight beam leveler CM via CAN communication and switches the display of the SRH switch in the center information display.
Swivel actuator	This is built into the headlight, and it receives the drive control signal from the auto headlight beam leveler CM and adjusts the headlight beams.
Combination meter	• Sends the SRH ON/OFF request signal received from the Cockpit Control Module (CCM) to the auto headlight beam leveler CM via CAN communication. • Receives the indicator display output signal from the auto headlight beam leveler CM and displays the steering responsive headlight (SRH) warning in the combination meter.
Subaru Select Monitor 4	The diagnosis information can be read.

**1: MT*
**2: CVT*

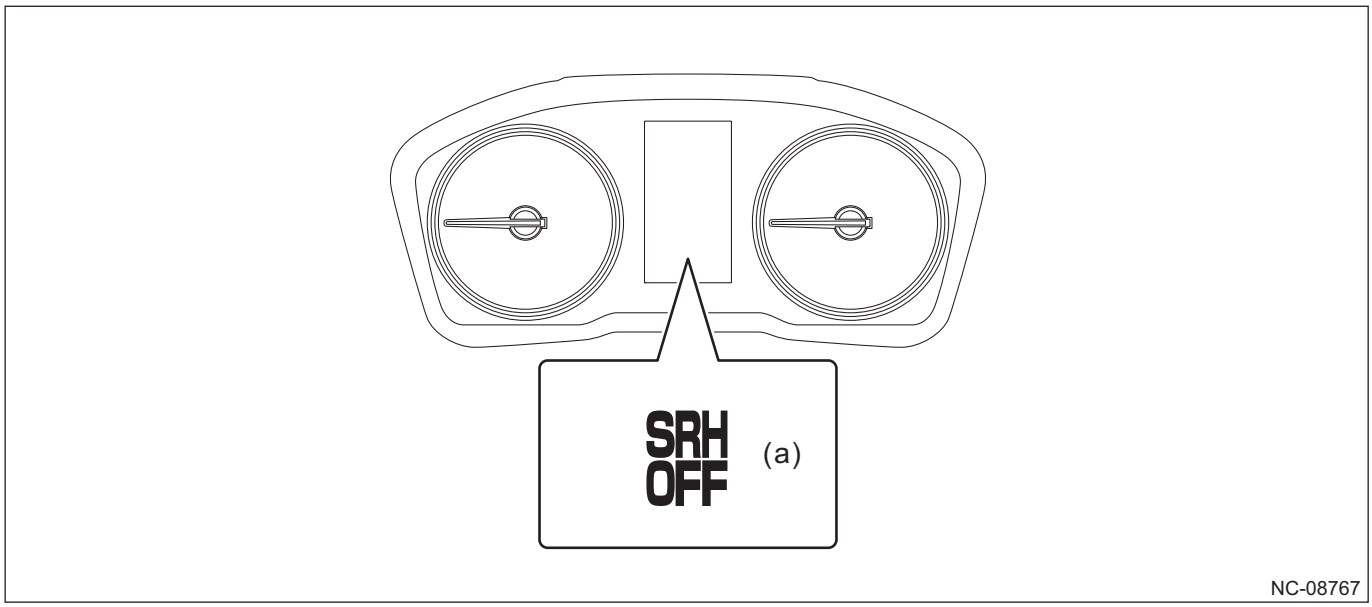
Operating conditions

The steering responsive headlight (SRH) operates under the following conditions.

- When the vehicle is driving forward
- When vehicle speed is approximately 5 mph (8 km/h) or more
- After initialization is complete
- When the SRH OFF indicator light is turned off

When the engine is started at a vehicle speed of 0 km/h, steering responsive headlight (SRH) executes initialization. When initialized, the headlight beams move left and right.

Turning ON/OFF the steering responsive headlight (SRH) can be set via the vehicle settings in the center information display. When it's off, the SRH OFF operation light on the multi information display in the combination meter turns on.

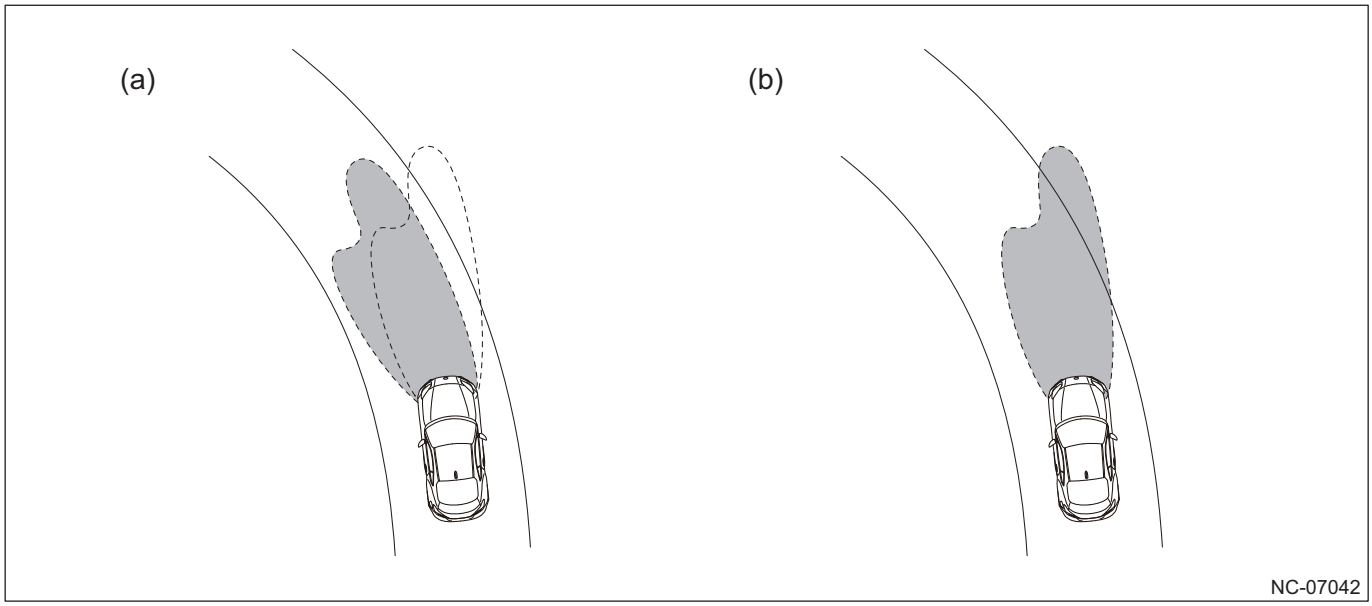


(a) SRH OFF operation light

Basic operation

The illumination direction of the headlight beams is adjusted by moving the swivel actuator installed in the headlights.

Operation image



(a) When steering responsive headlight (SRH) ON

(b) When steering responsive headlight (SRH) OFF

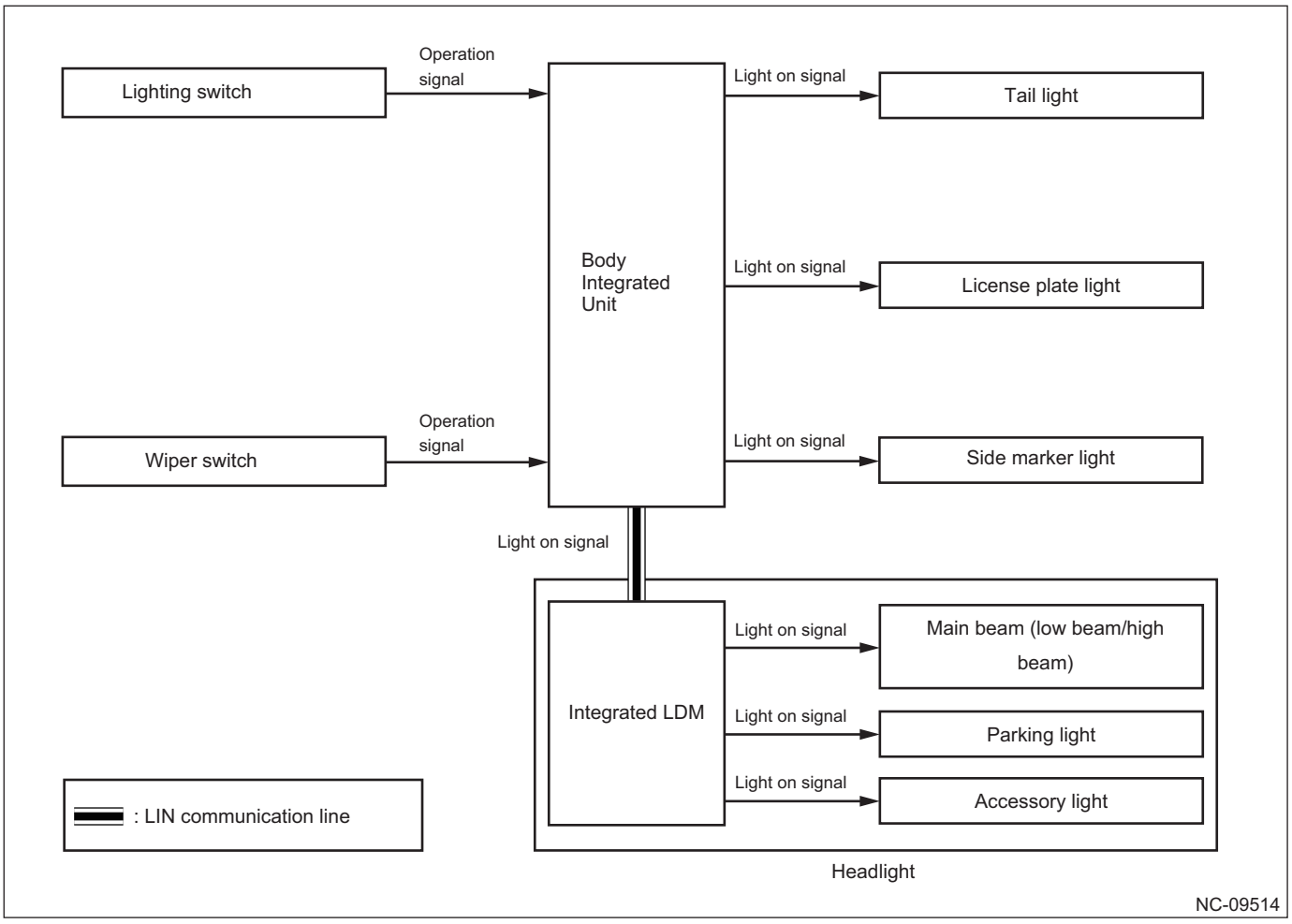
Wiper interlocked headlight

When the front wiper operates for a certain length of time while the lighting switch is in the AUTO position, the headlight, tail light, etc. automatically turn on. The lights turn on automatically when driving in rain to ensure the view field of the driver, and improve conspicuousness from the surroundings.

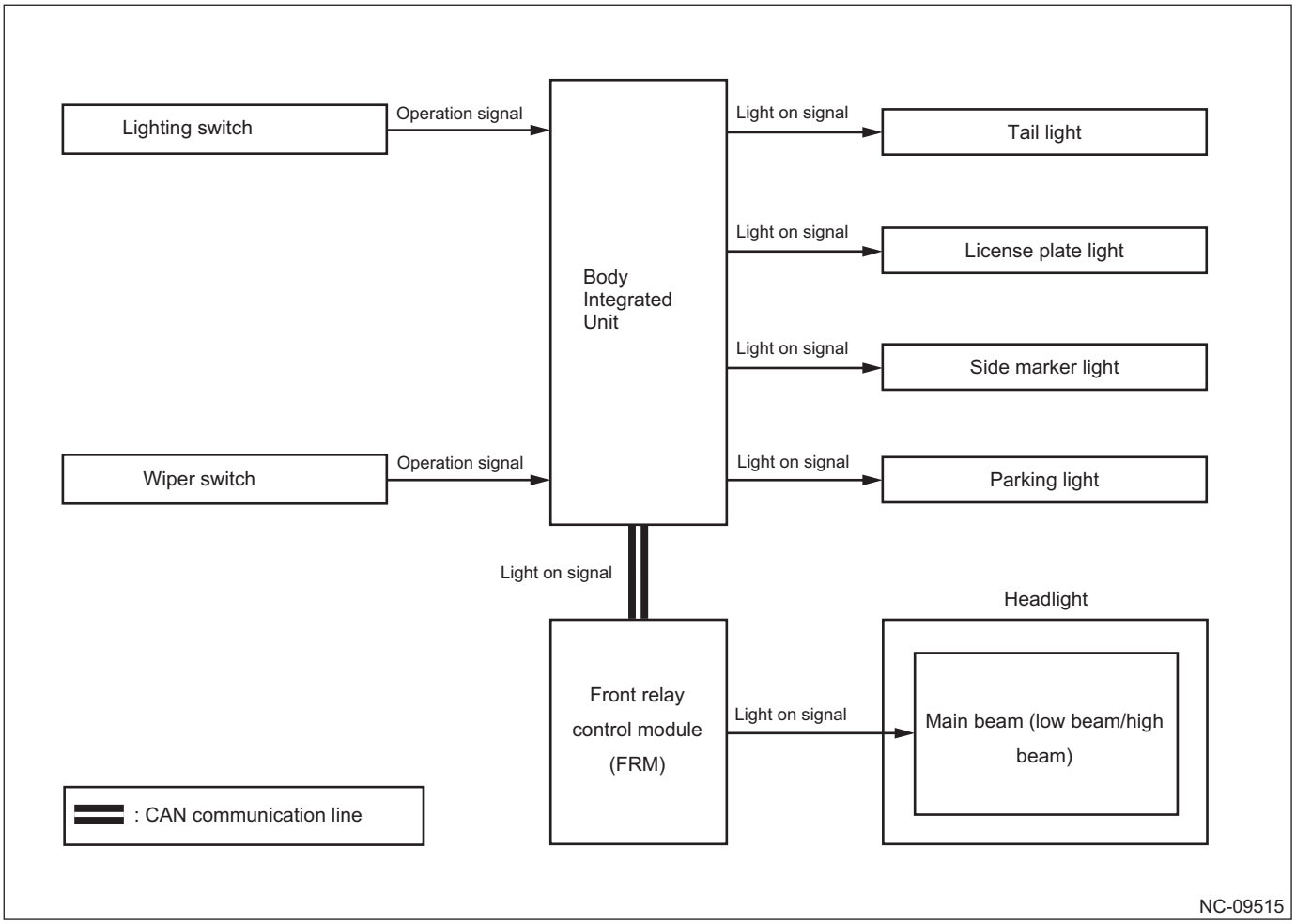
- The headlight turns off if the front wiper stops the operation for 60 seconds or more after the headlight turns on.
- The headlight turns off when the lighting switch is turned off.
- The wiper interlocked headlight does not operate when the front wiper operates by the front washer operation.
- Even when the headlight turns on interlocking with the wiper in the daytime, the meter illumination, etc. are not dimmed because the auto dimmer cancel function is activated.

System diagram

Models with steering responsive headlight (SRH) function



Models without steering responsive headlight (SRH) function



Main component functions

Component	Function
Body Integrated Unit	• Receives signals from the units, sensors, and switches, and controls the on/off of the various lights. • Receives signals from the units, sensors, and switches, and sends the light on signal to the integrated LED driver module (LDM) via LIN communication. *1 • Receives signals from the units, sensors, and switches, and sends the light on signal to the front relay control module (FRM) via CAN communication. *2
Lighting switch	Sends the switch operation signal to the Body Integrated Unit.
Wiper switch	Sends the switch operation signal to the Body Integrated Unit.
Integrated LED driver module (LDM)*1	Receives the light on signal from the Body Integrated Unit and controls the on/off of the main beam (low beam/high beam), parking light, and accessory light.
Front relay control module (FRM)*2	Receives the light on signal from the Body Integrated Unit and controls the on/off of the main beam (low beam/high beam).
Main beam (low beam/high beam)	Turns on during the wiper interlocked headlight operation.
Parking light	
Accessory light*2	
Tail light	
License plate light	

**1: Models with steering responsive headlight (SRH) function*
**2: Models without steering responsive headlight (SRH) function*

Operating conditions

When the lighting switch is in the AUTO position with the ignition switch*1 or engine switch*2 turned ON, and if the front wiper operates for approximately 10 seconds, the various lights turn on automatically.

The various lights turn off if the front wiper stops the operation for 60 seconds or more after the various lights turn on.

**1: Models with keyless entry system*
**2: Models with keyless access & push button start system*

Reference

The wiper interlocked headlight does not operate when the front wiper operates by the front washer operation.

Customization function

It is possible to customize wiper interlocked headlight ON/OFF at the dealer using the Subaru Select Monitor 4 or via the vehicle settings in the center information display. (The factory setting is ON.)

Light reminder warning

A light reminder warning is adopted that sounds a buzzer warning if the driver's door opens with the headlight or tail light turned on in a state where the keyless transmitter is removed from the ignition switch or the engine switch is OFF in order to remind the driver to turn off the lights.

Reference

The light reminder warning buzzer does not sound when various lights are turned on by welcome lighting control.

Operating conditions and basic operations

If the driver's door opens while the keyless transmitter is removed from the ignition switch or the engine switch is OFF with the headlight or tail light turned on, the buzzer will sound continuously, reminding the driver to turn off the lights. The sound of the light reminder buzzer stops when the lights turn off or when the driver's door closes.

Direction indicator one-touch function

The direction indicator one-touch function is adopted that flashes the indicator in the pressed direction three times when a short press (level 1 operation) of the turn signal switch is performed.

Customization function

It is possible to customize the direction indicator one-touch function ON/OFF at the dealer using the Subaru Select Monitor 4 or center information display. (The factory setting is ON.)

Battery Save Function

A battery save function has been adopted that can prevent the battery from being depleted or undergoing rapid deterioration when the user forgets to turn off the lights.

Operating conditions and basic operations

When the ignition is OFF and the headlights or parking lights are illuminated for a certain length of time (doors not opened or closed and lighting switch not operated for approximately 10 minutes or more*), the lights are automatically turned off.

After the lights were automatically turned OFF by the battery save function, operating the lighting switch will cancel the automatic lights-OFF status.

Reference

*: If a door was opened or closed, or the lighting switch was operated, under conditions when the battery save function is ready to operate, the count time is reset.

9.4 Fender Garnish

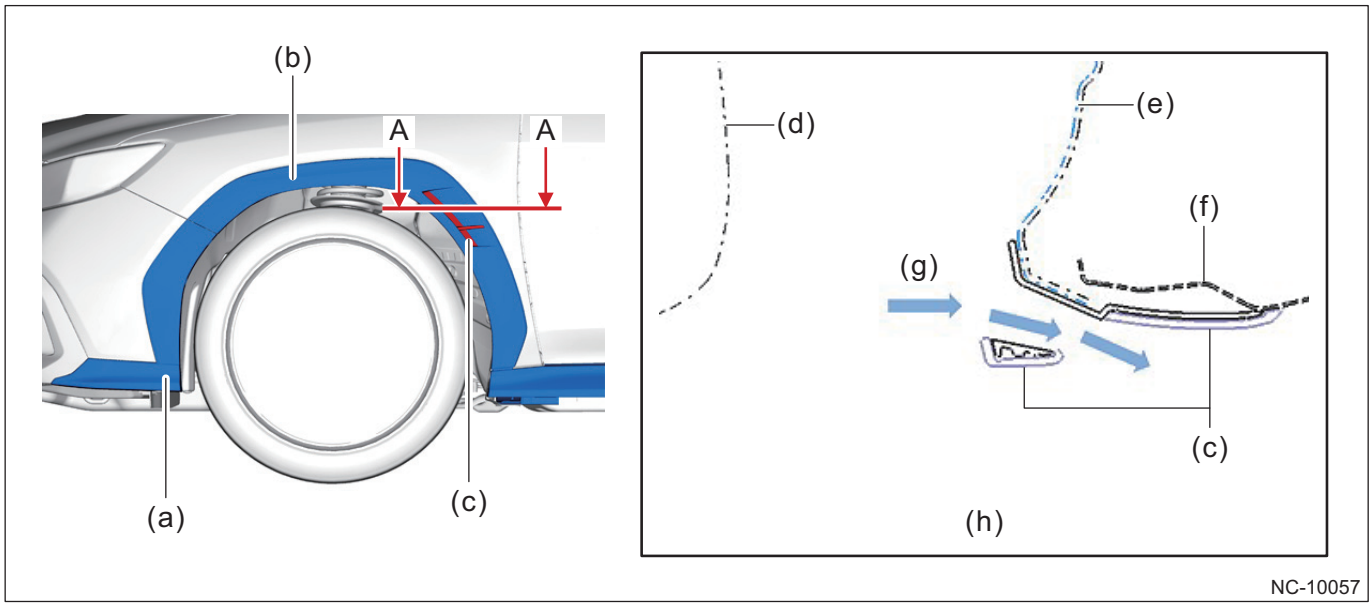
9.4.1 Overview

Overview

Front fender garnish

A front fender garnish that uses a hexagonal dimpled pattern texture is adopted.

An air outlet that is effective for improving steering stability is provided for the front fender garnish.

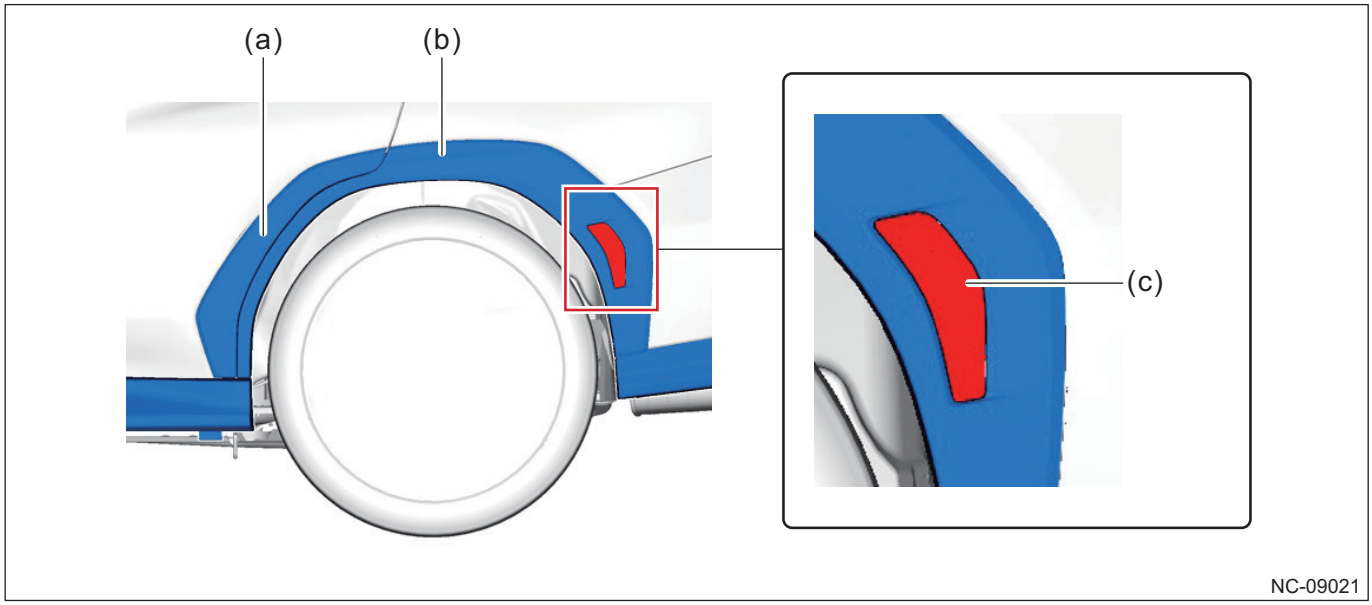


(a) Arch garnish
(b) Fender garnish
(c) Air outlet
(d) Tire
(e) Mud guard
(f) Front fender
(g) Airflow
(h) A-A cross section

Rear fender garnish

A rear fender garnish that uses a hexagonal dimpled pattern texture is adopted.

A rear side reflex reflector is provided for the rear quarter garnish.



(a) Rear door garnish
(b) Rear quarter garnish
(c) Rear side reflex reflector

9.5 Side sill spoiler

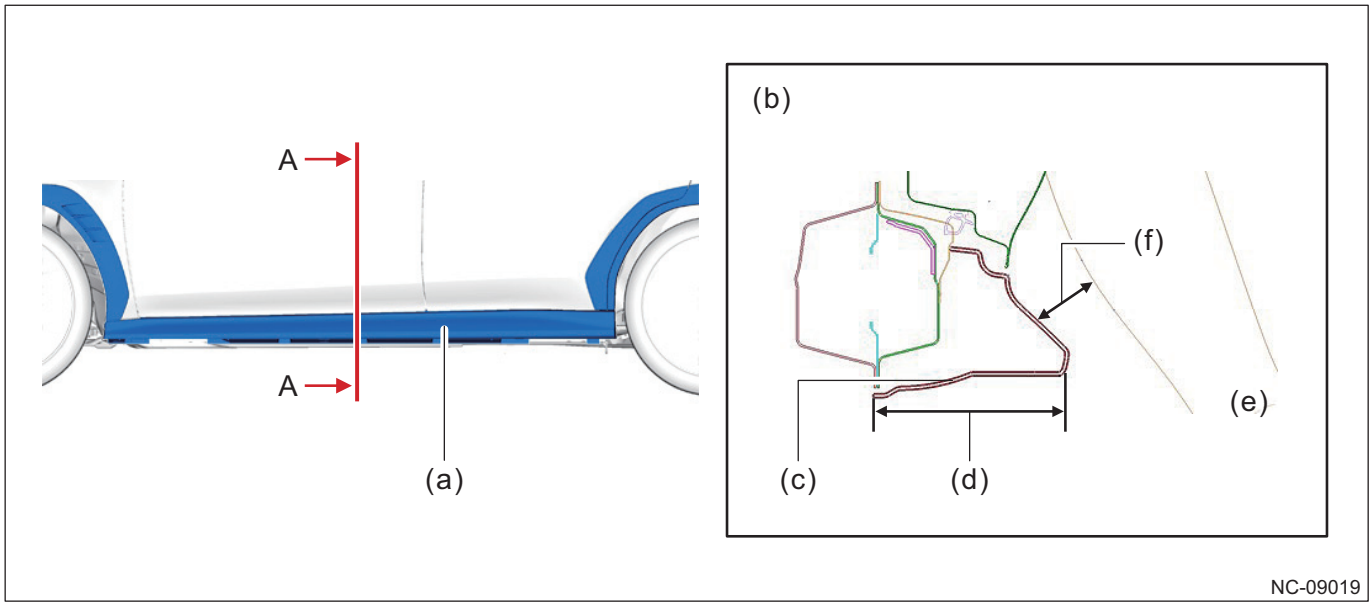
9.5.1 Overview

Overview

A side sill spoiler that uses a hexagonal dimpled pattern texture is adopted.

A bottom surface width is secured that contributes to aerodynamic performance while also being considerate of the ease of entering and exiting the vehicle.

Curvature is used on the cross section to increase rigidity and reduce noise from stone chips.



(a) Side sill spoiler

(b) A-A cross section

(c) Curvature used on cross section to reduce noise from stone chips

(d) Bottom surface width secured to contribute to aerodynamic performance

(e) Leg trajectory when entering/exiting

(f) Clearance secured in consideration of ease of entering/exiting

9.6 Wiper and Washer System

9.6.1 Overview

Overview

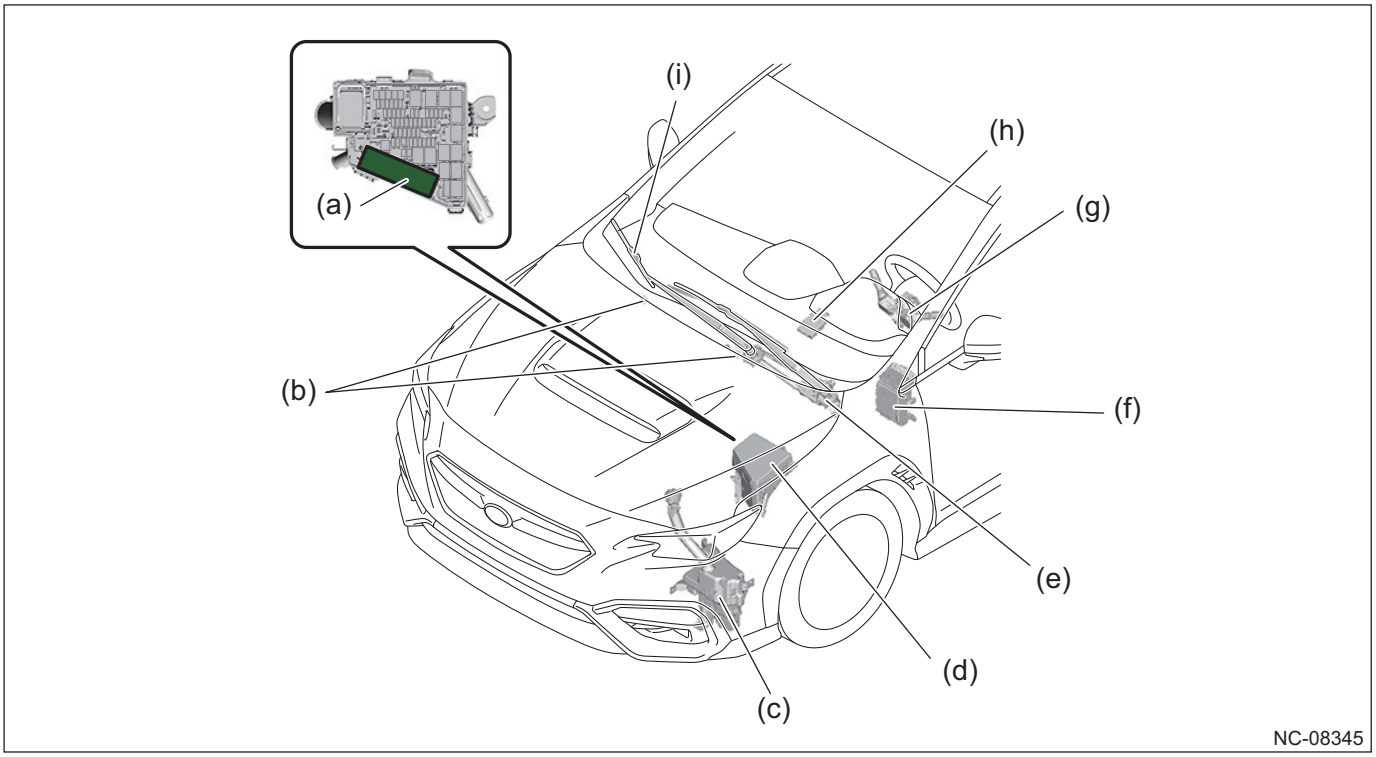
The flat blade is adopted for the front wiper blade. The blade height is lowered to prevent shielding of visibility in wiper operation and reduce wind noise.

The high-pressure pump with strong jet force is adopted for the washer system.

A wet wiper is provided that sprays the washer fluid from the nozzle at the end of the passenger's seat side wiper arm into the wiper blade area.

9.6.2 Component

Component layout drawing



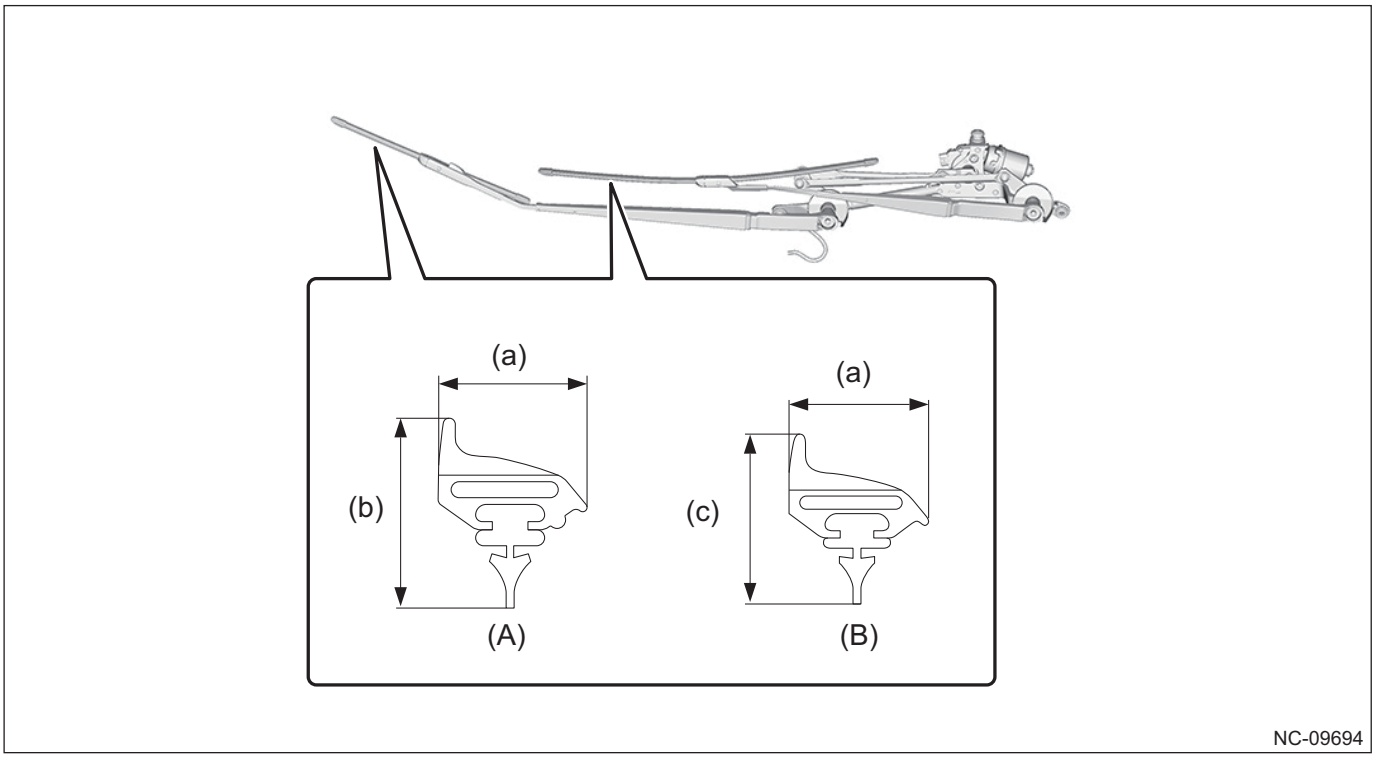
(a) Front relay control module (in main fuse & relay box)
(b) Nozzle windshield washer
(c) Washer tank assembly
(d) M/B (main fuse & relay box)
(e) Motor assembly windshield wiper
(f) Body Integrated Unit (BIU)
(g) Switch assembly combination wiper
(h) Central gateway CM (CGW)
(i) Arm assembly windshield wiper and blade assembly windshield wiper

Component details

Wiper

■ Flat blade

The flat blade is adopted for the front wiper blade. The blade height is lowered to prevent shielding of visibility in wiper operation and reduce wind noise. The wiper protrusion viewed from the vehicle interior is reduced, realizing a smart appearance.



(A) Driver's seat side

(B) Passenger's seat side

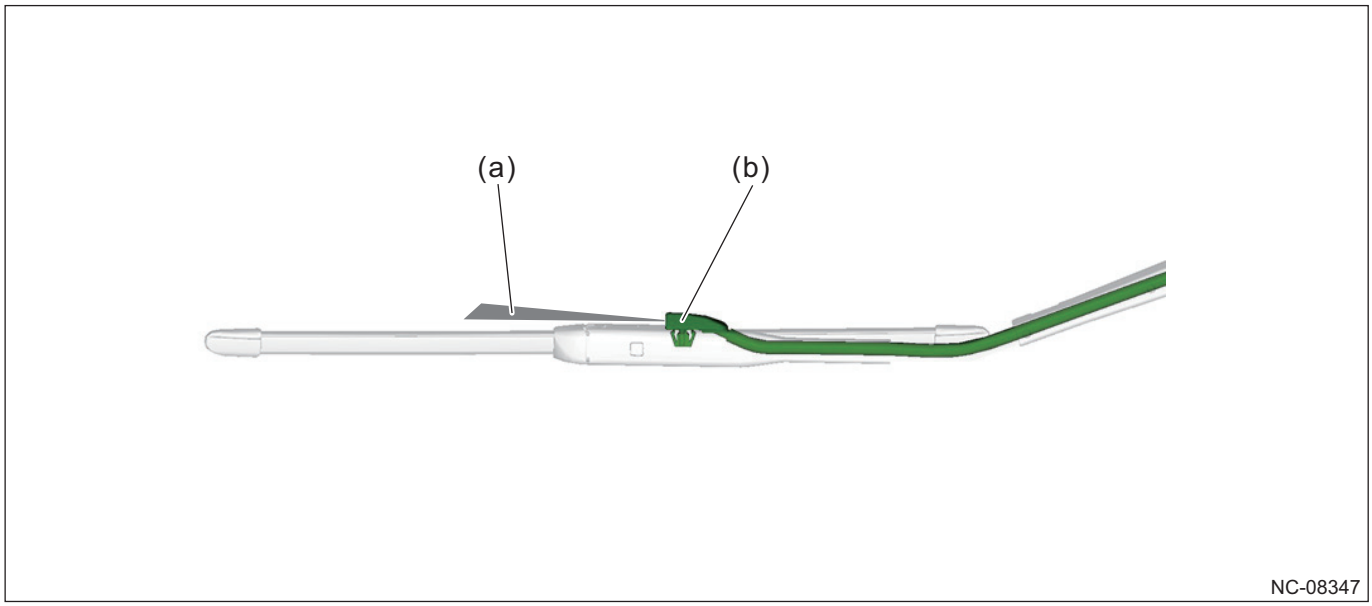
(a) 0.50 in (12.6 mm)

(b) 0.63 in (15.9 mm)

(c) 0.60 in (15.3 mm)

■ Wet wiper

A wet wiper is provided that sprays the washer fluid from the nozzle at the end of the passenger's seat side wiper arm into the wiper blade area. Also, the size of the wet wiper nozzle is reduced for a sleek appearance.



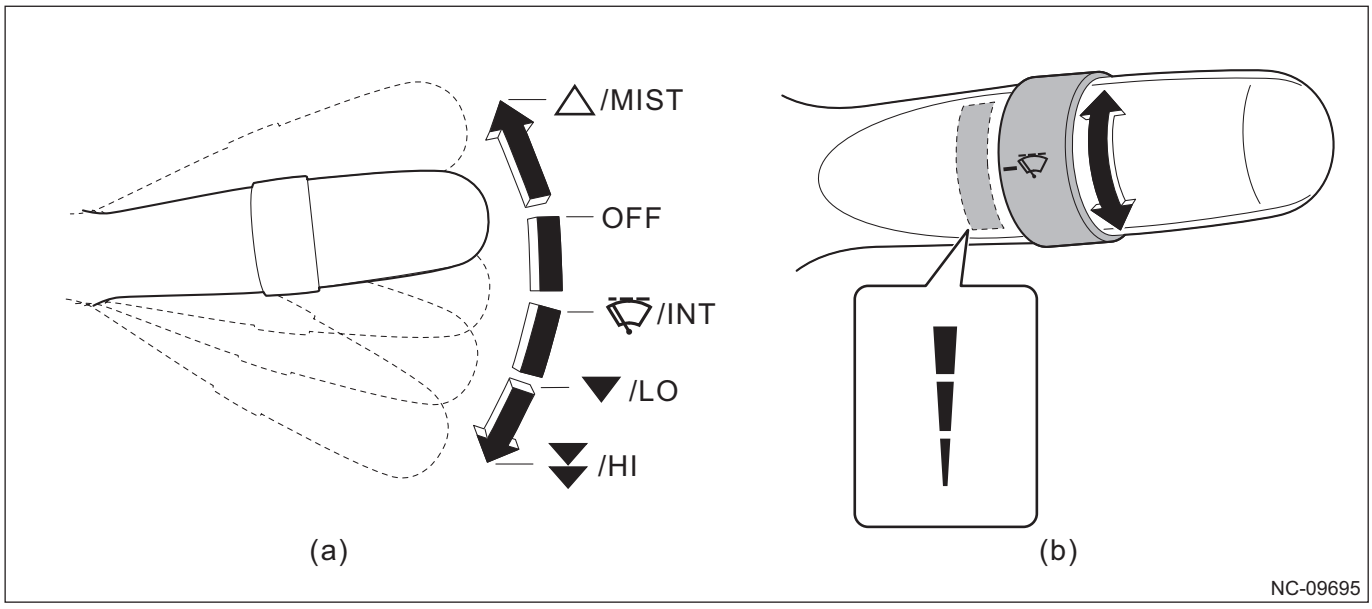
(a) Washer fluid spraying

(b) Nozzle

■ Front wiper control switch (switch assembly combination wiper)

▮ Intermittent wiper mode

When the engine switch or ignition key switch is ON, the switch assembly combination wiper is set to MIST to operate the wiper once. The wiper operates continuously until releasing the switch. When releasing the lever, the switch returns to the OFF position automatically. When the switch assembly combination wiper is set to INT, the wiper operates intermittently. While the intermittent windshield wiper operates, the wiper operation interval can be adjusted to four stages by switching sensitivity volume.

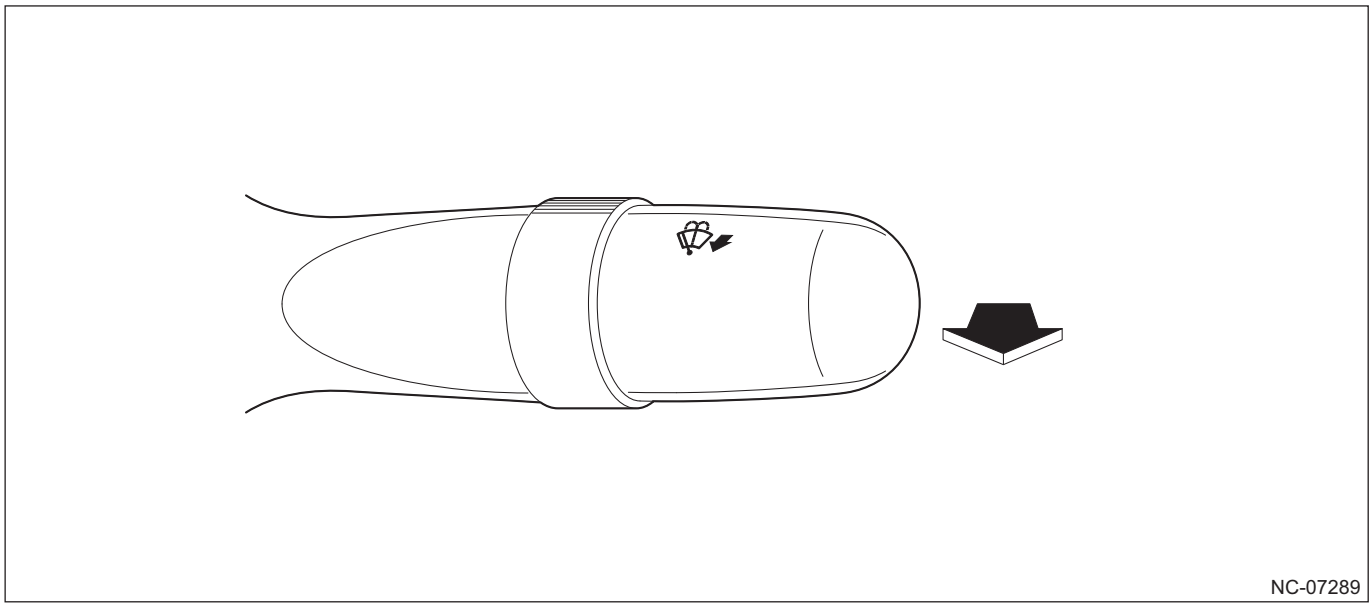


(a) Switch assembly combination wiper

(b) Sensitivity volume

■ Front washer switch (switch assembly combination wiper)

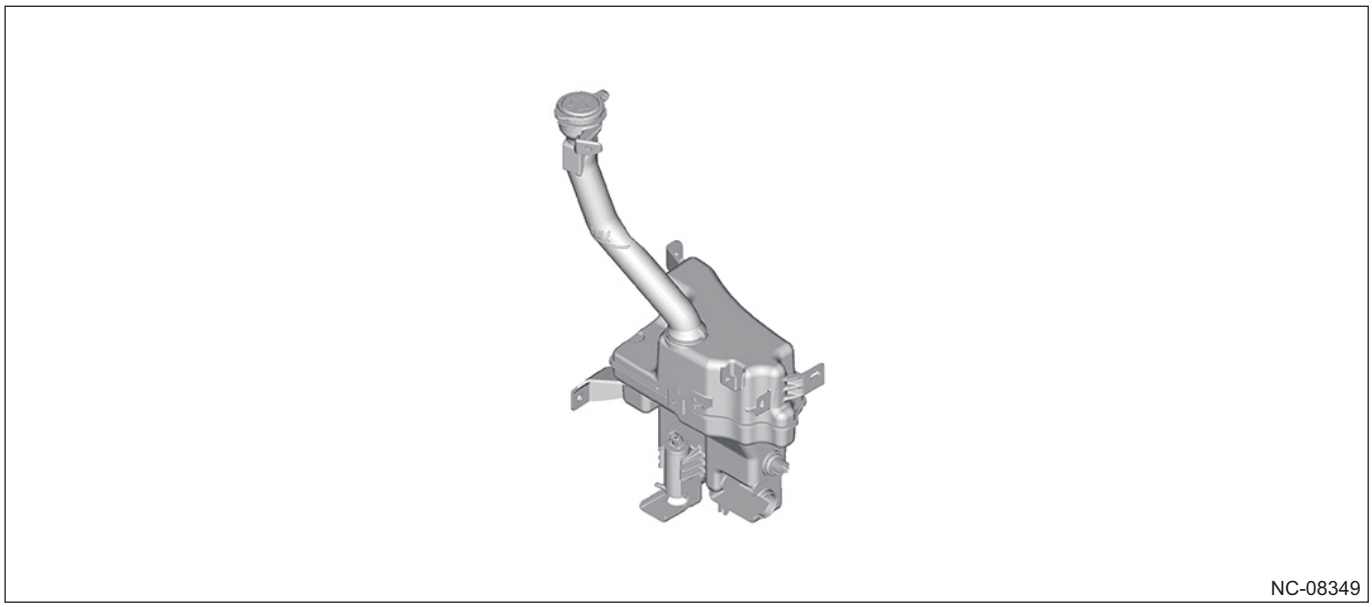
The front washer operates by pulling the switch assembly combination wiper toward the driver side. The front washer stops by returning the switch to the original position. In addition, when the Body Integrated Unit (BIU) receives the signal of the front washer switch ON, the front wiper operates in cooperation with the washer after the delay time (300 ms) has elapsed.



Washer

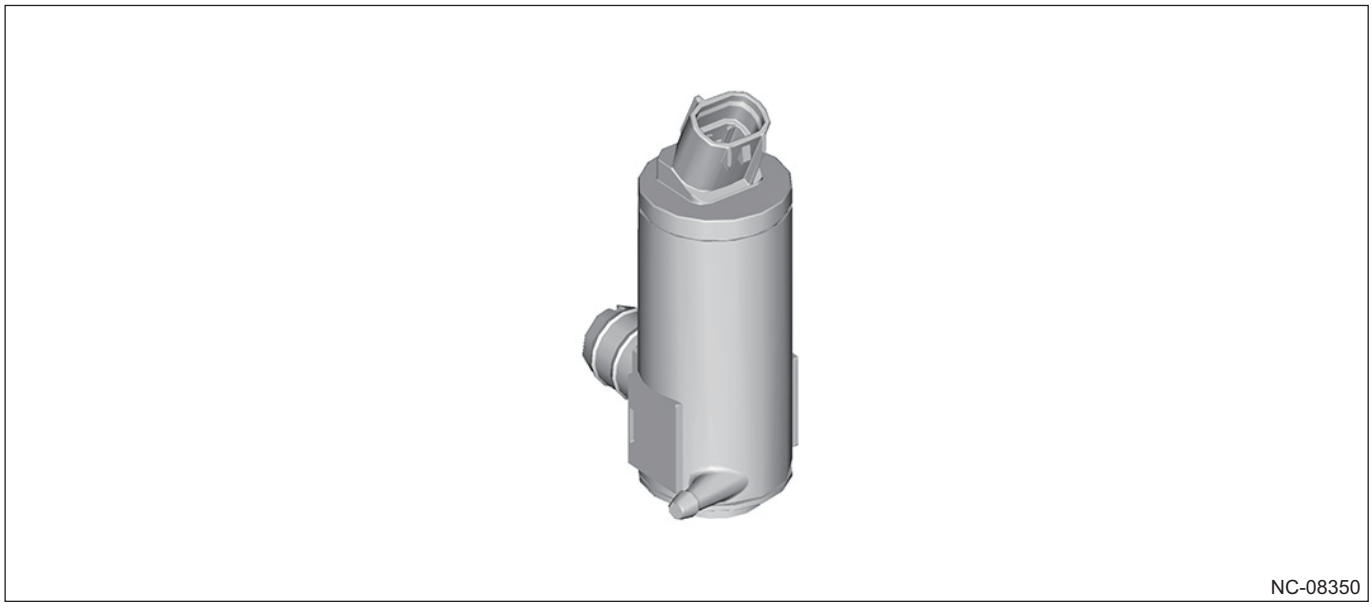
■ Washer tank assembly

The washer tank assembly with a capacity of 4.2 US qt (4.0 L, 3.5 Imp qt) is adopted. The remaining amount warning function (level sensor) is mounted to inform the decrease of washer fluid.



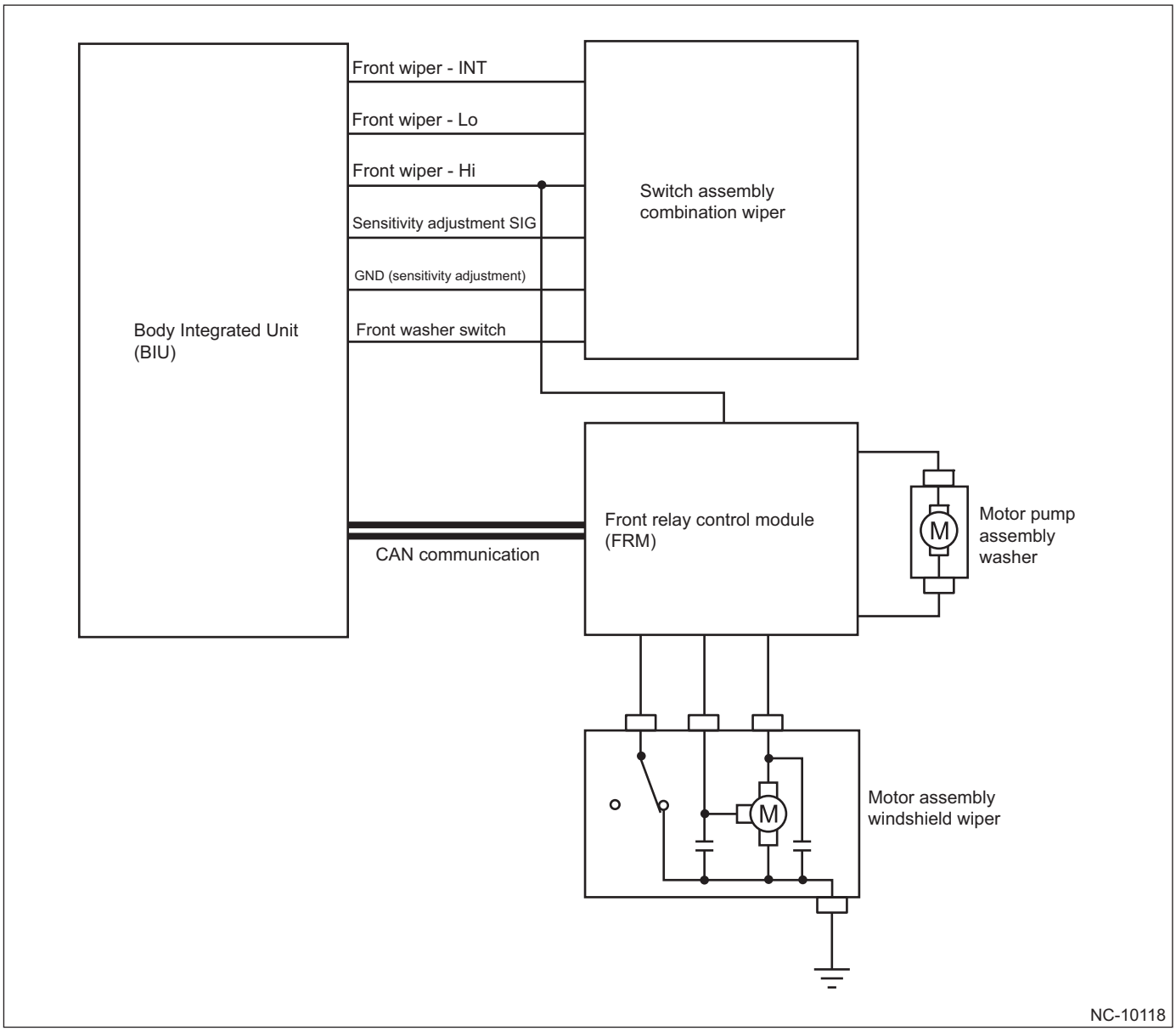
■ Motor pump assembly washer

The high-pressure pump with strong jet force for washer fluid is adopted to improve washability.



9.6.3 Construction and Operation

System diagram



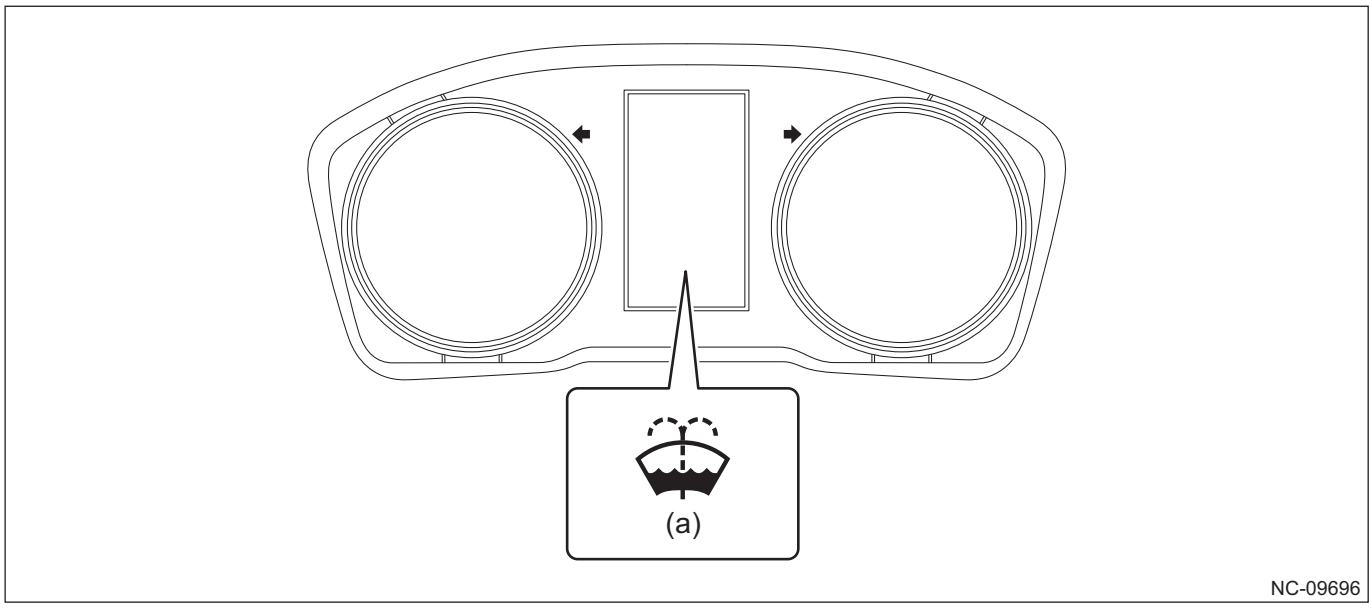
Main component functions

Name	Function and construction
Arm assembly windshield wiper and blade assembly windshield wiper	Operates by being driven by the front wiper motor.
Motor assembly windshield wiper	Operates according to the signal from the front relay control module (FRM), and drives the arm assembly windshield wiper and blade assembly windshield wiper via the front wiper link.
Motor pump assembly washer	Pumps the washer fluid to the washer nozzle.
Nozzle windshield washer	Sprays the washer fluid.
Washer tank assembly	A container for the washer fluid used to wash dirt from the windshield glass.
Level sensor	Outputs the low washer fluid level signal to the combination meter when the washer fluid level is low.
Body Integrated Unit (BIU)	Receives various signals and sends the information to the front relay control module (FRM).
Front relay control module (FRM)	Receives signals from the Body Integrated Unit (BIU) and controls the wiper motor and washer motor.
Switch assembly combination wiper	Switches the position of the wiper control switch, the ON/OFF of the washer switch, and the status of the sensitivity adjustment switch.

Display screen details

Warning light

The washer fluid level warning light is displayed on the multi information display (MID) when the low washer fluid level signal from the level sensor is input to the combination meter.



(a) Washer fluid level warning light

9.7 Glass/Windows/Mirrors

9.7.1 Overview

Overview

Glass

- A hidden molding is adopted for the front windshield to create a flush surface.
- Green glass with a UV cut function is adopted for the rear glass.

Window

- A power window with the driver's seat + passenger's seat automatic opening and closing function or all-seat automatic opening and closing function is adopted, and provided depending on the grade.
- The off-delay function is adopted for windows with the automatic opening and closing function, allowing window operation for a certain length of time even after the engine switch is turned OFF.
- A high quality smart motor for when the glass rises and lowers is adopted for the power window motor assembly for windows with the automatic opening and closing function. The added speed control function during automatic operation realizes sophisticated opening and closing operation.

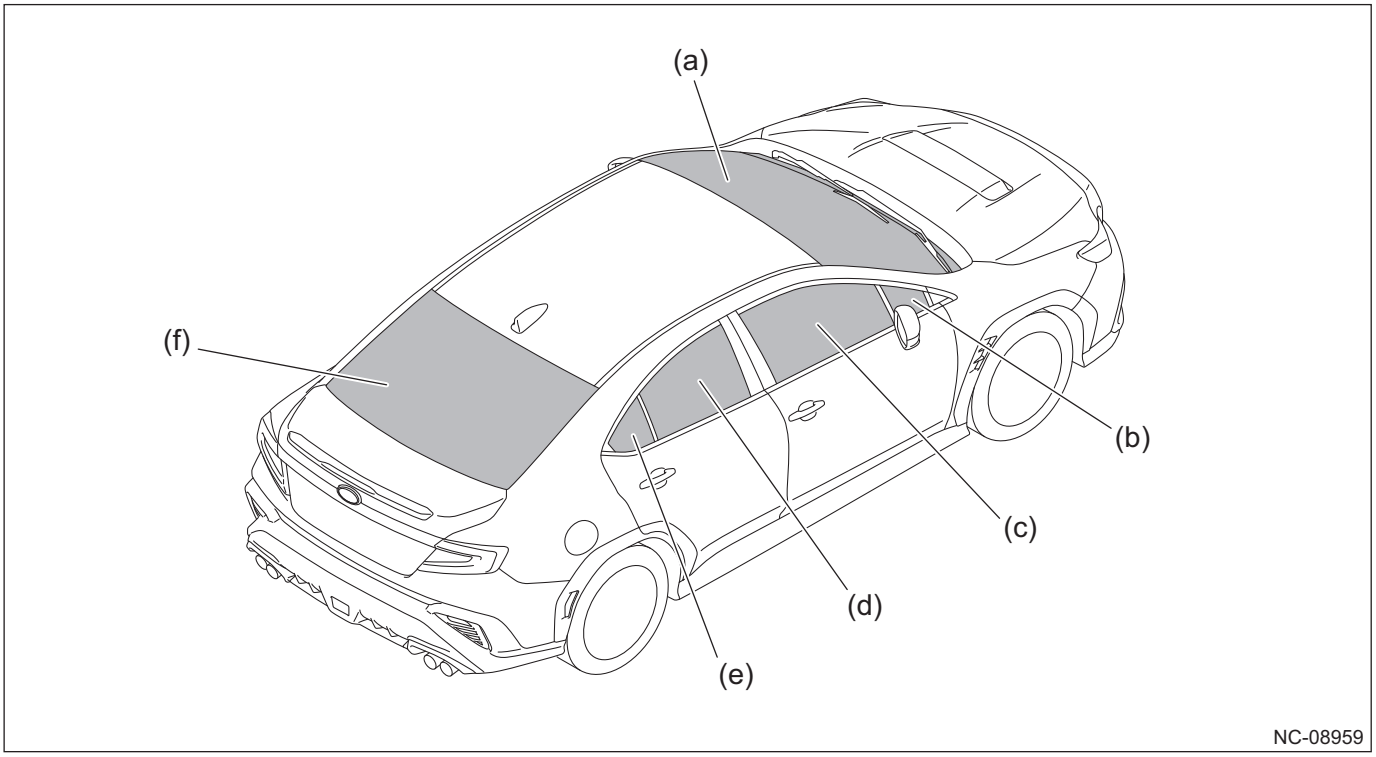
Mirror

- A new mirror body is adopted.
- Wind noise has been reduced with the improved shape.
- The LED indicator of Blind Spot Detection/Rear Cross Traffic Alert is located inside the outer mirror so that the visual line of the driver moves less. (Models with Blind Spot Detection/Rear Cross Traffic Alert)

9.7.2 Component

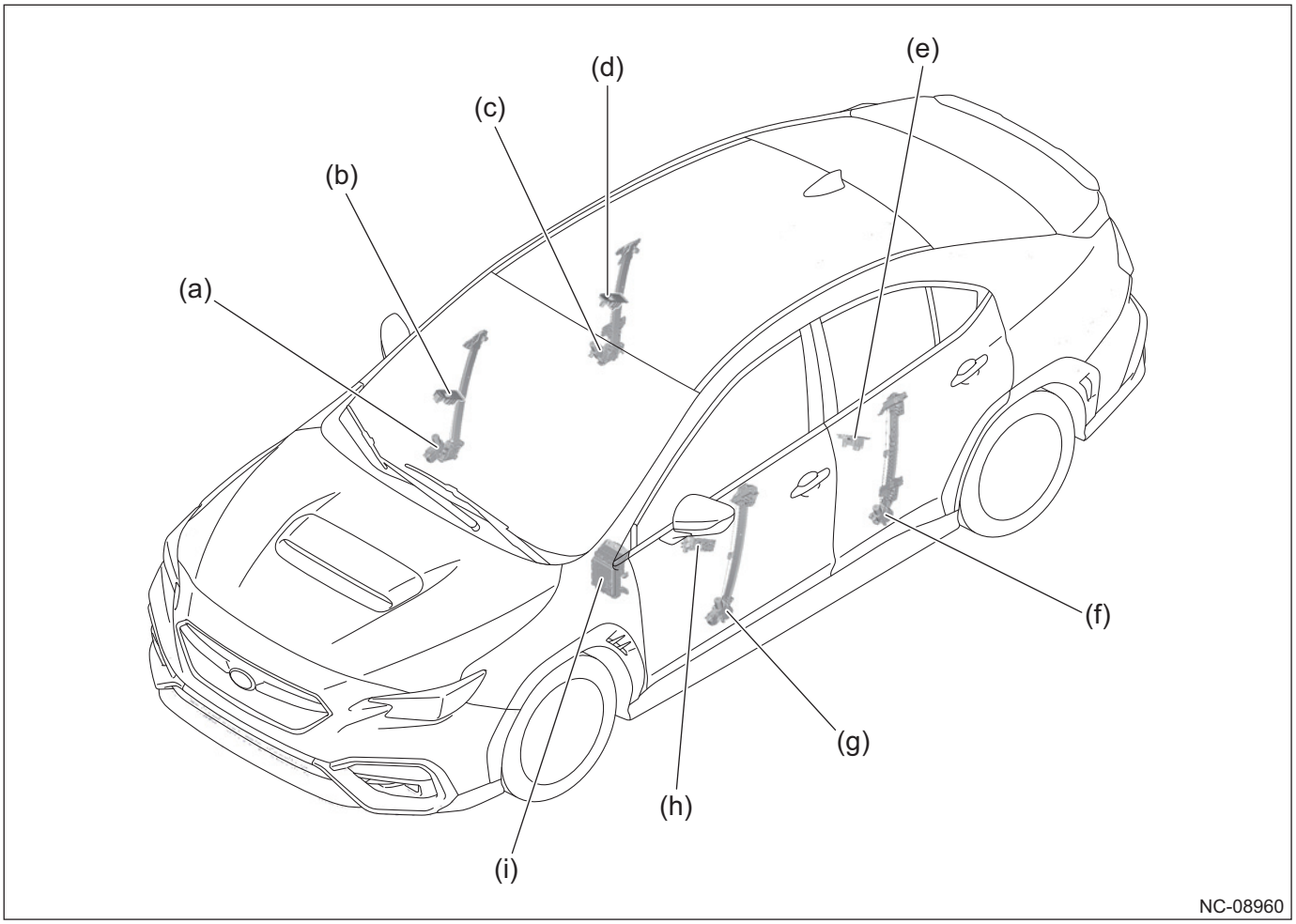
Component layout drawing

Glass



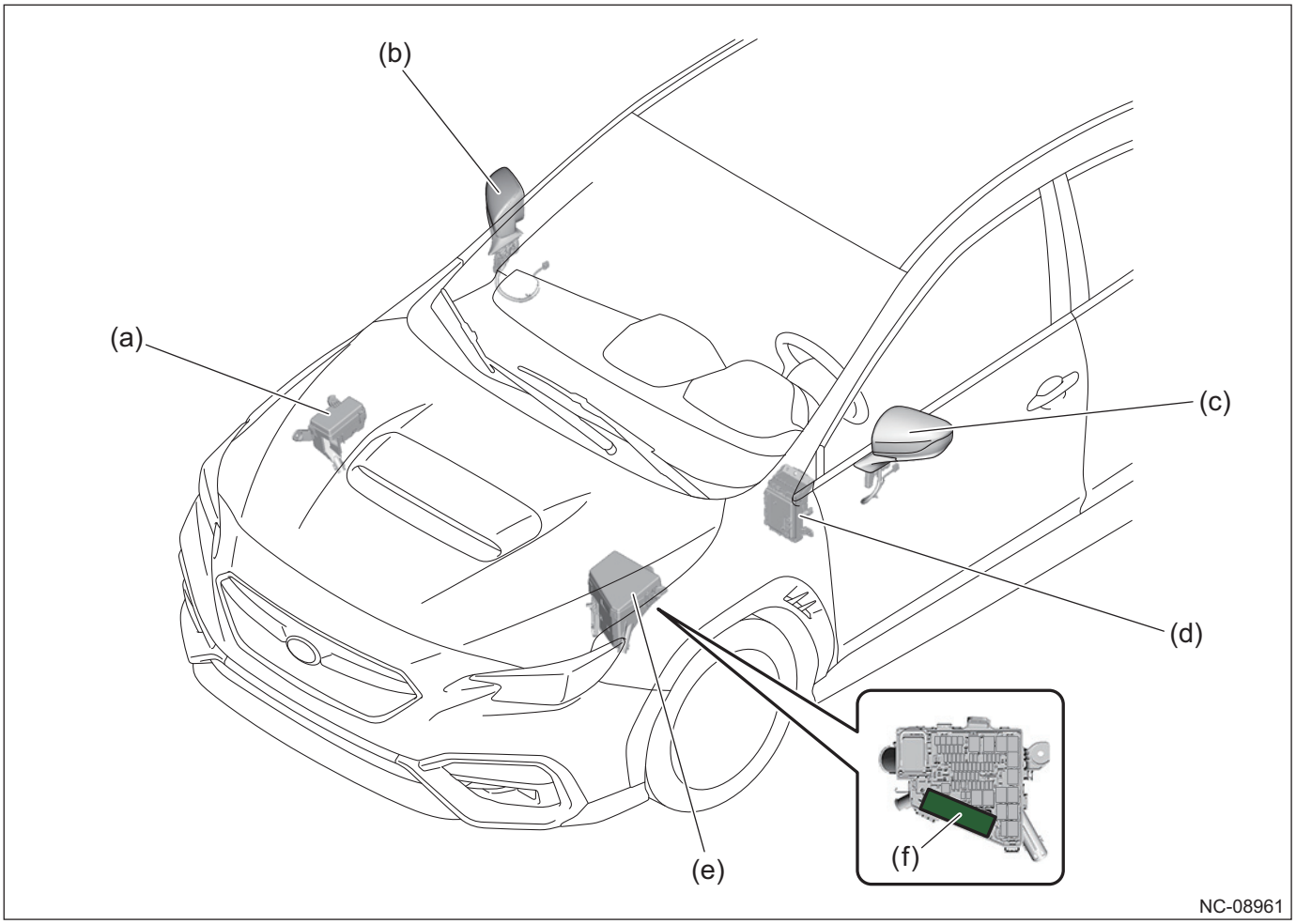
(a) Glass windshield
(b) Glass front door partition
(c) Glass assembly front door
(d) Glass assembly rear door
(e) Glass rear door partition
(f) Glass rear window

Power window



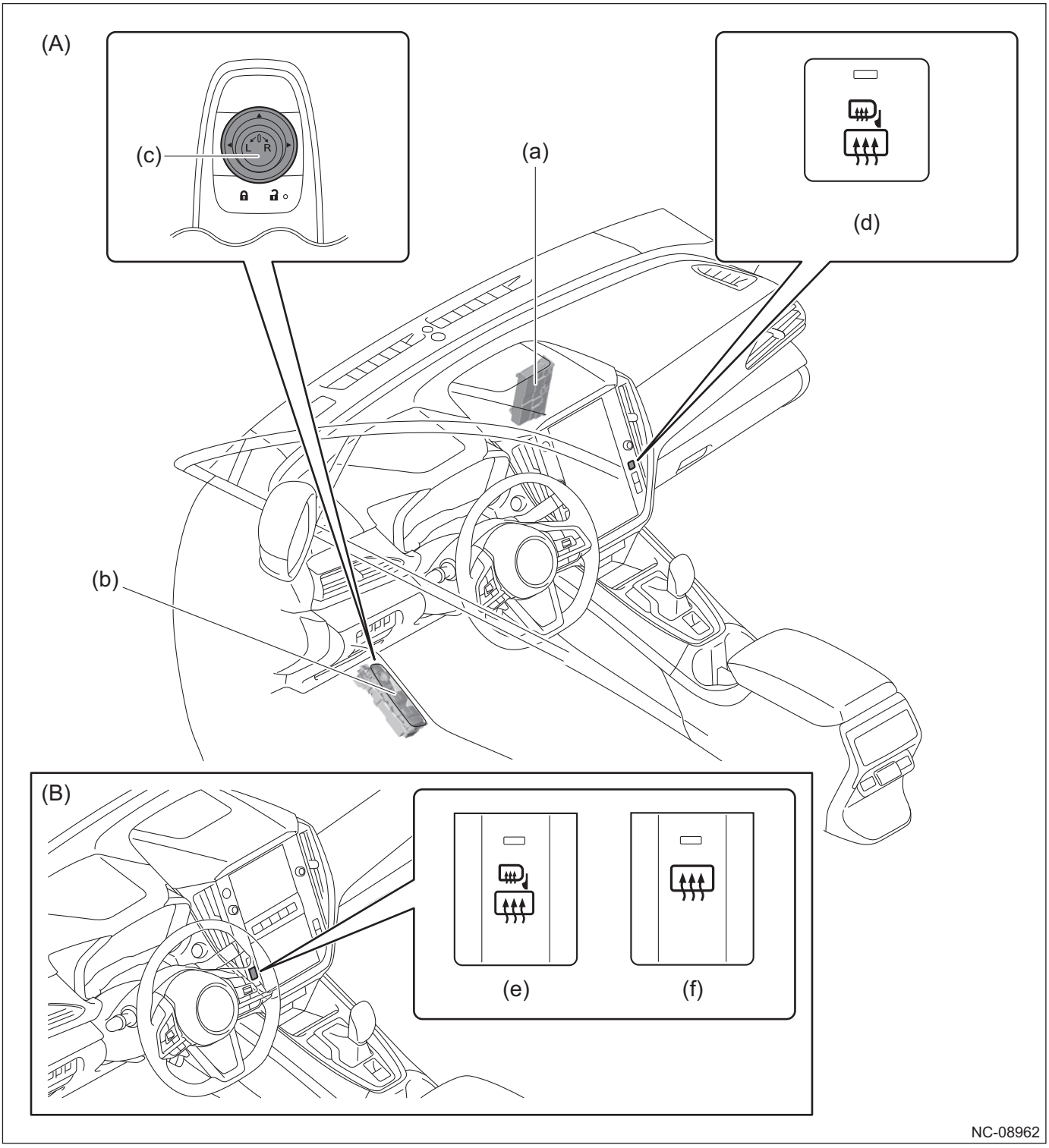
(a) Front regulator & motor assembly (passenger's seat)
(b) Front power window sub switch
(c) Rear regulator & motor assembly RH
(d) Rear power window sub switch RH
(e) Rear power window sub switch LH
(f) Rear regulator & motor assembly LH
(g) Front regulator & motor assembly (driver's seat)
(h) Power window main switch
(i) Body Integrated Unit (BIU) (in joint box)

Mirror



(a) Relay holder
(b) Outer mirror RH
(c) Outer mirror LH
(d) Body Integrated Unit (BIU) (in joint box)
(e) M/B (main fuse & relay box)
(f) Front relay control module (FRM)

Mirror



(A) Models with 11.6-inch center information display

(a) A/C CM

(b) Power window main switch

(c) Mirror surface adjustment and left-right selector switch

(B) Models with Dual 7-inch center information display

(d) Rear window defogger switch/heated door mirror switch

(e) Rear window defogger switch/heated door mirror switch (models with mirror heater)

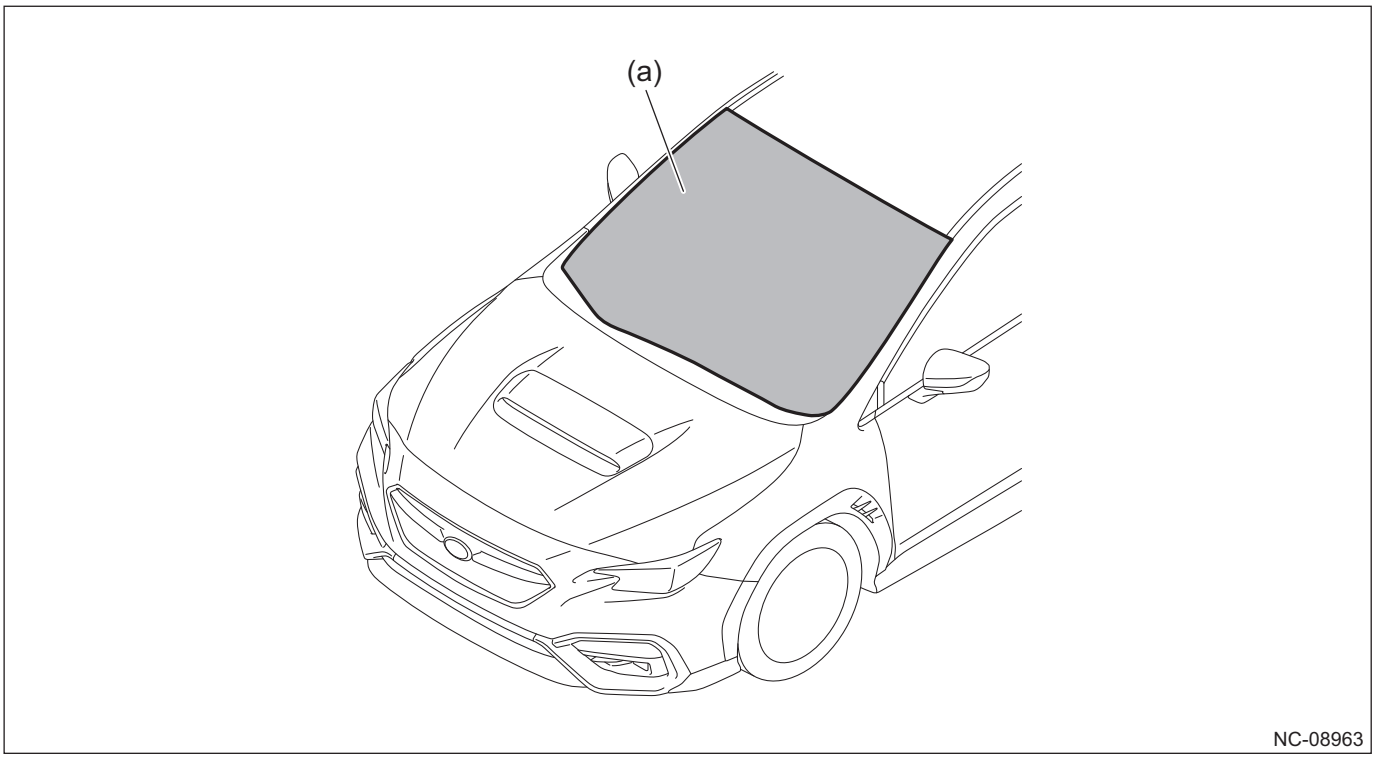
(f) Rear window defogger switch/heated door mirror switch (models without mirror heater)

Component details

Glass

■ Front windshield glass

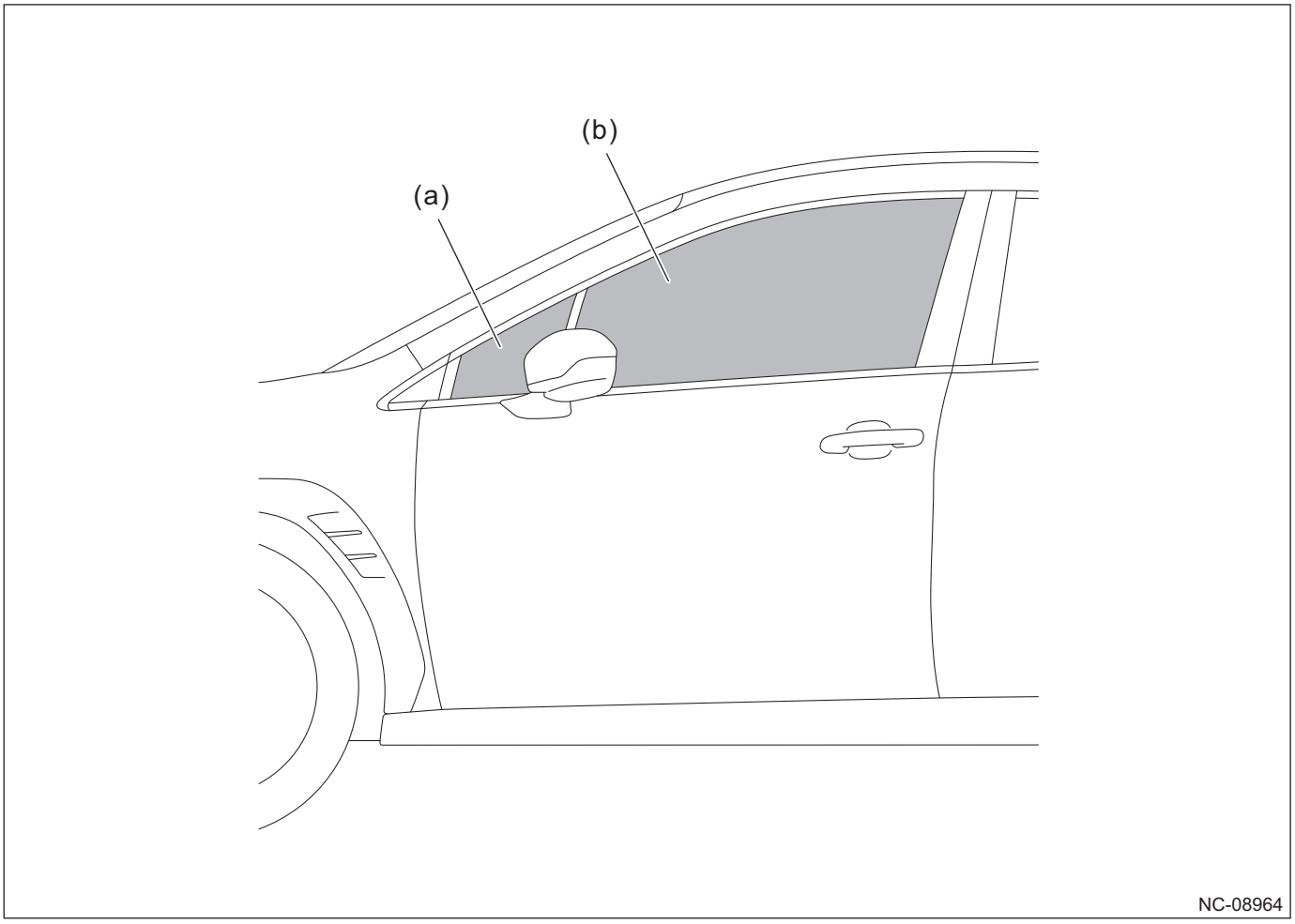
A hidden molding is adopted to create a flush surface.



(a) Glass windshield

■ Front door glass

Green glass with a UV cut function is adopted for the front door glass.

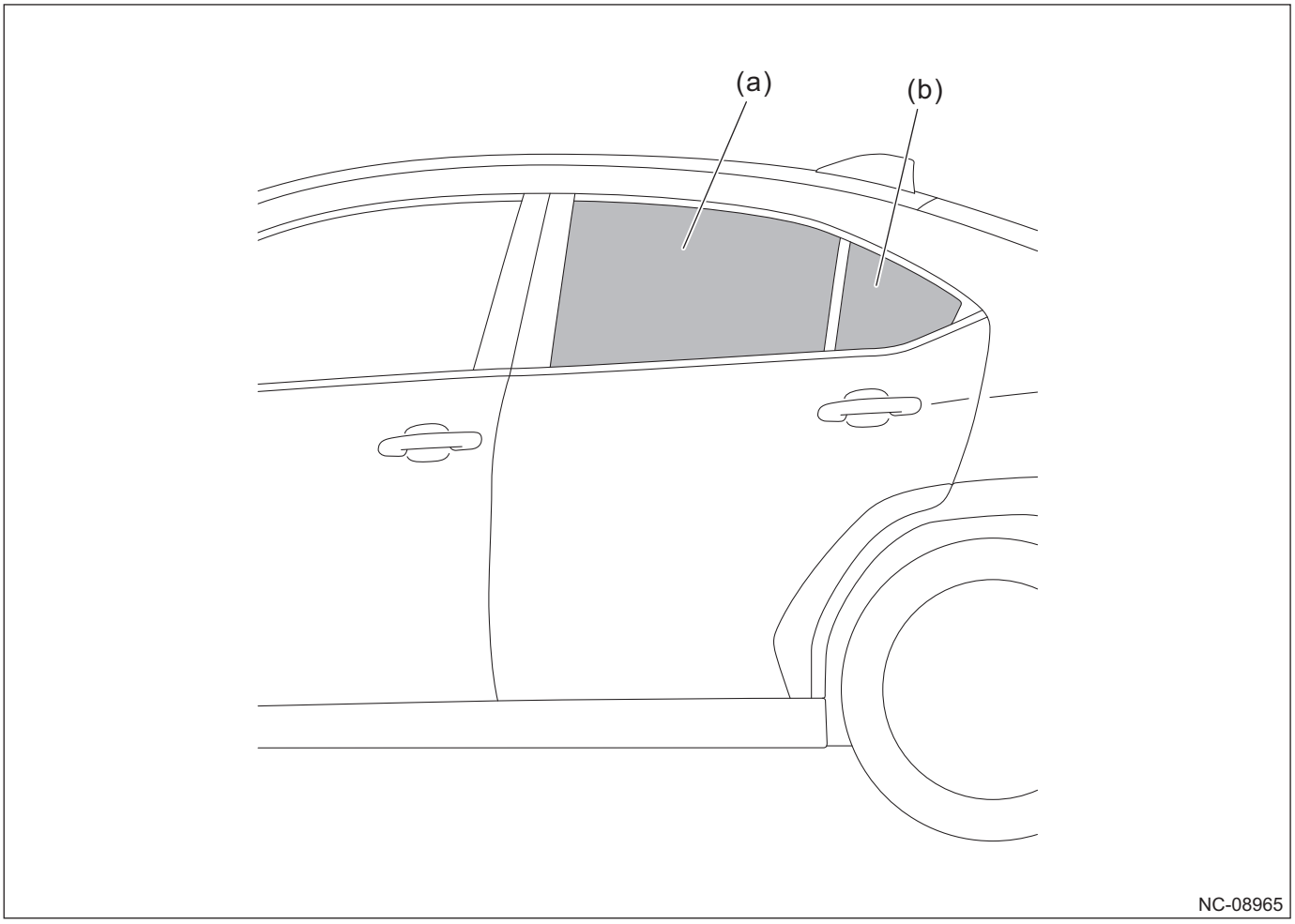


(a) Glass front door partition

(b) Glass assembly front door

■ Rear door glass

Green glass with a UV cut function is adopted for the rear door glass and rear door partition glass.

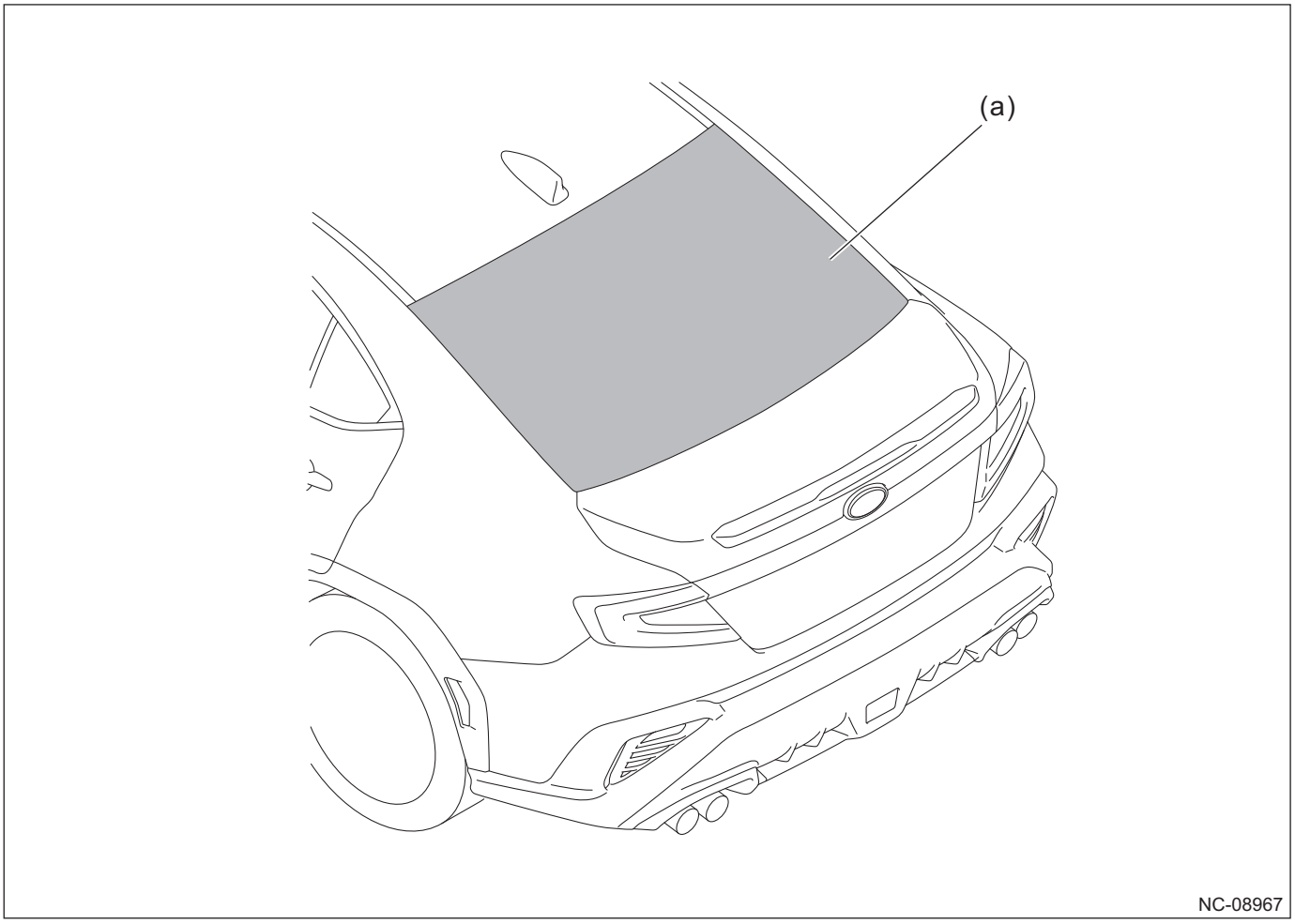


(a) Glass assembly rear door

(b) Glass rear door partition

■ Rear glass

Green glass with a UV cut function is adopted for the rear glass.



(a) Glass rear window

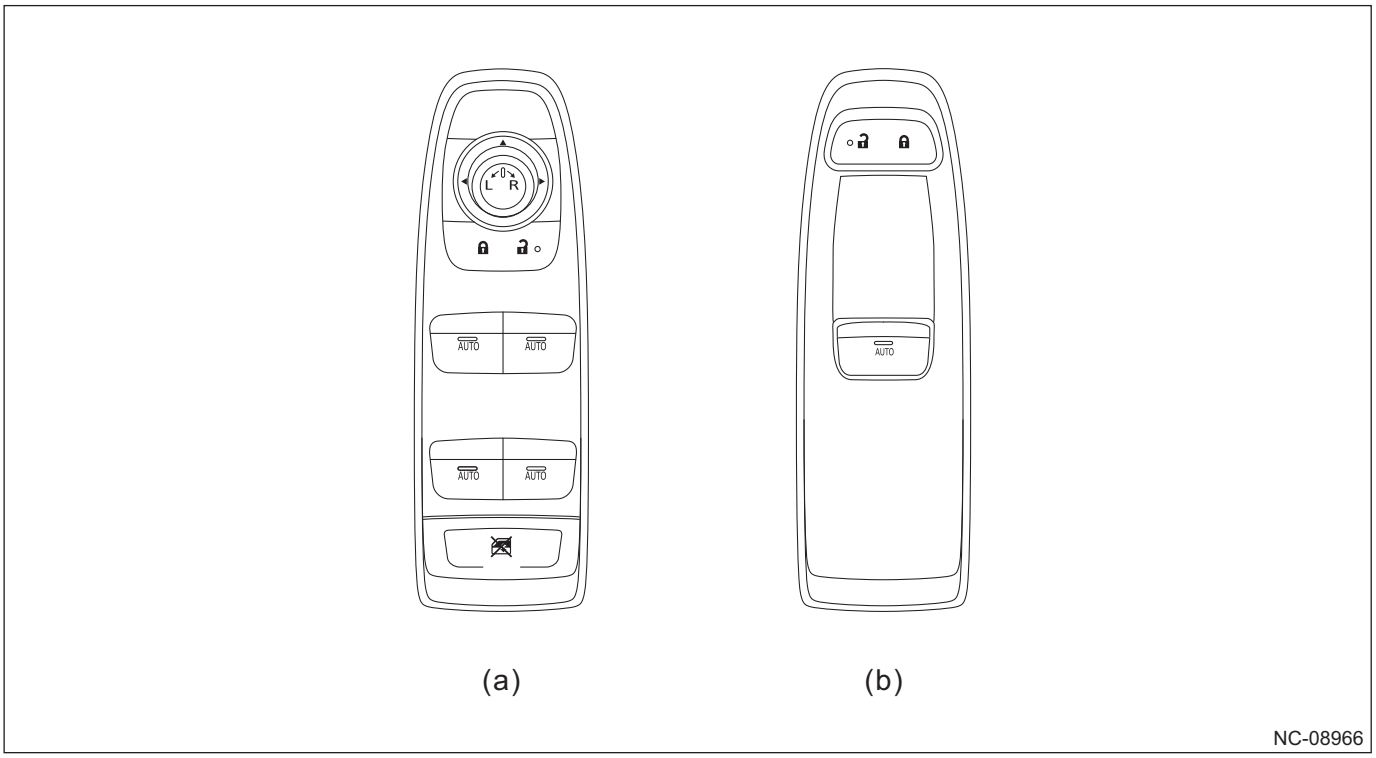
Power window

■ Power window switch

A power window auto function is provided for all seats to improve convenience. (Models with all-seat automatic opening and closing function)

A red color is adopted for the nighttime illumination of the power window switch, silver paint is provided for the remote control mirror switch, and chrome plating is provided for the power window switch decoration to create a luxurious feel. (Models with all-seat automatic opening and closing function)

Power window



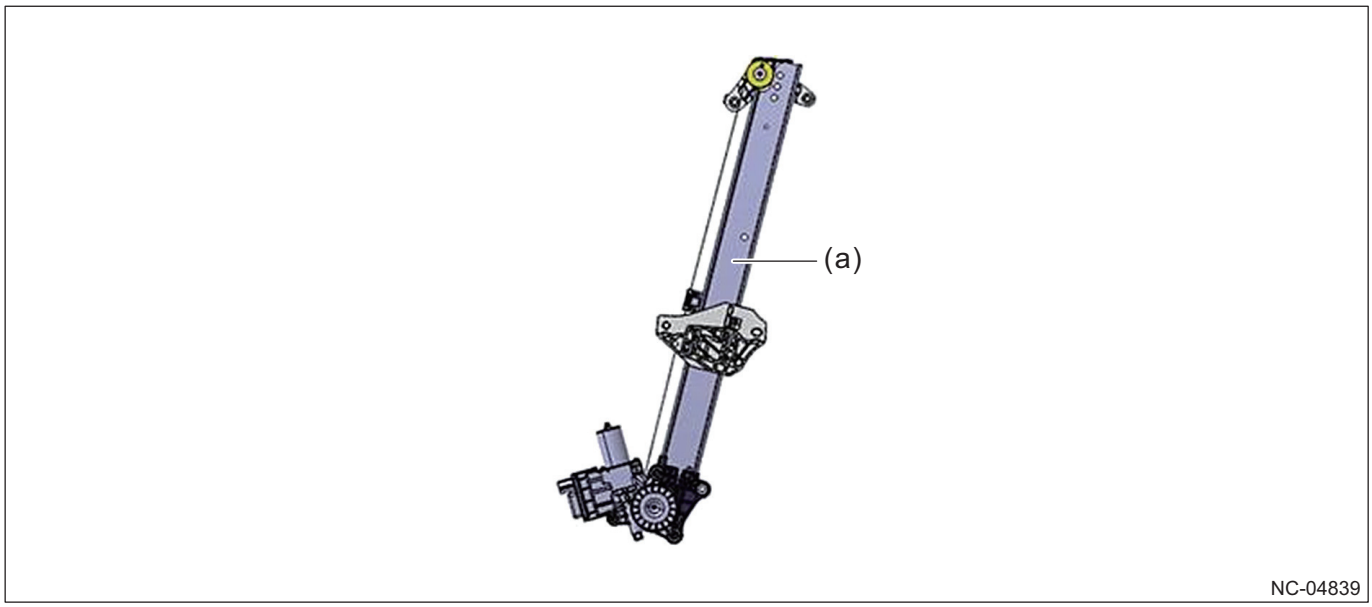
(a) Power window main switch

(b) Front power window sub switch

■ Rear door regulator (window with automatic opening and closing function)

A single rail type of rear door regulator is adopted to enable glass rising and lowering along the curved surface of the door and restrict deflection of the door trim.

Also, the adoption of the single rail type enables weight reduction and gives the glass closing a high-quality feel.



(a) Rear regulator & motor assembly

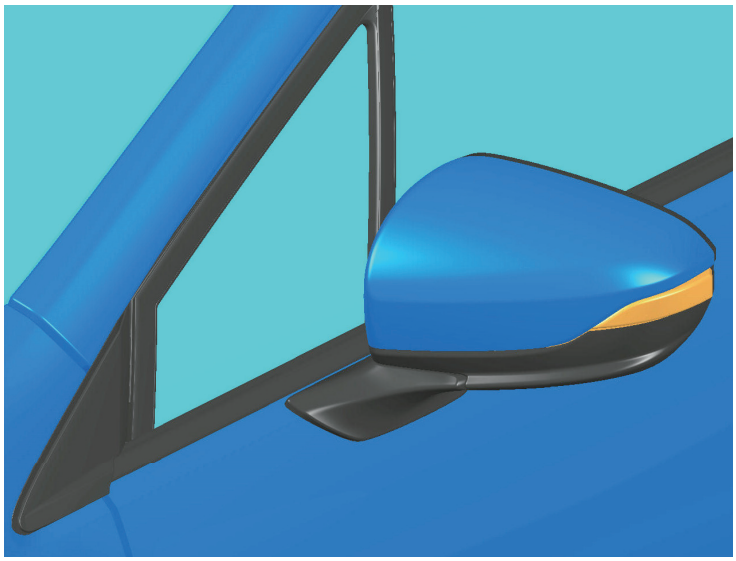
Mirror

■ Outer mirror

A smaller mirror body is adopted to ensure a wide field of view from the triangular window.

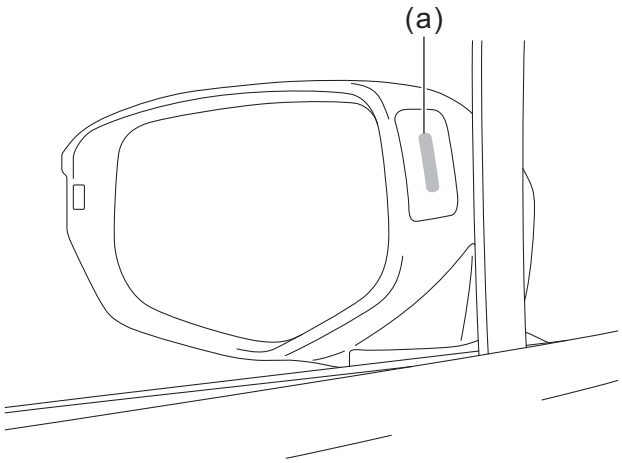
The optical guiding type of LED whose entire light body illuminates is adopted for the turn light to ensure conspicuousness from the surroundings and improve the quality feel. (Models with turn light)

A small body and stay are adopted and the shape is optimized to improve aerodynamic performance and reduce wind noise.



NC-04784

The LED indicator position of Blind Spot Detection/Rear Cross Traffic Alert has been changed from the mirror surface to inside the outer mirror to improve visual safety by limiting the movement of the driver's visual line. (Models with Blind Spot Detection/Rear Cross Traffic Alert)



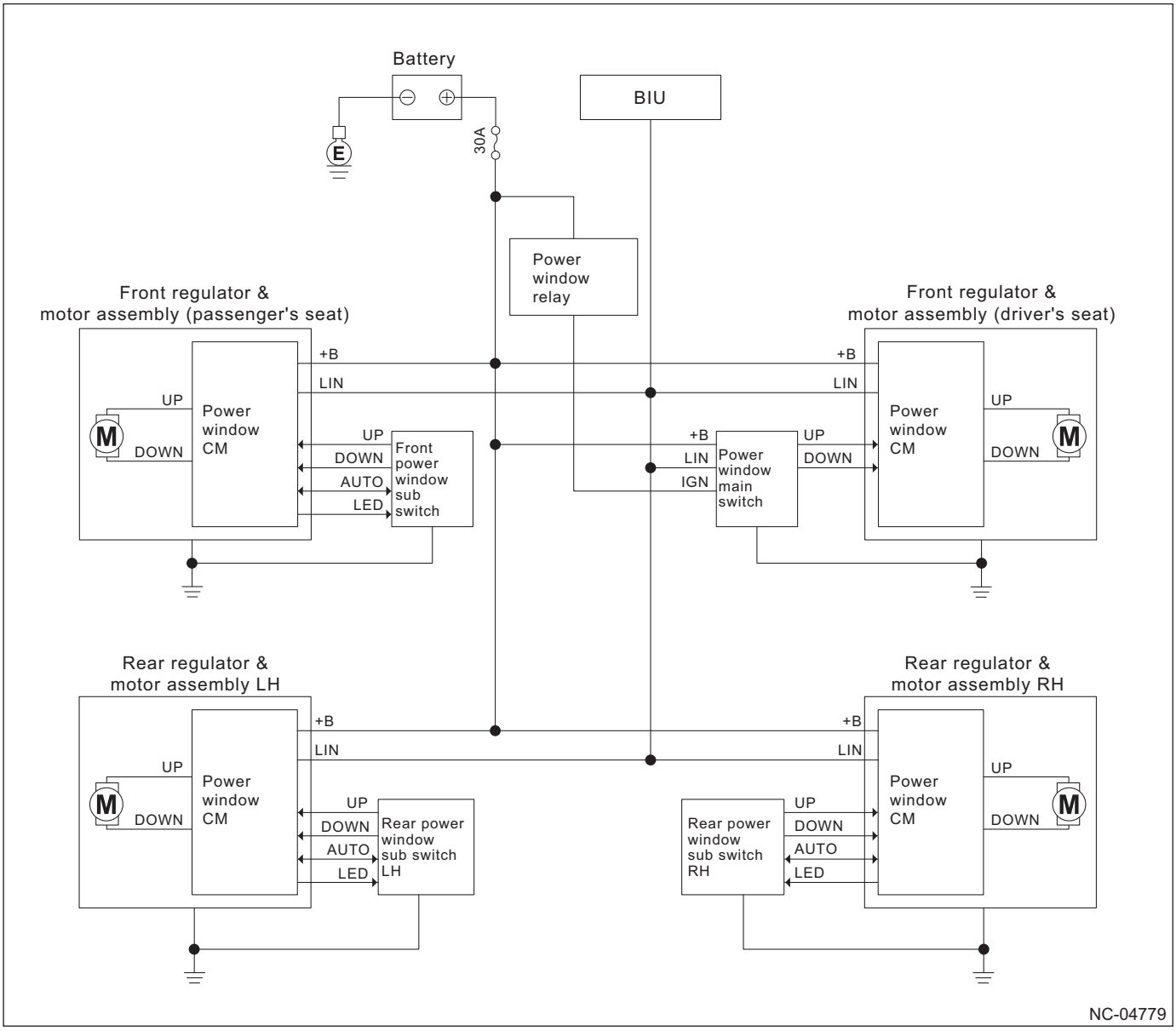
NC-04812

(a) BSD/RCTA approach indicator light

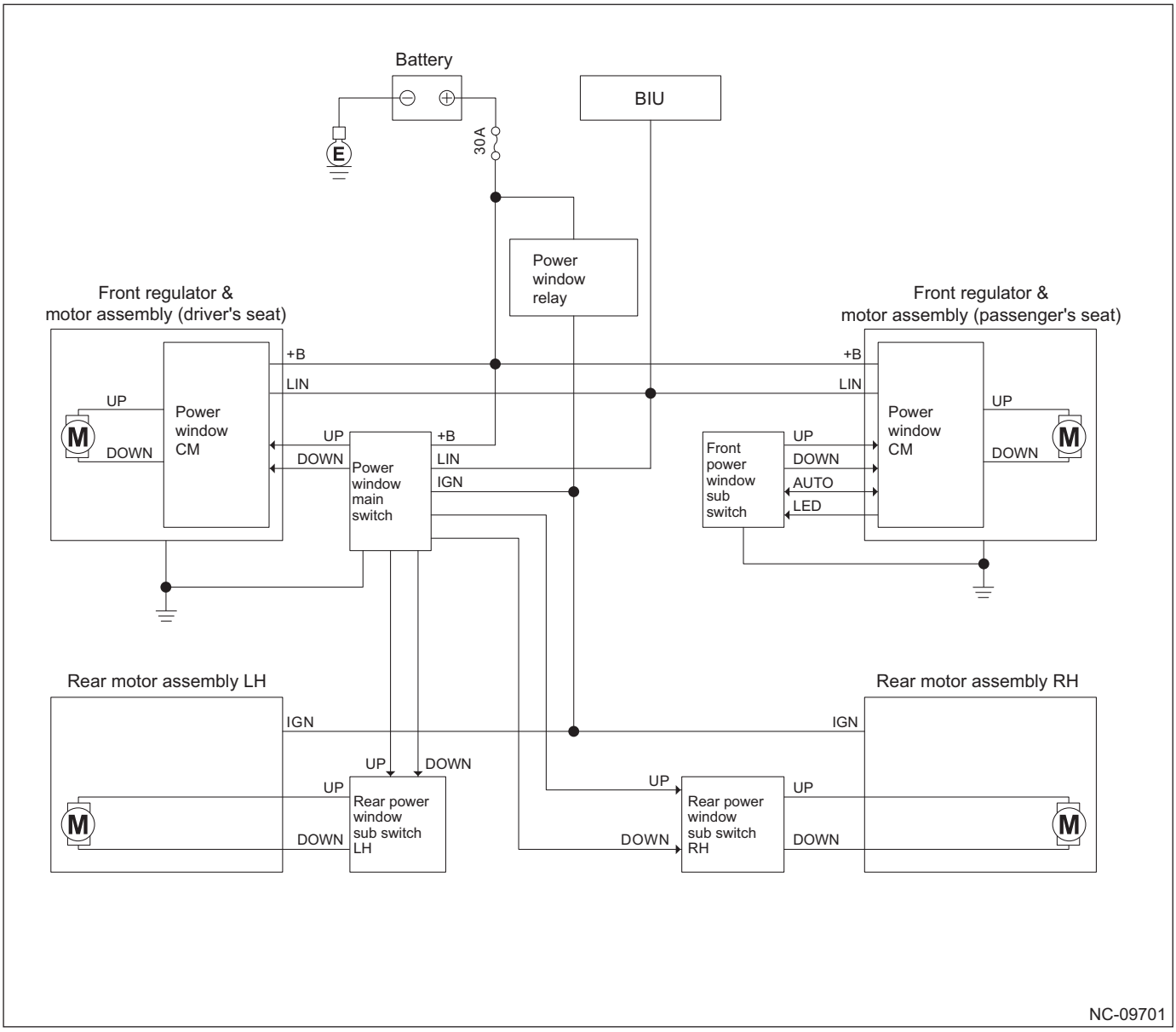
9.7.3 Construction and Operation

System diagram

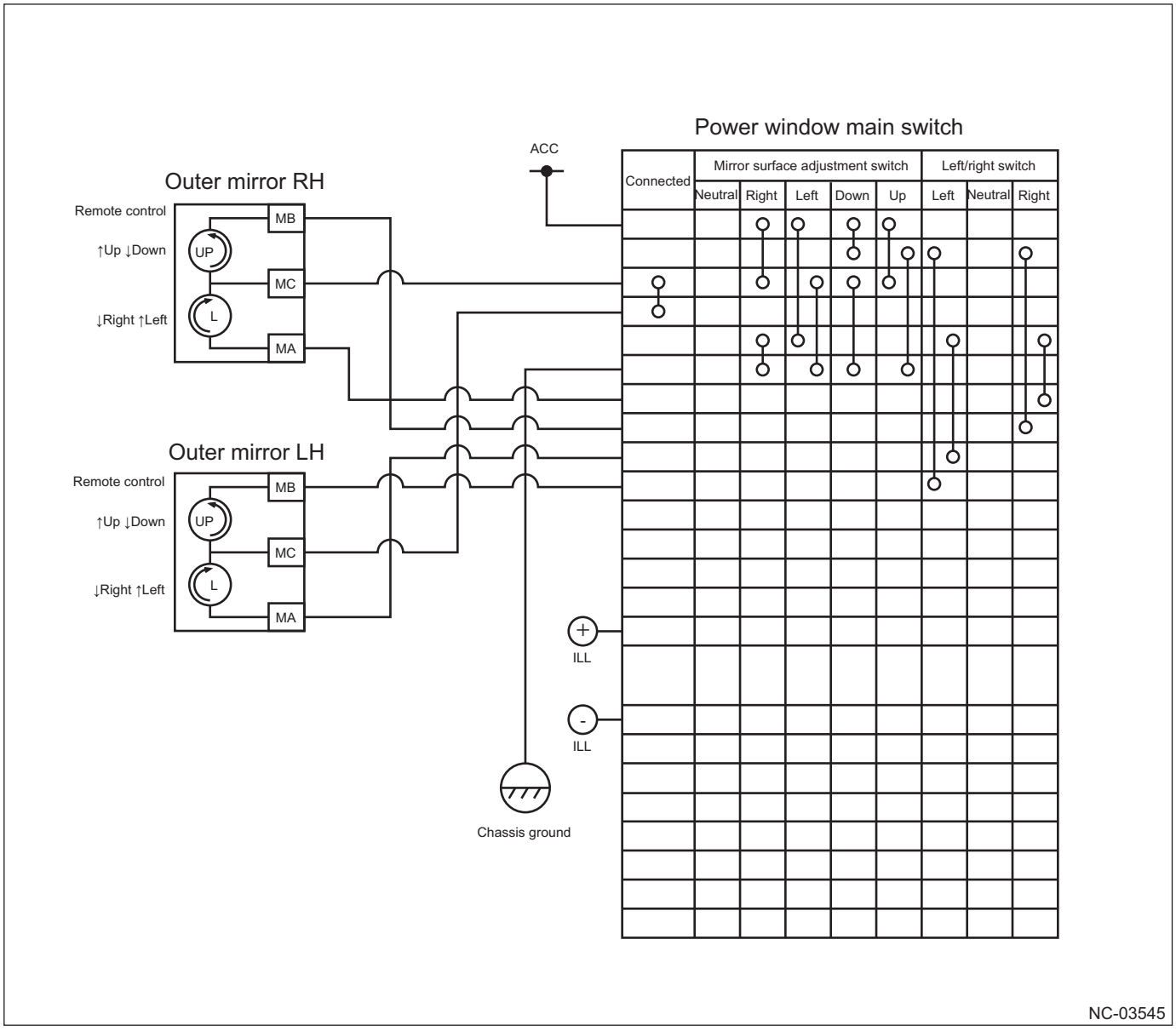
Power window system (models with all-seat automatic opening and closing function)



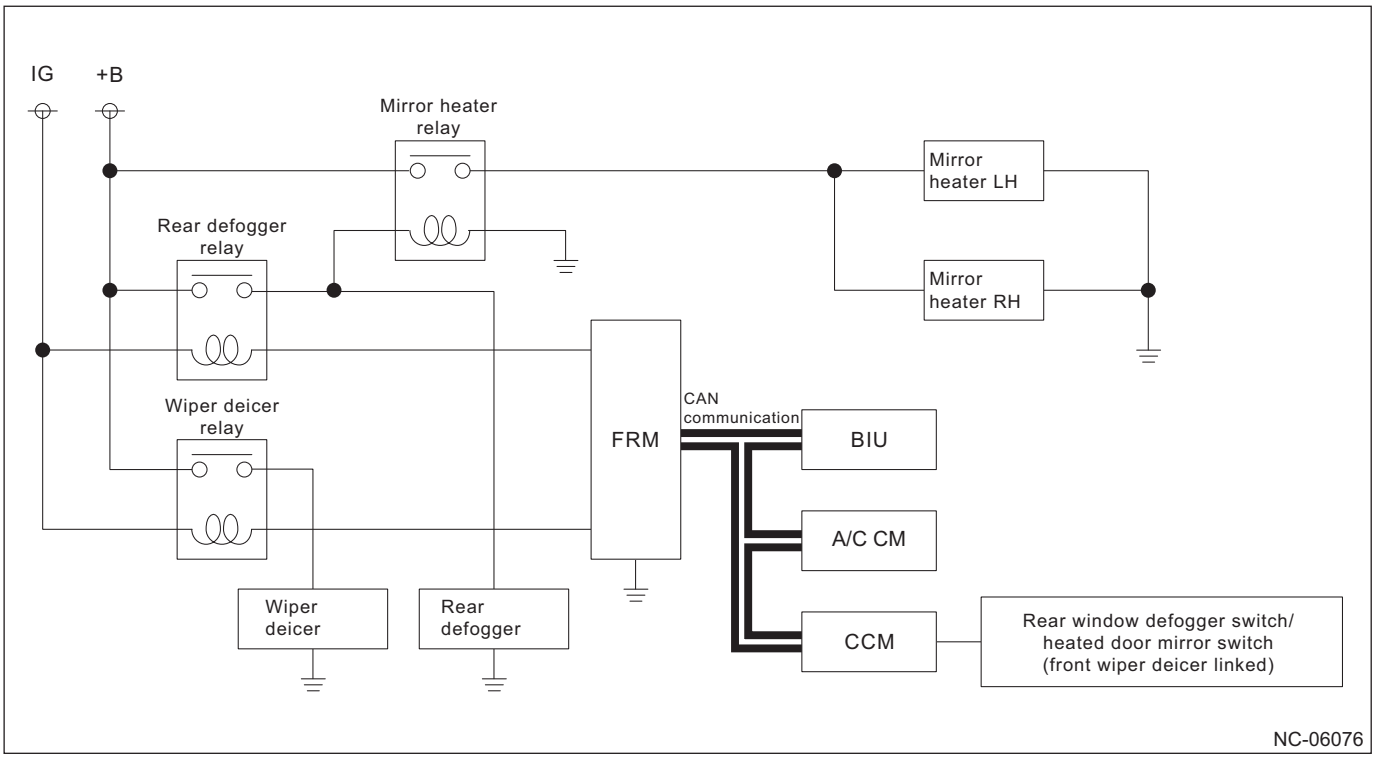
Power window system (models with driver's seat + passenger's seat automatic opening and closing function)



Electric mirror system



Mirror heater (models with mirror heater)/wiper deicer (models with wiper deicer)/rear window defogger system



Main component functions

Power window system

Component	Main functions
Body Integrated Unit (BIU)	• Outputs the power window operation permission signal to the power window CM of each door. • Outputs the power window control signal to the power window CM of each door.
Power window main switch	Outputs each switch signal to the power window CM of each door. (Models with all-seat automatic opening and closing function)
	Outputs each switch signal to the power window CM of the passenger's seat door or rear seat motor. (Models with driver's seat + passenger's seat automatic opening and closing function)
Front power window sub switch	Outputs the switch operation signal to the power window CM of the front door RH.
Rear power window sub switch RH	Outputs the switch operation signal to the power window CM of the rear door RH. (Models with all-seat automatic opening and closing function)
	Outputs the switch operation signal to the power window motor of the rear door RH. (Models with driver's seat + passenger's seat automatic opening and closing function)
Rear power window sub switch LH	Outputs the switch operation signal to the power window CM of the rear door LH. (Models with all-seat automatic opening and closing function)
	Outputs the switch operation signal to the power window motor of the rear door LH. (Models with driver's seat + passenger's seat automatic opening and closing function)
Regulator and motor assembly	Drives the window regulator of the front door and rear door according to the forward or reverse rotation of the power window motor.
Power window CM	Outputs the pulse signal with a built-in pulse sensor, and determines pinching and snagging according to the rate of change.

Electric mirror system

Component	Main functions
Outer mirror	Adjusts the mirror surface angle according to the control signal from the remote control mirror switch.
Remote control mirror switch (mirror surface adjustment switch)	Sends the mirror surface adjustment signal to the outer mirror.
Remote control mirror switch (left-right selector switch)	Selects the outer mirror for which to adjust the mirror surface angle.

Mirror heater (models with mirror heater)/wiper deicer (models with wiper deicer)/rear window defogger system

Component	Main functions
Rear window defogger/heated door mirror switch (front wiper deicer linked)	Outputs the switch ON signal to the Cockpit Control Module (CCM).
Cockpit control module (CCM)	Receives the ON signal input of the rear window defogger/ heated door mirror switch (front wiper deicer linked) and outputs the relay drive ON signal to the A/C CM.
A/C CM	Receives the switch ON signal input, and outputs the relay drive ON signal to the Body Integrated Unit (BIU).
Body Integrated Unit (BIU) (in joint box)	Determines the output and outputs the determined result to the front relay control module (FRM).
Front relay control module (FRM)	Turns each relay ON based on the determined result.
Mirror heater relay*1	Supplies mirror heater drive current according to the ON/OFF control of the front relay control module (FRM).
Mirror heater*1	Heats the heater of the mirror surface according to the mirror heater operation request signal.
Rear defogger relay	Supplies rear defogger drive current according to the ON/ OFF control of the front relay control module (FRM).
Rear defogger	Heats the defogger (heating wires) of the rear glass according to the rear defogger operation request signal.
Wiper deicer relay*2	Supplies wiper deicer drive current according to the ON/OFF control of the front relay control module (FRM).
Wiper deicer*2	Heats the glass printed wiper deicer according to the wiper deicer operation request signal.

**1: Models with mirror heater*
**2: Models with wiper deicer*

System details

Power window system

The power window system varies in functions as shown below.

	LIN communication	Manual up and down function	Auto up and down function	Remote control for the driver's seat	Automatic opening/ closing speed control function	Window lock function	Remote operation for the passenger's seat when the window lock switch is on	Operation after the ignition switch is turned off (timer operation)	Pinch prevention mechanism	Fail-safe function	Snag prevention
Driver's seat	●	●	●	-	●	-	-	●	●	●	●
Passenger's seat	●	●	●	●	●	●	●	●	●	●	●
Rear seat	● *	●	● *	●	● *	●	-	● *	● *	● *	● *

● : Applicable
-: Not applicable
**: Models with all-seat automatic opening and closing function*

■ LIN communication

LIN (Local Interconnect Network) communication is adopted for the communication between power window switches. LIN communication is a multiplex communication network for data communication mainly between body system control CM, and a bus is configured for each system. LIN communication is a single communication line, and sends digital signal at the predetermined speed in accordance with the dedicated communication protocol (communication standard).

The power window motor assemblies for the front seats and rear seats (models with all-seat automatic opening and closing function) have the built-in power window CM, receive operation signals of switch, etc. by LIN communication, and perform the up/down control and window lock control, as well as perform the judgment and the control for the pinch prevention function and the snag prevention function.

■ Manual up and down function

▮ Manual operation by switch operation for each seat

If the power window main switch or each passenger's power window switch is operated upward (downward) by one stage with the ignition switch turned ON, a manual up (down) signal is output to the corresponding regulator & motor assembly. The regulator & motor assembly rotates the power window motor upward (downward) while this signal is being input.

When the power window switch operation is stopped, the signal output stops, and the power window motor stops rotating.

▮ Remote control manual operation by the power window main switch

If the passenger's seat or rear seat power window switch in the power window main switch is operated upward (downward) by one stage with the ignition switch turned ON and window lock switch turned OFF, a remote control manual up (down) signal is output to the passenger's seat or rear seat regulator & motor assembly. The passenger's seat or rear seat regulator & motor assembly rotates the power window motor upward (downward) while this signal is being input.

When the operation of the passenger's seat or rear seat remote power window switch in the power window main switch is stopped, the signal output stops, and the power window motor stops rotating.

Reference

When the window lock switch is ON, remote control operation of the passenger's seat side is possible from the power window main switch.

■ Auto up and down function

▮ Automatic operation by the power window switch

If the driver's seat power window switch in the power window main switch is operated upward (downward) by two stages with the ignition switch turned ON, an auto up (down) signal is output to the driver's seat power window CM (built into the power window motor assembly). When the driver's seat power window CM inputs this signal, it rotates the driver's seat power window motor upward (downward).

If the passenger's seat power window switch is operated upward (downward) by two stages with the ignition switch turned ON and window lock switch turned OFF, an auto up (down) signal is output to the passenger's seat power window CM (built into the power window motor assembly). When the passenger's seat power window CM inputs this signal, it rotates the passenger's seat side power window motor upward (downward).

If a rear seat power window switch is operated upward (downward) by two stages with the ignition switch turned ON and window lock switch turned OFF, an auto up (down) signal is output to the rear seat power window CM (built into the power window motor assembly). When the rear seat power window CM inputs this signal, it rotates the power window motor upward (downward) for the rear door whose switch has been operated. (Models with all-seat automatic opening and closing function)

The power window CM (built into the power window motor assembly) counts a pulse signal from the Hall IC within the power window motor assembly and rotates the power window motor until the door glass is fully closed (fully open) based on the pulse signal even if the power window switch operation is stopped.

▮ Remote control automatic operation by the power window main switch

If the passenger's seat power window switch in the power window main switch is operated upward (downward) by two stages with the ignition switch turned ON, a remote control auto up (down) signal is sent to the passenger's seat power window CM (built into the passenger's seat power window motor assembly).

When the passenger's seat power window CM receives the above signal, it rotates the passenger's seat power window motor until the door glass reaches the fully closed (fully open) position.

If the rear seat power window switch in the power window main switch is operated upward (downward) by two stages with the ignition switch turned ON, a remote control auto up (down) signal is sent to the rear seat power window CM (built into the rear seat power window motor assembly). (Models with all-seat automatic opening and closing function)

When the rear seat power window CM receives the above signal, it rotates the rear seat power window motor until the door glass reaches the fully closed (fully open) position. (Models with all-seat automatic opening and closing function)

▮ Auto operation stop conditions

When any of the following conditions is satisfied, the auto operation stops.

- When a fully close (fully open) door glass is detected
- When operation signal is input in an opposite direction from the switch
- When pinching or snagging in the door glass is detected
- When the timer stop time (about 10 seconds) has passed after auto operation begins
- When a fail item is detected

■ Elevation speed control function

The following elevation speed control performed during auto up and down operation and manual up and down operation is added.

Control description		Effect
Slow start/Slow stop	During up operation, the rising speed slows from just before the fully close position and the window closes slowly at the end. During down operation, the lowering speed slows from just before the fully open position and the window opens slowly at the end.	The windows are moved slower before being fully closed/opened to produce a more premium quality feel.

■ Window lock operation

When the window lock switch is set to ON while the ignition switch is ON or during a post-key OFF operation, a window lock signal is sent from the power window main switch to the passenger's seat and rear seat (models with all-seat automatic opening and closing function) power window CM.

While the passenger's seat and rear seat (models with all-seat automatic opening and closing function) power window CM receive the window lock signal, operation by the passenger's seat and rear seat power window switches is prohibited. Power window switch indicator, the operation of which is prohibited, turns off.

Reference

When the window lock switch of the model with normal motor is operated, power from the directly connected cable is shut off, and the power window switch operation is prohibited.

▮ Power window remote operation for the passenger's seat when the window lock switch is on

Even when the window lock switch is ON, the passenger's seat power window operates if the passenger's seat remote switch on the power window main switch is operated.

■ Power window operation after ignition switch OFF (timer operation)

If the ignition switch is switched from ON to OFF, the Body Integrated Unit (BIU) detects this and begins a post-key off operation count for about 40 seconds and sends the post-key off operation signal to the power window CM for the driver’s seat, passenger's seat, and rear seats (models with all-seat automatic opening and closing function). This makes the power window operation of each seat possible. The pinch prevention mechanism also operates for the driver’s seat, passenger's seat, and rear seats (models equipped with all-seat automatic opening and closing function).

When approximately 40 seconds elapse after turning OFF the ignition switch, or the Body Integrated Unit (BIU) receives a "Close" to "Open" signal for the driver's or front passenger's door switch, the BIU sends a post-key off operation signal as OFF. When the post-key off operation signal is OFF, the power window CM controls automatic operation (pinch prevention mechanism operates) until completion while manual operation is stopped.

■ Power window pinch prevention mechanism operation

▮ Operation overview

The pinch prevention mechanism is controlled by the power window CM. If the power window motor is locked or its rotation speed changes when all of the following conditions are satisfied, the power window CM judges that pinching has occurred and performs reverse operation. In order to prevent a malfunction, pinching judgment is not performed when the door glass position is within a predetermined section.

▮ Pinch prevention mechanism operation preconditions (when all are met)

- During upward operation of any one of manual operation, auto operation, and post-key off operation
- A state where the power window CM is "learning" the door glass fully opened/fully closed state as standard positions due to an initialization
- When the door glass position is not immediately before being fully closed
- Other than immediately after the power window motor is driven
- When not in the fail mode

▮ Reversal conditions and descent amounts after pinch detection

If the pinch prevention mechanism operates and the amount of the door glass opening (gap) does not reach about 200 mm even if it is down to about 50 mm, it continues its reverse operation until it reaches about 200 mm or about 10 seconds have passed. However, if the door glass is in the fully open position before the down operation has reached about 50 mm, the operation stops at that point.

For manual down and auto down, the switch input is accepted even during the reverse operation.

The system transitions to manual down or auto down after the reverse operation has finished.

▮ Pinch reverse operation

When the power window CM judges pinching, the power window motor is operated in reverse by controlling the built-in drive circuit downward.

▮ Pinch prevention mechanism canceling operation

If the door glass does not close due to a malfunction of the pinch prevention mechanism, the operation of the pinch prevention mechanism can be canceled to close the window by repeating auto up operation of the power window switch three consecutive times (The absence of operations other than the auto up operation between the first and third operations is a precondition.).

■ Snag prevention mechanism operation

▮ Operation overview

The snag prevention mechanism is controlled by the power window CM. If a predetermined amount of rotating speed change (decrease amount) of the power window motor is detected when all of the following conditions are satisfied, the power window CM judges that an extraneous body has been snagged and stops the down operation. In order to prevent a malfunction, snag prevention judgment is not performed when the door glass position is within a predetermined section.

▮ Snag prevention mechanism operation preconditions (when all are met)

- During down operation of any one of manual operation, auto operation, and post-key off operation (except reverse down operation)
- When the door glass position is in the snag prevention detection range in the downward operation direction from the fully closed position
- Other than immediately after the power window motor is driven
- When not in the fail mode

▮ Stop operation after snag prevention detection

When the power window CM determines snagging, the down operation of the power window motor is stopped by drive stop control of the built-in motor drive circuit.

■ Fail-safe function

In case of malfunction in which the glass can't rise or lower properly, fail-safe control is triggered.

▮ Power window operation in fail-safe control

<table>
<tr><th rowspan="3">Seat</th><th colspan="4">Operation for one's own seat</th><th colspan="4">Remote control from the driver's seat</th><th rowspan="3">Pinch prevention</th><th rowspan="3">Snag prevention</th></tr>
<tr><th colspan="2">Manual function</th><th colspan="2">Auto function</th><th colspan="2">Manual function</th><th colspan="2">Auto function</th></tr>
<tr><th>Up</th><th>Down</th><th>Up</th><th>Down</th><th>Up</th><th>Down</th><th>Up</th><th>Down</th></tr>
<tr><td>Driver's seat</td><td rowspan="3">● (*1)</td><td rowspan="3">●</td><td rowspan="3" colspan="2">● /X (*2)</td><td colspan="4">-</td><td rowspan="3">● /X (*2)</td><td rowspan="3">X</td></tr>
<tr><td>Passenger's seat</td><td colspan="2">● /X (*2)</td><td colspan="2">● /X (*2)</td></tr>
<tr><td>Rear seat</td></tr>
</table>

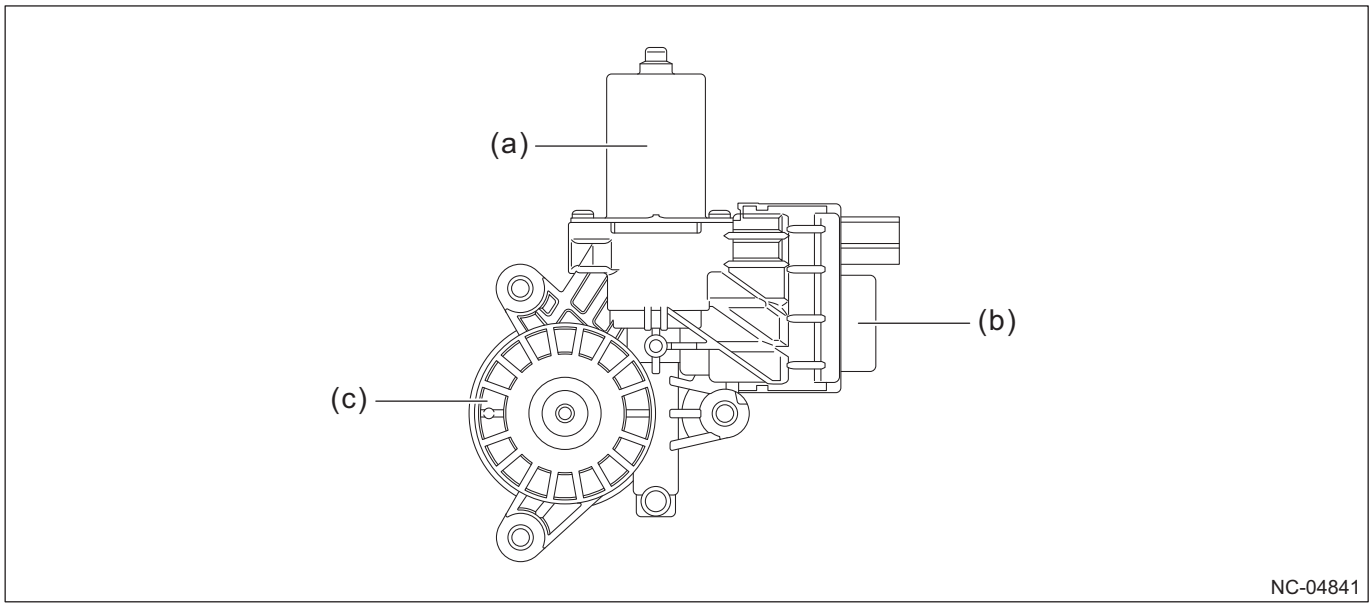
● : Functions
X: Does not function
**1: Inching operates (slightly rises and stops) depending on the malfunction mode*
**2: It sometimes functions and sometimes doesn't, depending on the malfunction mode*

■ Construction

▮ Power window smart motor assembly

The power window smart motor assembly is composed of a motor section, a CM section, and a gear section.

The power window smart motor assembly has a pulse sensor (Hall IC) integrated with the motor body for the pinch prevention mechanism and snag prevention mechanism, and this detects the rotation of the power window smart motor.



(a) Motor section

(b) CM section (models with automatic opening and closing function)

(c) Gear section

Electric mirror system

■ Mirror surface adjustment

▮ Switch locations and arrangement

The mirror surface adjustment and left-right selector switch are located within the power window main switch.

▮ Operation after operation switches

When the left-right selector switch operates, it is placed in a state where only the internal contacts on the selected mirror side can be turned on.

When the mirror surface adjustment switch operates, it switches to the corresponding internal contacts and rotates/reverse rotates the up/down angle or left/right angle motor to change the angle of the mirror surface.

Mirror heater (models with mirror heater)/wiper deicer (models with wiper deicer)/rear defogger system

■ ON Operation

If the rear window defogger/heated door mirror switch (front wiper deicer linked) is turned ON with the ignition switch turned ON, a rear window defogger switch/heated door mirror switch ON signal is output to the Cockpit Control Module (CCM).

The A/C CM, to which the signal is input, outputs a relay drive ON signal to the Body Integrated Unit (BIU), and then the Body Integrated Unit (BIU) determines the output.

The Body Integrated Unit (BIU) outputs the determined result to the front relay control module (FRM).

The front relay control module (FRM) turns on the rear defogger relay (mirror heater relay linked) and wiper deicer relay and then heats the mirror heater LH/RH, wiper deicer, and rear defogger.

■ OFF Operation

When the wiper deicer is operated for 15 minutes, the Body Integrated Unit (BIU) outputs the relay drive OFF signal to the front relay control module (FRM) to turn OFF the wiper deicer.

In the same manner, when the rear defogger and mirror heater continue operation for 15 minutes, the Body Integrated Unit (BIU) turns OFF the rear defogger and mirror heater using the relay drive OFF signal.

■ Customize

It is possible to customize operations of the mirror heater, wiper deicer, and rear defogger to the continuous operation via the Center Information Display (CID) or at the dealer using Subaru Select Monitor 4. (The factory setting is normal.)

9.8 Roof Molding

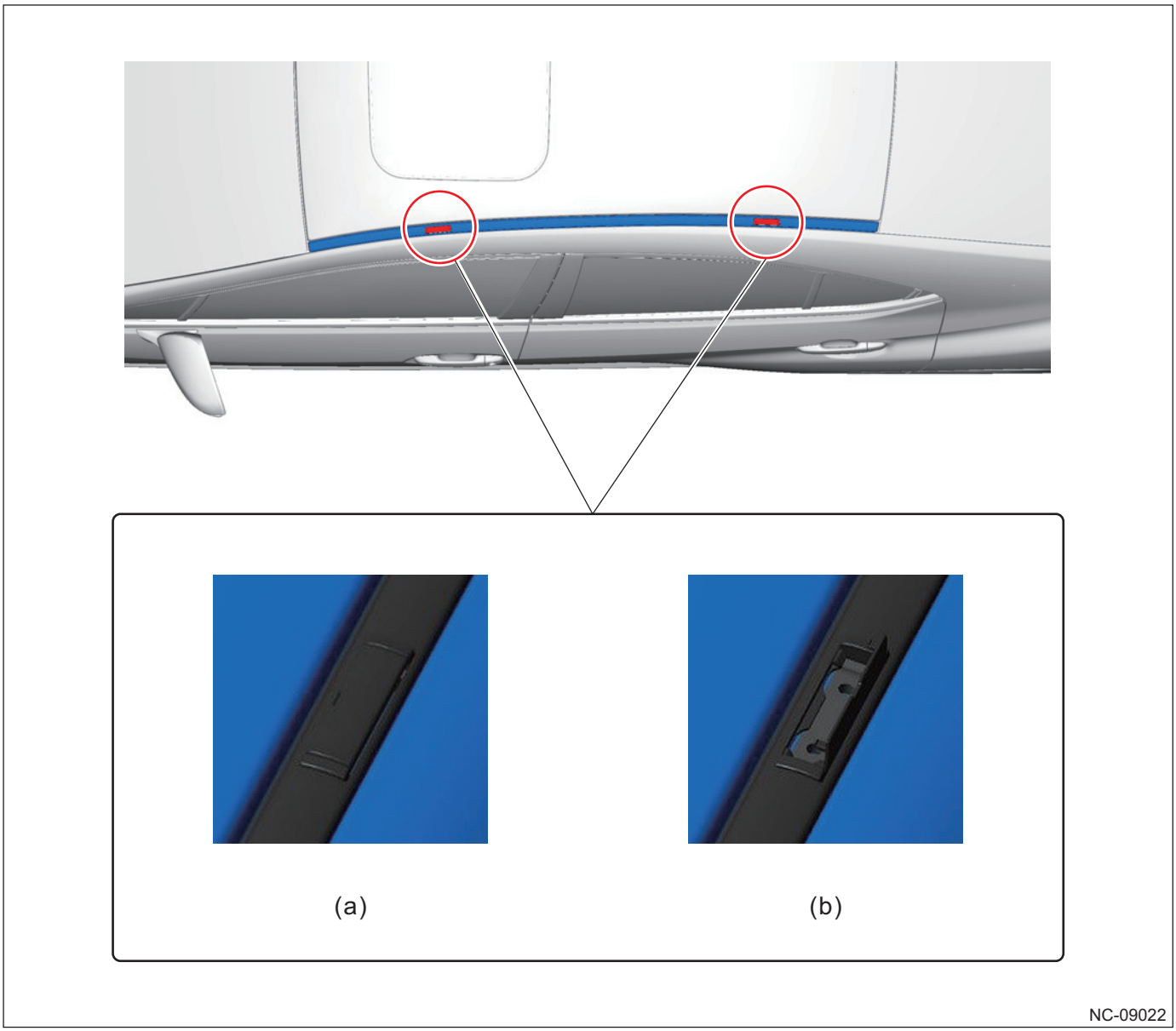
9.8.1 Overview

Overview

A roof carrier bracket is adopted inside the roof molding to enable the installation of a roof carrier that supports the roof carrier bracket.

The cap of the roof carrier bracket is designed to enable opening and closing without a tool to improve operability.

Also, the size of the roof molding width is reduced and the cross section is optimized to create a shape that is visually thin, creating a smart appearance.



(a) Carrier cap closed

(b) Carrier cap open

9.9 Door and Fuel Flap

9.9.1 Overview

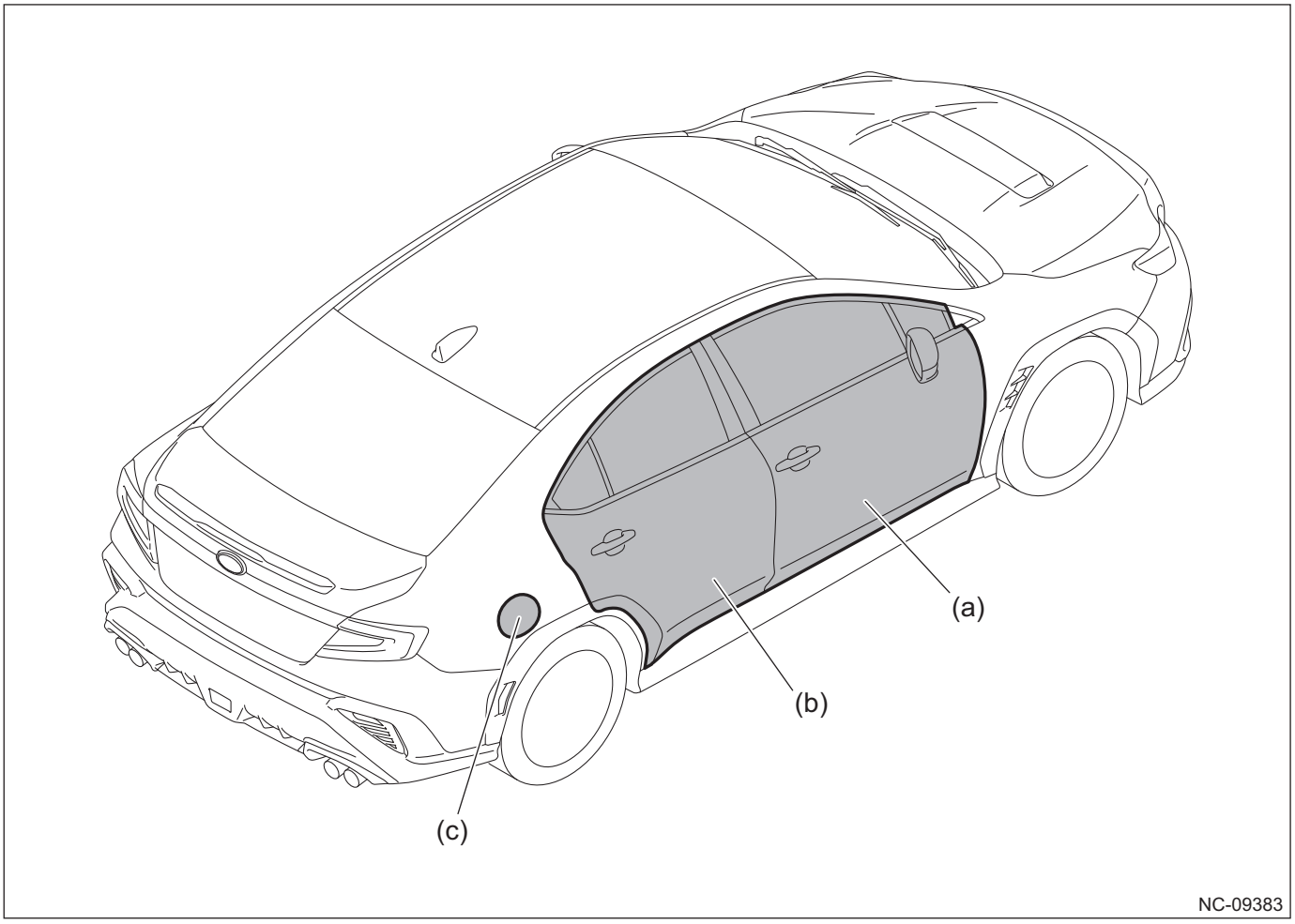
Overview

The following mechanisms are adopted for the door and the fuel flap.

- The side door beam is adopted as a passenger protection measure.
- The weatherstrip with high soundproof performance is adopted.
- A push-open type resin fuel flap is adopted.

9.9.2 Component

Component layout drawing



(a) Front door
(b) Rear door
(c) Fuel flap

Component details

Door

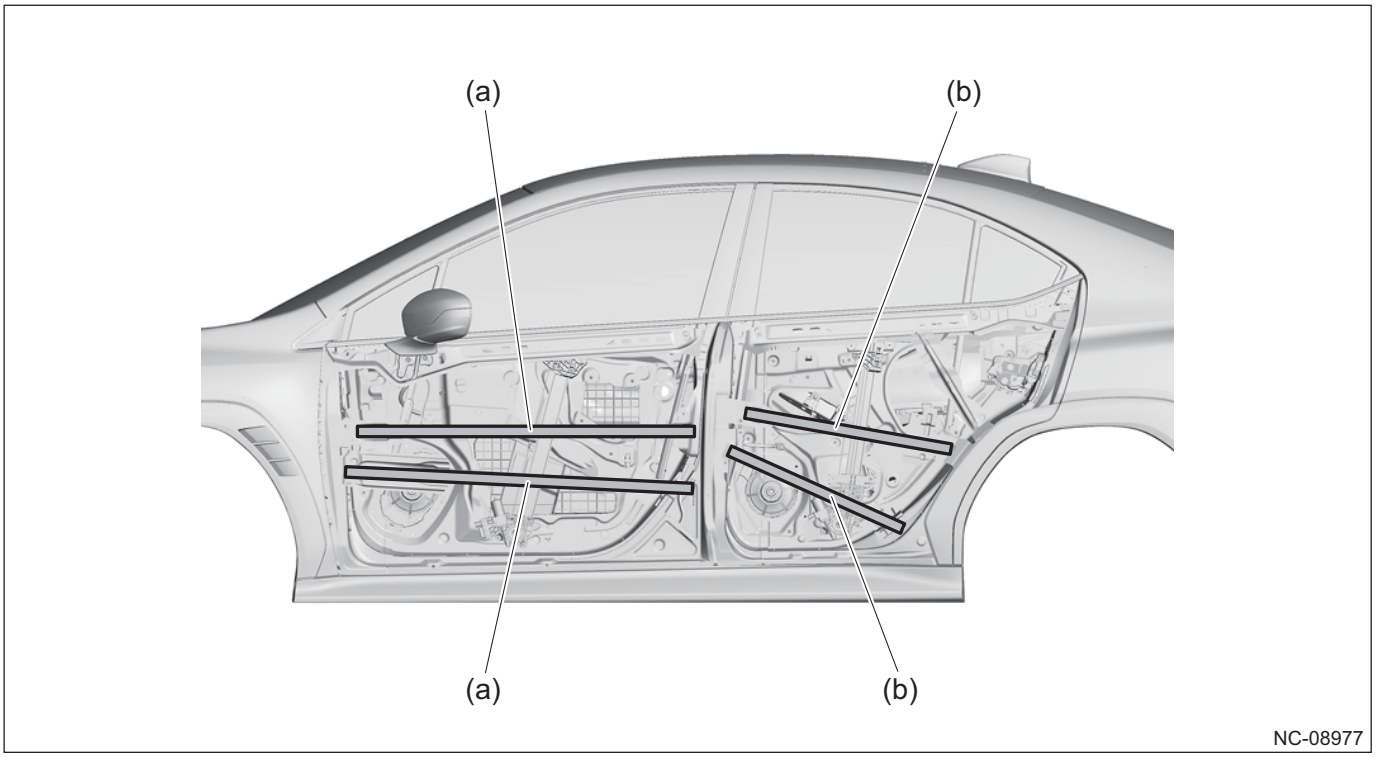
A coil spring type is adopted for the checker internal structure to improve closing performance while maintaining the good packaging and lightness.

Opening positions are set so that when the door is opened, the door is held at 3 stages to improve usability when exiting.

■ Side door beam

Side door beams with high rigidity are adopted for the frames of front doors on both sides of the vehicle as well as rear doors.

Side door beams within door frames disperse the shock on side collisions from the door frames to pillars and lockers, limiting torsion and deformation of the cabin.



(a) Side door beam (front)

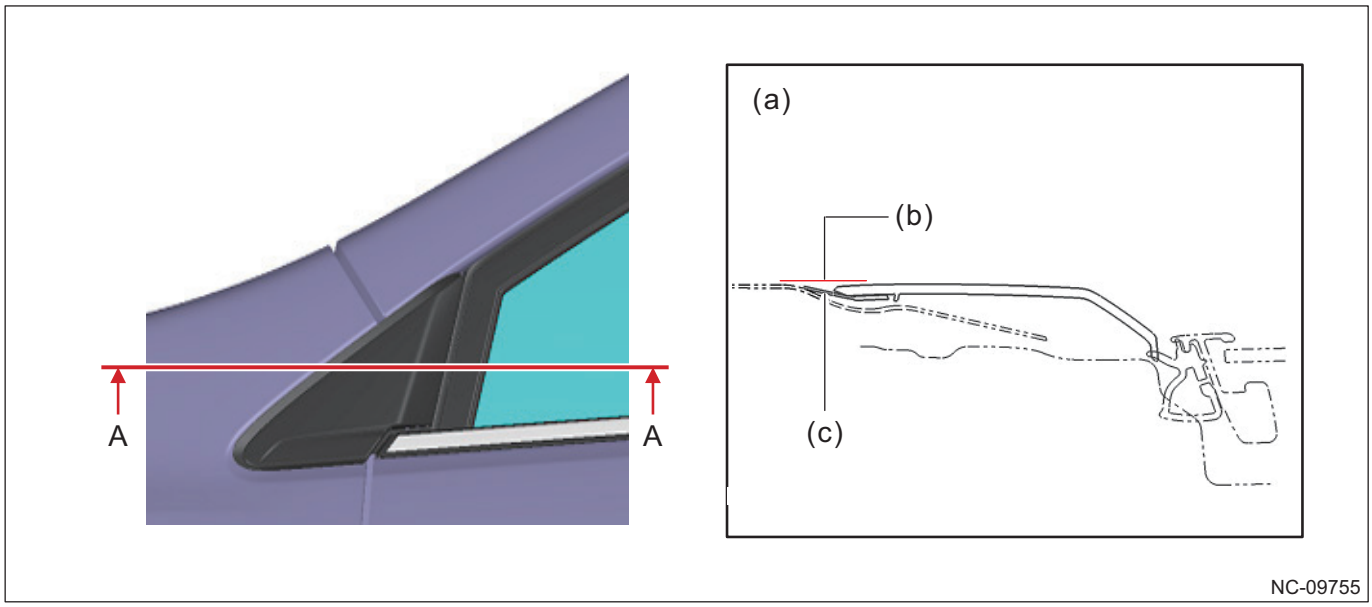
(b) Side door beam (rear)

■ Pillar cover

▮ A pillar cover

A protector is provided to improve the appearance of the division.

Level differences with the A pillar are reduced and a flush surface is created to restrict air disturbances, improving aerodynamic performance and reducing wind noise.

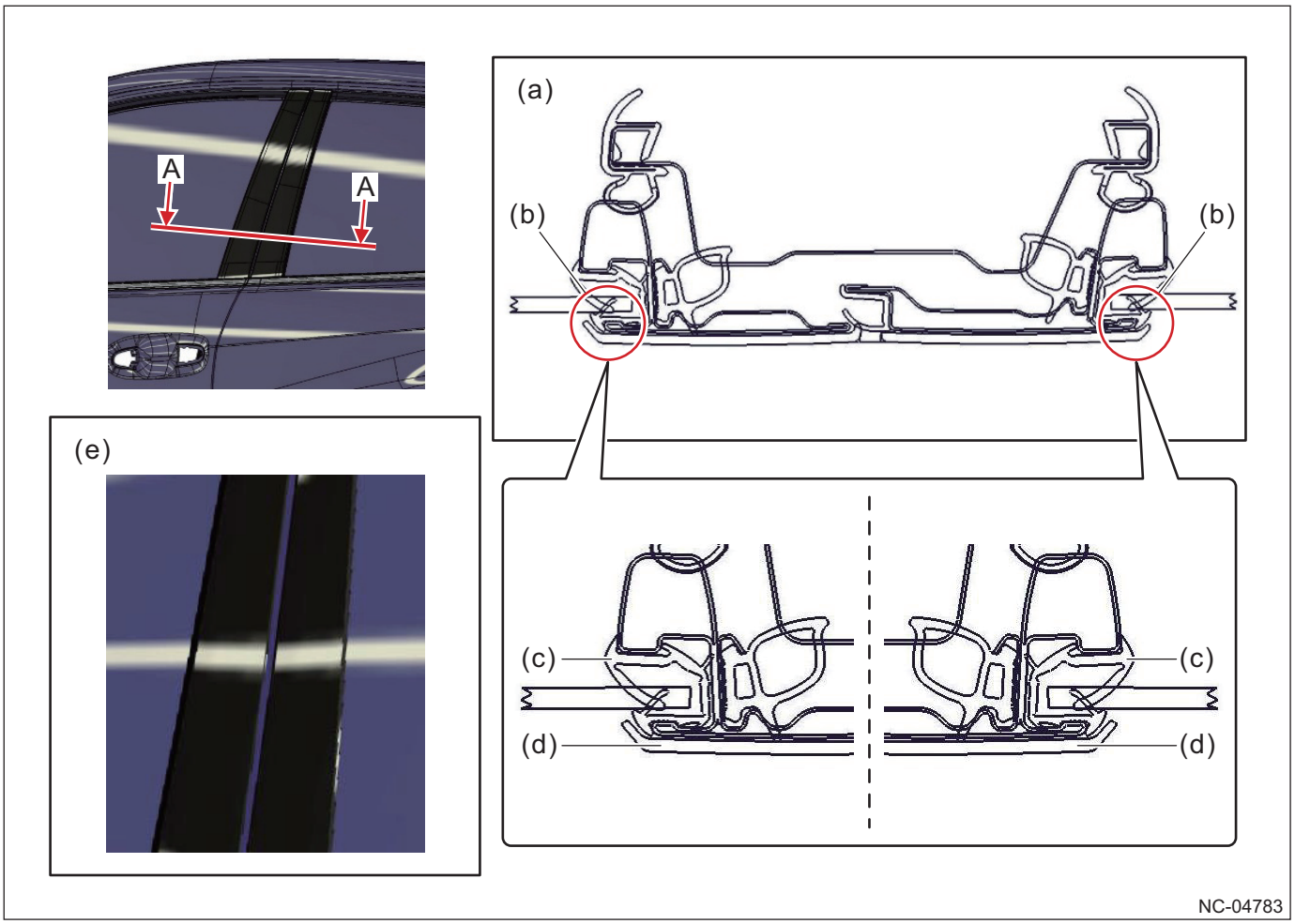


(a) A-A cross section
(b) Flush surface created
(c) Protector

B pillar cover

A resin cover structure is adopted for the B pillar.

To improve the appearance, the glass run is concealed and the surface curvature is matched with the glass. This reduces the distortion of the light entering the glass and resin cover.



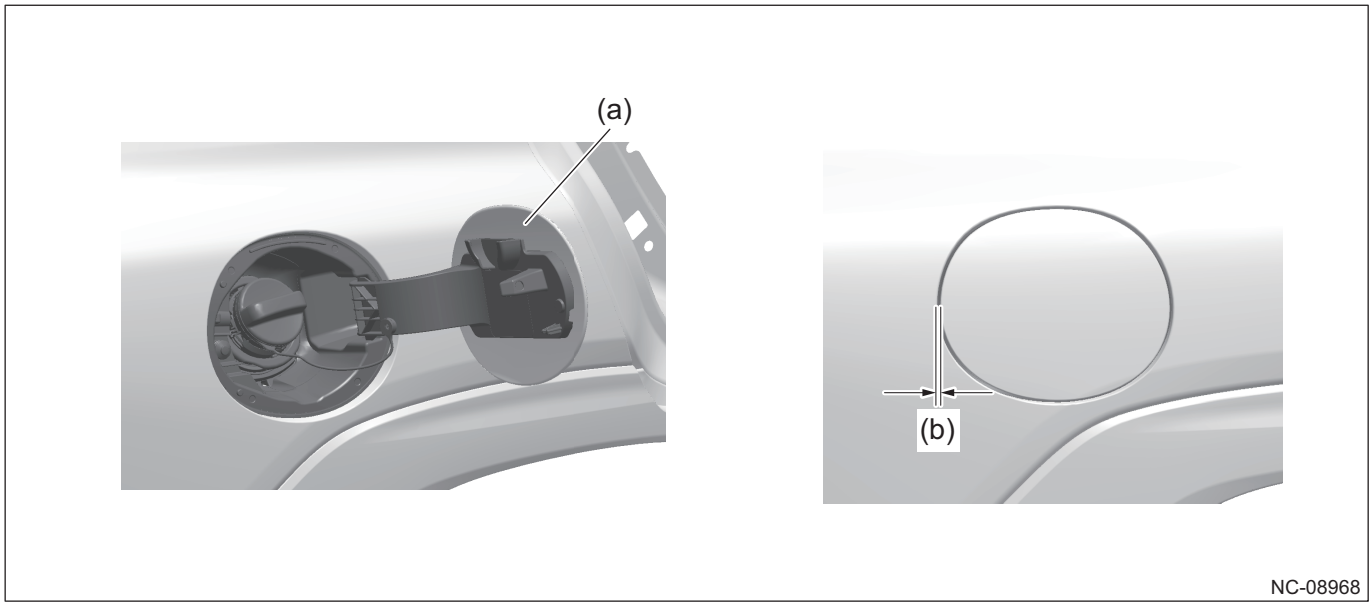
(a) A-A cross section
(b) Matched the surface curvature with the glass
(c) Glass run
(d) Pillar cover
(e) Image of entering light

Fuel flap

Fuel flap with an electric lock/unlock system is adopted.

Resin is adopted for the fuel flap for a lighter weight.

The division width of the fuel flap opening and closing area is reduced to improve appearance.

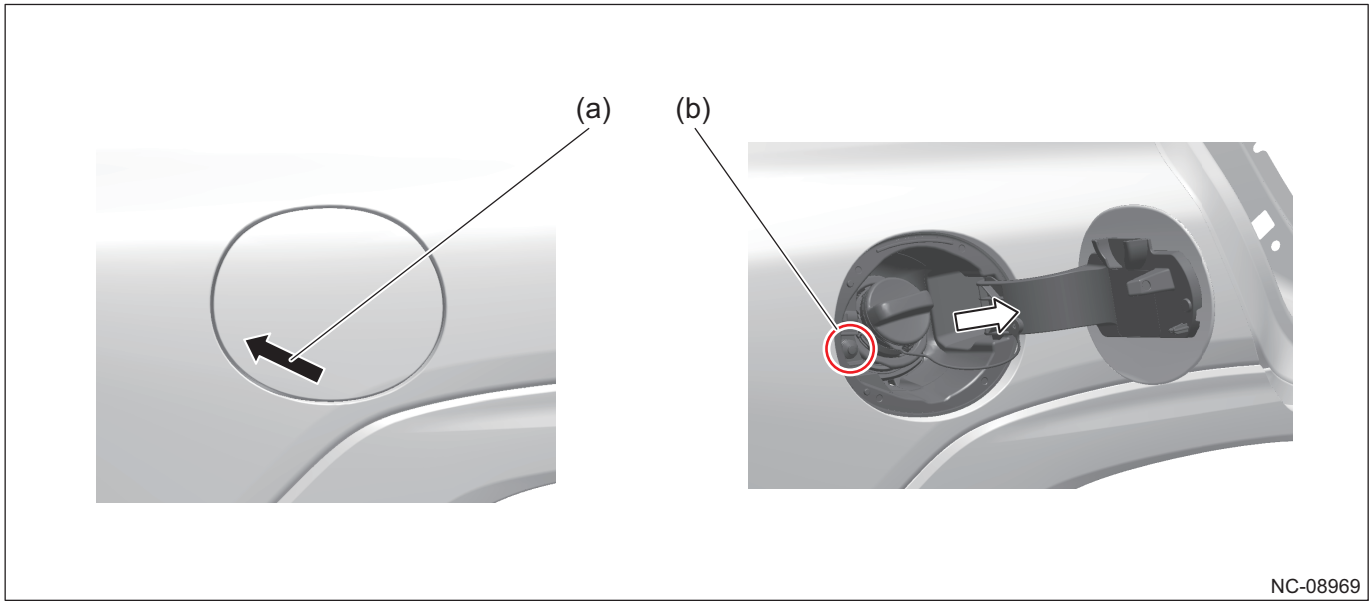


(a) Fuel flap

(b) Division width

The interior opener lever of the fuel flap is discontinued and changed to the push open type of fuel flap, and an electric lock/unlock system with actuator is adopted.

In addition to improving convenience, the discontinuance of the interior opener lever also opens up nice foot space for the driver's seat.



(a) In an unlocked state, push the fuel flap

(b) The push lifter pushes the fuel flap open

■ Fuel flap lock/unlock

The fuel flap is locked in the following conditions.

- When the door is locked by the access key operation, keyless access, central door lock, or power rear gate lock switch
- When the automatic door lock function operates

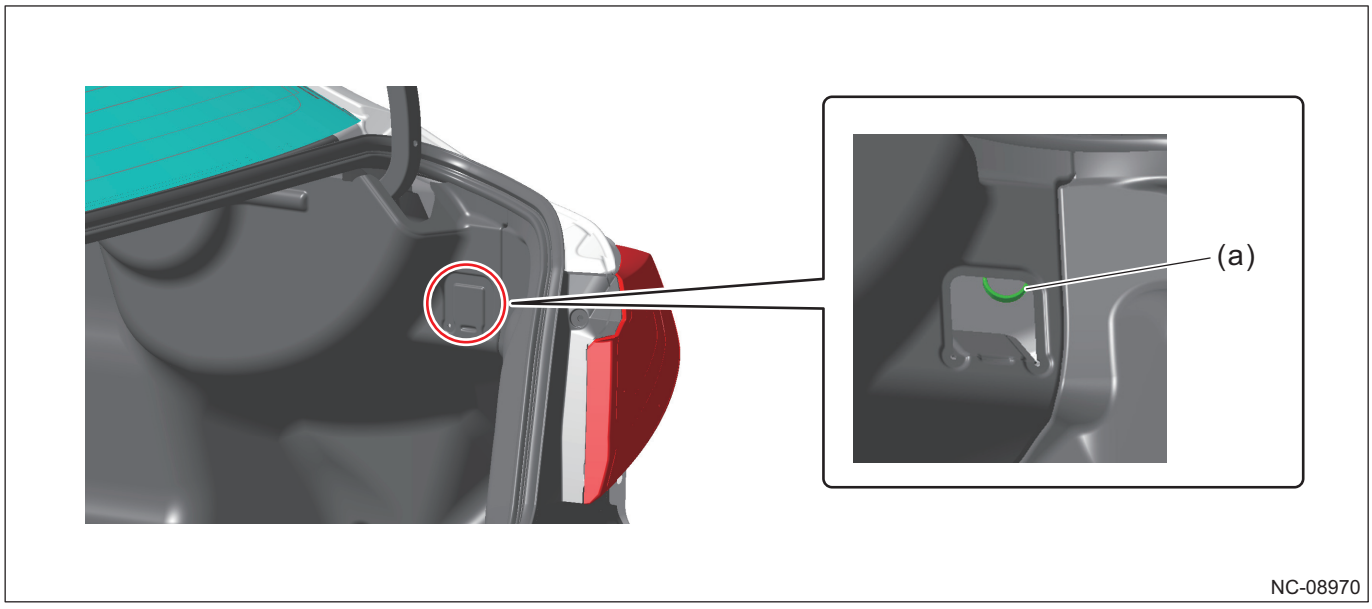
The fuel flap is unlocked in the following conditions.

- When the door is unlocked by the access key operation, keyless access, or central door lock
- When the engine switch is turned on then off
- When the automatic door unlock function operates

■ Opener emergency cable

In order to handle the case where the fuel flap cannot unlock (for example, the case where the battery has been running out), the emergency cable is installed that can unlock the fuel flap.

The emergency cable is accessed by pressing the slit on the right side of the trunk SD trim with a finger. Remove the cable from the holder and pull the cable towards the driver side to unlock the fuel flap. The cable is colored with green that has high visibility. A shape that is easy to hold is adopted for the front end.



(a) Emergency cable

9.10 Moonroof (For Some Grades)

9.10.1 Overview

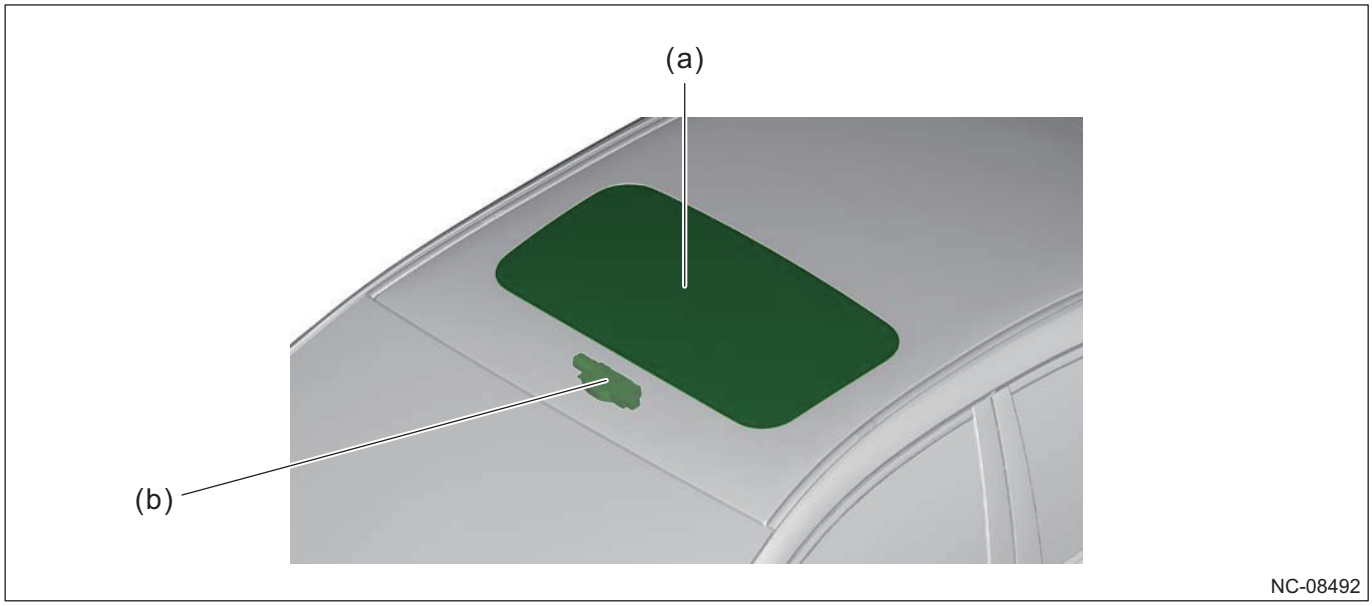
An inner slide type of moonroof equipped with an automatic opening and closing function and pinch prevention function is adopted.

The moonroof components are revised for a thinner and more lightweight structure.

Resin is adopted for the deflector and its shape is optimized to create a structure that restricts ear pressure caused by changes in the atmospheric pressure and wind noise.

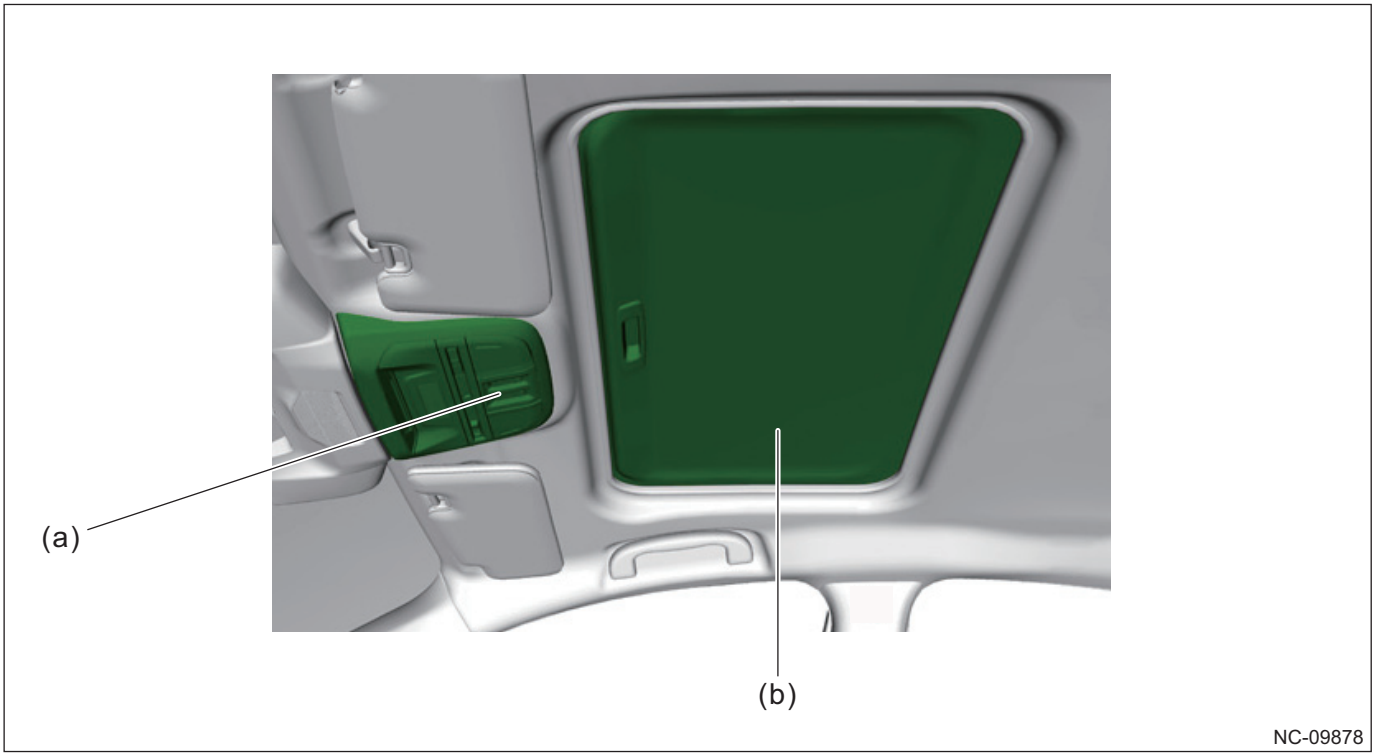
9.10.2 Component

Component layout drawing



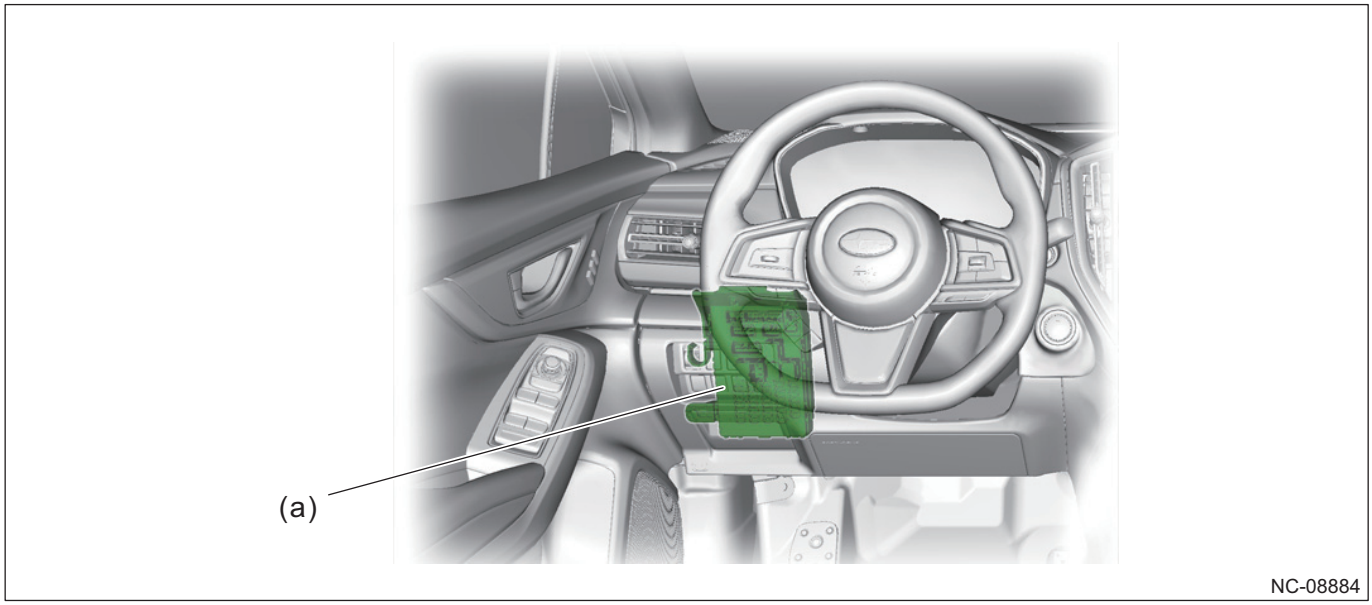
(a) Moonroof glass

(b) Moonroof gear assembly



(a) Moonroof switch (in map light assembly)

(b) Shade assembly



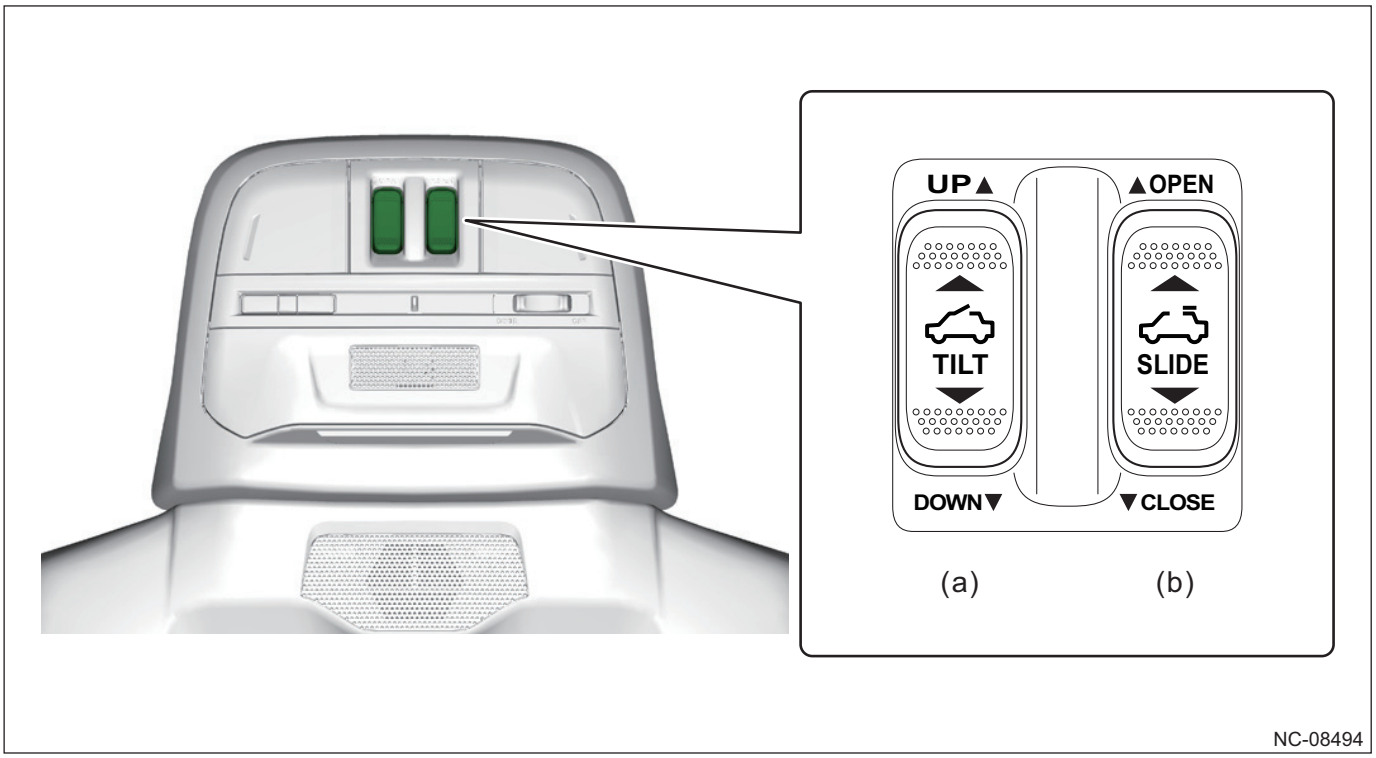
(a) Body Integrated Unit (in joint box)

Component details

Moonroof switch

Two moonroof switches are provided next to each other in the map light assembly; the tilt up/tilt down switch and slide open/slide close switch.

A mark is added to the switches to make them easier to recognize.

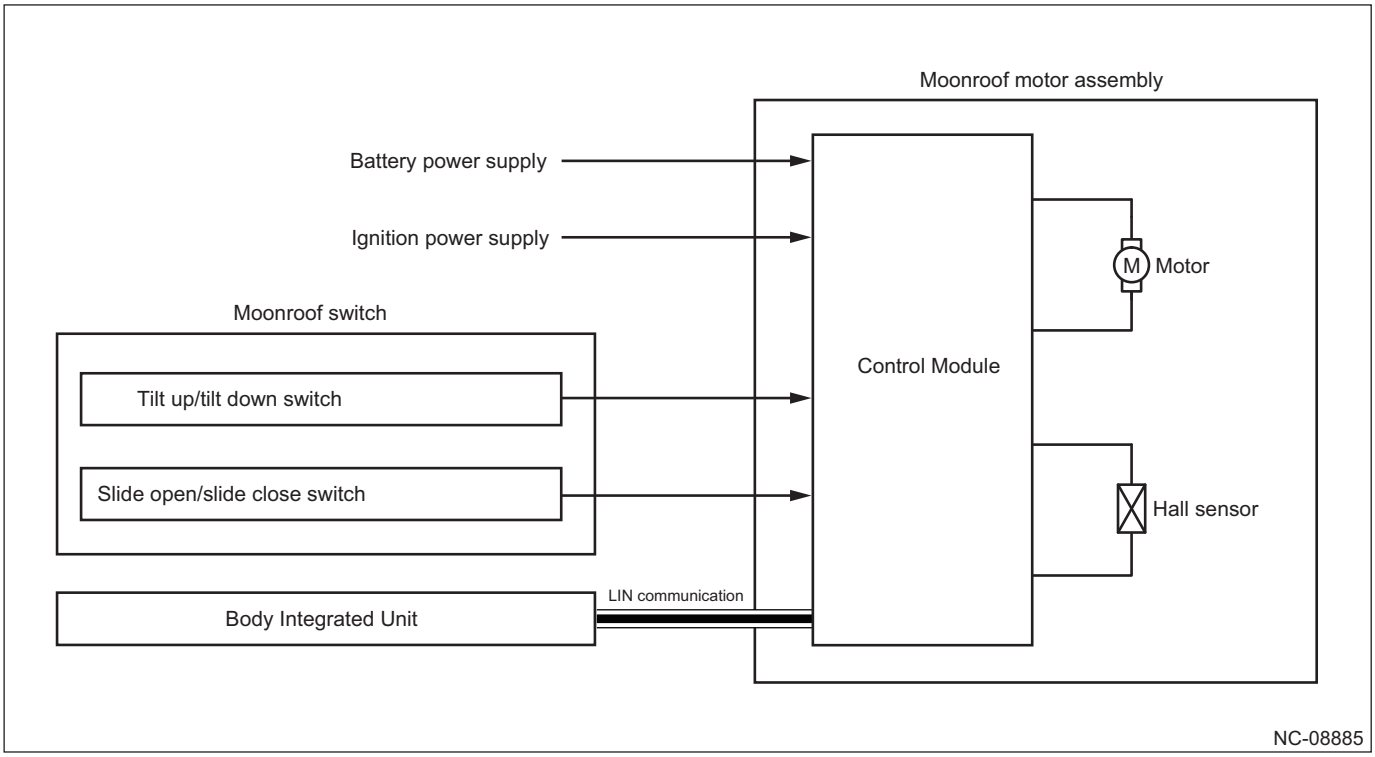


(a) Tilt up/tilt down switch

(b) Slide open/slide close switch

9.10.3 Construction and Operation

System diagram



Main component functions

Component		Function
Moonroof switch • Tilt up/tilt down switch • Slide open/slide close switch		Sends the operation signal of each switch to the moonroof motor assembly.
Moonroof motor assembly	Control Module	• Receives signals from the units, sensors, and switches, and controls the various functions of the moonroof. • Calculates the movement amount of the moonroof glass according to the pulse signals from the Hall sensor.
	Motor	Slides or tilts the moonroof glass according to the drive signals from the control module.
	Hall sensor	Detects the magnetic field generated by the motor rotation. Sends the information about the motor rotation amount and rotation direction based on changes in the magnetic field as pulse signals to the control module.
Body Integrated Unit		Sends the remote start signal to the moonroof motor assembly via LIN communication.

System details

Automatic opening and closing function

When the ignition switch or engine switch is ON, the moonroof glass can be opened or closed automatically by operating various switches.

■ Tilt up/tilt down

The moonroof glass can be opened or closed in the up or down direction by operating the tilt up/tilt down switch located in the map light assembly.

Auto operation performs up to the tilt up limit position when the tilt up switch is pressed for 0.3 seconds or more. The operation stops partway when the switch is pressed during automatic operation.

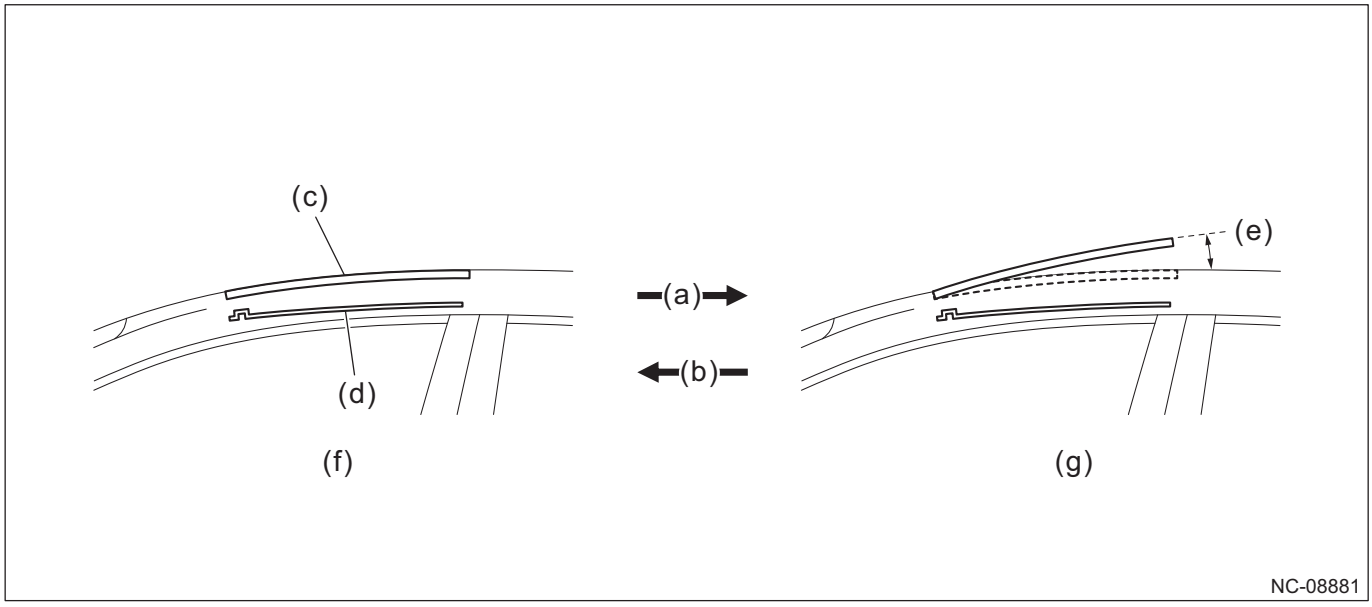
Upward operation performs when the tilt up switch is pressed for less than 0.3 seconds.

Downward operation performs while the tilt down switch is pressed.

Reference

- Tilt up is not possible while the moonroof glass is in the slide open position.
- When the tilt down switch is pressed for 0.3 seconds or more while the moonroof glass is in the slide open position, automatic operation performs up to the fully closed position.

Operation image



(a) Tilt up switch operated
(b) Tilt down switch operated
(c) Moonroof glass
(d) Sunshade
(e) Tilt up limit position
(f) Fully closed
(g) Tilted up

■ Slide open/slide close

The moonroof glass can be slid open or closed by operating the slide open/slide close switch located in the map light assembly.

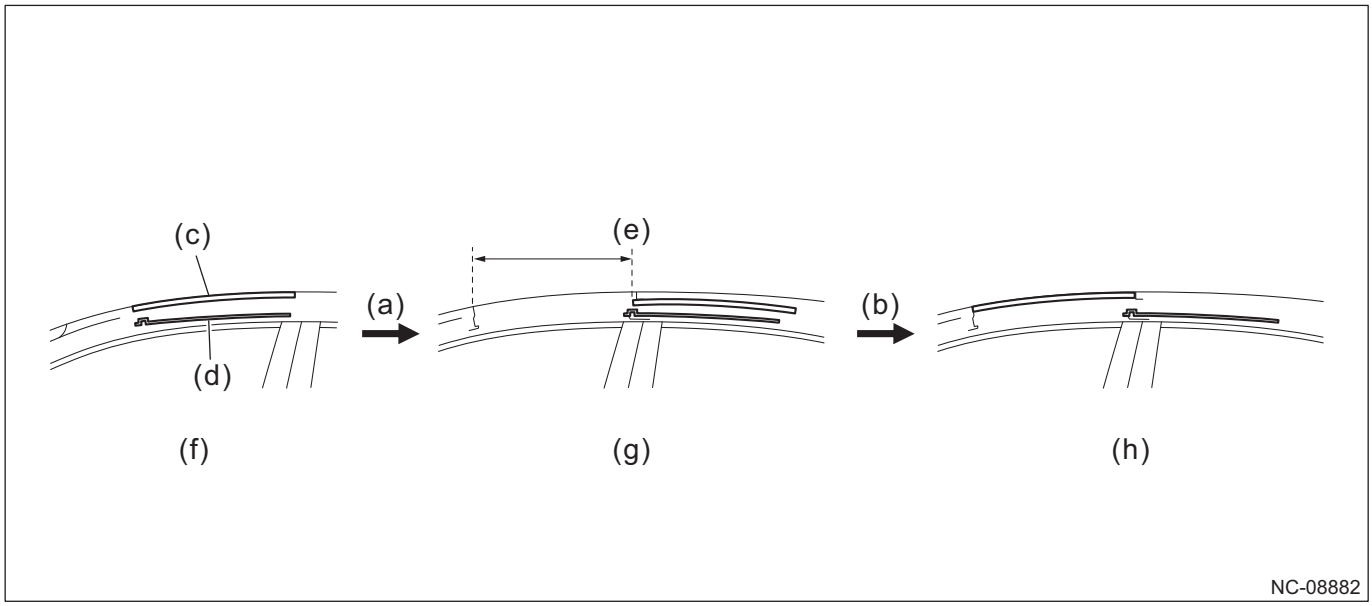
When the slide open/slide close switch is pressed for 0.3 seconds or more, automatic operation performs up to the slide open limit position (fully open)/slide close limit position (fully closed). The operation stops partway when the switch is pressed during automatic operation.

Operation in the corresponding direction performs when the slide open/slide close switch is pressed for less than 0.3 seconds.

Reference

- When the slide close switch is pressed while the moonroof glass is tilted up, operation performs in the close direction while the switch is pressed.
- When slide open is operated while the sunshade is closed, the sunshade also slides at the same time as the moonroof glass.

Operation image



(a) Slide open switch operated
(b) Slide close switch operated
(c) Moonroof glass
(d) Sunshade
(e) Slide open limit position
(f) Fully closed
(g) Fully open
(h) Fully closed (moonroof glass only)

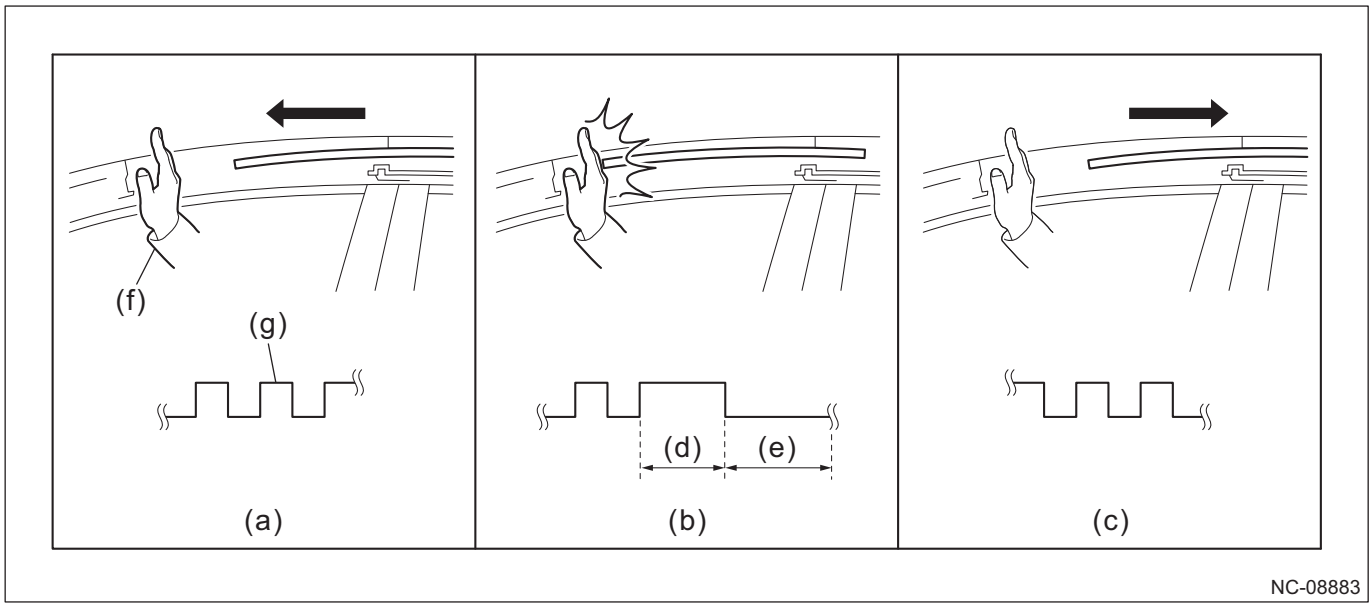
Pinch prevention function

If an object is pinched during the tilt down or slide close automatic operation, the moonroof glass moves in the open direction and the moonroof operation stops.

The drop in the motor rotation speed caused by the pinching is detected by the Hall sensor, and the pulse signals output by the Hall sensor change. This causes the control module to recognize the anomaly in the operation and it performs the control of the pinch prevention function.

Caution
- Do not use a finger, hand, arm, or other body part to check the operation of the pinch prevention function.
- When the moonroof receives a strong impact, the pinch prevention function may operate even if no object is pinched.

Operation image



(a) Normal operation
(b) When pinching occurs
(c) When pinch prevention function operates
(d) Pulse signal (when motor speed drops)
(e) Pulse signal (when motor locked)
(f) Detected object
(g) Pulse signal (when motor normal)

9.11 Rear Bumper/Letter Mark/Muffler Cutter

9.11.1 Overview

Overview

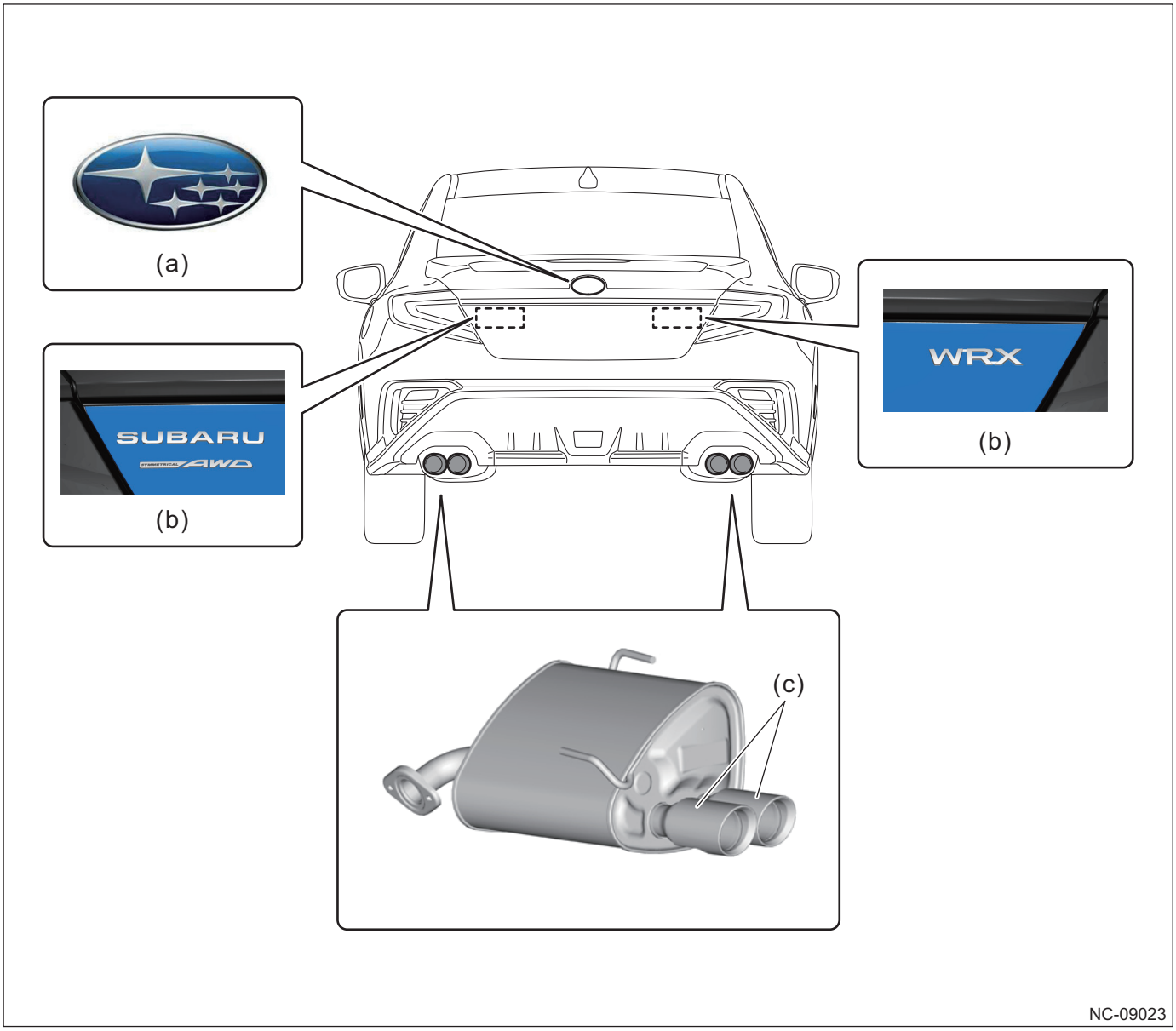
A rear bumper with both good design and functionality is adopted.

A rear spoiler that delivers both aerodynamic performance and visibility performance is adopted.

The letter mark is positioned on the trunk.

9.11.2 Component

Component layout drawing



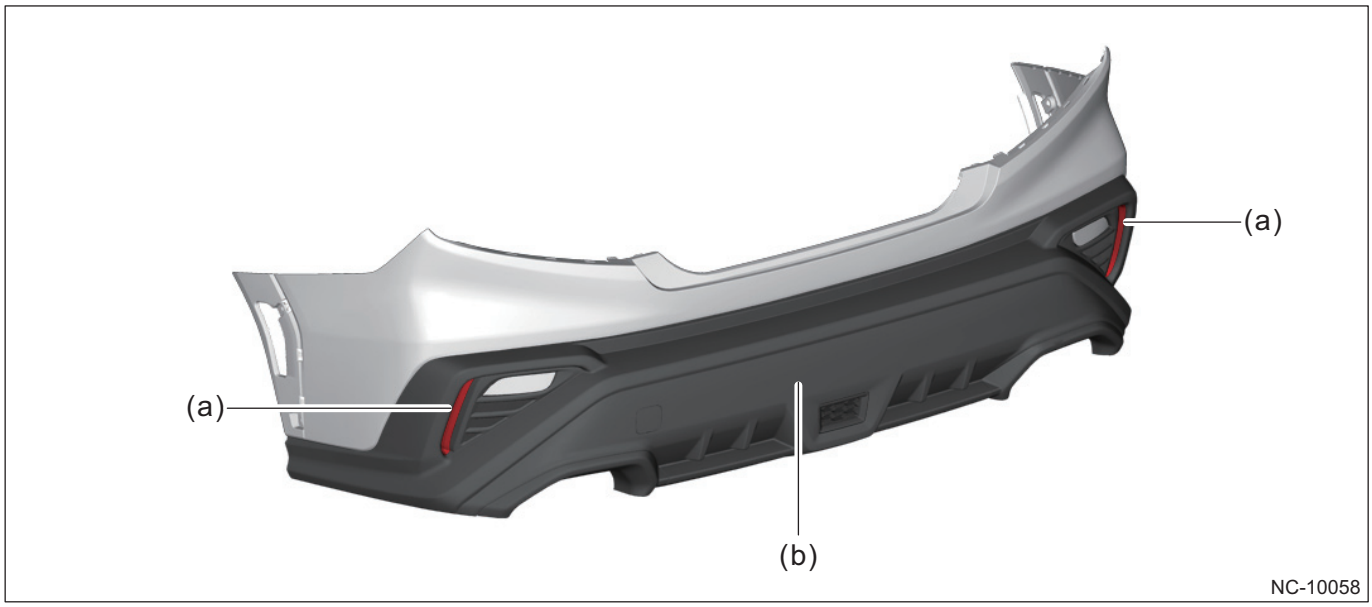
(a) Ornament rear
(b) Letter mark
(c) Muffler cutter

Component details

Rear bumper

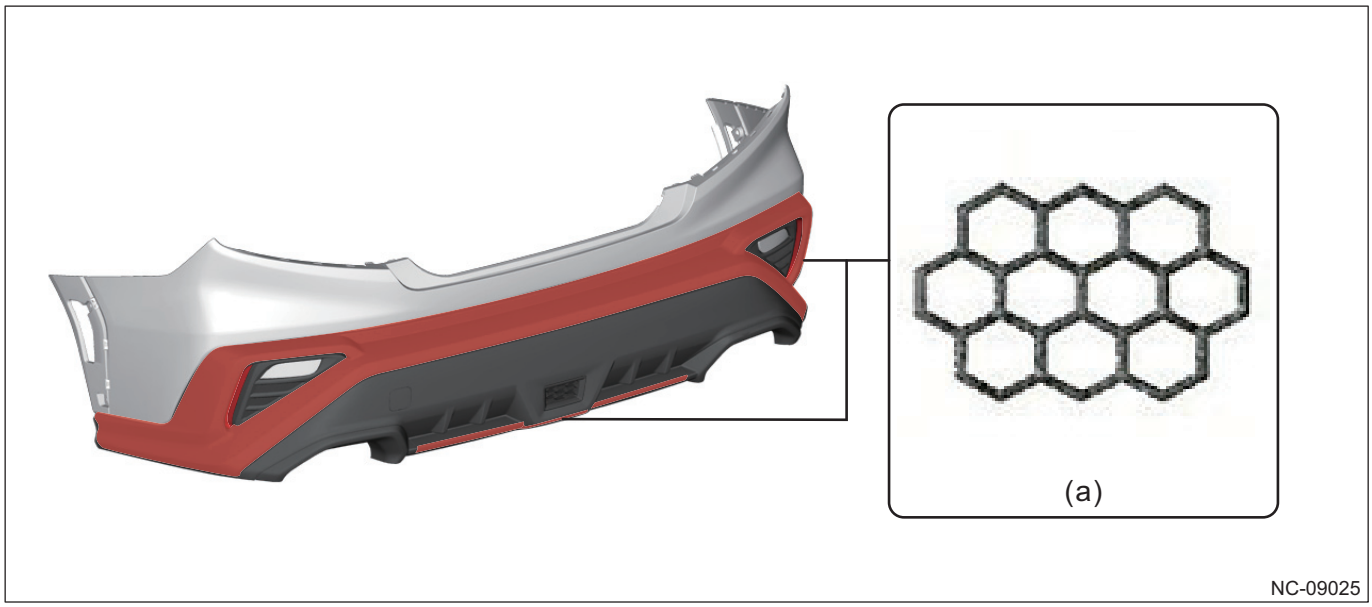
An air outlet that improves steering stability due to aerodynamics is adopted.

Black outs are adopted for the air outlet and the black out areas on the rear bumper are enlarged for a design around the rear that emphasizes a sporty feel.



(a) Air outlet (b) Black out

A hexagonal dimpled pattern texture is adopted for the black outs on the rear bumper.

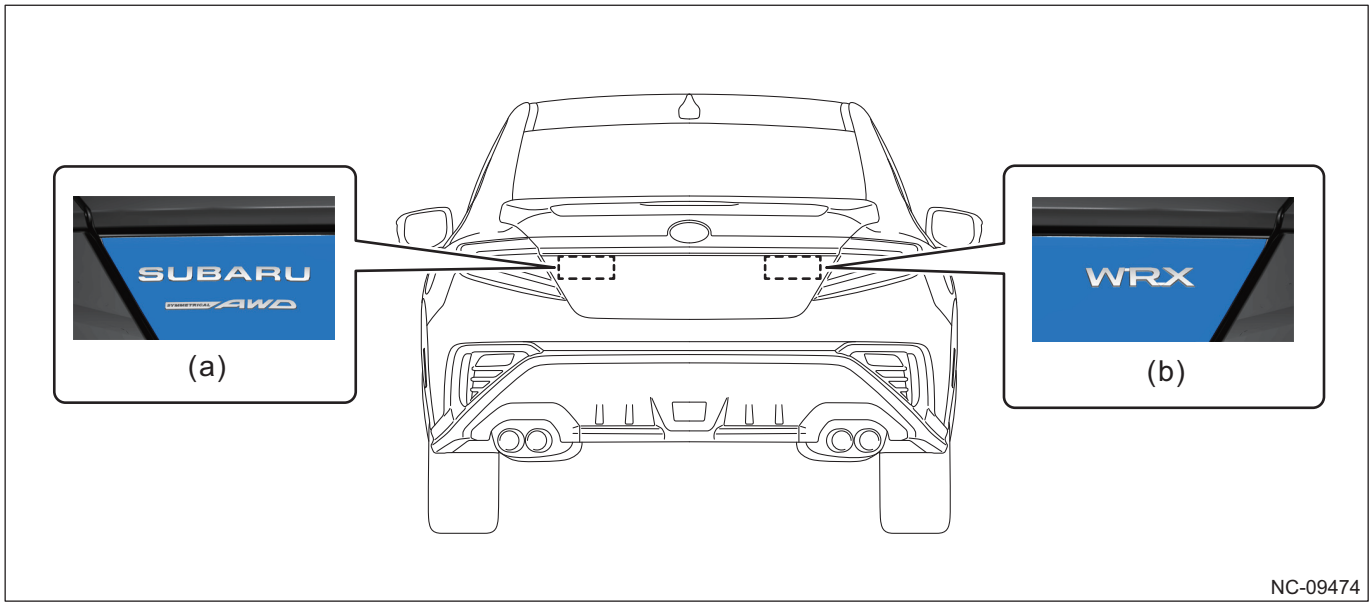


(a) Hexagonal dimpled pattern

Letter mark

The SUBARU mark and AWD mark are positioned on the left side of the trunk and the vehicle name mark is positioned on the right side.

- Hexavalent plating is adopted as the surface plating treatment for the letter mark.

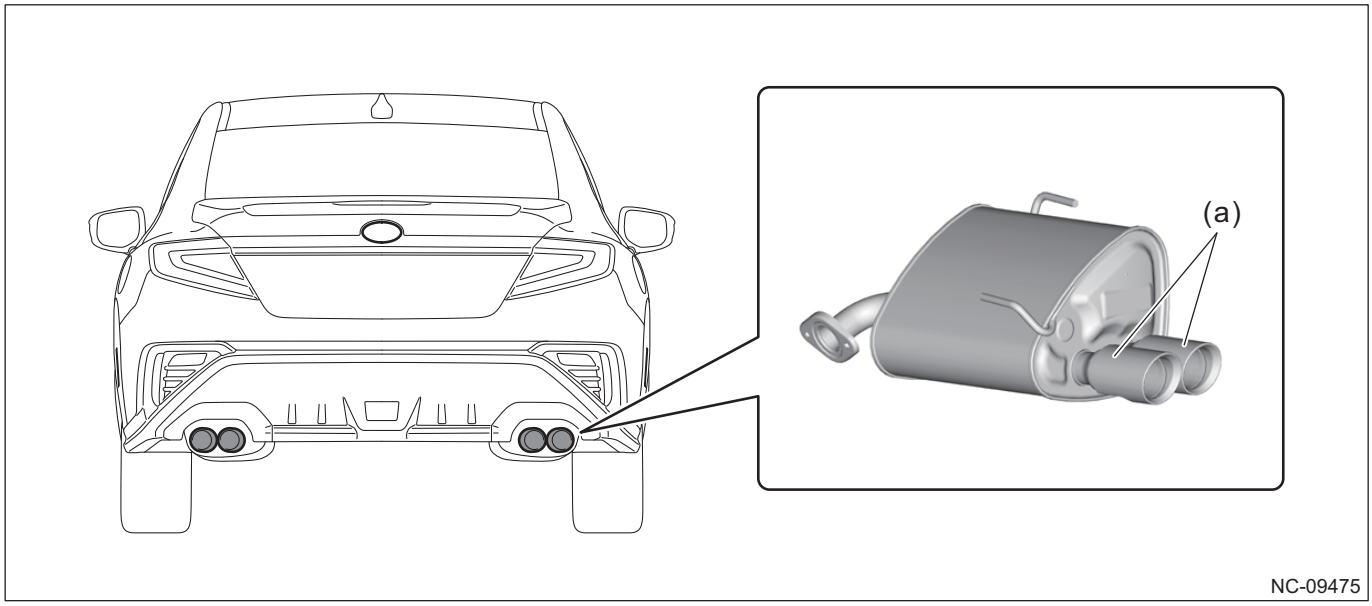


(a) SUBARU mark, AWD mark

(b) Vehicle name mark

Muffler cutter

Four protruding mufflers are adopted on the left and right, and a muffler cutter is provided.



(a) Muffler cutter

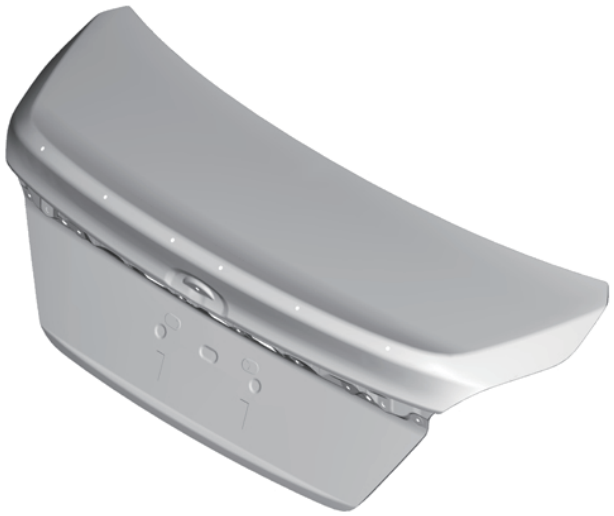
9.12 Trunk/Trunk Garnish

9.12.1 Overview

Overview

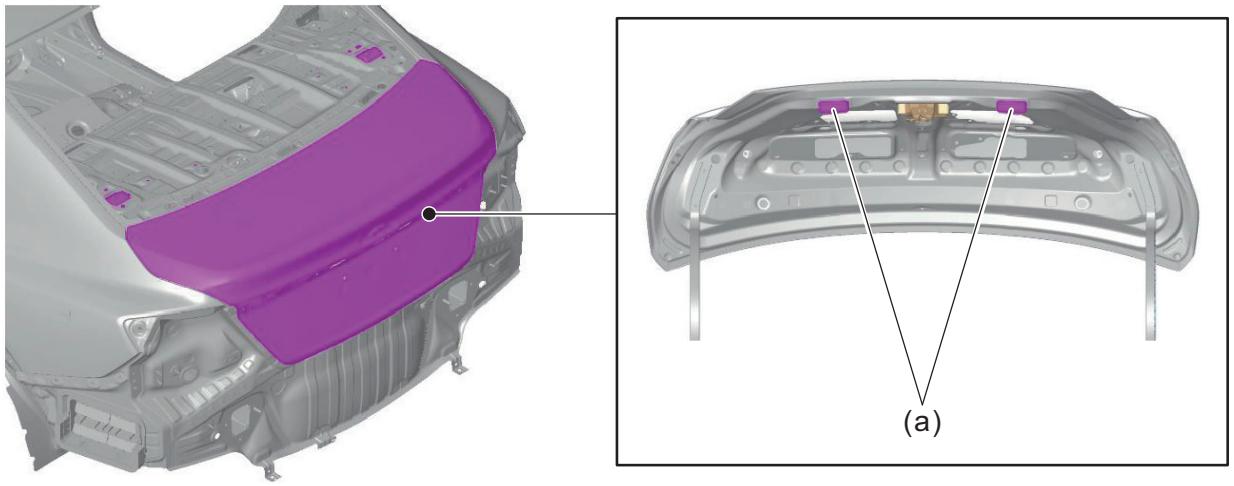
Trunk

- The stopper structure and torsion bar reaction force are optimized for smooth opening and closing of the trunk.



NC-09028

- A large trunk stopper is provided and the energy absorbing ratio when closing the trunk is increased to avoid interference with vehicle body caused by overrun when closing the trunk strongly, and to improve the ease of closing (closing speed).
- The torsion bar reaction force is increased to improve the ease of opening (pop-up amount).

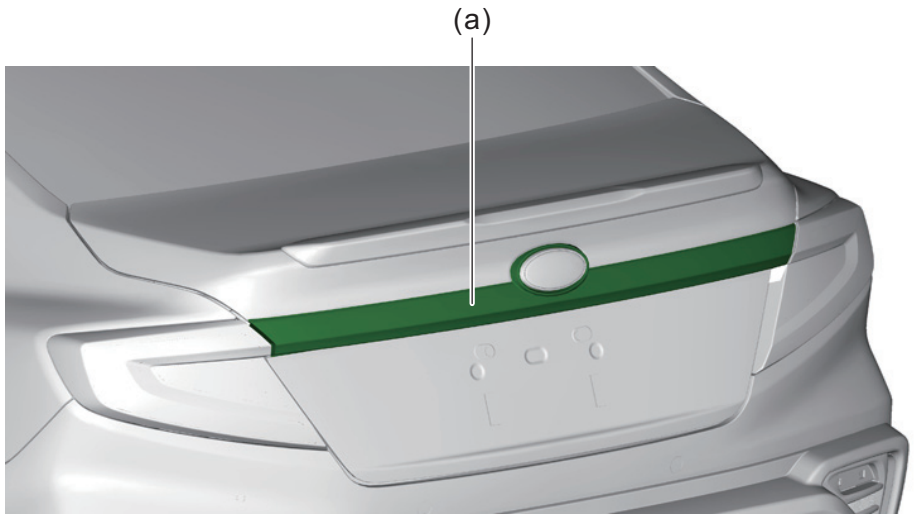


NC-09030

(a) Trunk stopper

Trunk garnish

- Black paint is adopted and a design that connects the rear combination lights is used to improve the design around the rear.



NC-09029

(a) Trunk garnish

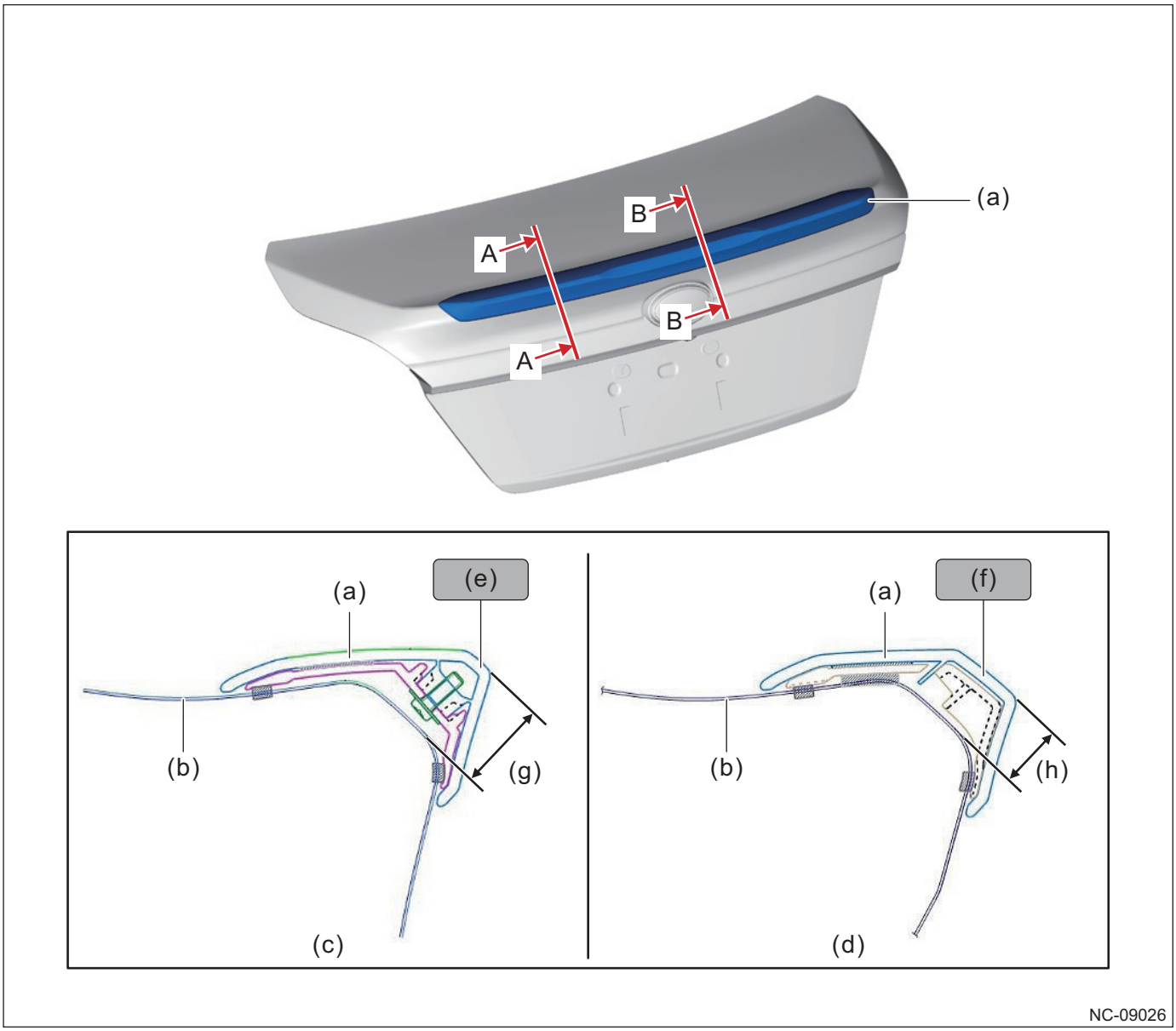
9.13 Rear Spoiler

9.13.1 Overview

Overview

A small rear spoiler made of resin that provides a sporty appearance is adopted.

- The spiral airflow generated to the rear of the vehicle is reduced and the air resistance is decreased to contribute to fuel efficiency.
- The vehicle center part of the rear spoiler is lowered in consideration of rearward visibility performance.



(a) Rear spoiler
(b) Trunk panel
(c) A-A cross section
(d) B-B cross section
(e) Achieved both smaller size and aerodynamic performance
(f) Lowered center part in consideration of rearward visibility
(g) 0.949 in (24.1 mm)
(h) 0.669 in (17 mm)

10 INTERIOR TRIM

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10.1 General Overview

10.1.1 Overview

Overview

In this chapter, the following components configuring the body interior are described.

- Air conditioning system
- Airbag system
- Seat and Seat belt
- Instrument panel
- Interior Trim/Interior Equipment
- Door Lock and Security System
- Lighting System
- Inner mirror

10.2 Air conditioning system

10.2.1 Overview

Overview

The following performances are mainly improved for the air conditioning system.

- An air conditioning system that improves ride quality, practical fuel efficiency, and comfort is adopted
- Internal structure of the air conditioning module (HVAC) is modified to achieve the quietness of air conditioning
- Adoption of an air conditioning system that supports a new refrigerant (HFO-1234yf) for compliance with environmental regulations in consideration of preventing global warming
- Two air conditioning mode types are provided as air conditioning modes that are linked to and selected by drive mode select (models with drive mode select) in order to create a comfortable interior space according to user preference
- Comfort, convenience, and usability are improved while carrying over "Voice recognition air conditioning" (models with 11.6-inch center information display) and "Multistage outlet mode"
- A temperature and humidity sensor (models with temperature and humidity sensor) is added to increase the interior air recirculation rate and contribute to the improvement of heating performance and fuel efficiency

Specifications

HVAC system

Heater system

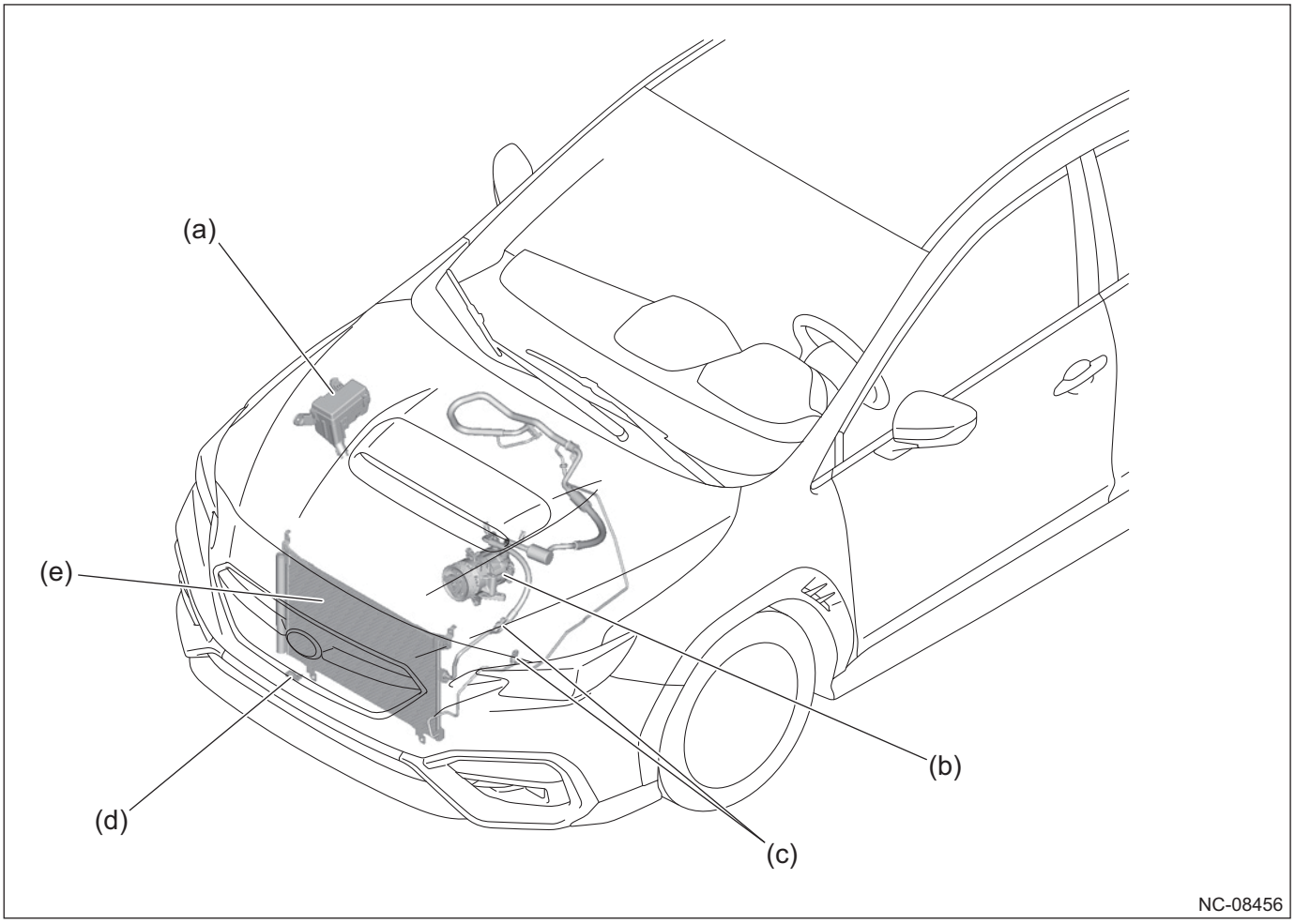
Item	Specifications	Condition
Air flow amount	380 m^3/h	Temperature setting: HI (warmest) Fan speed: HI (MAX) Fresh air and recirculation switching position (FRESH) Mode switching position (FOOT)

Air conditioning system

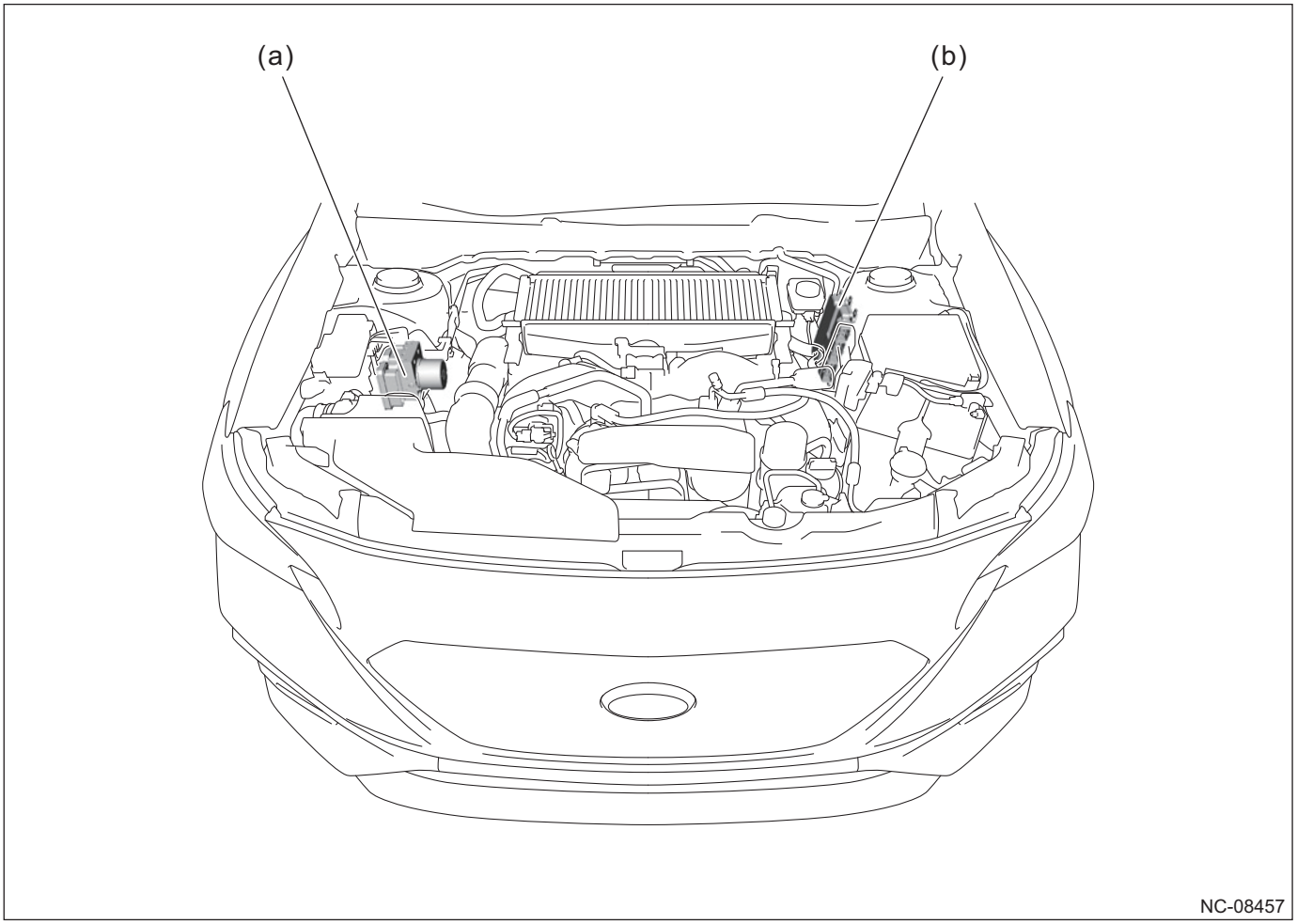
Item	Specifications	Condition
Air flow amount	530 m^3/h	Temperature setting: LO (coolest) Fan speed: HI (MAX) Fresh air and recirculation switching position: RECIRC Mode switching position: VENT
Compressor	Clutch-less variable capacity type (VCS-14E)	-
Type of air conditioner type	Reheat air-mix type	-
Refrigerant	HFO-1234yf (CH2=CFCF3) [0.400±0.025 kg]	-

10.2.2 Component

Component layout drawing

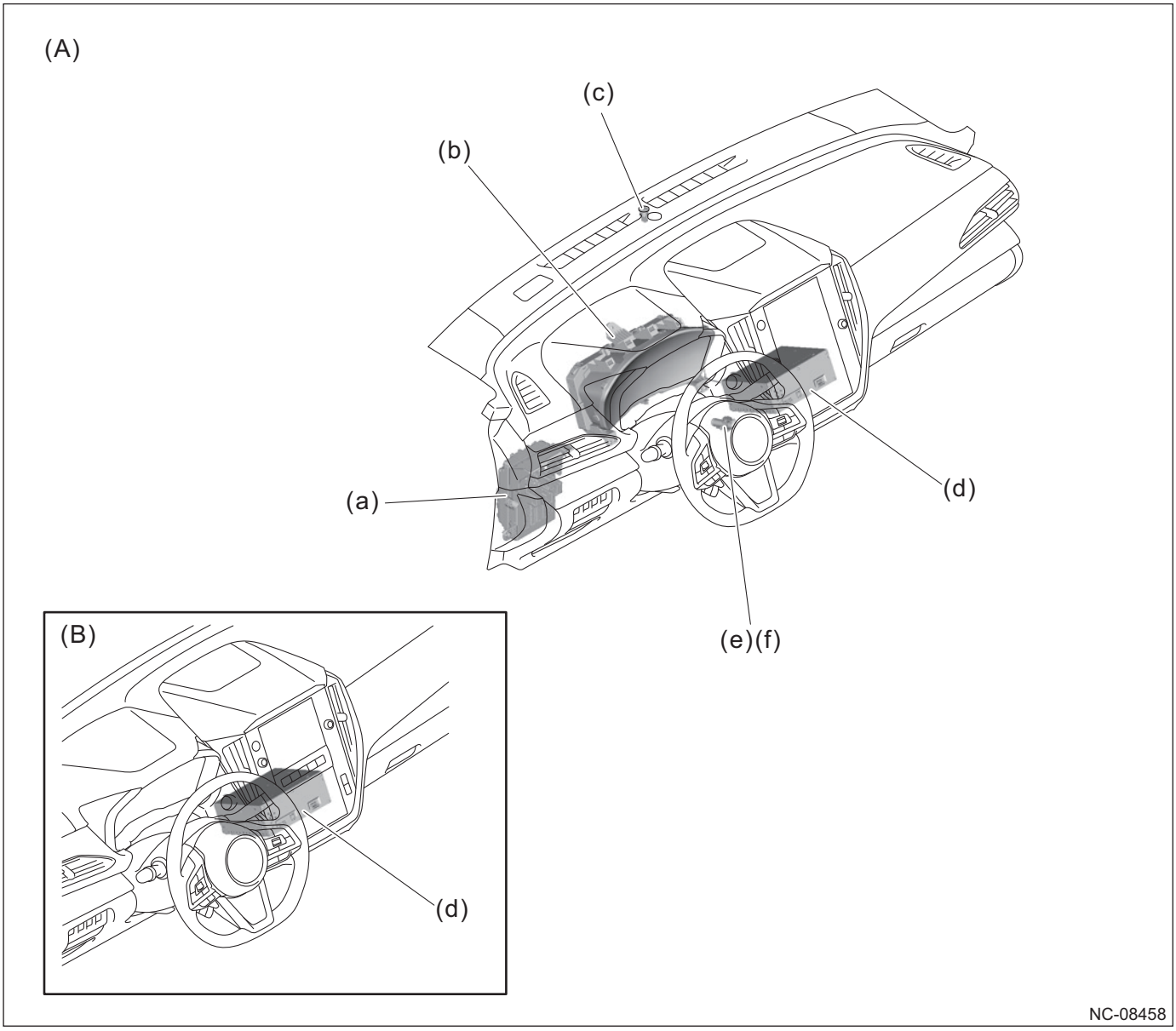


(a) Relay holder
(b) Compressor assembly
(c) Pressure sensor
(d) Ambient sensor
(e) Condenser assembly



(a) VDC CM & H/M

(b) Engine control module (ECM)



(A) Models with 11.6-inch center information display

(B) Models with Dual 7-inch display

(a) Body Integrated Unit (BIU)

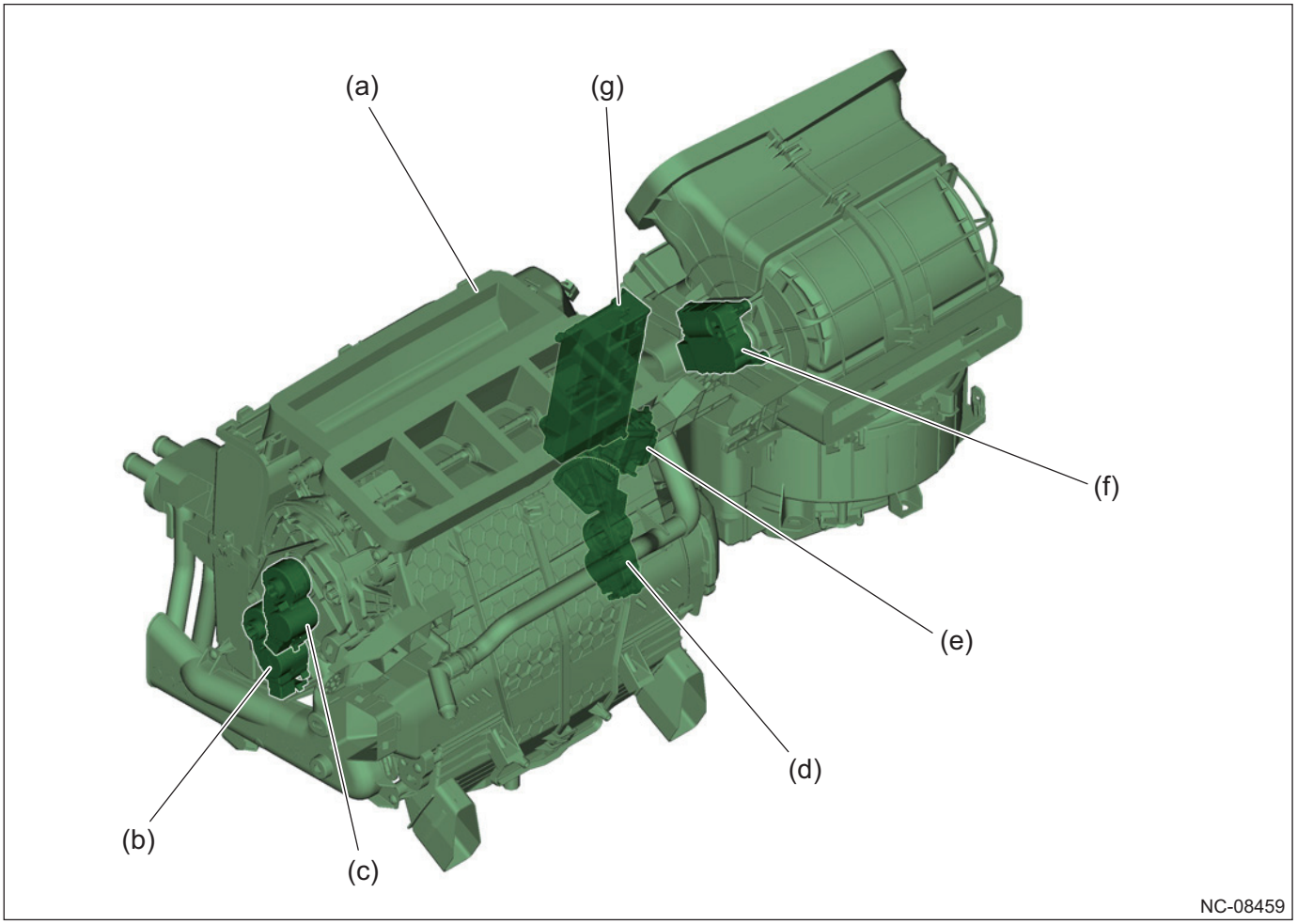
(b) Combination meter

(c) Sunload sensor

(d) Cockpit Control Module (CCM)

(e) Temperature and humidity sensor (models with temperature and humidity sensor)

(f) Interior temperature sensor (models with interior temperature sensor)



(a) Air conditioning module (HVAC)

(b) Air mix door actuator LH (models with independent driver seat/passenger seat type)

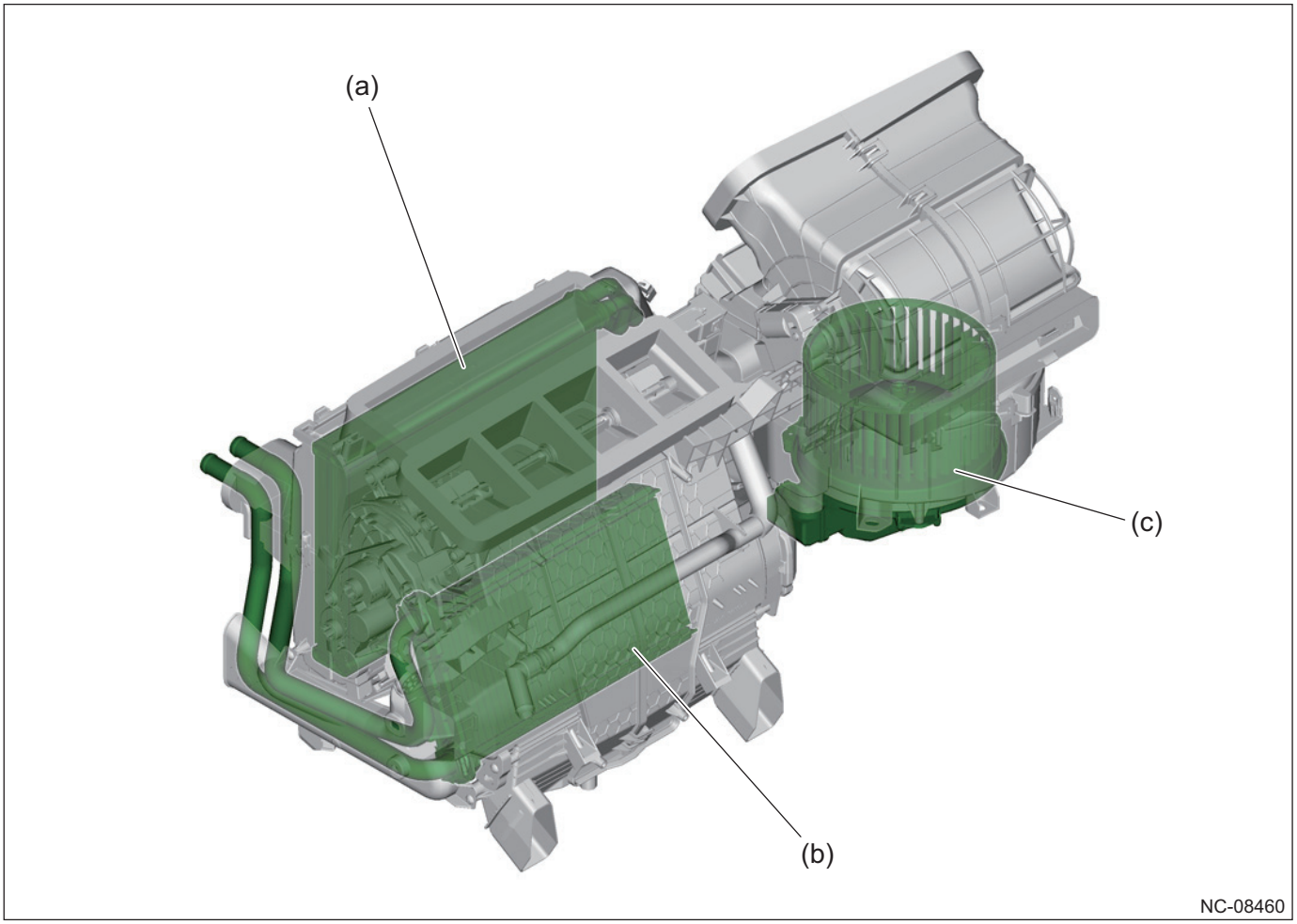
(c) Mode door actuator

(d) Air mix door actuator RH

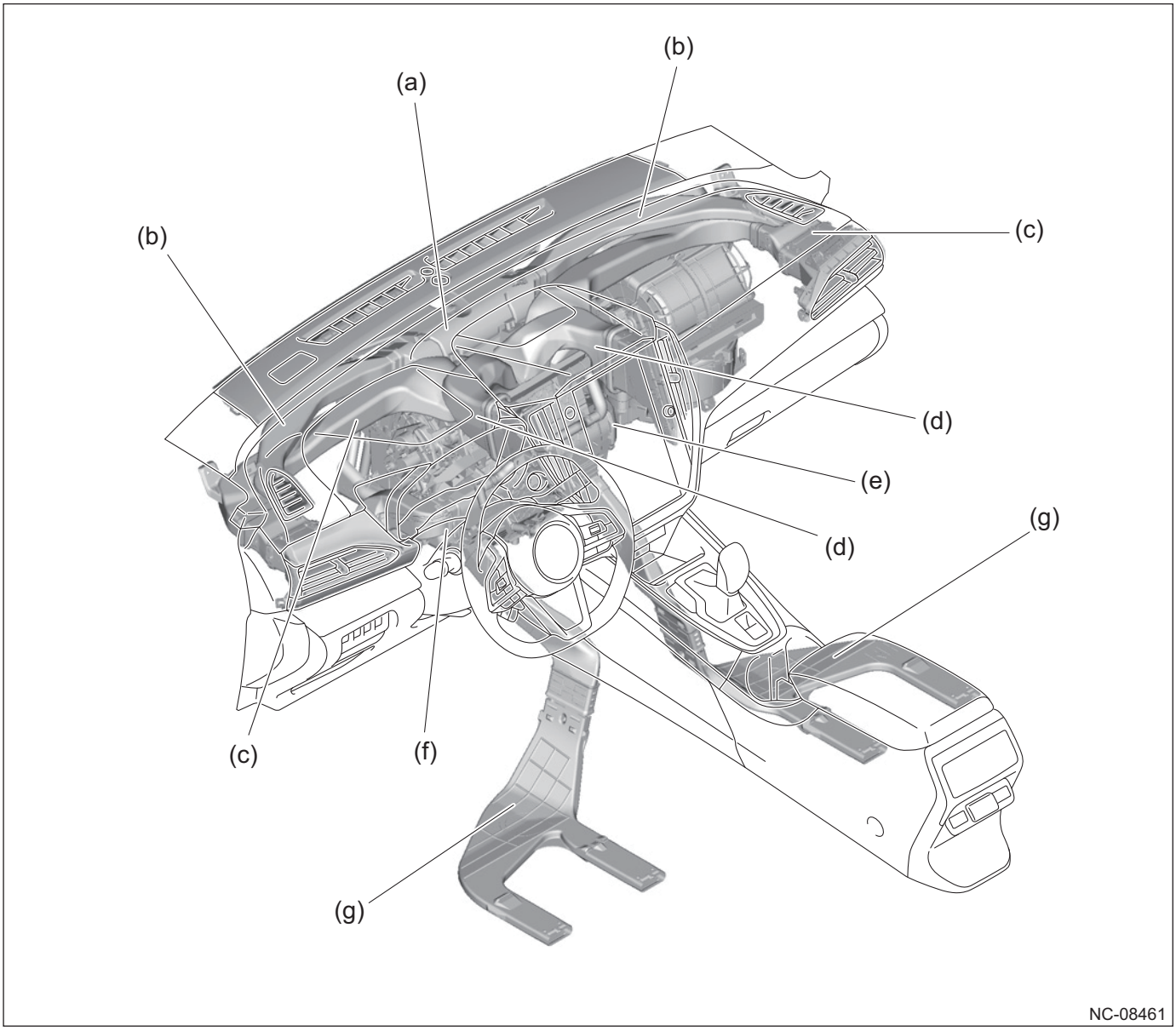
(e) Power transistor

(f) Fresh air flap control door actuator

(g) A/C CM



(a) Evaporator assembly
(b) Heater core
(c) Blower motor assembly



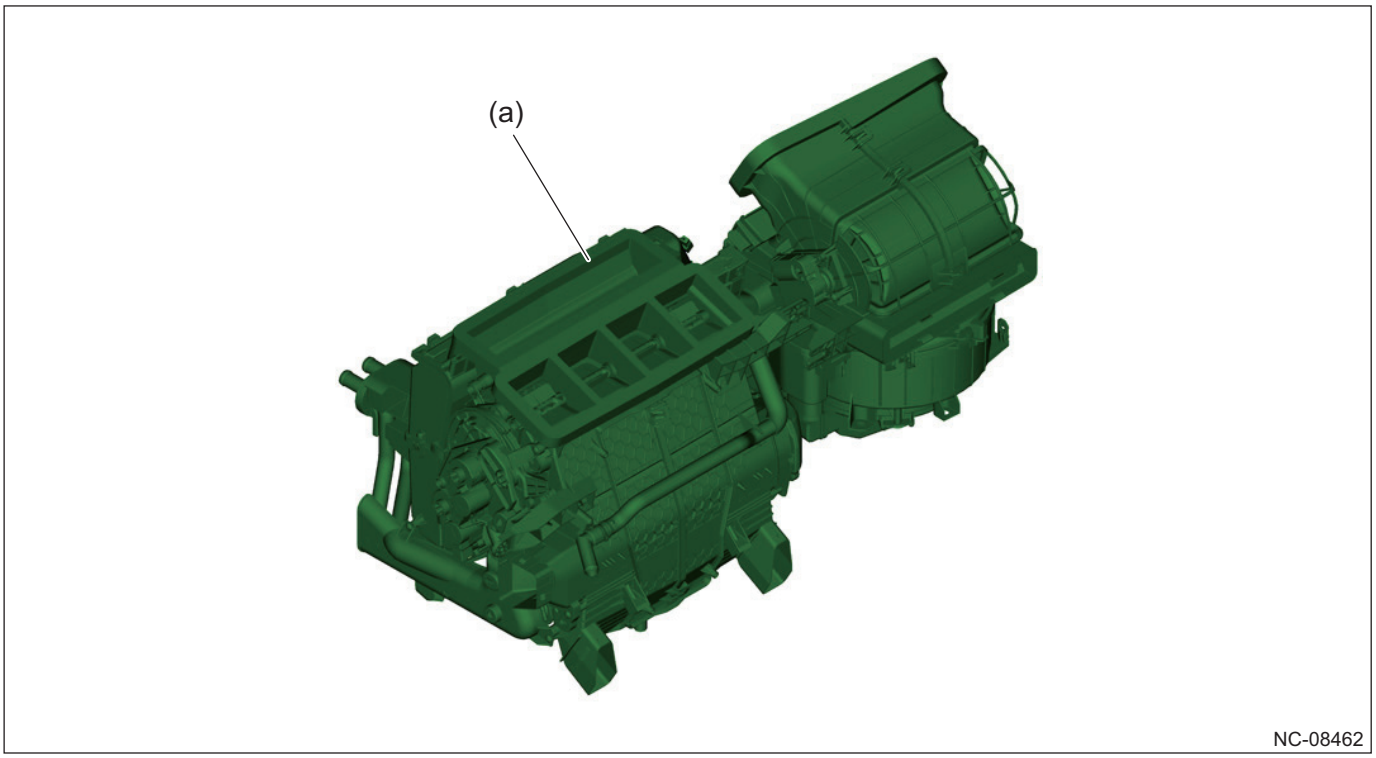
(a) Nozzle front defroster assembly
(b) Duct side defroster
(c) Duct side ventilation
(d) Duct center ventilation front
(e) Duct foot passenger
(f) Duct foot driver
(g) Duct heater rear

Component details

Air conditioning module (HVAC)

The air conditioning module (HVAC) internal parts and air conditioning duct shape are optimized to reduce pressure loss, thus reducing air conditioning noise while ensuring sufficient air flow volume.

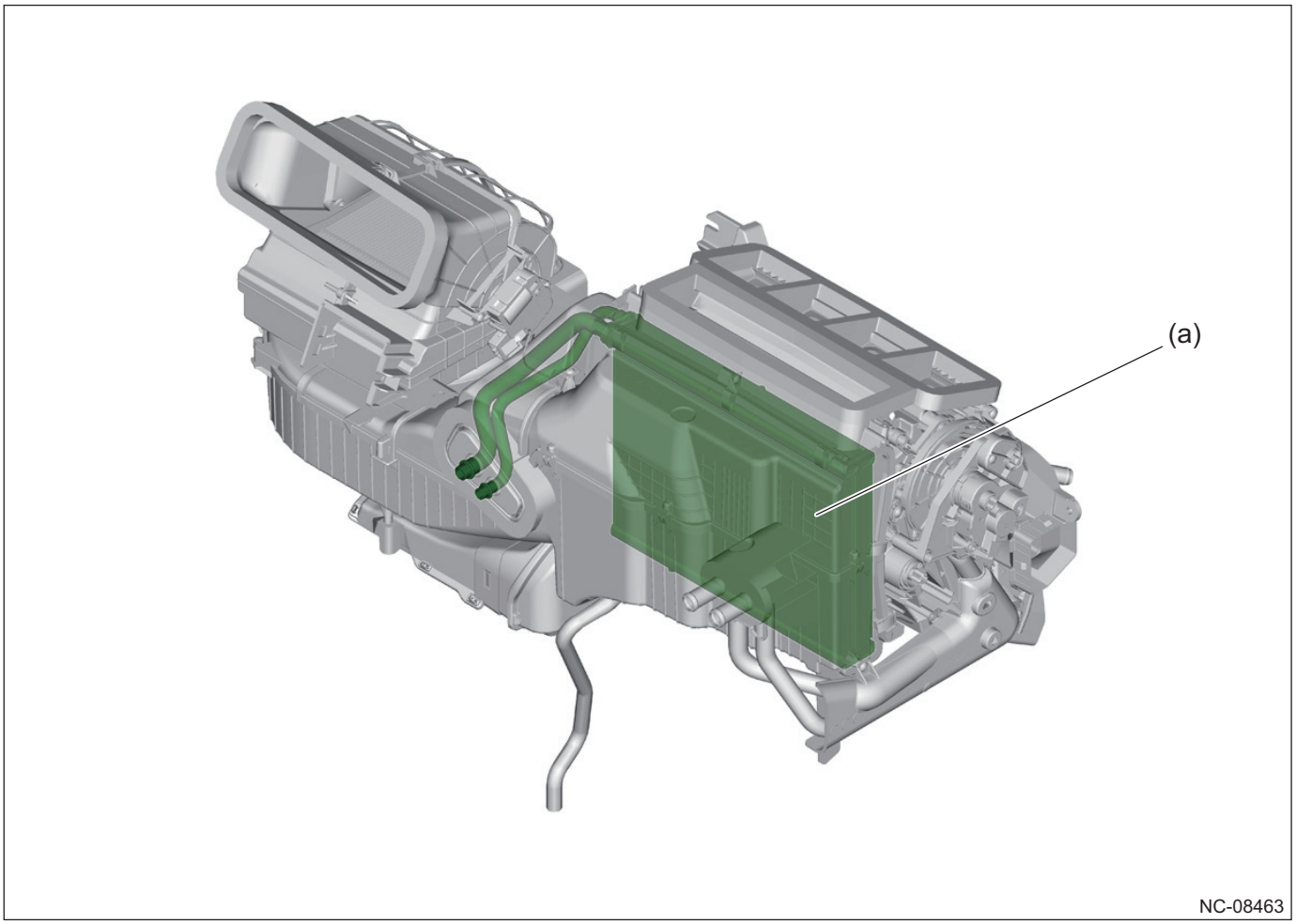
Large evaporator is adopted to improve cooling performance.



(a) Air conditioning module (HVAC)

■ Evaporator

In order to ensure the cooling performance for the air conditioning module (HVAC), the evaporator is enlarged and the fin pitch is narrowed to improve the heat exchange performance.

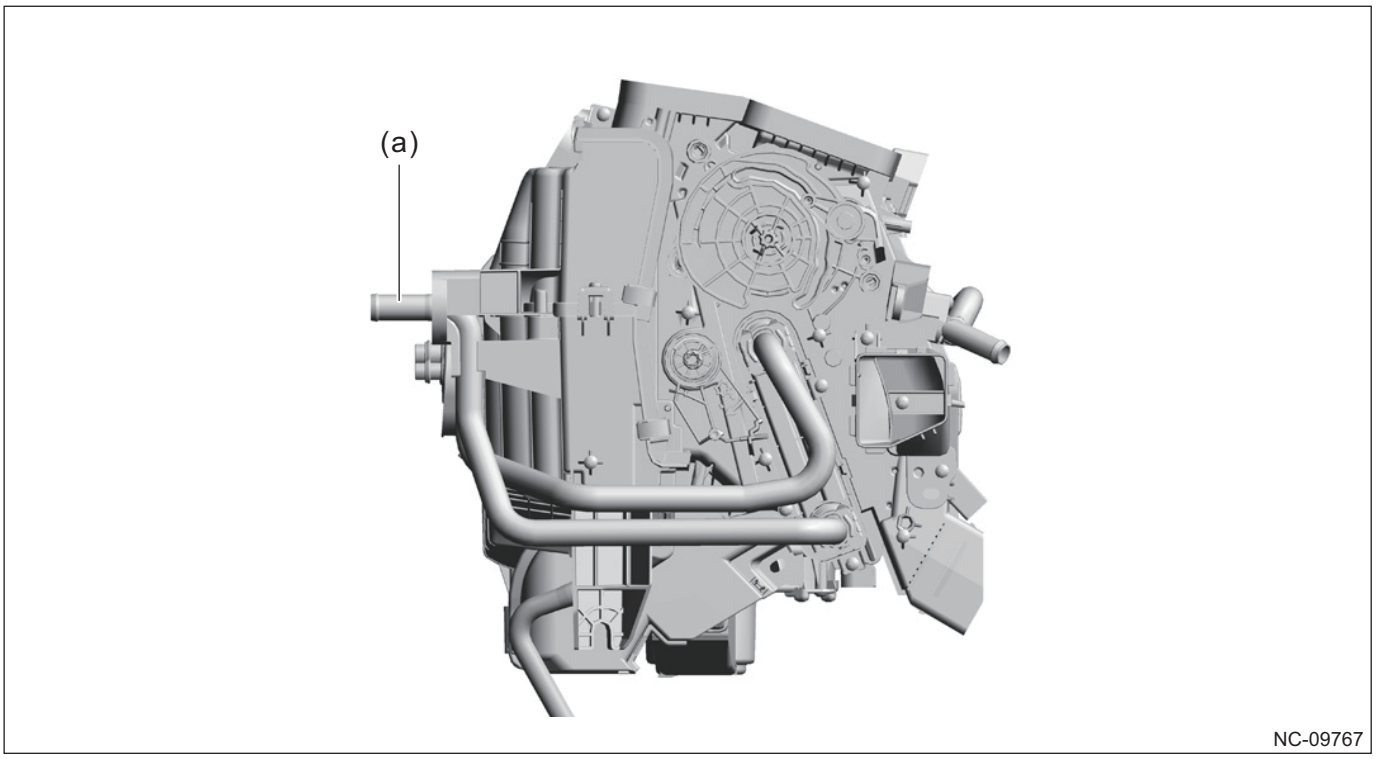


(a) Evaporator assembly

■ Heater pipe

The heater pipe diameter is enlarged to increase the warm water flow rate.

This compensates for the reduced heat amount that results from the low engine heat source that was adopted to improve fuel efficiency, thus ensuring the heating performance.

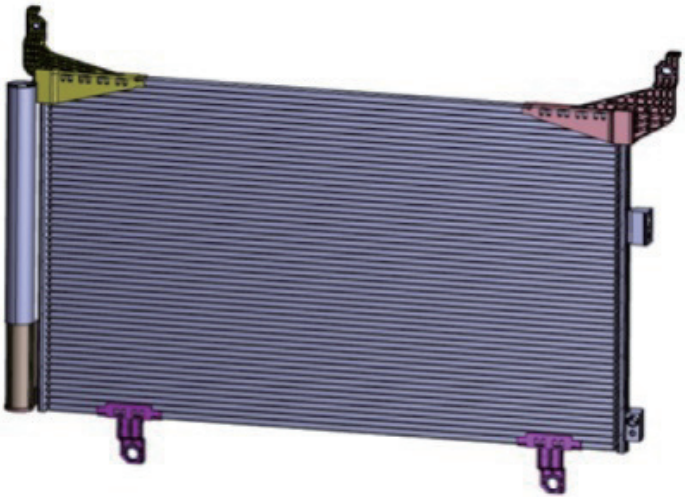


(a) Heater pipe

Condenser

An enlarged condenser is adopted to improve cooling performance.

Also, a more efficient structure inside the condenser is adopted to make the structure thinner and lighter even while enlarging the size.

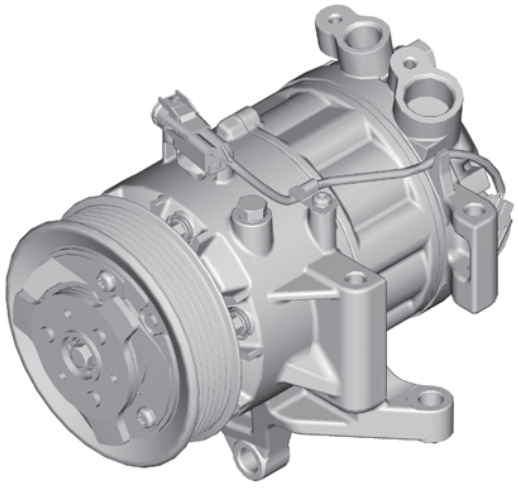


NC-04791

Compressor

A variable displacement type of compressor is adopted to improve fuel efficiency during the use of air conditioning.

The variable displacement compressor raises the amount of work in stages to minimize fluctuations in the engine speed and reduce vibration and noise.

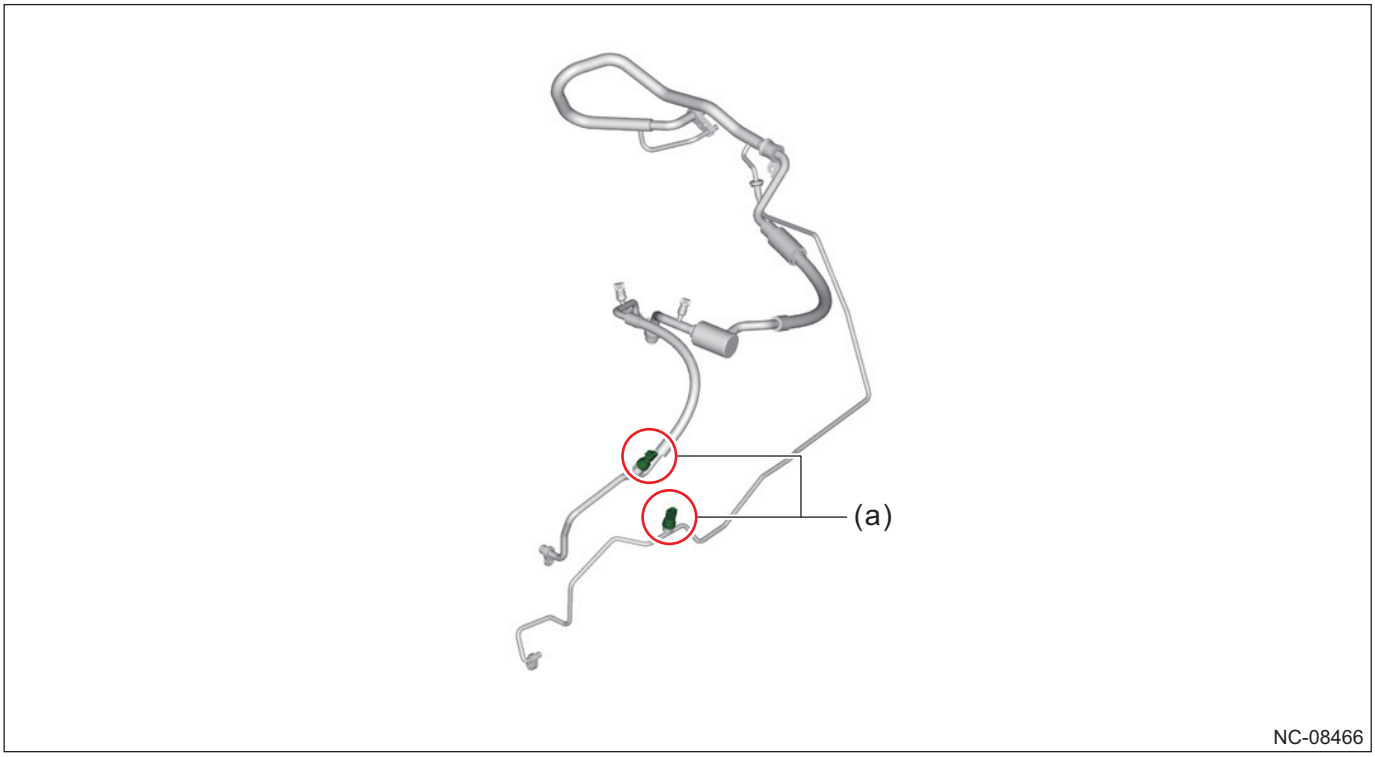


NC-08465

Pressure sensor

A pressure sensor is provided for the hose and pipe, and information expressing the pressure status of the sealed refrigerant is transmitted to the A/C CM, enabling engine control as appropriate for the air conditioning status and improving the fuel efficiency.

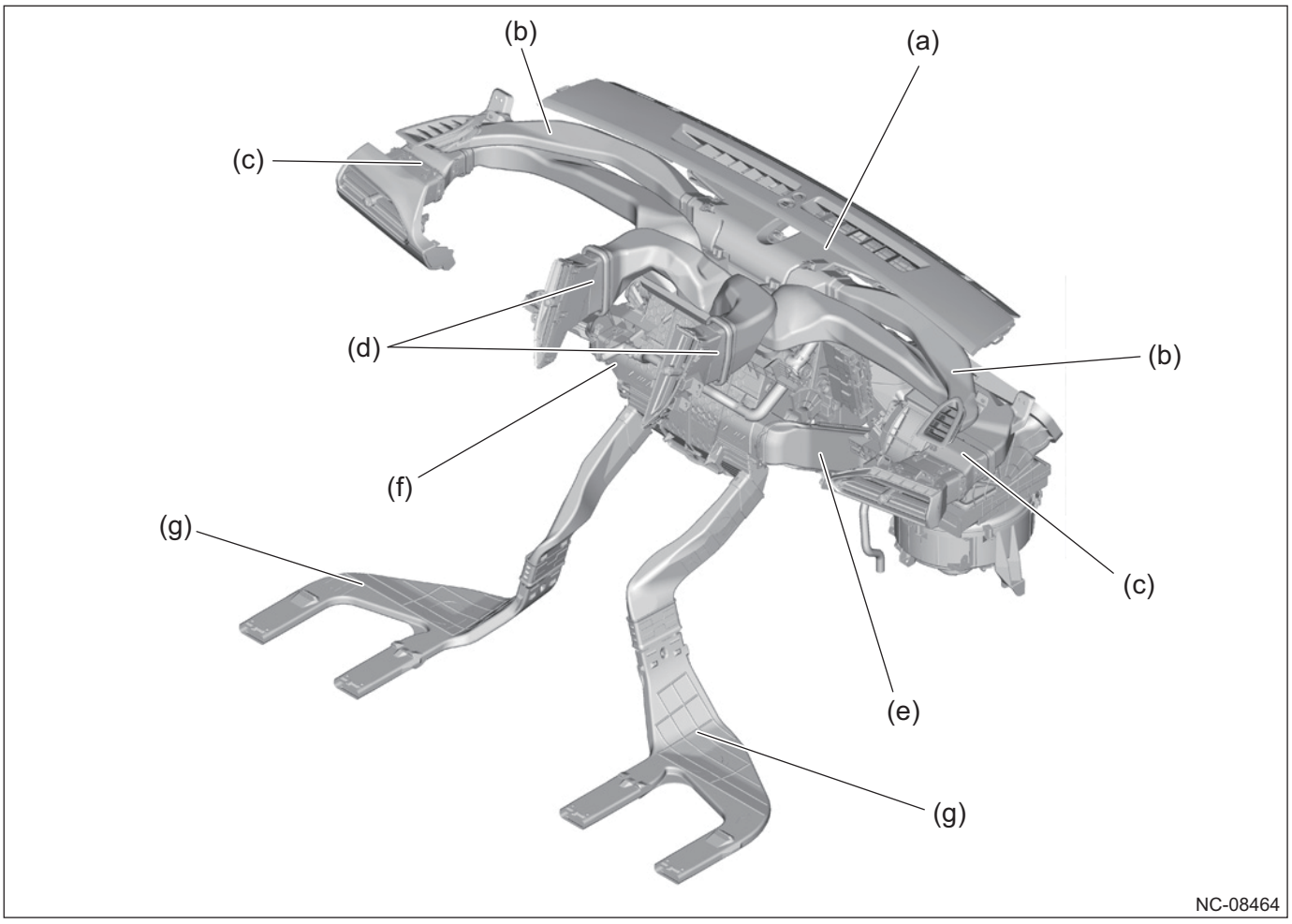
A heat exchange function is adopted for the low pressure pipes to both improve cooling performance and improve fuel efficiency by reducing the compressor load.



(a) Pressure sensor

Duct for air conditioning

The air conditioning module (HVAC) internal parts and air conditioning duct shape are optimized to reduce pressure loss, thus reducing air conditioning noise while ensuring sufficient air flow volume. Also, a large foot duct is adopted to form a structure where air is blown around the whole feet.

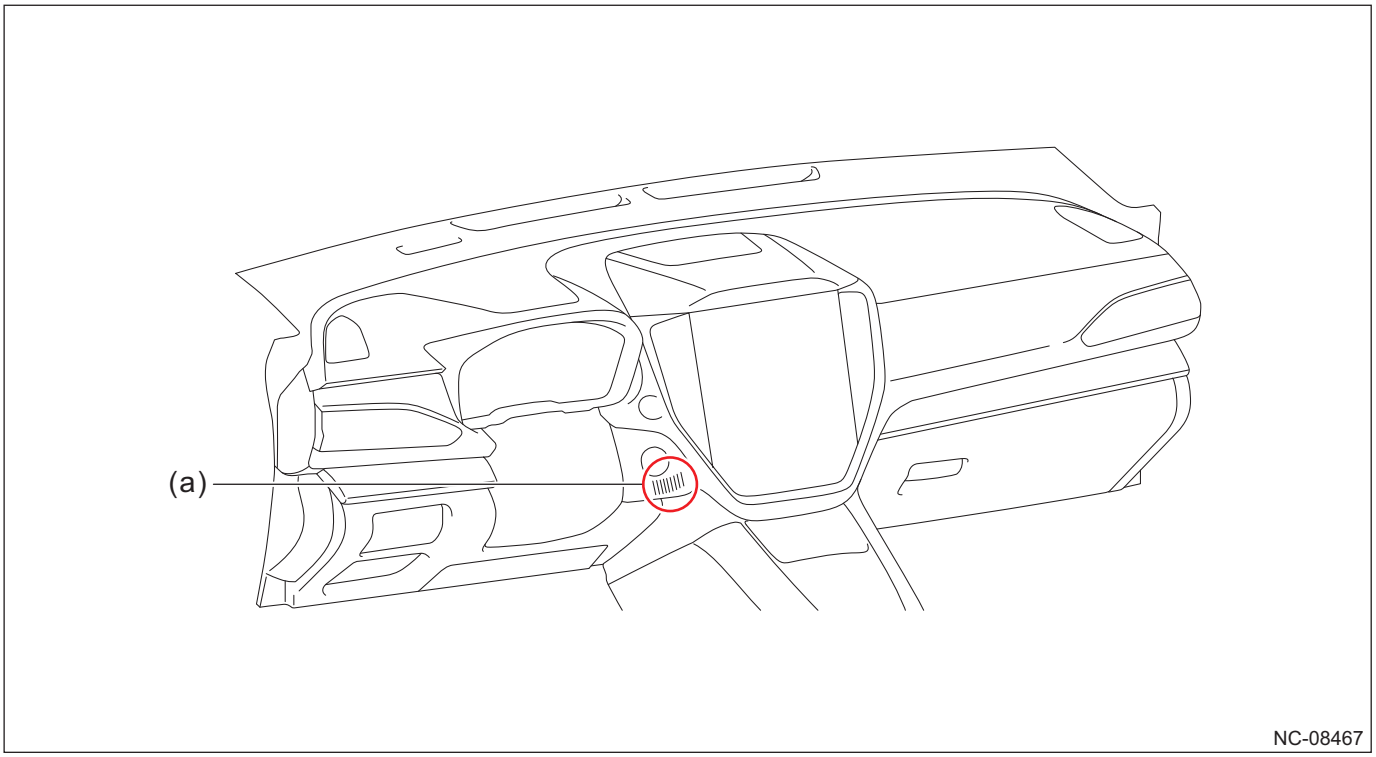


(a) Nozzle front defroster assembly
(b) Duct side defroster
(c) Duct side ventilation
(d) Duct center ventilation front
(e) Duct foot driver
(f) Duct foot passenger
(g) Duct heater rear

Temperature and humidity sensor (models with temperature and humidity sensor)

A temperature and humidity sensor is adopted to improve comfort and fuel efficiency.

The air conditioning control also utilizes humidity information to provide air conditioning more appropriate to the environment, and improve heating performance and reduce power consumption by efficient air conditioning operation.



(a) Sensor position

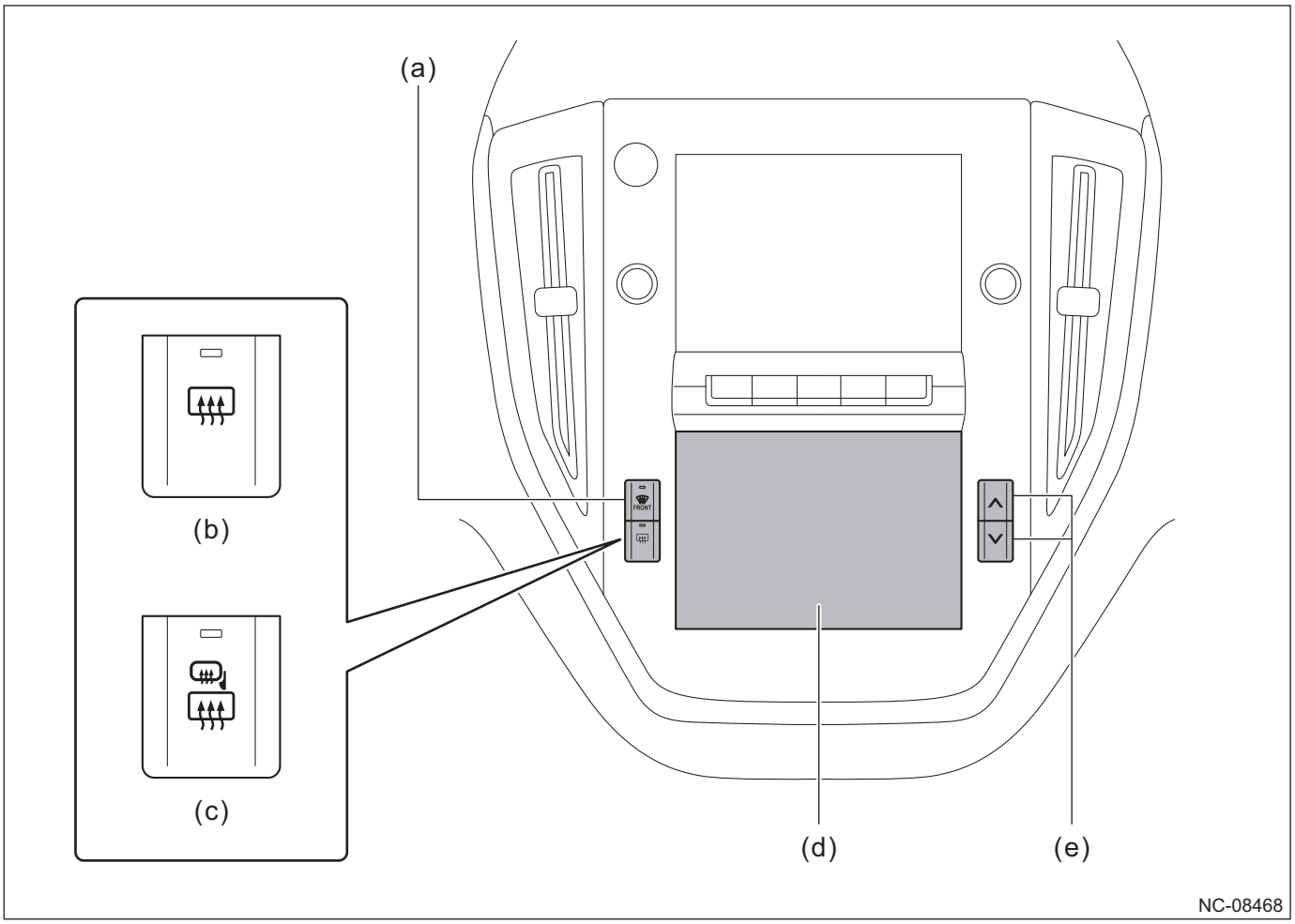
Center information display

The number of physical switches is reduced by consolidating some switches in the center information display.

Air conditioning operations are divided between the physical switches and air conditioning setting screen for an interior that is more sleek without losing user friendliness.

Two types are provided depending on the vehicle specification: Dual 7-inch display and 11.6-inch center information display.

Models with Dual 7-inch display



(a) Defroster switch

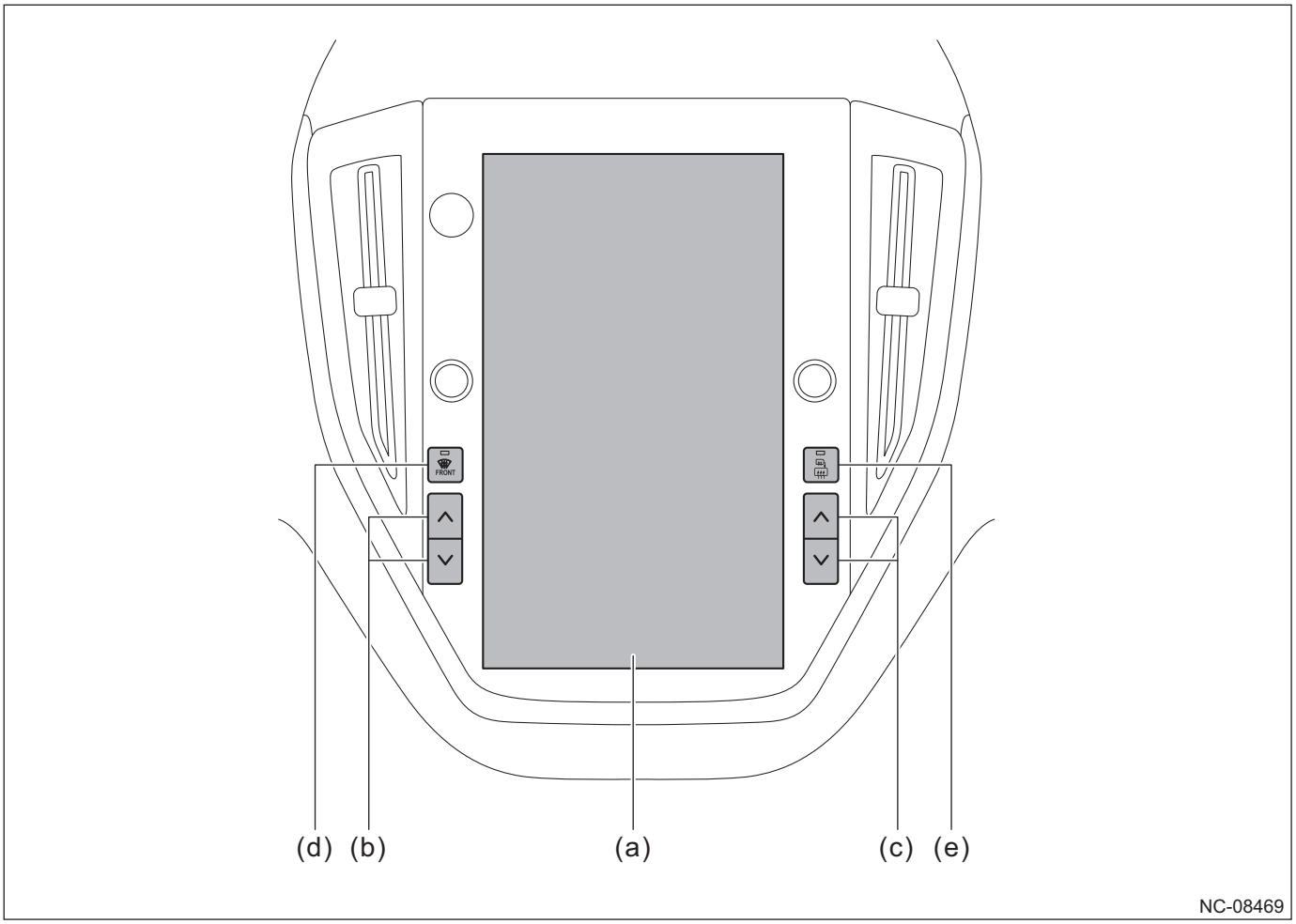
(b) Rear window defogger switch (models without mirror heater)

(c) Rear window defogger switch/heated door mirror switch (models with mirror heater)

(d) Dual 7-inch display

(e) Temperature control switch

Models with 11.6-inch center information display



(a) 11.6-inch center information display

(b) Temperature adjustment switch (driver's seat side)

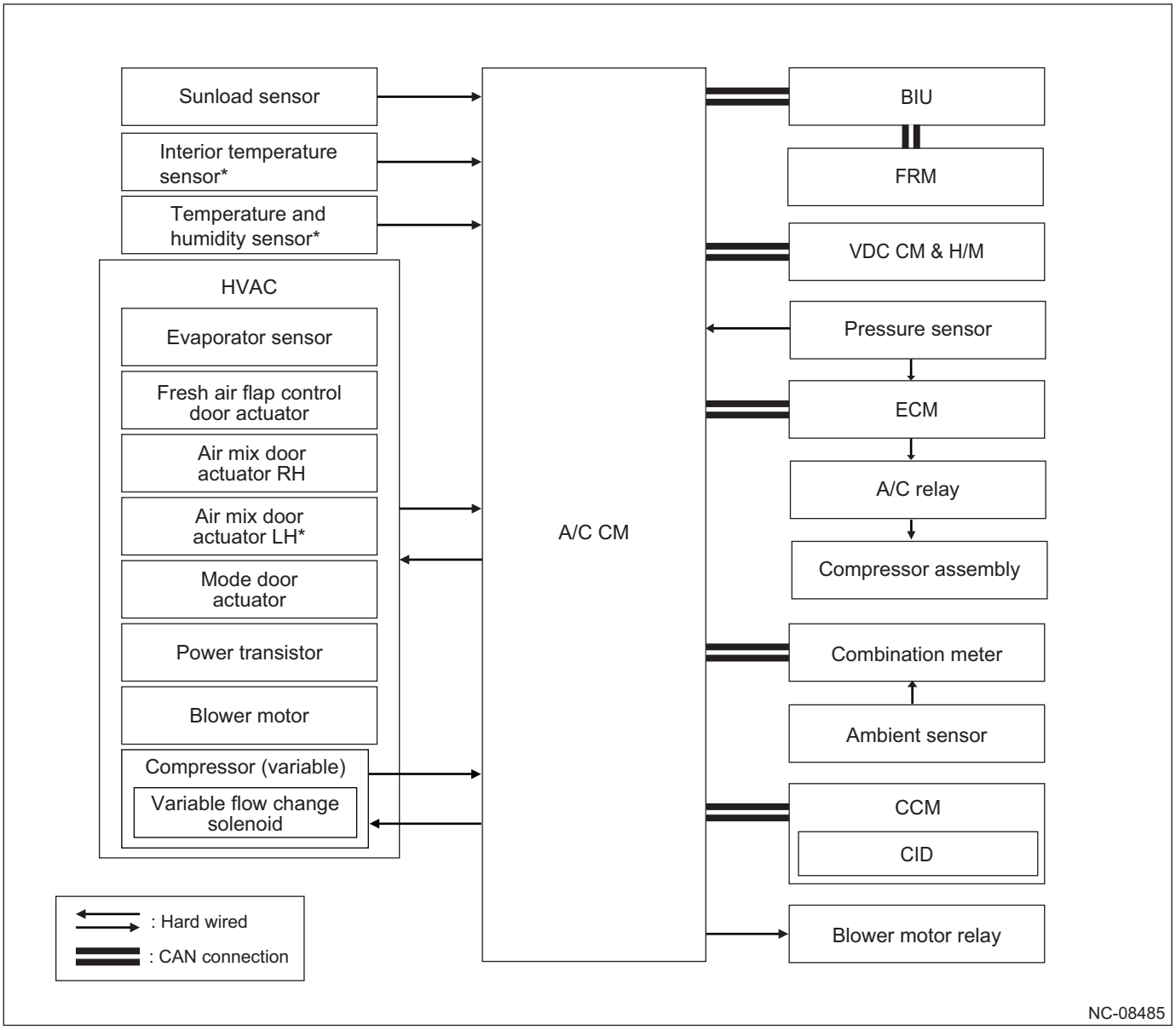
(c) Temperature adjustment switch (passenger's seat side)

(d) Defroster switch

(e) Rear window defogger switch/heated door mirror switch (front wiper deicer linked)

10.2.3 Construction and Operation

System diagram



*: For some grades

Main component functions

Air conditioning system

Component	Main functions
Sunload sensor	Detects the sunload amount and sends the information to the A/C CM.
Temperature and humidity sensor (models with temperature and humidity sensor)	Detects the interior temperature and humidity and sends the information to the A/C CM.
Interior temperature sensor (models with interior temperature sensor)	Detects the interior temperature and sends the information to the A/C CM.
Evaporator sensor	Detects the evaporator temperature and sends the information to the A/C CM.
Fresh air flap control door actuator	Opens and closes the fresh air flap control door.
Mode door actuator	Opens and closes the mode switching door.
Air mix door actuator RH	Opens and closes the air mix door.
Air mix door actuator LH (models with independent driver seat/passenger seat type)	
Blower motor	Driven according to the target air flow volume calculated by the A/C CM. Blows air into the vehicle interior.
Compressor assembly	Performs refrigerant intake, compression, and discharge.
A/C CM	Controls the air conditioning system according to the signals from the switches, sensors, and computers.
Pressure sensor	Detects the refrigerant pressure and sends the information to the A/C CM.
Engine Control Module (ECM)	Sends information such as the engine speed signal and engine coolant temperature to the A/C CM.
VDC CM & H/M	Sends the average speed signal to the A/C CM.
Body Integrated Unit (BIU)	Determines the rear defogger/wiper deicer control based on the control signal from the A/C CM and sends the information to the front relay control module (FRM).
Front relay control module (FRM)	Turns each relay ON for parts such as the rear defogger based on the determined result.
Combination meter	Sends the ambient temperature signal to the A/C CM.
Ambient sensor	Detects the ambient temperature and sends the information to the combination meter.
Cockpit control module (CCM)	• Sends the signal of each switch to the A/C CM. • Displays the control status of the air conditioning system. • Sends the voice recognition signal to the A/C CM.

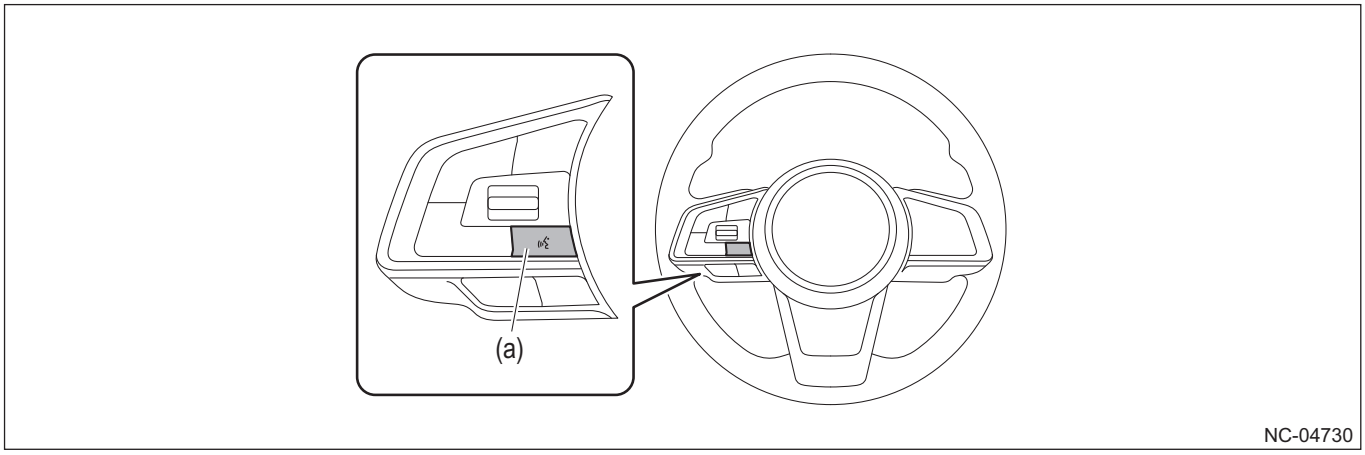
System details

Voice recognition air conditioning

Voice recognition air conditioning that enables air conditioning operations by voice is provided. (Models with 11.6-inch center information display)

This enables the driver to make safe operations without releasing the steering wheel or diverting the driver's visual line.

Pressing the voice recognition switch activates the voice recognition function.



(a) Voice switch

Purpose	Voice command
Display the voice recognition command for air conditioning operation.	Go to climate.
Turn on the auto A/C.	Auto AC ON.
Set to the specified temperature*1.	[*2] degrees
Raise the set temperature in 4 steps*1.	Warmer.
Lower the set temperature in 4 steps*1.	Cooler.
Increase the fan speed by 1 level*1.	Increase fan speed.
Decrease the fan speed by 1 level*1.	Decrease fan speed.
Set the fan speed.	Fan speed [*3]

**1: When the auto A/C is OFF, switches to ON before performing the operation*
**2: Settable temperature range (60 to 85°F (15 to 29°C) and Low/High)*
**3: Fan speed range (1 to 7)*

Control linked to drive mode select (models with drive mode select linked control)

Normal/Mild air conditioning modes are provided as air conditioning control that is linked to drive mode select.

In Mild mode, internal air circulation is prioritized for air conditioning that decreases the air flow volume while not changing the sensed temperature.

The control linked to the modes of drive mode select creates a comfortable space according to user preference.

COMFORT	NORMAL	SPORT	SPORT+	INDIVIDUAL
Mild	Normal	Normal	Normal	Mild/Normal

Normal: Normal air conditioning setting
Mild: Air conditioning setting that prioritizes internal air circulation and decreases air flow volume

Display screen details

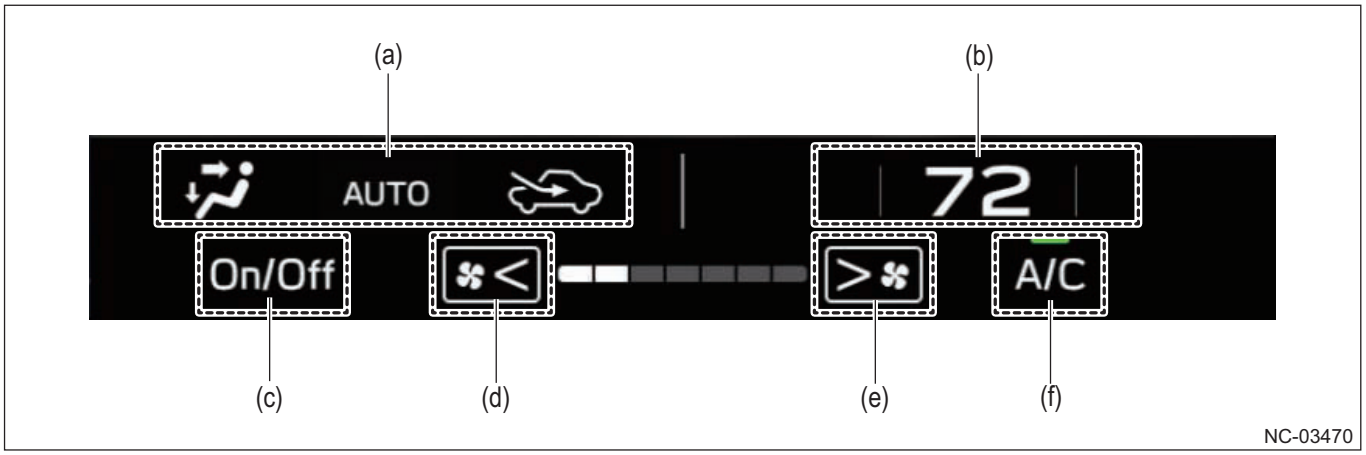
Icons in the Center Information Display

■ Air conditioning operation bar area

The air conditioning operation bar area is located in the lower area of the center information display.

By consolidating the switches, convenience is improved.

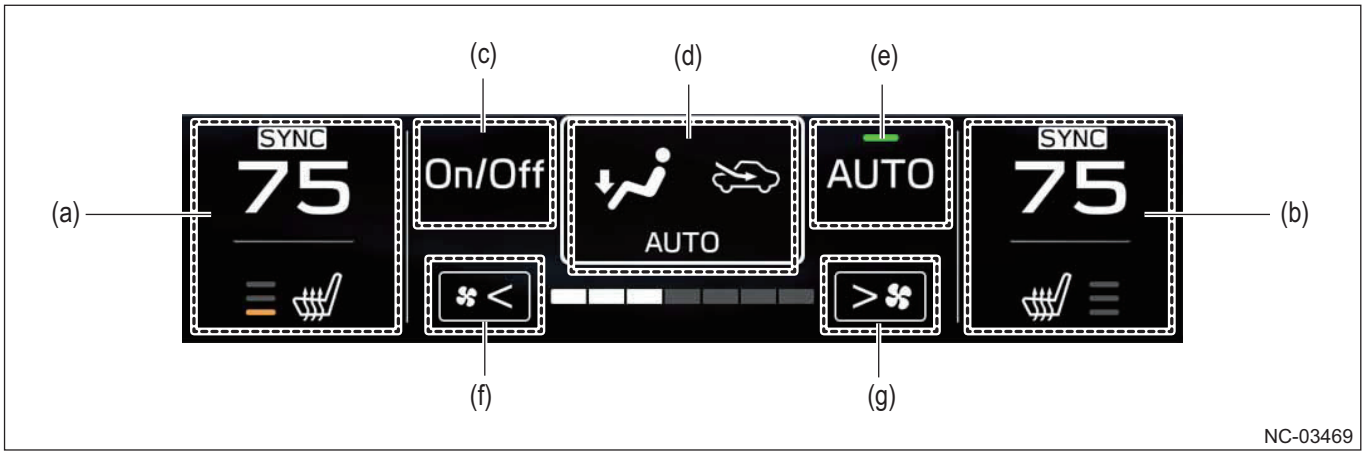
Models with Dual 7-inch display



**The illustration shows a typical example that may differ from the actual display.*

(a) Air conditioning status display
(b) Temperature detail setting button
(c) ON/OFF button
(d) Air flow volume control button (decrease)
(e) Air flow volume control button (increase)
(f) Customize button

Models with 11.6-inch center information display



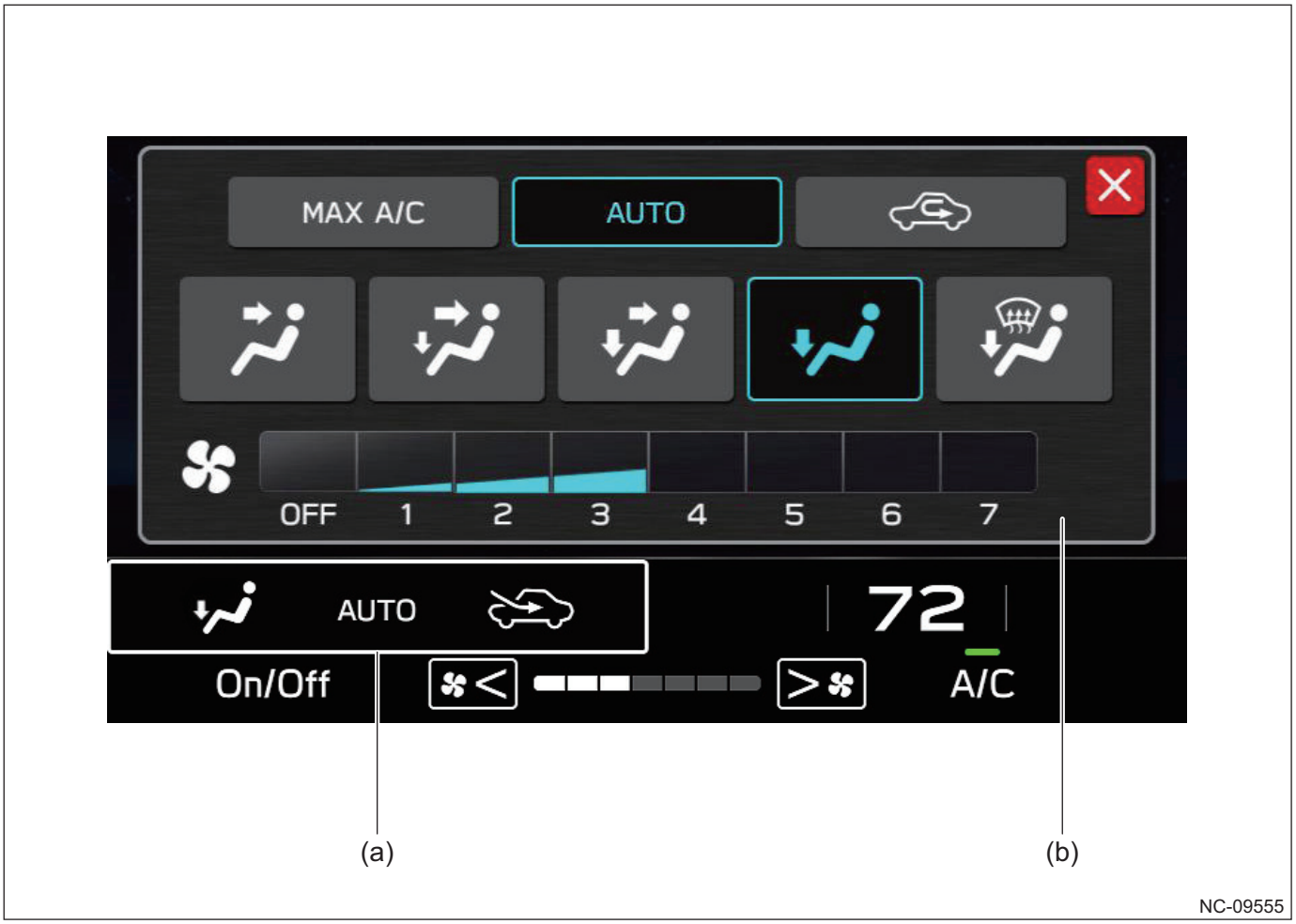
**The illustration shows a typical example that may differ from the actual display.*

(a) Temperature detail setting button (driver's seat side)
(b) Temperature detail setting button (passenger's seat side)
(c) ON/OFF button
(d) Air conditioning status display
(e) Customize button
(f) Air flow volume control button (decrease)
(g) Air flow volume control button (increase)

■ Pop-up display screen

▮ Air conditioning status display

Models with Dual 7-inch display



The illustration shows a typical example that may differ from the actual display.

(a) Air conditioning status display

(b) Pop-up display screen

When (a) is touched, (b) is displayed.

Models with 11.6-inch center information display

NC-09556

**The illustration shows a typical example that may differ from the actual display.*

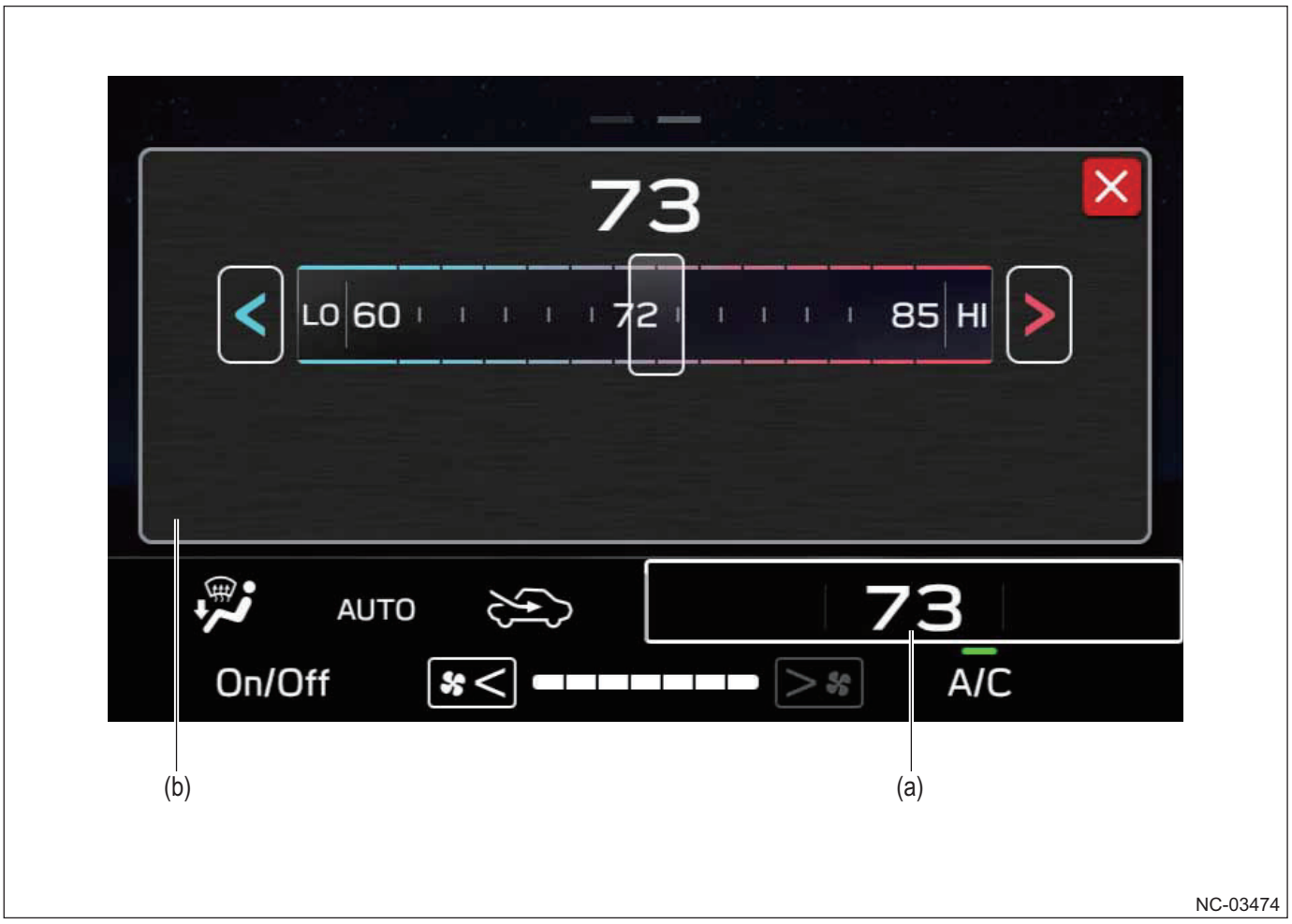
(a) Air conditioning status display

(b) Pop-up display screen

When (a) is touched, (b) is displayed.

▮ Temperature detail setting button

Models with Dual 7-inch display



**The illustration shows a typical example that may differ from the actual display.*

(a) Temperature detail setting button

(b) Pop-up display screen

When (a) is touched, (b) is displayed.

Models with 11.6-inch center information display

The illustration shows a typical example that may differ from the actual display.

(a) Temperature detail setting button

(b) Pop-up display screen

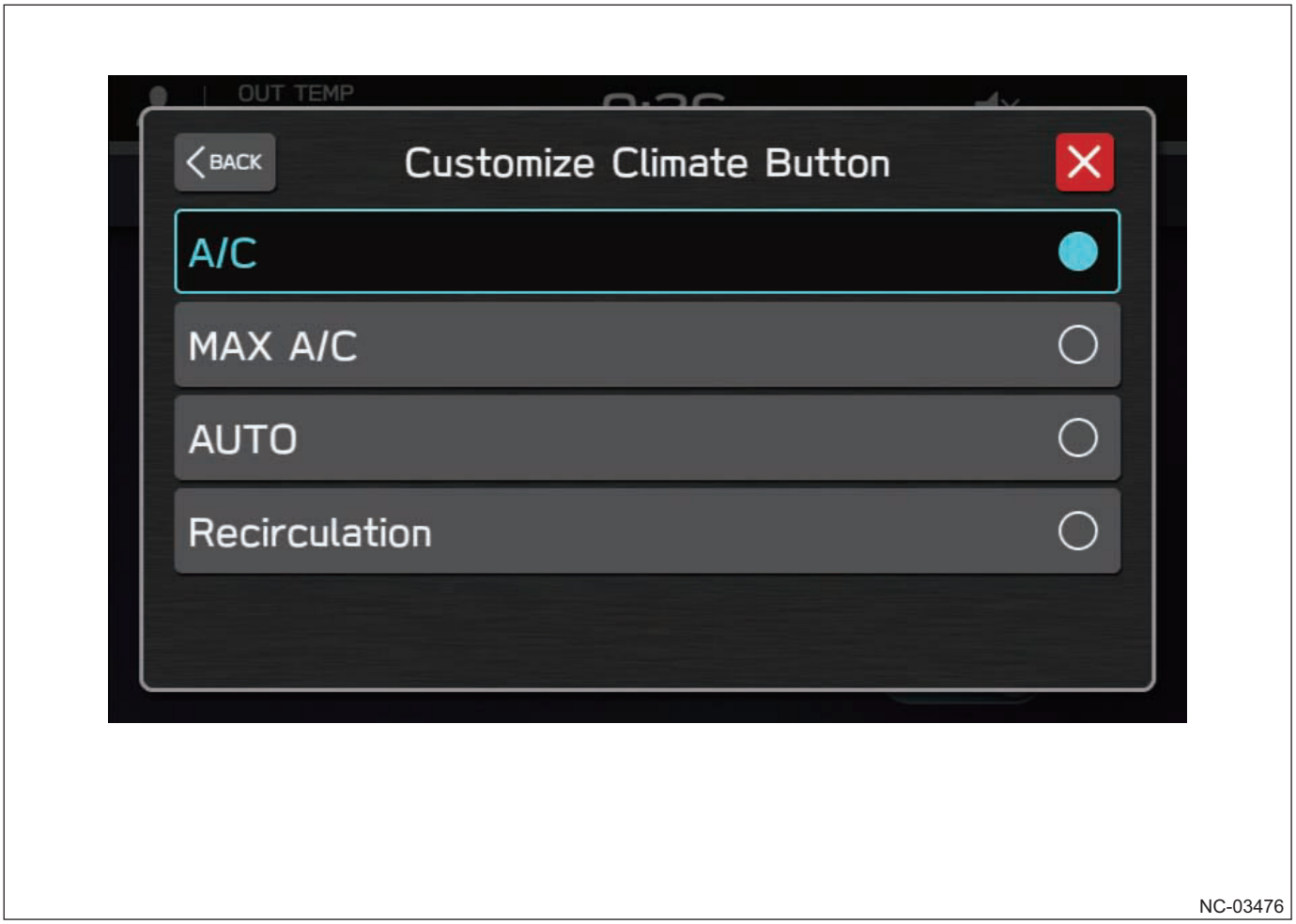
When (a) is touched, (b) is displayed.

■ Customize button setting

The icon displayed on the customize button can be arbitrarily changed in the setting screen of the center information display.

The setting screen for the air conditioning button can be opened by operating in the order of "General" → "Climate Control" → "Customize Climate Button".

Models with Dual 7-inch display



**The illustration shows a typical example that may differ from the actual display.*

Models with 11.6-inch center information display

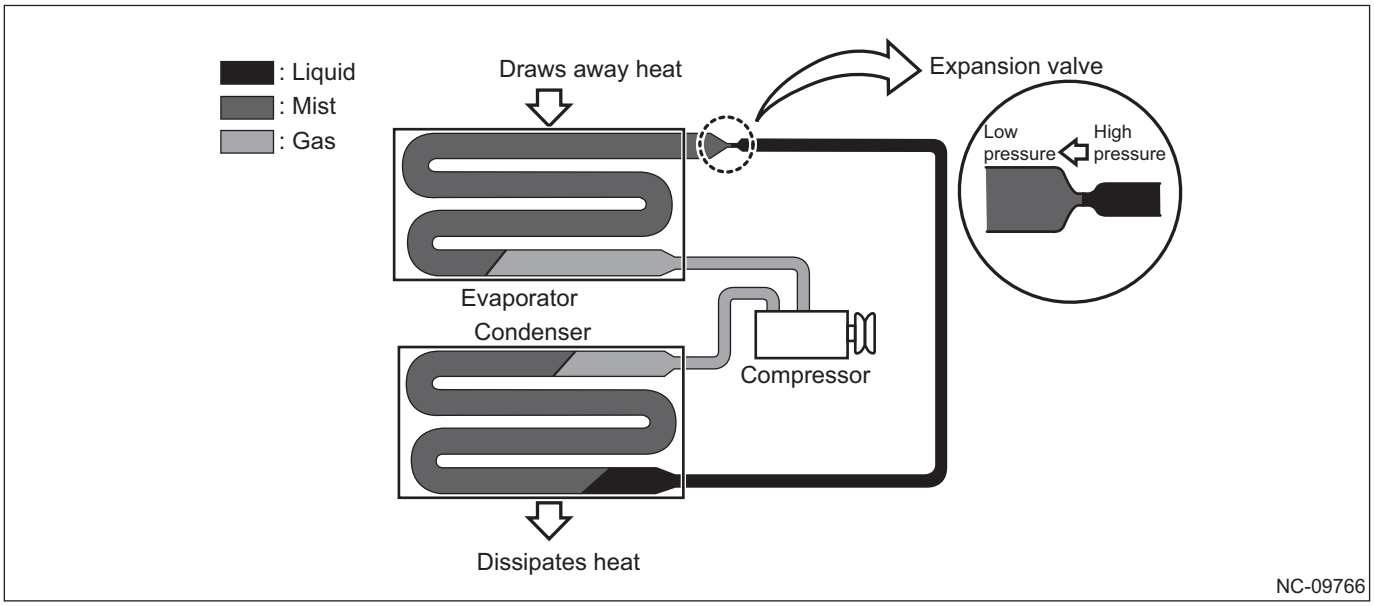
NC-09558

**The illustration shows a typical example that may differ from the actual display.*

Function

Refrigeration cycle

In the refrigeration cycle, refrigerant (gas) is sealed in a pipe to circulate the gas into the cycle that is composed of components such as a compressor, a condenser, and an evaporator. In the process where the refrigerant circulates into the cycle, changes (vaporization to liquefaction to vaporization) are repeated to perform cooling by absorbing the heat in the passenger room or releasing the heat outside the passenger room.

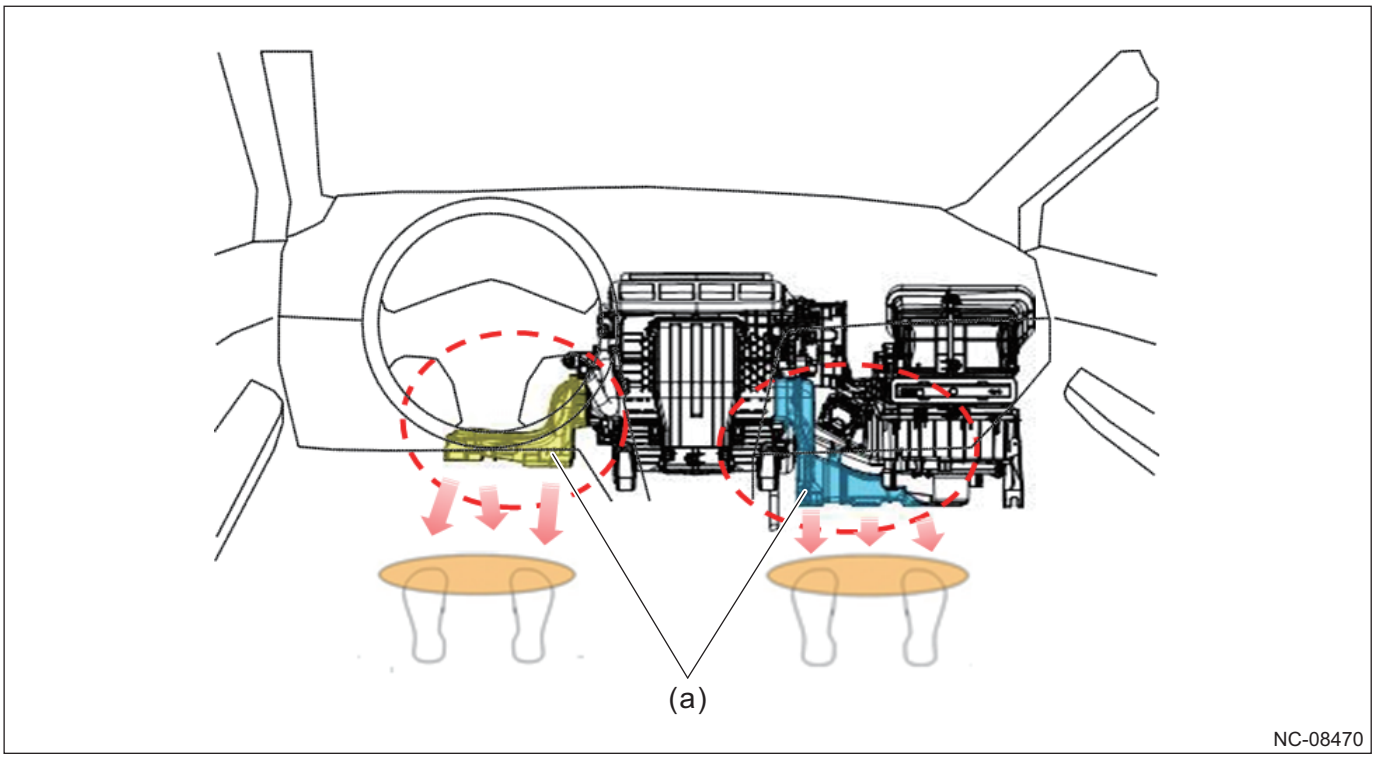


Main part name	Operations
Compressor	The compressor takes in low temperature, low pressure refrigerant gas vaporized by removing the heat by the evaporator and then compresses the gas to make it high temperature, high pressure gas to feed it to the condenser.
Condenser	The condenser cools the refrigerant gas with high temperature and high pressure fed from the compressor and then condenses and liquefies the gas.
Expansion valve	• The expansion valve injects liquid refrigerant at high temperature and high pressure from a small hole and inflates it rapidly. This causes the liquid refrigerant to become low temperature and low pressure misty refrigerant. • The expansion valve adjusts the amount of refrigerant, depending on refrigerant evaporation status in the evaporator.
Evaporator	When the misty refrigerant with lowered temperature and lowered pressure by the expansion valve is evaporated in large amount in the evaporator, the evaporator becomes a low temperature state. Cold air flows out when the wind passes through the low temperature evaporator.

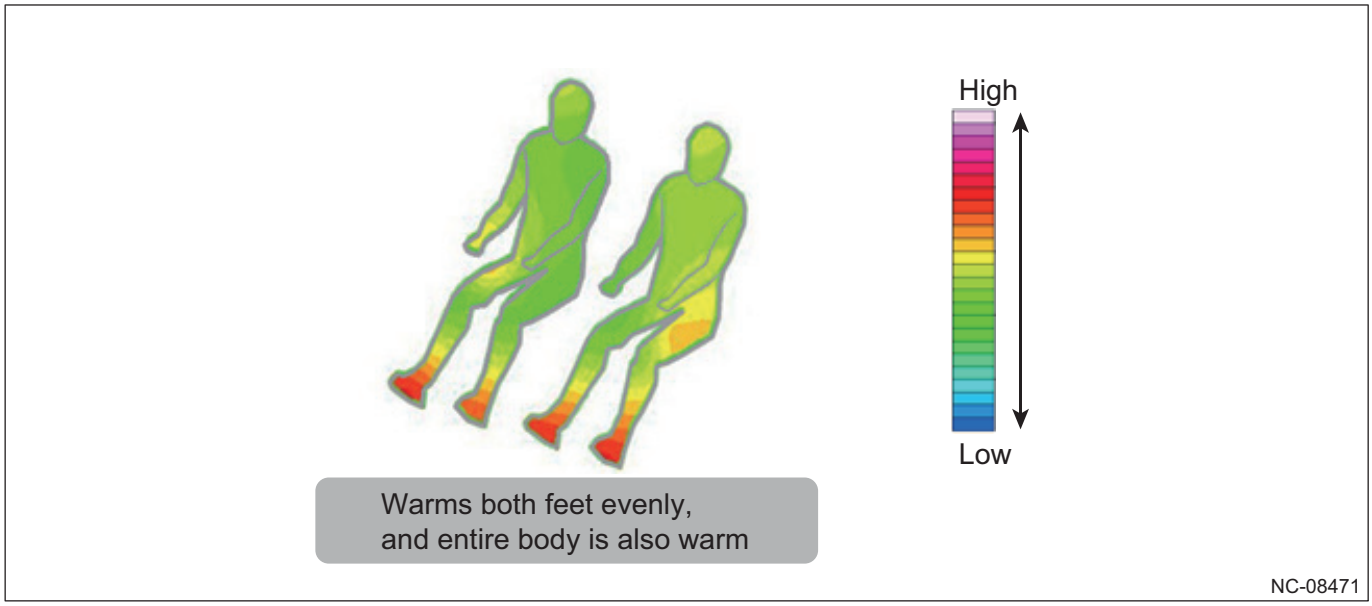
Achieving uniform cabin temperature

■ large foot duct

The foot duct is enlarged to provide an even temperature around the feet and the air is directed over the entire feet to increase the heating feel around the feet and improve comfort.



(a) Front foot duct



■ Multistage outlet mode

The multistage outlet mode is adopted to create a comfortable temperature space.

In particular, "VENT II" mode that sends a small amount of cool air around the feet during cooling is adopted to solve the moist feeling around the feet when hot. In addition to "VENT II", inter-mediate mode is added for the AUTO control to enable optimal air flow and provide more comfortable temperature space.

Outlet mode control list

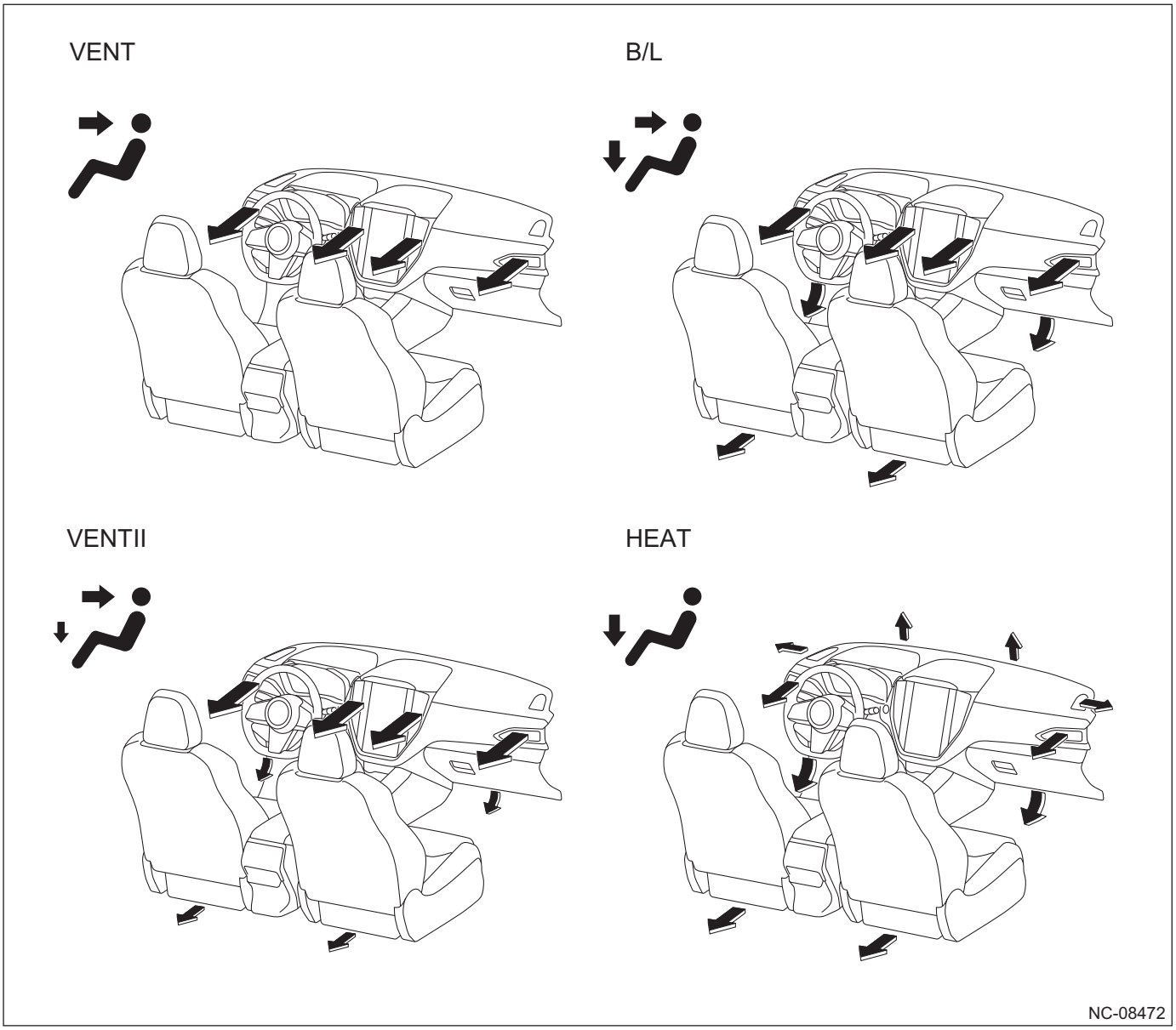
Mode							
VENT	VENT Ⅱ	B/L	Inter-mediate mode A ●	HEAT	Inter-mediate mode B ●	D/H	DEF
✓	✓	✓	★	✓	★	✓	✓

[Symbols] ✓: Selectable, ★: Operates during AUTO control

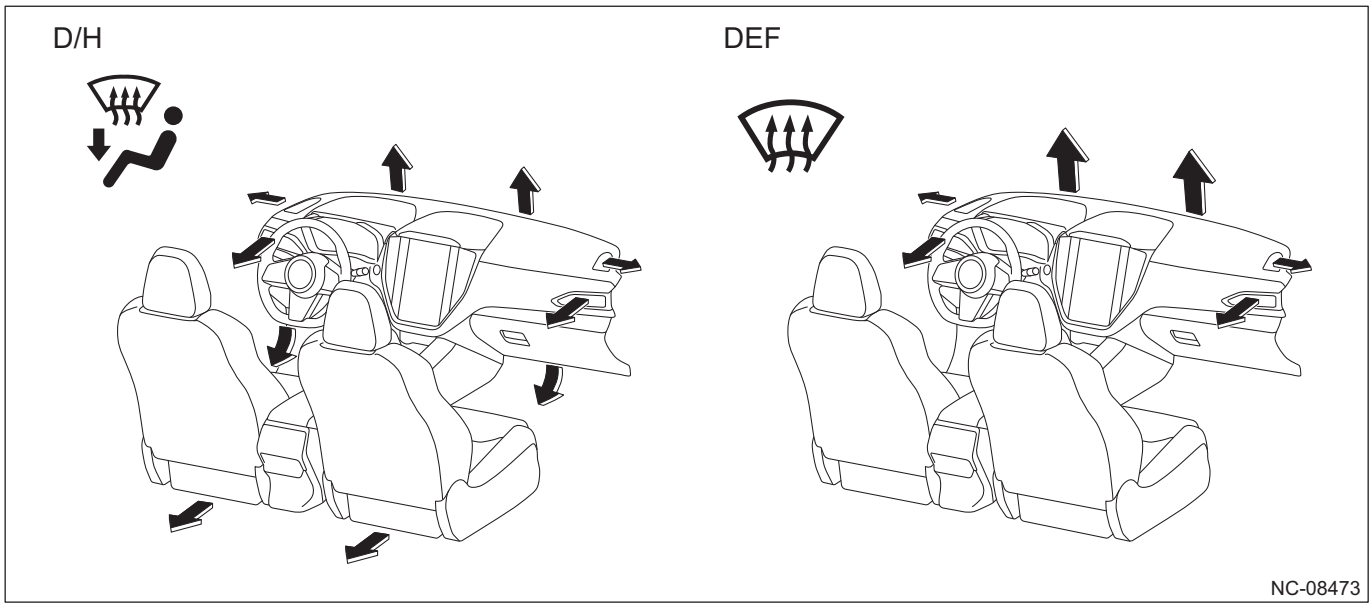
■ Mode display and air flow outlet

Each mode display and air conditioning air flow outlet are shown.

Driver/front passenger/rear seats



Defroster and heater



■ MAX A/C function

MAX A/C function that is helpful when quickly lowering the temperature is needed during summer, etc. is adopted.

When this function is activated, cooling is turned ON and the setting is automatically switched to temperature LO, air flow volume MAX, VENT mode, or internal air circulation to improve convenience.

10.3 Airbag system

10.3.1 Overview

Overview

In the airbag system, the following systems are adopted to improve passenger protection performance.

- Driver's and front passenger's airbags
- Driver's knee airbag
- Side airbag
- Curtain airbag
- Double belt pretensioner (passenger's seat)
- Pretensioner with force limiter (driver's seat and passenger's seat shoulder belts, shoulder belts of outer rear seats)
- Adaptive force limiter (passenger's seat)

In the layout of each sensor, the pressure sensor is arranged within the front door to enable early and stable collision sensing and operate the airbag safely to improve passenger protection performance.

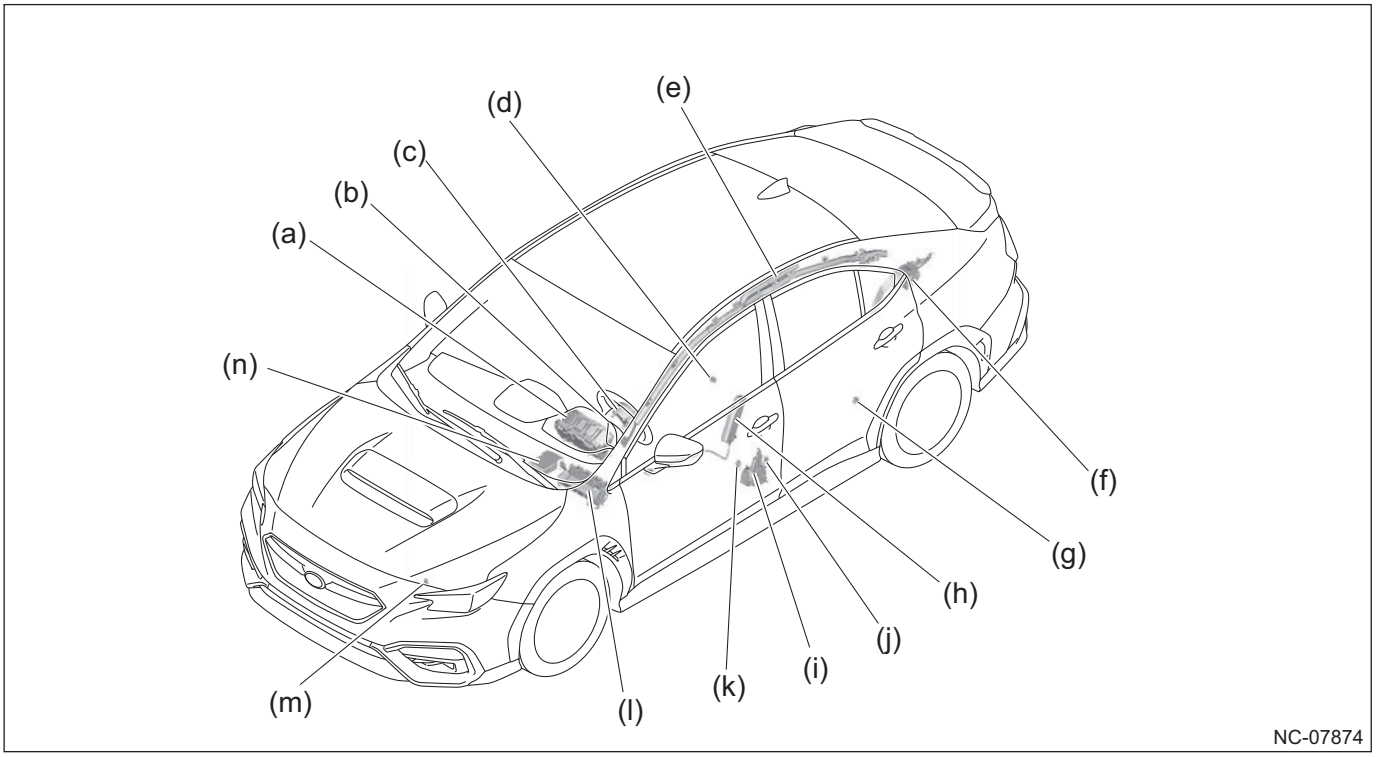
The seat belt locking tongues are adopted for the driver's and passenger's seats, and the outer rear seat.

An occupant detection sensor is adopted for the passenger's seat.

10.3.2 Component

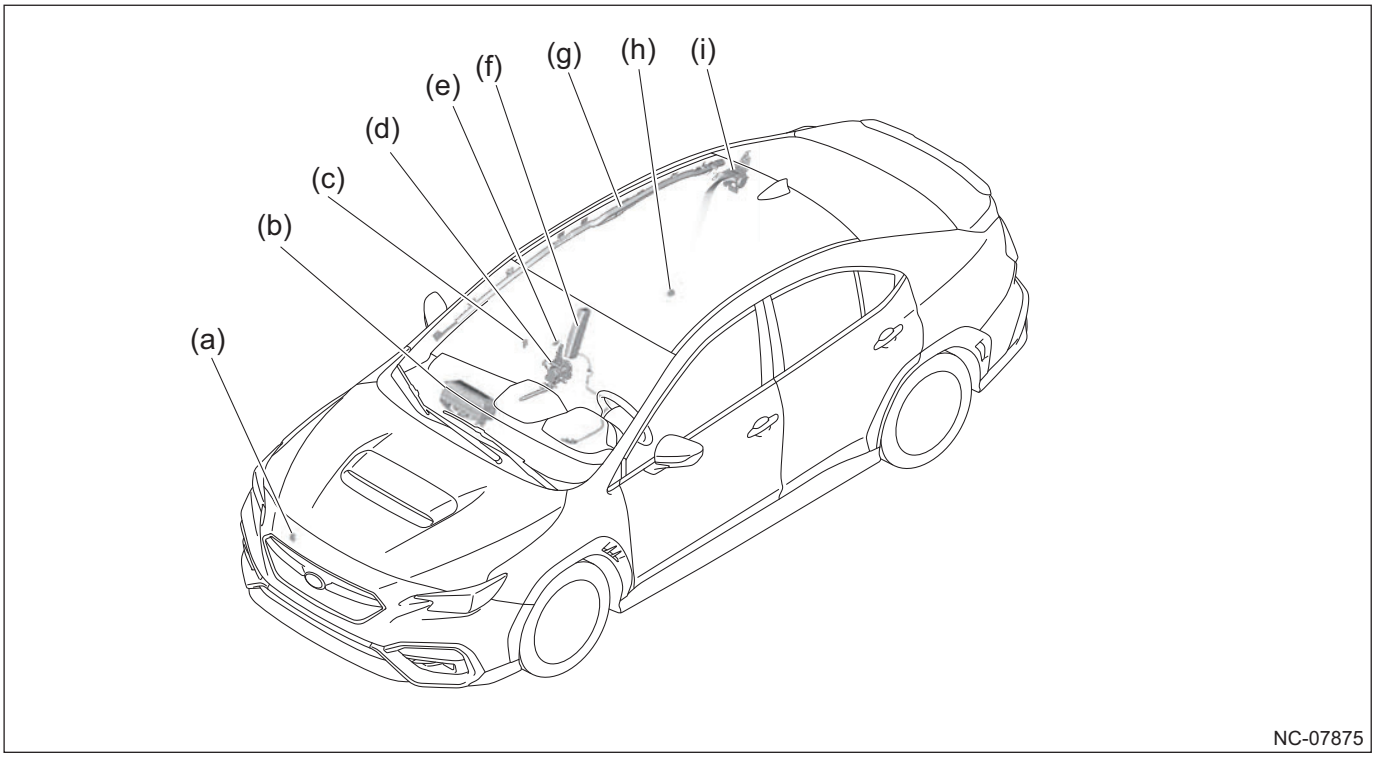
Component layout drawing

Airbag system, seat belt pretensioner 1



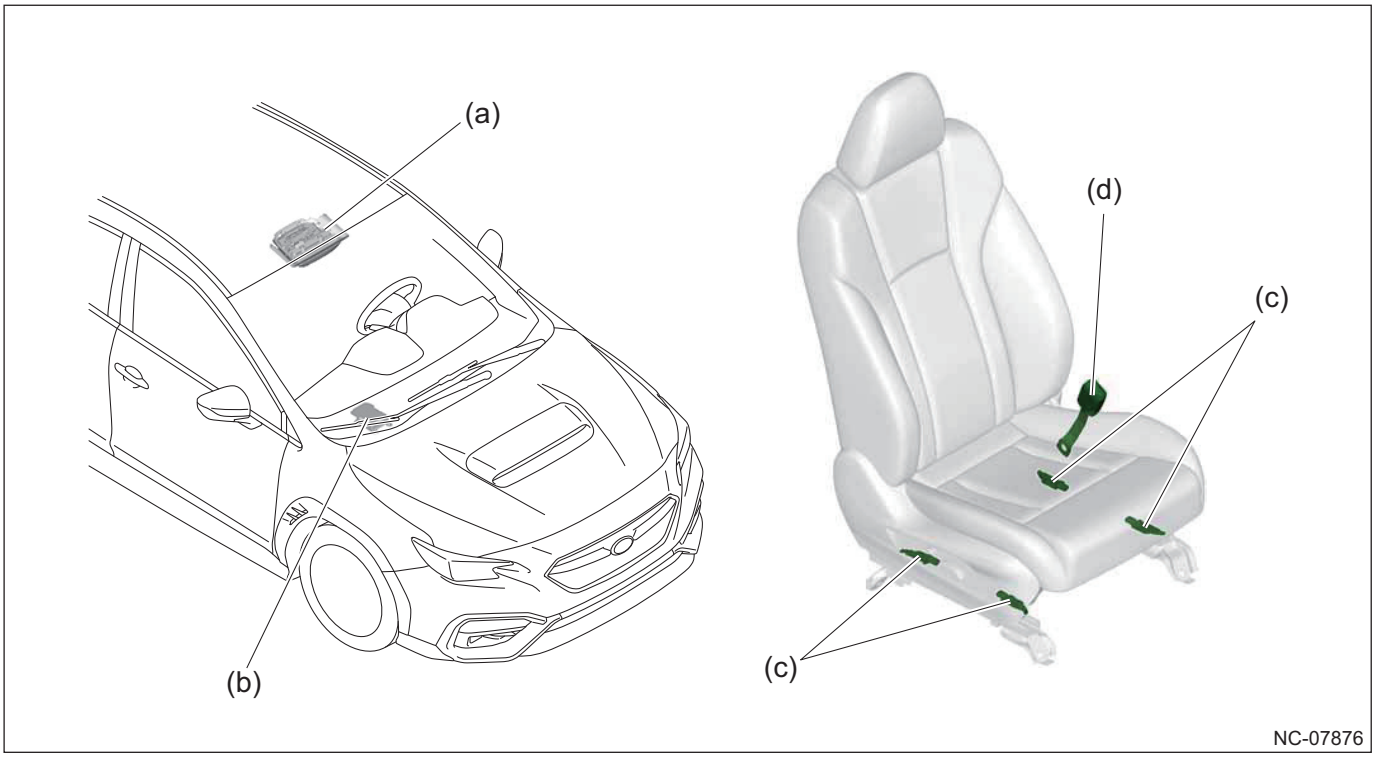
(a) Airbag warning light (in combination meter)
(b) Steering roll connector
(c) Driver's airbag module
(d) Side impact sensor (under the rear seat)
(e) Curtain airbag module LH
(f) Rear seatbelt pretensioner LH
(g) Side impact sensor LH (rear wheel house)
(h) Side airbag module LH
(i) Front seat belt pretensioner LH
(j) Side impact sensor LH (center pillar)
(k) Side impact sensor LH (front door)
(l) Knee airbag module
(m) Front impact sensor LH
(n) Airbag control module

Airbag system, seat belt pretensioner 2



(a) Front impact sensor RH
(b) Passenger's airbag module
(c) Side impact sensor RH (front door)
(d) Double belt pretensioner and adaptive force limiter RH
(e) Side impact sensor RH (center pillar)
(f) Side airbag module RH
(g) Curtain airbag module RH
(h) Side impact sensor RH (rear wheel house)
(i) Rear seatbelt pretensioner RH

Occupant detection system (passenger's seat)



(a) Passenger's airbag ON/OFF indicator light (in warning box)

(b) Airbag control module

(c) Occupant detection sensor

(d) Buckle switch (passenger's seat)

Component details

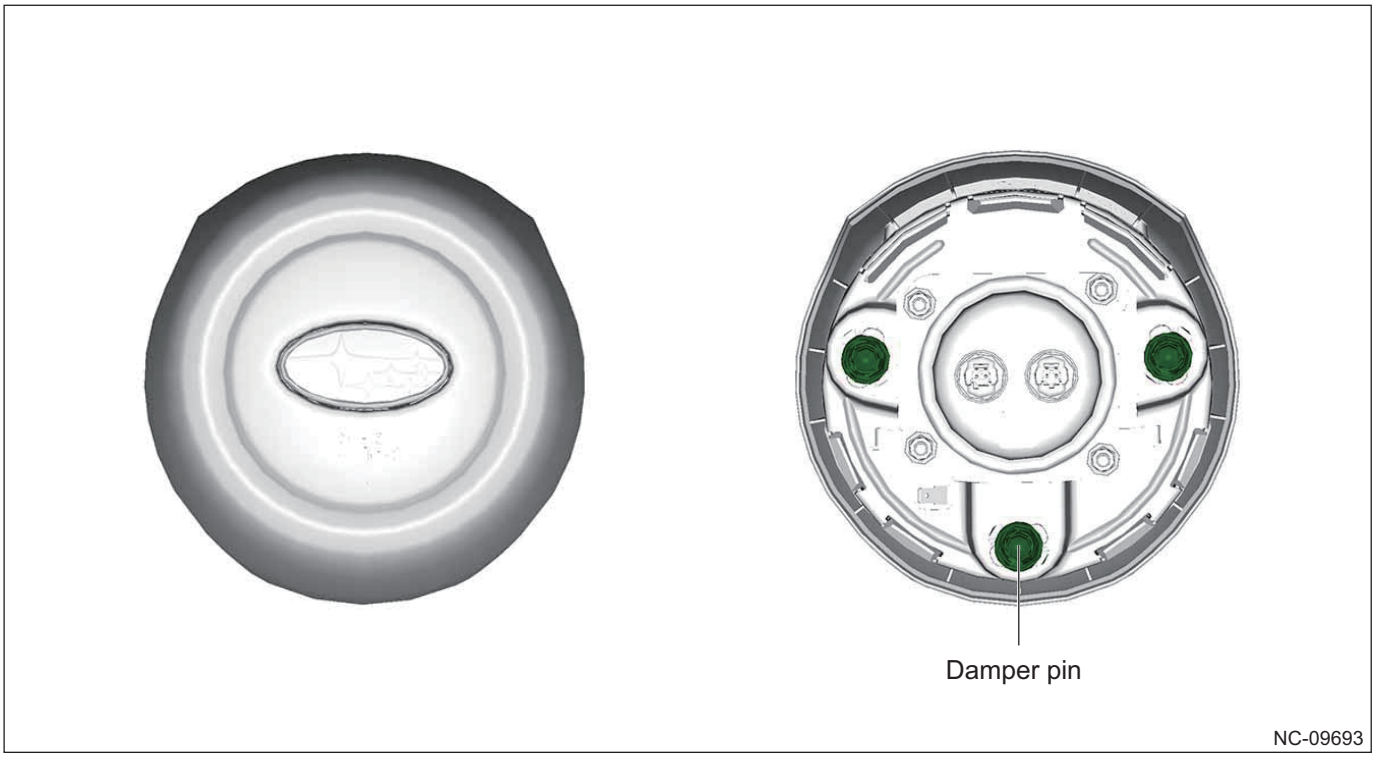
Driver's airbag module

The size of the driver's airbag module is reduced as a result of adopting a small steering wheel, reducing weight and improving the design.

Rubber is adopted for the installation structure of the airbag module, resulting in a structure where the entire airbag module functions as a steering mass damper. This reduces vibration from the road that is transmitted to the driver's hands while driving.

The damper mass is increased even while reducing the overall weight of the airbag module, ensuring ample mass that functions as a mass damper.

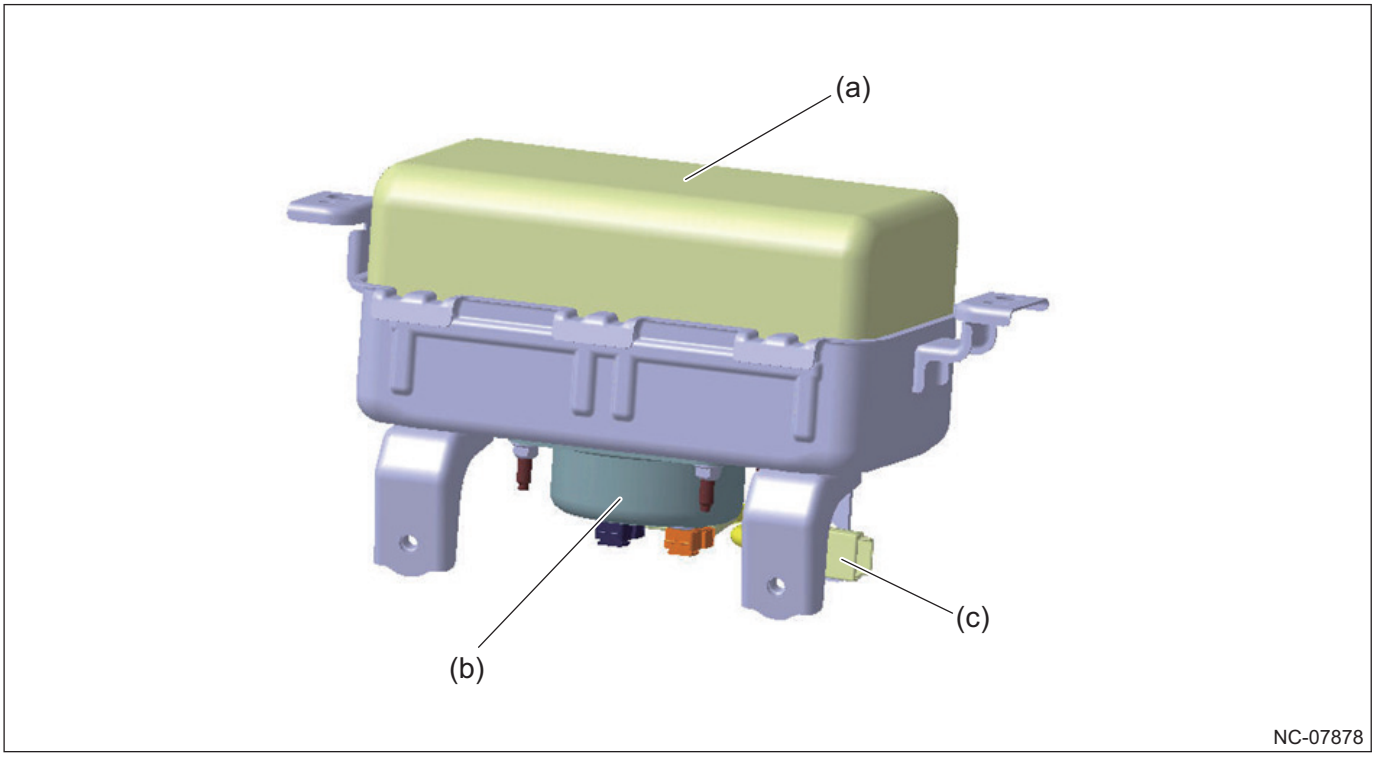
The driver's airbag module is a non-disassembling type, and is composed of a cover, case, inflator, airbag, etc.



Passenger's airbag module

The front passenger's airbag module is installed in the upper part in instrument panel on the front passenger's seat side.

The passenger's airbag module is a non-disassembling type, and is composed of a case, inflator, airbag, etc.

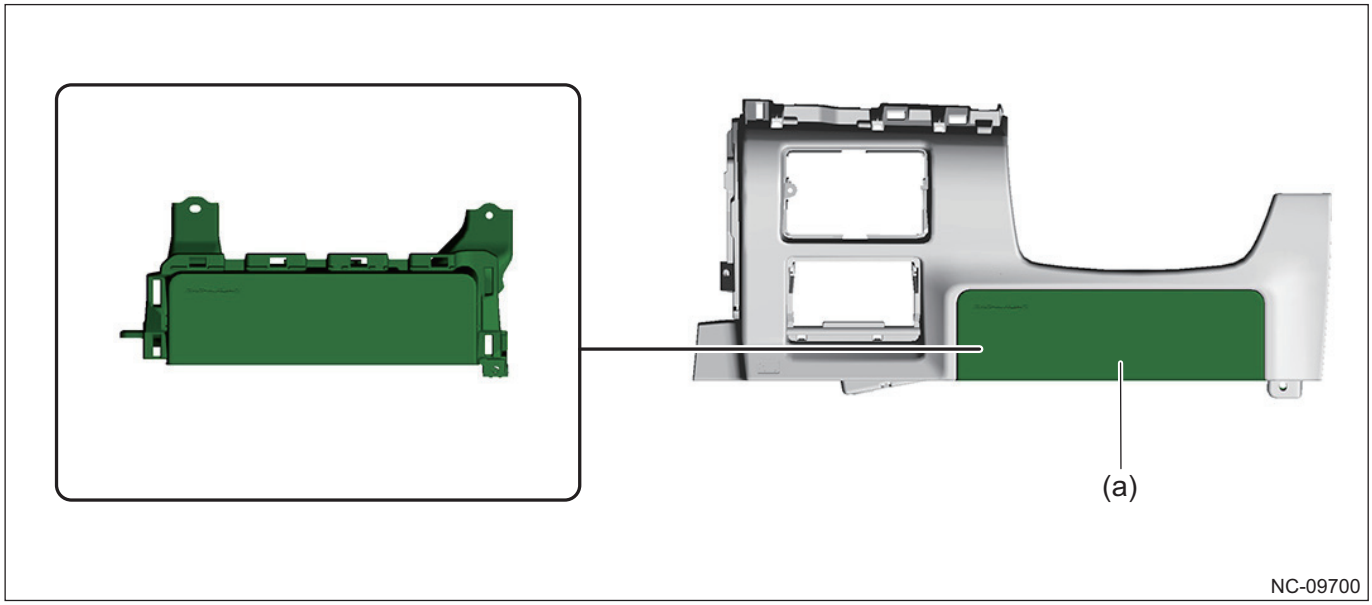


(a) Airbag
(b) Inflator
(c) Inflator connector

Knee airbag module

The knee airbag module is a non-disassembling type, and is composed of a cover, case, inflator, airbag, etc.

The case size is reduced for a lighter weight.

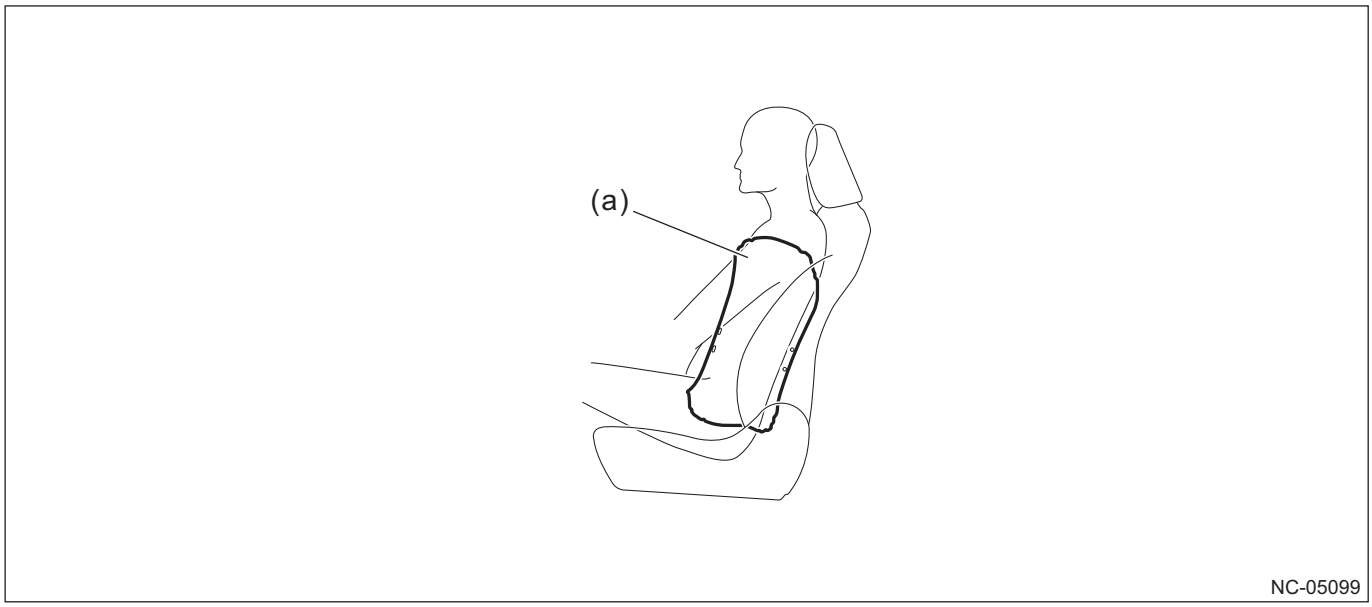


(a) Knee airbag module

Side airbag module

The side airbag modules are arranged in the seat backs of the driver's seat and passenger's seat. The side airbag module is a non-disassembling type, and is composed of an inflator, airbag, retainer, etc.

An airbag structure is adopted that reduces the harm to the occupant regardless of the occupant's position by restricting the amount that the airbag projects toward the vehicle front.

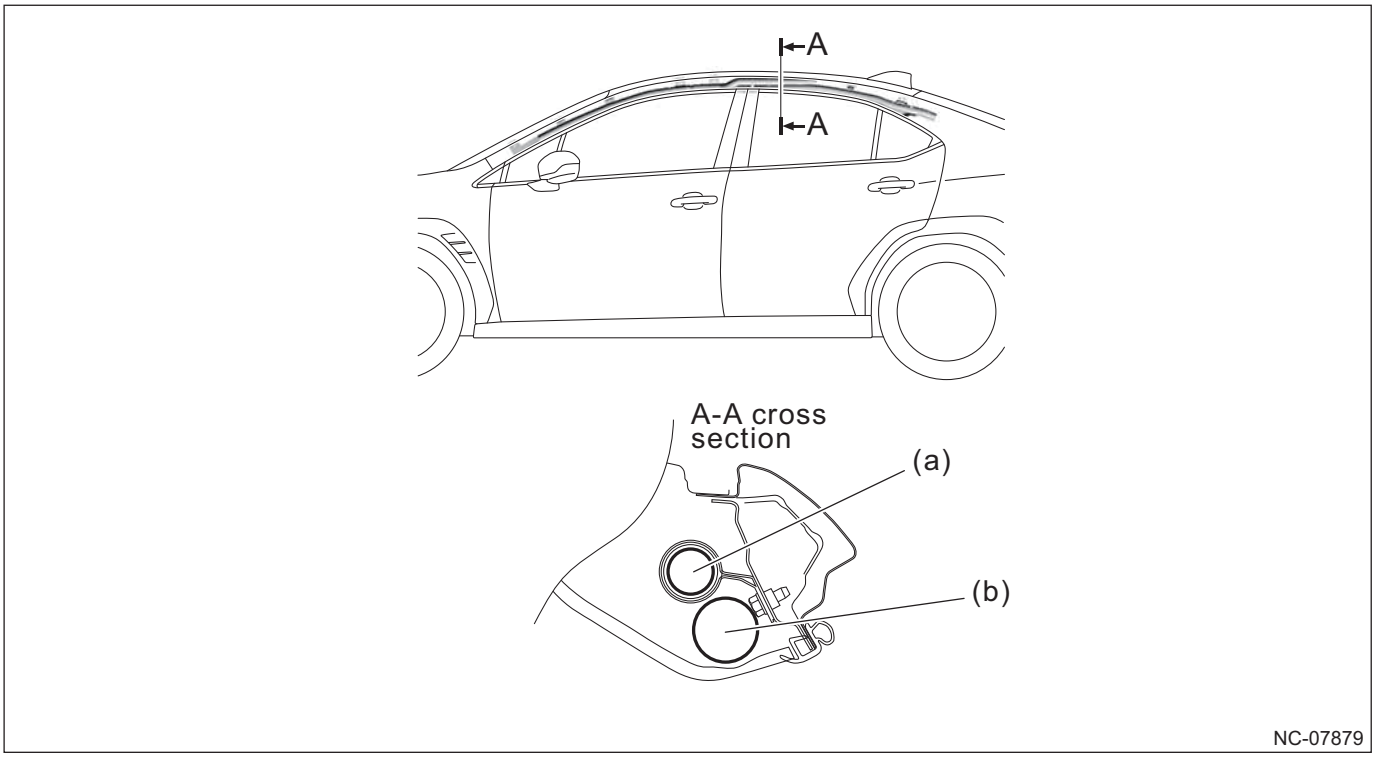


(a) Side airbag module

Curtain airbag module

The curtain airbag module is a non-disassembling type, and is composed of an inflator, airbag, etc.

The inflator position is moved to the B pillar to adopt earlier timing for protecting front seat occupants, improving the passenger protection performance. Also, resin is adopted for the bracket for a lighter weight.



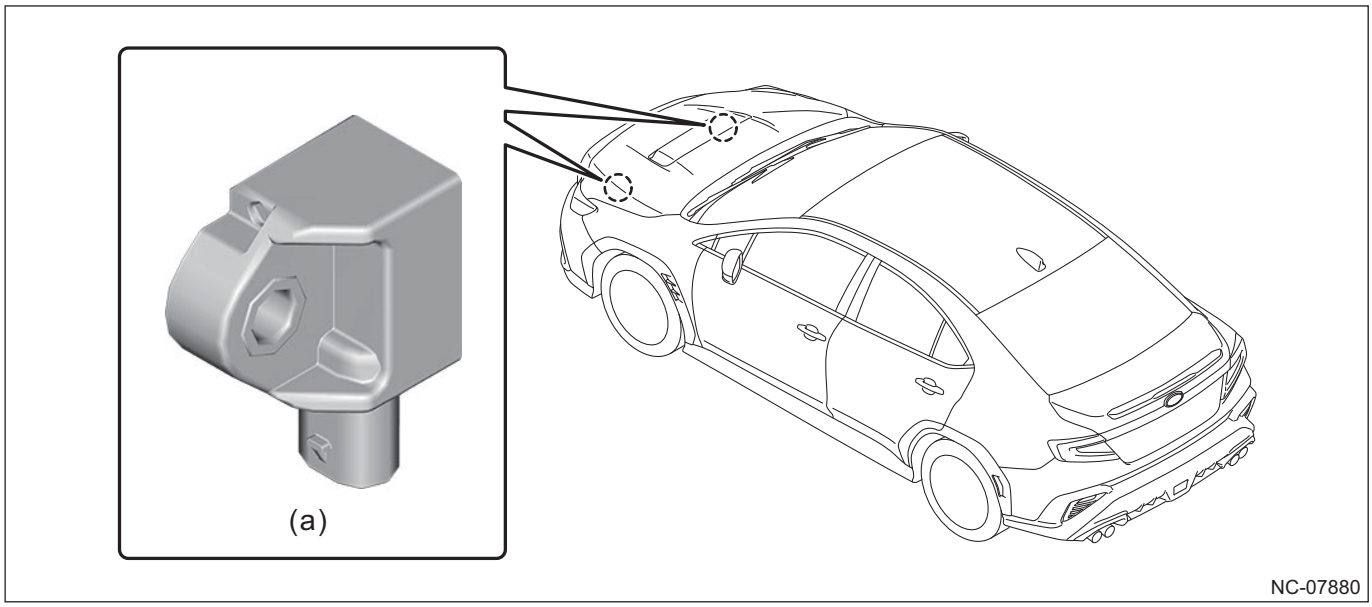
(a) Inflator

(b) Airbag

Front impact sensor

The front impact sensors are composed of a semiconductor type G sensor, a communication circuit, etc., sense the impact from the front, and send the deceleration signal to the airbag control module.

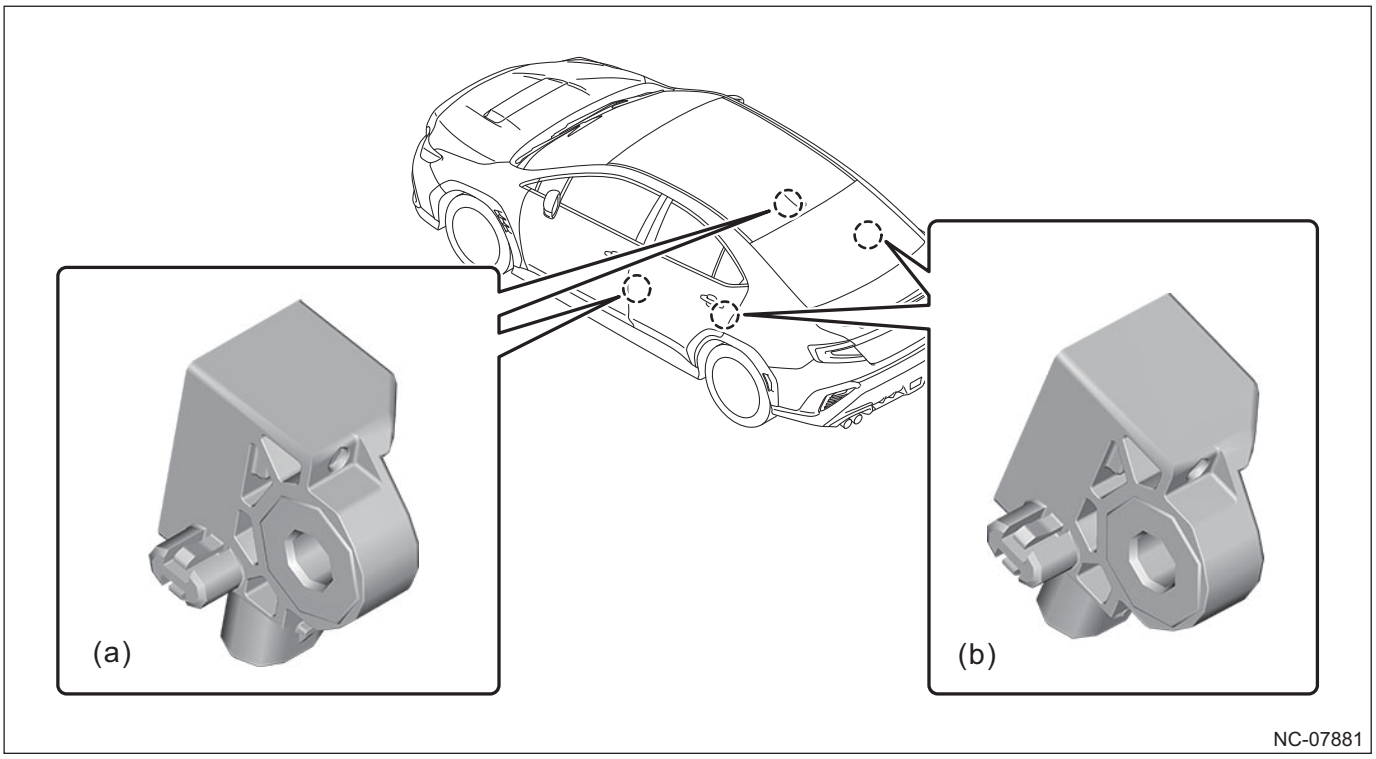
By adding the Y-axis (lateral direction) sensor to the front impact sensor and using two axes, the optimal airbag deployment control suitable for wider collision conditions is achieved.



(a) Front impact sensor

Side impact sensor (center pillar), side impact sensor (rear wheel house)

Side impact sensor (center pillar) is installed on the bottom of the B pillar, and the side impact sensors (rear wheel houses) are installed at front of the rear wheel house. They are composed of a semiconductor type G sensor, a communication circuit etc., and sense the impact from the side and send the deceleration signal to the airbag control module.

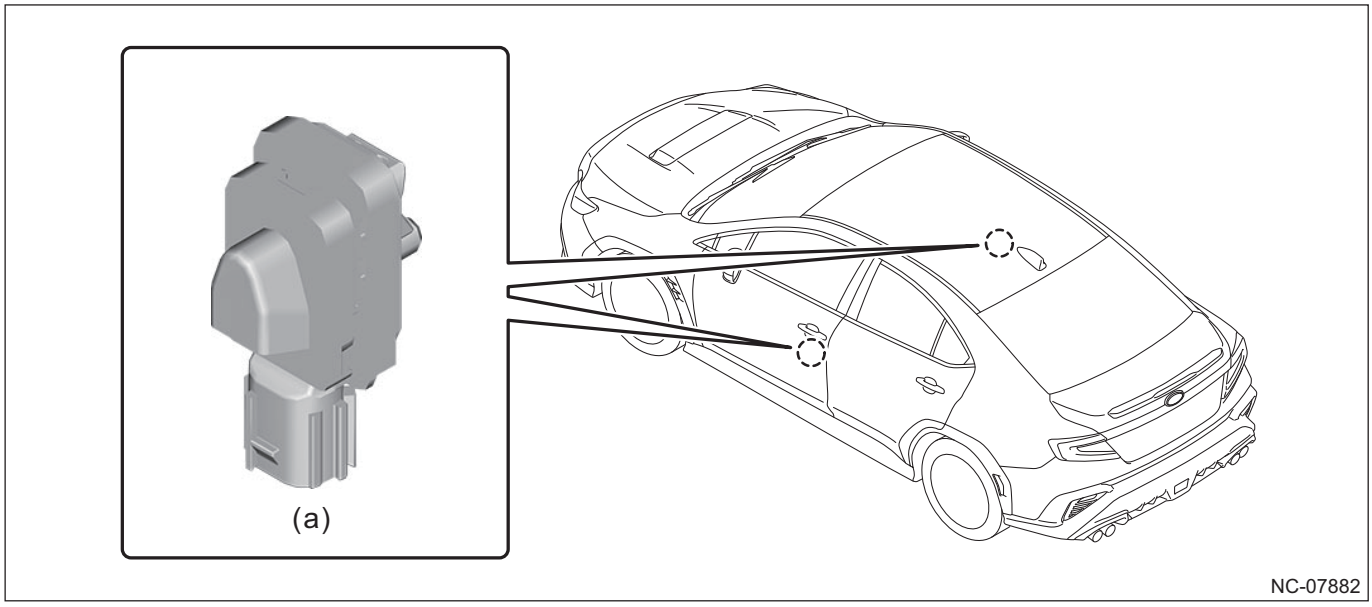


(a) Side impact sensor (center pillar)

(b) Side impact sensor (rear wheel house)

Side impact sensor (front door)

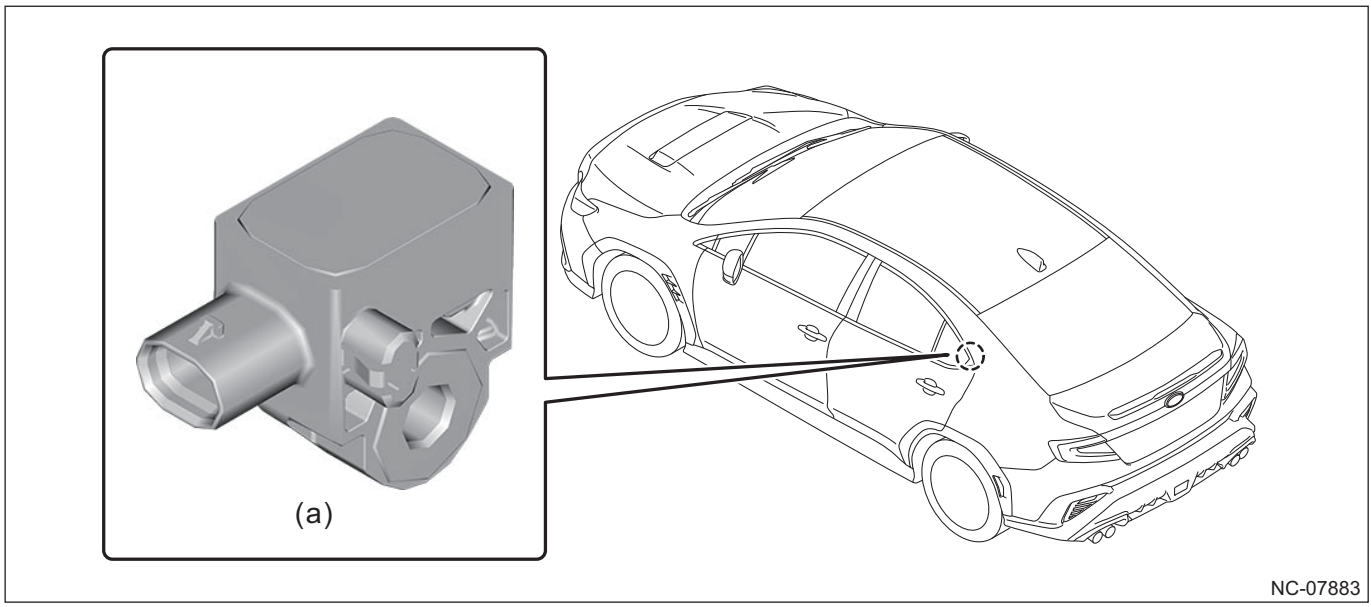
The pressure sensor is installed on the front door panel passenger room side. It is possible to make the sensing earlier by detecting the deformation of the door as a pressure instead of the G sensor which relies on transmission of amount of deceleration on collision. Also, since the dependence on the amount of deceleration is low, the risk of erroneous ignition is reduced.



(a) Side impact sensor (front door)

Side impact sensor (under the rear seat)

The side impact sensor is installed under the center of rear seat. They are composed of a semiconductor type G sensor, a communication circuit etc., and sense the impact from the side and send the deceleration signal to the airbag control module.



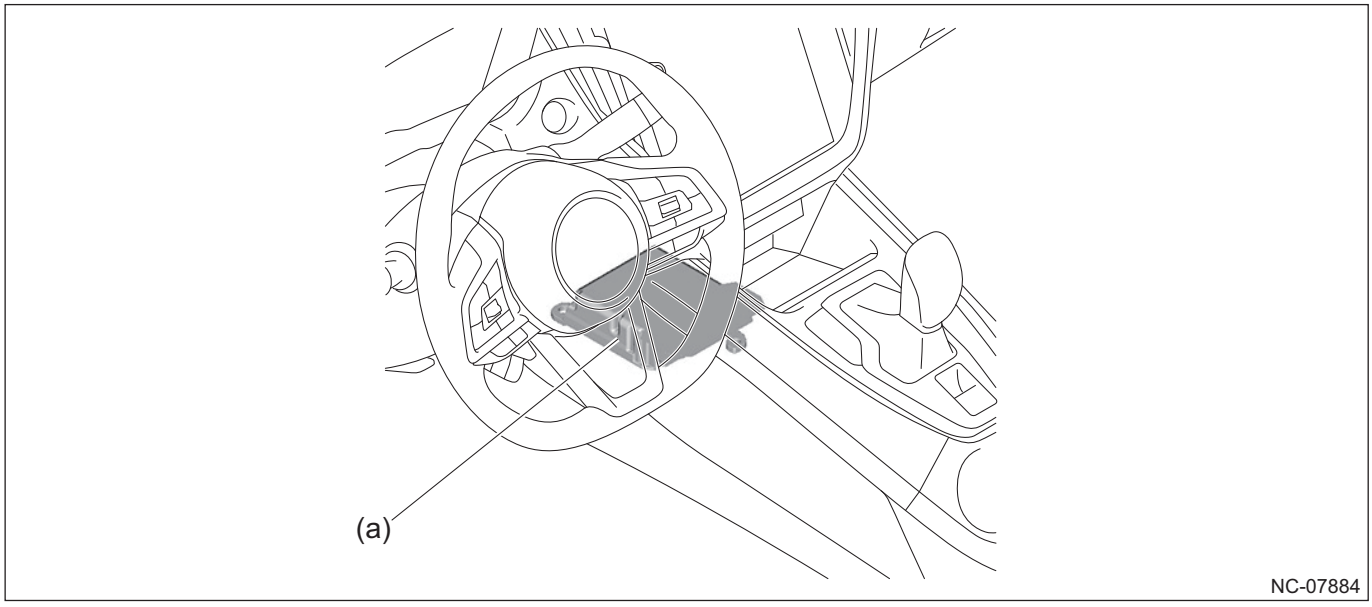
(a) Side impact sensor (under the center of rear seat)

Airbag control module

The airbag control module is installed in front of the shift lever under the center console. The airbag control module is composed of G sensor, ignition determination circuit, a backup power supply, etc.

The airbag control module, based on signals from each of the sensors and sensor signals inside the airbag control module, determines ignition of the driver's airbag, passenger's airbag, driver's knee airbag, side airbag, and curtain airbag modules, as well as seat belt pretensioner and double belt pretensioner, depending on conditions. The airbag control module is also provided with a diagnosis function and performs self diagnosis when there is a system anomaly.

The occupant detection control module, which was previously an independent module, is integrated into the airbag control module, achieving weight reduction.

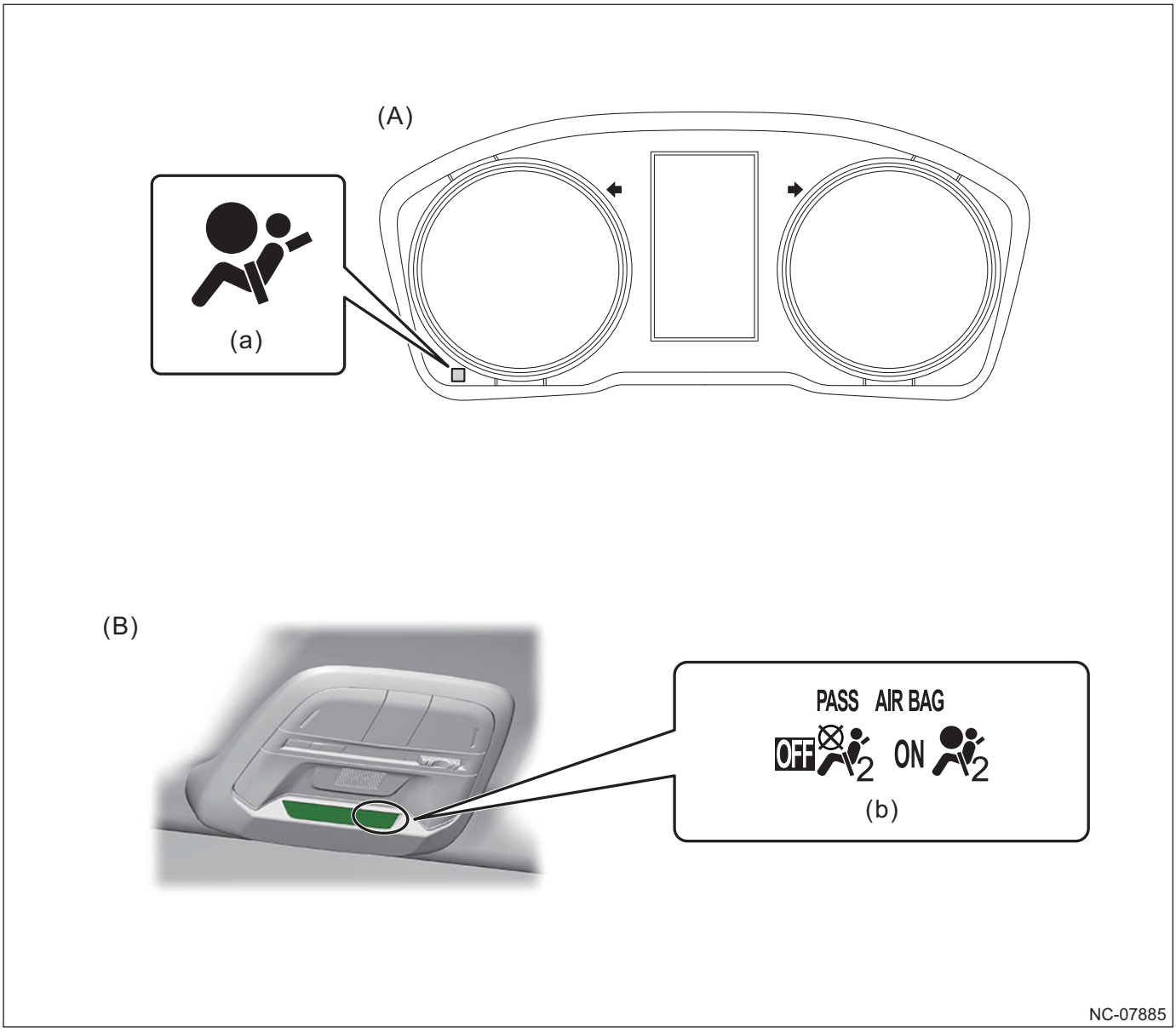


(a) Airbag control module

Airbag warning light

When there is a system anomaly, the airbag warning light arranged in the combination meter turns on to warn the driver.

The status of the passenger's airbag (ON or OFF) is indicated by the passenger's airbag indicator light arranged in the warning box.



(A) Combination meter

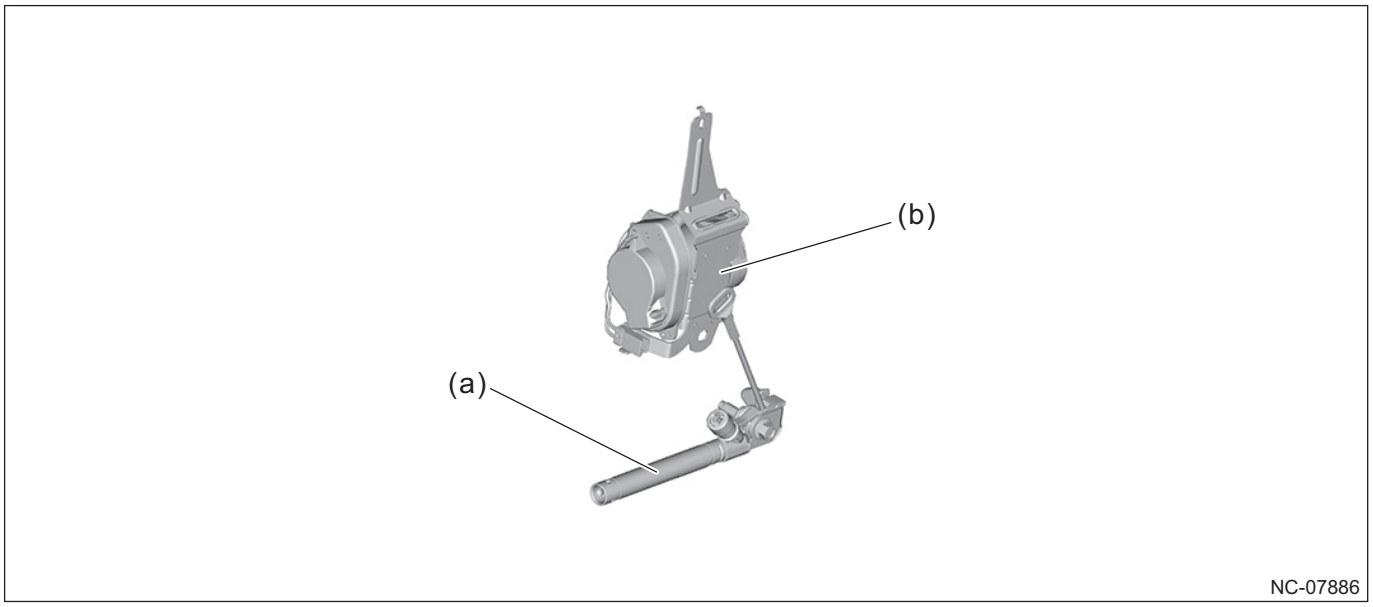
(B) Warning box

(a) Airbag warning light

(b) Passenger's airbag ON/OFF indicator light

Double belt pretensioner (passenger's seat)

A double belt pretensioner that has adopted pretensioners for both the shoulder belt and lap belt of the passenger's seat belt is installed.



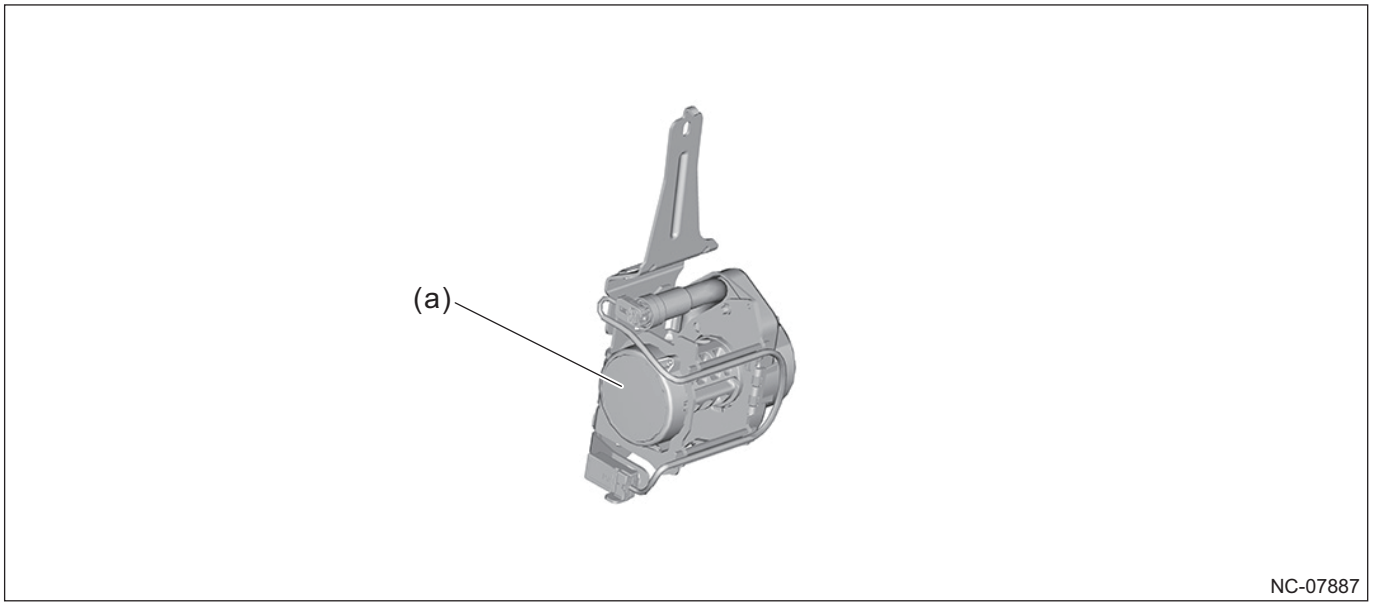
(a) Lap belt pretensioner (lap belt pretensioner RH)

(b) Shoulder belt pretensioner

Seat belt pretensioner (driver's seat, rear outer seat)

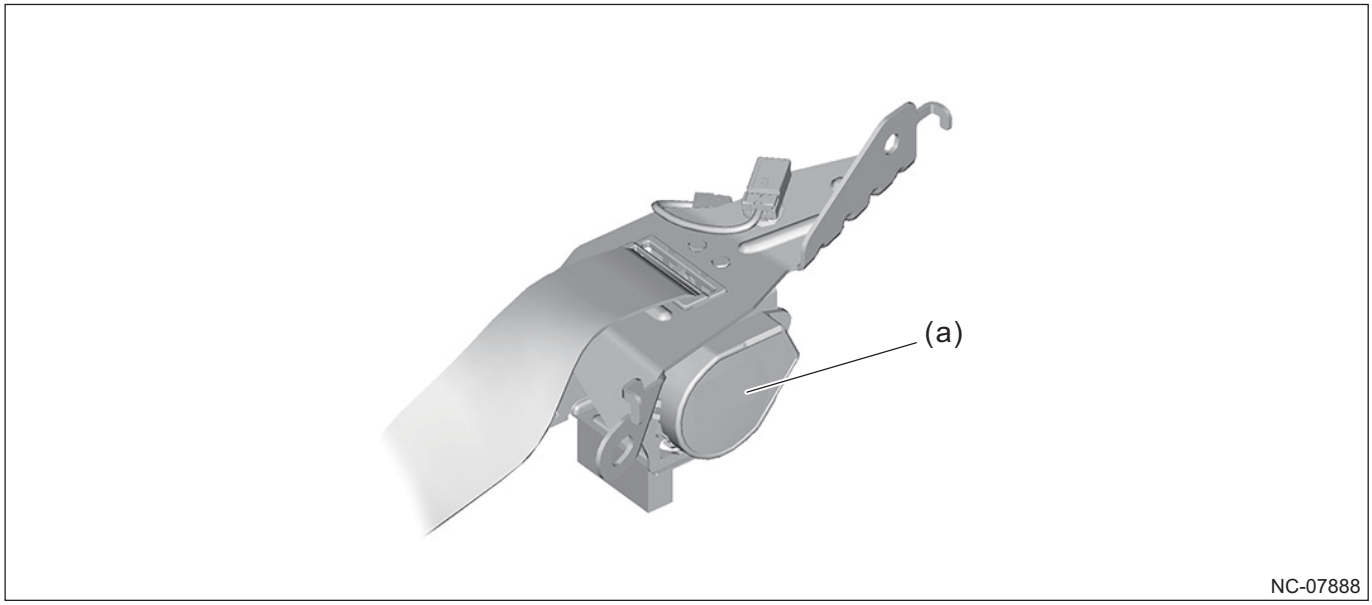
The seat belt pretensioner that increases passenger restraint to reduce injury value on collision is adopted for the driver's seat and outer rear seats.

Driver's seat belt pretensioner



(a) Shoulder belt pretensioner

Seat belt pretensioner for outer rear seat



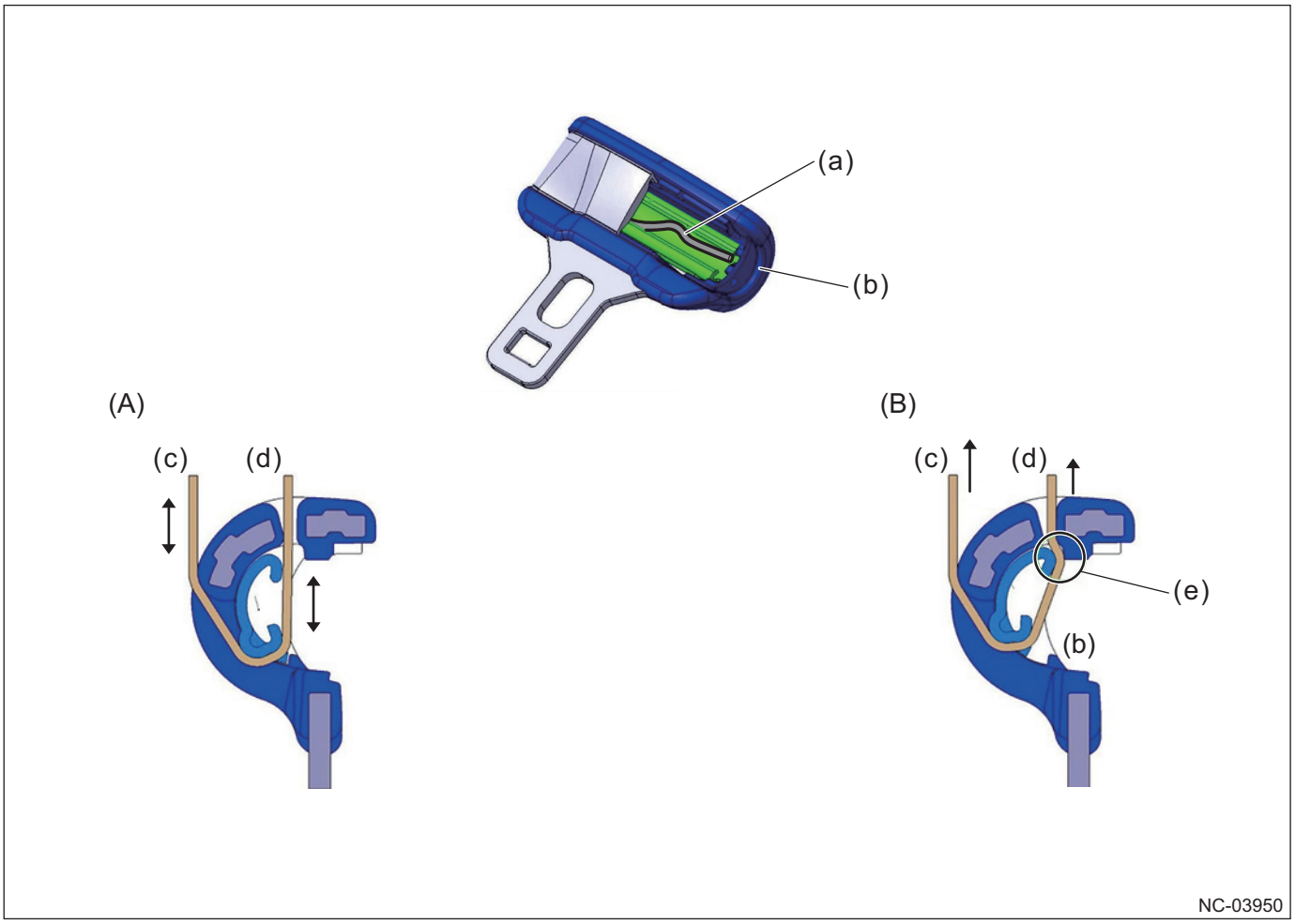
(a) Seat belt pretensioner

Locking tongue

The locking tongue, which locks the lap belt to increase passenger restraint and reduce injury on collision, is adopted for the driver's seat, passenger's seat, and the (outer) rear seats.

Normally, the belt freely moves on the cam of the tongue. When a certain load is applied to the belt on collision or in other situations, the shear rib is disconnected and the cam rotates so that the belt is trapped between the cam and tongue to lock the belt. This keeps the shoulder belt from being pulled down on the lap belt side to suppress tension on the shoulder belt.

Inner construction of locking tongue



(A) Under normal conditions

(B) On collision

(a) Lock member

(b) Tongue (curled portion)

(c) Lap belt side

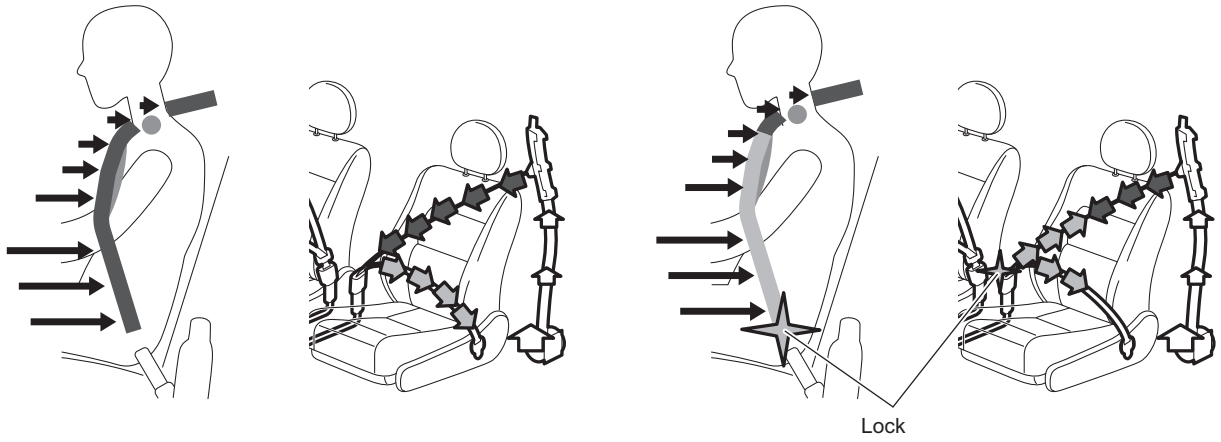
(d) Shoulder belt side

(e) Belt secured by the tongue curl and lock member

Chest area protection mechanism on collision by the locking tongue (driver's seat)

When the lap moves forward on collision, the load on the lap belt increases, and the load under the breast area also increases.

The belt is locked with the locking tongue on collision to suppress the lap belt movement and reduce the load under the breast area.



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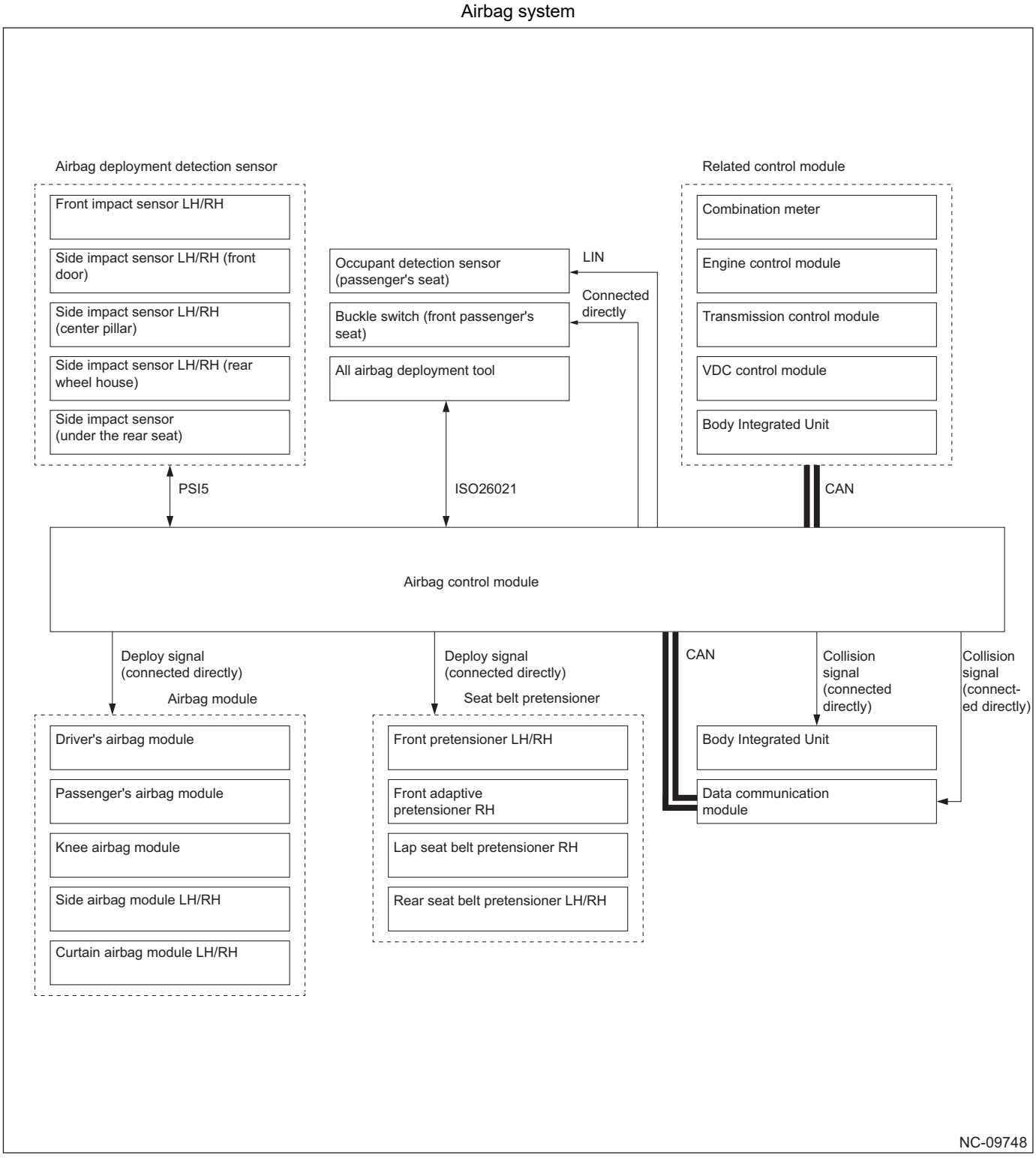
10.3.3 Construction and Operation

System diagram



Main component functions

Component		Function
Steering roll connector		Transmits the ignition signal from the airbag control module to the driver's airbag module.
Driver's airbag module		Composed of an inflator and bag. The gas generated by the inflator according to the ignition signal from the airbag control module makes the bag inflate instantaneously to alleviate the impact on the occupant.
Passenger's airbag module		
Knee airbag module		Composed of an inflator and bag. The gas generated by the inflator according to the ignition signal from the airbag control module makes the bag inflate instantaneously to alleviate the impact on the legs of the occupant.
Side airbag module		Composed of an inflator and bag. The gas generated by the inflator according to the ignition signal from the airbag control module makes the bag inflate instantaneously to alleviate the impact on the chest of the occupant.
Curtain airbag module		Composed of an inflator and bag. The gas generated by the inflator according to the ignition signal from the airbag control module makes the bag inflate instantaneously to alleviate the impact on the head of the occupant.
Seat belt pretensioner		• The pretensioner mechanism includes a gas generator that ignites according to the ignition signal from the airbag control module, winding up the seat belt instantaneously to increase the restraining effect on the occupant. • When a load of a specified value or higher is applied to the seat belt, the force limiter mechanism maintains this specified value and reduces the impact on the chest.
Front impact sensor		Detects the deceleration and door internal pressure during a collision, and sends a signal for determining ignition to the airbag control module.
Side impact sensor	Center pillar	
	Rear wheel house	
	Front door	
	Under the rear seat	
Combination meter		When there is a system anomaly, the airbag warning light turns on to warn the driver.
Airbag control module		• Composed of a safing circuit, ignition drive circuit, G sensor, etc. • Determines the ignition based on the signals from the built-in G sensor, front impact sensor, and side impact sensor, and sends the ignition signal to the airbag module and seat belt pretensioner. • When there is a system anomaly, performs system diagnosis by switching to diagnosis mode.

System details

Airbag system

The airbag system protects passengers in the vehicle on collision in combination with the following systems.

Airbag	If the passengers receive a strong impact force that could lead to serious injury, bags which act as cushions are instantly inflated along with the physical restraining actions of the seat belts to alleviate the impact on the passenger's heads, chests, and legs (driver).
Seat belt pretensioner	The seat belt pretensioner increases the restraining effect on the passenger by instantaneously pulling the seat belt inward when the vehicle receives a strong impact force.
Adaptive force limiter	The adaptive force limiter switches the force limiter (EA: energy absorber) load according to the collision form to optimally control the passenger restraint.

Notes

The airbag system is effective when the seat belts are correctly fastened with the passengers in the correct seating posture. Do not place objects or attach accessories close to the airbag deployment areas. Passengers may result in injury when operating. Also, if there is any cracking or damage in the airbag deployment sections, do not use the airbag as is and consult your retailer.

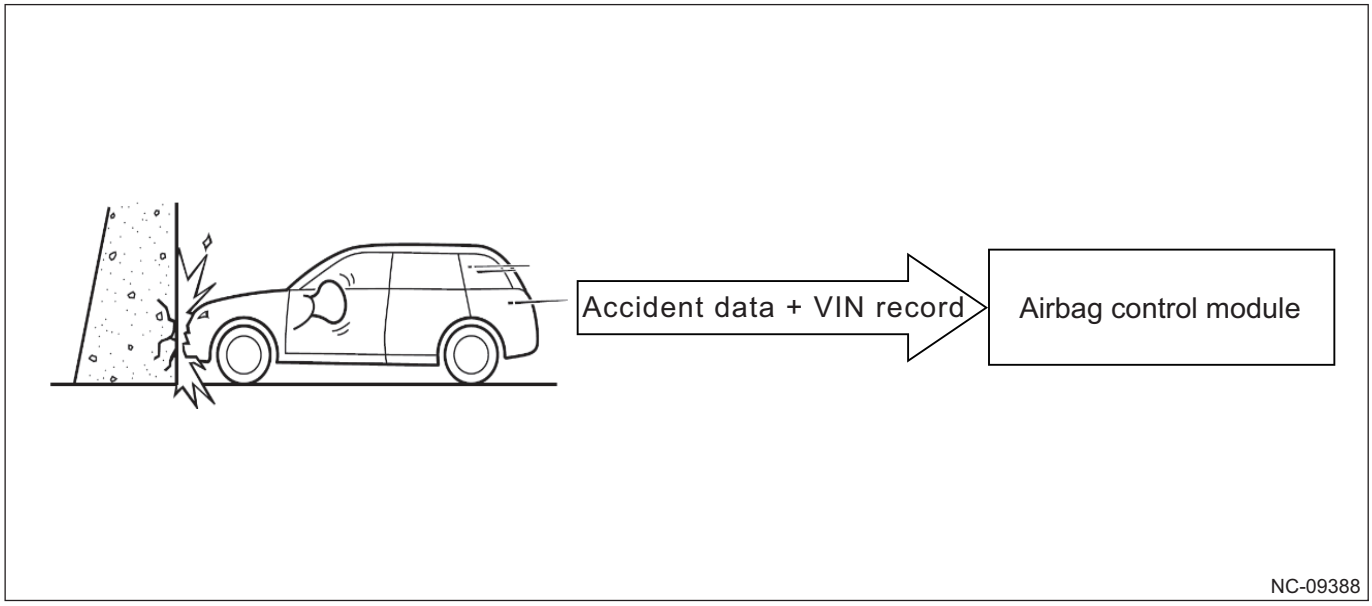
Refer to the user's manual and service manual for the detailed precautions and warnings.

■ EDR (Event Data Recorder)

When collisions of a certain magnitude or situations close to an impact (such as airbag activation or contact with an obstacle on the road) occur, the vehicle movements and data related to the safety systems can be recorded for a short time in the airbag control module.

The EDR (Event Data Recorder) records the following types of data.

- Operation status of each vehicle system
- Operation status of accelerator pedal and brake pedal
- Vehicle speed
- Information related to airbag activation



■ Airbag sensing system

In order to improve passenger protection performance, the optimum impact sensing system and optimum deployment control of passenger protection devices have been realized.

The system is composed of an airbag control module located in the front of the shift lever (center console) and sensors arranged in the front and sides of the vehicle.

Pressure detection type sensors are adopted for the side impact sensors (front doors) to improve sensing performance. This supports passenger protection on inclined pole collisions at low speeds.

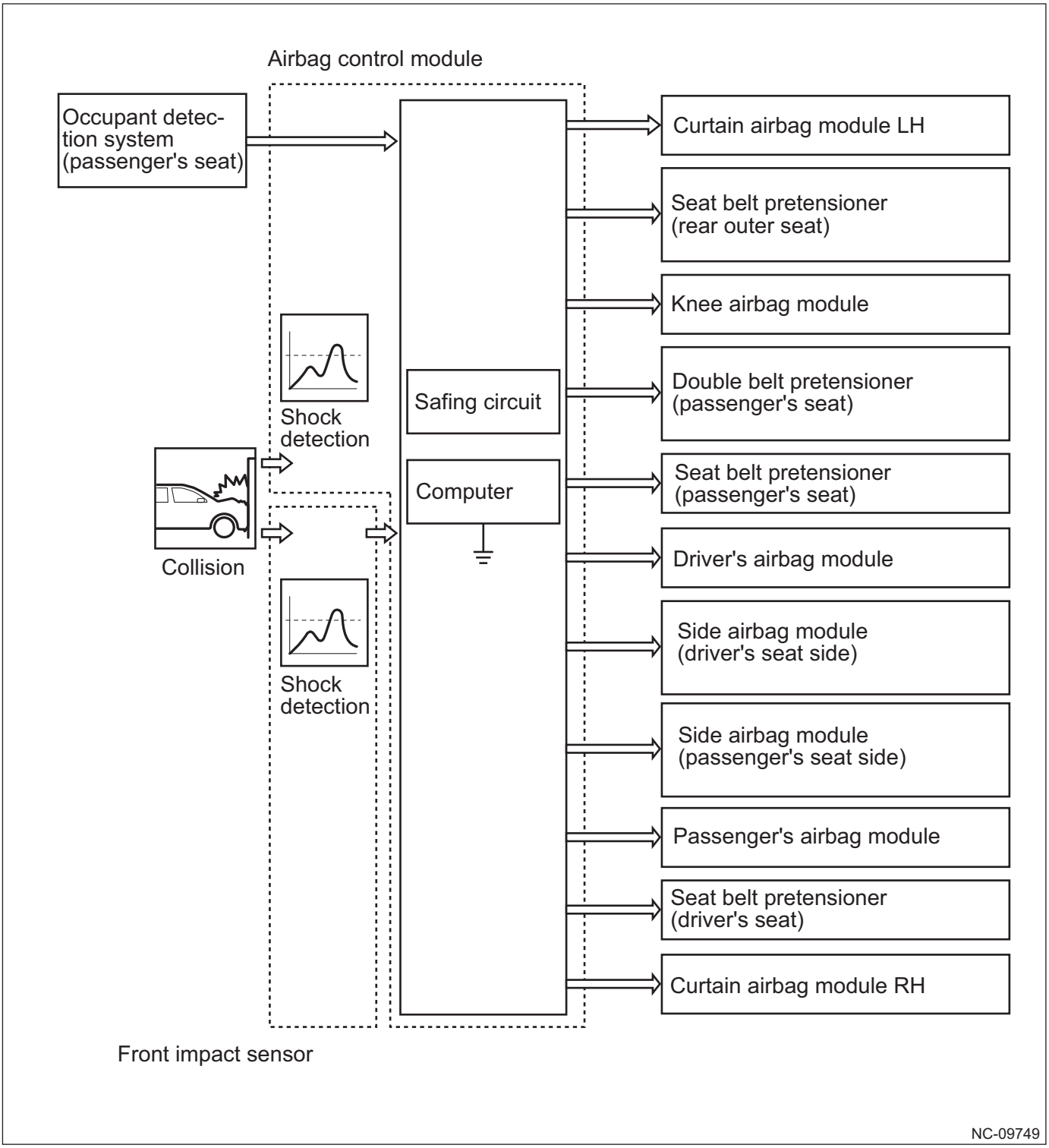
The system optimally restrains the occupant by selecting the seat belt load on collision based on the passenger's seat occupant status information detected by the passenger's seat occupant detection system, and sends information on whether the passenger's seat belt is buckled or unbuckled to the meter based on passenger's seat belt buckle switch information detected by the system.

▮ On front collision

Ignitions of the driver's airbag module, passenger's airbag module, knee airbag module, curtain airbag module, side airbag module, seat belt pretensioner, and double belt pretensioner are determined according to the signals from the front impact sensor and the G sensor in the airbag control module.

For the passenger's seat, the seat belt load on collision is selected based on the front passenger occupant status information determined by the occupant detection system (occupant detection sensors and airbag control module).

Reference
The airbag deployment/non-deployment control may differ depending on the collision condition.


Airbag control module
Occupant detection system (passenger's seat)
Curtain airbag module LH
Seat belt pretensioner (rear outer seat)
Knee airbag module
Double belt pretensioner (passenger's seat)
Seat belt pretensioner (passenger's seat)
Driver's airbag module
Side airbag module (driver's seat side)
Side airbag module (passenger's seat side)
Passenger's airbag module
Seat belt pretensioner (driver's seat)
Curtain airbag module RH
Safing circuit
Computer
Shock detection
Shock detection
Collision
Front impact sensor
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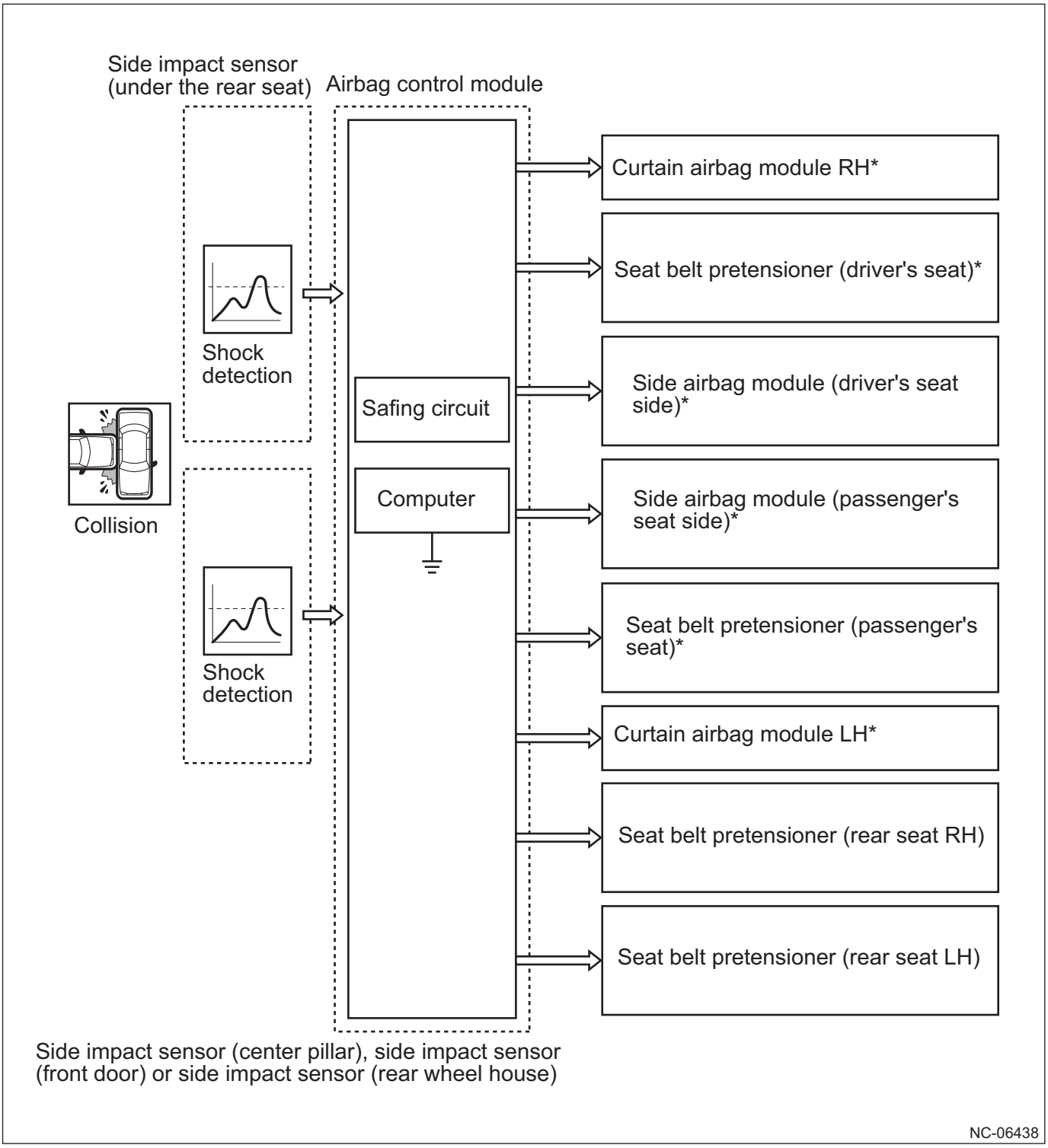
On side collision

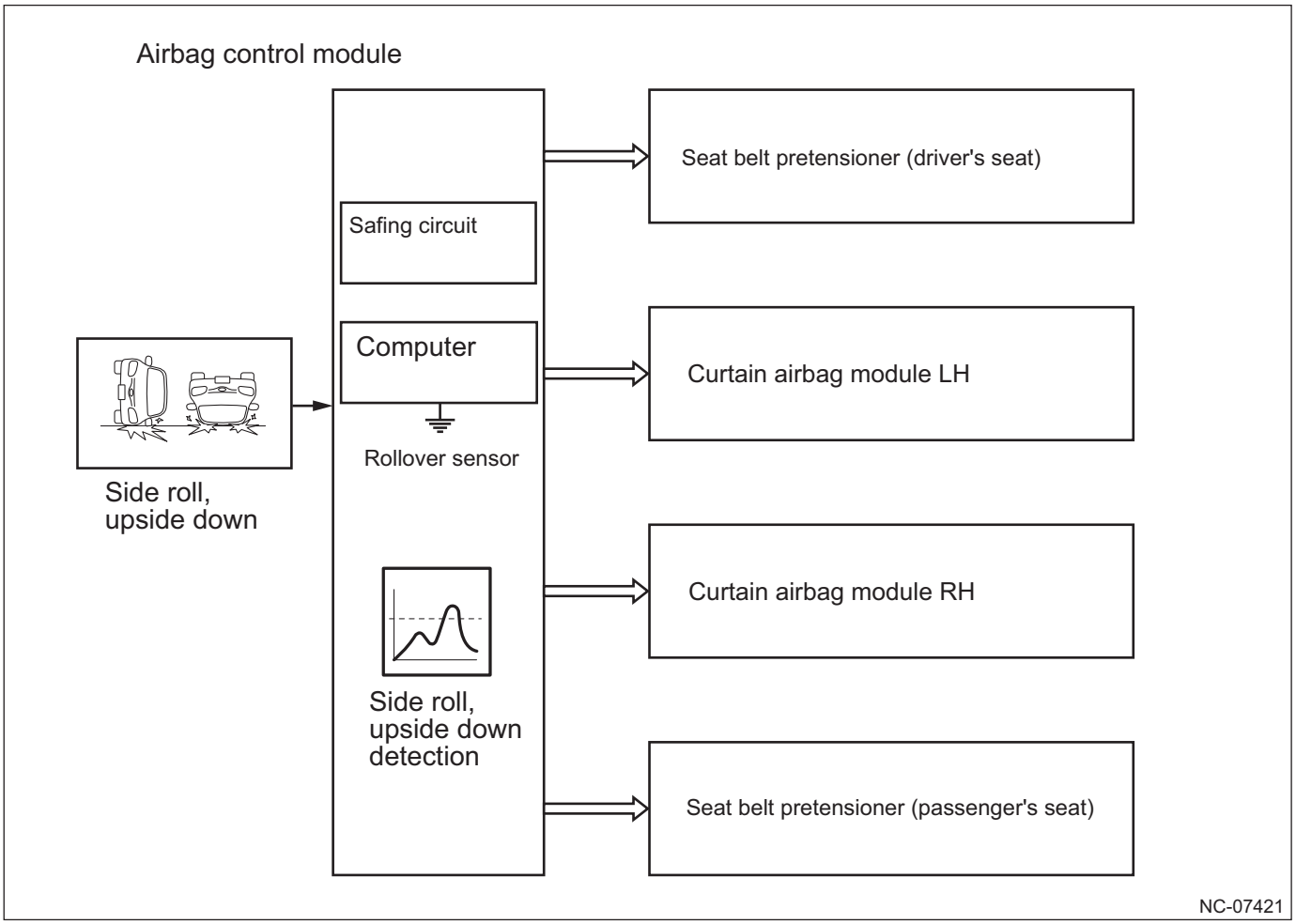
The system determines whether to ignite the side airbags, curtain airbags and seat belt pretensioners on the collision side based on the signals from the side impact sensors (center pillar), side impact sensor (front door), side impact sensor (rear wheel house), and side impact sensor (under the center of rear seat).



*: Operation is on impact side only.

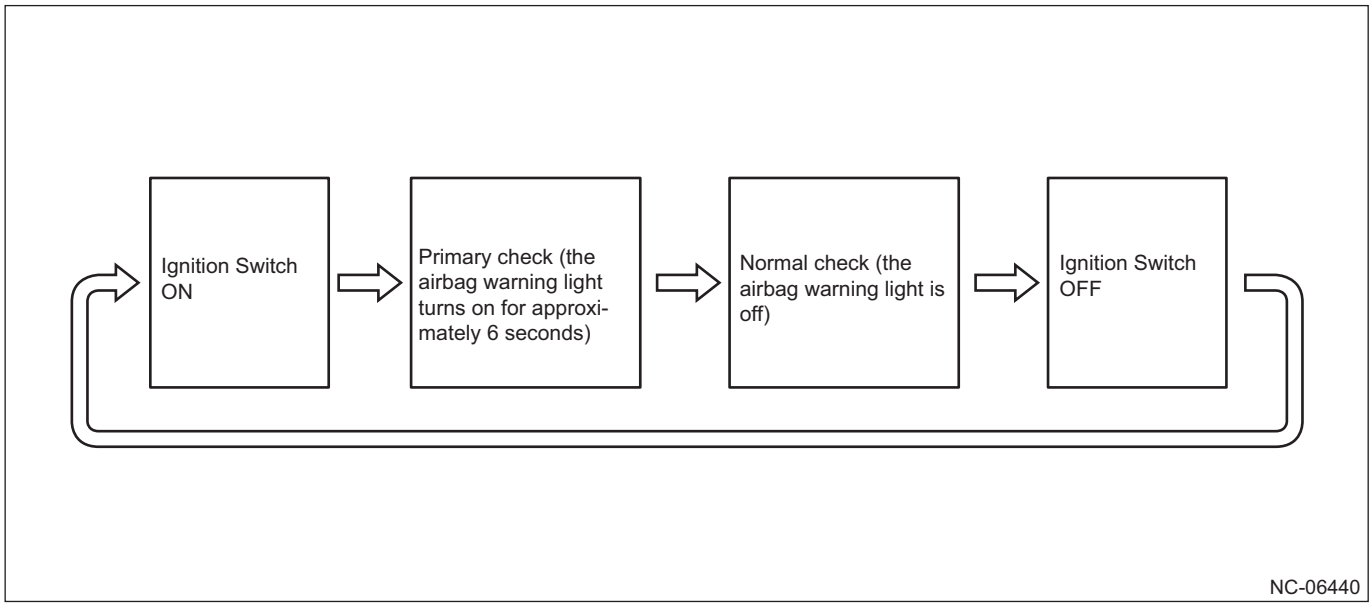
▮ Side roll/upside down

Ignitions of the curtain airbag module and seat belt pretensioner are determined according to the rollover sensor in the airbag control module.



■ Diagnostic circuit

Operation of the diagnostic circuit is displayed by the airbag warning light in the combination meter. The diagnostic circuit operates over two periods of the primary check and the normal check.



Primary check	When the ignition switch is turned ON, the airbag warning light turns on for approximately 6 seconds to perform the primary check. During this period, an operational diagnosis of the airbag control module is also performed in an ignition inhibited state.
	If an anomaly is detected by the primary check, the airbag warning light does not turn off for over 6 seconds and continues to illuminate.
	Regardless of whether the fault has occurred or not, the deployed airbag control module keeps the airbag warning light on after the primary check.
Normal check	After the primary check, the system enters an ignitable state after the airbag warning light turns off, and the diagnostic circuit performs a normal check to detect whether there are any anomalies in the system. If a fault is detected during the normal check, the airbag warning light turns on. (The warning display on power supply voltage dropping turns off after the power supply voltage returns to normal.)

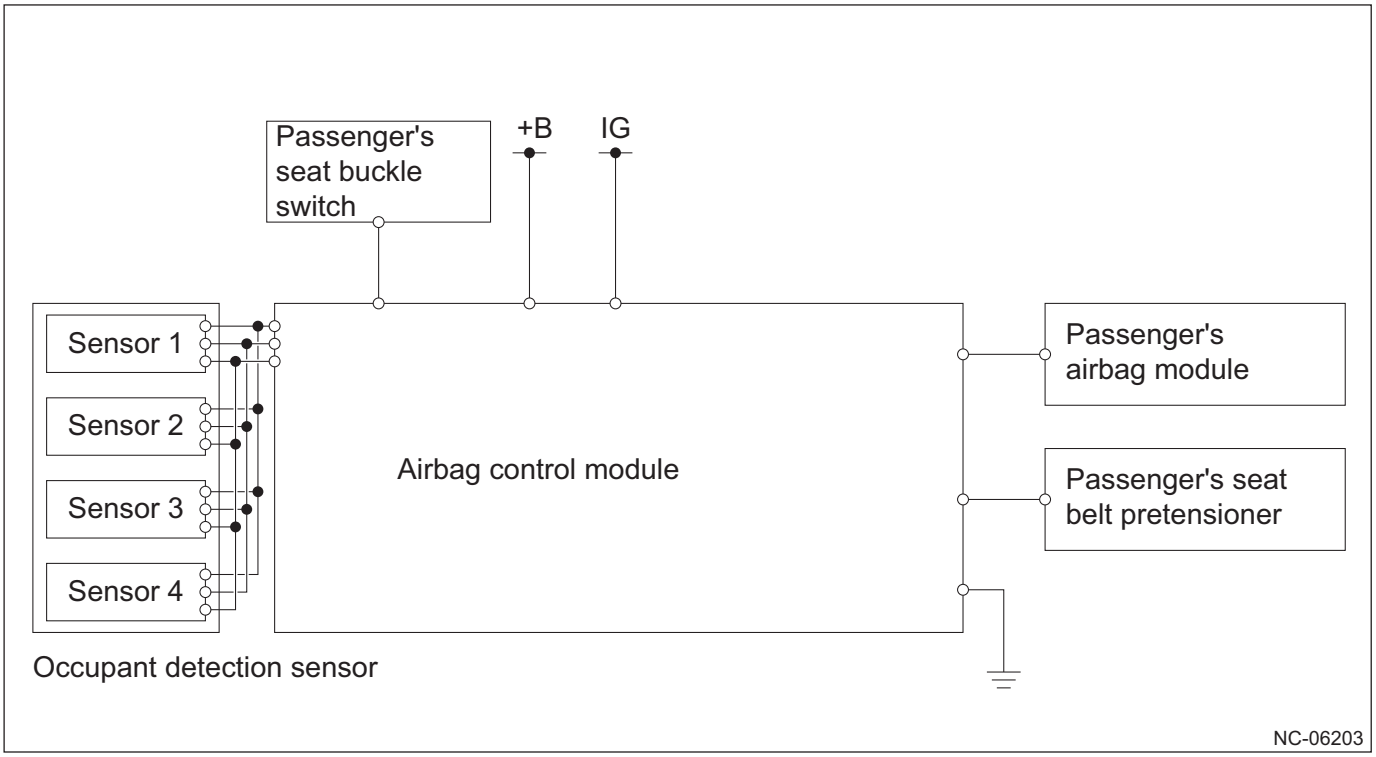
■ Occupant detection system (passenger's seat)

The occupant detection system is composed of four occupant detection sensors (distortion type weight detection sensors) installed between the passenger's seat side frame and the seat slide rails, and an airbag control module, and determines the passenger's seat occupant status, based on information about sensor output and belt buckle switch (passenger's seat).

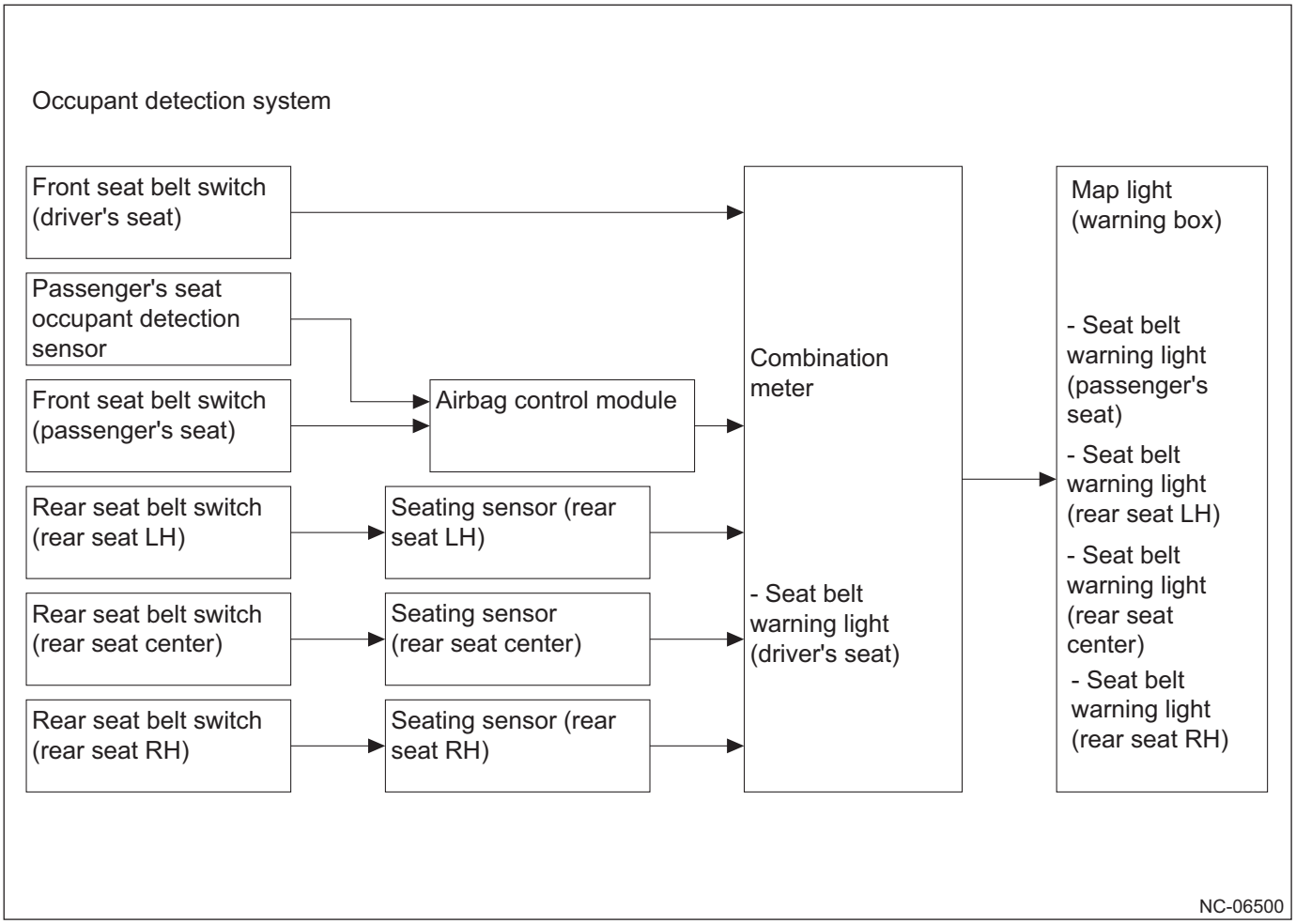
The occupant detection sensors detect distortion of the seats as weight when occupants are present, and send the information to the airbag control module.

The airbag control module automatically determines the status of the passenger's seat occupant (empty, infant + child seat, small adult, or large adult), and selects the seat belt load on collision.

Occupant detection system diagram 1



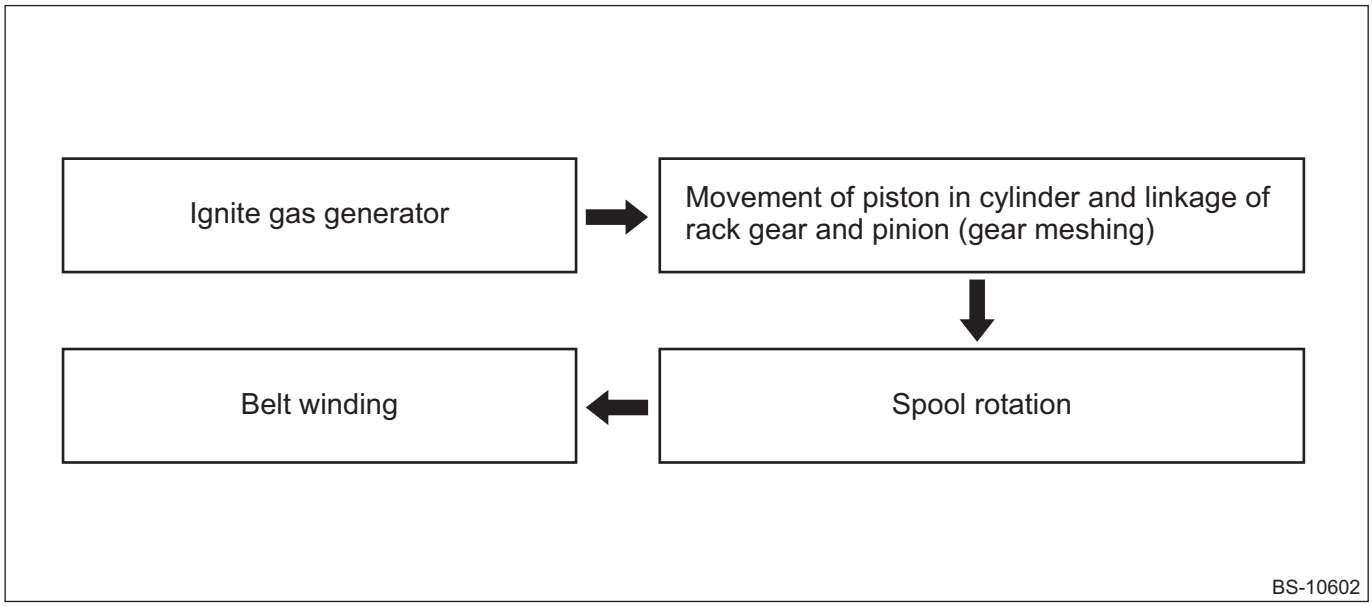
Occupant detection system diagram 2



Seat belt pretensioner

The passenger's seat belt is equipped with the double belt pretensioner that uses pretensioners for both the shoulder belt and lap belt, and the driver's seat and outer rear seat belts are equipped with the pretensioner and force limiter to improve the occupant restraining on collision.

Diagram of pretensioner operation

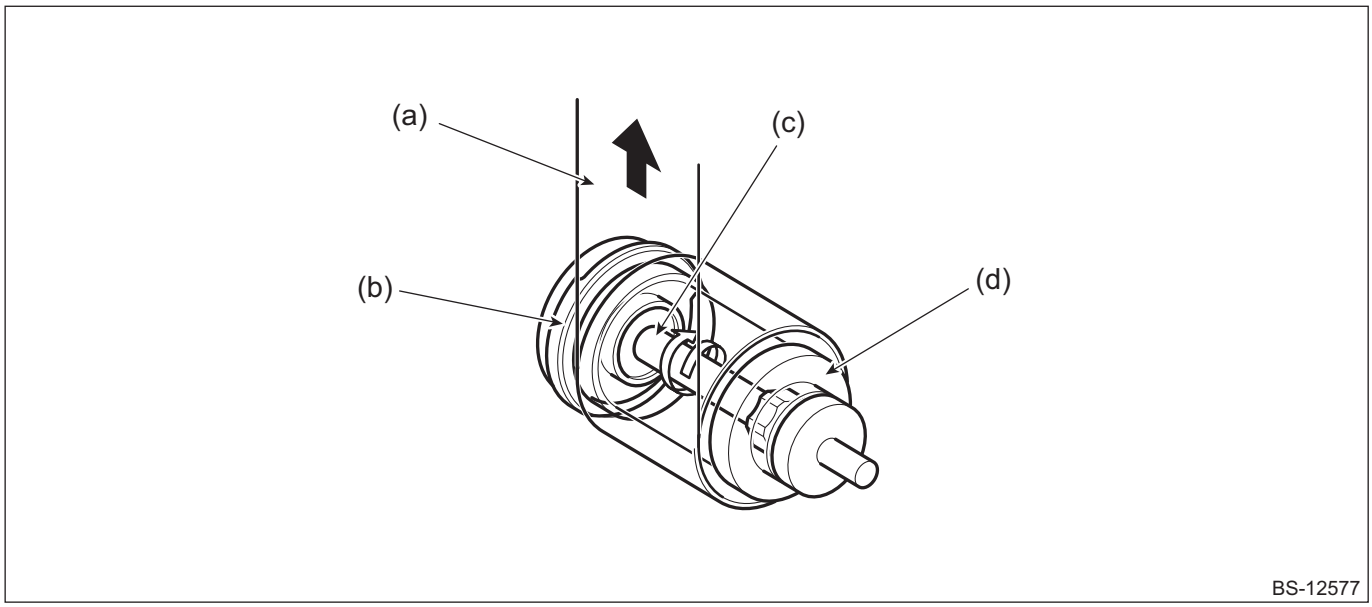


■ Force limiter mechanism

The force limiter mechanism is composed of a torsion bar, spool, etc. The force limiter function of the seat belt is a function that loosens the seat belt to prevent a load above a certain amount (energy absorption load) from being applied to the passengers when the vehicle collides.

When the pretensioner completes its operation and the seat belt is drawn by passenger motion, the ELR mechanism locks and the force limiter starts to operate. The ELR mechanism operates when the belt is drawn out faster than a specified acceleration value or when acceleration faster than a specified value is applied to the vehicle to lock the belt from being drawn out.

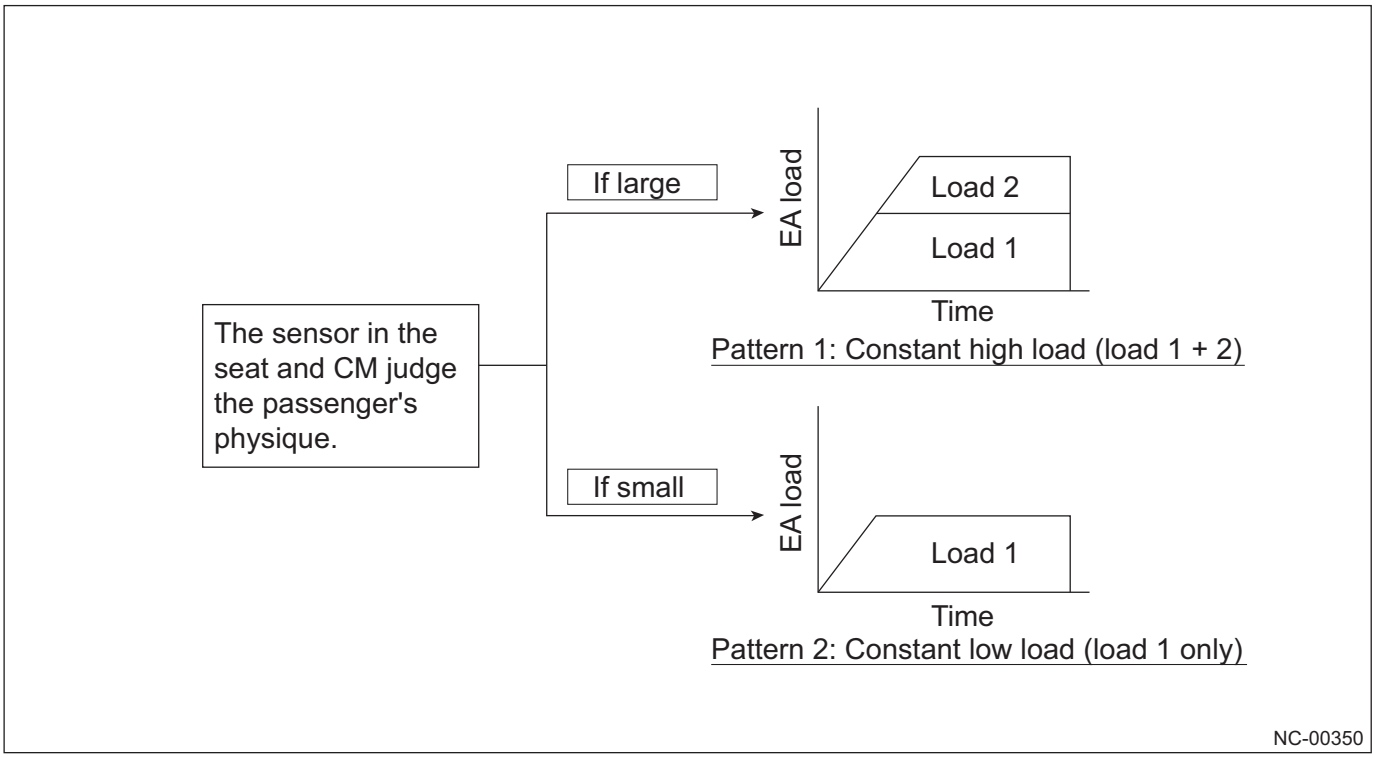
If tension in excess of the specified load is applied to the belt with the ELR locked, the torsion bar twists and the spool mated with the torsion bar spins to pull the belt and keep belt tension constant.



(a) Belt
(b) ELR mechanism
(c) Torsion bar
(d) Spool

■ Adaptive force limiter mechanism (passenger's seat)

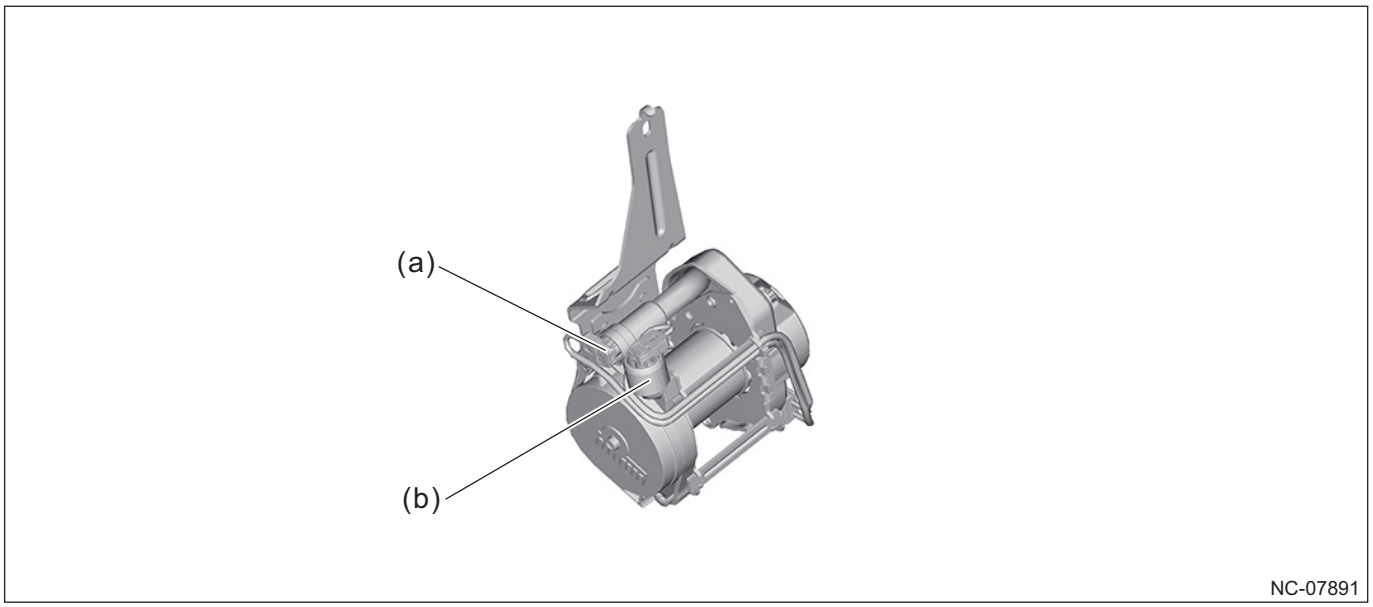
The adaptive force limiter is adopted that can switch the optimal energy absorption load by determining body type of a passenger according to the signals from the vehicle.



The gas generator for an adaptive force limiter is included in the retractor with pretensioner.

On front collision, after the pretensioner is activated, the force limiter maintains seat belt tension at a fixed level while gradually loosening the seat belt to ease pressure on the chest so the excess load of a given level are not applied to the passenger. The fixed load applied to the passenger at that time can be switched according to the collision type and the body type of the passenger.

The fixed load to passengers is switched by activating or deactivating the gas generator for the adaptive force limiter and selectively operating one of the two torsion bars (for high load and low load) which have different twisting forces.



(a) Gas generator for pretensioner

(b) Gas generator for adaptive force limiter

10.4 Seat and Seat belt

10.4.1 Overview

Overview

Front seat

- Weight reduction of lumbar support
- Stronger support for shoulders and thighs
- Increased adjustment amount for seat slide
- Expansion of seat heater area
- Adoption of new RECARO seats (for some grades)

Rear seat

- Adoption of seat heater
- Adoption of lock release knob

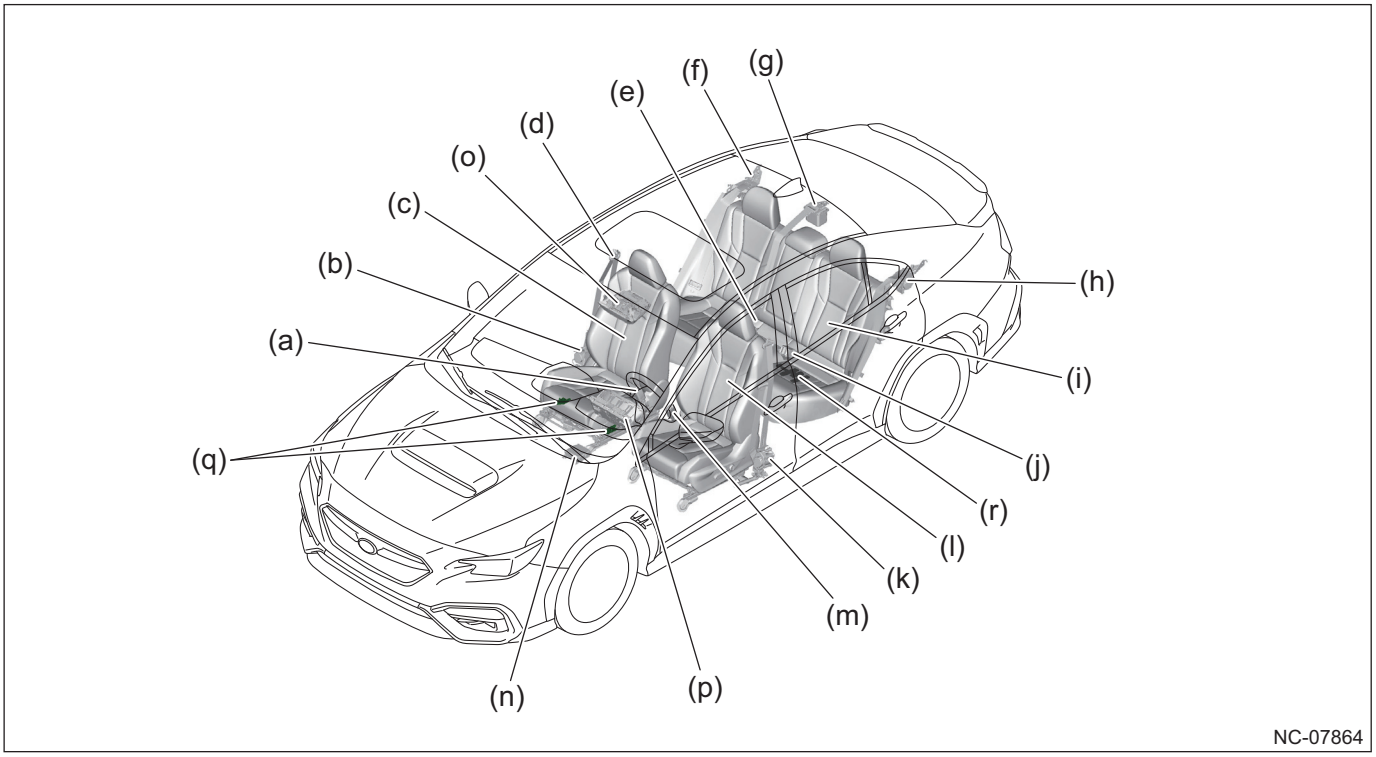
Seat belt

- The tongue cushion is adopted.
- Adoption of rear seat belt reminder function
- Adoption of adaptive force limiter mechanism
- Adoption of rear seat center belt guide
- Adoption of rear seat seating sensor

10.4.2 Component

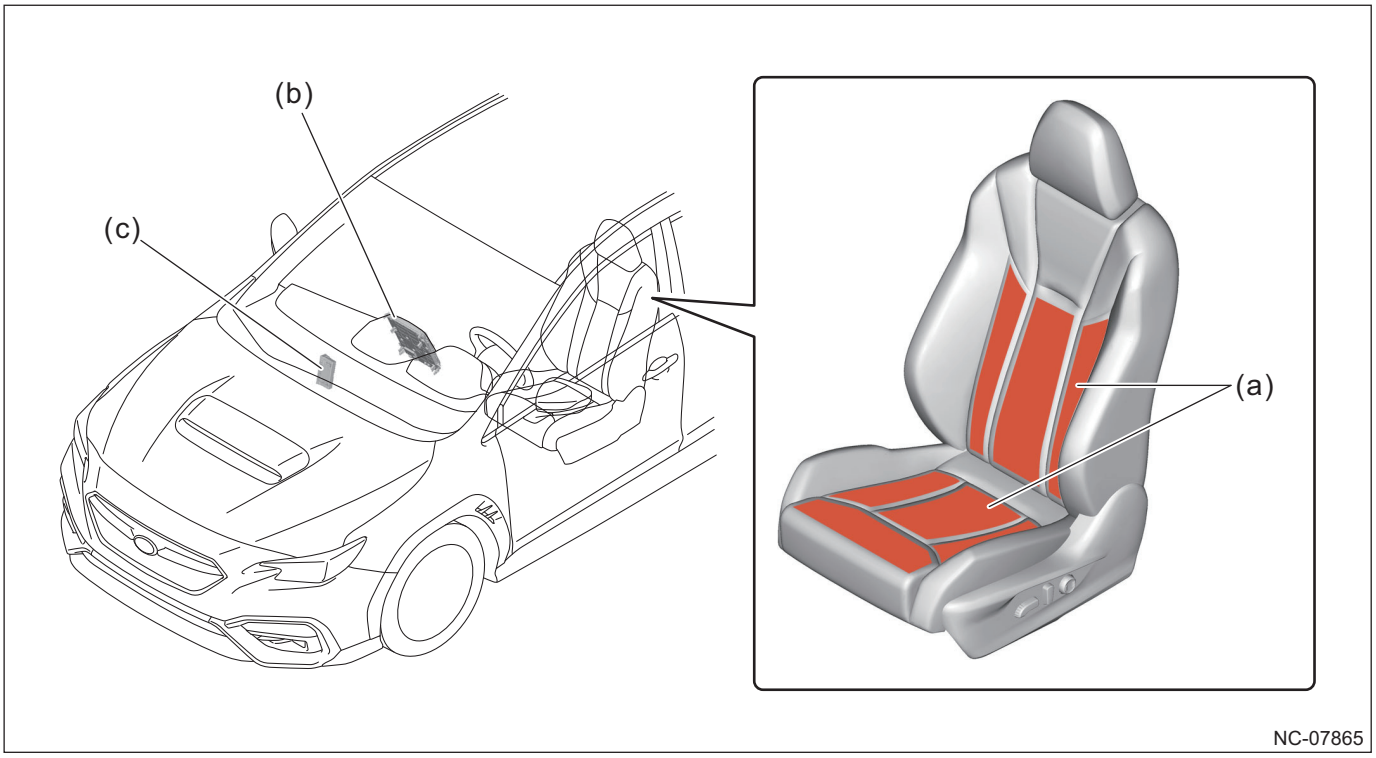
Component layout drawing

Seat/seat belt/seat belt warning light system



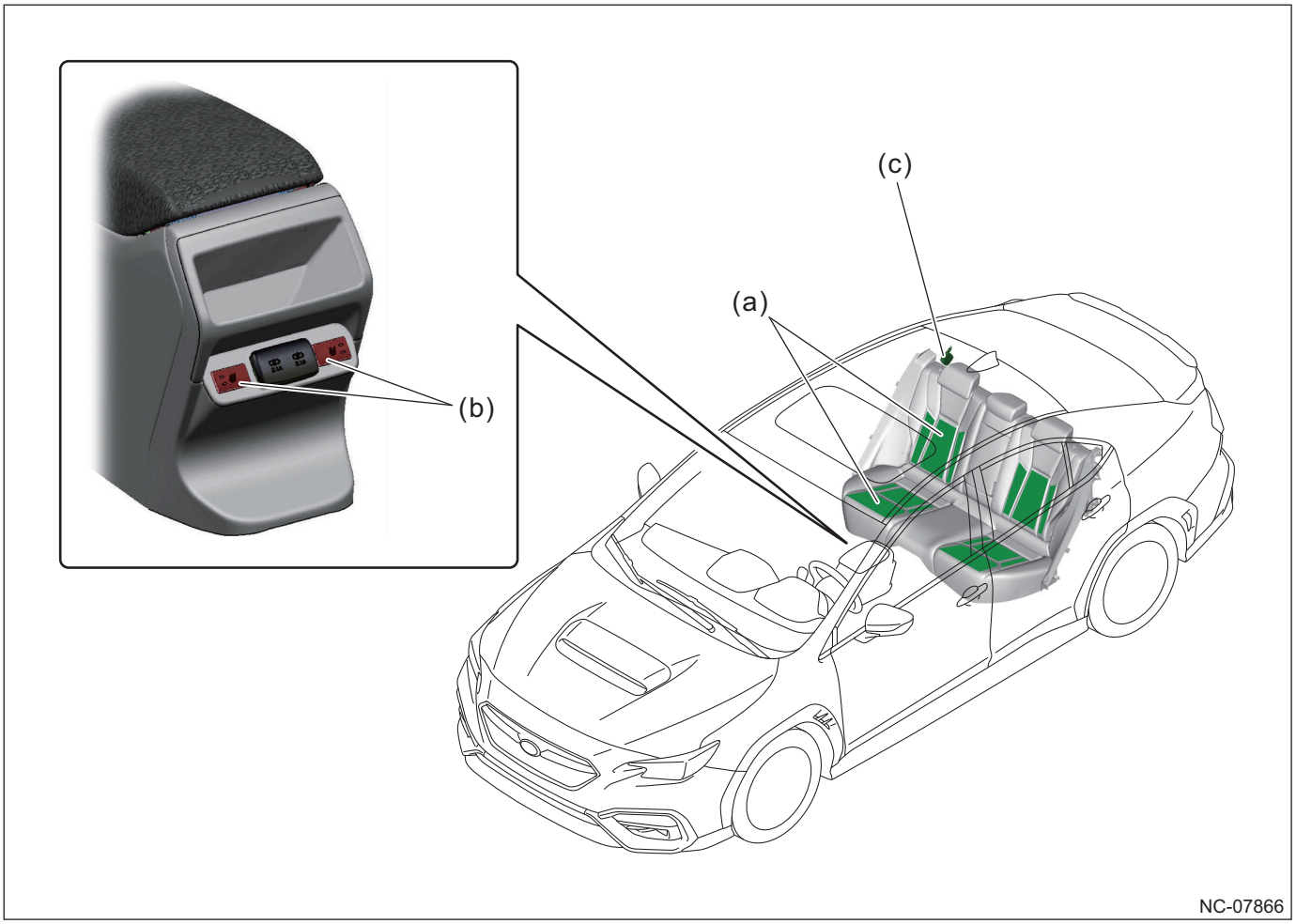
(a) Belt assembly front INN RH (front seat belt switch)
(b) Belt assembly front OUT RH
(c) Front seat RH
(d) Seat belt guide
(e) Belt assembly INN center RH (rear seat belt switch)
(f) Belt assembly rear OUT RH
(g) Belt assembly rear OUT center
(h) Belt assembly rear OUT LH
(i) Rear seat
(j) Belt assembly rear INN LH & center (rear seat belt switch)
(k) Belt assembly front OUT LH
(l) Front seat LH
(m) Belt assembly front INN LH (front seat belt switch)
(n) Airbag CM
(o) Map light
(p) Combination meter
(q) Passenger's seat occupant detection sensor
(r) Seating sensor

Front seat heater system



(a) Front seat heater
(b) Center information display (seat heater switch)
(c) A/C CM

Rear seat heater system



(a) Rear seat heater
(b) Rear seat heater switch
(c) Rear seat heater CM

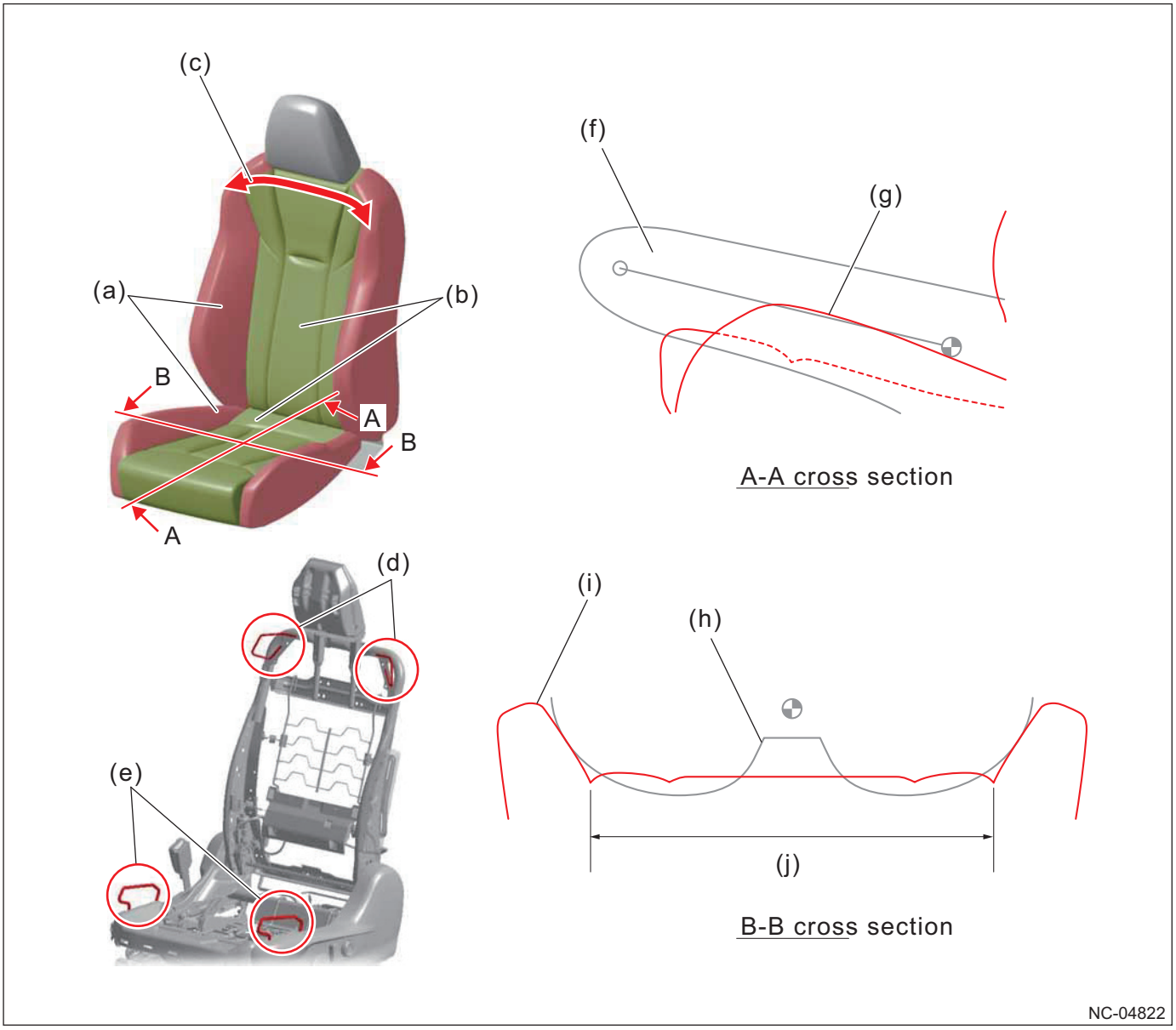
Component details

Front seat

■ Improvement in seating comfort

The following functions are adopted to realize a front seat that is reliable and comfortable when driving.

- Different shape and urethane hardness are chosen for each section, which realizes an embracing and supportive feel so that the occupant can comfortably lie on the seat.
- By balancing the spring and the urethane hardness at a high level, both the posture stability and the cushion feel suitable for the vehicle grade are achieved.
- In addition to the wire frame in the shoulder section, a wire frame is adopted in the thigh section to ensure sufficient support even during sporty driving.
- By distributing the pressure when a passenger is seated, the seat creates less fatigue even after a long drive.
- Allowance for different body types is provided by widening the main section (j) width.
- Support is improved by raising the cushion mound height (g).



(a) Sufficient hardness to securely support the body

(b) Softness that fits the body

(c) Multi-faceted shape that embraces the body of the occupant

(d) Shoulder section wire frame

(e) Thigh section wire frame

(f) Image of occupant leg

(g) Mound height

(h) Image of occupant buttocks

(i) Concave surface that fits the body when a passenger is seated

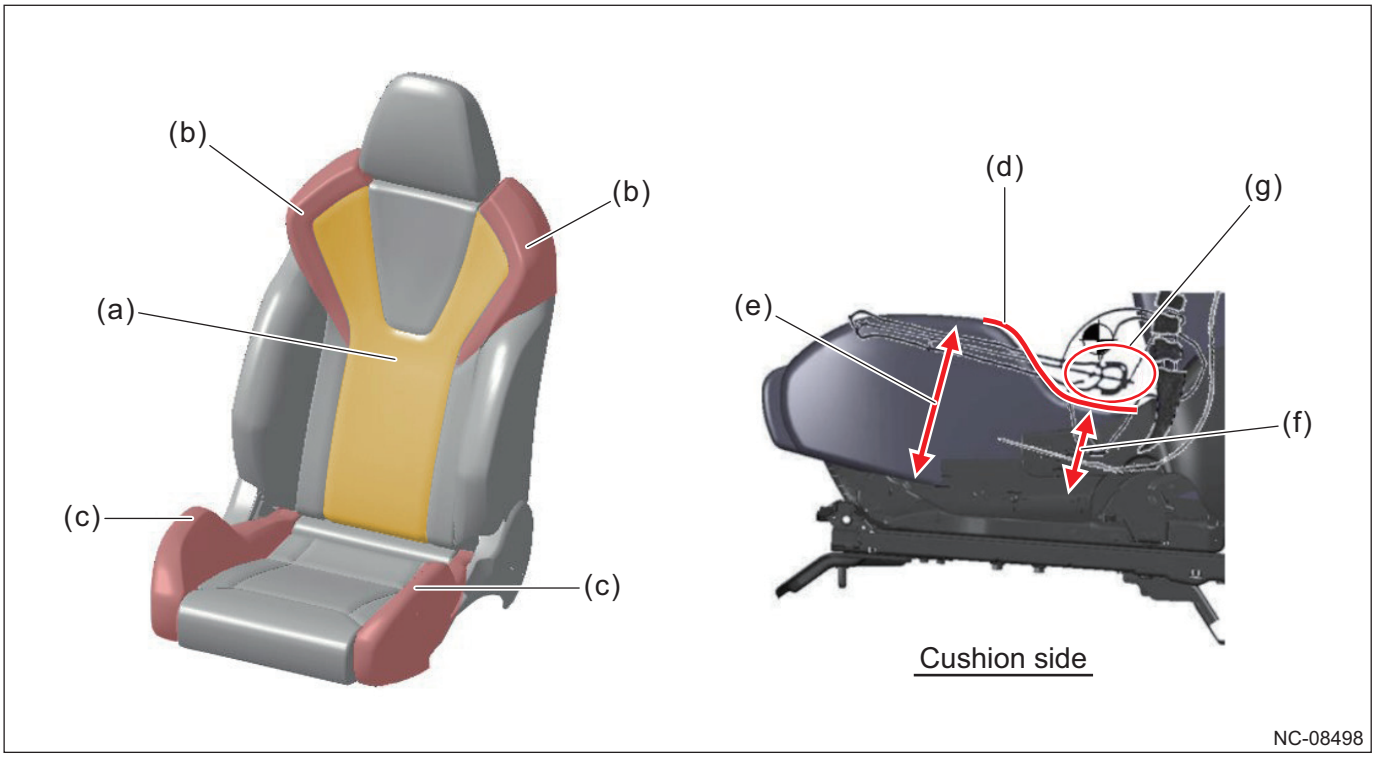
(j) Seating surface width

RECARO seats (for some grades)

New RECARO seats are provided that achieve both comfort and support, while also improving the sporty styling.

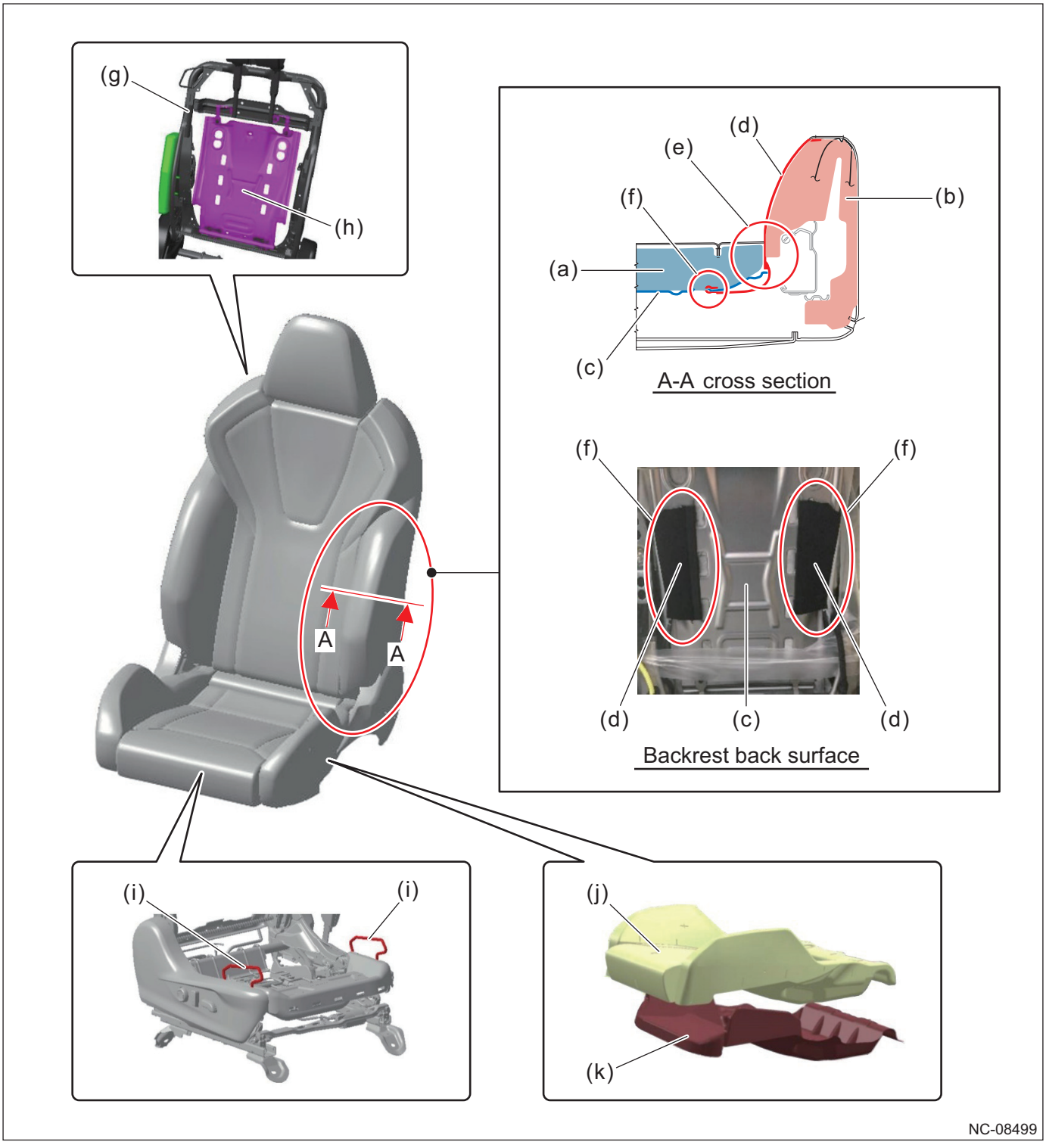
- Ultrasuede is adopted on the surface to improve the quality feel.
- The renewed seat design enhances support under the buttocks, to the sides of the thighs, and to the sides of the torso.
- The cushion side support height to the side of the thighs is increased to improve holding performance, and the cushion side support height near the top of the thigh is restricted to reduce feelings of constraint while seated.
- The main section and side sections of the backrest pad are divided to restrict deformation of the pad main section by loads while cornering, improving the posture stability of occupants.
- The backrest side covers are fixed directly to the backrest panel to restrict deformation of the backrest side covers while cornering, resulting in stable side supports.
- A solid panel designed exclusively for RECARO is adopted for the backrest panel to restrict movement (rotation) of the pelvis, resulting in excellent support.
- A lightweight seat frame and mechanism are adopted to achieve excellent support, comfort, and safety performance.
- A wire frame is added to the cushion frame to increase the rigidity of the side supports, increasing their holding performance while cornering.
- Molded felt is adopted as the rear surface material of the cushion pad to increase the rigidity of the cushion rear surface and restrict the rolling or sliding of the buttocks while cornering or braking.

Shape



(a) Y-shaped seat back support
(b) Shoulder support
(c) Cushion side support
(d) Relief shape reduces feelings of constraint
(e) Height increased
(f) Height restricted

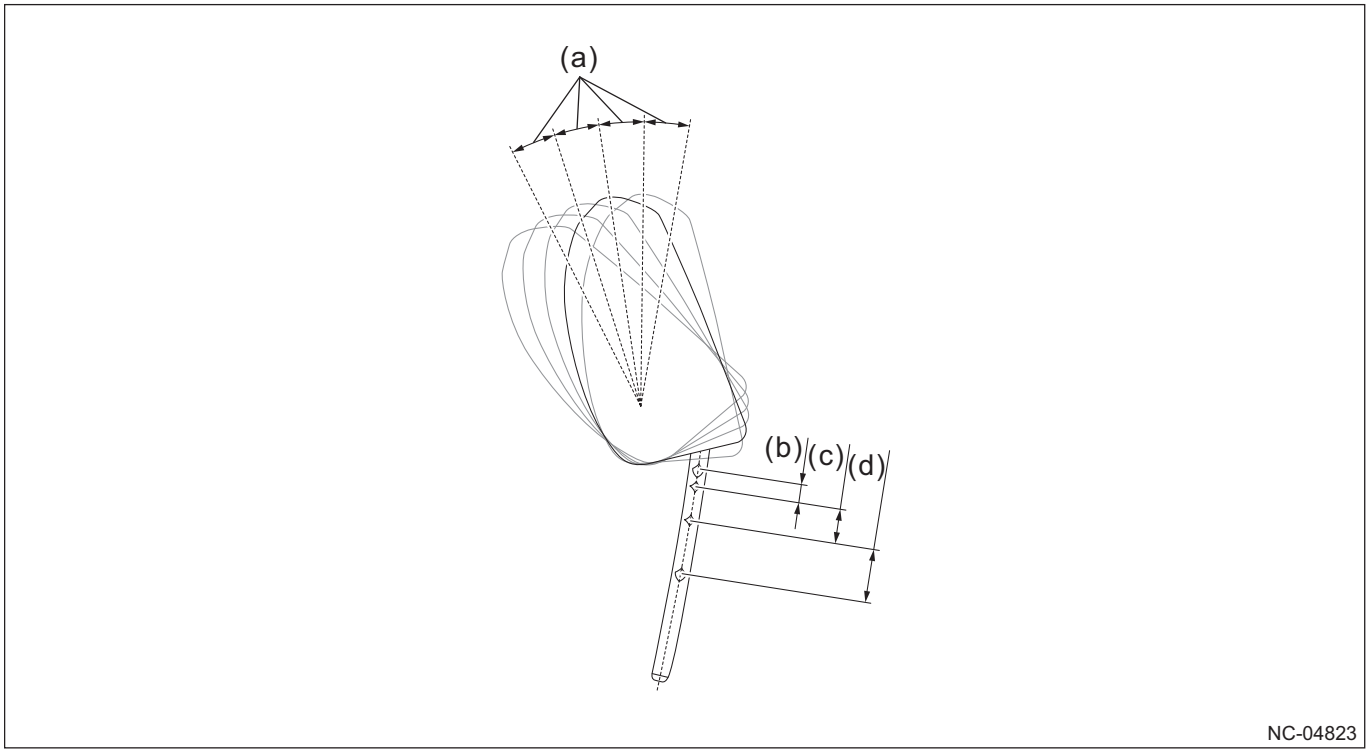
Construction



(a) Backrest pad main section
(b) Backrest pad side section
(c) Backrest panel
(d) Backrest side cover
(e) Pad main section and side sections divided
(f) Fixed directly to backrest panel
(g) Same lightweight seat frame as standard sporty seat
(h) Backrest panel designed exclusively for RECARO
(i) Wire frame
(j) Driver's seat cushion pad
(k) Driver's seat cushion pad rear surface material (molded felt)

Headrest

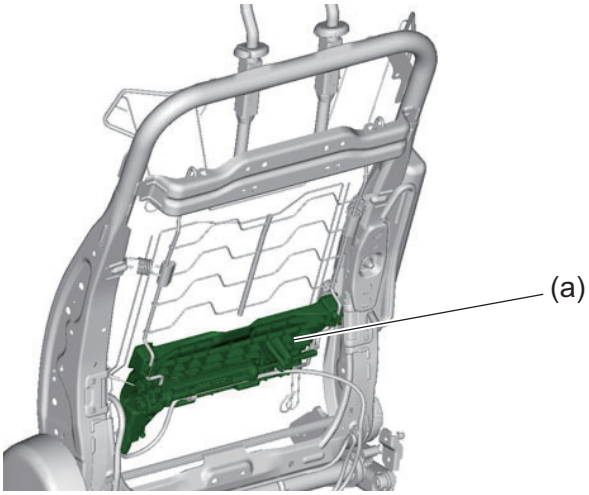
A forward/back adjustable type of headrest is adopted that enables the headrest to be adjusted in accordance with the preference and physical constitution of the occupant.



(a) 9°
(b) 0.591 in (15 mm)
(c) 1.098 in (27.9 mm)
(d) 1.697 in (43.1 mm)

Power lumbar support

The power lumbar support, which can adjust the lower back portion of the backrest in accordance with the preference and physical constitution of the occupant, is provided in the driver's seat. The smaller-sized motor and the lumbar mat are integrated to reduce weight.



NC-04824

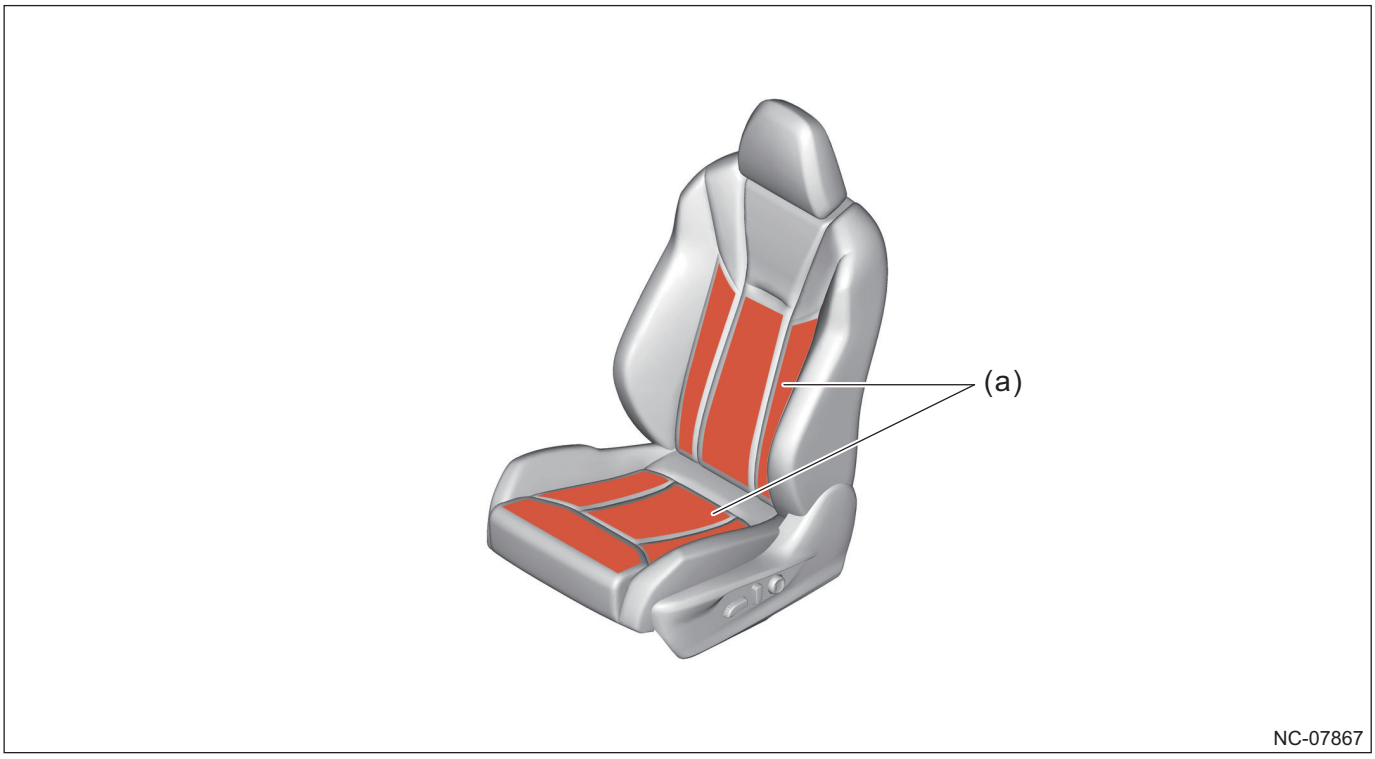
(a) Motor-integrated flat mat

■ Improvement in comfort

▮ Seat heater system

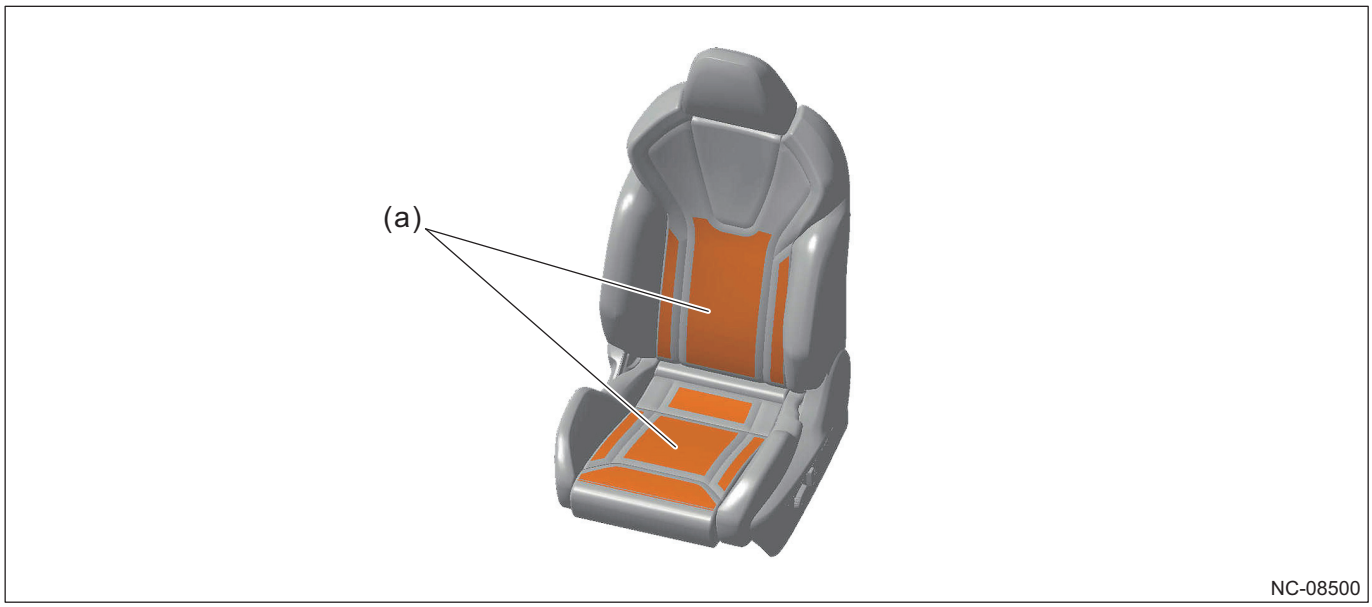
The seat heater with 3-level temperature adjustment is provided. The heating wires are also arranged to efficiently warm the occupant according to the body pressure, improving comfort.

Standard seat



(a) Heater area

RECARO seat



(a) Heater area

Seat slide

The forward/back slide amount is increased by 0.787 in (20 mm) to 10.24 in (260 mm) to support a wide range of driving postures.

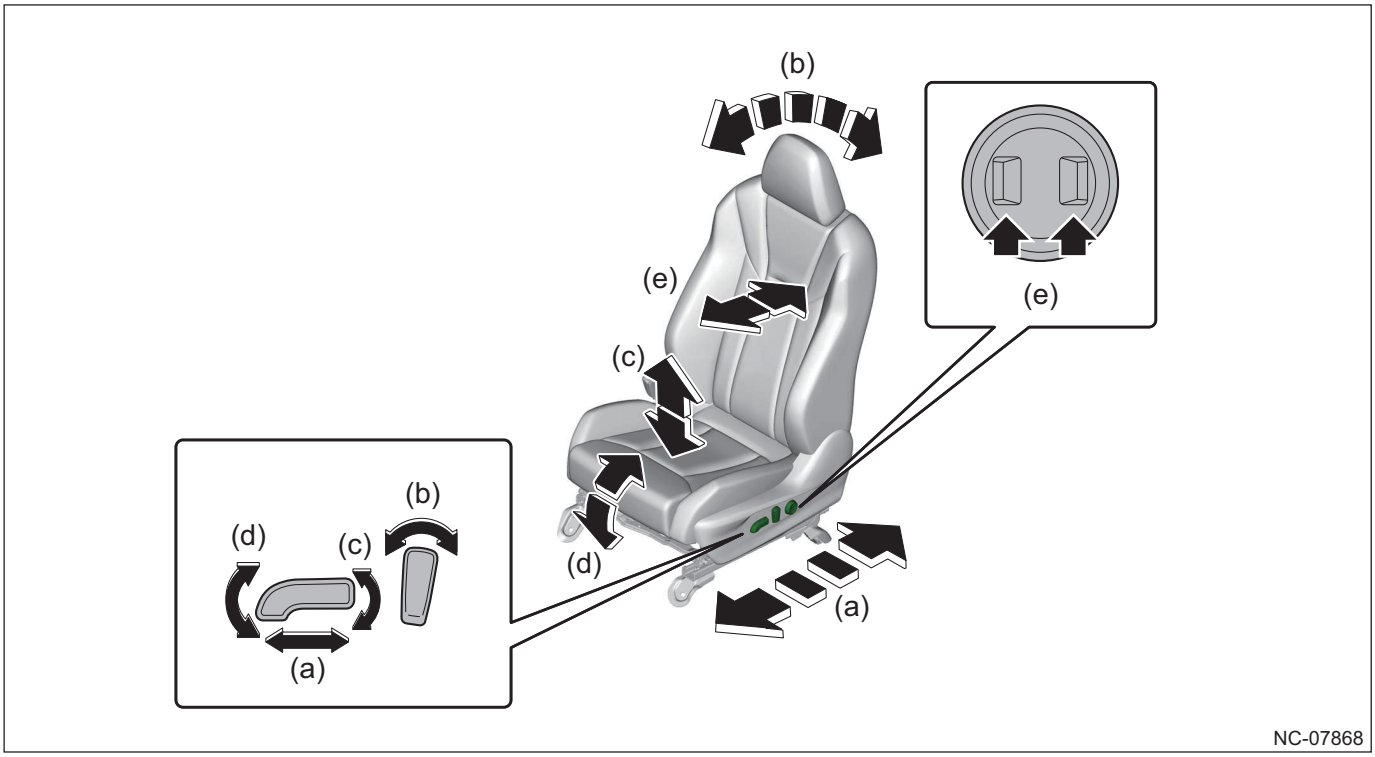
Seat heater switch

The seat heater switch is operated using the center information display.

NC-09747

▮ Power seat system

The power seat is adopted for the driver's seat to improve comfort.

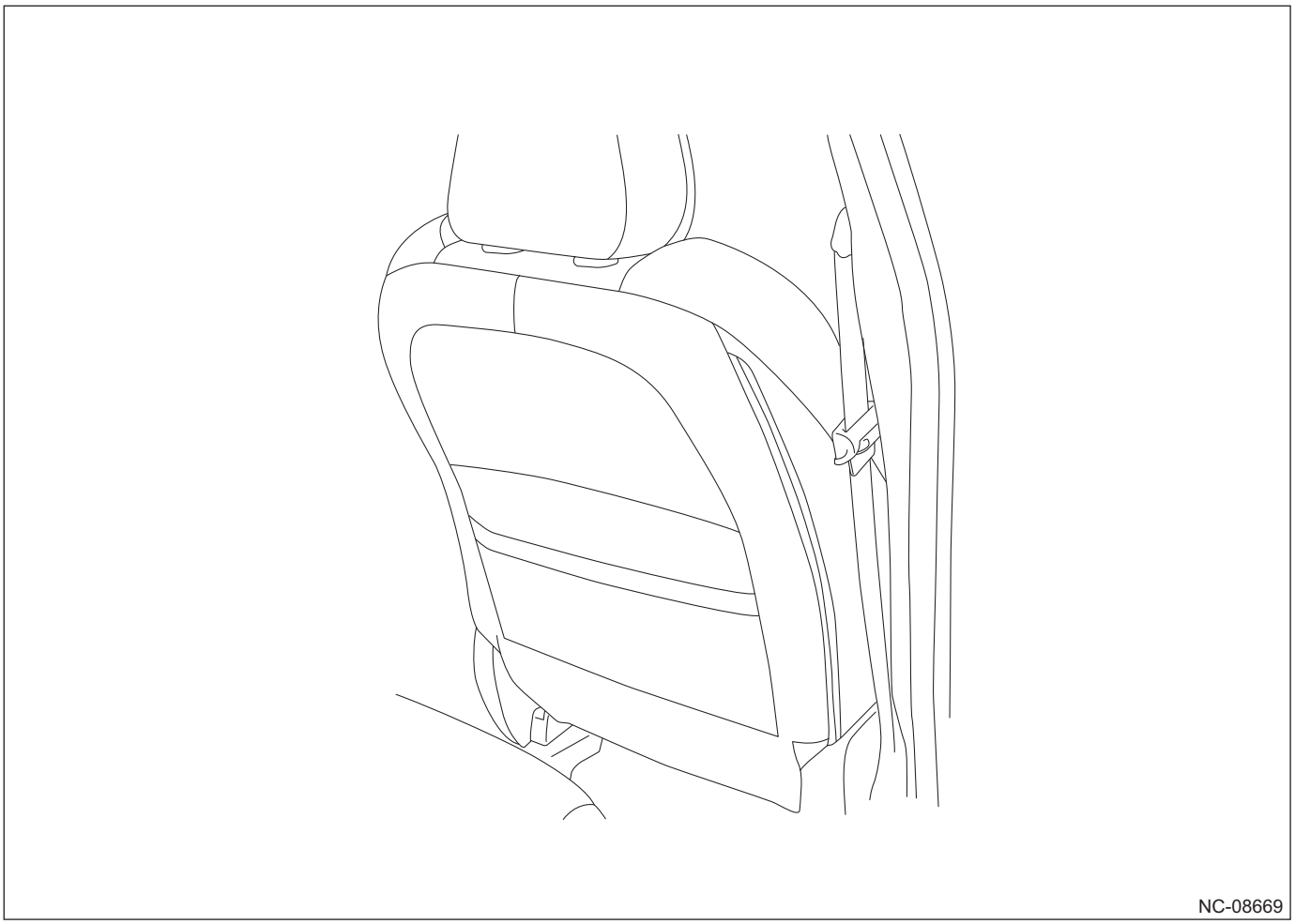


(a) Slide adjustment
(b) Reclining adjustment
(c) Lifter adjustment
(d) Tilt adjustment
(e) Lumbar support adjustment (for some models)

■ Improvement of practicality

▮ Seat back pocket

The driver's seat back pocket (for some grades) and passenger's seat back pocket are provided to accommodate rear seat passengers' baggage.

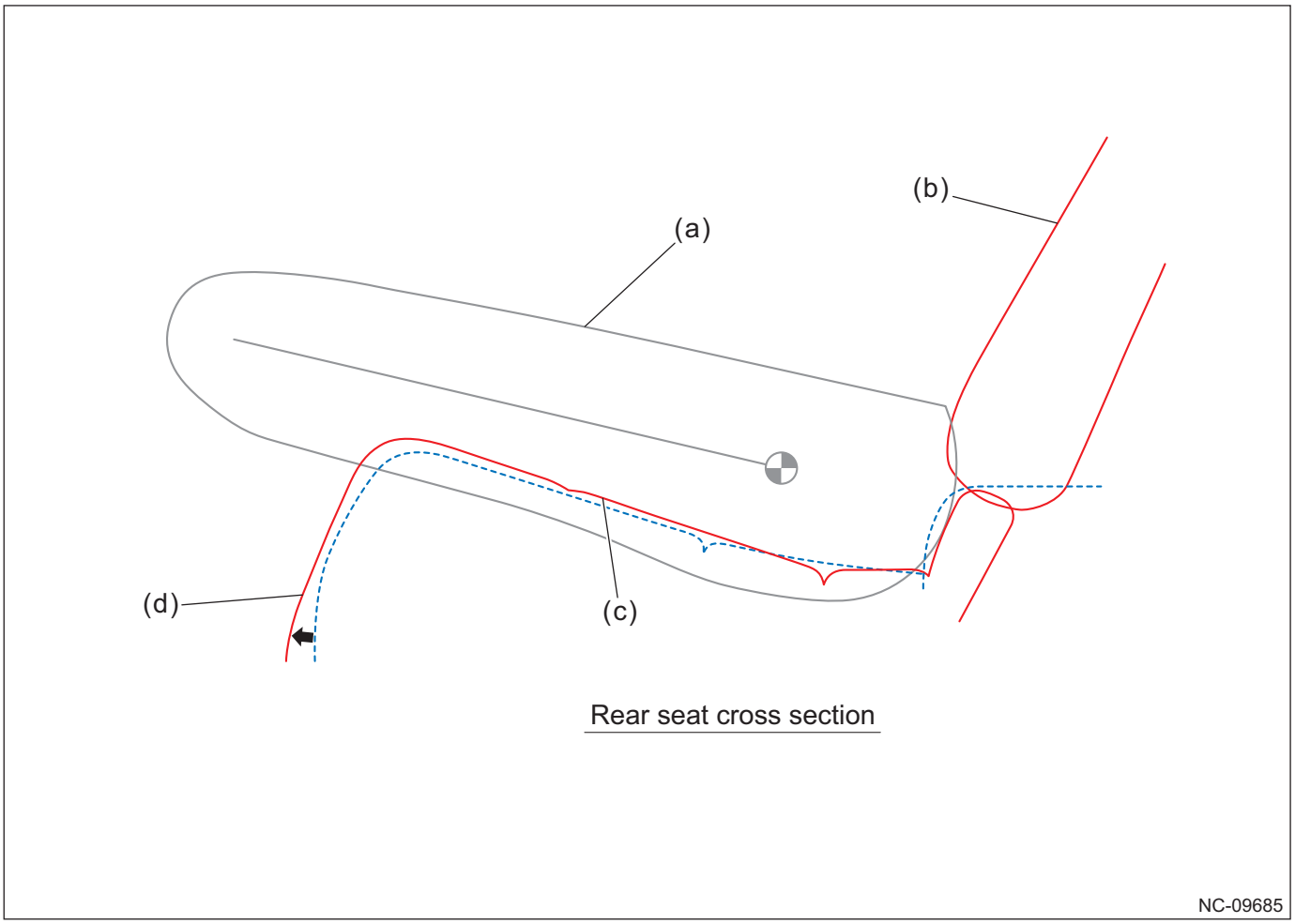


Rear seat

■ Improvement of seating comfort

The following functions are adopted to realize a rear seat that is reliable and comfortable when driving.

- Support in the thigh section is improved by extending the cushion length. This reduces the fatigue of occupants who are seated for a long time, improving the comfort of rear seat occupants.

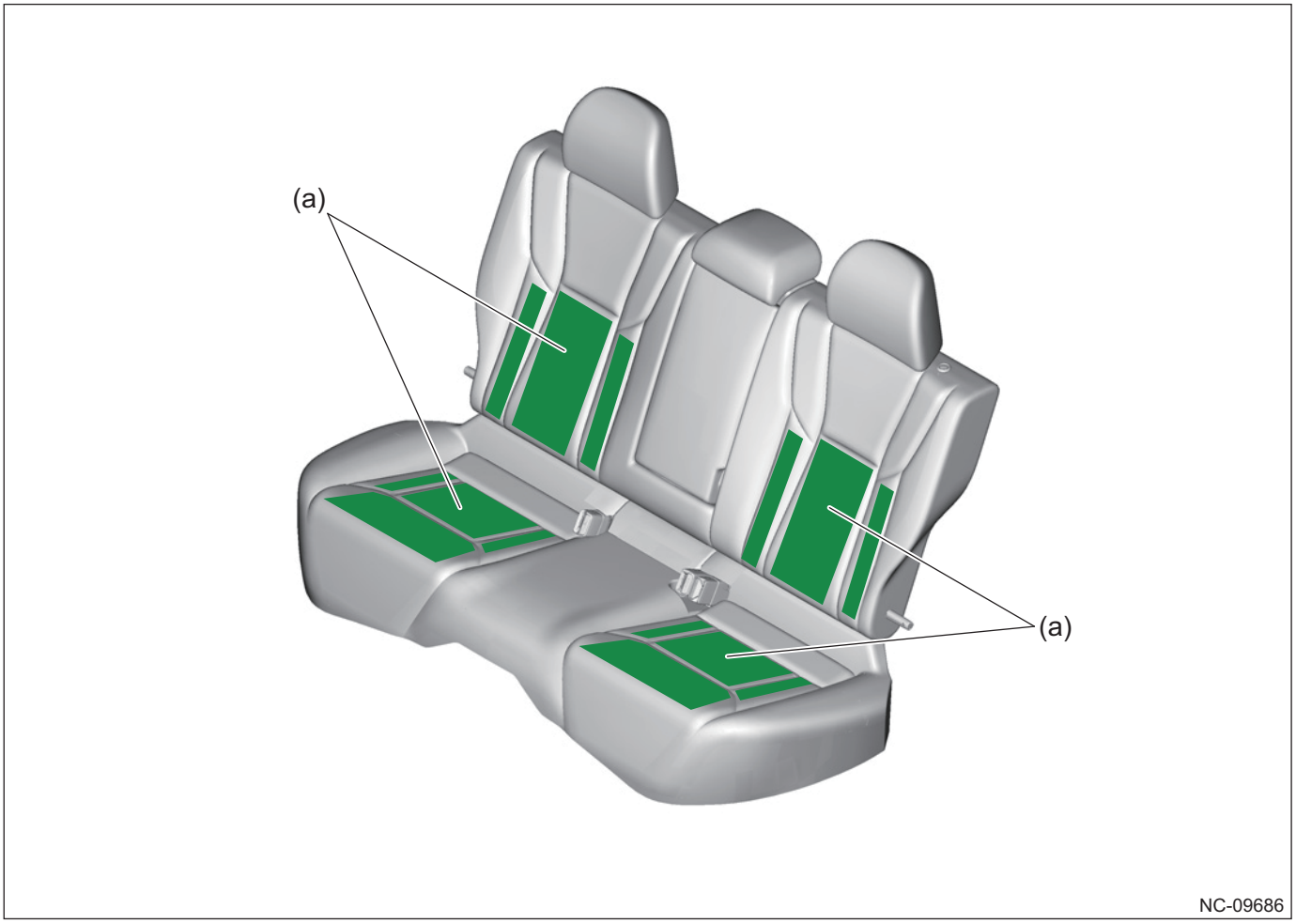


(a) Occupant thigh section
(b) Backrest section
(c) Cushion section
(d) Cushion length

■ Improvement in comfort

▮ Rear seat heater

A rear seat heater is adopted in the leg section and lower back section to improve comfort.



(a) Heater area

▮ Rear seat heater switch

The rear seat heater switch is installed at the center console rear portion.

(a) Rear seat heater switch

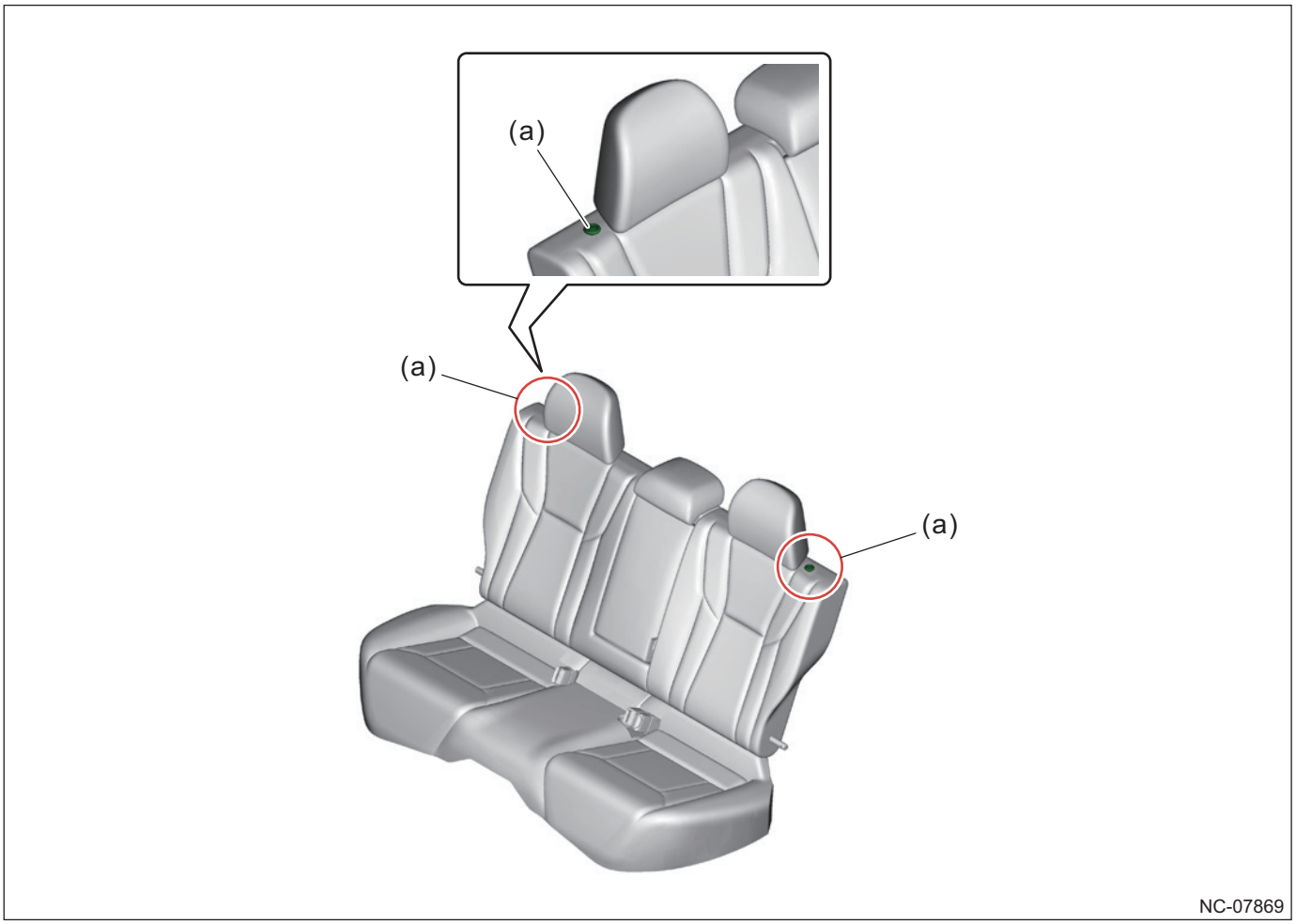
■ Convenience

▮ Foldable 6:4 separate rear seat type

Foldable 6:4 separate type rear seats are adopted to enable the luggage compartment to be freely enlarged according to the situation.

A lock release knob is adopted at the top of the backrest.

A belt guide is adopted for the center seat to improve the wearability of the seat belt.



(a) Release knob

Seat surface

2 types of seat surface are provided to differentiate the grades. (for some grades)

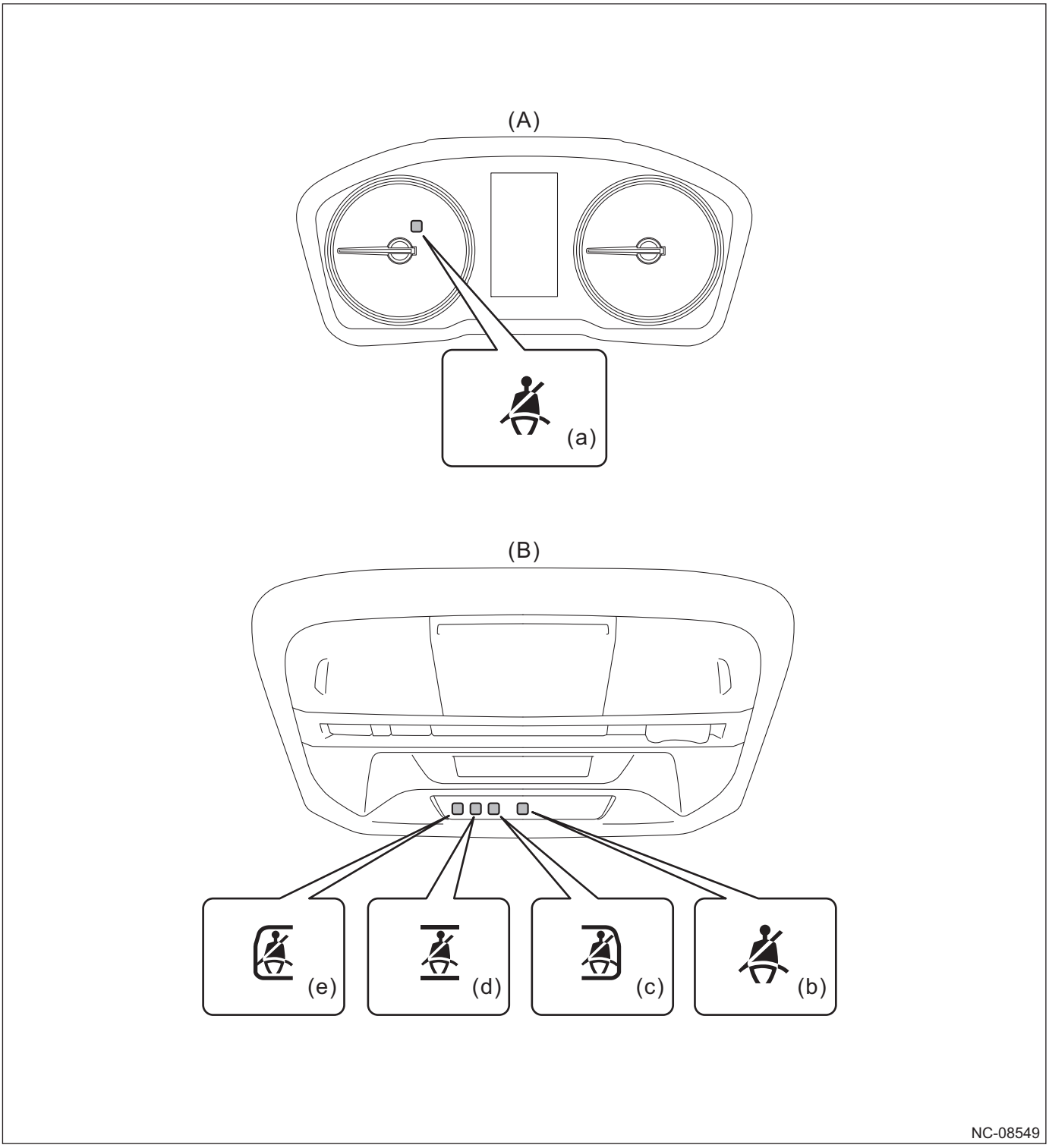
- Fabric
- Ultrasuede

Seat belt

■ Seat belt warning light

- The driver's seat belt warning light is located in the combination meter.

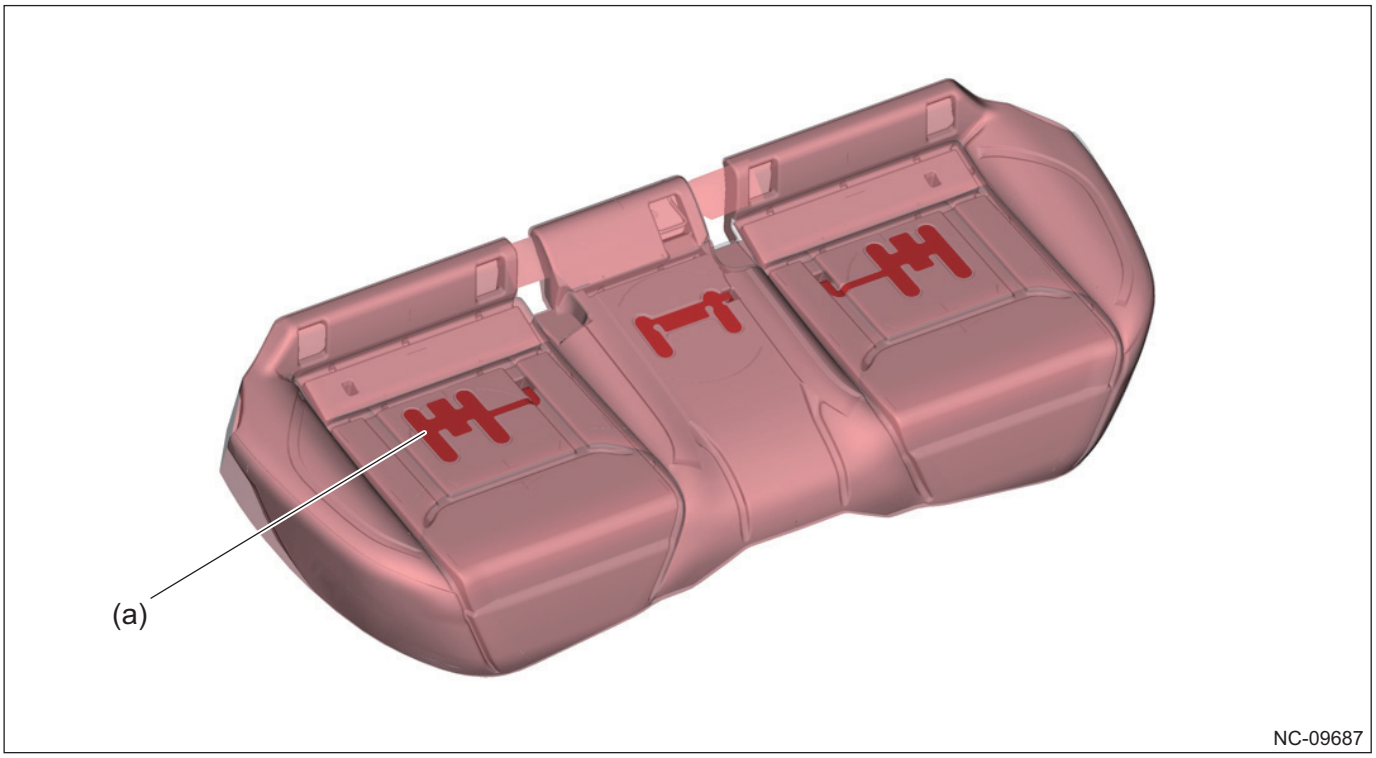
- The passenger's seat and rear seat belt warning lights are located in the warning box of the spot map light.



(A) Combination meter
(a) Driver's seat belt warning light
(b) Passenger's seat belt warning light
(c) Rear seat RH seat belt warning light
(B) Spot map light
(d) Rear seat center seat belt warning light
(e) Rear seat LH seat belt warning light

■ Seating sensor

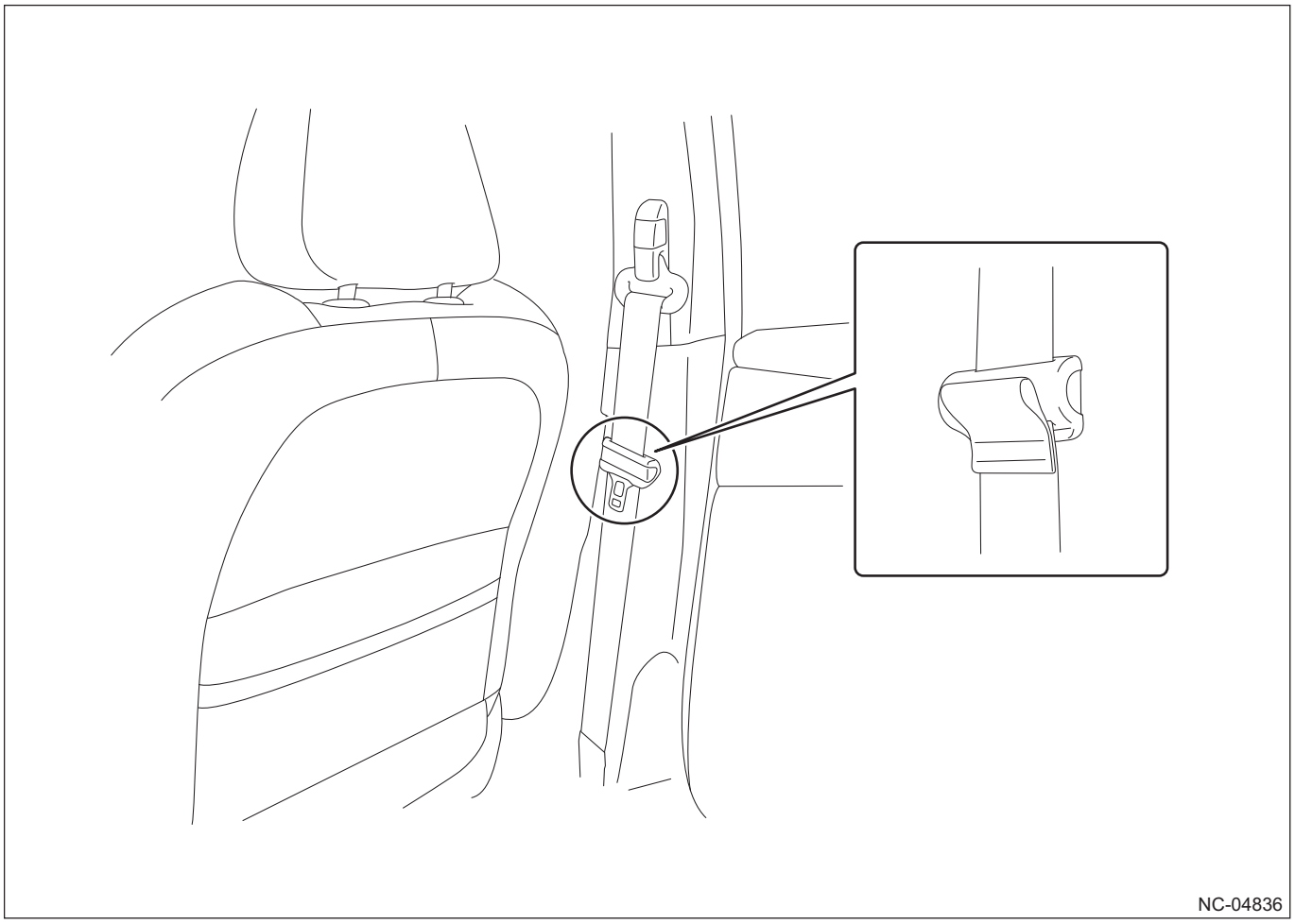
A seating sensor is adopted for all the rear seats. The sensor detects whether a rear seat occupant is present, and detects if the seat belt is unfastened.



(a) Seating sensor

■ Tongue cushion

The tongue cushion is adopted to reduce the sound of the tongue hitting the trim when the vehicle is traveling without a passenger in the passenger's seat and outer rear seats.



■ Equipment list

Equipment	Front seat (Driver's seat)	Front seat (Passenger's seat)	Rear seat (Outer seat)	Rear seat (Center seat)
Locking tongue	✓	✓	✓	-
Adaptive force limiter	-	✓	-	-
Double pretensioner & Force limiter	-	✓	-	-
Tongue cushion	✓	✓	✓	-
Pretensioner & force limiter	✓	✓	✓	-

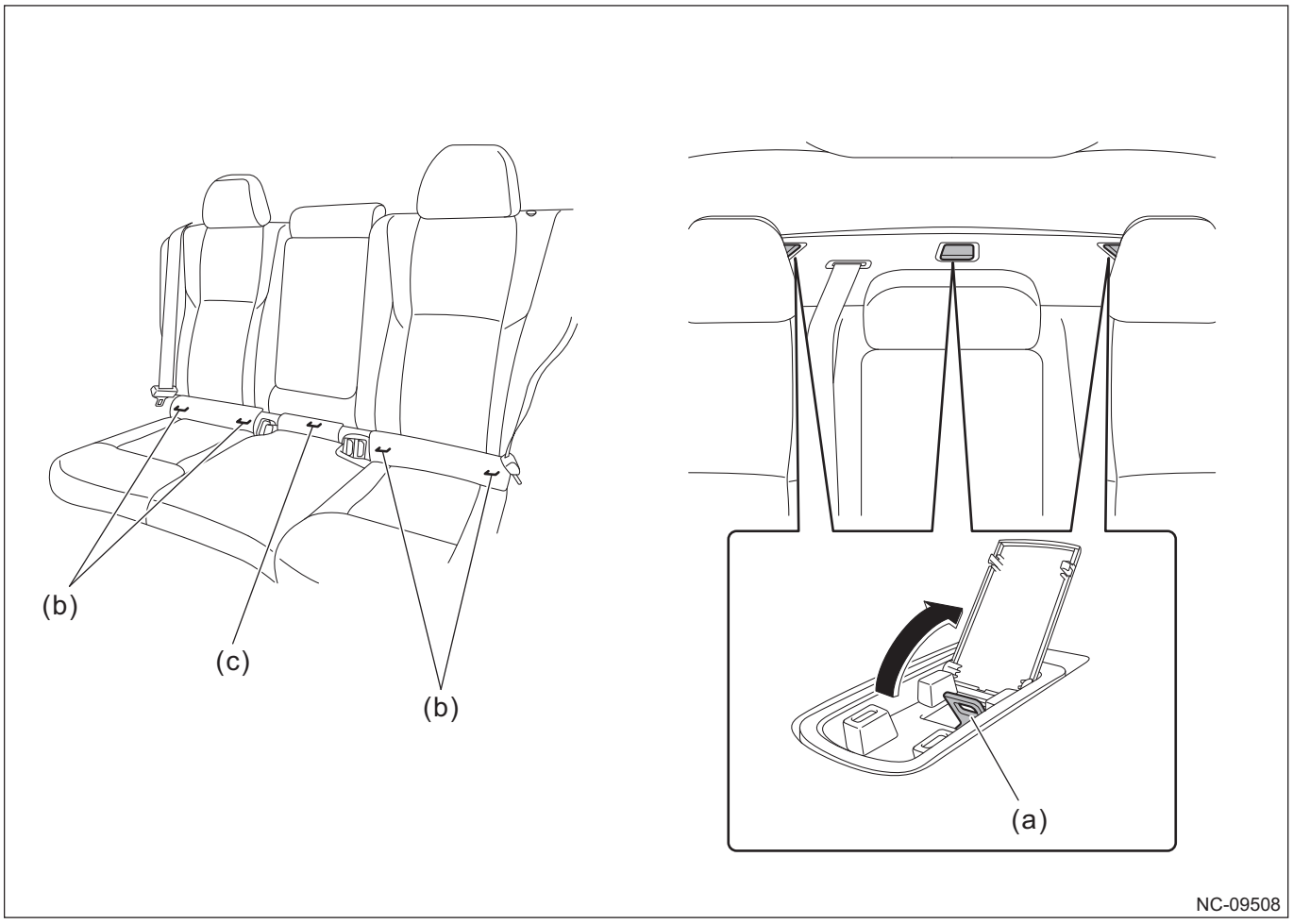
Refer to "10.3 Airbag System" for the following equipment.

- Locking tongue
- Adaptive force limiter
- Double pretensioner
- Seat belt pretensioner
- Force limiter

■ Anchor for installing child seat

One anchor is added to the lower anchors for securing a child seat on the rear seats to make a total of five anchors, enabling a child seat to be anchored with the lower anchors even on the center seat.

Layout of anchor for installing child seat



(a) Tether anchor
(b) Lower anchor
(c) Center seat lower anchor*

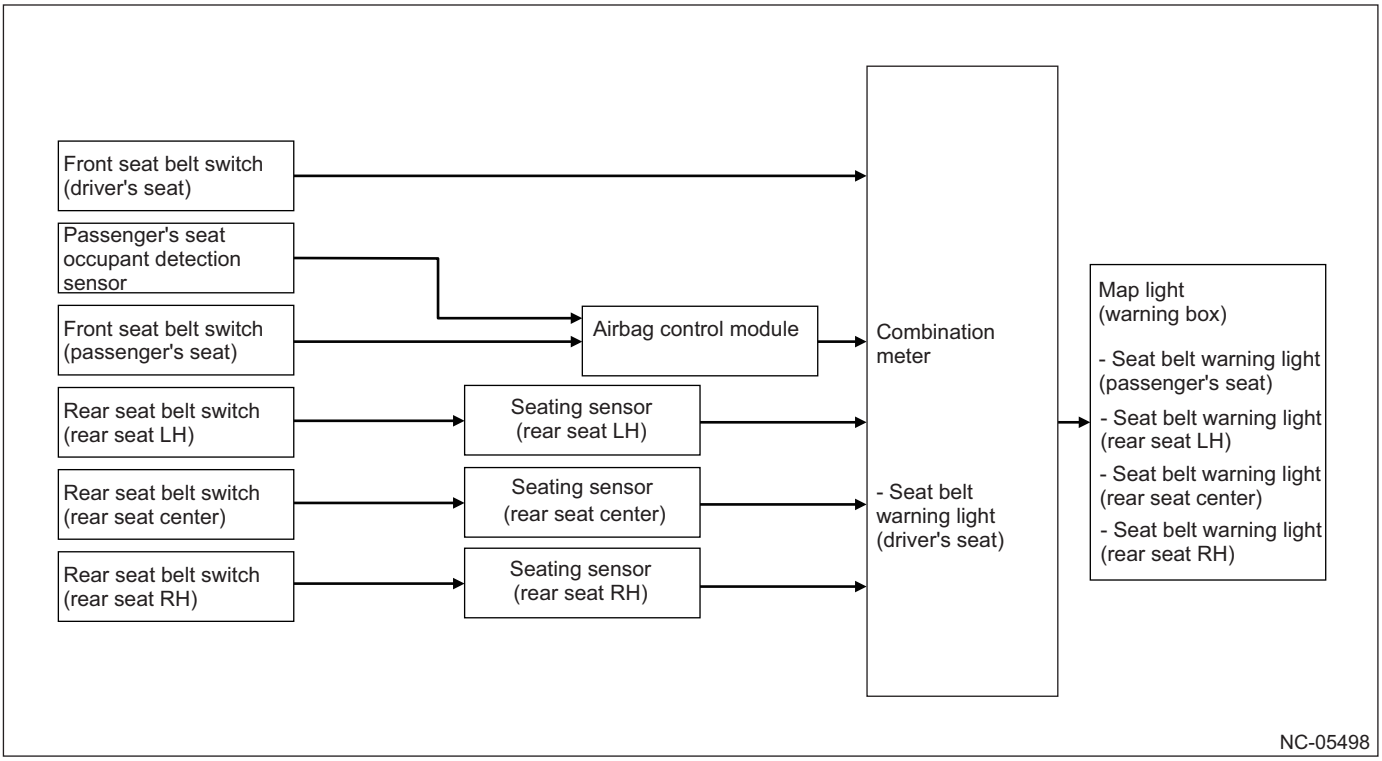
- *When the center seat lower anchor (c) is used to install the child seat, sitting in the rear seat RH is prohibited.
- The specification about the anchor for installing child seat (lower anchor, tether anchor) is in accordance with ISO FIX.

10.4.3 Construction and Operation

Seat belt warning light system

If an occupant is not wearing the seat belt during driving (at a vehicle speed of 12.4 mph (20 km/h) or higher), the seat belt warning light flashes, and the buzzer sounds to warn the driver.

System diagram



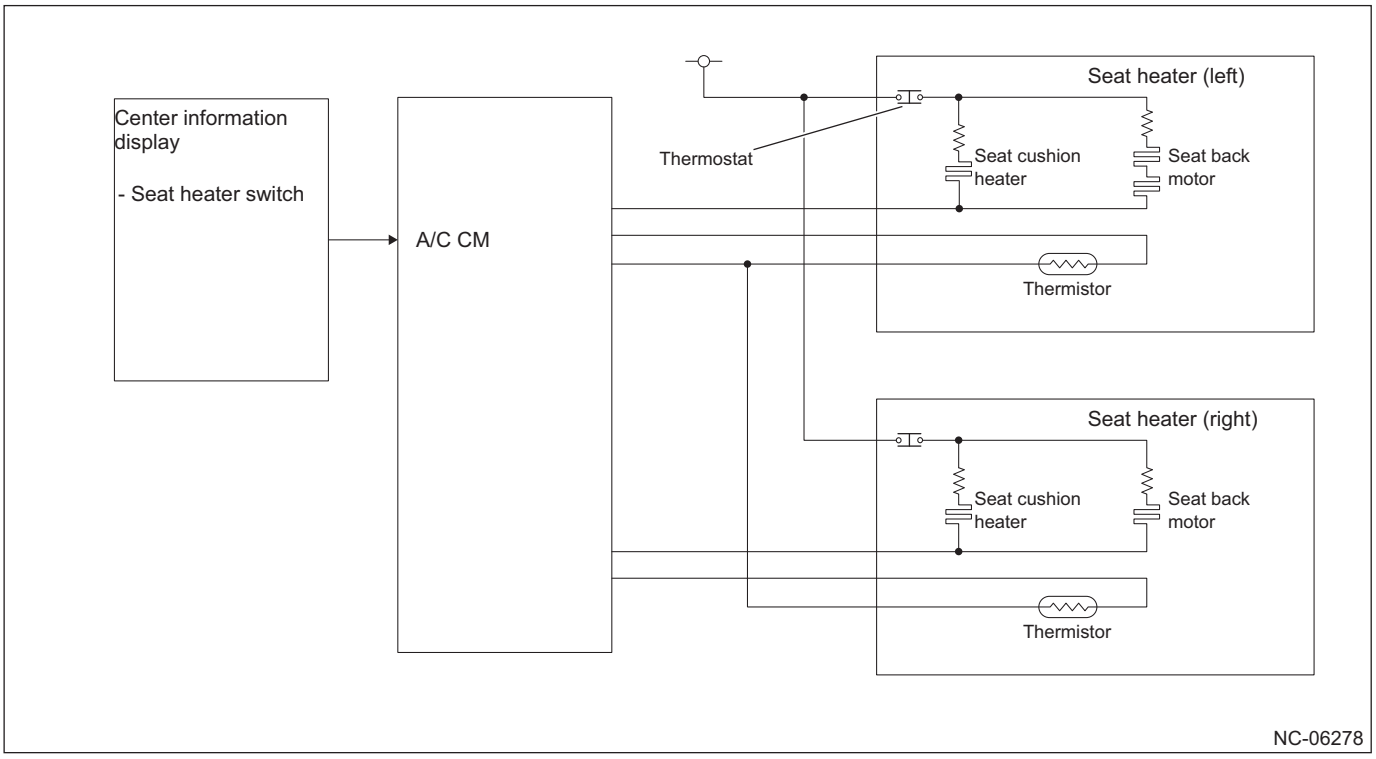
Main component functions

Component	Function
Combination meter	• Turns on the driver's seat belt warning light to warn the driver if the driver is not wearing the seat belt. • Sends the seat belt warning light on signal to the map light based on the information received from the airbag control module and seating sensor.
Map light	Turns on the seat belt warning light as a warning if a seat belt is not worn while an occupant is sitting in the passenger's seat or rear seat.
Front seat belt switch (driver's seat)	Sends the seat belt warning light on signal to the combination meter if the driver is not wearing the driver's seat belt.
Front seat belt switch (passenger's seat)	Sends the passenger's seat belt fastening status to the airbag control module.
Passenger's seat occupant detection sensor	Sends the passenger's seat occupant detection judgment to the airbag control module.
Airbag control module	Sends the seat belt warning light on signal to the combination meter based on the passenger's seat belt fastening status and occupant detection judgment.
Rear seat belt switch	Sends the rear seat belt fastening status to the seating sensor.
Seating sensor	Sends the seat belt warning light on signal to the combination meter if a seat belt is not worn while an occupant is sitting in a rear seat.

Front seat heater system

The front seat heater is composed of a center information display, A/C CM, and heater. Performing an operation on the center information display inputs a signal to the A/C CM and activates the seat heater. The operation status (LO mode, MID mode, HI mode, or OFF) can be checked on the Center Information Display.

System diagram



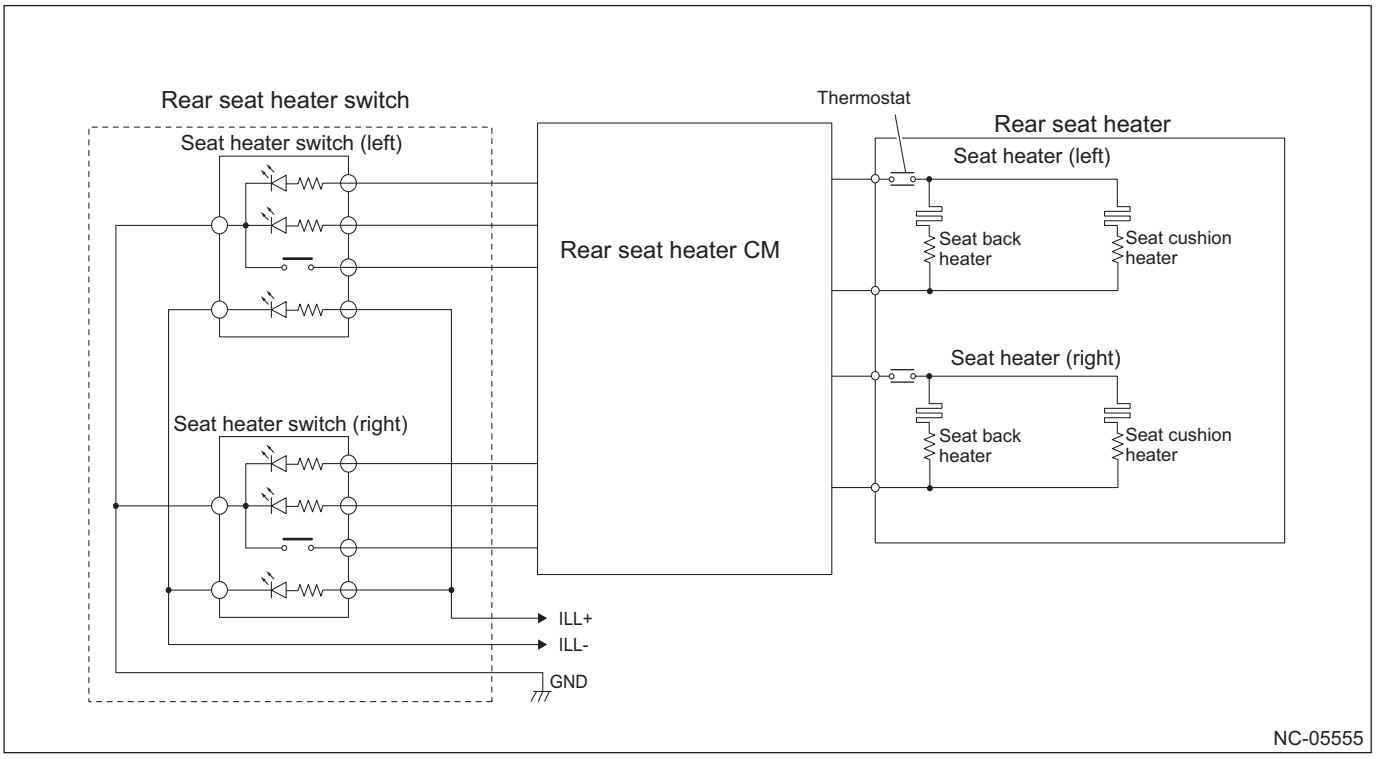
Main component functions

Component	Function
Center information display • Seat heater switch	Outputs the input operation signals to the A/C CM.
A/C CM	• Controls the set temperature of the front seat heater according to the operation signal input from the center information display. • Adjusts the temperature to the set temperature by detecting the temperature from the thermistor installed on the front seat and energizing the front seat heater with an amount of electricity appropriate for the conditions.
Front seat heater	• Sends the temperature detected by the thermistor to the A/C CM. • Operates the seat heater according to the control signal from the A/C CM.

Rear seat heater system

The rear seat heater is composed of the rear seat heater switch, rear seat heater CM, and heater. Operating the seat heater switch inputs a signal into the rear seat heater CM and activates the seat heater. Every time the switch is operated, the heater operation mode switches from LO to HI to OFF. The operation status can be checked by the indicator light.

System diagram



Main component functions

Component	Function
Rear seat heater switch	Outputs the input operation signals to the rear seat heater CM.
Rear seat heater CM	Controls the set temperature of the rear seat heater according to the operation signal input from the rear seat heater switch.
Rear seat heater	Operates the seat heater according to the control signal from the rear seat heater CM.

10.5 Instrument panel

10.5.1 Overview

Overview

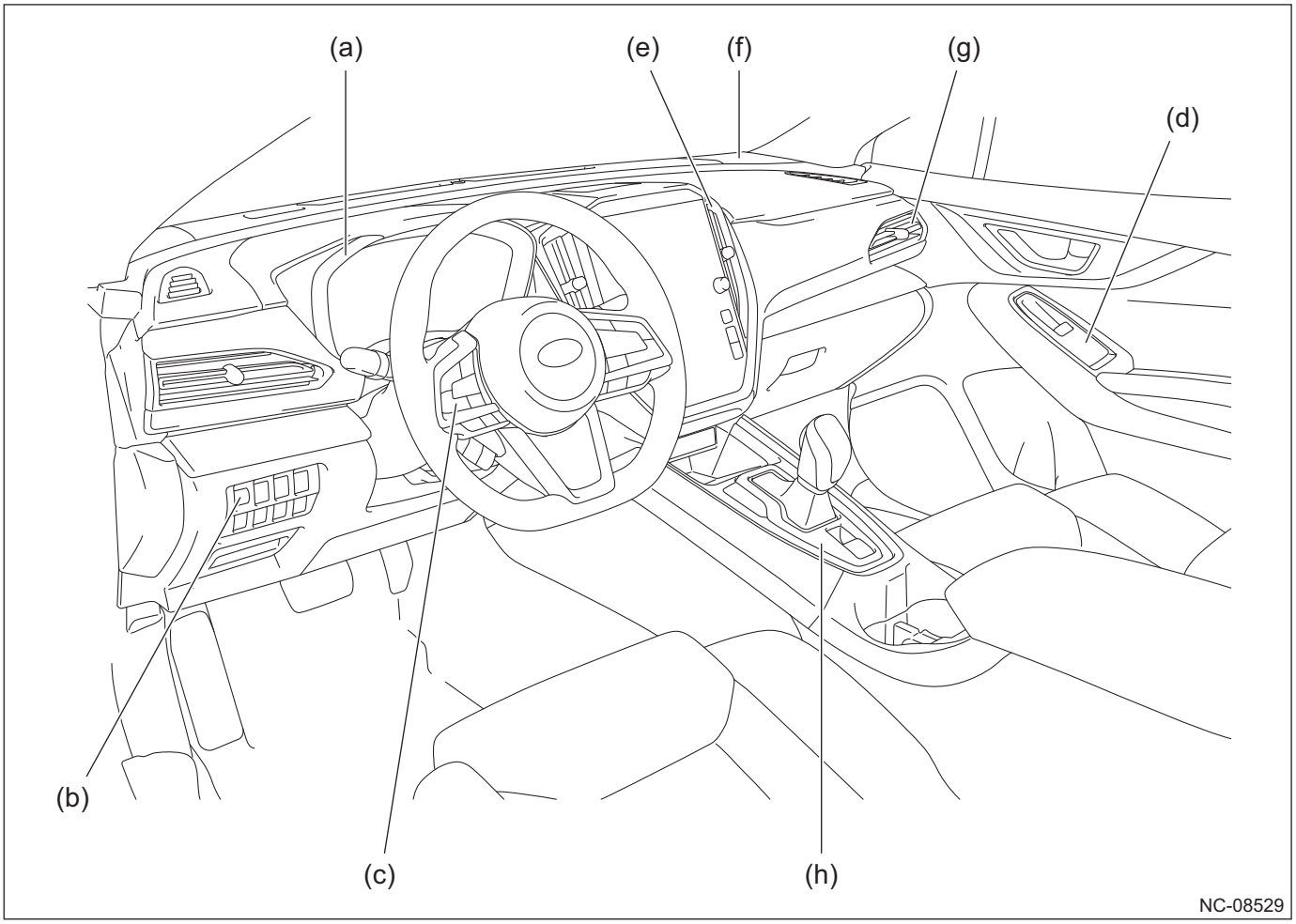
Materials for the area around the instrument panel and console are selected carefully, even taking into account factors such as how they feel to touch.

The interior design containing red stitching and red illumination makes the user feel the aggressive and sporty performance.

*The specifications differ by vehicle grade.

10.5.2 Component

Component layout drawing



(a) Meter shield ring
(b) Instrument panel switch
(c) Steering switch
(d) Door switch
(e) Center ventilation grille
(f) Speaker grille
(g) Side ventilation grille
(h) Shift panel

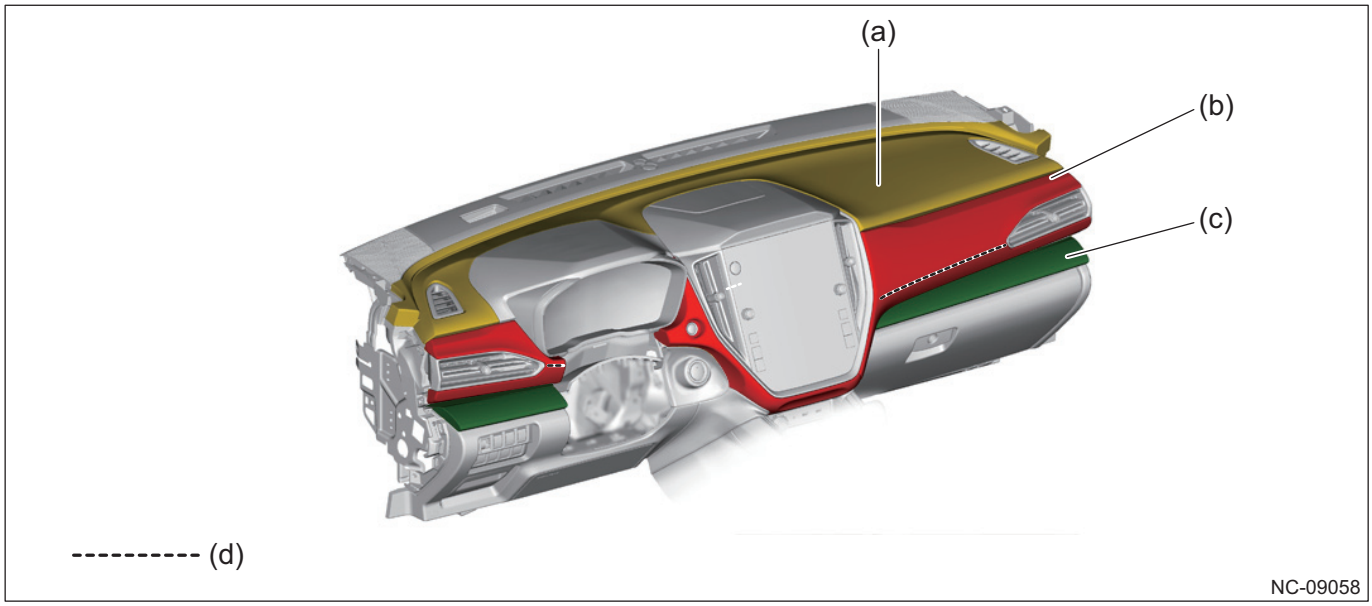
**: The illustration shows a typical example.*

Component details

Instrument panel

A multi-layer structure is adopted for the instrument panel with materials divided between each layer, creating a variety of stylistic expressions.

- Nubuck style artificial leather, PVC surface wrapping, and double stitching are provided for instrument panel mid decorations. The highly durable surface is soft to the touch and an outer surface looks like it was installed manually by a craft-worker, creating a luxurious feel. (for some grades)
- Base color black is adopted for the instrument panel mid decoration in the base grade. The weight is lighter compared to the surface-wrapped specification and the texture is switched above and below the decoration, resulting in a design that is in balance with the surrounding interior. (for some grades)



(a) Instrument panel upper

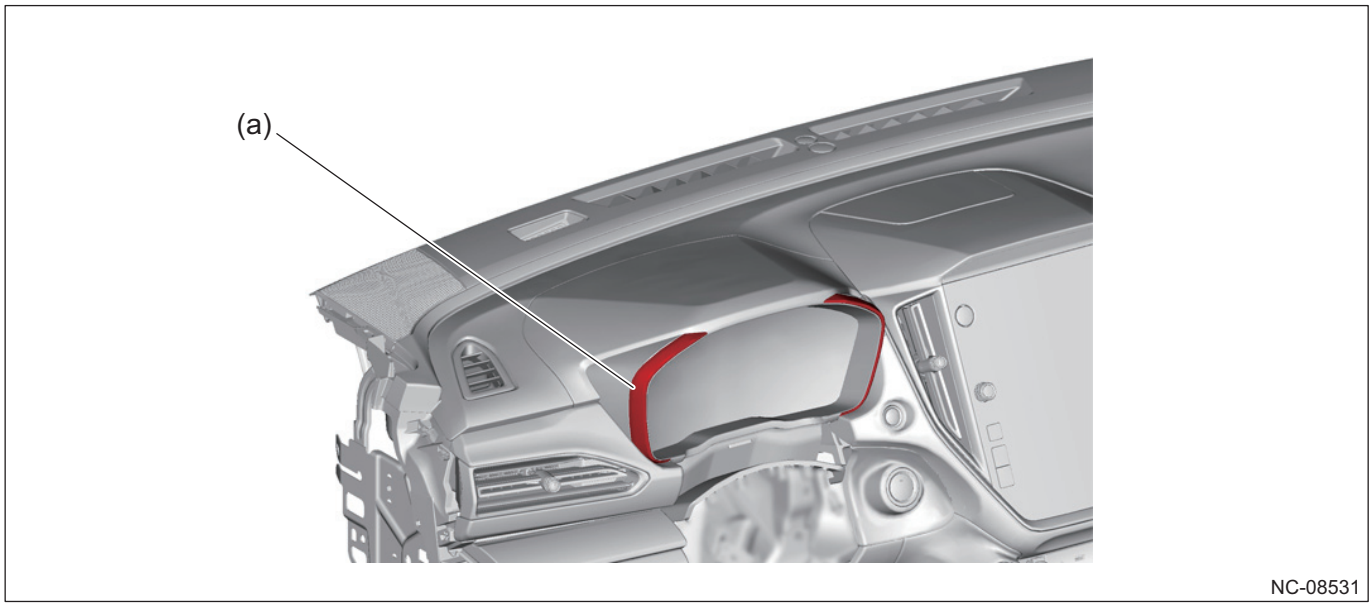
(b) Instrument panel mid (surface wrapping/base color black) (for some grades)

(c) Instrument panel ornament decoration

(d) Double stitching (for some grades)

■ Meter shield ring

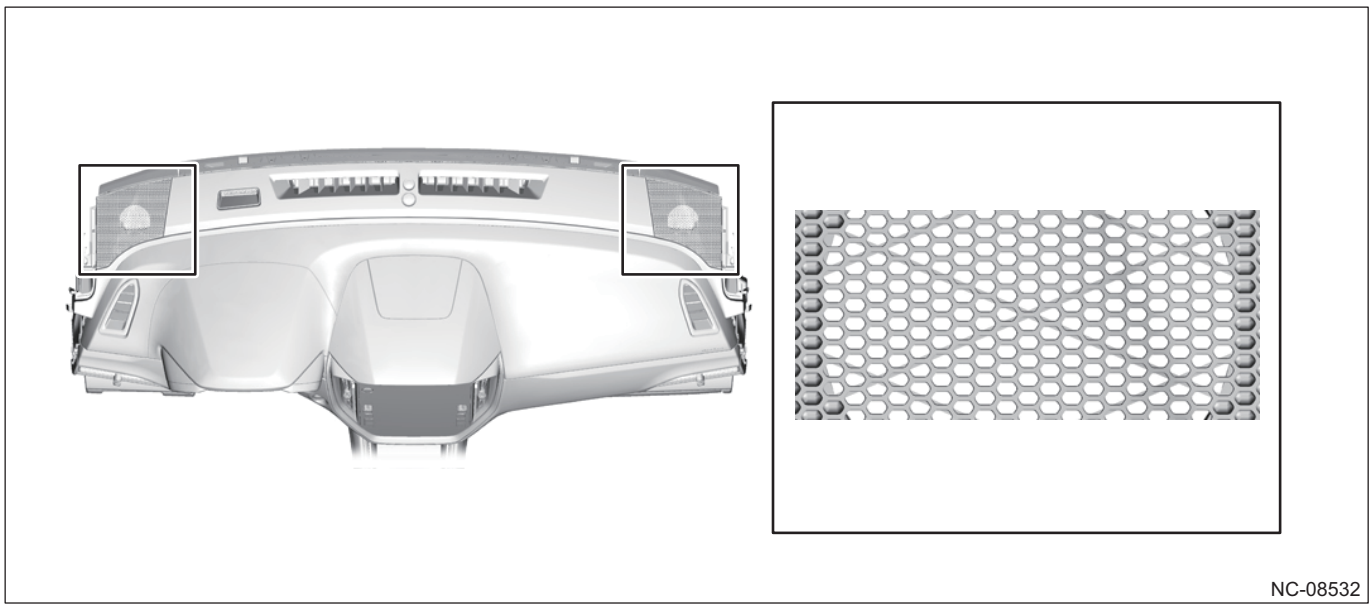
Two color types, cast black and base color black, are adopted for the meter shield ring of the combination meter. (for some grades)



(a) Meter shield ring

■ Speaker grille

The hexagonal shape of the speaker grille holes improves the aperture ratio and contributes to the improvement of sound quality.

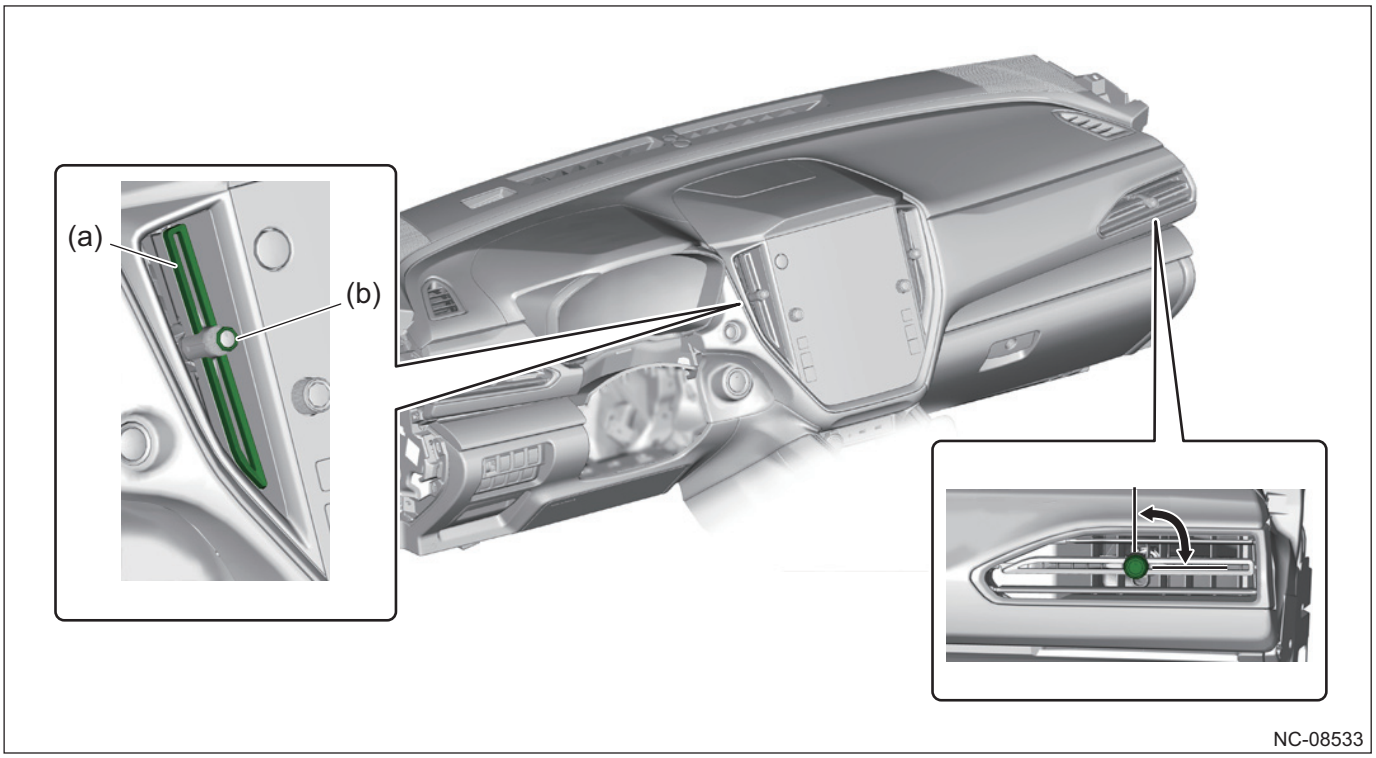


■ Ventilation grille

A ventilation grille is adopted whose air flow direction can be adjusted and shutter opened and closed with a single knob in consideration of usability. Also, rubber material is used on the outer circumference of the operation knob that is touched by the user for a soft touch, improving the quality feel during use.

- Shutter opening/closing: Turn the operation knob
- Air flow direction adjustment: Move the operation knob up, down, left, or right

A plated decoration ring is used on the operation knob and a silver paint decoration is used on the air flow direction fin to create a luxurious feel.

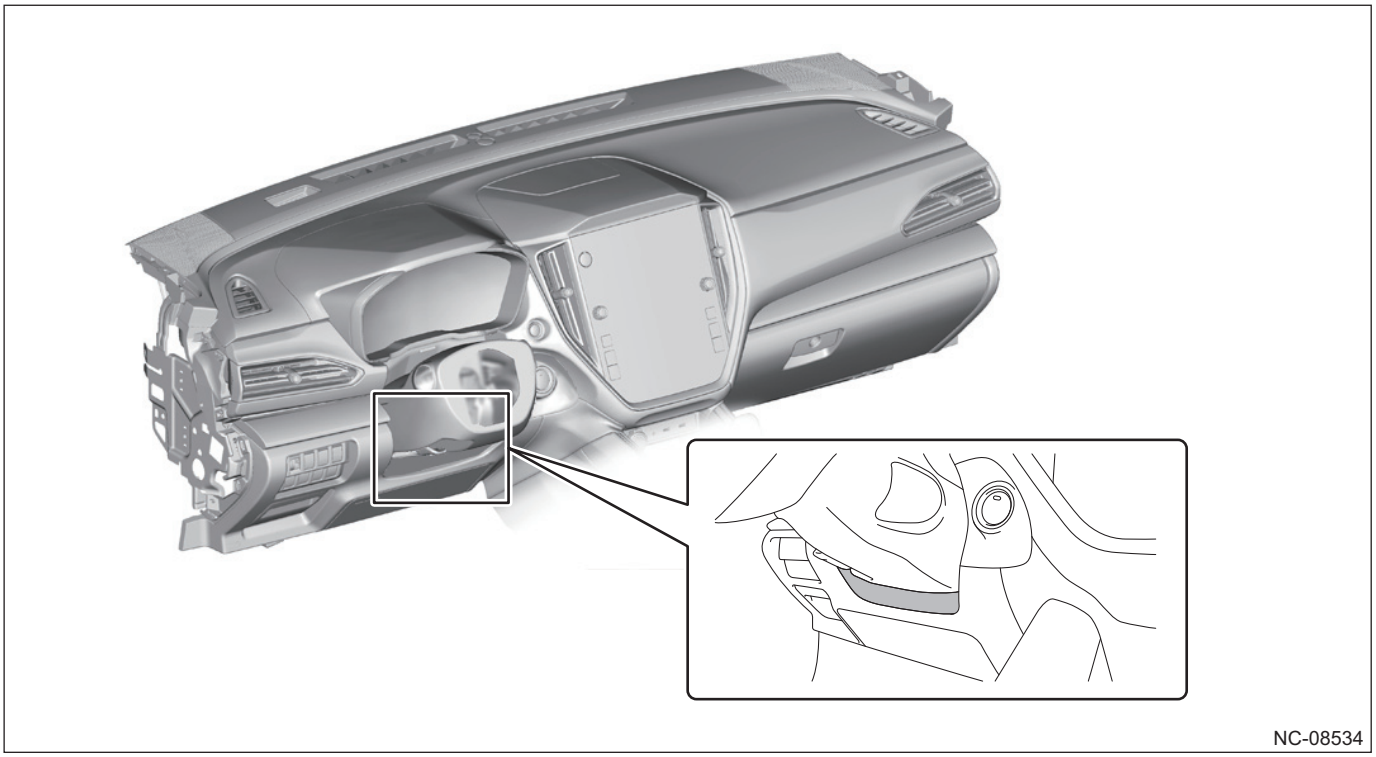


(a) Air flow direction fin (silver decoration)

(b) Operation knob (plated decoration ring)

■ Cover steering

A screening cover is provided for the lower part of the column cover to improve the quality feel and to hide the internal structural parts after the steering position is adjusted. Also, a wrinkle-free shape is used for the cover surface at the upper part of the column in consideration of appearance.

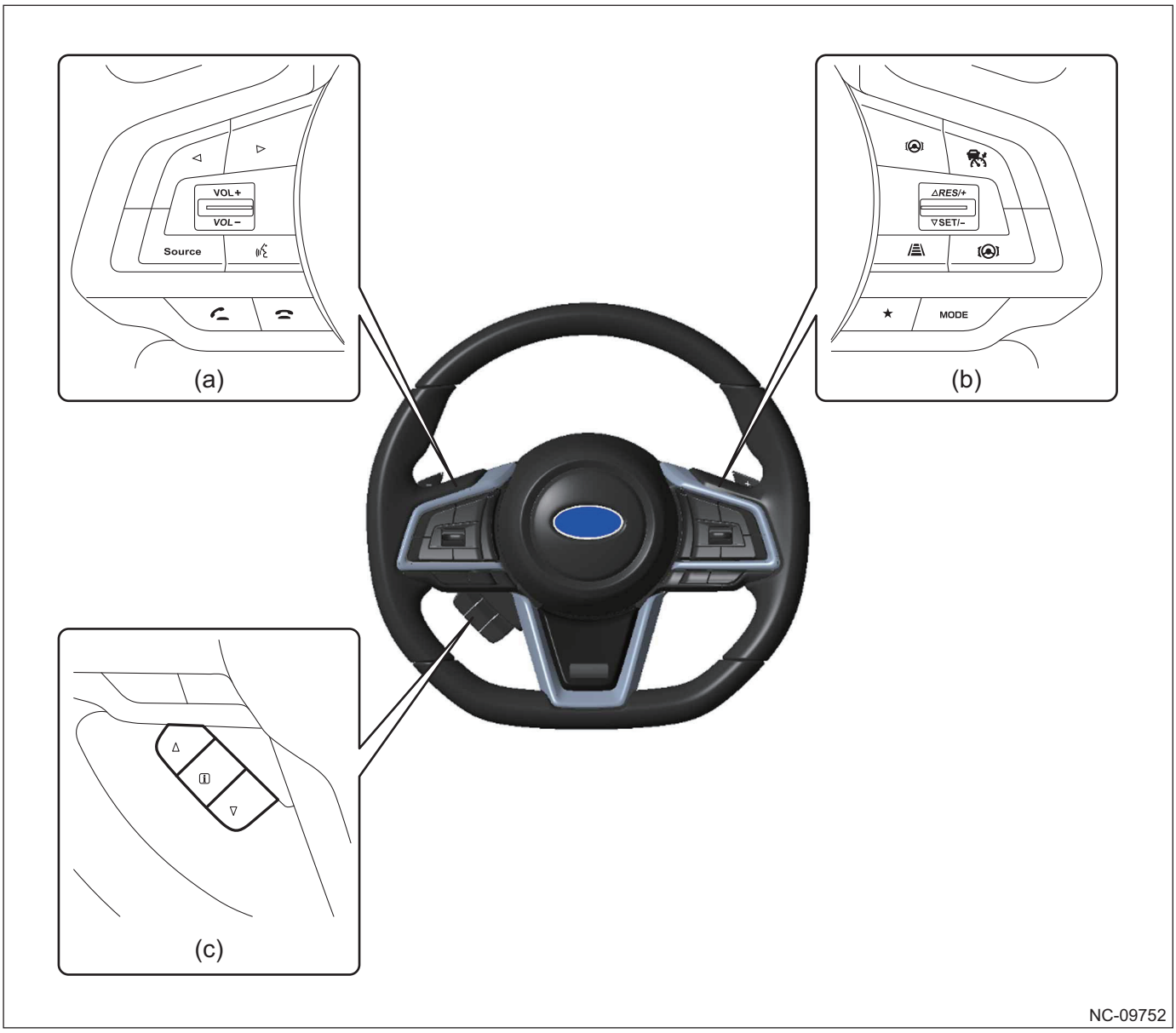


Switch

■ Steering Switch

Steering switches are laid out to group necessary functions and allow for direct, quick operation.

- A red color is adopted for the switch nighttime illumination to improve the quality feel.
- As a result of providing the center information display, an information switch is provided as a meter display switch.
- The meter display switches are positioned under the satellite switch. These enable operations such as screen transitions without releasing the steering wheel.
- Newly designed marks are adopted for the cruise control satellite switches and meter display switches.
- A function is provided for the information switch that switches the screen to the full LCD meter when the switch is pressed and held, and a mark is provided on the switch.



(a) Satellite switches (audio side)

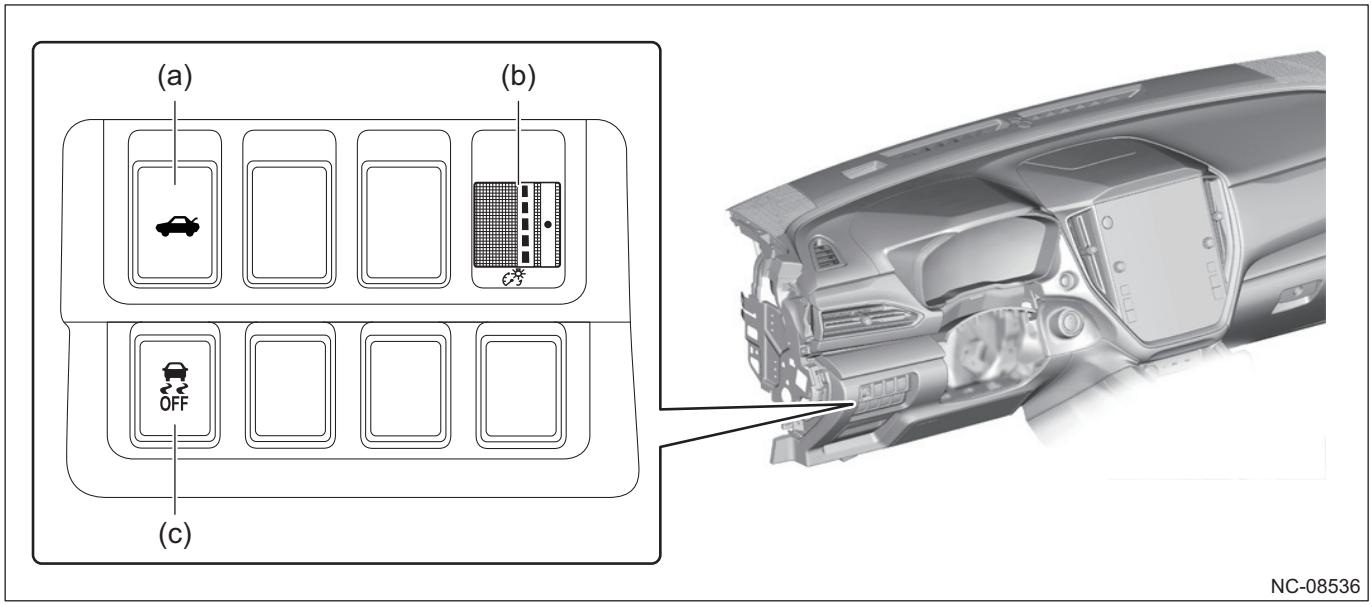
(b) Satellite switches (Cruise Control side)

(c) Meter switches (information switch)

■ Instrument panel switch

A white color is adopted for the illumination of the instrument panel switch cluster to improve the visibility and usability.

- A trunk opener switch that can unlock the trunk lid with a switch operation from the driver's seat is provided in consideration of convenience.
- An illumination control switch that allows the brightness of the interior illumination to be adjusted is provided in consideration of usability.
- A VDC OFF switch is provided on the bottom level of the instrument panel switches.



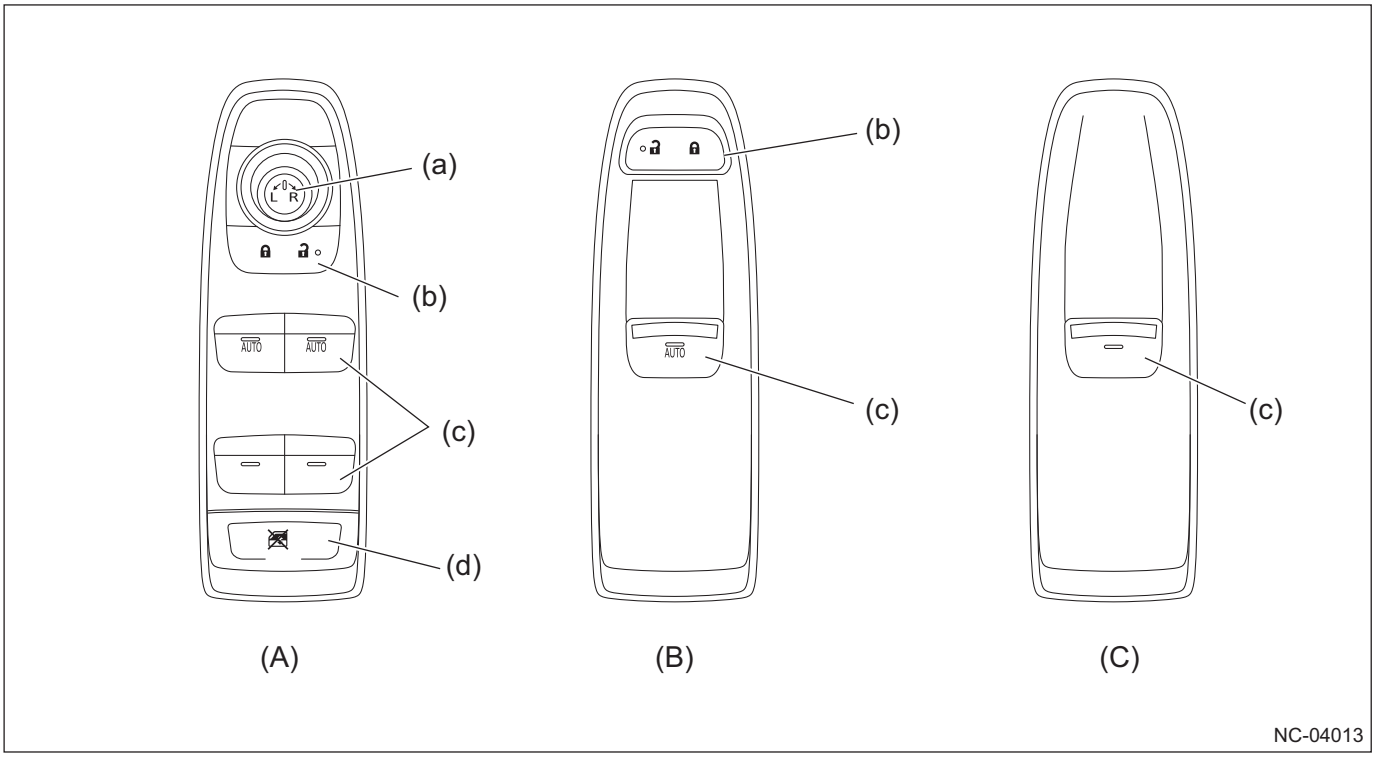
(a) Trunk opener switch
(b) Illumination control switch
(c) VDC OFF switch

■ Door panel switch

A bezel in base color black is provided for the switch panel.

A red color is adopted for the switch nighttime illumination to create a luxurious feel.

Door panel switch



(A) Driver's seat
(B) Passenger's seat
(C) Rear seat

(a) Mirror control switch
(b) Central door lock switch
(c) Power window switch
(d) Window lock switch

10.6 Interior Trim/Interior Equipment

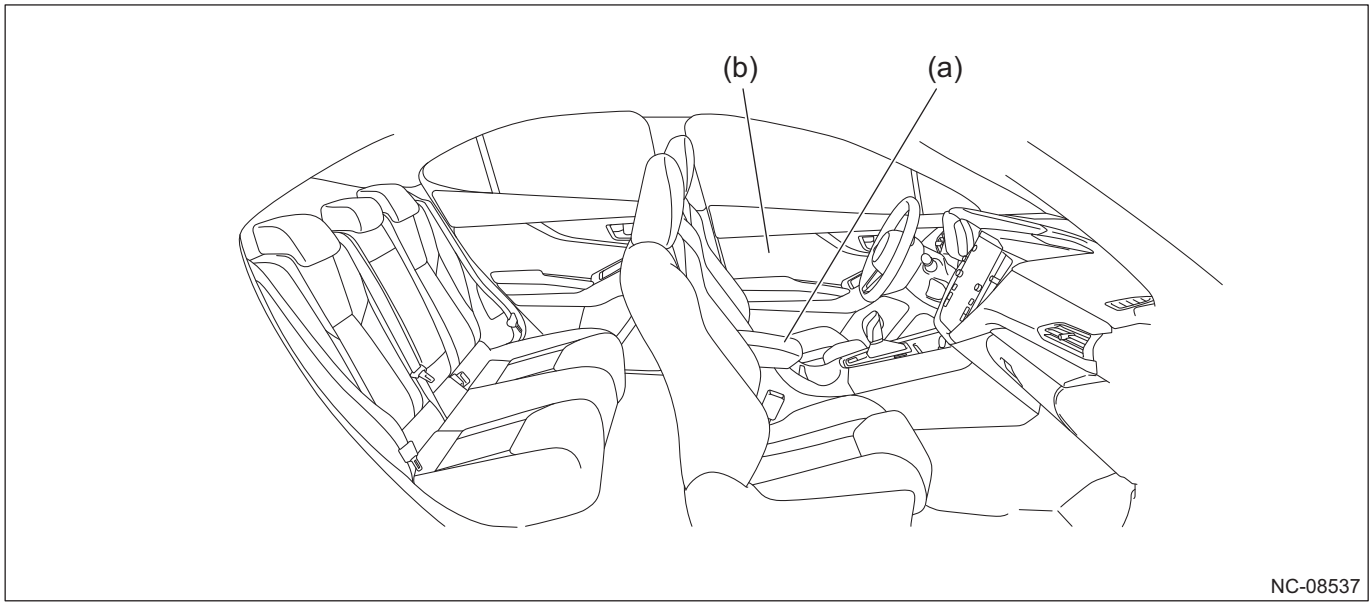
10.6.1 Overview

Overview

Interior colors are adopted with sporty black as the basic tone to heighten expectations for driving.

10.6.2 Component

Component layout drawing



(a) Center console

(b) Door trim

**: The illustration shows a typical example.*

Component details

Center console

A higher center console top surface is provided to reduce the level difference with the armrest, resulting in a powerful design around the center and a structure that seems to enclose the driver, providing peace of mind.

In addition to a large armrest, a low rebound type of cushion is adopted to improve comfort. Elbow contact during shift operations and practicality when using the cup holder have been considered.

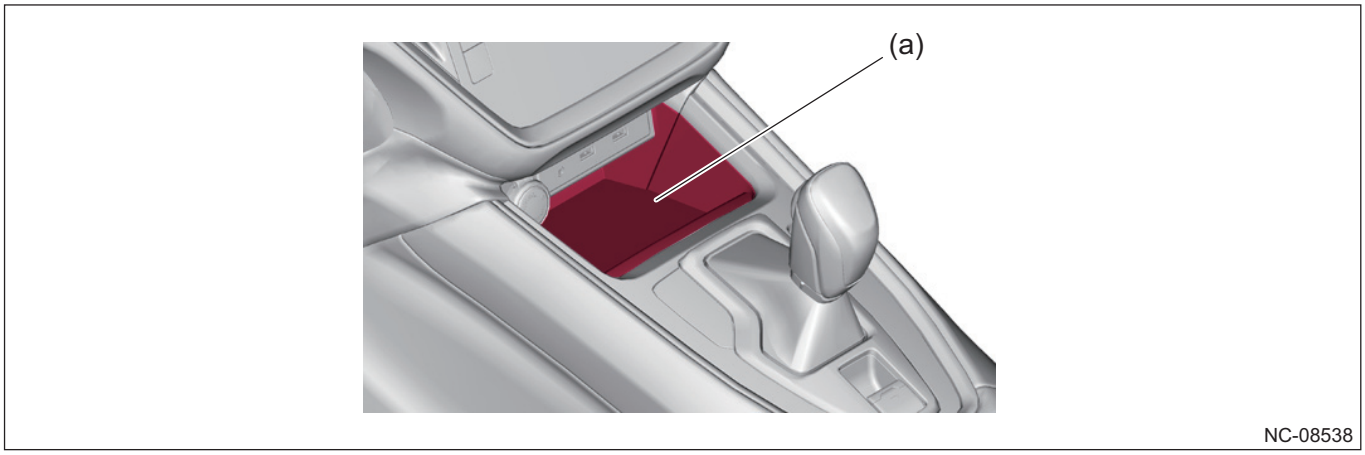
Parts such as the cup holder and small storage space are positioned practically by considering arm movements during shift operations.

■ Pocket in front of the shift lever

A useful pocket for storing a smartphone or other items is provided in front of the shift lever. Further, a 12 V power socket, USB power supply, external input terminals, and illumination are provided in consideration of convenience.

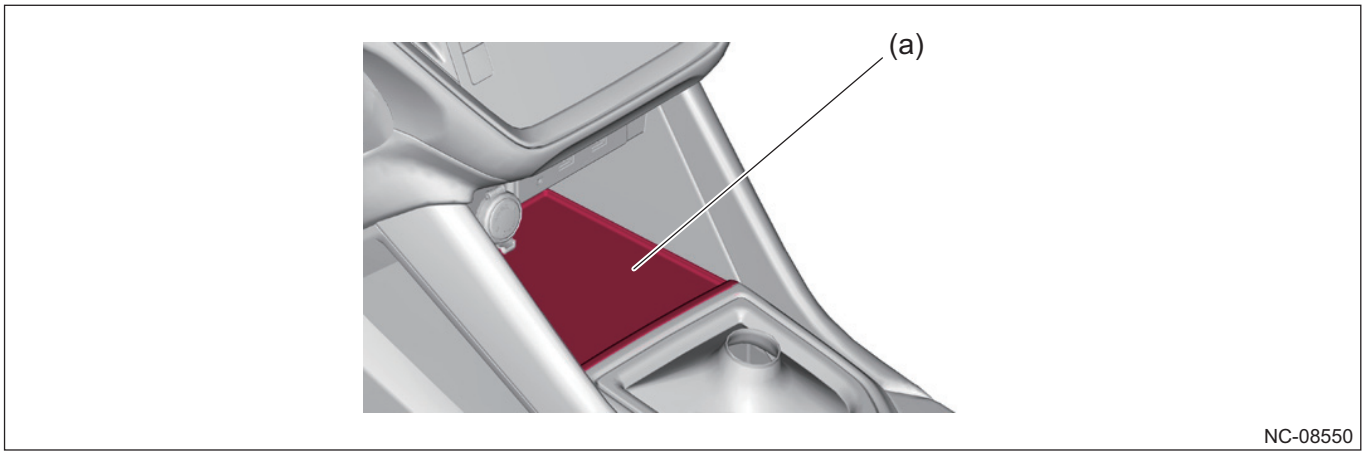
- The pocket opening shape is designed by considering the use of the USB power supply so that shift operations are not obstructed even while charging a large smartphone, and to make it easy to access when connecting or disconnecting a USB cable.
- White LED illumination is provided inside the pocket to create an advanced feel.

CVT



(a) Pocket in front of the shift lever

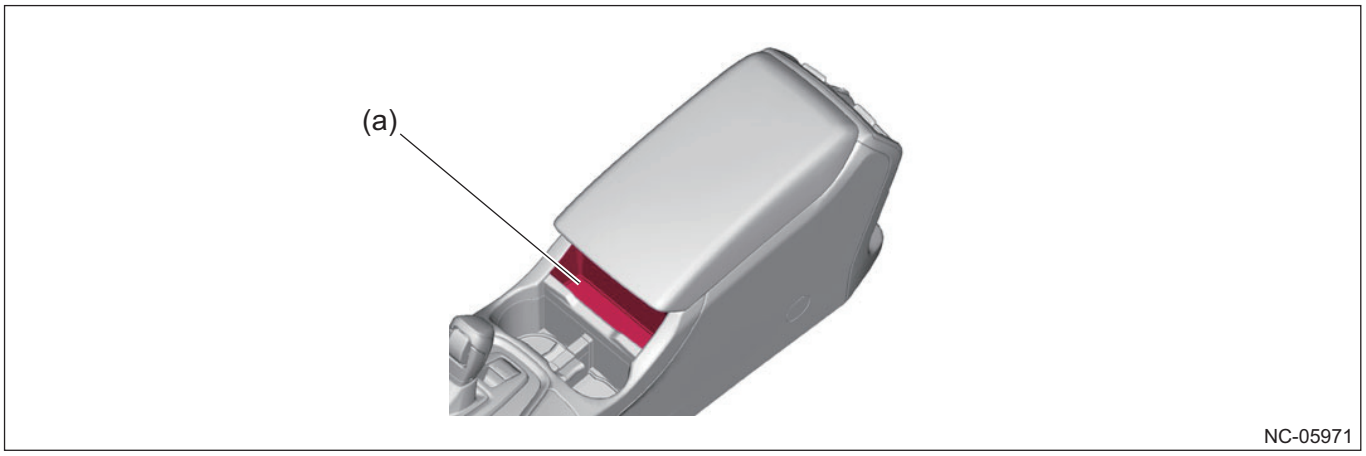
MT



(a) Pocket in front of the shift lever

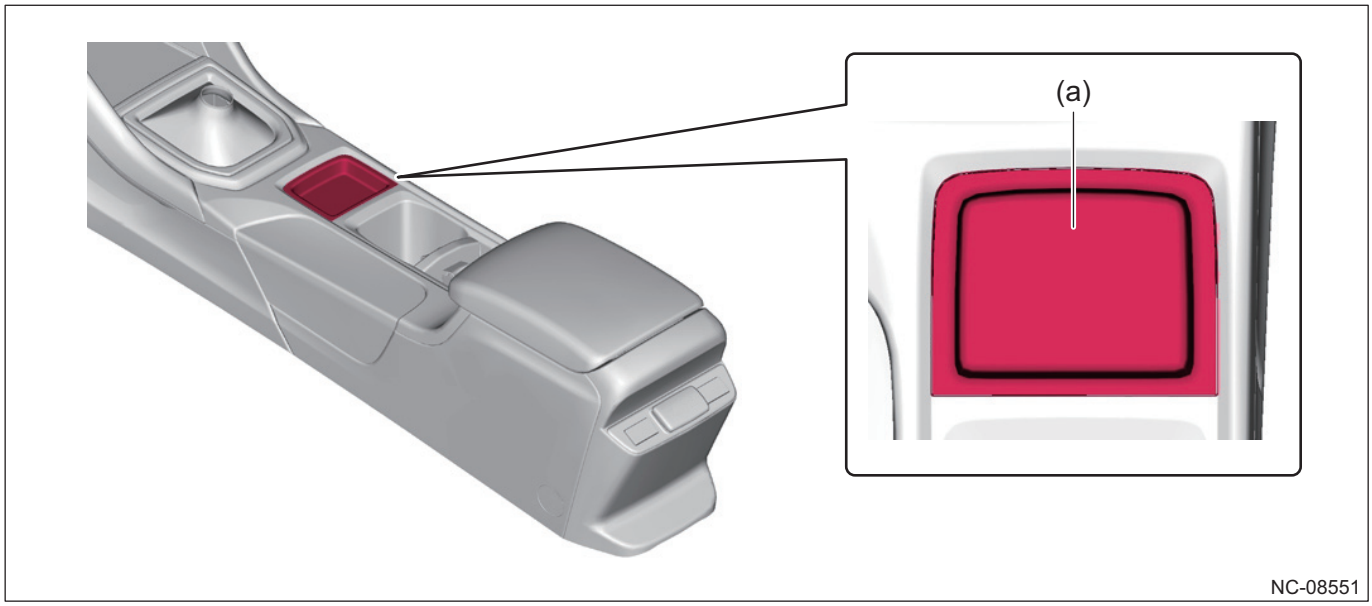
■ Console small storage space

A convenient small storage space for small objects such as a smartphone or keyless access key is adopted to the rear of the cup holder in consideration of convenience. (CVT)



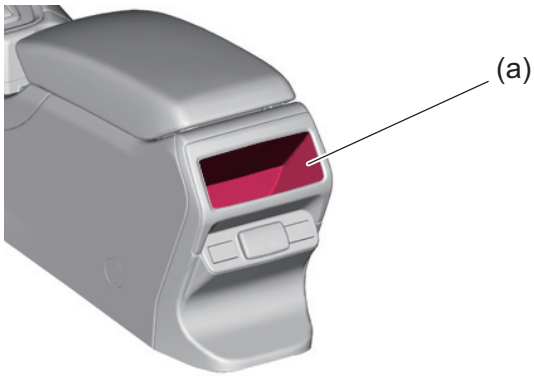
(a) Console small storage space

A convenient small storage space for small objects such as a keyless access key is adopted to the front of the cup holder in consideration of convenience. (MT)



(a) Console small storage space

A small storage space is adopted to the rear of the console box for use by the rear seat occupants. (CVT)

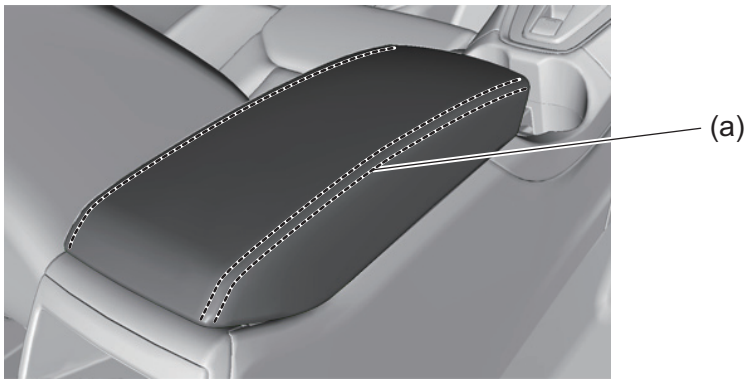


NC-08552

(a) Console small storage space

■ Console armrest

PVC surface wrapping with double stitching is adopted for the armrest for an outer surface that looks like it was installed manually by a craft-worker, creating a luxurious feel.



NC-08542

(a) Double stitching

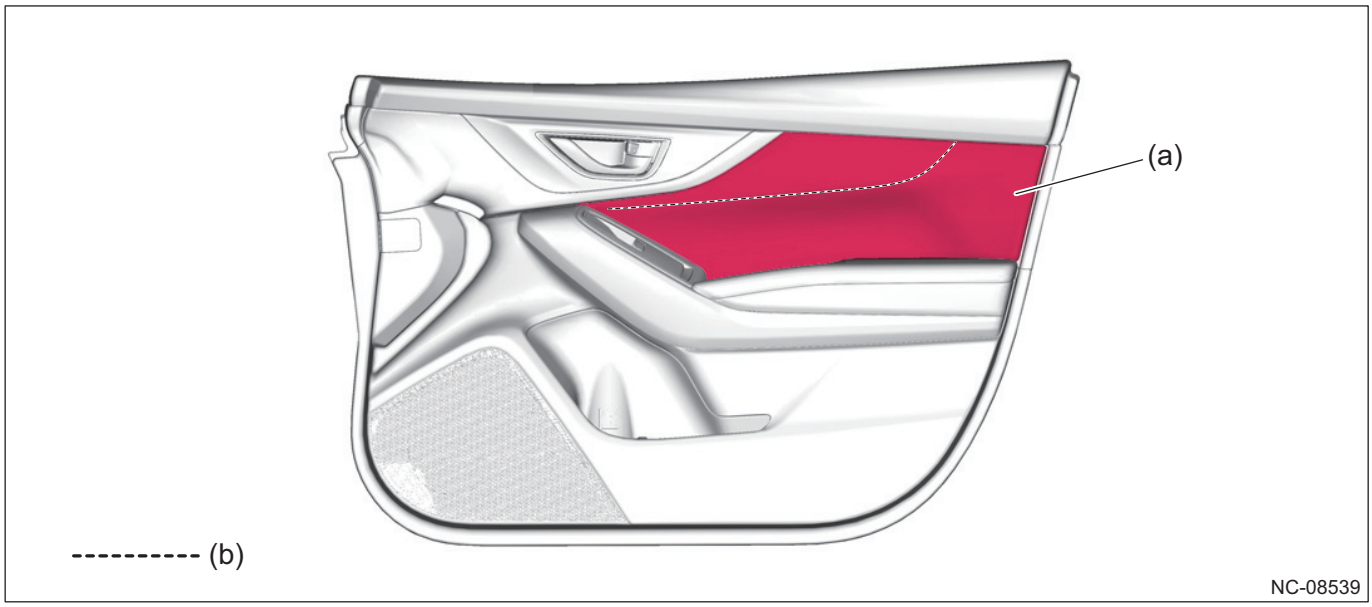
*: The illustration shows a typical example.

Trim

■ Door trim

Surface wrapping and stitching are provided for the mid section of the door trim for a high-quality feel.

- The colors of the surface wrapping and stitches are coordinated with the seat, which creates a luxurious feel with a sense of unity across the entire cabin.

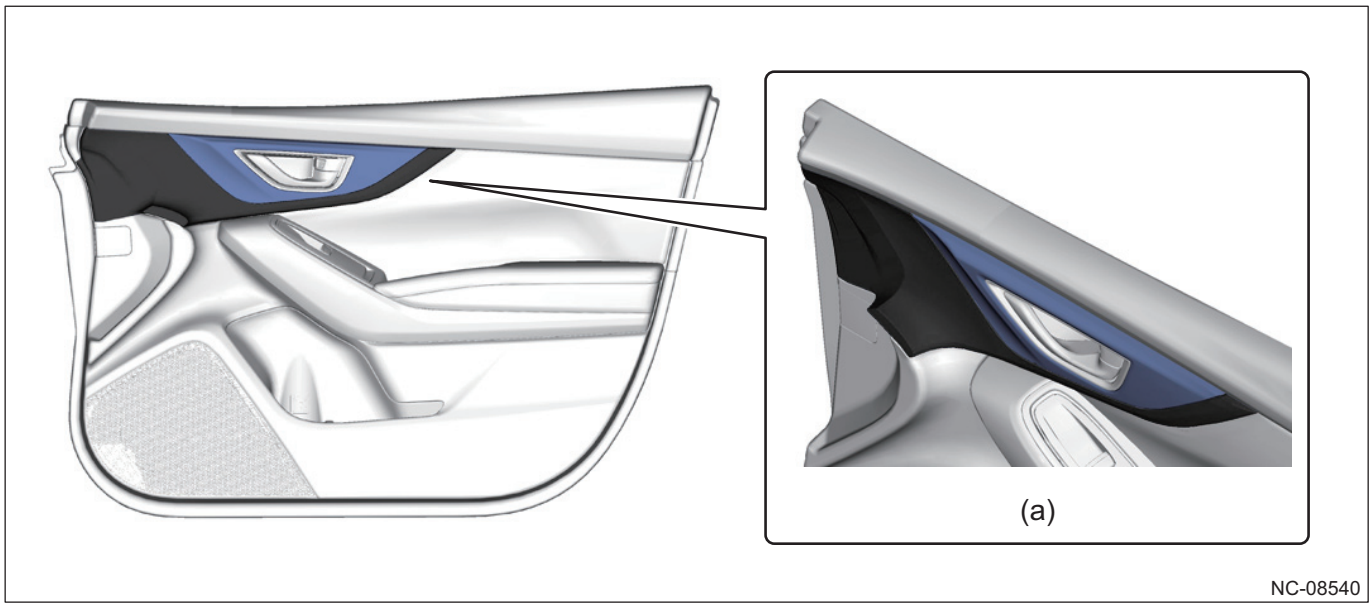


(a) Door mid decoration (surface wrapping)

(b) Double stitching

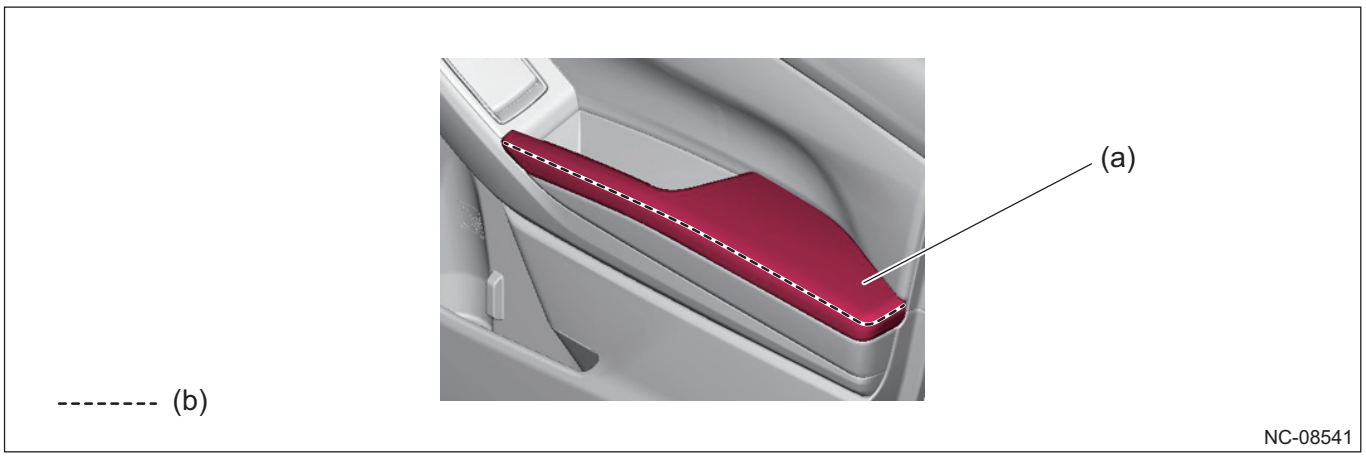
A decoration that matches the instrument panel ornament decoration is provided for the door trim center of the front seat doors and rear seat doors to improve the quality feel.

Two types of ornament decoration are provided; cast black for all doors, or silver paint for the front doors and base color black for the rear doors. (for some grades)



(a) Door trim center decoration

In addition to adopting a large armrest, a cushion thickness of approximately 0.8 in (20 mm) is provided to improve comfort and the quality feel.



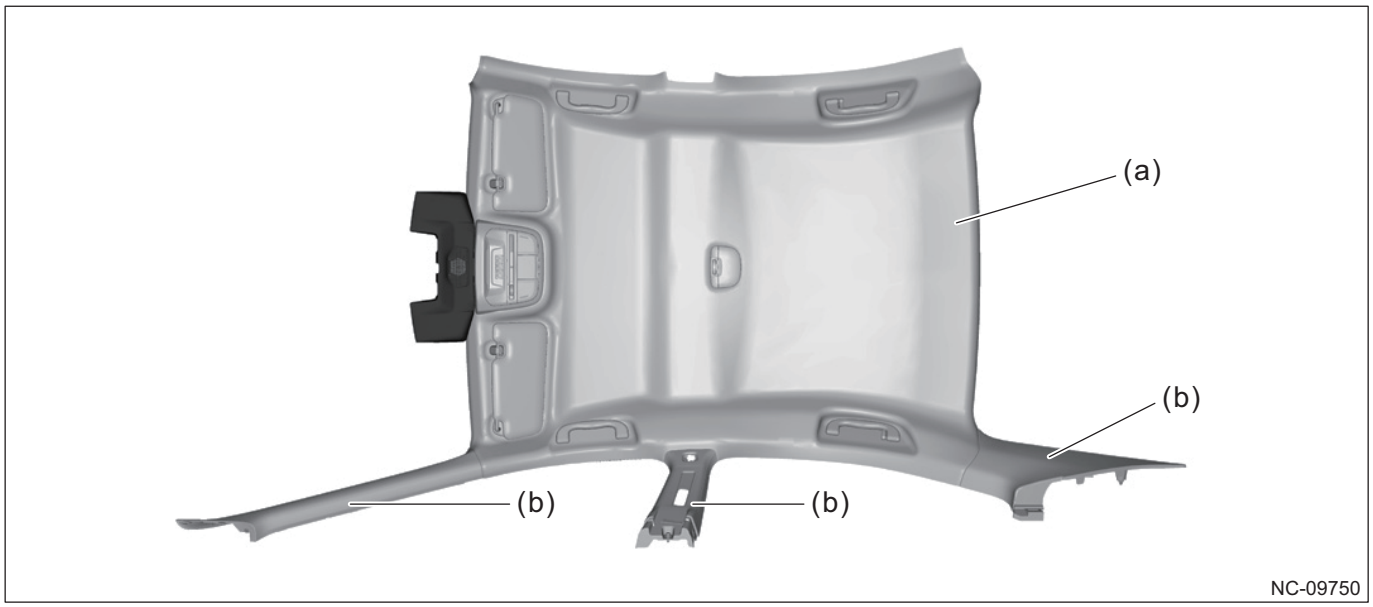
(a) Cushion section

(b) Double stitching

■ Roof trim

Tricot that feels good to touch is adopted for the surface of the roof trim. Further, a urethane laminated cushion layer is added for a soft, high-quality feel.

The fitting of the connecting area between the roof trim and pillar trim is optimized to improve the quality feel.



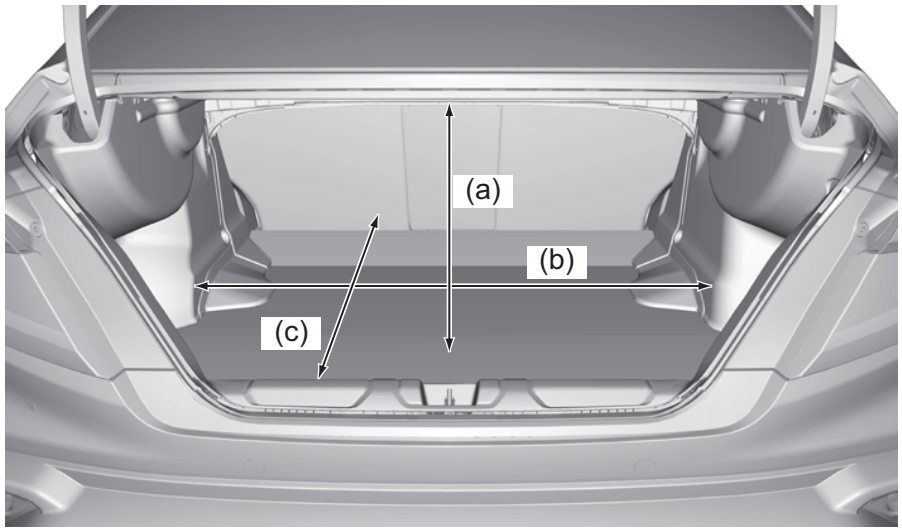
(a) Roof trim

(b) Pillar trim

Trunk room

■ Luggage compartment dimension

Over floor trunk space of sufficient size is secured, and the luggage compartment width and height are increased in consideration of user friendliness.



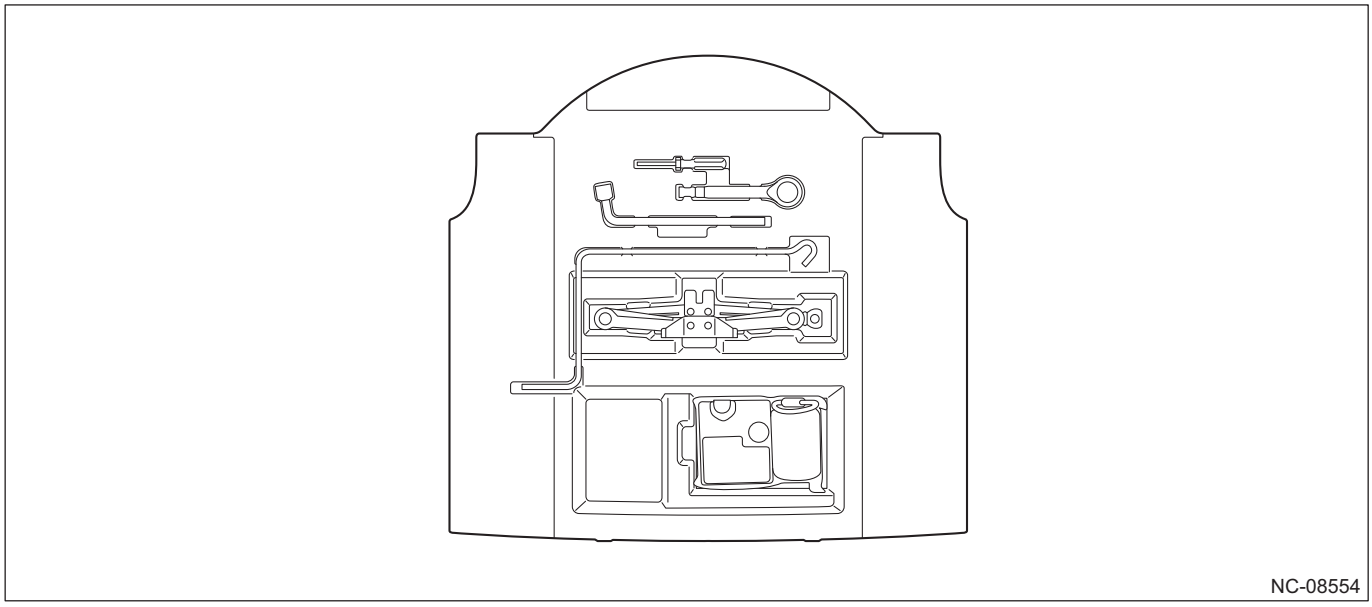
NC-08553

Luggage compartment dimension

Parts	Item	Dimension
(a)	Luggage compartment height (Between rear panel and deck floor board)	19.7 in (500 mm)
(b)	Luggage compartment width (Between rear deck side trim wheel houses)	43.3 in (1100 mm)
(c)	Luggage compartment floor depth (Between rear skirt trim and seat back trim)	39.4 in (1001 mm)

■ Sub trunk (Underfloor storage)

A sub trunk that is convenient for storing a puncture repair kit or tools is provided under the floor mat in the trunk room.



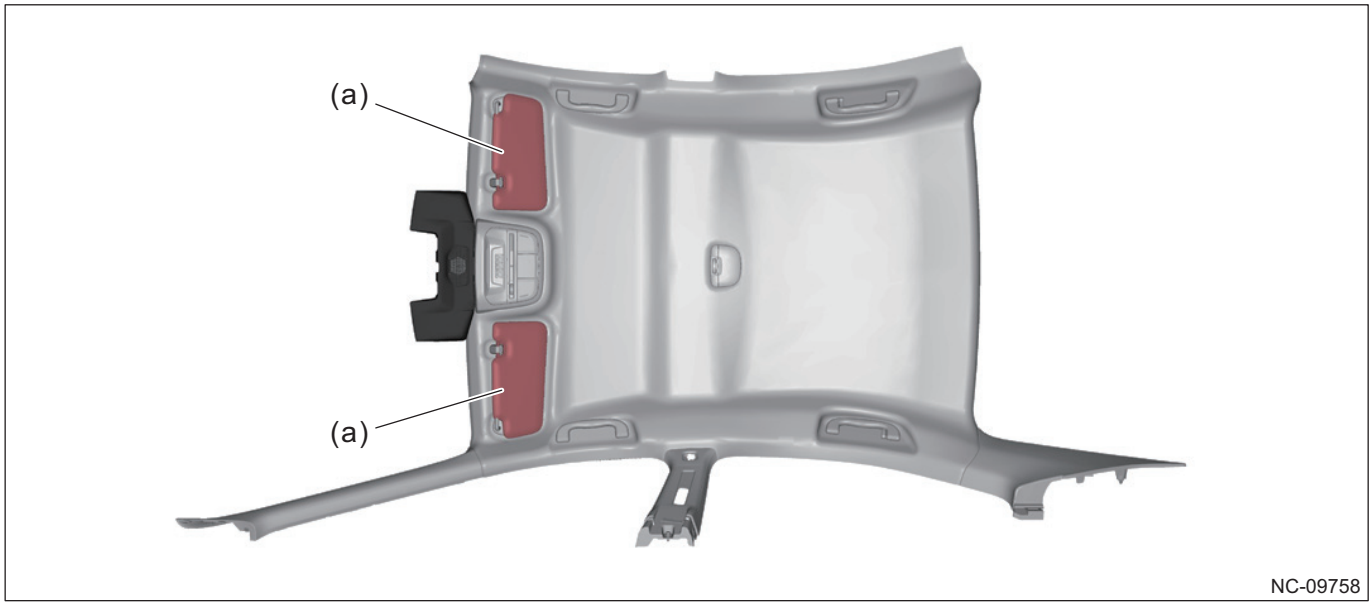
*: The illustration shows an example of loading.

Other

■ Sun visor

A sun visor with a PVC surface is adopted in consideration of practical factors such as preventing dirt.

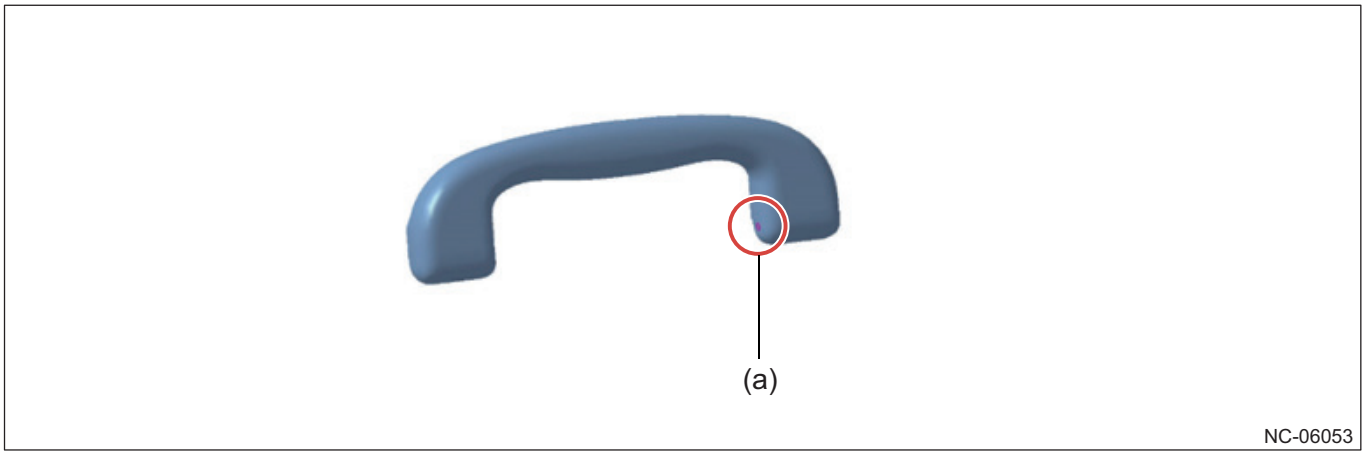
A vanity mirror is provided on the sun visor, and in some specifications, illumination is also provided. (for some grades)



(a) Sun visor

■ Assist grip

- A rotating retractable type that is pulled out for use is adopted for the coat hook (provided for rear seats). This makes it easier to hang up clothes or other objects and improves convenience.
- The spring and damper are optimized for a construction that ensures slow and quiet movement from the position of use to the retracted position, creating a luxurious feel.
- A shape is adopted with a thicker cross section that follows the hand shape when gripped, dispersing the gripping pressure without accumulating in one area. This makes it easier to support the body when gripping and improves gripping comfort.
- A structure is adopted for the pinning of the assist grip where a black hinge pin is inserted from the inside. This makes the hinge pin less noticeable in consideration of the appearance.



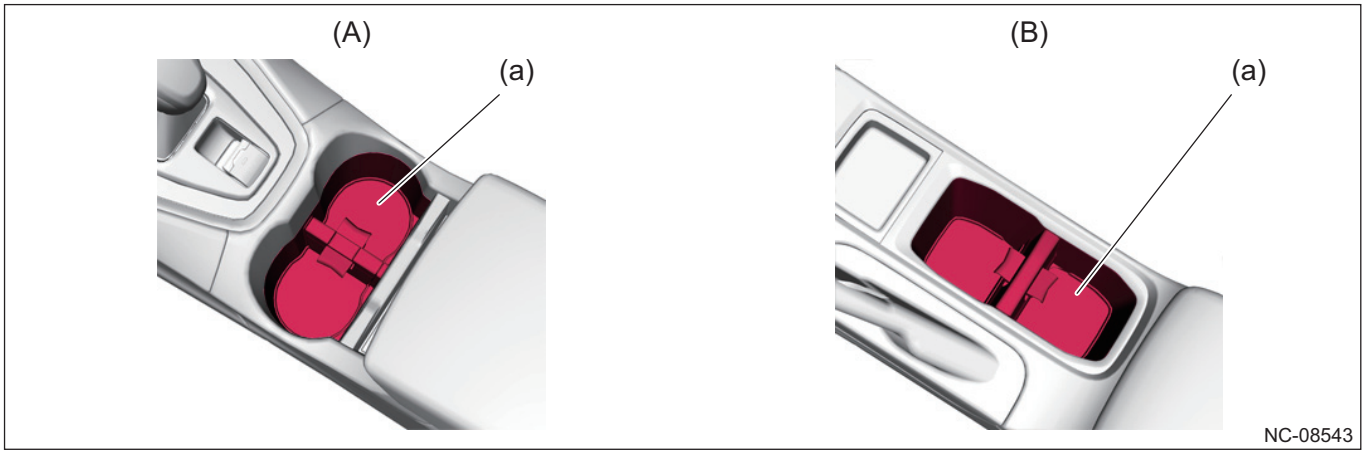
(a) Black hinge pin inserted from inside

■ Storage function

▮ Cup holder/bottle holder

Cup holders with a horizontal layout that are easy to use from both the driver's seat and passenger's seat are provided in the center console as the front seat cup holders in CVT models.

Cup holders with a vertical layout are provided in the center console as the front seat cup holders in MT models in consideration of ease of operation for the shift lever and parking brake lever.



(A) CVT

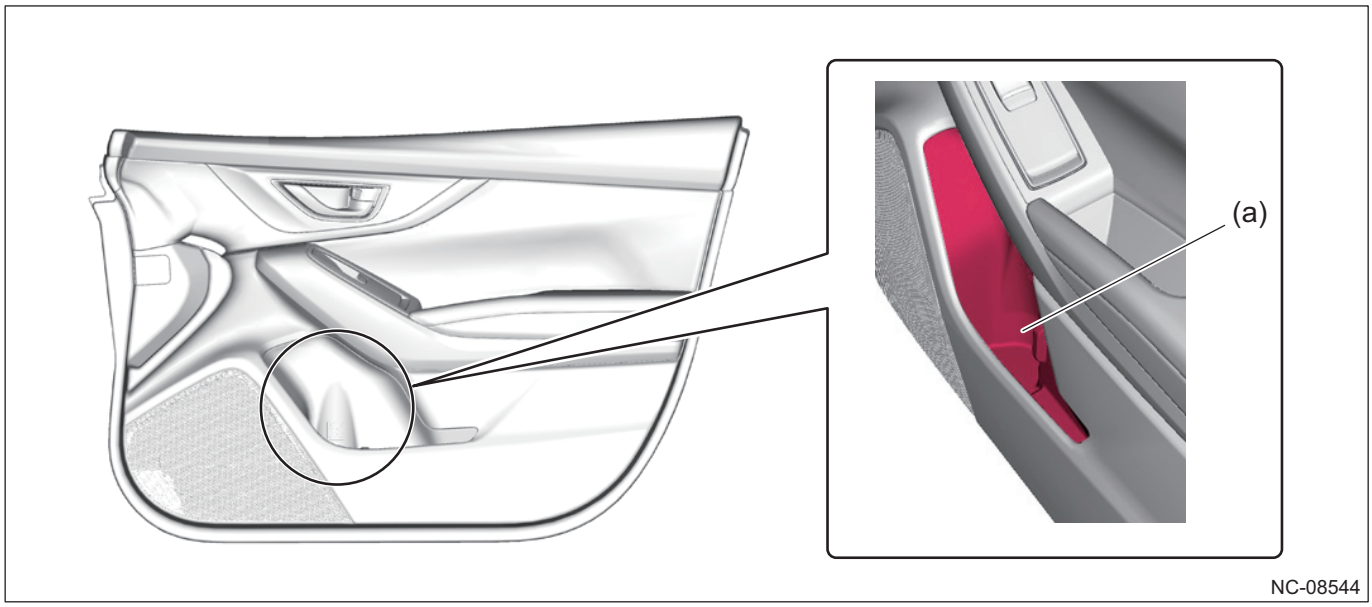
(B) MT

(a) Cup holder

A rear seat cup holder is provided in the rear center armrest.

A bottle holder that can store objects such as a plastic bottle is provided in the door side pocket of the driver's seat, passenger's seat, and rear seats.

Non-woven fabric is provided across the entire surface of the bottle holder to achieve a high-quality feel, and good user-friendliness where inserted objects do not make a sound. (for some grades)



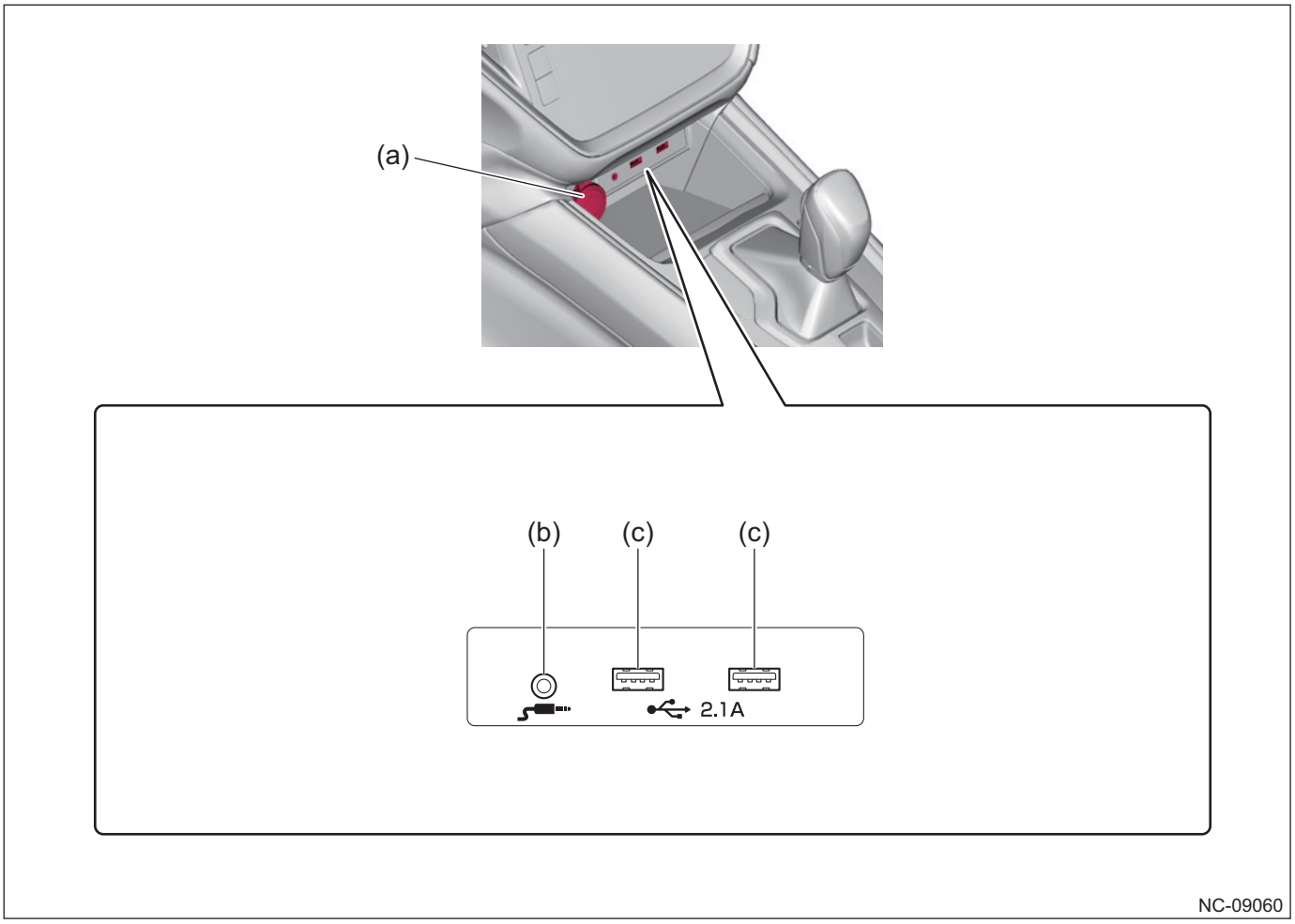
(a) Bottle holder

■ Power supply and external input terminals

▮ Front seat USB power supply/12 VDC power socket/external input terminal

The front seat USB power supply and 12 VDC power socket are positioned inside the pocket in front of the shift lever.

The external input terminal is provided inside the pocket in front of the shift lever.



(a) 12 VDC power socket

(b) AUX input terminal (audio only)

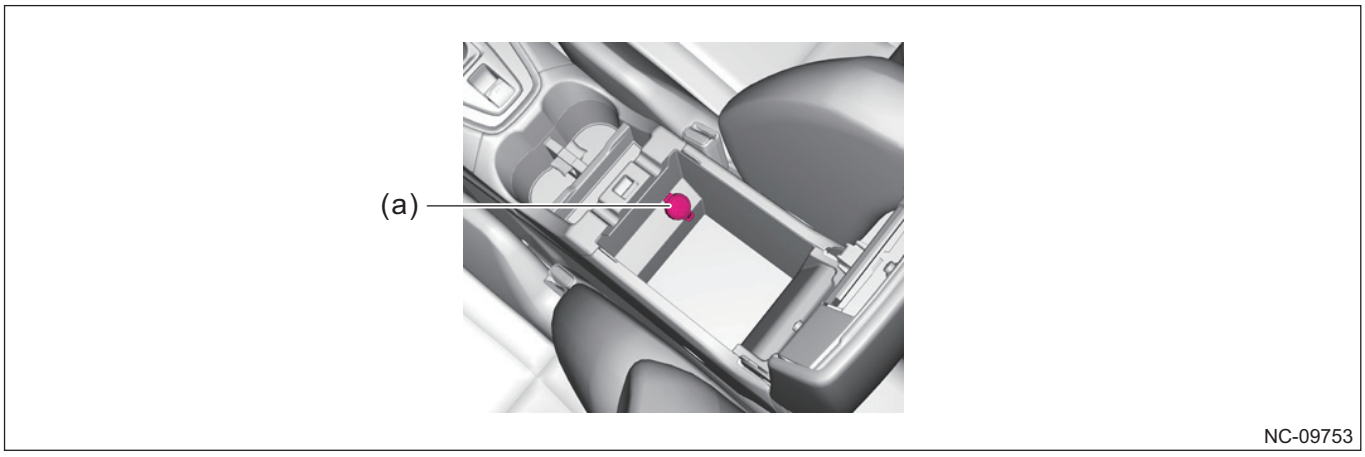
(c) Communication USB port

USB power supply
- The maximum rated current of each port is set to 2.1 A, ensuring convenience by allowing 2 devices such as tablets to be charged rapidly at the same time.
- An indicator for the maximum rated current (2.1 A) is added to indicate that rapid charging is possible and improve convenience.
- A cover-less type is adopted to eliminate the trouble of opening and closing the cover in consideration of usability.
- The communication USB port enables communication between the navigation system and a smartphone or tablet. Further, Apple CarPlay and Android Auto are newly supported to improve convenience.

12 VDC power socket
- Consideration is given to expandability, such as using portable navigation or increasing the number of USB power supply outlets.

External input terminal
- An AUX input terminal (audio only) is adopted in models with the navigation system to enable devices to be taken in and connected in consideration of usability and variety.

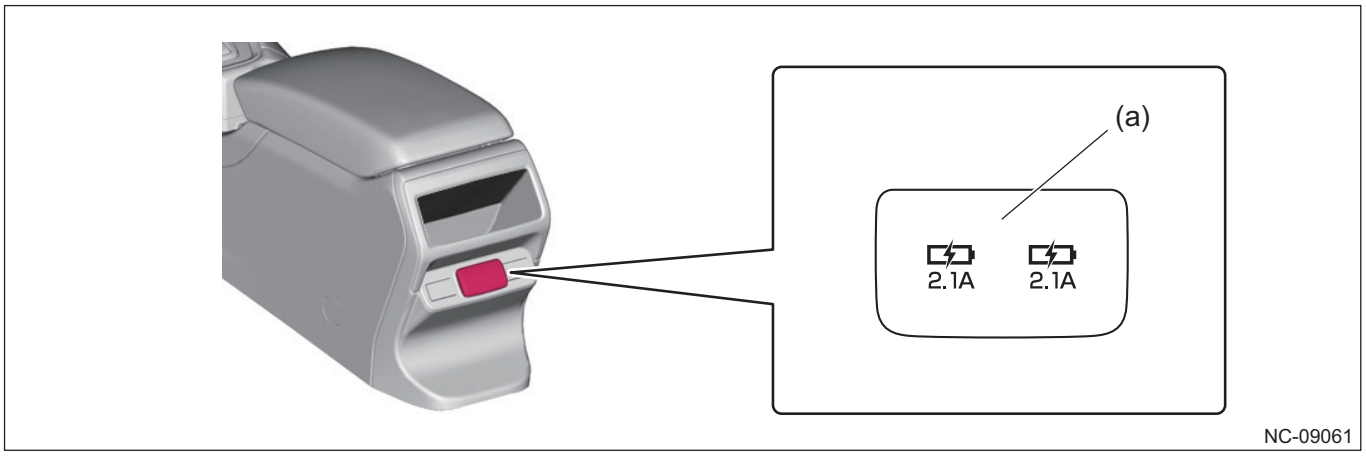
A 12 VDC power socket is provided in the console box.



(a) 12 VDC power socket

Rear seat USB power supply (for some grades)

Two ports for connecting a USB power supply are provided for the rear seat occupants at the rear end of the center console.



(a) Charging USB port (cover design)

- The maximum rated current of each port is set to 2.1 A, ensuring convenience by allowing 2 devices such as tablets to be charged rapidly at the same time.
- An indicator for the maximum rated current (2.1 A) is added to indicate that rapid charging is possible and improve convenience.

10.7 Door Lock and Security System

10.7.1 Overview

Overview

The electric door lock system and keyless access & push button start system are provided for the door lock system.

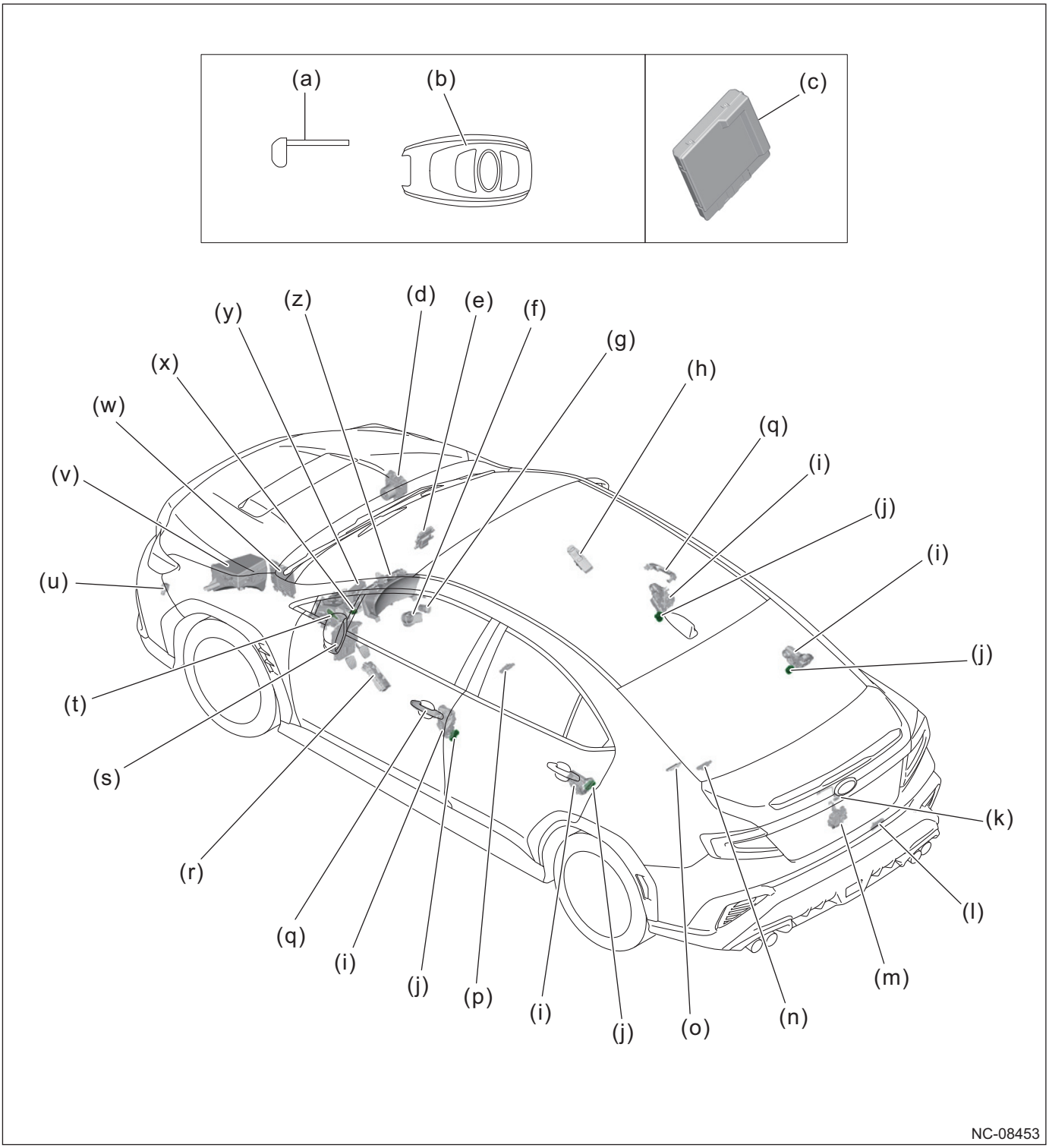
The immobilizer system and security alarm system are provided for the security system.

10.7.2 Component

Component layout drawing

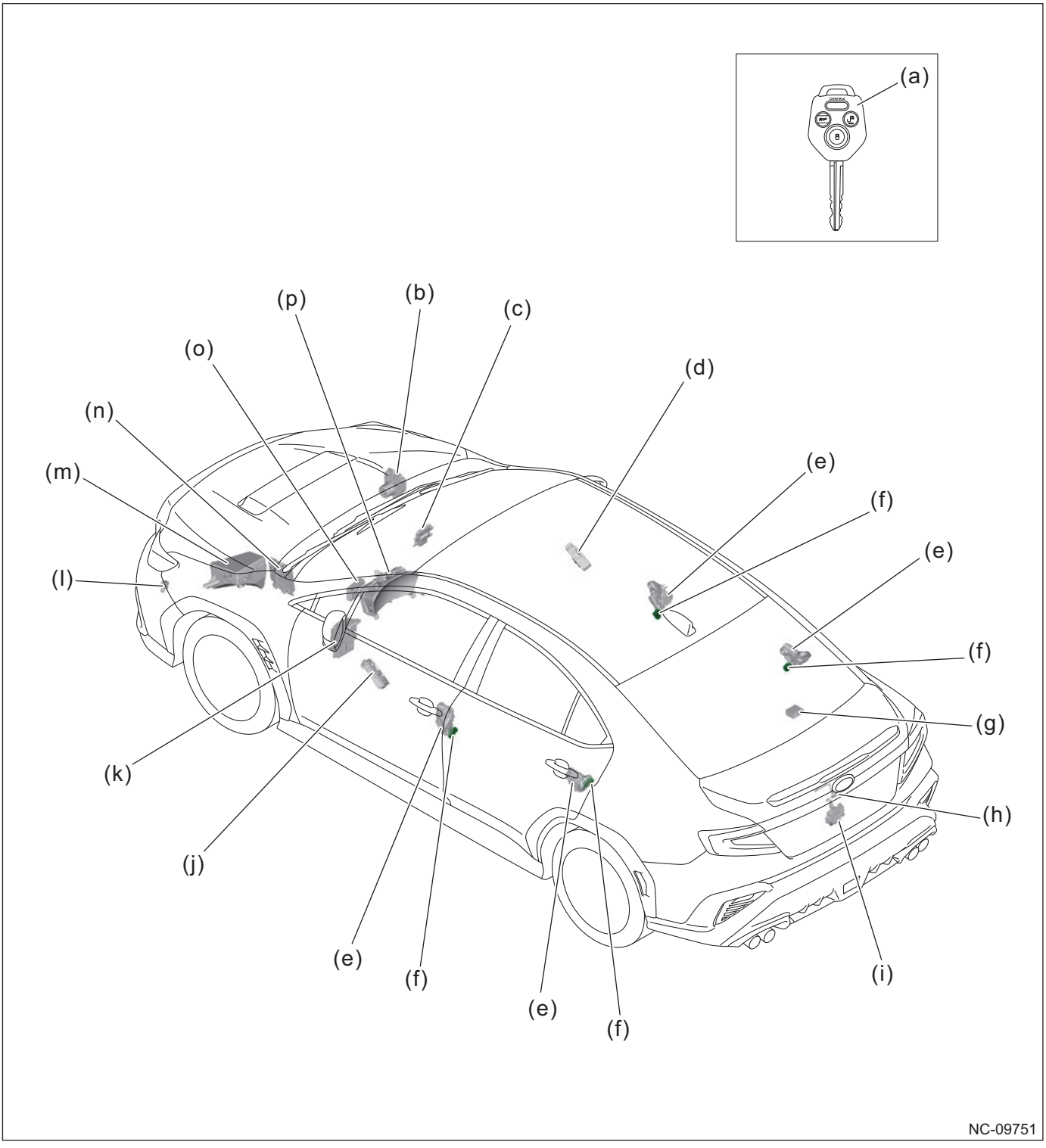
Door lock system

Models with keyless access & push button start system



(a) Mechanical key
(b) Access key
(c) Keyless access CM
(d) VDC CM & H/M
(e) Transmission control module (TCM) (CVT)
(f) Steering lock CM
(g) Engine switch
(h) Front power window sub switch
(i) Latch & actuator assembly
(j) Door switch
(k) Trunk request switch
(l) Trunk exterior antenna
(m) Lock assembly trunk lid
(n) Trunk interior antenna
(o) Center interior antenna
(p) Front interior antenna
(q) Front outer handle
(r) Power window main switch
(s) Body Integrated Unit (in joint box)
(t) Clutch start switch (MT)
(u) Keyless buzzer
(v) Front relay control module (in main fuse & relay box)
(w) Engine control module (ECM)
(x) Stop light switch
(y) Backup unit assembly
(z) Combination meter

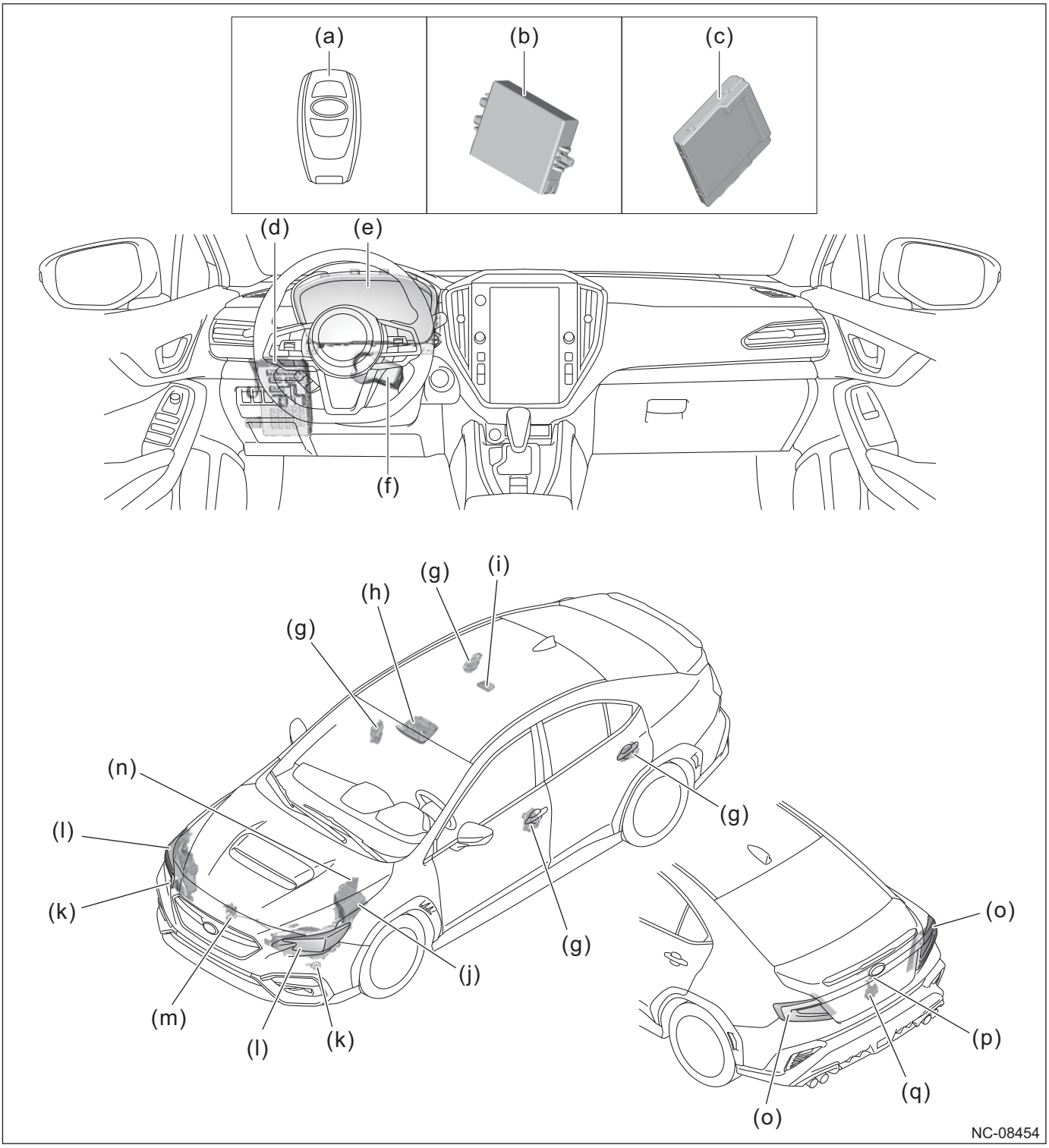
Models with keyless entry



(a) Keyless transmitter
(b) VDC CM & H/M
(c) Transmission control module (TCM) (CVT)
(d) Front power window sub switch
(e) Latch & actuator assembly
(f) Door switch
(g) Keyless entry module
(h) Trunk request switch
(i) Lock assembly trunk lid
(j) Power window main switch
(k) Body Integrated Unit (in joint box)
(l) Keyless buzzer
(m) Front relay control module (in main fuse & relay box)
(n) Engine control module (ECM)
(o) Backup unit assembly
(p) Combination meter

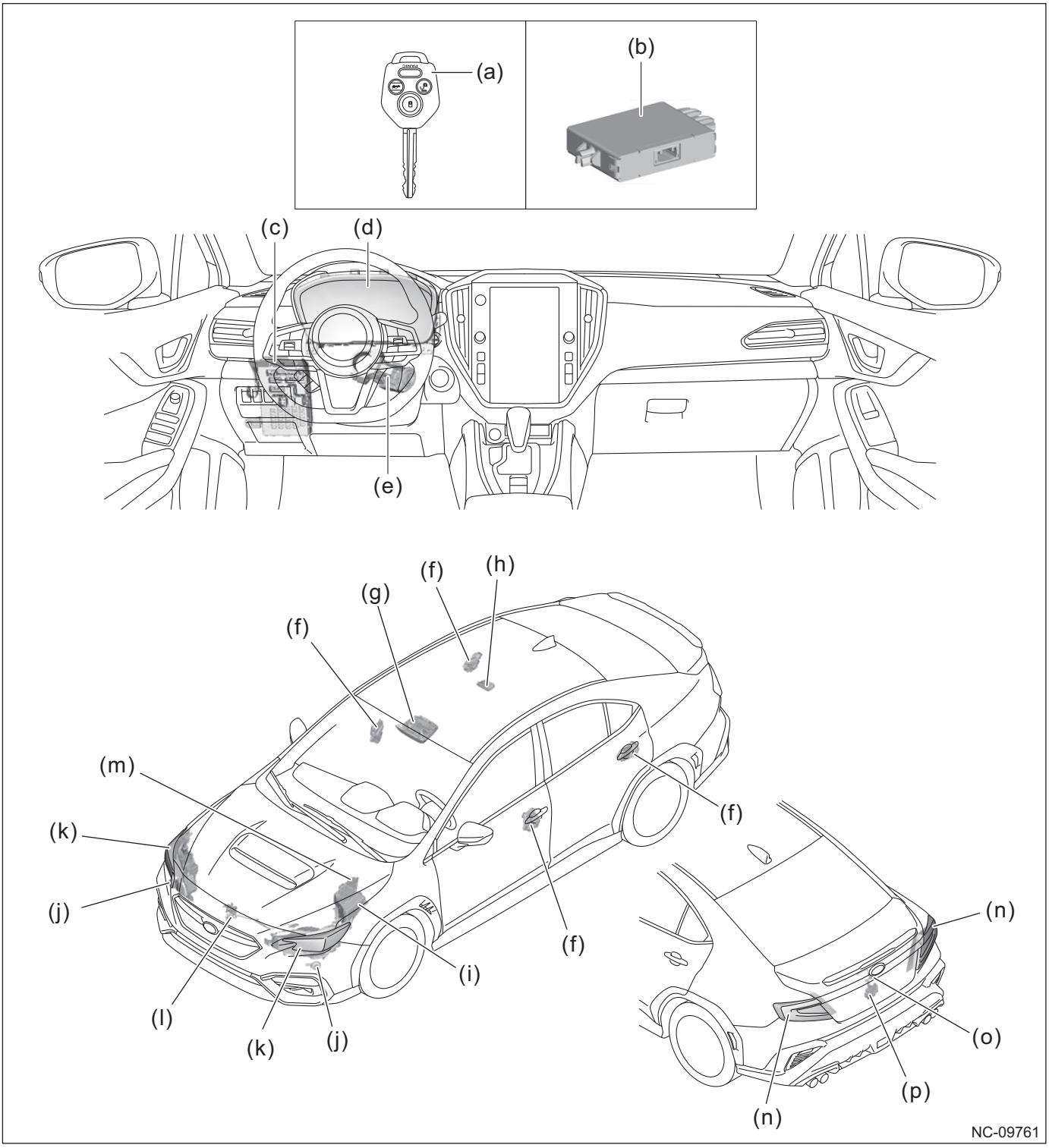
Security system

Models with keyless access & push button start system



(a) Access key
(b) ID code BOX (for Canada)
(c) Keyless access CM
(d) Body Integrated Unit (in joint box)
(e) Combination meter
(f) Steering lock CM
(g) Latch & actuator assembly
(h) Light assembly map
(i) Room light
(j) Horn relay (in main fuse & relay box)
(k) Horn assembly
(l) Turn signal light (in headlight)
(m) Hood switch (front hood lock assembly)
(n) Engine control module (ECM)
(o) Light assembly rear combination
(p) Trunk request switch
(q) Lock assembly trunk lid

Models with keyless entry

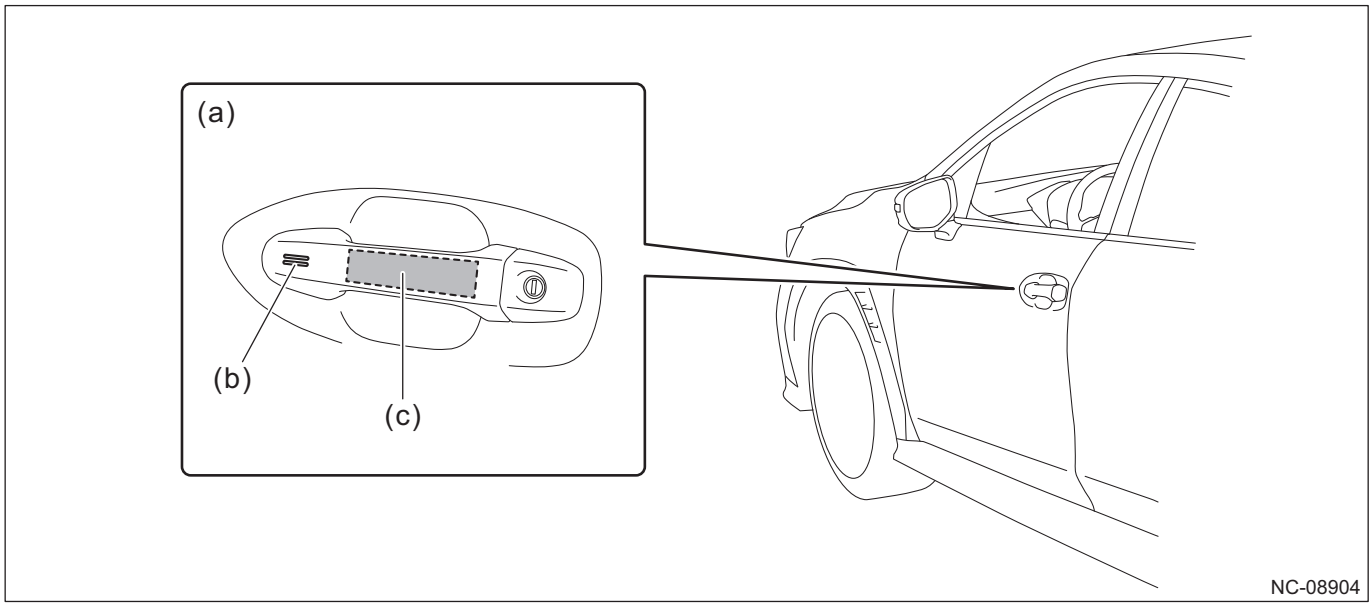


(a) Keyless transmitter
(b) Immobilizer CM
(c) Body Integrated Unit (in joint box)
(d) Combination meter
(e) Steering lock CM
(f) Latch & actuator assembly
(g) Light assembly map
(h) Room light
(i) Horn relay (in main fuse & relay box)
(j) Horn assembly
(k) Turn signal light (in headlight)
(l) Hood switch (front hood lock assembly)
(m) Engine control module (ECM)
(n) Light assembly rear combination
(o) Trunk request switch
(p) Lock assembly trunk lid

Component details

Door outer handle

A touch sensor is adopted for the request switch of the front door outer handle.



(a) Handle front door outer
(b) Lock sensor
(c) Unlock sensor (handle reverse side)

Access key (models with keyless access & push button start system)

The access key has a lock button, unlock button, and trunk open button attached to enable operation of the keyless entry system. CR2032 battery is used.

It has a built-in mechanical key and transponder function, and when the system does not operate correctly, such as when the battery of the access key runs down and when the peripheral radio wave environment is bad (there is high noise), you can lock/unlock the doors by inserting the mechanical key in the driver's door key cylinder. By touching the access key with the button side facing you onto the engine switch while depressing the brake pedal (CVT)/clutch pedal (MT), the engine switch is set to ACC or the ignition switch is set to ON.

Keyless transmitter (models with keyless entry system)

Equipped with a lock button, unlock button, and trunk open button to enable operation of the keyless entry system. CR1620 battery is used. The transponder is built in.

Antenna

A front interior antenna, a front exterior antenna, a center interior antenna, rear interior antenna, and rear exterior antenna are installed for the keyless access & push button start system.

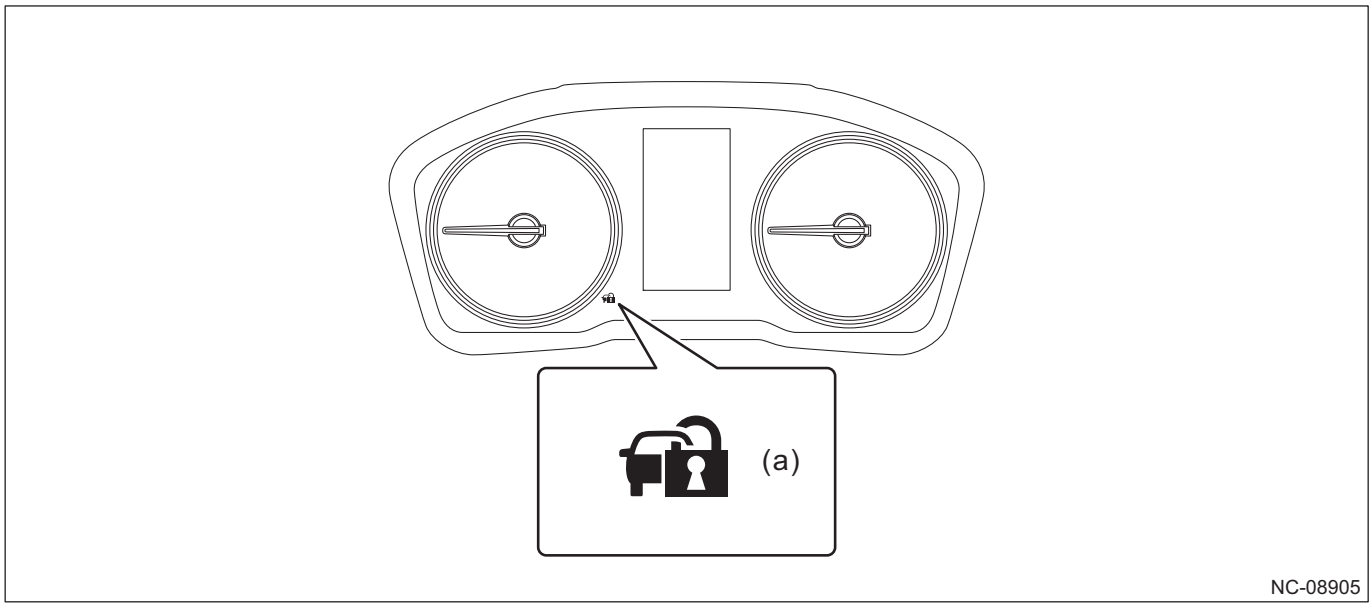
■ Precautions for people using implanted cardiac pacemakers etc.

There is a risk of the radio waves used in the keyless access & push button start system affecting medical electrical equipment such as cardiac pacemakers etc. When using the system, avoid approaching implanted cardiac pacemakers etc. within about 22 cm from each antenna, referring to the following description. There is a risk of influencing operation; caution is necessary.

The keyless access & push button start system uses the radio waves of the radio wave type remote control door lock and the radio frequency of 134 kHz. These radio waves are output from each interior and exterior antenna. A continuous radio wave is output from the external antenna inside the front outer handles when all of the doors are closed and locked. Radio waves are output from the interior antennas by door opening and closing, brake pedal (CVT)/clutch pedal (MT), and engine switch operations, etc. This function can be stopped by a customization function.

Security indicator light

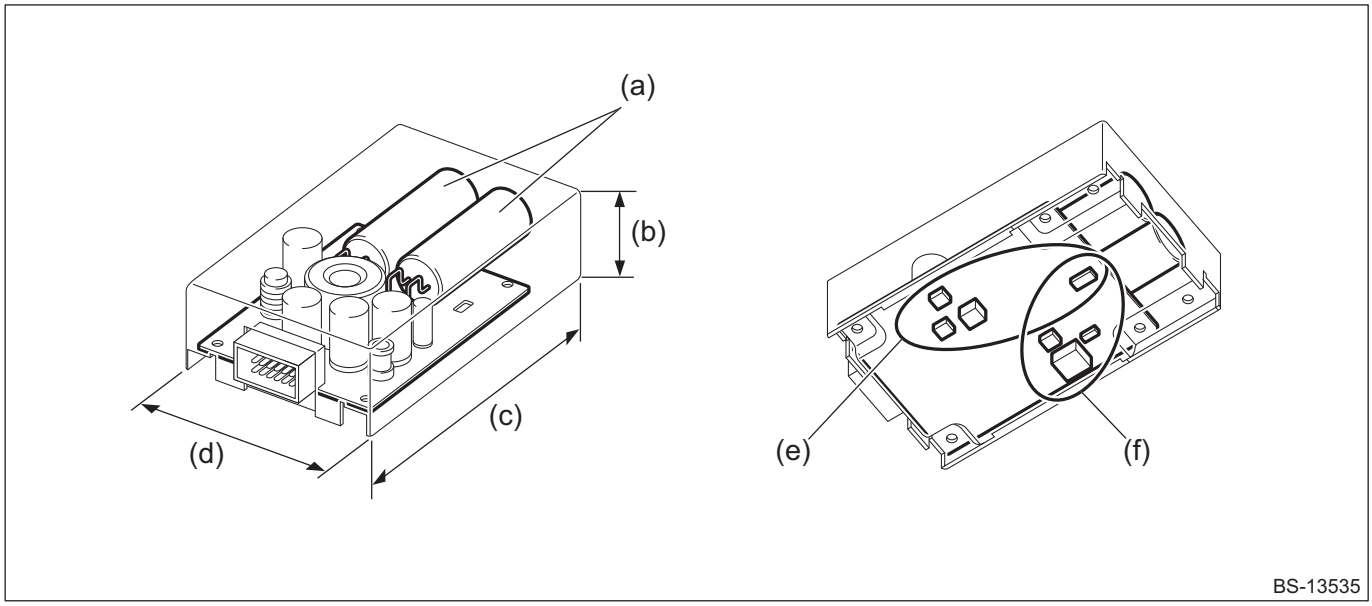
A security indicator light that indicates the warning status of the security system and operating status of the immobilizer system is positioned in the combination meter.



(a) Security indicator light

Backup unit (sub battery)

It is located at the rear of the combination meter so that it will not break easily on collision.



(a) Capacitor
(b) 1.29 in (32.8 mm)
(c) 4.51 in (114.5 mm)
(d) 2.58 in (65.6 mm)
(e) Charging DC/DC converter
(f) Output DC/DC converter

10.7.3 Construction and Operation

Main component functions

Door lock system (models with keyless access & push button start system)

Component		Function
Front outer handle RH/LH	Exterior antenna	Transmits the request signal from the keyless access CM via radio waves.
	Unlock sensor	Detects unlock operations by the keyless access.
	Lock sensor	Detects lock operations by the keyless access.
Access key		• Transmits the key button operation signal via radio waves. • After receiving a request signal transmitted from each antenna via radio waves, outputs the ID code. • Contains a built-in mechanical key for door unlocking/locking.
Front interior antenna		Transmits radio waves for determining whether or not the access key is in the interior detection area.
Center interior antenna		
Trunk interior antenna		
Trunk exterior antenna		Transmits radio waves for determining whether or not the access key is in the detection area in which the keyless access trunk open function can be used.
Stop light switch		Detects that the brake pedal is depressed and outputs the information to the keyless access CM.
Clutch start switch (MT)		Detects that the clutch pedal is depressed and outputs the information to the keyless access CM.
P position switch assembly (CVT)		Detects the shift position P signal and outputs the information to the keyless access CM.
Engine switch		• Switches the power supply or starts the engine when the switch is pressed. • Contains a built-in immobilizer amplifier that enables engine start when the access key does not operate correctly due to a flat battery or radio wave jamming. • Sends the ID code signal of the access key to the keyless access CM.
IG1 relay		Supplies power to each system according to the control of the keyless access CM.
IG2 relay		
ACC relay		
Steering lock CM		Detects the steering lock/unlock status and sends the information to the keyless access CM via LIN communication.
Keyless access CM		• Verifies the access key. • Controls each antenna. • Controls the lock/unlock sensor. • Sends control commands for steering lock/unlock to the steering lock CM. • Performs indicator light display and warning display control for the combination meter. • Controls the IG/ACC power supply. • Sends starter operation control commands to the Engine Control Module (ECM).

Component		Function
Body Integrated Unit		• Sends the open/close status and lock/unlock status of each door to the keyless access CM via CAN communication. • Controls the drive of the trunk actuator by the keyless access trunk open function. • Controls the drive of the door lock actuator by the door lock system. • Sends the sounding control signal for the access buzzer of the door lock system to the front relay control module via CAN communication.
Central gateway CM		Relays CAN communication between the control computers for the various devices installed in the vehicle.
Power window main switch	Central door lock switch	Outputs the central door lock switch signal to the Body Integrated Unit.
Front power window sub switch		
Latch & actuator assemblies	Door lock position switch	Outputs the door lock position switch signal to the Body Integrated Unit.
	Door lock actuator	Locks/unlocks each door according to the drive of the door lock actuator.
Door switches		Detects the open/close status of each door and outputs the information to the Body Integrated Unit.
Lock assembly trunk lid	Trunk actuator	Releases the trunk latch according to the drive of the trunk actuator.
	Trunk latch switch	Detects the open/close status of the trunk and outputs the information to the Body Integrated Unit.
Backup unit assembly		Supplies power to the Body Integrated Unit in the event of battery power supply loss.
Trunk request switch		Outputs the trunk request switch signal to the keyless access CM.
Access buzzer		Sounds during door lock system operation.
Combination meter		Performs indicator light display and warning display according to the signals from the keyless access CM.
VDC CM & H/M		Detects the vehicle speed information and sends the information to the Body Integrated Unit via CAN communication.
Starter relay		Outputs the drive signal to the starter.
Engine Control Module (ECM)		Outputs the drive signal to the starter relay according to the control command from the keyless access CM.
Transmission control module (TCM) (CVT)		Detects the shift position signal and outputs the information to the keyless access CM.
Front relay control module		Receives the access buzzer sounding control signal from the Body Integrated Unit and controls the access buzzer.

Door lock system (models with keyless entry system)

Body Integrated Unit		• Controls the drive of the door lock actuator by the door lock system. • Sends the sounding request signal for the access buzzer.
Power window main switch	Central door lock switch	Outputs the central door lock switch signal to the Body Integrated Unit.
Front power window sub switch		
Latch & actuator assemblies	Door lock position switch	Outputs the door lock position switch signal to the Body Integrated Unit.
	Door lock actuator	Locks/unlocks each door according to the drive of the door lock actuator.
Door switches		Detects the open/close status of each door and outputs the information to the Body Integrated Unit.
Lock assembly trunk lid	Trunk actuator	Releases the trunk latch according to the drive of the trunk actuator.
	Trunk latch switch	Detects the open/close status of the trunk and outputs the information to the Body Integrated Unit.
Backup unit assembly		Supplies power to the Body Integrated Unit in the event of battery power supply loss.
Access buzzer		Sounds during door lock system operation.
Combination meter		Performs indicator light display and warning display according to the signals from the immobilizer control module.
Keyless entry module		Outputs the radio wave signal received from the keyless transmitter to the Body Integrated Unit.
Keyless transmitter		• Transmits the key button operation signal via radio waves. • The transponder is built in.
Front relay control module		Receives the access buzzer sounding control signal from the Body Integrated Unit and controls the access buzzer.

Security system

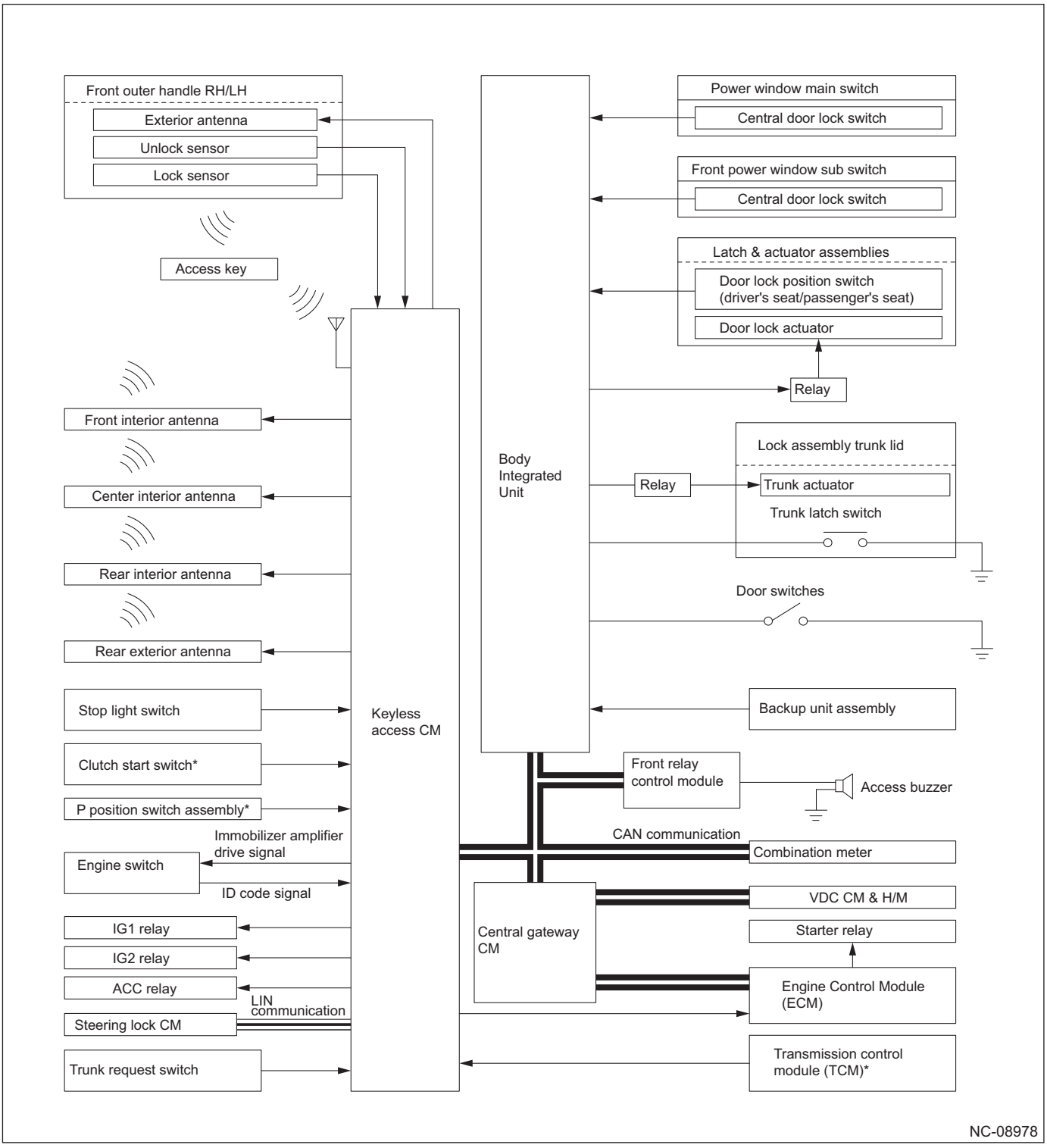
Component		Function
Combination meter	Security indicator light	Displays the security indicator light according to the operation of the security system.
Front seat map light		Turns on during the alarm operation of the security alarm system. *1
Rear seat spot map light		
Turn signal light (in headlight)		Flashes during the alarm operation of the security alarm system.
Horn relay		Supplies power to the horn assembly Hi/Lo during the alarm operation of the security alarm system.
Horn assembly		Sounds intermittently during the alarm operation of the security alarm system.
Body Integrated Unit		Performs security system status control, turning on control for each light, horn operation control, and display control of the indicator light according to the signals from the units and switches.
Lock assembly trunk lid	Trunk latch switch	Detects the open/close status of the trunk and outputs the information to the Body Integrated Unit.
Front hood lock assembly	Hood switch	Detects the open/close status of the engine hood and outputs the information to the Body Integrated Unit.
Door switches		Detects the open/close status of each door and outputs the information to the Body Integrated Unit.
Keyless access CM*2		• Verifies the access key. • Sends the operation signals of security system control to the Body Integrated Unit via CAN communication. • Compares the access key, steering lock CM, and ID code BOX (for Canada) to the ID code, and outputs the start permission signal to the Engine Control Module (ECM).
Steering lock CM*2		Compares the access key and ID code.
Access key*2		After receiving a request signal transmitted from an antenna via radio waves, outputs the ID code.
Keyless transmitter*3		When inserted into the key cylinder, transmits the ID code for verification with the immobilizer antenna assembly.
ID code BOX (for Canada)*2		Outputs immobilizer set/unset commands to the Engine Control Module (ECM).
Immobilizer control module (for Canada)*3		• Verifies the keyless transmitter. • Sends control commands for steering lock/unlock to the steering lock CM. • Performs security indicator light display control for the combination meter. • Sends the fuel injection permission signal to the Engine Control Module (ECM).

**1: When the "DOOR" door interlocked function switch is selected*
**2: Models with keyless access & push button start system*
**3: Models with keyless entry system*

System diagram

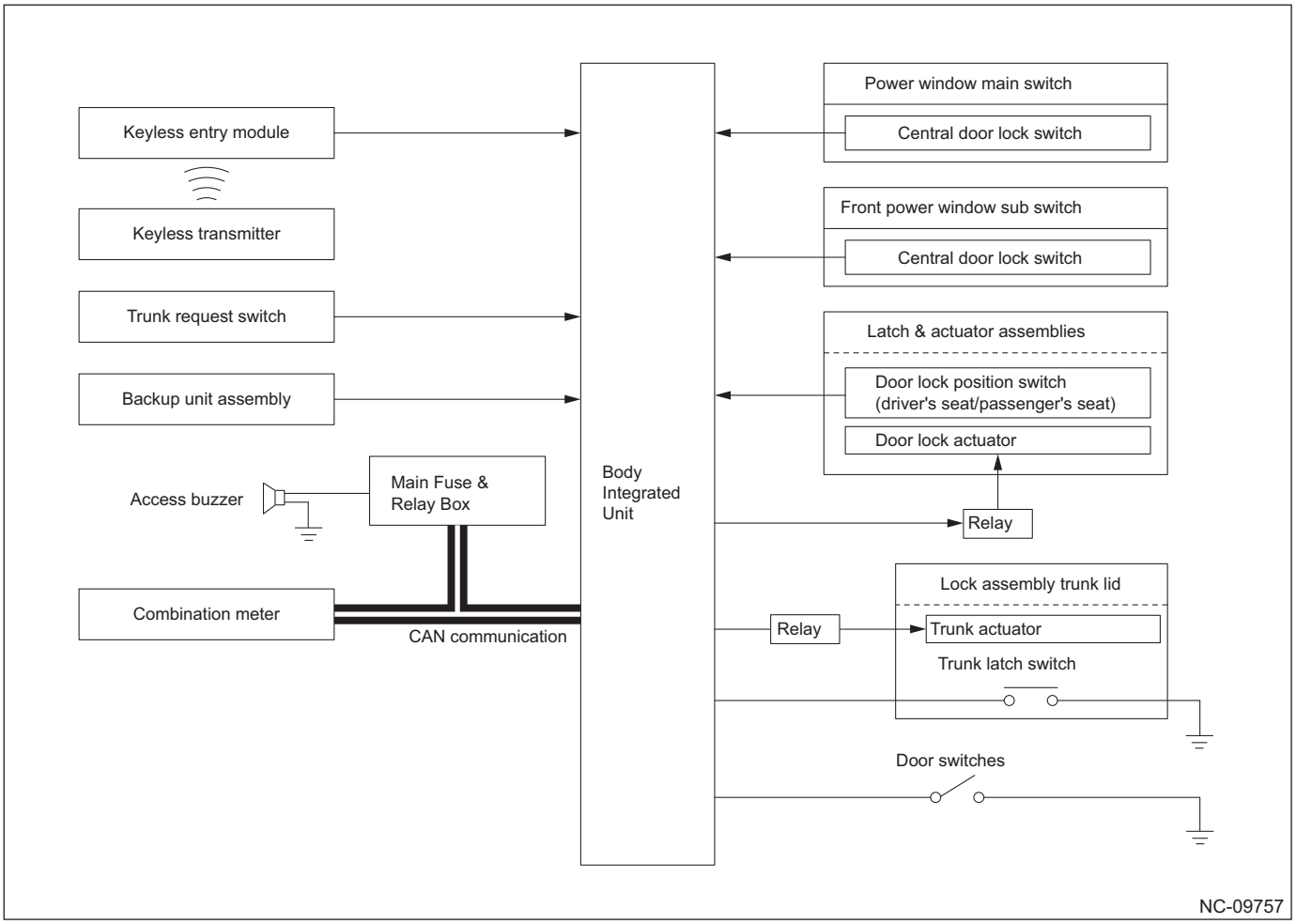
Door lock system

Models with keyless access & push button start system



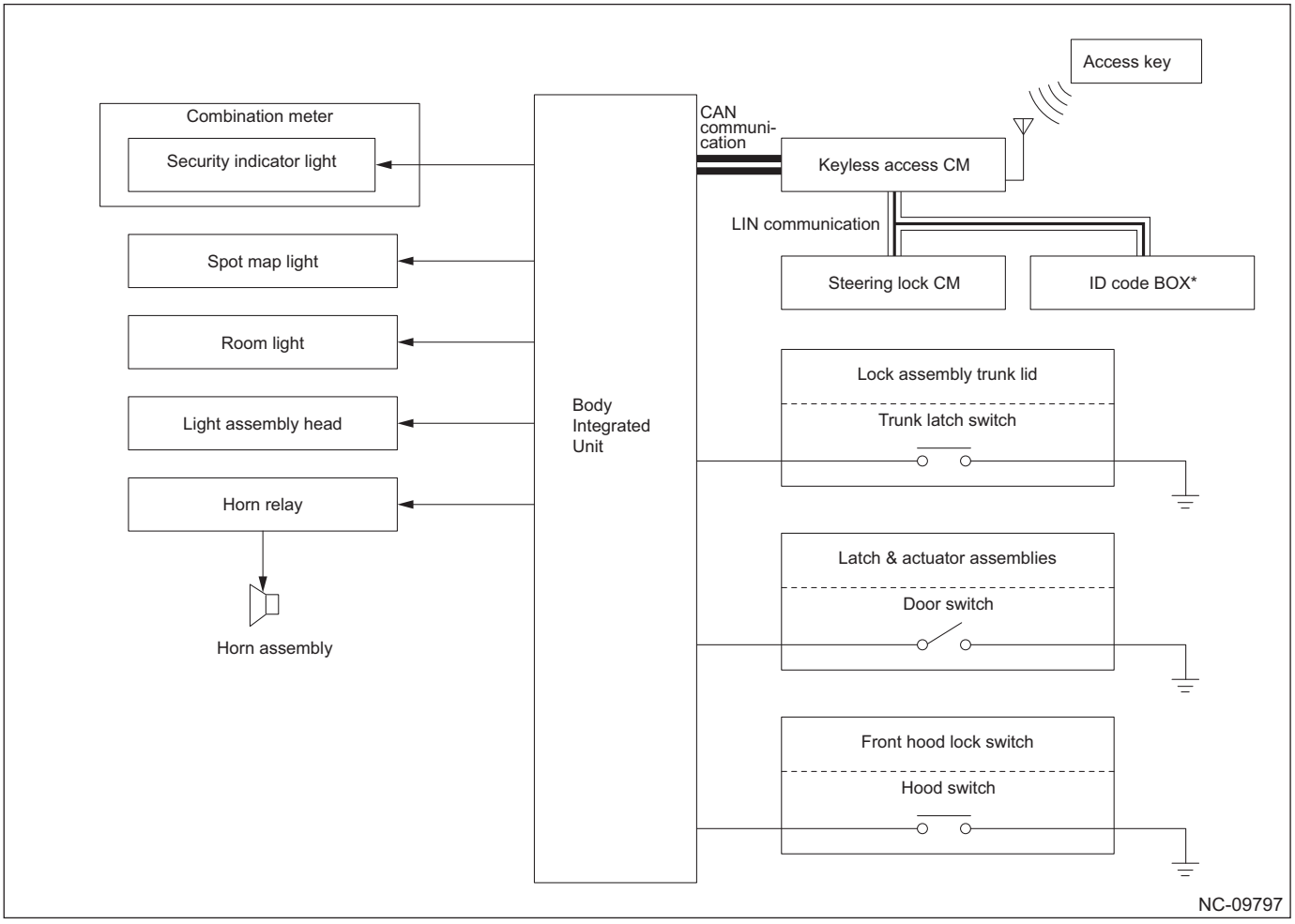
**: For some grades*

Models with keyless entry



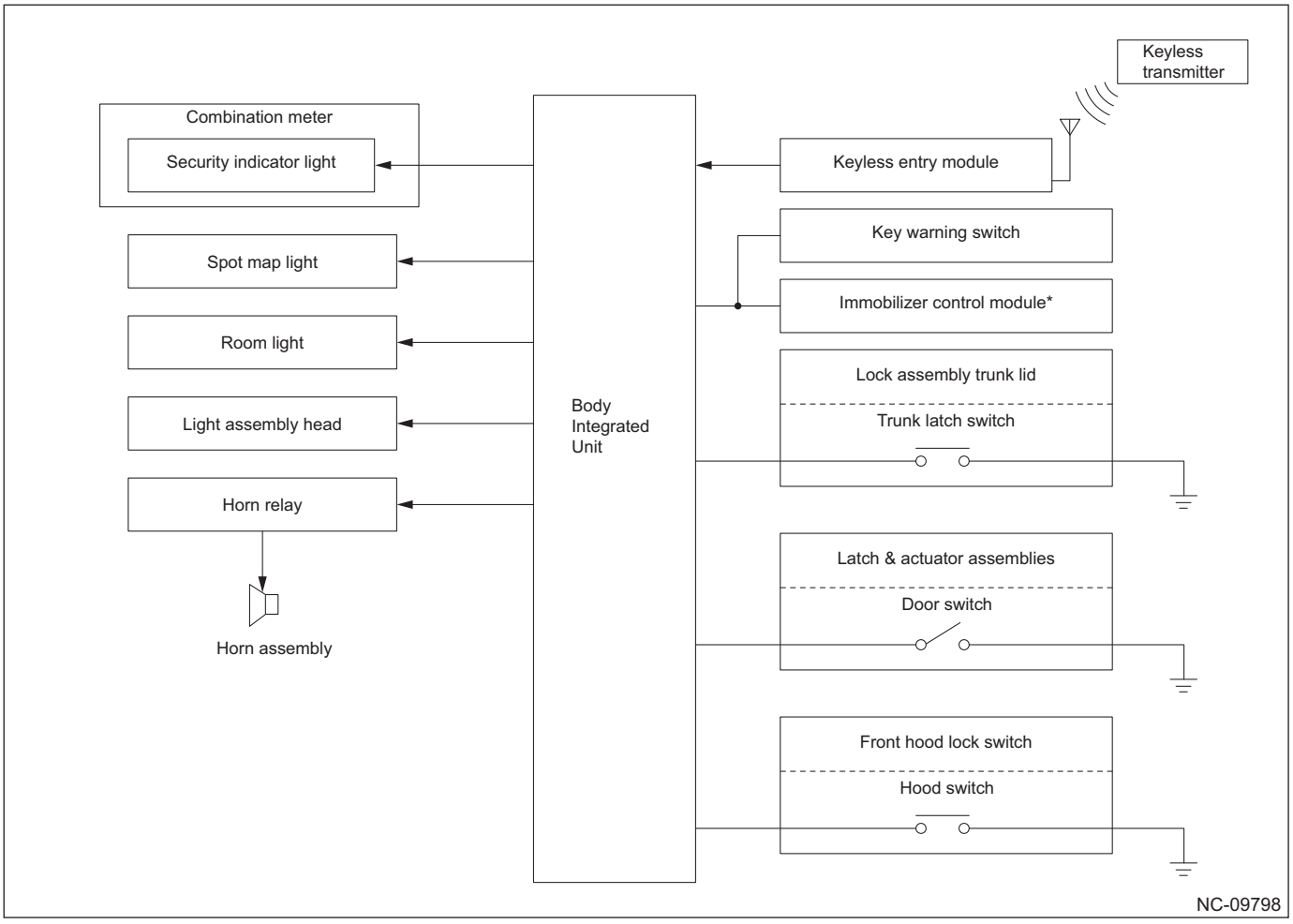
Security system

Models with keyless access & push button start system



**: For Canada*

Models with keyless entry



*: For Canada

Door lock system

Electric door lock system

Common functions (keyless entry system/keyless access & push button start system)

■ Manual lock (unlock) function

This is a function to lock/unlock doors with all the doors interlocked by operating the central door lock switch toward the lock (unlock) side.

If the central door lock switch is operated toward the lock (unlock) side, a manual lock (unlock) switch signal is output from the door lock control switch to the Body Integrated Unit. The Body Integrated Unit with the signal input sends a door lock (unlock) drive signal to each door lock actuator and locks (unlocks) each door by driving each door lock actuator.

■ Automatic door lock (unlock) function

▮ Automatic door lock

This function automatically locks all the doors and the fuel flap when the passengers get into the vehicle (when the driver starts driving the vehicle).

This function has a customization function. The user can select and set the operating condition using the center information display.

Operating condition for automatic door lock

Name	Setting	Default
Automatic vehicle door lock	OFF: Function OFF	Vehicle speed
	Vehicle speed: Vehicle speed is 20 km/h or higher	
	Select lever P: When the select lever is set to a position other than P	

▮ Automatic door unlock

This function automatically unlocks all the doors and the fuel flap when the passengers get out of the vehicle so that they do not need to unlock the doors manually when getting off.

This function has a customization function. The user can select and set the operating condition using the center information display.

Operating condition for automatic door unlock

Name	Setting	Default
Automatic vehicle door unlock	OFF: Function OFF	Driver's door open
	Select lever P: When the select lever is set to P	
	Power OFF: When the power supply position is switched from ON to OFF	
	Driver's door open: When the driver's seat side door is opened	

Reference

When a CAN signal is used for controlling the automatic lock (customization: Vehicle speed, Select lever P) / unlock (Select lever P), if the concerned CAN signal is not received or an error is detected, the customization setting prevents the automatic door lock/unlock from being activated.

▮ One-motion open mechanism

Due to the adoption of an automatic door lock that detects vehicle speeds, the one-motion open mechanism is adopted.

Even when the vehicle door is locked, pulling the inner remote lever at the driver's or passenger's seat releases the door lock.

The doors can be opened without manipulating the lock knob even after the activation of automatic door lock, eliminating the cumbersome process of unlocking.

■ Collision-detecting unlock function

This function automatically unlocks all the doors when the vehicle receives a strong impact, so as to prevent the passengers from being locked in.

If the unit cannot properly receive the signal due to some sort of error, all the doors will be unlocked, and the automatic lock/unlock function cannot be activated until the engine switch is turned OFF.

Caution

It may not be activated depending on the strength of the impact, etc.

After the collision-detecting unlock is activated, to cancel the system (i.e. to activate the automatic door lock again), turn OFF the IGN power supply and then turn it ON.

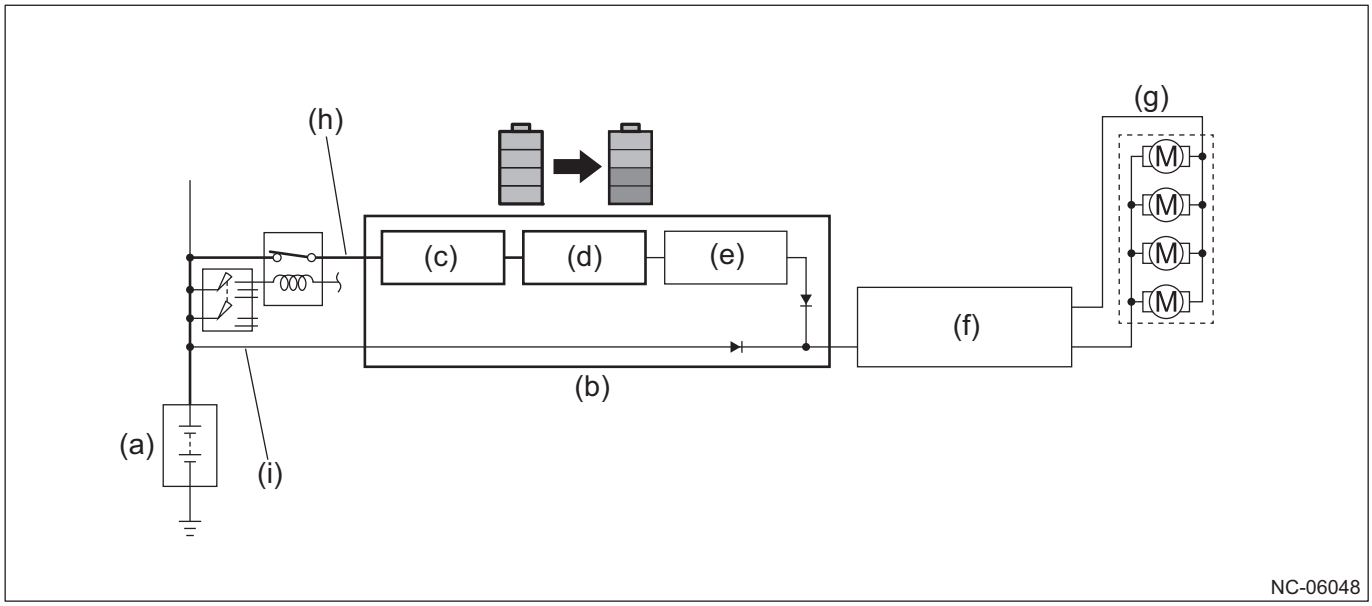
This function is related to safety and cannot be disabled with the customization function.

Backup unit

For the collision-detecting unlock function, the backup unit is adopted. In a normal state, the backup unit charges the electricity necessary for activating each door lock actuator. If the power supply of the Body Integrated Unit is lost due to a strong impact, such as a collision, the backup unit supplies the electricity necessary for unlocking.

During charging of backup unit (normal state)

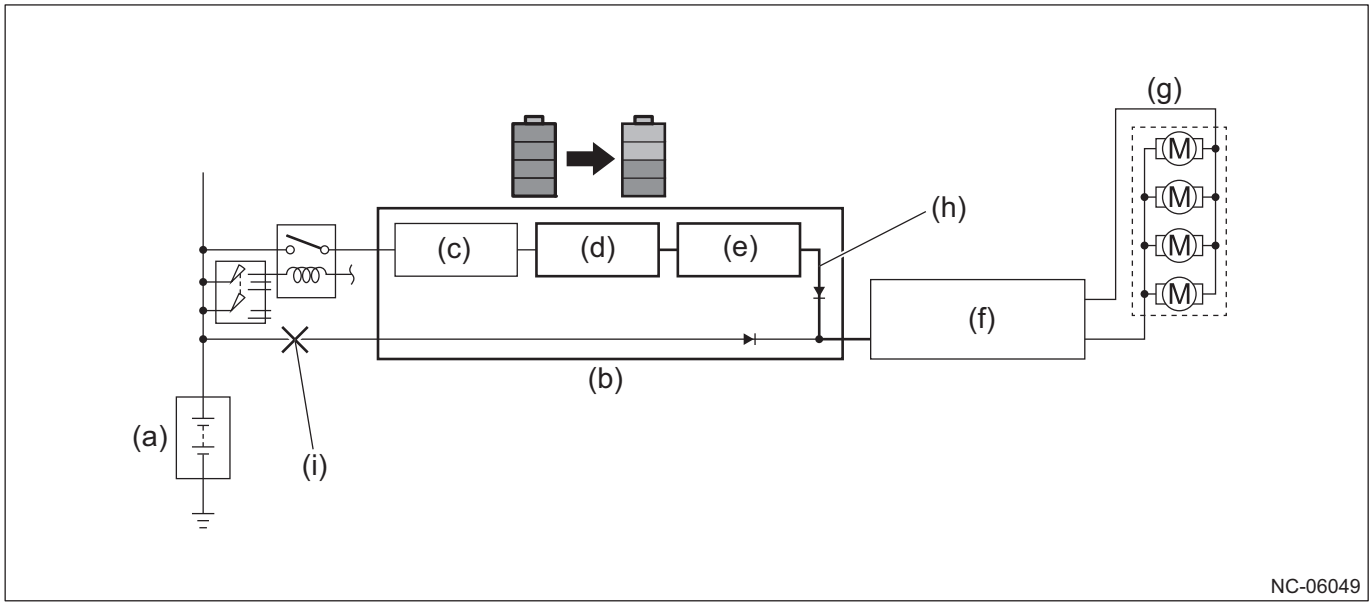
When the engine switch is turned ON, electricity is charged to the capacitor in the backup unit in approximately 90 seconds.



(a) Battery
(b) Backup unit assembly
(c) Charging DC/DC converter
(d) Capacitor
(e) Output DC/DC converter
(f) Body Integrated Unit
(g) Each door lock actuator
(h) Charging path
(i) Power supply path of Body Integrated Unit

When the backup unit activates (on collision)

If the power supply fails due to a collision or other similar reason, the charged capacitor will supply electricity to the Body Integrated Unit and each door lock actuator to cancel the door lock.



(a) Battery
(b) Backup unit assembly
(c) Charging DC/DC converter
(d) Capacitor
(e) Output DC/DC converter
(f) Body Integrated Unit
(g) Each door lock actuator
(h) Backup power supply path (on collision)
(i) Malfunction in power supply path of Body Integrated Unit

Keyless access & push button start system

The system is controlled by the keyless access CM communicating with the Body Integrated Unit, etc. based on the access key and vehicle ID code verification result, etc.

In order to perform "verification for access key and ID code" and "position confirmation of access key (person carrying the key)" depending on functions performed by the keyless access CM, a request signal is output to the interior antenna and external antenna. When an ID code including response code is received from the access key that received the request signal, discrimination/verification is performed, and an operation instruction signal is output to each CM depending on the function.

■ Wireless lock (unlock) function

When the lock button of the access key is pressed, all the doors are locked. When the unlock button of the access key is pressed once, only the driver's door is unlocked, and when the button is pressed once again within 5 seconds, all the doors are unlocked. Also, the trunk can be opened by pressing and holding the trunk open button of the access key.

When the lock button (unlock button) of the access key is pressed, a key identification code signal is sent to the keyless access CM. The keyless access CM which received the signal outputs a door lock (unlock) request signal to the Body Integrated Unit.

The keyless access CM verifies the ID code and distinguishes the function code, and if the ID code matches the vehicle code, it outputs the door lock (unlock) request signal to the body integrated unit, and then the Body Integrated Unit outputs a lock (unlock) operation request signal to each door lock actuator.

When the lock (unlock) signal is input, the Body Integrated Unit drives the door lock actuators of all the doors in the same manner as the manual lock (unlock) operation of the electric door lock system to lock (unlock) all the doors.

■ Keyless access door unlock function

If the driver's front outer handle is gripped while carrying the access key, only the driver's door is unlocked. (This function can be changed by the customization function to a specification where all the doors are unlocked when the driver's front outer handle is gripped while carrying the access key.)

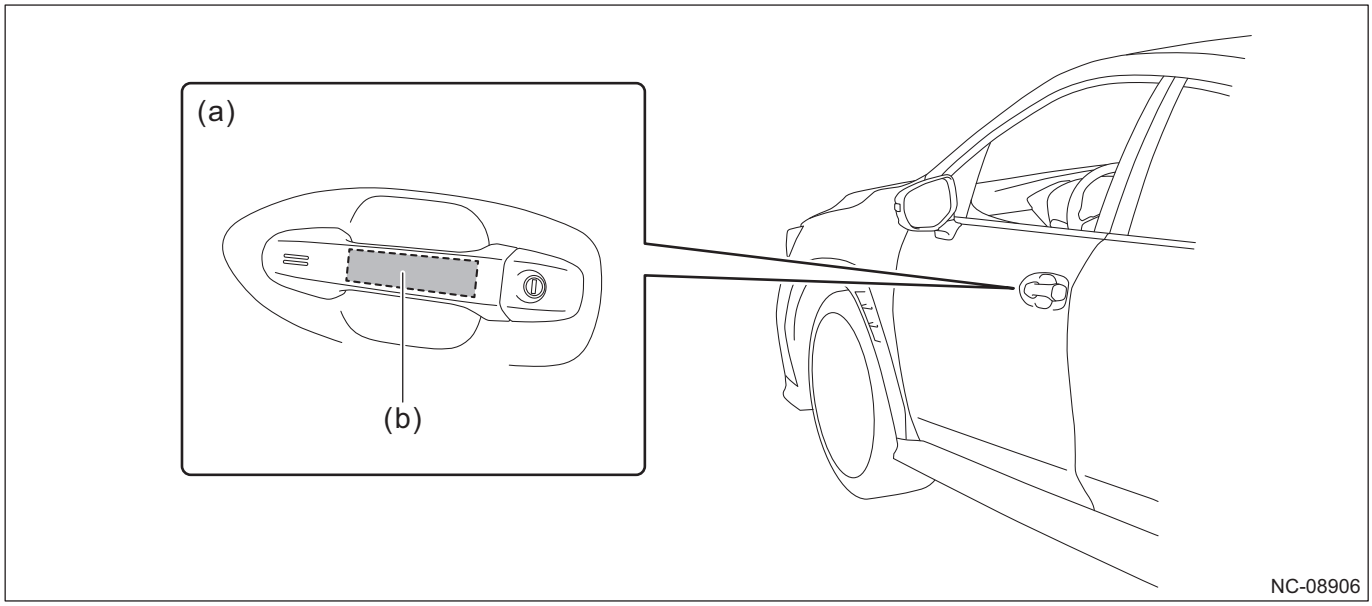
If the passenger's front outer handle is gripped while carrying the access key, all the doors are unlocked.

When the doors are unlocked, the hazard lights flash twice and the keyless buzzer sounds twice as an answer-back.

Caution

If the doors cannot be unlocked when you suddenly operate the front outer handle (gripping the front outer handle), or when you suddenly enter the exterior detection area to operate the front outer handle, release hands once from the door outer handle and perform the front outer handle operation again.

If the front outer handle operation is performed using gloves, the door may not unlock.



(a) Front outer handle

(b) Unlock sensor (handle reverse side)

■ Keyless access door lock function

When the lock button (unlock button) of the access key is pressed, an ID code/function code signal is sent to the keyless access CM. The keyless access CM which received the signal outputs a door lock (unlock) request signal to the Body Integrated Unit.

When you have exited the vehicle carrying the access key with all the doors closed, if you touch the lock sensor on the surface of the front outer handle in the exterior detection area, all the doors lock.

When all the doors are locked, the hazard lights flash once and the keyless buzzer sounds once as an answer-back.

Caution

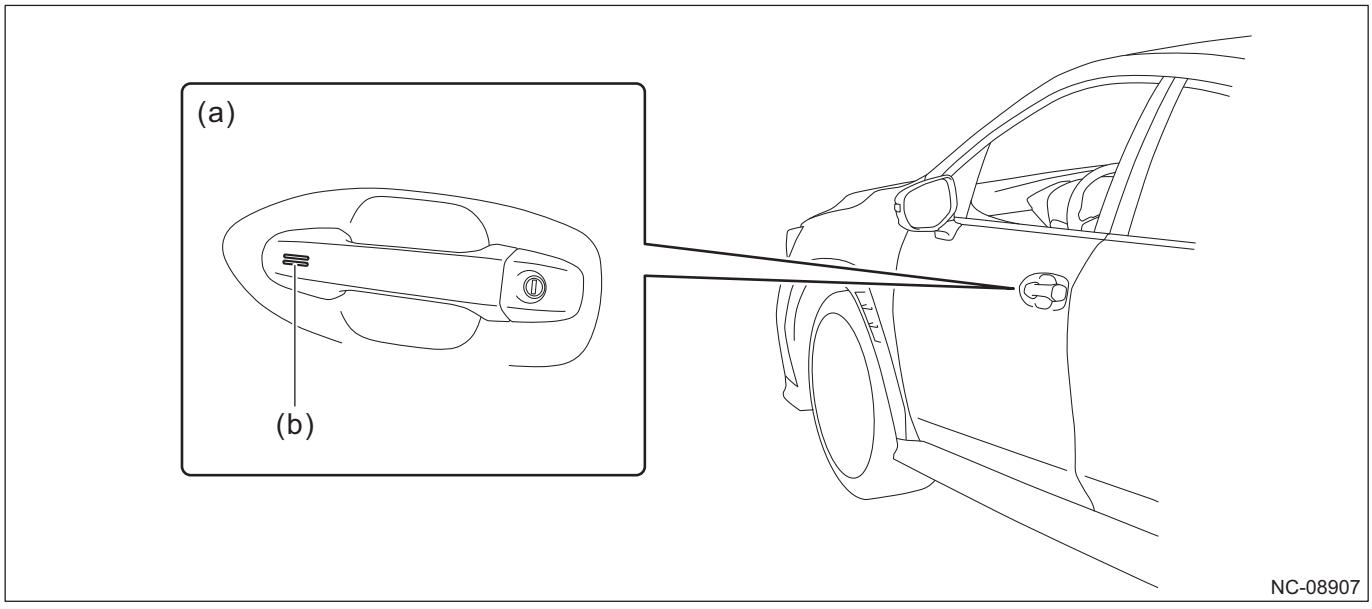
The keyless access door lock function is valid up to two consecutive times and inoperative at the third time or more. If the doors do not lock when you touch the lock sensor on the surface of the front outer handle, touch the lock sensor with your palm to lock the doors.

If you touch the lock sensor using gloves, the door may not lock.

If watering the front outer handle while carrying the access key when washing, the doors may lock and unlock repeatedly. In that case, wash the vehicle when the access key is away from the vehicle by about 2 m or more.

If watering the front outer handle when the vehicle is washed by a car washer with the access key being in the passenger room, the keyless buzzer may sound a warning. In that case, lock all the doors, and stop the warning.

If ice, snow, or dirt is adhered on the surface of the lock sensor, the sensor may not respond.

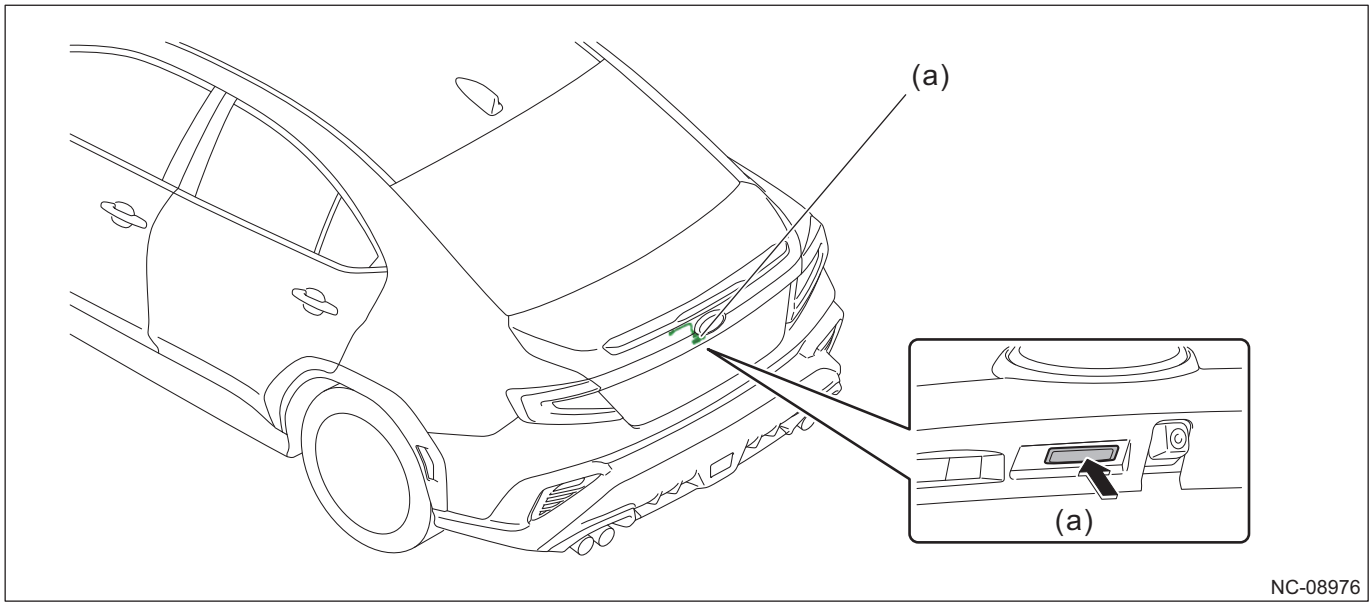


(a) Handle front door outer

(b) Lock sensor

■ Keyless access trunk open function

The trunk is unlocked when pressing the trunk request switch while carrying the access key in the detection area outside trunk and while all the doors are locked. Opening is possible even without carrying the access key if the doors are unlocked.



(a) Trunk request switch

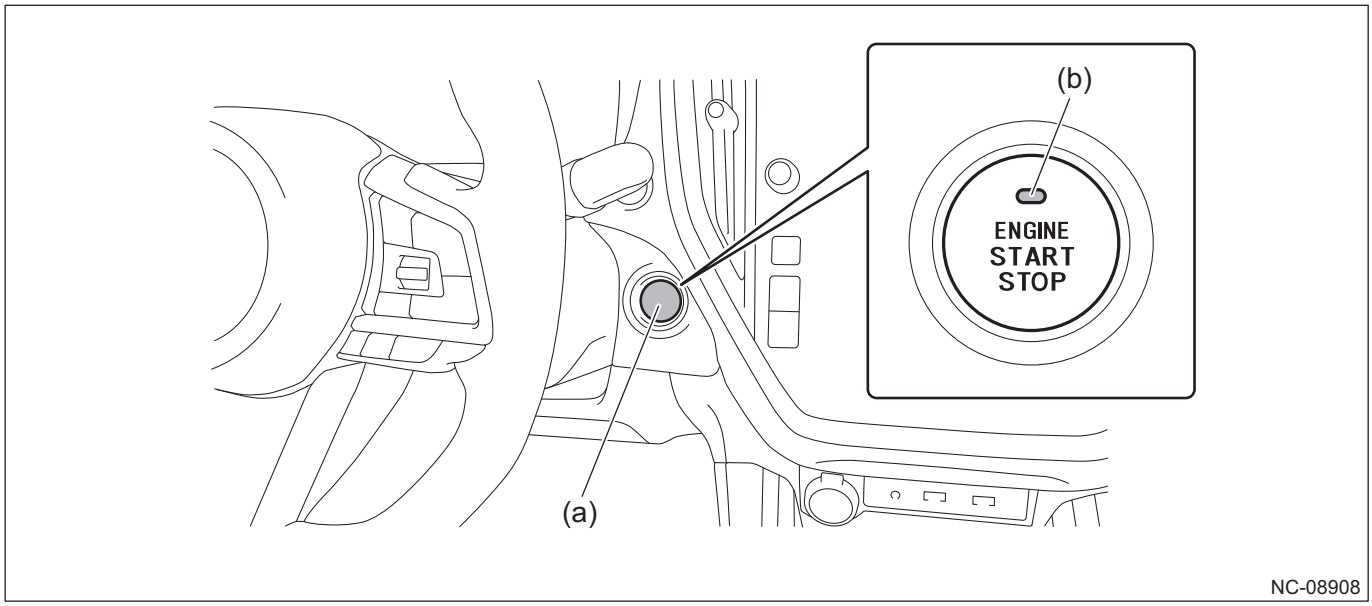
■ Push button start function

By pressing the engine switch in combination with brake pedal (CVT)/clutch pedal (MT) operation while carrying the access key in the interior detection area, the power supply switching and the engine start can be performed.

If you press the engine switch without depressing the brake pedal (CVT)/clutch pedal (MT) after entering the vehicle while carrying the access key with the power turned OFF, the power transitions to ACC. Each time the engine switch is pressed, the power supply position switches to OFF to ACC to ignition switch ON to OFF (repeated).

If you depress the brake pedal (CVT)/clutch pedal (MT) with the shift position in "P" (only when in the steering unlock condition) (CVT) when entering the vehicle while carrying the access key with the power OFF, the operation indicator light in the engine switch turns on green. If you press the engine switch while the operation indicator light turns on green, the engine starts.

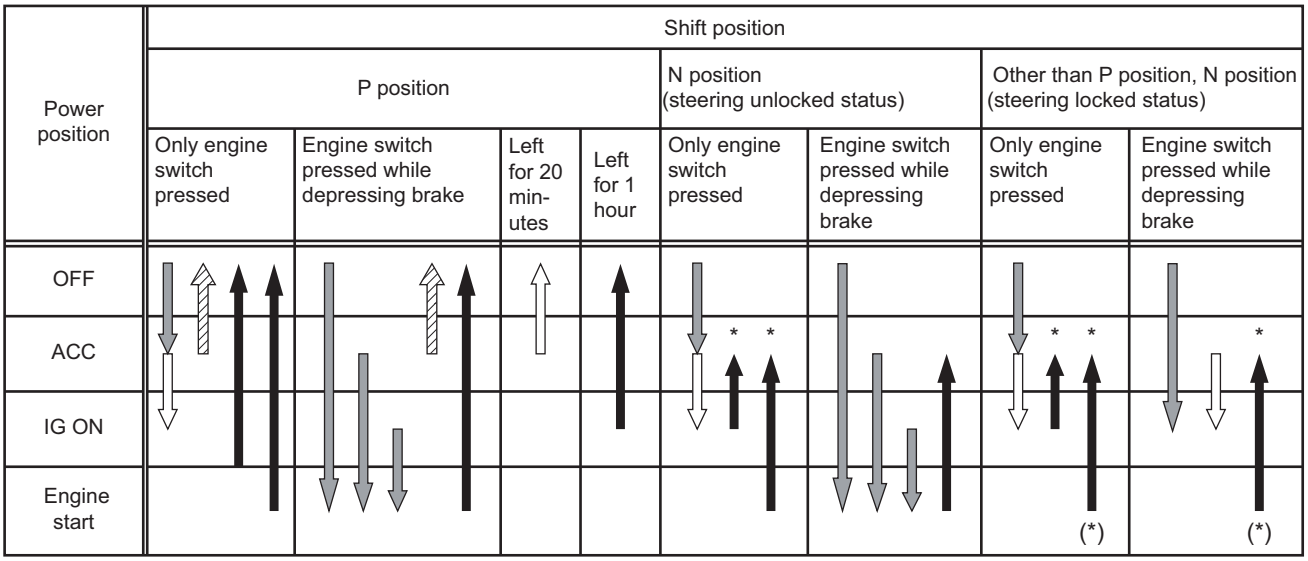
When the vehicle has stopped, if the engine switch is pressed with the shift position in "P" (CVT) while the engine is starting, the power position transitions to OFF. If the engine switch is pressed with the shift in a position other than "P" (CVT), the power position transitions to ACC.



(a) Engine switch

(b) Operation indicator light

Power position transition diagram (CVT)



: Power transition

: Power transition available when key comparison OK

: Power transition available when vehicle stopped (while driving, press the engine switch quickly 3 times or more, or press and hold for 3 seconds or more to stop the engine and transition to ACC)

: Power transition available only after * is established and the shift position is changed to the "P" position

(*) Except for N position (steering locked status)

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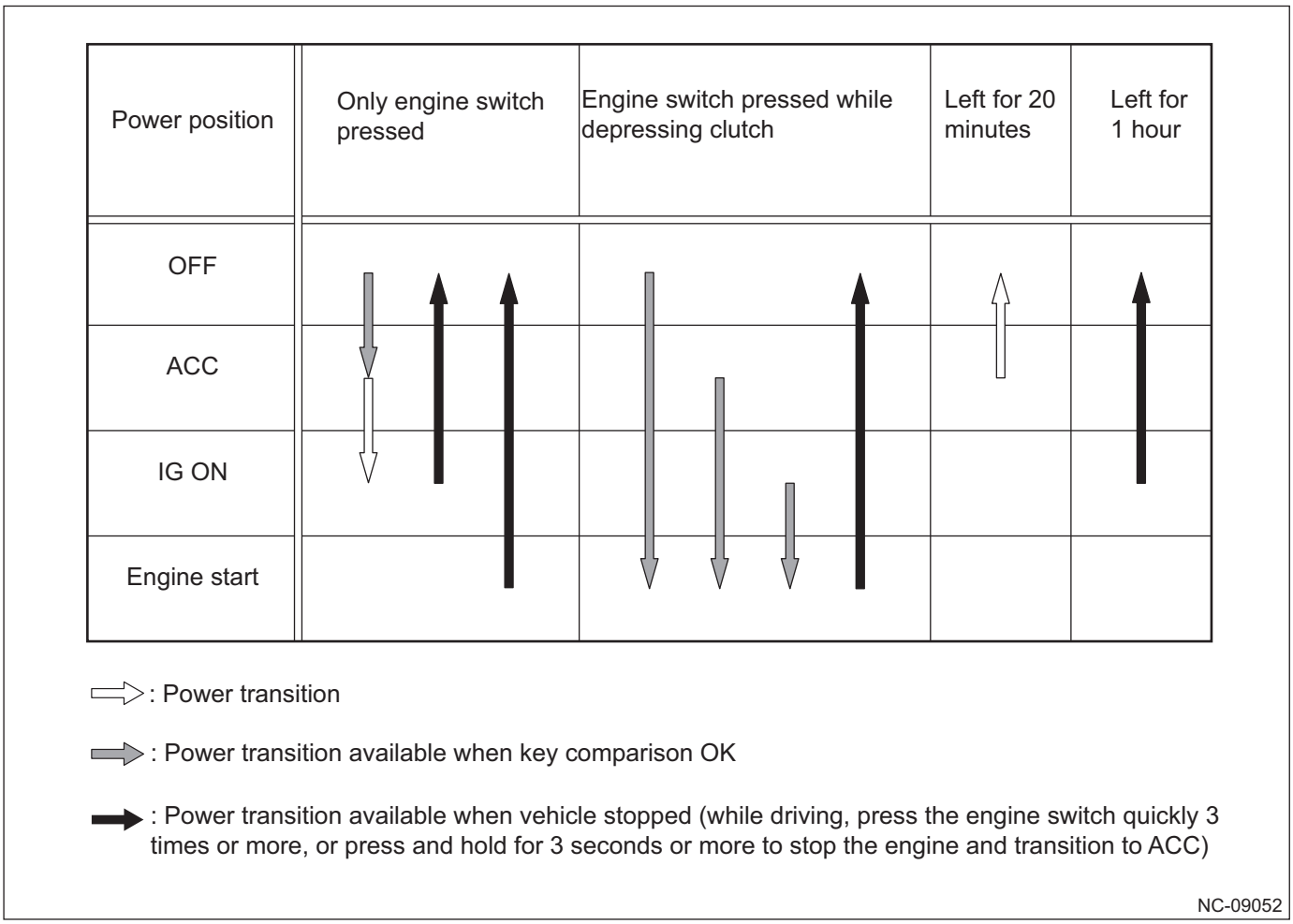
Power position transition diagram (MT)



▮ Power transition when the access key does not operate correctly due to a flat access key battery or radio wave jamming

Unlock the door with the mechanical key built into the access key and enter the vehicle while carrying the access key.

When touching the access key with the button side facing you to the front of the engine switch, while depressing the brake pedal (CVT)/clutch pedal (MT) with the shift position in "P" (CVT), the ignition switch transitions to ON. (The position transitions to ACC when the keyless access & push button start system is canceled.)

Each time the brake pedal (CVT)/clutch pedal (MT) is released and the engine switch is pressed, the power supply position switches to ACC* to ignition switch ON to OFF. After the position is OFF, it is necessary to touch the access key to the engine switch again to restart the power.

**: When canceling the keyless access & push button start system*

▮ Engine start when the access key does not operate correctly due to a flat access key battery or radio wave jamming

Unlock the door with the mechanical key built into the access key and enter the vehicle while carrying the access key.

Touch the ornament side of the access key to the front of the engine switch while depressing the brake pedal (CVT)/clutch pedal (MT) with the shift position in "P" (CVT) to turn ON the ignition switch.

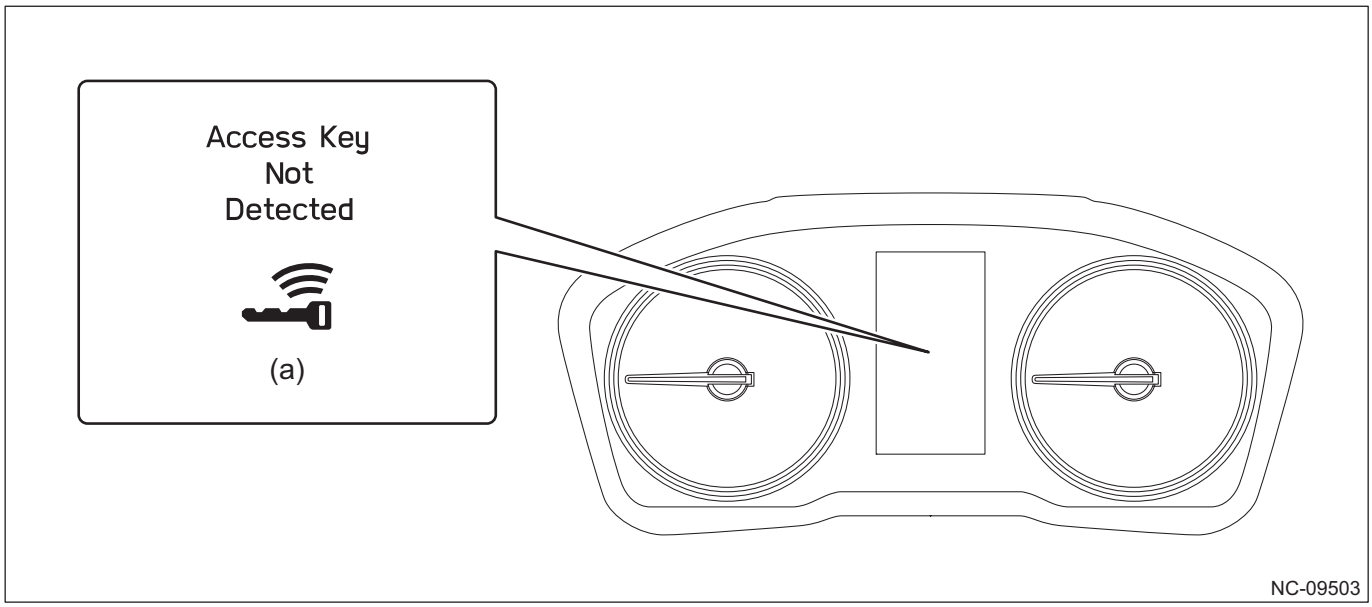
If the engine switch is pressed while depressing the brake pedal (CVT)/clutch pedal (MT), the engine starts.

■ Illuminated entry function

When the map light switch is in the "DOOR" position, if either the access key is carried into the exterior detection area or the unlock button on the access key is pressed, some internal lights, such as the light assembly map, will turn on for 30 seconds (default setting value).

■ Warning/warning function

Keyless access & push button start system warnings are given by a buzzer and a warning display, etc. in the combination meter.



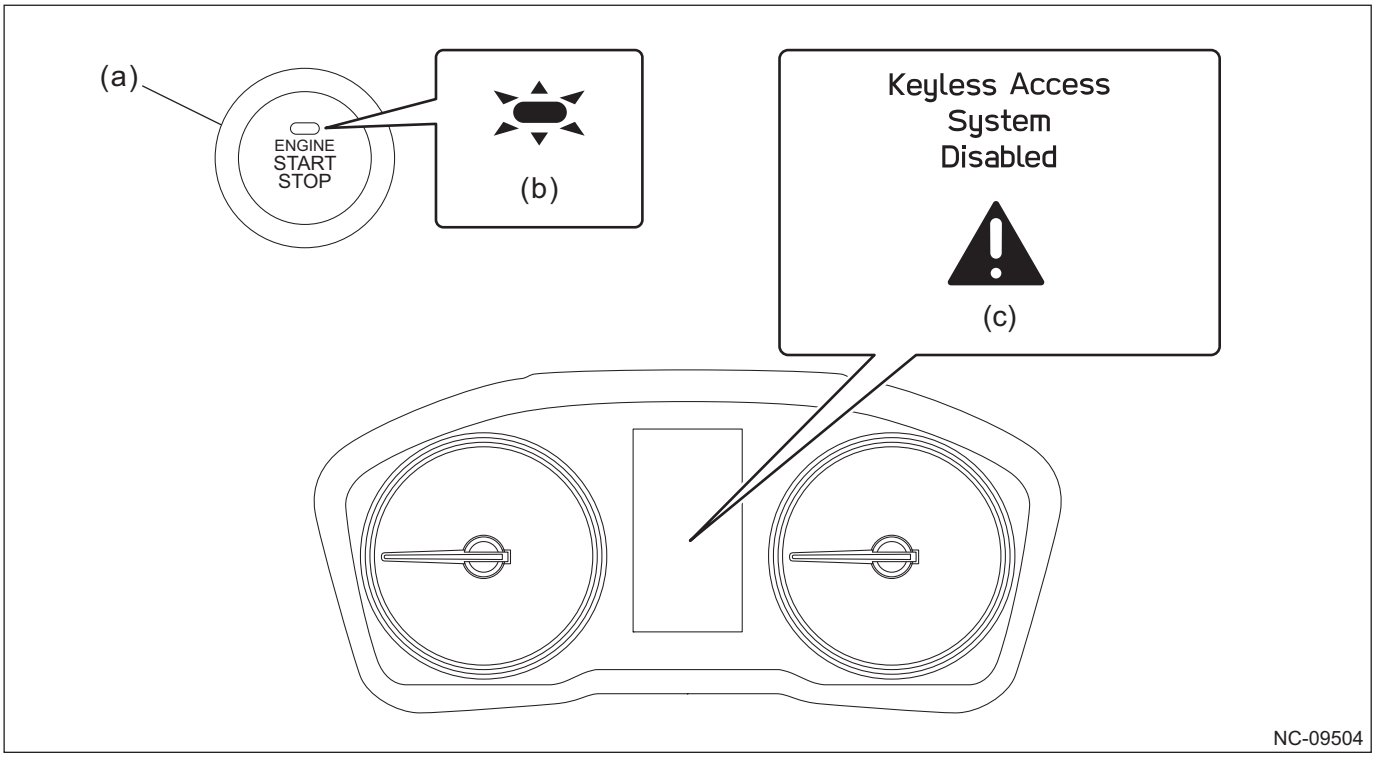
(a) Warning display in combination meter (access key warning)

Warning function list

Item	Function
Door open warning	A warning buzzer sounds when a locking operation is performed by the touch sensor (lock) of the front outer handle or the access key with any of the doors opened.
Lock-in prevention warning	If you attempt to lock all the doors by "locking from outside the vehicle without using the key" with the access key left in the vehicle, an exterior buzzer sounds for 2 seconds and all the doors are unlocked.
Mislaid key warning	This sounds the keyless buzzer for 2 seconds if the doors are closed and a locking operation is performed by the touch sensor (lock) of the front outer handle with the access key left in the vehicle and the power turned OFF.
Access key warning	When traveling with no access key in the vehicle, an internal buzzer sounds and the access key warning in the combination meter is displayed.
Power off reminder warning	This continuously sounds the exterior buzzer for a maximum of 60 seconds and displays a warning in the combination meter if the touch sensor (lock) of the front outer handle is pressed while carrying the access key when the power is in a position other than OFF. The warning ends if any of the following conditions are satisfied. • 60 seconds or more have elapsed • Ignition OFF • Shift position is operated to a position other than P (CVT model) • Vehicle speed is present
Engine start warning	If the engine switch is pressed when there is no access key, a warning buzzer sounds and the access key warning in the combination meter is displayed.
Key removal warning	This sounds a warning buzzer and displays the access key warning in the combination meter if the driver leaves the vehicle and closes the driver's door while carrying the access key when the power is in a position other than OFF.
	If a passenger takes the access key out of the vehicle and closes a door other than the driver's door when the power is in a position other than OFF, a warning buzzer sounds.
Engine switch or communication line fault warning	If the engine switch or communication line is faulty, an internal buzzer sounds, the indicator in the engine switch turns on in a 2 second cycle, and an interrupt warning is displayed in the combination meter.
Key remaining battery charge warning	When the remaining charge of the access key battery is low, an internal buzzer sounds and the key remaining battery charge warning in the combination meter is displayed.

■ Engine switch or communication line fault notification function

If the engine switch or communication line is faulty, an internal buzzer sounds (warning sound: long beep), and a warning is issued by an operation indicator light (orange: 2-second cycle) in the engine switch and a warning display (interrupt display) in the combination meter, notifying the driver of the fault before the vehicle gets into danger during travel.



(a) Engine switch

(b) Operation indicator light in engine switch

(c) Warning display (interrupt warning) in combination meter

■ Cabin interior lockout prevention feature

If you attempt to forcibly lock the door (open the door, lower the lock knob to the lock position, and close the door) with the access key left in the passenger room, the access key is determined to be left inside the cabin. To prevent the access key from being left inside, the doors are unlocked, and simultaneously, a buzzer sounds for 2 seconds.

■ Trunk interior lockout prevention feature

If you close the trunk with the access key left in the trunk, the access key is determined to be left inside the trunk and a buzzer sounds for 2 seconds.

■ Power saving function

Reduction of the battery power is suppressed by stopping periodic transmission of request signals and restricting keyless access & push button start system functions for doors other than the driver's door when the vehicle is not used for an extended period of time.

When the access key is in the exterior detection area for about 10 minutes or more, periodic transmission of request signals is stopped to save the access key battery power.

Since the keyless access & push button start system forms a detection area by periodically transmitting request signals about every 0.25 seconds, if the vehicle is left for a long period, there is a possibility of the battery mounted in the vehicle going flat. The following controls are set to prevent the battery going flat.

▮ Vehicle power saving control

If the engine has not been started for 5 days or more, the periodic transmission of the front exterior antenna is stopped. (Locking/unlocking of the doors by the keyless access & push button start system and access key buttons is enabled.)

If the engine has not been started for 14 days or more, the lock/unlock sensors in the front outer handles other than the driver's door are disabled. (Locking/unlocking of the doors by the access key buttons is enabled.)

If any one of the following recovery conditions is satisfied, the lock/unlock sensors in the front outer handles other than the driver's door are enabled.

Recovery conditions:

- When the door is locked/unlocked by the button on the access key.
- When the door is locked/unlocked by a door lock/unlock sensor in the driver's seat front outer handle.
- When the door is opened and then closed.

▮ Access key battery power saving function

If the access key is left for an extended period in the exterior detection area, there is a possibility of the access key battery going flat because the access key continues to send its ID code to the antennae. The following controls are set to prevent the battery going flat.

Also, switching to the power saving mode is possible by operating the buttons of the access key. If you press the unlock button twice while pressing and holding the lock button on the access key, the mode changes to power saving mode after the indicator flashes four times. In the power saving mode, standby for radio wave transmission by the access key stops and the access key's battery consumption is suppressed. (However, use of the keyless access & push button start system is not possible during power saving mode.) When pressing any of the buttons on the access key, the power saving mode can be canceled.

▮ Automatic power saving control

If the key is in the exterior detection area for about 10 minutes or more, the request signal periodic transmission (creation of the detection area) of each front exterior antenna of the front outer handles that detect the access key is stopped.

If any one of the following recovery conditions is satisfied, the vehicle returns from power saving control to normal keyless access & push button start system control.

Recovery conditions:

- When the door is locked/unlocked by the button on the access key.
- When the door is locked/unlocked by a door lock/unlock sensor in the door outer handle.
- When the driver's door or front passenger's seat door is closed and then opened.

■ Keyless access & push button start system cancellation function

The following keyless access & push button start system control can be canceled by performing a specified operation.

You can lock/unlock the doors by operating the access key buttons or using the mechanical key while the keyless access & push button start system is canceled. Also, ACC can be set to ON by touching the access key on the front of the engine switch.

Items that can be canceled:

- Keyless access & push button start system control
- Warning function
- Lockout prevention feature

▮ Switching the cancel function ON/OFF

When the power is OFF, and the driver's door is closed but unlocked, you can switch the cancel function ON/OFF by performing the following operations.

Keyless access & push button start system cancellation methods

Initial state	Power OFF, driver's door "Closed", driver's door unlocked
Operation 1	Perform door unlocking once with central door lock switch.
Operation 2	Open driver's door within about 5 seconds after Operation 1 (driver's door "Close" to "Open").
Operation 3	Perform door unlocking twice with central door unlock switch within about 5 seconds after Operation 2.*
Operation 4	Within approximately 10 seconds after the execution of Operation 3, repeat "Opening" and "Closing" of the driver's door twice, and open the driver's door again. (Driver's door "Open" -> "Close" -> "Open" -> "Close" -> "Open")
Operation 5	Perform door unlocking twice with the central door lock switch within about 10 seconds after Operation 4.*
Operation 6	Within approximately 10 seconds after the execution of Operation 5, repeat "Open" and "Close" of the driver's door once, and open the driver's door again. (Driver's door "Open" -> "Close" -> "Open")
Operation 7	Close the driver's door within about 5 seconds after Operation 6.

**: If there has been a driver's door "Open" and "Close" operation in Operation 3 and 5, the keyless access & push button start system cancellation operation is cleared.*

Reference

To return to a state where the keyless access & push button start system can be used, from a state where the keyless access & push button start system is canceled, perform again the above "keyless access & push button start system cancellation methods".

▮ Answer-back during canceling function

When the "cancellation operation of keyless access & push button start system/recovery operation from system cancellation" are complete, the keyless buzzer sounds as an answer-back.

Answer-back

When canceling the keyless access & push button start system	Keyless buzzer sounds for 2 seconds.
When recovering from keyless access & push button start system cancellation	Keyless buzzer sounds once.

▮ Customization function

In addition to the cancellation of the control of keyless access & push button start system by performing a specified operation, it is possible to turn the functions ON/OFF and customize the other settings using the Subaru Select Monitor 4 at the dealer.

Function that can be changed only at the dealer

Function	Setting change available range	Initial setting
Answer-back buzzer volume	OFF, 1 (Low) to 7 (High)	5

■ Keyless access & push button start system detection area

A request signal sent from the keyless access CM is transmitted from the front exterior antenna and rear exterior antenna of the front outer handle to form an access key detection area. The formed detection area is a range of about 0.4 to 0.8 m from the front outer handle/rear bumper central area.

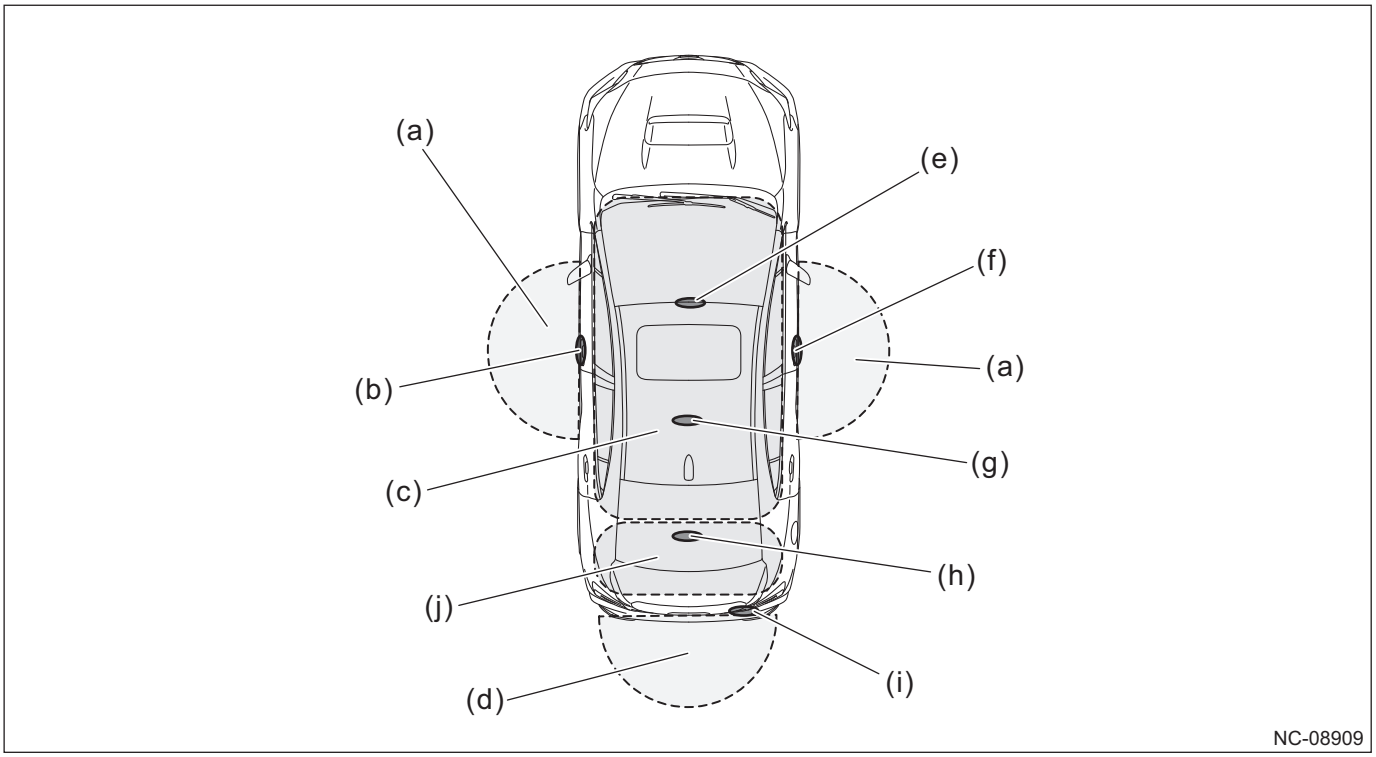
The detection area of the front exterior antenna is formed by request signals periodically transmitted about every 0.25 seconds when parked (power OFF, door locked) to sense the approach of the access key (person carrying the key). Also, by touching the lock sensor when the doors are locked, the existence of the access key (person carrying the key) in the exterior detection area formed by transmitted request signals is detected.

The detection area of the rear exterior antenna is formed by turning ON the trunk request switch.

The cabin interior detection areas are formed when the following operations are performed to detect whether the access key (person carrying the key) is inside the passenger room.

- When opening and closing the driver's door
- When depressing brake pedal (CVT)/clutch pedal (MT)
- When operating the ignition
- When the necessary conditions for each type of warning are satisfied
- When the keyless access door lock operation is performed

▮ Antenna and detection area



(a) Exterior detection area
(b) Front outer handle LH (front exterior antenna)
(c) Interior detection area
(d) Trunk exterior detection area
(e) Front interior antenna
(f) Front outer handle RH (front exterior antenna)
(g) Center interior antenna
(h) Trunk interior antenna
(i) Trunk exterior antenna
(j) Trunk interior area

Keyless entry system functions

The lock/unlock operations of the keyless entry system are controlled by the body integrated unit.

The key identification code signal from the operation of the lock/unlock button on the keyless transmitter is received by the Body Integrated Unit. When the lock/unlock signal is received, the door lock actuators of the latch & actuator assemblies are driven, and all the doors and the rear gate are locked/unlocked.

■ Wireless lock (unlock) function

When the lock button of the keyless transmitter is pressed, all the doors are locked. When the unlock button of the keyless transmitter is pressed once, only the driver's door is unlocked, and when the button is pressed once again within 5 seconds, all the doors are unlocked.

When the lock button (unlock button) of the keyless transmitter is pressed, a key identification code signal is sent to the keyless entry control module. The keyless entry control module which received the signal outputs a door lock (unlock) request signal to the Body Integrated Unit.

The keyless entry control module verifies the ID code and distinguishes the function code, and if the ID code matches the vehicle code, it outputs the door lock (unlock) request signal to the Body Integrated Unit, and then the Body Integrated Unit outputs a lock (unlock) operation request signal to each door lock actuator.

When the lock (unlock) signal is input, the Body Integrated Unit drives the door lock actuators of all the doors in the same manner as the manual lock (unlock) operation of the electric door lock system to lock (unlock) all the doors.

■ Lockout prevention & mistaken operation prevention function

The keyless transmitter operations are disabled while the key is inserted into the key lock cylinder.

■ Key removal reminder function

If the driver's door is opened while the key is inserted into the key lock cylinder with the ignition switch OFF, the Body Integrated Unit outputs the buzzer sounding request from each signal to the combination meter. The combination meter sounds the buzzer intermittently based on the requests received from the Body Integrated Unit to warn of the forgotten key removal.

The buzzer sounding is stopped by turning the ignition switch ON, closing the driver's door, or removing the key.

■ Answer-back function

When the lock/unlock button of the keyless transmitter is pressed, the hazard light flashes and the keyless buzzer sounds once for locking and twice for unlocking.

■ Illuminated entry function

When the map light switch is in the "DOOR" position, if the unlock button on the keyless transmitter is pressed, some internal lights, such as the map light, will turn on for 30 seconds (default setting value).

■ Keyless transmitter registration function

Up to 4 can be registered at the dealer using the Subaru Select Monitor 4.

Security system

Immobilizer system

An immobilizer system is provided that prohibits engine start when using an access key other than the correct access key that was registered for the vehicle. This prevents vehicle theft using a method such as a duplicated key plate.

Immobilizer system operating status list

Condition	Condition	Security indicator light
When operated	When the engine switch is turned OFF	Flashes slowly
When canceled	When the engine switch is pressed while carrying a registered access key	Off

Security alarm system

The security alarm system starts the activation of the theft warning automatically on the vehicle side when the keyless access door lock function or wireless door lock function is used to lock the doors while all the doors, trunk, and hood (bonnet) are closed.

When a door, trunk, or hood (bonnet) is forcibly unlocked or opened with an unauthorized method while the warning is activated, the alarm operates (horn sounds intermittently, hazard warning lights and headlights flash, interior lights turn on).

The security alarm system can be set by the customization function. For details, refer to the service manual.

Security alarm system operating status list

Condition	Condition	Security indicator light
During standby (alarm is not operating)	For approximately 30 seconds after the engine switch is turned OFF and all the doors, trunk, or hood (bonnet) are locked	Flashes quickly
When warning activated (alarm is operating)	After approximately 30 seconds elapse since standby	Flashes twice consecutively
When canceled (alarm is not operating)	When unlocked with the keyless access function	Flashes slowly

10.8 Lighting System

10.8.1 Overview

Overview

Various interior illuminations are adopted to ensure convenience at night.

A door interlocked function is adopted that controls the turning on and off of the front seat map light, room light, and trunk room light according to operations such as door opening and closing, and locking and unlocking.

An ignition switch illumination function is adopted that enables the keyless transmitter to easily access the ignition switch even in the dark. (Models with keyless entry system)

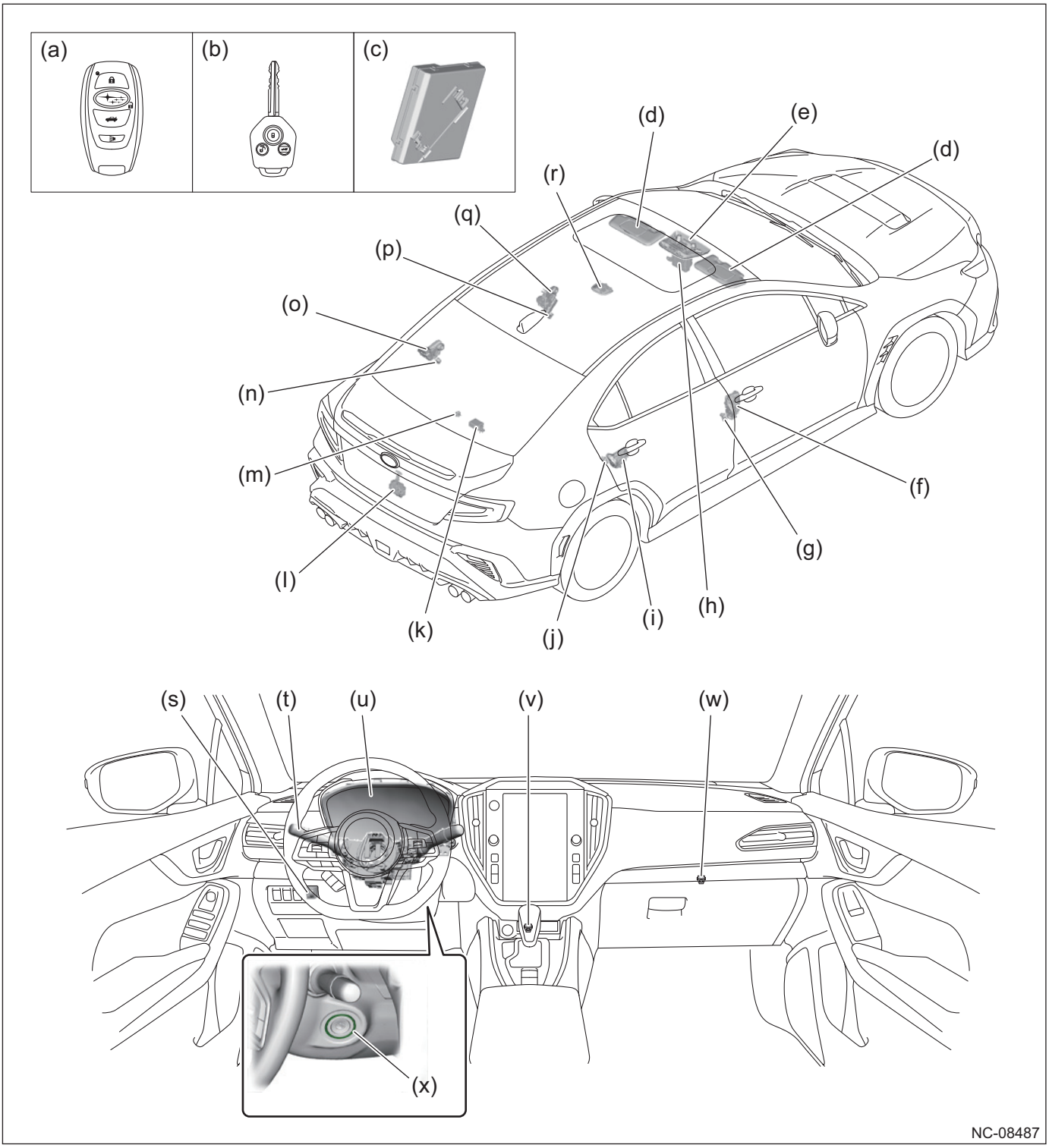
A door ajar response function is adopted that automatically turns off the interior illumination to prevent battery depletion if the interior illumination stays turned on continuously, such as when a door is ajar.

Specifications

Light name	Specifications
Front seat map light	12 V/8 W (SF6/7)
Vanity light (for some grades)	12 V/2 W (SF6/7)
Glove box light (for some grades)	LED
Ignition switch light (models with keyless entry system)	LED
Room light	12 V/8 W (T10)
Trunk room light	12 V/3.8 W (T10)
Light of pocket in front of shift lever	LED

10.8.2 Component

Component layout drawing



(a) Access key (models with keyless access & push button start system)

(b) Keyless transmitter (models with keyless entry system)

(c) Keyless access CM (models with keyless access & push button start system)

(d) Vanity light (in sun visor) (for some grades)

(e) Front seat map light

(f) Latch & actuator assembly (passenger's seat side)

(g) Door switch assembly (passenger's seat side)

(h) Body Integrated Unit (in joint box)

(i) Latch & actuator assembly (rear seat RH)

(j) Door switch assembly (rear seat RH)

(k) TPMS & keyless entry CM (models with keyless entry system)

(l) Trunk lid lock assembly

(m) Trunk room light

(n) Door switch assembly (rear seat LH)

(o) Latch & actuator assembly (rear seat LH)

(p) Door switch assembly (driver's seat side)

(q) Latch & actuator assembly (driver's seat side)

(r) Room light

(s) Illumination control switch

(t) Lighting switch

(u) Combination meter

(v) Light of pocket in front of shift lever

(w) Glove box light (for some grades)

(x) Ignition switch light (models with keyless entry system)

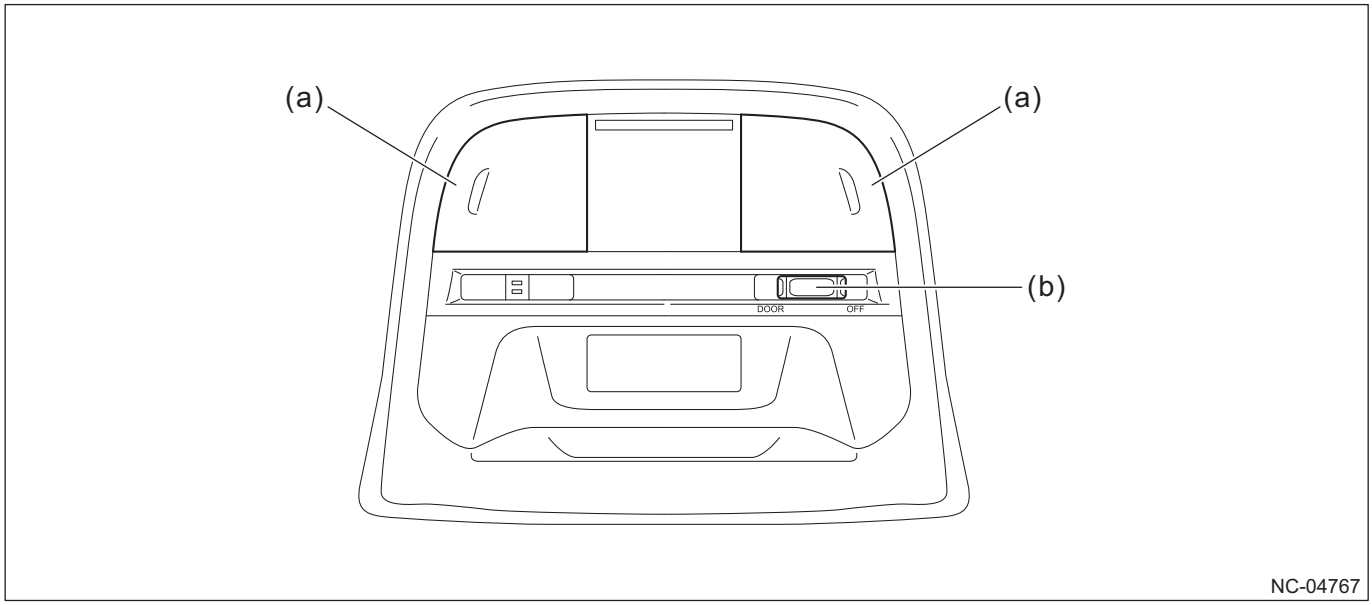
Component details

Front seat map light

A front seat map light with door interlocked function switch is positioned in the overhead console.

The light is turned on and off by pressing the ON/OFF switch on the outer side of the front seat map light.

For details on the control of the door interlocked function for turning the light on and off, refer to "System details" in "Construction and Operation."



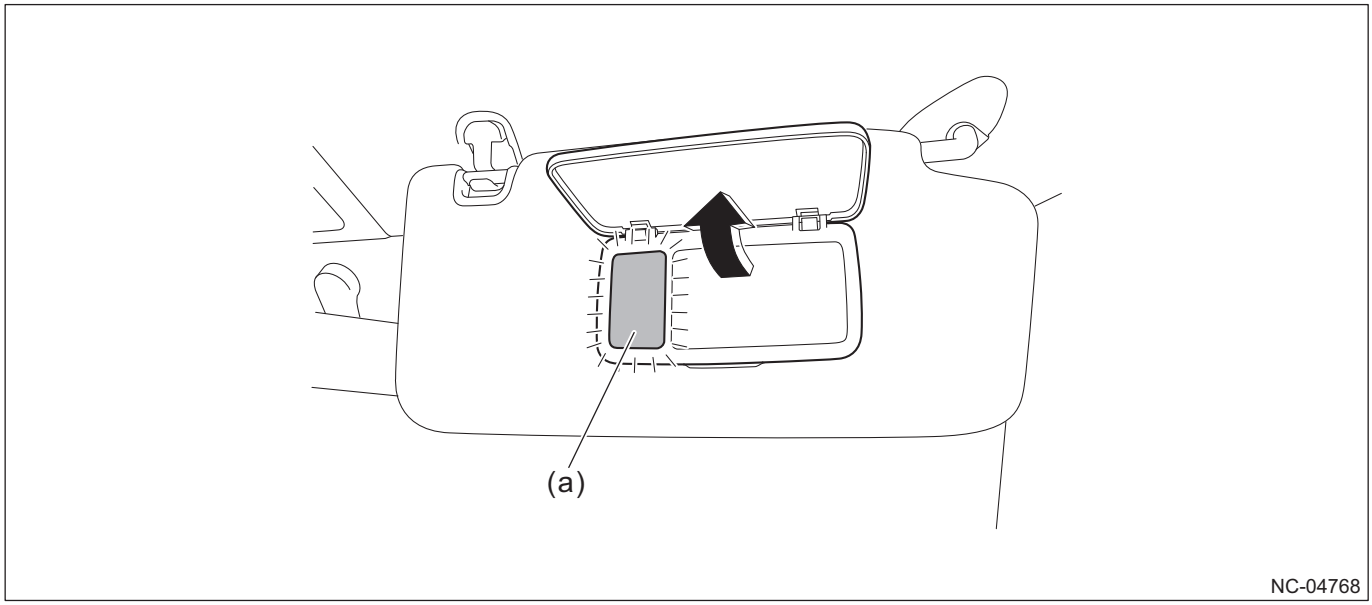
(a) Front seat map light (with ON/OFF switch)

(b) Door interlocked function switch

Vanity light (for some grades)

A vanity light is positioned in the driver's seat and passenger's seat sun visor.

This turns on when the lid of the vanity mirror is opened.

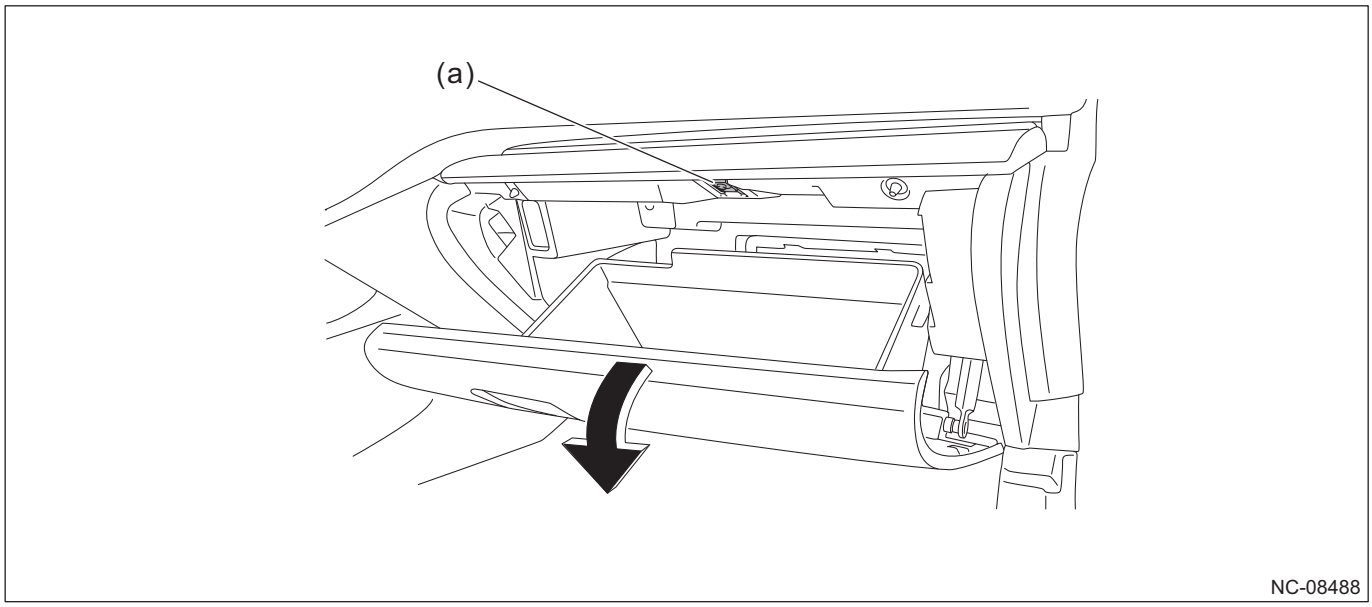


(a) Vanity light

Glove box light (for some grades)

A glove box light is positioned in the glove box.

This turns on when the glove box is opened while the headlight/parking light is turned on.

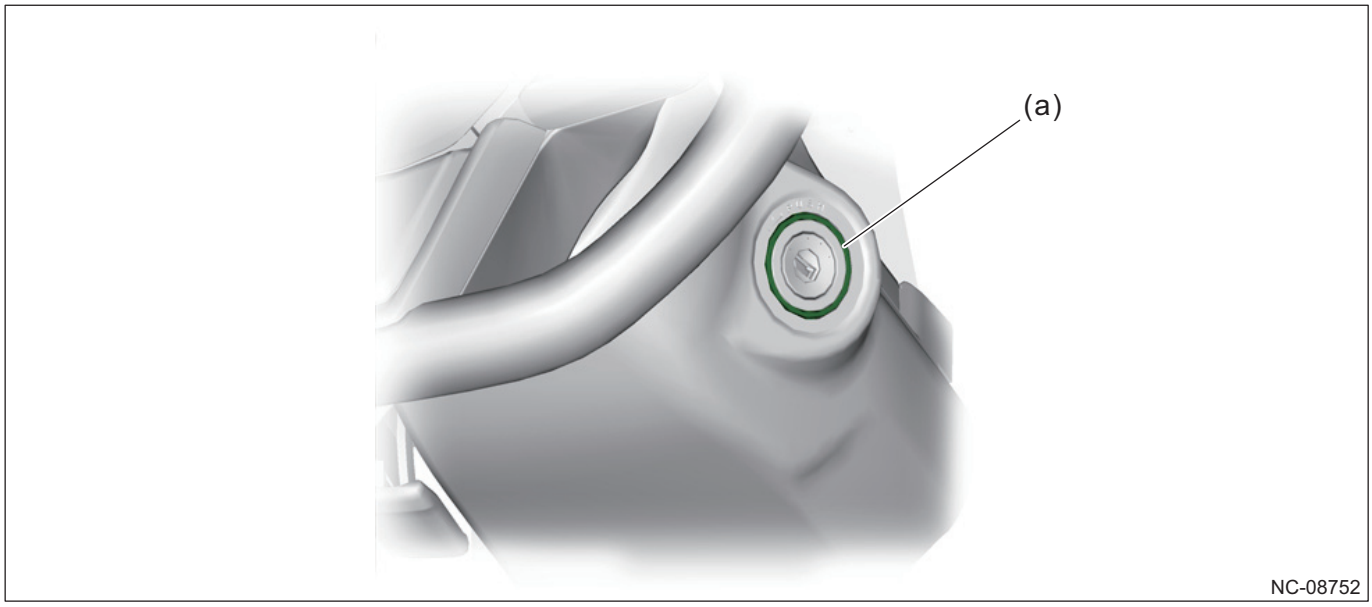


(a) Glove box light

Ignition switch light (models with keyless entry system)

An ignition switch light is positioned around the key cylinder of the ignition switch.

For details on the control of the ignition switch illumination function for turning the light on and off, refer to "System details" in "Construction and Operation."



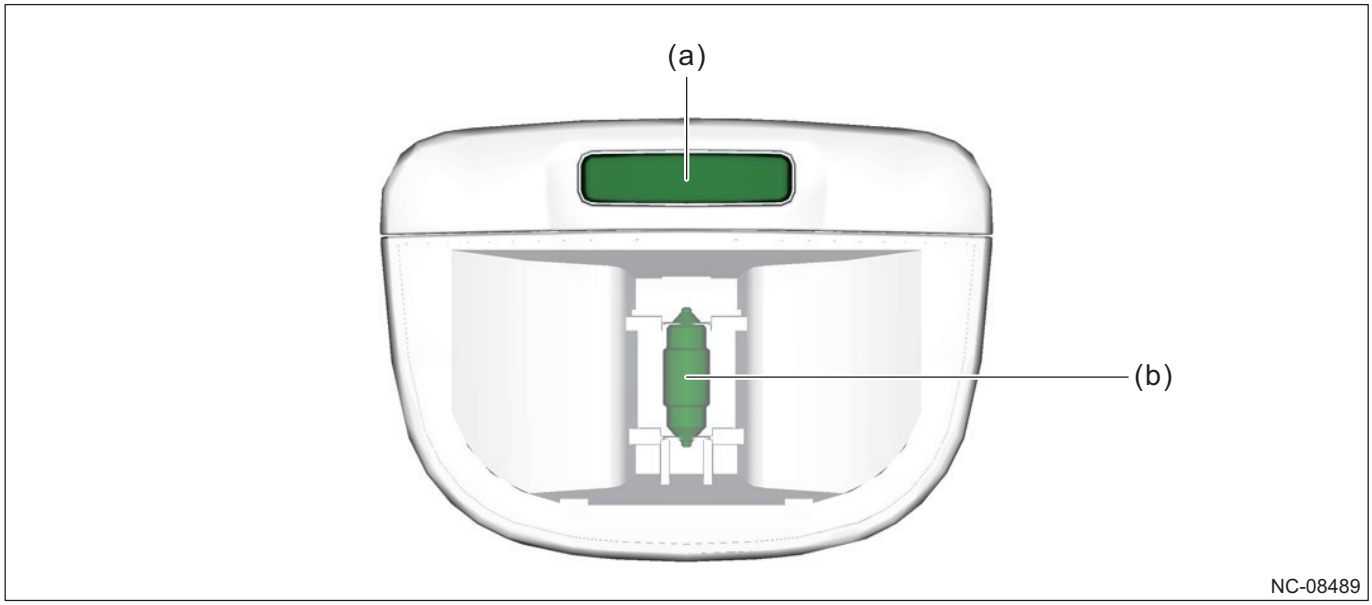
(a) Ignition switch light

Room light

A room light with door interlocked function switch is positioned in the roof trim.

The light is turned on and off by pressing the ON/OFF/door interlocked function switch on the outer side of the room light.

For details on the control of the door interlocked function for turning the light on and off, refer to "System details" in "Construction and Operation."



(a) ON/OFF/door interlocked function switch

(b) Room light

Trunk room light

A trunk room light is positioned in the luggage compartment.

By positioning the harness and connector inside the panel, a structure is adopted where luggage cannot catch the harness or connector.

This light turns on in an interlocked operation with the opening of the trunk.

For details on the control of the door interlocked function for turning the light on and off, refer to "System details" in "Construction and Operation."

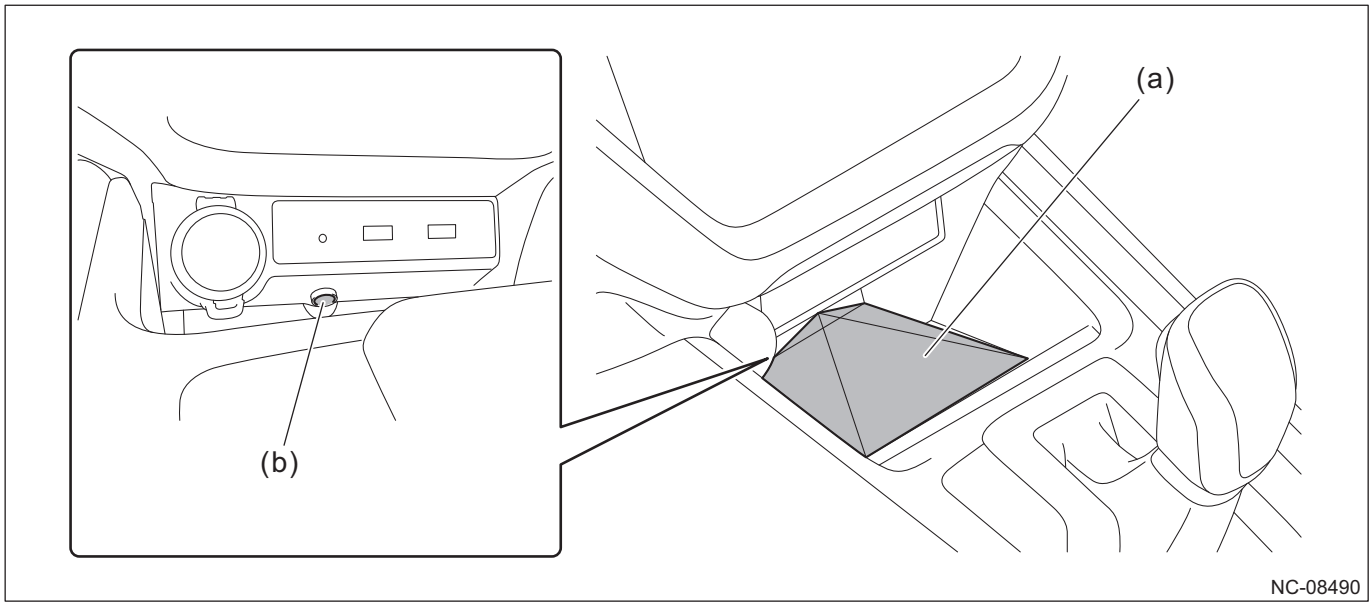
(a) Trunk room light

Light of pocket in front of shift lever

A pocket light is positioned in the center tray section in front of the shift lever.

White LED is adopted for improved visibility.

This turns on when the headlight/parking light is turned on.

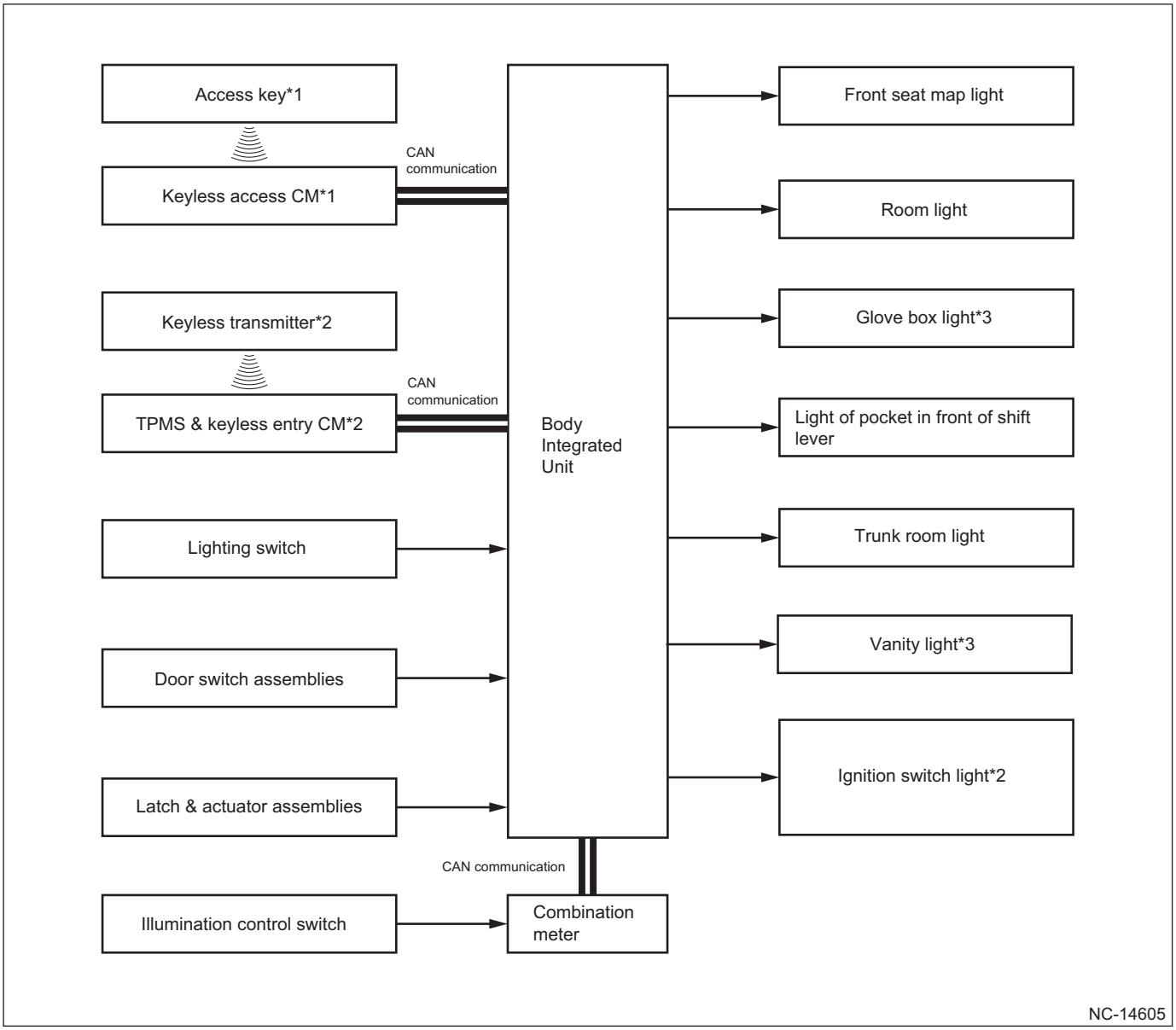


(a) Illumination image

(b) Light of pocket in front of shift lever

10.8.3 Construction and Operation

System diagram



**1: Models with keyless access & push button start system*
**2: Models with keyless entry system*
**3: For some grades*

Main component functions

Component	Function
Access key*1	• Transmits the lock/unlock operation signal of the button operation to the keyless access CM via radio waves. • Transmits the exterior verification result signal to the keyless access CM via radio waves.
Keyless access CM*1	Sends the detection signal based on carrying the access key and the door lock/unlock signal based on the locking operation to the Body Integrated Unit via CAN communication.
Keyless transmitter*2	Transmits the lock/unlock operation signal of the button operation to the TPMS & keyless entry CM via radio waves.
TPMS & keyless entry CM*2	Sends the door lock/unlock signal based on the keyless transmitter locking operation to the Body Integrated Unit via CAN communication.
Lighting switch	Sends the lighting switch operation signal to the Body Integrated Unit.
Door switch assemblies	Sends the open/close status signal for each door to the Body Integrated Unit.
Latch & actuator assemblies	Sends the lock/unlock status signal for each door to the Body Integrated Unit.
Body Integrated Unit	• Receives signals from the units and switches, and controls the on/off of each interior illumination. • Adjusts the brightness of each interior illumination based on the illumination brightness value information from the combination meter.
Illumination control switch	• The brightness of each interior illumination can be adjusted by turning the dial located on the instrument panel. • Sends the illumination control switch operation signal to the combination meter.
Combination meter	• Calculates the illumination brightness value information based on the illumination control switch operation signal. • Sends the illumination brightness value information to the Body Integrated Unit via CAN communication.
Front seat map light	Turns on/off when the operating conditions are met.
Room light	
Trunk room light	
Light of pocket in front of shift lever	
Glove box light*3	
Ignition switch light*2	
Vanity light*3	

**1: Models with keyless access & push button start system*
**2: Models with keyless entry system*
**3: For some grades*

System details

Door interlocked function

■ Front seat map light/room light

This light turns on when a door (excluding the trunk lid) is opened while the door interlocked function switch of the front seat map light and room light is in the DOOR position.

While the door interlocked function switch of the front seat map light and room light is in the DOOR position, the light turns on when any of the following operations is performed, and turns off after the interior light off time (30 seconds) elapses.

- Any of the doors (excluding the trunk lid) is opened and closed.
- The doors are unlocked with the keyless access function[*1], or access key[*1] or keyless transmitter[*2] button operation.
- The access key is carried close to the car while the doors are locked. [*1]

The light turns off when any of the following operations is performed.

- Engine switch[*1] or ignition switch[*2] is turned to ACC or ON.
- The doors are locked with the keyless access function, or access key[*1] or keyless transmitter[*2] button operation.

It is possible to customize the interior light off time to OFF, 30 seconds, 20 seconds, or 10 seconds via the vehicle settings in the center information display. (The factory setting is 30 seconds.)

**1: Models with keyless access & push button start system*
**2: Models with keyless entry system*

■ Trunk room light

When an open trunk lid is detected, the trunk room light turns on, and when the trunk lid is closed, the light turns off after the interior light off time (30 seconds) elapses.

When the light is turned on with the trunk lid closed, the light turns off when any of the following operations is performed.

- Engine switch[*1] or ignition switch[*2] is turned to ACC or ON.
- The doors are locked with the keyless access function, or access key[*1] or keyless transmitter[*2] button operation.

It is possible to customize the interior light off time to OFF, 30 seconds, 20 seconds, or 10 seconds via the vehicle settings in the center information display. (The factory setting is 30 seconds.)

**1: Models with keyless access & push button start system*
**2: Models with keyless entry system*

Ignition switch illumination function (models with keyless entry system)

When the driver's door is unlocked using the keyless transmitter and the driver's door is opened, the ignition switch light turns on.

When any of the following operations is performed after the light turns on, the light turns off after 30 seconds elapse.

- Driver's door is closed
- Driver's door is unlocked using the keyless transmitter

When any of the following operations is performed after the light turns on, the light turns off.

- Ignition switch is turned ON
- Driver's door is locked using the keyless transmitter

Door ajar response function

When the engine switch*1 or ignition switch*2 is OFF and the interior illumination stays turned on continuously due to the door interlocked function (door is ajar, etc.) for 20 minutes, the lights turn off automatically.

It is possible to customize door ajar response function ON/OFF at the dealer using the Subaru Select Monitor 4. (The factory setting is ON.)

**1: Models with keyless access & push button start system*
**2: Models with keyless entry system*

Battery Save Function

When approximately 20 minutes elapse after the ignition is turned OFF, the battery save function operates.

When the battery save function operates, if any front seat map lights, room lights, trunk room lights, or vanity lights* are on, they are turned off automatically.

Also, while the battery save function is operating, the control prevents the front seat map lights, room lights, trunk room lights, and vanity lights* from being turned on.

**: For some grades*

- Ignition is turned to ACC or ON.
- Any door is opened and closed.
- Trunk is opened or closed.
- Unlock button or panic button on the access key is pressed (models with keyless access & push button start).
- Unlock button or panic button on the keyless transmitter is pressed (models with keyless entry system).
- User approaches the driver's seat or passenger's seat of the vehicle with its doors locked while carrying the access key (models with keyless access & push button start system).
- User grips the front door outer handle and unlocks the doors while carrying the access key (models with keyless access & push button start system).
- User presses the trunk opener switch while carrying the access key (models with keyless access & push button start system).
- Keyless transmitter is inserted into the ignition switch (models with keyless entry system).

10.9 Inner mirror

10.9.1 Overview

Overview

The manual anti-glare mirror and the automatic anti-glare mirror (with High Beam Assist (HBA)) are adopted. (for some grades)

10.9.2 Component

Component details

Automatic anti-glare mirror

An automatic anti-glare mirror is provided that reduces the glare seen by the driver via the reflection of the inner mirror from sources such as the shining headlights of vehicles to the rear at night.

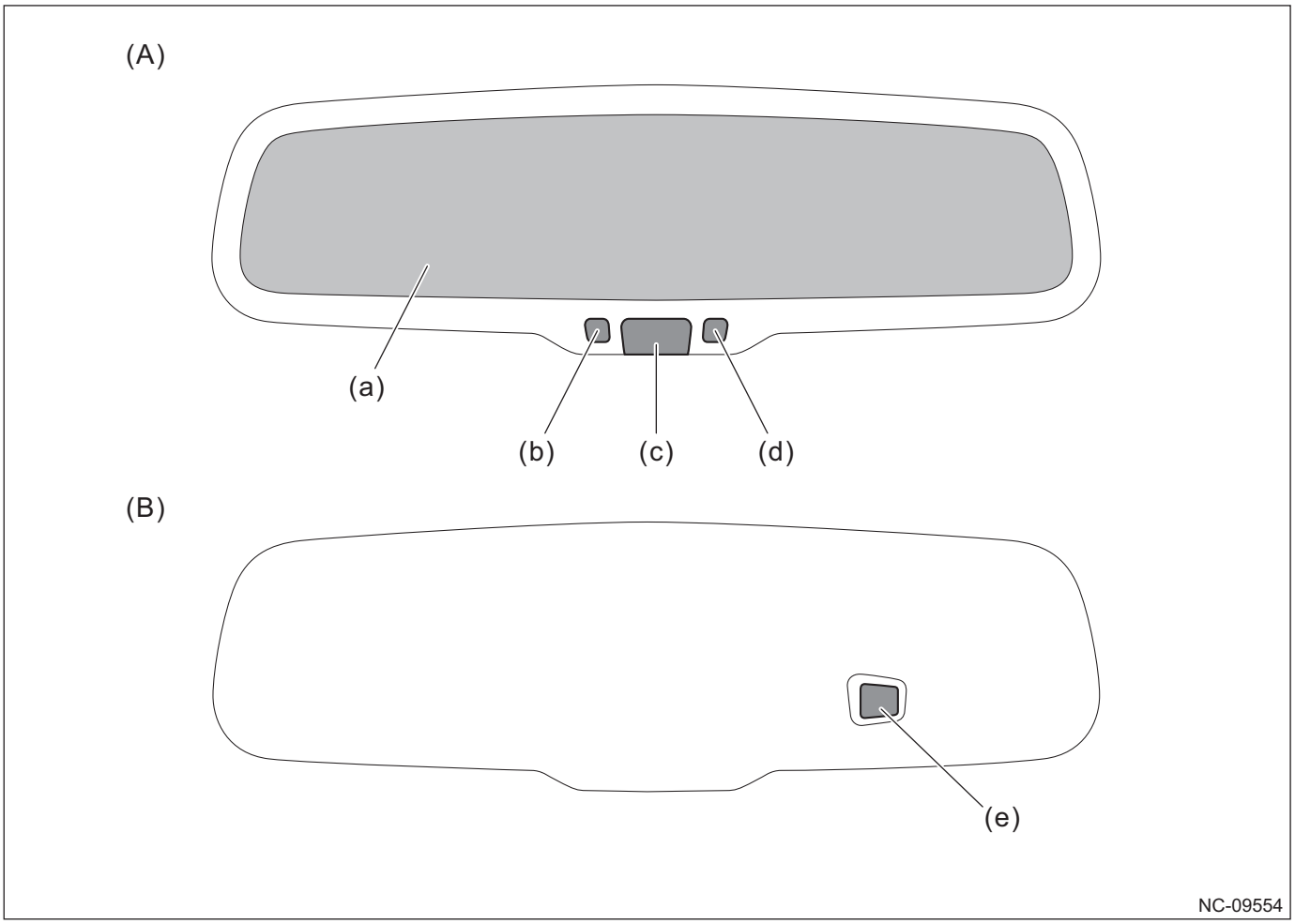
The mirror determines whether there is glare by detecting the amount of received light with a rear sensor under the mirror surface and detecting the surrounding brightness with a front sensor on the windshield glass side. When glare is determined to be present, the reflection rate on the mirror surface is adjusted automatically to reduce the glare seen by the driver.

Caution
If an accessory or sticker is attached in front of the front or rear sensor, the automatic anti-glare function may not operate correctly.

The automatic anti-glare function can be switched between stopped and ready for operation by pressing the switch.

Automatic anti-glare will function when the engine switch is turned from OFF to ON regardless of the switch status. Also, if the vehicle is reversed with a shift operation while the automatic anti-glare function is operating, reverse is determined from the light on input of the back-up light and the automatic anti-glare function is stopped.

The indicator light turns on while the automatic anti-glare function is operating.



(A) Mirror rear view (interior view)

(B) Mirror front view (windshield glass side)

(a) Mirror surface (reflection rate adjustment range)

(b) Indicator light

(c) Switch

(d) Rear sensor

(e) Front sensor

11 ENTERTAINMENT

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11.1 General Overview

11.1.1 Overview

Overview

In this chapter, the following items configuring the entertainment system are described.

- Audio/Navigation and Speaker System
- Telematics system
- Combination Meter/MID
- Information
- Rearview camera
- Antenna

11.2 Audio/Navigation and Speaker System

11.2.1 Overview

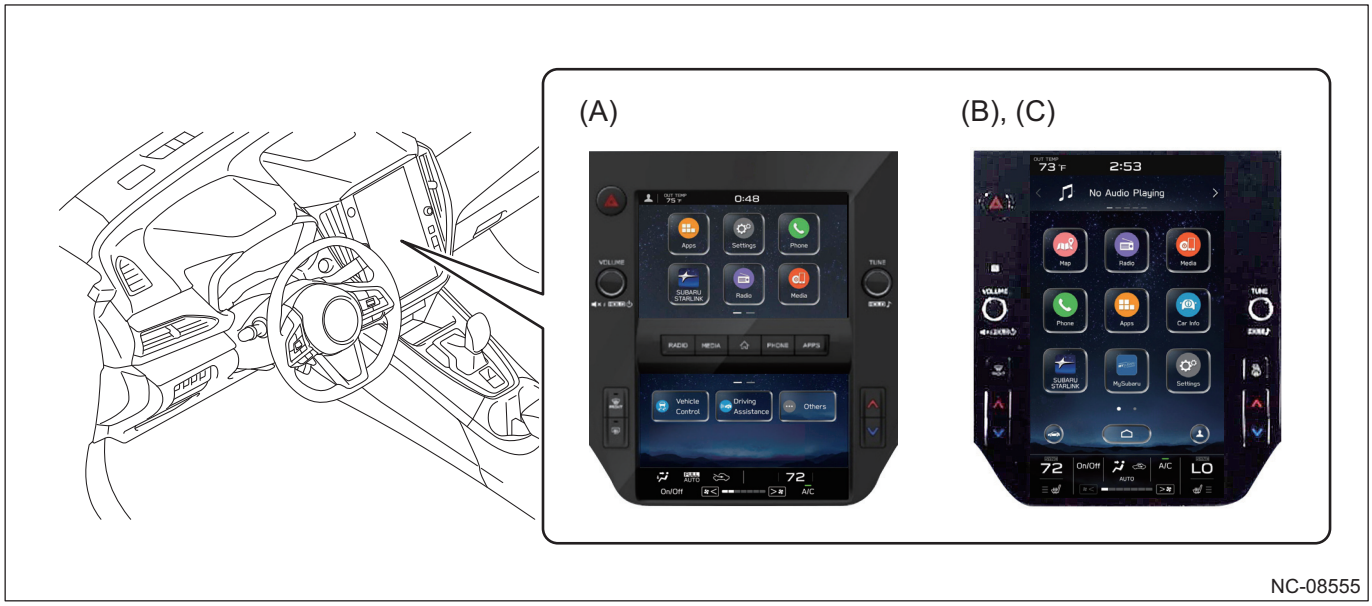
Overview

The Cockpit Gen.1.0 infotainment system is adopted for the audio/navigation system.

The Cockpit Gen.1.0 infotainment system is mainly equipped with the following features.

- This beautiful and easy-to-use system is available in three types: Dual 7.0-inch display audio, 11.6-inch display audio, and 11.6-inch display navigation.
- A hardware full of high-performance functions
- A design integrating the advanced feeling and user friendliness
- Extensive information functions integrated with the vehicle, and a wide range of entertainment functions
- GUI considering the use case
- Smartphone connectivity such as Apple CarPlay, Android Auto, etc.
- Featuring a wide range of operating commands, and voice recognition function that can control most functions
- Support for wireless communication systems (Bluetooth, Wi-Fi)
- Support for Over The Air (OTA) software updates and map data updates (11.6-inch display navigation only)

The speaker system comes in two types: 6 speakers (standard audio system) and 11 speakers (Harman/Kardon® audio system) (for some grades).



**The illustration shows a typical example that may differ from the actual display.*

Symbol	Type	Overview
(A)	Base audio	A combination of a Dual 7.0-inch display audio and 6 speakers (standard audio system).
(B)	High grade audio	A combination of 11.6-inch display audio and 6 speakers (standard audio system), or 11.6-inch display audio and 11 speakers (Harman/Kardon® audio system).
(C)	Navi & High grade audio	A combination of 11.6-inch display navigation and 11 speakers (Harman/Kardon® audio system).

Specifications

Audio/navigation specification list

Specifications			Type		
			Base audio	High grade audio	Navi & High grade audio
Display	Size/resolution		Dual 7.0-inch display/ WVGA (800x480)	11.6-inch/Full HD (1080x1920)	
Touch screen	Resistive multi-touch capable		O	-	
	Electrostatic, multi-touch capable		-	O	
Remote operation	Satellite switch		8 buttons		
Navigation	On-board navigation		-		O
	On-board navigation vendor		-		Tom Tom
Traffic information	SXM		-		O
Radio tuner	AM/FM		O		
	Radio Broadcast Data System (RBDS)		O		
	HD Radio (ver.1.5 dual tuner)		O		
	SiriusXM Radio		O		
Media slot	Support for separate CD player (dealer option)		O		
CDDB (Gracenote)			-	O	
Wireless connection	Bluetooth	Audio control	O		
		Hands-free control	O		
	Wi-Fi (2.4 GHz)		-	O	
	Near Field Communication (NFC)		-	O	
Wired connection	USB	Supported version	USB2.0		
		No. of ports	2		
	AUX		O		
	USB audio (iPod/iPhone/USB memory)		O		
Smartphone link	Apple CarPlay		O (supports iOS 13.4 or later)		
	Google Android Auto		O (supports Android8.1 or later)		
Server service	SUBARU STARLINK	Clarion Cloud Service	O		
SiriusXM Travel Link	Fuel prices, Sports, Stocks, Weather, Weather alerts, Parking		O		

Specifications		Type		
		Base audio	High grade audio	Navi & High grade audio
Voice recognition control	Audio functions	O		
	Navigation function	-		O
	Hands-free function	O		
	Air conditioner function	O		
Vehicle system control	Combination meter (multi information display)	O		
	Data communication module (DCM)	-	O	
	Air conditioning system	O		
Supported languages	Display screen	[English (USA), French (Canadian), Spanish (Mexican)]		
	Voice recognition	[English (USA), French (Canadian), Spanish (Mexican)]		
Map data updates	USB memory (full update)	-		O
	Wi-Fi (differential update)	-		O
	Mobile (differential update)	-		O
Software updates	USB memory	O		
	Wi-Fi	-	O	
	Smartphone	-	O	
Update Server	Redbend	-	O	

Specification list [symbol] O: Applicable, -: Not applicable

Speaker function list: 6 speakers (standard audio system) (for some grades)

Speaker	Size, type	Number installed	Usage	Playback frequency range
Side speaker	25 mm tweeter	2	Midrange to treble	4 kHz to 20 kHz
Front door speaker	160 mm full range speaker	2	Bass to treble	80 Hz to 10 kHz
Rear door speaker	160 mm full range speaker	2	Medium bass to treble	80 Hz to 20 kHz

Speaker function list: 11 speakers (Harman/Kardon® audio system) (for some grades)

Speaker	Size, type	Number installed	Usage	Playback frequency range
Side speaker	80 mm + 16 mm coaxial speaker	2	Midrange to treble	250 Hz to 20 kHz
Front door speaker	7 x 10 in full range speaker	2	Bass to treble	40 Hz to 1.6 kHz
Rear door speaker	170 mm + 25 mm coaxial speaker	2	Medium bass to treble	80 Hz to 20 kHz
Woofer	265 mm woofer	1	Bass	40 Hz to 1.0 kHz

Power amplifier specification: 11 speakers (Harman/Kardon® audio system) (for some grades)

Channel	Rated output (maximum output)
8 ch	- (504 W equivalent)

Hardware

Specifications		Type		
		Base audio	High grade audio	Navi & High grade audio
CPU	Name	Intel Apollo Lake		
	Spec.	37,944 MIPS 4-Core 1.8 GHz		42,160 MIPS 4-Core 2.0 GHz
Main memory	Main	16 GB		64 GB
	RAM	3 GB		4 GB
Display	LCD size	Dual 7.0-inch display WVGA (800x480)	11.6-inch Full HD (1080x1920)	
	Touch panel	Resistive	Electrostatic	
Wi-Fi module		-	2.4 GHz	
Near Field Communication (NFC) module		-	NFC Passive Tag	
Bluetooth module		Bluetooth 4.2 + EDR		
Voice recognition	Recognition engine	Cerence		
	Number of microphones	2		
USB terminal		USB2.0 x 2 (maximum 2.1 A each)		

Specification list [symbol] -: Not applicable

Applicable USB memory specification

USB communication format	USB2.0 LS (1.5 Mbps)/FS (12 Mbps)/HS (480 Mbps)
File format	FAT 32
Communication class	Mass storage class

Applicable iPod/iPhone specification

Made for	• iPhone 11 Pro Max • iPhone 11 Pro • iPhone 11 • iPhone XS Max • iPhone XS • iPhone XR • iPhone X • iPhone 8 Plus • iPhone 8 • iPhone 7 Plus • iPhone 7 • iPhone SE • iPhone 6s Plus • iPhone 6s • iPhone 6 Plus • iPhone 6 • iPhone 5s • iPhone 5c • iPhone 5 • iPod touch (6th generation)

Even if your device corresponds to an usable model, it may not be able to be used depending on the model, software version, individual difference, etc.
iPod video is not supported.

Applicable music file specification

Codec	Sampling frequency/bit rate*	Channel	Container/extension
MPEG-4 AAC LC	8 to 48 kHz sampling rate 8 to 320 kbps CBR, VBR	Monaural, stereo	.m4a, .aac
MPEG-4 HE AAC	16 to 48 kHz sampling rate 8 to 320 kbps CBR, VBR	Monaural, stereo	.m4a, .aac
MPEG-4 HE AAC v2	16 to 48 kHz sampling rate 8 to 320 kbps CBR, VBR	Monaural, stereo	.m4a, .aac
MP3	8 to 48 kHz sampling rate 8 to 320 kbps CBR, VBR	Monaural, stereo, joint stereo	.mp3
WMA2/7/8/9/9.1/9.2	16 to 48 kHz sampling rate 8 to 320 kbps CBR, VBR	Monaural, stereo	.wma
PCMWAVE	8bit, 16bit 8000, 16000, 44100 Hz sampling frequency	Monaural, stereo	.wav
FLAC	44.1 kHz, 48 kHz, 88.2 kHz, 96 kHz, 176.4 kHz, 192 kHz sampling rate 16 bit, 24 bit	Monaural, stereo	.flac
ALAC	44.1 kHz, 48 kHz, 88.2 kHz, 96 kHz, 176.4 kHz, 192 kHz sampling rate 16 bit, 24 bit	Monaural, stereo	.m4a

**: Supports Variable Bit Rate (VBR).*

Applicable Bluetooth specification

Specifications	Function	Mandatory condition	Recommendation
Bluetooth Specification	Registration of Bluetooth compatible devices	Ver. 2.1	Ver. 4.2

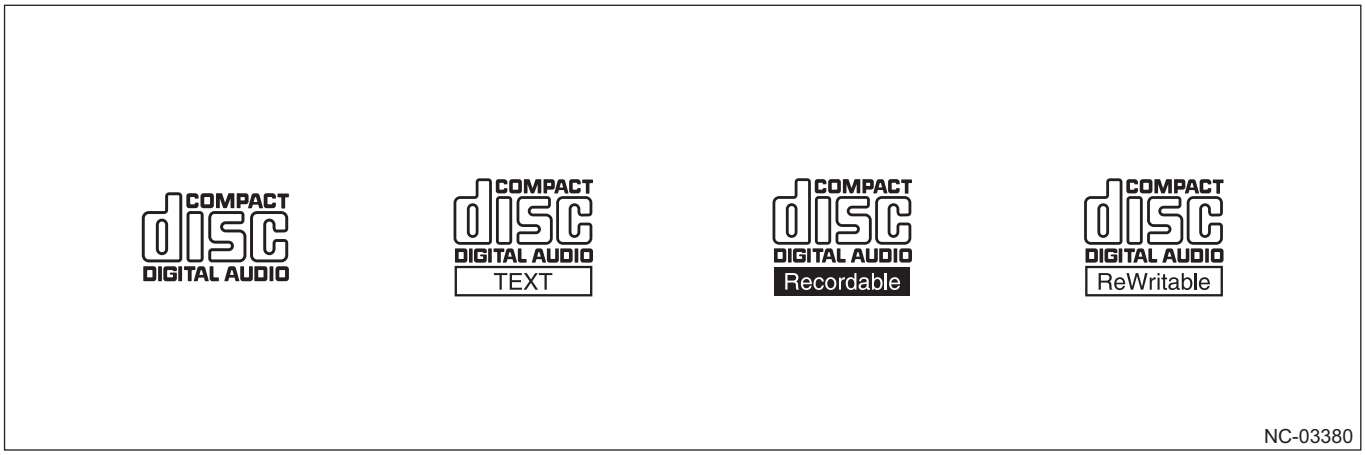
Applicable Bluetooth profile specification

Profile	Function	Mandatory condition	Recommendation
A2DP (Advanced Audio Distribution Profile)	Bluetooth audio	Ver. 1.0	Ver. 1.3
AVRCP (Audio/Video Remote Control Profile)	Bluetooth audio	Ver. 1.0	Ver. 1.6
HFP (Hands-Free Profile)	Bluetooth hands-free system	Ver. 1.0	Ver. 1.7
PBAP (Phone Book Access Profile)	Phone book transfer	Ver. 1.0	Ver. 1.2
MAP (Message Access Profile)	Bluetooth mobile phone message	-	Ver. 1.3
SPP (Serial Port Profile)	APPS	-	Ver. 1.2

Wi-Fi specification (wireless LAN interface)

Compatible standard	• IEEE802.11b • IEEE802.11g • IEEE802.11n (2.4 GHz frequency band)
Security	• WPA • WPA2

Disc types applicable to the disc player (for models with disc player (dealer option))



Reference
The disc player is a dealer option. Install to enable playback of supported discs.

Characteristics

Panel design

■ Dual 7.0-inch display audio

- An appearance is adopted in which 7.0-inch size displays are arranged vertically on the mat black-painted panel with only frequently-used dial knobs and physical buttons set up in a simple design.
- While achieving both high functionality and convenience, it provides an advanced infotainment system with GUI that allows intuitive smartphone-like operation.

**The illustration shows a typical example that may differ from the actual display.*

(a)	Resistive touch operation display	(c)	Dial knob ('TUNE')
(b)	Dial knob ('VOLUME')	(d)	Physical buttons ('RADIO', 'MEDIA', Home mark, 'PHONE', 'APPS')

Operation

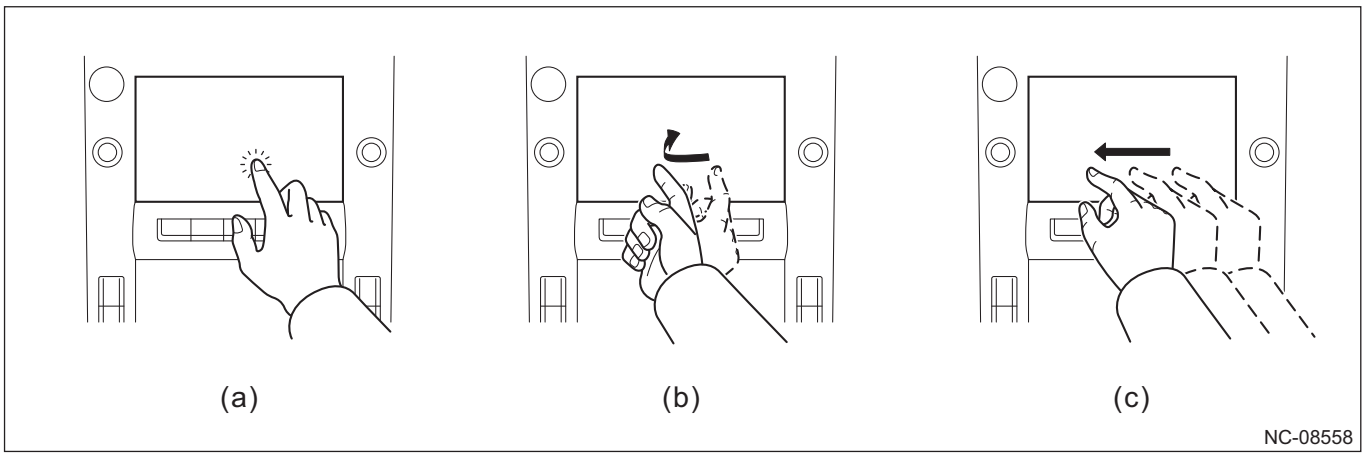
- The following functions or displays are selected by operating a dial knob or physical button.

Switch name		Operation	Description
Dial knob	'VOLUME'	Turn	Adjusts the volume.
		Press	Short press: Mutes the audio. Long press: Turns the audio power ON/OFF.
	'TUNE'	Turn	Use to select the frequency or track.
		Press	Long press: Displays the <Sound Customization> screen.
Physical button	'RADIO'	Press	Displays the Radio Screen.
	'MEDIA'	Press	Displays the media screen.
	Home mark	Press	Displays the Home Screen.
	'PHONE'	Press	Displays the Hands-free Screen.
	'APPS'	Press	Displays the App Selection Screen.

- The display shows the audio screen, Bluetooth hands-free screen, settings screen and other screens. Touch, swipe, or drag on the screen to perform various operations.

Reference

Depending on the screen display contents, swipe and drag operations may not be possible.



(a) Touch operation
(b) Swipe operation
(c) Drag operation

■ 11.6-inch display audio/11.6-inch display navigation

- It has a 11.6-inch display embedded in the in-mold molded gloss black-painted panel, realizing a seamless appearance with only frequently-used dial knobs and physical buttons set up in a simple design.
- While achieving both high functionality and convenience, it provides an advanced infotainment system with GUI that allows intuitive smartphone-like operation.

**The illustration shows a typical example that may differ from the actual display.*

(a)	NFC symbol (NFC detection area)	(c)	Dial knob ('TUNE')
(b)	Electrostatic touch operation display	(d)	Dial knob ('VOLUME')

Operation

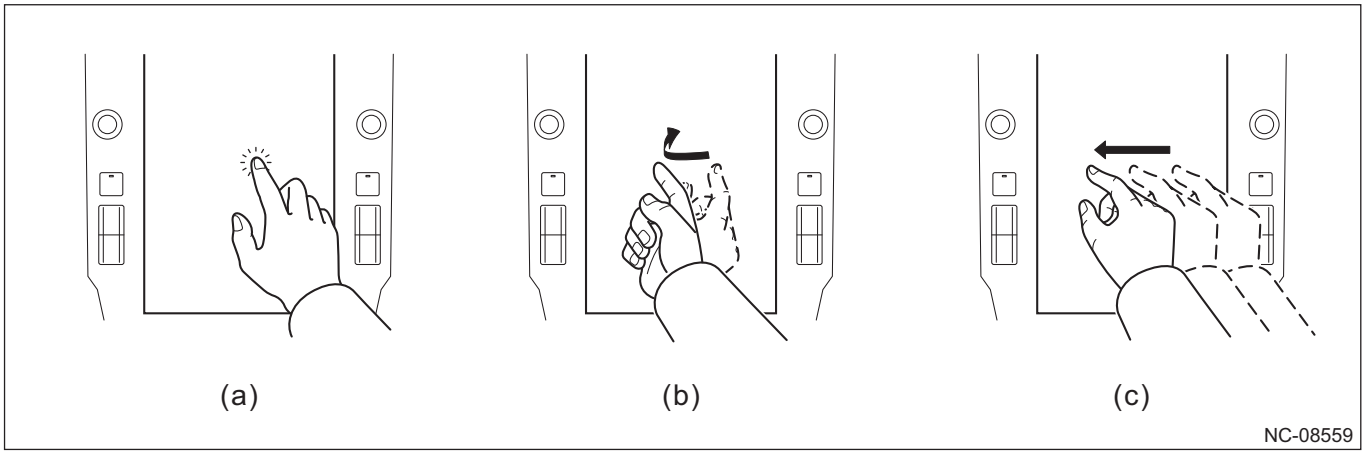
- The following functions or displays are selected by operating a dial knob.

Switch name		Operation	Description
Dial knob	'VOLUME'	Turn	Adjusts the volume.
		Press	Short press: Mutes the audio. Long press: Turns the audio power ON/OFF.
	'TUNE'	Turn	Use to select the frequency or track.
		Press	Long press: Displays the <Sound Customization> screen.

- The display shows the audio screen, Bluetooth hands-free screen, settings screen and other screens. Touch, swipe, or drag on the screen to perform various operations.

Reference

- Depending on the screen display contents, swipe and drag operations may not be possible.
- The map screen can also be operated by pinching in or out. For details, refer to "Map scale" in "Navigation function". (11.6-inch display navigation) {11-37}

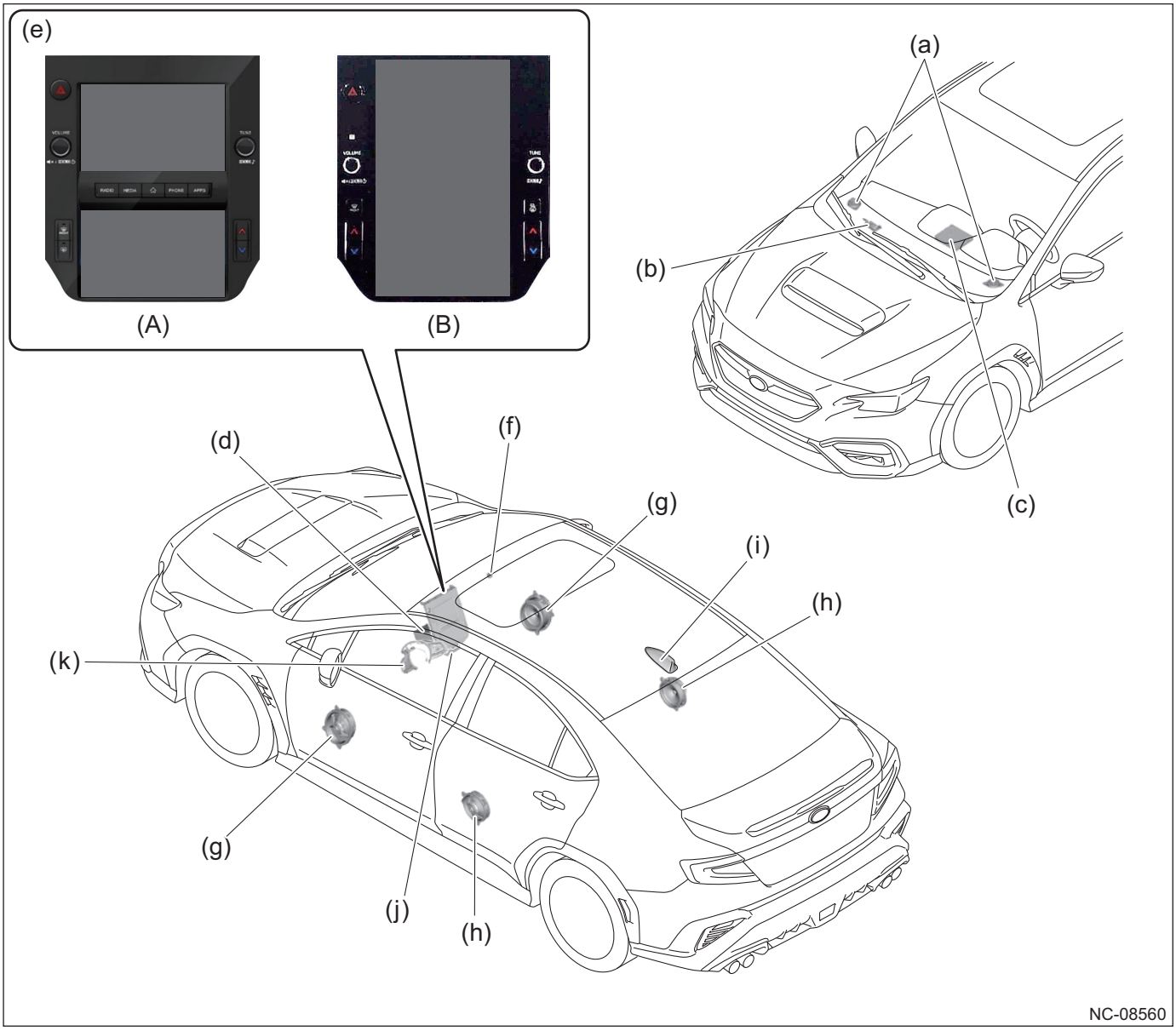


(a) Touch operation
(b) Swipe operation
(c) Drag operation

11.2.2 Component

Component layout drawing

6 speakers (standard audio system) (for some grades)



(A) Dual 7.0-inch display audio

(B) 11.6-inch display audio

(a) Side speaker

(b) GPS antenna

(c) Data communication module (DCM)

(d) Cockpit Control module (CCM)

(e) Center Information Display (CID)

(f) Microphone

(g) Front door speaker

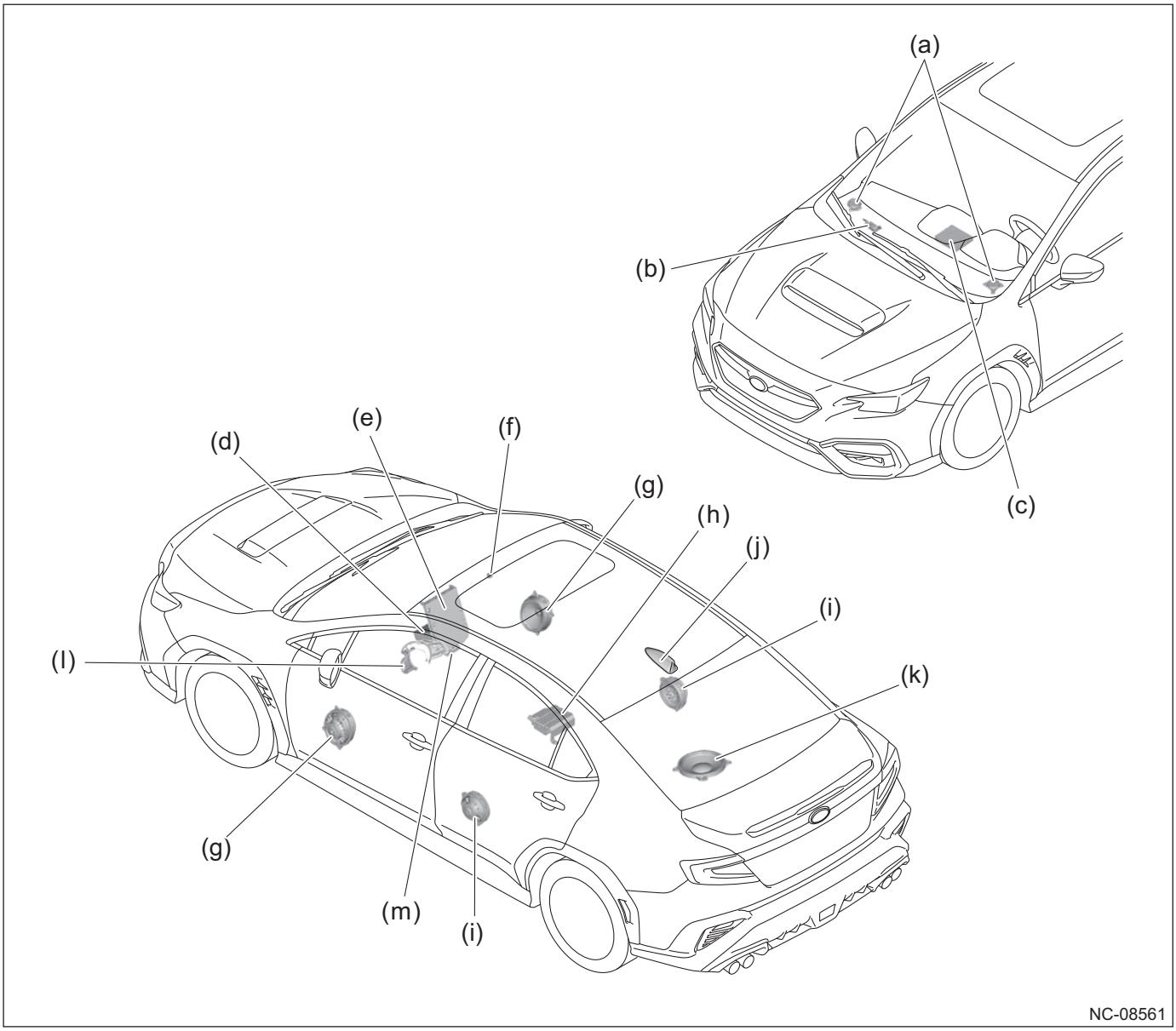
(h) Rear door speaker

(i) Roof antenna
- AM
- FM
- SXM
- Radio antenna amplifier

(j) External input terminal

(k) Satellite switch

11 speakers (Harman/Kardon® audio system) (for some grades)



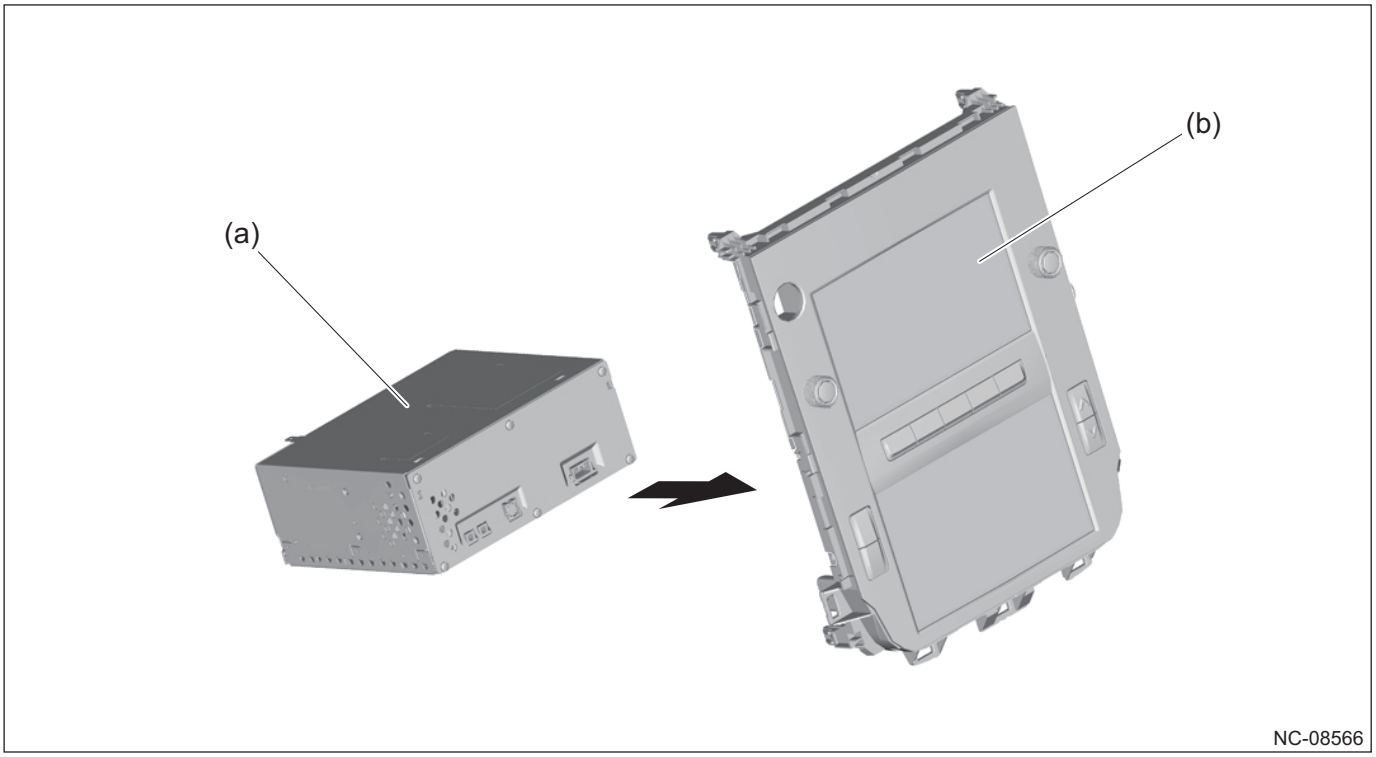
(a)	Side speaker	(h)	Power Amplifier
(b)	GPS antenna	(i)	Rear door speaker
(c)	Data communication module (DCM)	(j)	Roof antenna • AM • FM • SXM • Radio antenna amplifier
(d)	Cockpit Control module (CCM)	(k)	Woofer
(e)	Center Information Display (CID)	(l)	Satellite switch
(f)	Microphone	(m)	External input terminal
(g)	Front door speaker		

Component details

Infotainment system hardware

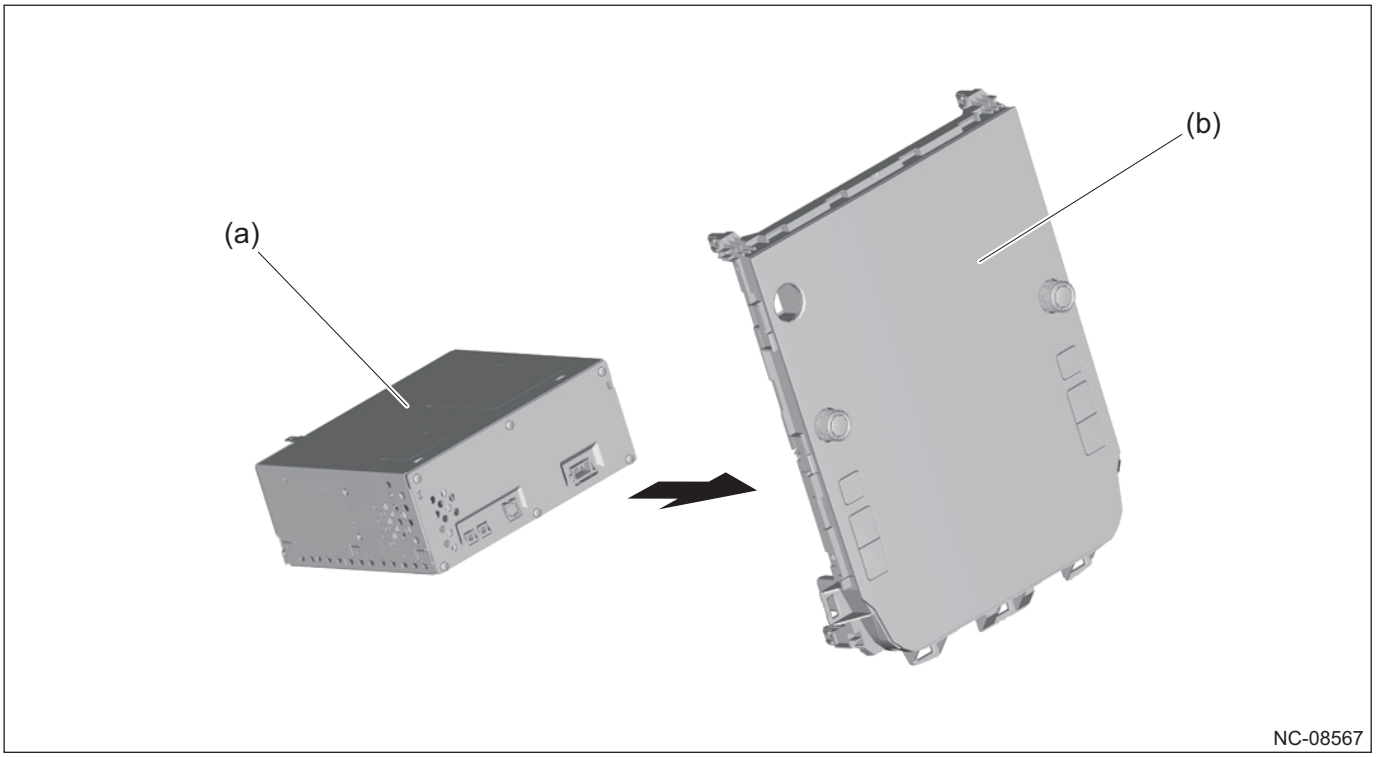
The Cockpit Gen.1.0 Infotainment System is composed of the Cockpit Control Module (CCM) that controls the system as a whole and the Center Information Display (CID) providing a user interface.

■ Dual 7.0-inch display audio



Symbol	Part name	Function
(a)	Cockpit Control module (CCM)	• Adopts a System on Chip (SOC) method, and its hypervisor system achieves integrated control of the Center Information Display (CID) as well as the multi information display (with a built-in combination meter) with the help of one chip. • Equipped with features including an AM/FM tuner and SiriusXM tuner, and USB Audio controller, loaded with highly satisfying audio functions. • Also equipped with a built-in Bluetooth module that enables wireless communication with external devices. • Its voice recognition module allows the people in the vehicle to control functions such as audio and air conditioning just by speaking.
(b)	Center Information Display (CID)	• Equipped with 7.0-inch WVGA liquid crystal displays arranged one above the other. • The display content is controlled by the Cockpit Control Module (CCM), providing a variety of information using multiple screens. • The operation information given by a resistive film type touch operation display as well as dial knobs and physical buttons arranged on the panel is sent to the Cockpit Control Module (CCM). • It has a built-in Bluetooth antenna.

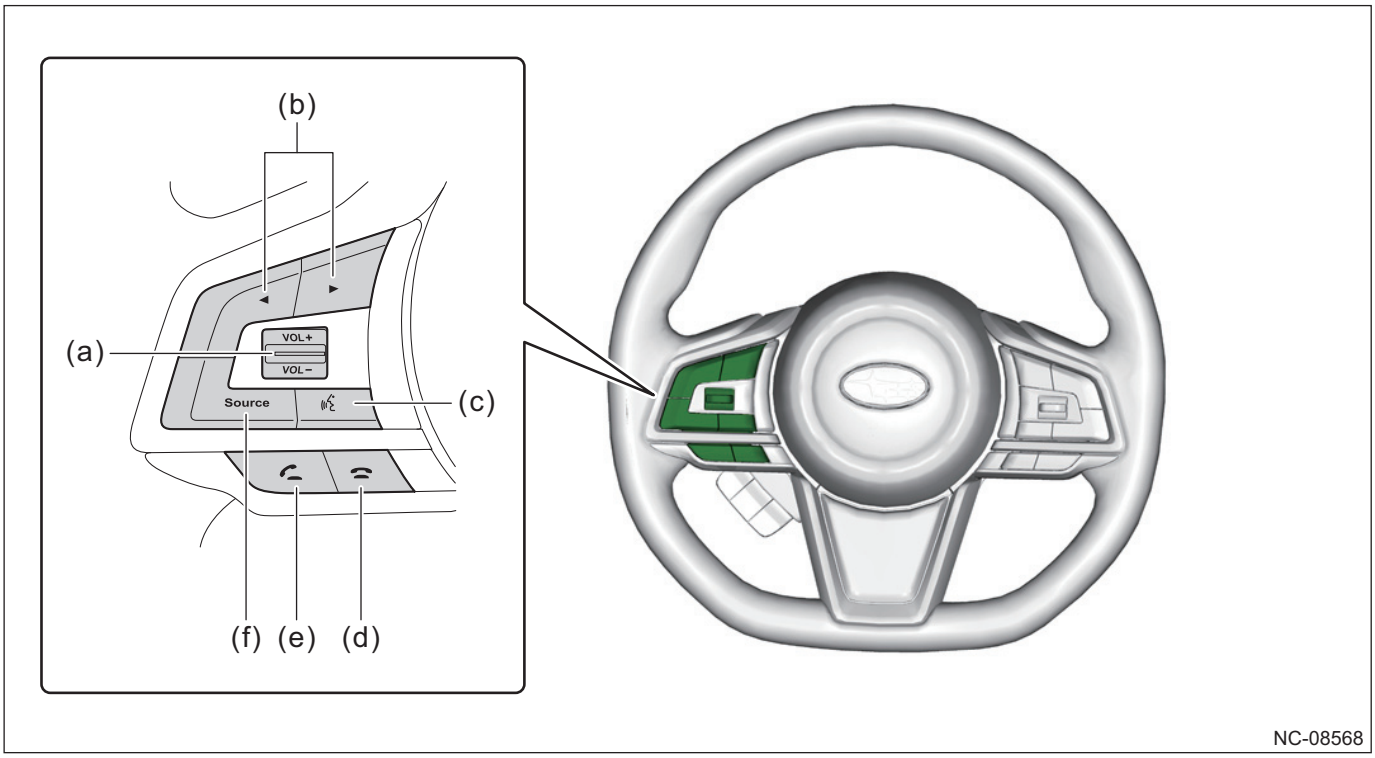
■ 11.6-inch display audio/11.6-inch display navigation



Symbol	Part name	Function
(a)	Cockpit Control module (CCM)	• Adopts a System on Chip (SOC) method, and its hypervisor system achieves integrated control of the Center Information Display (CID) as well as the multi information display (with a built-in combination meter) with the help of one chip. • Equipped with features including an AM/FM tuner and SiriusXM tuner, and USB Audio controller, loaded with highly satisfying audio functions. • Also equipped with a built-in Bluetooth module and Wi-Fi module that enable wireless communication with external devices. • Its voice recognition module allows the people in the vehicle to control functions such as audio and air conditioning just by speaking. • A navigation module with built-in gyroscope sensor and angle sensor is installed. (11.6-inch display navigation)
(b)	Center Information Display (CID)	• Equipped with an 11.6-inch Full HD liquid crystal display. • The display content is controlled by the Cockpit Control Module (CCM), providing a variety of information using a very wide screen. • The operation information given by an electrostatic touch operation display as well as dial knobs and physical buttons arranged on the panel is sent to the Cockpit Control Module (CCM). • It has built-in Bluetooth and Wi-Fi antennas. • It incorporates a Near Field Communication (NFC) reader for easier Bluetooth connection.

Satellite switch

Satellite switches are provided so that it is possible to adjust the audio volume or change the playing audio source without the driver taking his or her hands off of the steering wheel.

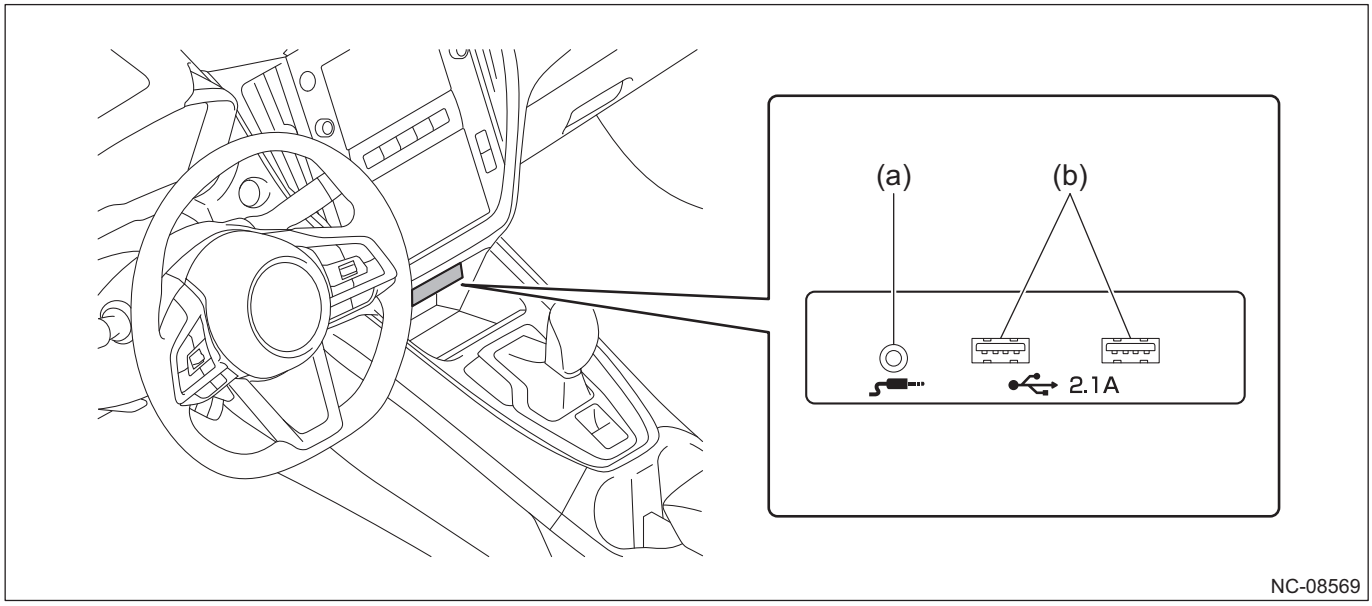


(a)	Volume switch	(d)	Hands-free switch (on-hook)
(b)	Tuning/track selection switch	(e)	Hands-free switch (off-hook)
(c)	Talk switch	(f)	'Source' switch

External input terminal

The front of the center console is provided with external input terminals that include USB ports that can be connected to USB memory, an iPod, or an iPhone or other smartphone, and an AUX port that can be connected to a portable audio device, etc.

Two USB ports are provided, which can also be used for charging. By enabling multiple USB devices to be connected, the diverse needs and preferences of users are supported.



(a) AUX port

(b) USB port

Speaker

The speaker system comes in two types depending on the grade: 6 speakers (standard audio system (for some grades)) and 11 speakers (Harman/Kardon® audio system (for some grades)).

■ 6 speakers (standard audio system) (for some grades)

- It has dynamic sound quality optimized for the cabin acoustic space while reducing the mass by pursuing optimum design of the magnetic circuit.

■ 11 speakers (Harman/Kardon® audio system (for some grades))

- High-efficiency speakers are provided that have adopted the "GreenEdge" system, Harman's proprietary acoustic technology. These are used in combination with a power amplifier that is optimally designed to match the speakers, which maximizes the reduction of power loss in the vehicle wiring and inside the circuit. Also, larger volume than the standard audio system can be output depending on the condition, while low power consumption is realized on mid to small volume.
- A large-diameter woofer embedded in the rear tray is provided. Also, a resin type of woofer bracket is adopted to achieve powerful, deep bass reproduction while also reducing weight.

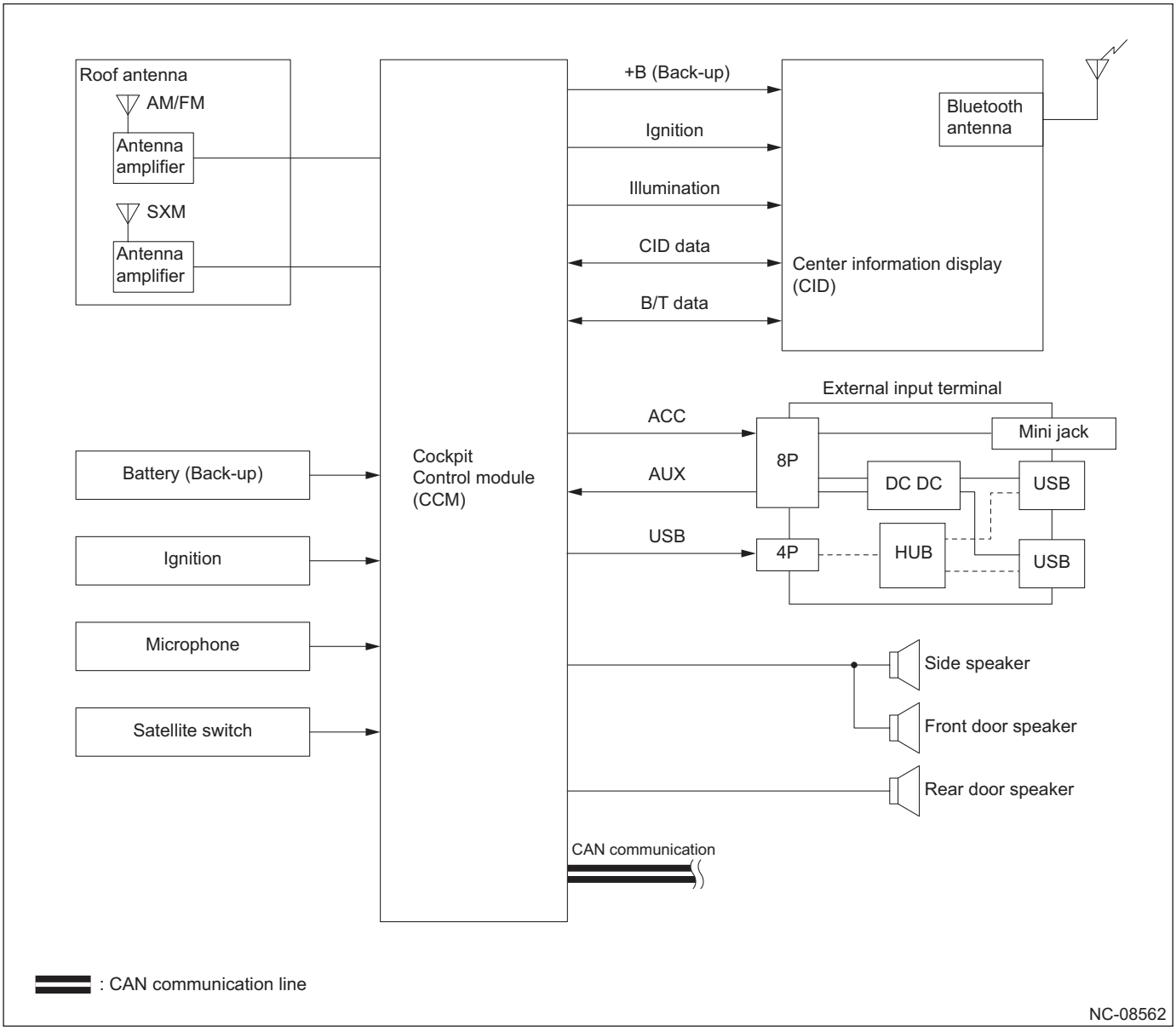
Power amplifier (Harman/Kardon® audio system)

- A power amplifier is provided for the Harman/Kardon® audio system that is optimally designed to match the high-efficiency speakers.
- "Clari-Fi" technology, Harman's proprietary acoustic technology and compressed sound restoration technology is adopted for the power amplifier. This can reproduce high-quality sound equivalent to CDs by using a digital process to compensate for sound source quality that was lost due to lossy compression, and it can also restore MP3 (MPEG1 Audio layer3), ACC (Advanced Audio Coding), and other various audio sources with different compression rates with their appropriate correction amount through a real-time calculation process.

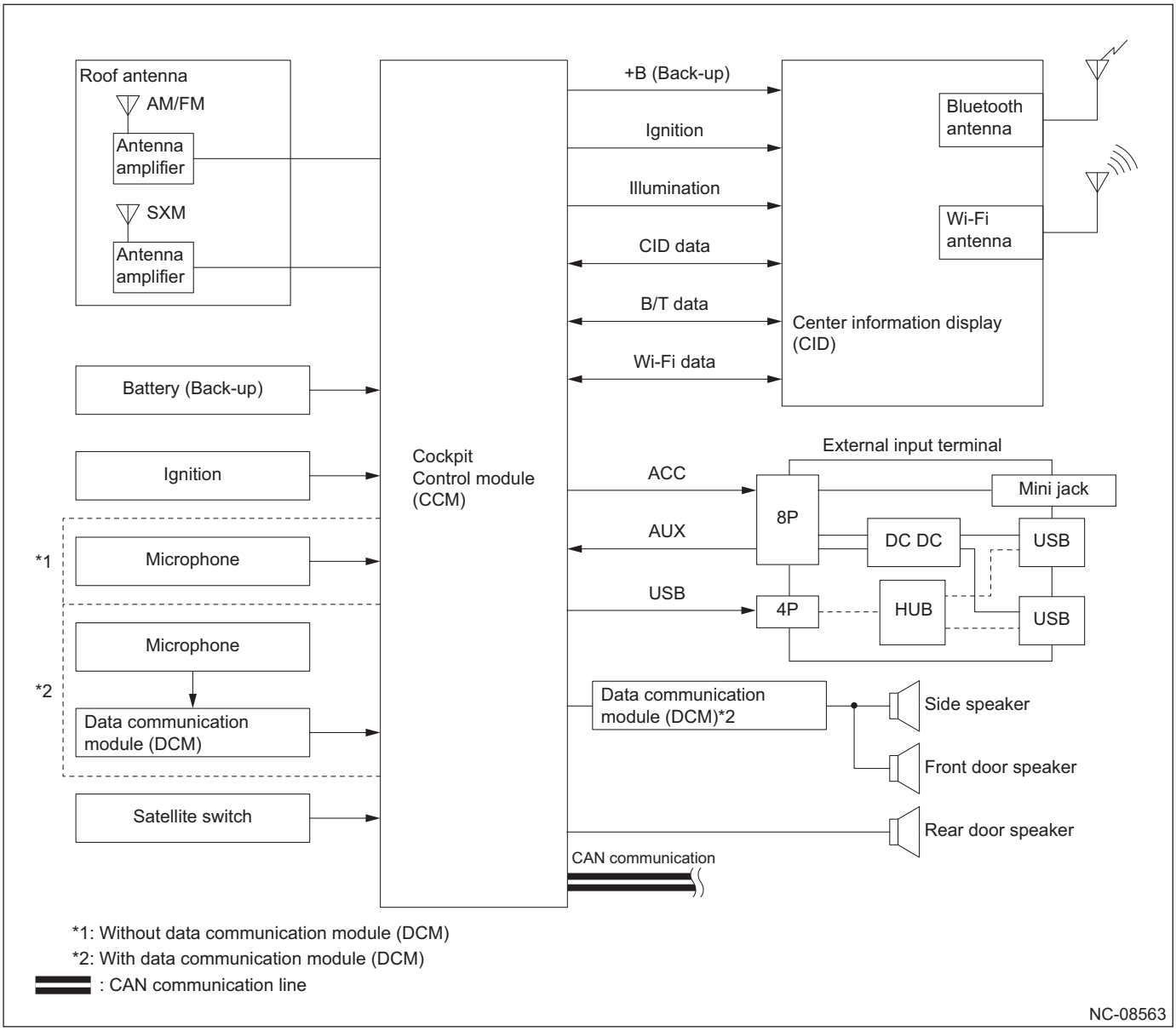
11.2.3 Construction and Operation

System diagram

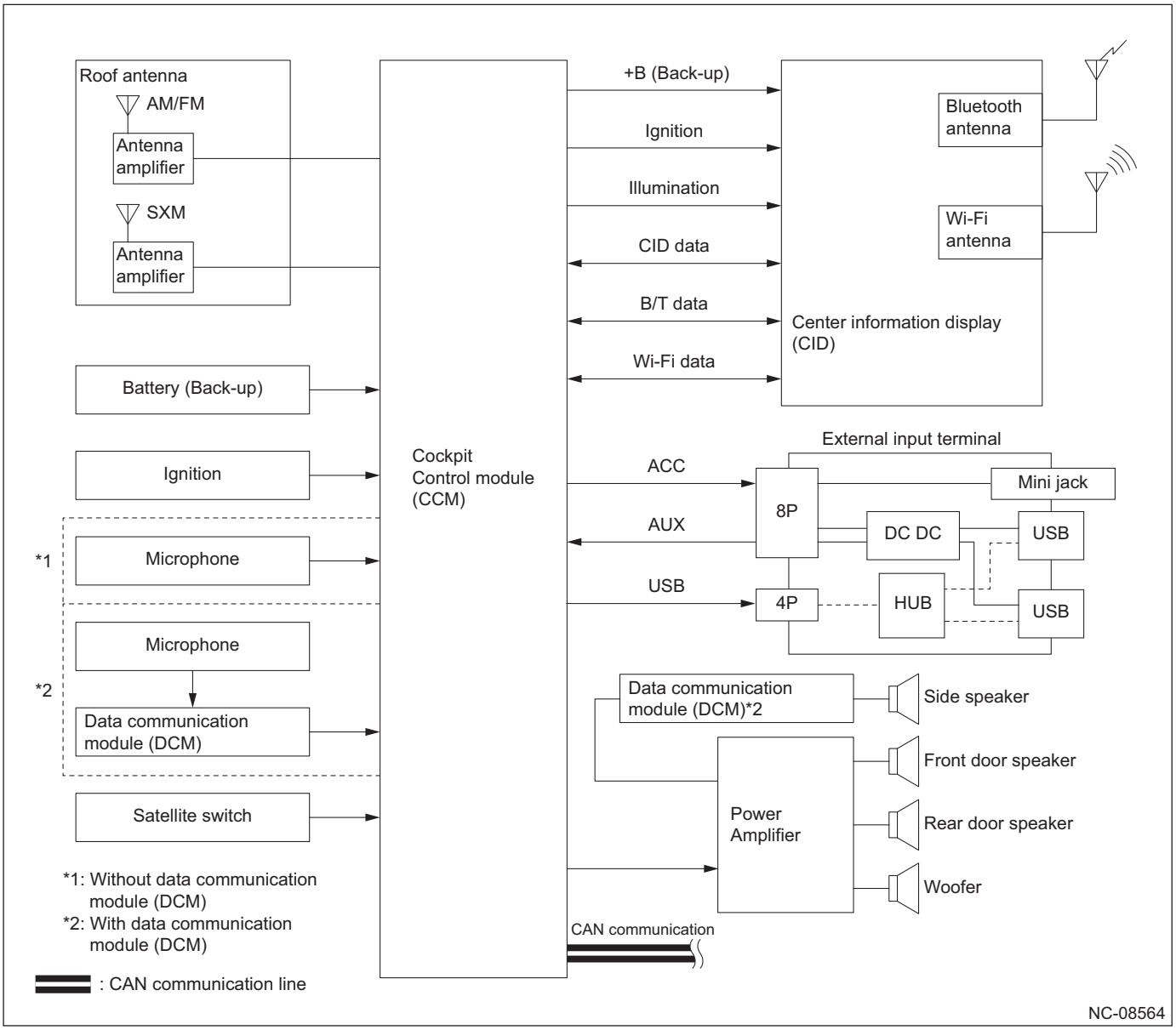
Base audio (6 speakers (standard audio system)) (for some grades)



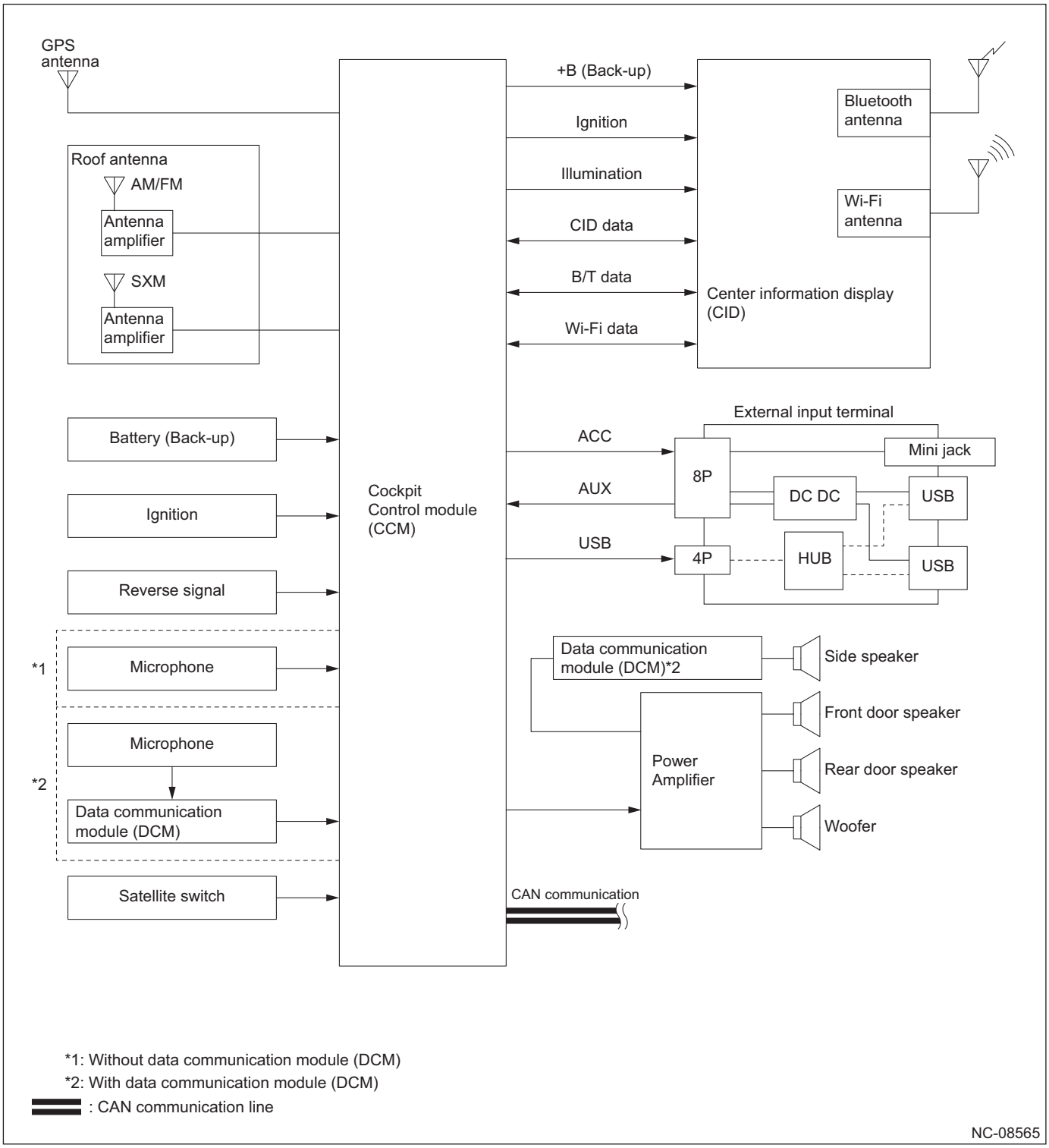
High grade audio (6 speakers (standard audio system)) (for some grades)



High grade audio (11 speakers (Harman/Kardon® audio system)) (for some grades)



Navi & High grade audio (11 speakers (Harman/Kardon® audio system)) (for some grades)



Main component functions

Base audio (6 speakers (standard audio system)) (for some grades)

Part name	Function
Cockpit Control module (CCM) (Product of DENSO Corporation)	• Controls Cockpit Gen.1.0 Dual 7.0-inch display to play the sound from audio sources including radio and USB audio. • Performs operation by recognizing voice commands given by the people in the vehicle through a microphone. • Outputs the audio signal from each audio source to speakers. • Built-in Bluetooth module connected to applicable devices enables the playback of audio files and use of hands-free functions and other functions.
Center Information Display (CID) (Product of DENSO Corporation)	• Displays the operation screen of a selected audio source and status information on the display screen. • It has a built-in Bluetooth antenna.
Roof antenna • AM • FM • SXM • Antenna amplifier	• Receives AM/FM airwaves. (AM/FM antenna) • Receives SiriusXM radio broadcast signals. (SXM antenna) • Amplifies AM/FM/SXM airwaves received with the radio antenna and forwards them to the Cockpit Control Module (CCM). (Radio antenna amplifier)
Microphone	• Located inside the map light, it picks up the voices of people in the vehicle for the voice recognition function and hands-free operation. • The collected voice signals are sent to the Cockpit Control Module (CCM).
Satellite switch	Sends audio operation signals for adjusting volume, changing modes, tuning, etc., and signals for hands-free switch operations and talk operations to the Cockpit Control Module (CCM).
External input terminal	• One AUX terminal and two USB terminals are provided. • If you connect an audio player to this AUX terminal, audio signals are sent to the Cockpit Control Module (CCM). • The USB terminals are used to connect USB memory, or smartphone such as iPod/iPhone, etc. to the Cockpit Control Module (CCM) for USB communication. You can also charge your devices using the USB terminal.
Side speaker	Audio is output based on the audio signal input from the Cockpit Control Module (CCM).
Front door speaker	
Rear door speaker	

High grade audio (6 speakers (standard audio system)) (for some grades)

Part name	Function
Cockpit Control module (CCM) (Product of DENSO Corporation)	• Controls the Cockpit Gen.1.0 11.6-inch display audio to play the sound from audio sources including radio and USB audio. • Performs operation by recognizing voice commands given by the people in the vehicle through a microphone. • Outputs the audio signal from each audio source to speakers. • Built-in Bluetooth module connected to applicable devices enables the playback of audio files and use of hands-free functions and other functions. • The built-in wireless LAN module communicates via Wi-Fi with the wireless client to enable use of Over The Air (OTA) functions.
Center Information Display (CID) (Product of DENSO Corporation)	• Displays the operation screen of a selected audio source and status information on the display screen. • It has built-in Bluetooth and Wi-Fi antennas. • The built-in Near Field Communication (NFC) module enables supported Bluetooth devices to be paired and used.
Roof antenna • AM • FM • SXM • Antenna amplifier	• Receives AM/FM airwaves. (AM/FM antenna) • Receives SiriusXM radio broadcast signals. (SXM antenna) • Amplifies AM/FM/SXM airwaves received with the radio antenna and forwards them to the Cockpit Control Module (CCM). (Radio antenna amplifier)
Microphone	• Located inside the map light, it picks up the voices of people in the vehicle for the voice recognition function and hands-free operation. • The collected voice signals are sent to the Cockpit Control Module (CCM). *1 • The collected voice signals are sent to the Cockpit Control Module (CCM) via the data communication module (DCM). *2
Satellite switch	Sends audio operation signals for adjusting volume, changing modes, tuning, etc., and signals for hands-free switch operations and talk operations to the Cockpit Control Module (CCM).
External input terminal	• One AUX terminal and two USB terminals are provided. • If you connect an audio player to this AUX terminal, audio signals are sent to the Cockpit Control Module (CCM). • The USB terminals are used to connect USB memory, or smartphone such as iPod/iPhone, etc. to the Cockpit Control Module (CCM) for USB communication. You can also charge your devices using the USB terminal.
Data communication module (DCM)*2	• Outputs the microphone audio signal to the Call Center when using the SUBARU STARLINK service. • Outputs the audio signal input from the Cockpit Control Module (CCM) to the side speakers and front door speakers. • Outputs the audio signal received from the Call Center to the side speakers and front door speakers when using the SUBARU STARLINK service.
Side speaker	• Audio is output based on the audio signal input from the Cockpit Control Module (CCM). *1 • Outputs audio based on the audio signal input from the Cockpit Control Module (CCM), and the audio signal input from the data communication module (DCM). *2
Front door speaker	
Rear door speaker	Audio is output based on the audio signal input from the Cockpit Control Module (CCM).

**1: Without data communication module (DCM)*
**2: With data communication module (DCM)*

High grade audio (11 speakers (Harman/Kardon® audio system)) (for some grades)

Part name	Function
Cockpit Control module (CCM) (Product of DENSO Corporation)	• Controls the Cockpit Gen.1.0 11.6-inch display audio to play the sound from audio sources including radio and USB audio. • Performs operation by recognizing voice commands given by the people in the vehicle through a microphone. • Outputs the audio signal from each audio source to the power amplifier. • Built-in Bluetooth module connected to applicable devices enables the playback of audio files and use of hands-free functions and other functions. • The built-in wireless LAN module communicates via Wi-Fi with the wireless client to enable use of Over The Air (OTA) functions.
Center Information Display (CID) (Product of DENSO Corporation)	• Displays the operation screen of a selected audio source and status information on the display screen. • It has built-in Bluetooth and Wi-Fi antennas. • The built-in Near Field Communication (NFC) module enables supported Bluetooth devices to be paired and used.
Roof antenna • AM • FM • SXM • Antenna amplifier	• Receives AM/FM airwaves. (AM/FM antenna) • Receives SiriusXM radio broadcast signals. (SXM antenna) • Amplifies AM/FM/SXM airwaves received with the radio antenna and forwards them to the Cockpit Control Module (CCM). (Radio antenna amplifier)
Microphone	• Located inside the map light, it picks up the voices of people in the vehicle for the voice recognition function and hands-free operation. • The collected voice signals are sent to the Cockpit Control Module (CCM). *1 • The collected voice signals are sent to the Cockpit Control Module (CCM) via the data communication module (DCM). *2
Satellite switch	Sends audio operation signals for adjusting volume, changing modes, tuning, etc., and signals for hands-free switch operations and talk operations to the Cockpit Control Module (CCM).
External input terminal	• One AUX terminal and two USB terminals are provided. • If you connect an audio player to this AUX terminal, audio signals are sent to the Cockpit Control Module (CCM). • The USB terminals are used to connect USB memory, or smartphone such as iPod/iPhone, etc. to the Cockpit Control Module (CCM) for USB communication. You can also charge your devices using the USB terminal.
Power Amplifier	Amplifies the audio signal output from the Cockpit Control Module (CCM), and outputs signals to the data communication module (DCM), front door speakers, rear door speakers, and woofer.
Data communication module (DCM)*2	• Outputs the microphone audio signal to the Call Center when using the SUBARU STARLINK service. • Outputs the audio signals input from the power amplifier to the side speakers. • Outputs the audio signal received from the Call Center to the side speakers when using the SUBARU STARLINK service.
Side speaker	• Outputs audio based on the audio signal input amplified by the power amplifier and input from the Cockpit Control Module (CCM). *1 • Outputs audio based on the audio signal input amplified by the power amplifier and input from the Cockpit Control Module (CCM), and the audio signal input from the data communication module (DCM). *2
Front door speaker	Outputs audio based on the audio signal input amplified by the power amplifier and input from the Cockpit Control Module (CCM).
Rear door speaker	
Woofer	

**1: Without data communication module (DCM)*
**2: With data communication module (DCM)*

Navi & High grade audio (11 speakers (Harman/Kardon® audio system)) (for some grades)

Part name	Function
Cockpit Control module (CCM) (Product of DENSO Corporation)	• Controls the Cockpit Gen.1.0 11.6-inch display navigation to play the sound from audio sources including radio and USB audio. • Performs operation by recognizing voice commands given by the people in the vehicle through a microphone. • Outputs the audio signal from each audio source to the power amplifier. • A navigation computer installed in the unit calculates the current location and displays it on the screen based on the navigation information obtained via antenna. • Built-in Bluetooth module connected to applicable devices enables the playback of audio files and use of hands-free functions and other functions. • The built-in wireless LAN module communicates via Wi-Fi with the wireless client to enable use of Over The Air (OTA) functions.
Center Information Display (CID) (Product of DENSO Corporation)	• Displays the operation screen of a selected audio source and status information on the display screen. • It has built-in Bluetooth and Wi-Fi antennas. • The built-in Near Field Communication (NFC) module enables supported Bluetooth devices to be paired and used. • Displays the navigation screen generated by the Cockpit Control Module (CCM) on the display screen.
Roof antenna • AM • FM • SXM • Antenna amplifier	• Receives AM/FM airwaves. (AM/FM antenna) • Receives SiriusXM radio broadcast signals. (SXM antenna) • Amplifies AM/FM/SXM airwaves received with the radio antenna and forwards them to the Cockpit Control Module (CCM). (Radio antenna amplifier)
Microphone	• Located inside the map light, it picks up the voices of people in the vehicle for the voice recognition function and hands-free operation. • The collected voice signals are sent to the Cockpit Control Module (CCM). *1 • The collected voice signals are sent to the Cockpit Control Module (CCM) via the data communication module (DCM). *2
Satellite switch	Sends audio operation signals for adjusting volume, changing modes, tuning, etc., and signals for hands-free switch operations and talk operations to the Cockpit Control Module (CCM).
GPS antenna	Receives the orbit signal from the artificial satellite placed on the orbit around the earth at an altitude of about 20,000 km and sends it to the navigation computer installed in Cockpit Control Module (CCM).
External input terminal	• One AUX terminal and two USB terminals are provided. • If you connect an audio player to this AUX terminal, audio signals are sent to the Cockpit Control Module (CCM). • The USB terminals are used to connect USB memory, or smartphone such as iPod/iPhone, etc. to the Cockpit Control Module (CCM) for USB communication. You can also charge your devices using the USB terminal.
Power Amplifier	Amplifies the audio signal output from the Cockpit Control Module (CCM), and outputs signals to the data communication module (DCM), front door speakers, rear door speakers, and woofer.
Data communication module (DCM)*2	• Outputs the microphone audio signal to the Call Center when using the SUBARU STARLINK service. • Outputs the audio signals input from the power amplifier to the side speakers. • Outputs the audio signal received from the Call Center to the side speakers when using the SUBARU STARLINK service.

Part name	Function
Side speaker	• Outputs audio based on the audio signal input amplified by the power amplifier and input from the Cockpit Control Module (CCM). *1 • Outputs audio based on the audio signal input amplified by the power amplifier and input from the Cockpit Control Module (CCM), and the audio signal input from the data communication module (DCM). *2
Front door speaker	Outputs audio based on the audio signal input amplified by the power amplifier and input from the Cockpit Control Module (CCM).
Rear door speaker	
Woofer	

**1: Without data communication module (DCM)*
**2: With data communication module (DCM)*

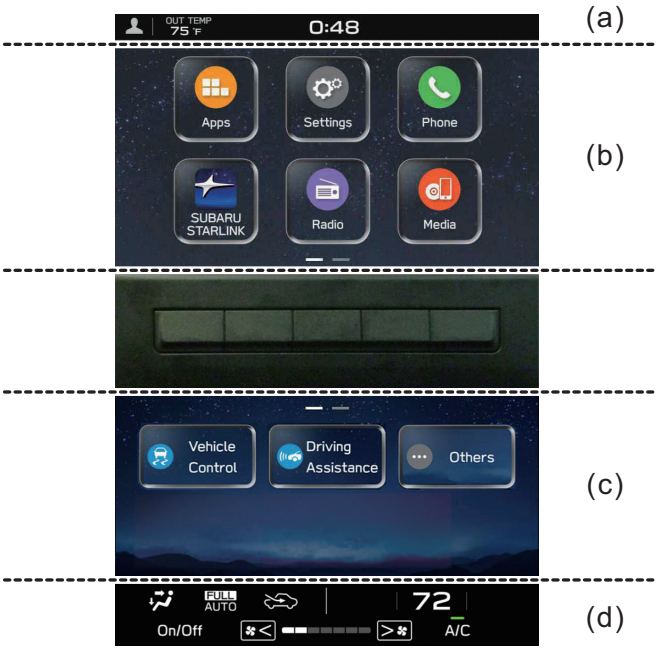
Display screen details

GUI

Installed with GUI that allows intuitive smartphone-like operation so users can easily use the various functions of the infotainment system. The unique GUI is designed so that the size, arrangement, and features of the display can be easily used.

■ Dual 7.0-inch display audio

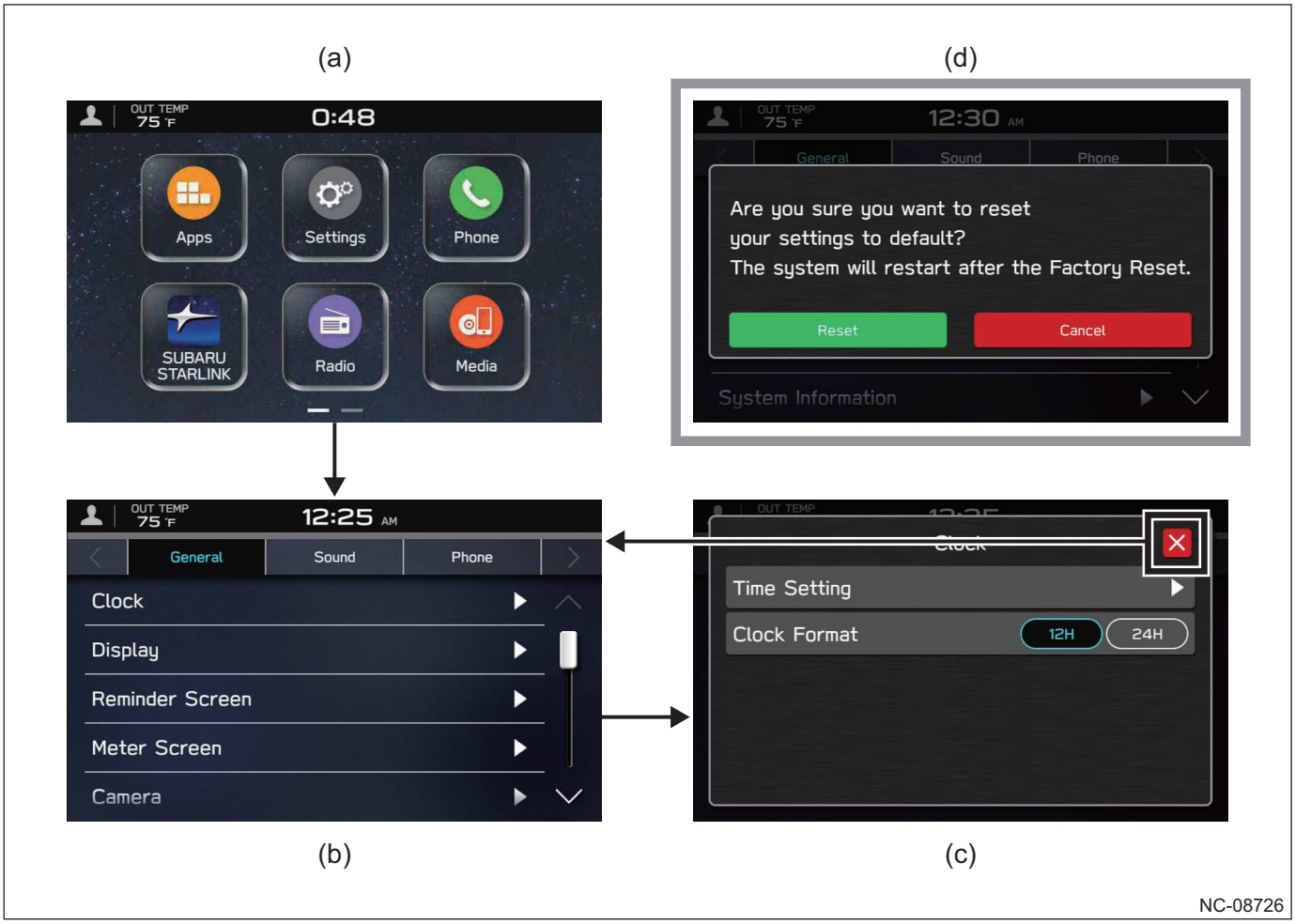
- A Home Screen is provided that is composed of categorized icons that are designed to make it easy for the user to understand the main infotainment functions.
- Physical buttons are positioned between the upper and lower screens. A button can be pressed to return to the Home Screen.
- Touch operations such as drag and swipe can be used.
- The operation buttons of the main functions installed in the vehicle are integrated in the Center Information Display (CID), enabling operation from a switch on the screen.
- The Customize menu supporting customization of the vehicle functions is integrated in the Center Information Display (CID). The user can use all the customization functions by operating the screen.
- The status and operation panel of the air conditioner are displayed in the screen and the main operation buttons are integrated into in-screen switches.
- By setting the display area in the screen, simultaneous display of various information and operation of each function was made available without affecting visibility.



**The illustration shows a typical example that may differ from the actual display.*

Symbol	Area name	Display contents
(a)	Status bar area	• Displays the driver profile button, ambient temperature, clock, and status icons (Bluetooth connected devices and status of volume mute, etc.). • The clock display area can be touched to directly display the time setting screen.
(b)	Category area	• Displays the selecting screens and screens provided to operate and select sources such as audio and those screens are in hierarchies some levels down from the Home Screen. • Main operations are done in this area.
(c)	Setting area	• In addition to displaying the Driving Statistics contents and Maintenance contents, it displays the screens for setting the air conditioner and other functions provided in the vehicle. • See the information section for details on the "Driving Statistics" contents and "Maintenance" contents {11-214}.
(d)	Air conditioner operation bar area	• Displays the screen for air conditioning operation and its status. • See "Air Conditioning System" for details on the air conditioner operation bar area {10-24}

- The screens that are shown in the category area consist of three hierarchical displays and pop-ups to support Infotainment System operation with a simple GUI that focuses on visibility and operability.



**The illustration shows a typical example that may differ from the actual display.*

Symbol	Display hierarchy		Display contents
(a)	1st hierarchy	Home Screen	Displays icons to open the main categories of the Infotainment System.
(b)	2nd hierarchy	Category screen	Displays the main screen of the category selected on the Home Screen that provides information on the category and displays the setting items.
(c)	3rd hierarchy	Detailed category screen	• Provides detailed information on the setting item selected on the category screen. • Select "X" (close) to return to the category screen.
(d)	Pop-up Screen		Notifications and inquiries from the Infotainment System are displayed on each display hierarchy based on the operation selected.

■ 11.6-inch display audio/11.6-inch display navigation

- A Home Screen is provided that is composed of categorized icons that are designed to make it easy for the user to understand the main infotainment functions.
- The Home button is always displayed on the screen. The Home Screen can be displayed by operating the button.
- Touch operations such as drag and swipe can be used.
- The operation buttons of the main functions installed in the vehicle are integrated in the Center Information Display (CID), enabling operation from a switch on the screen.
- The Customize menu supporting customization of the vehicle functions is integrated in the Center Information Display (CID). The user can use all the customization functions by operating the screen.
- The status and operation panel of the air conditioner are displayed in the screen and the main operation buttons are integrated into in-screen switches.
- By setting the display area in the screen, simultaneous display of various information and operation of each function was made available without affecting visibility.

**The illustration shows a typical example that may differ from the actual display.*

Symbol	Area name	Display contents
(a)	Status bar area	• Displays the ambient temperature, clock, and status icons (Bluetooth connected devices, Wi-Fi communication signal strength, and status of volume mute, etc.). • The clock display area can be touched to directly display the time setting screen.
(b)	Information bar area	• Displays the simplified status of the selected audio source and frequently-used functions, such as Favorite Widgets and turn by turn (11.6-inch display navigation only). This area also shows interrupt displays, such as a processing completion notification responding to the operation request, and notifications from the Infotainment System. • See the information section for details on "Favorite Widgets" {11-214}.
(c)	Category area	• Displays setting screens, screens for operating or selecting sources like audio, and setting screens for the function provided in the vehicle, which screens are in hierarchy some level down from the Home Screen. • Main operations are done in this area.
(d)	Home button area	Always displays the Home buttons, shortcut buttons for vehicle settings, and driver profile button.
(e)	Air conditioner operation bar area	• Displays the screen for air conditioning operation and its status. • See "Air Conditioning System" for details on the air conditioner operation bar area {10-24}

- The screens that are shown in the category area consist of three hierarchical displays and pop-ups to support Infotainment System operation with a simple GUI that focuses on visibility and operability.

**The illustration shows a typical example that may differ from the actual display.*

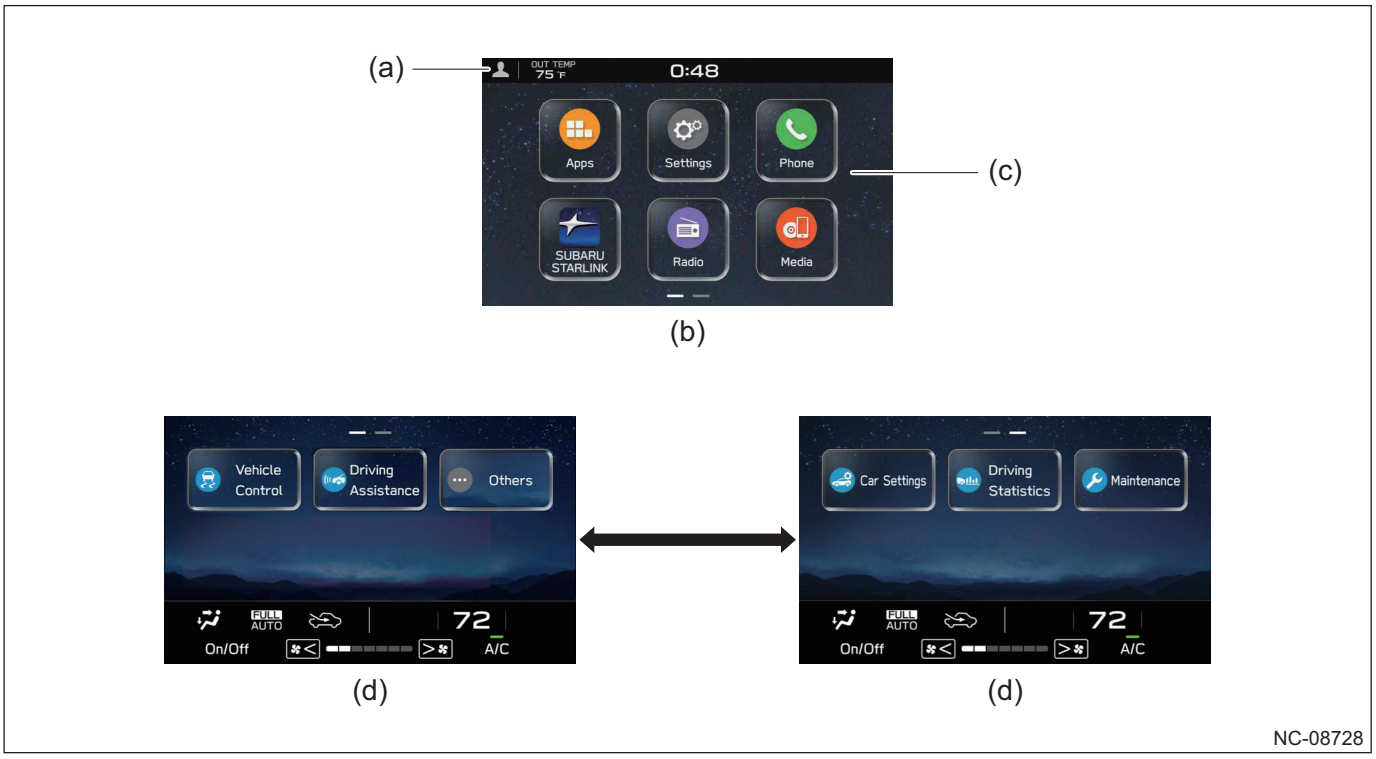
Symbol	Display hierarchy		Display contents
(a)	1st hierarchy	Home Screen	Displays icons to open the main categories of the Infotainment System.
(b)	2nd hierarchy	Category screen	Displays the main screen of the category selected on the Home Screen that provides information on the category and displays the setting items.
(c)	3rd hierarchy	Detailed category screen	• Provides detailed information on the setting item selected on the category screen. • Select "X" (close) to return to the category screen.
(d)	Pop-up Screen		Notifications and inquiries from the Infotainment System are displayed on each display hierarchy based on the operation selected.

Function

Screen buttons (Home Screen)

On the Home Screen, icons that serve as gateways to the main Infotainment System functions are displayed in such a way that the intended infotainment system operation can be executed intuitively. The arrangement of icons on the Home Screen can be customized by dragging or adding shortcuts.

■ Dual 7.0-inch display audio



**The illustration shows a typical example that may differ from the actual display.*

(a)	Driver profile button	(c)	Home Screen
(b)	Upper Screen	(d)	Lower Screen

Display area	Icon name / button name	Description
Upper	Driver profile button	If associated with your mobile phone via Bluetooth, the language and user's name for the Infotainment System can be registered.
	<Apps>	Used to operate the Apple CarPlay function, Android Auto function, SXM Travel Link function, and SUBARU STARLINK function.
	<Settings>	Used to enter the settings for the Infotainment System.
	<Phone>	Used to establish a Bluetooth connection with your mobile phone, and to execute each hands-free function.
	<SUBARU STARLINK>	Used to operate the SUBARU STARLINK function.
	<Radio>	Used to operate the AM/FM radio function and SXM radio function.
	<Media>	Used to operate any iPod/iPhone connected to the USB terminal, USB devices like USB memory containing music files, and Bluetooth-connected audio equipment containing music files, and also to operate the audio output of the portable audio player connected to the AUX terminal.
	<Add Shortcut>	Used to select, add, or delete shortcut icons to/from the Home Screen.
Lower	<Vehicle Control>	• Used to enter the settings for the vehicle equipment included in the <Vehicle Control> category. • Operable while you are driving.
	<Driving Assistance>	• Used to enter the settings for the vehicle equipment included in the <Driving Assistance> category. • Operable while you are driving.
	<Others>	• Used to enter the settings for the vehicle equipment included in the <Others> category. • Operable while you are driving.
	<Car Settings>	Used to operate the customizable items of each function provided in the vehicle.
	<Driving Statistics>	• Displays operating conditions such as the steering wheel angle, the operating status of Vehicle Dynamics Control (VDC), the vehicle posture, and the Auto Vehicle Hold (AVH) status. • See the information section for details on <Driving Statistics> {11-214}.
	<Maintenance>	• Used to operate the maintenance function. • See the information section for details on <Maintenance> {11-214}.

■ 11.6-inch display audio/11.6-inch display navigation

**The illustration shows a typical example that may differ from the actual display.*

(a)	Home Screen	(c)	Home button
(b)	Vehicle settings shortcut button	(d)	Driver profile button

Icon name / button name	Description
Vehicle settings shortcut button	• Used to operate the settings for the vehicle equipment included in the <Vehicle Control>, <Driving Assistance> and <Others> items. • Operable while you are driving.
Home button	Displays the Home Screen. By touching the Home button, the screen will return to the Home Screen regardless of the display contents of the category screen.
Driver profile button	If associated with your mobile phone via Bluetooth, the language and user's name for the Infotainment System can be registered.
<Map> (only for 11.6-inch display navigation)	The map screen allows you to execute navigation functions.
<Radio>	Used to operate the radio function.
<Media>	Used to operate any iPod/iPhone connected to the USB terminal, USB devices like USB memory containing music files, Bluetooth-connected audio equipment containing music files, and disc player (for models with disc player (dealer option)), and also to operate the audio output of the portable audio player connected to the AUX terminal.
<Phone>	Used to establish a Bluetooth connection with your mobile phone, and to execute each hands-free function.
<Apps>	Used to operate the Apple CarPlay function, Android Auto function, SXM Travel Link function, SUBARU STARLINK function, and MySubaru function.
<Car Info>	• Used to display and operate the tab-categorized information screen for <Driving Statistics>, <Advanced Package>, and <Maintenance>. • See the information section for details on "Car Info" {11-214}.
<SUBARU STARLINK>	Used to operate the SUBARU STARLINK function.
<MySubaru>	Used to operate the MySubaru function.
<Settings>	Used to enter the settings for the Infotainment System.
<Add Shortcut>	Used to select, add, or delete shortcut icons to/from the Home Screen.

Infotainment system settings

By touching the <Settings> icon on the Home Screen, the setting items for the Infotainment System are displayed. Each setting item is categorized according to the functions on separate tabs.

■ Dual 7.0-inch display audio

Tab	Set item
<General>	• Configure the settings for <Clock>, <Display>, <Reminder Screen>, <Meter Screen>, <Camera>, <Climate Control>, <Language>, <Tire Pressure Units>, <Home Screen Shortcuts>, <Welcome Screen>, <Goodbye Screen>, <Birthday List>, <Anniversary List>, <SUBARU STARLINK Apps Recovery>, and <SUBARU STARLINK Auto Connect>. • Used to operate <Factory Data Reset>. • <System Information> and <Free/Open Source Software Information> of Infotainment System can be displayed.
<Sound>	Used to configure the settings for <Audio>, <Notification Volume>, <Beep Sound Setting>, <Beep Sound Volume>, <Phone Ringtone Volume>, <Incoming Call Volume>, <Call Volume>, <SMS/MMS Ringtone Volume>, <SMS/MMS Read Out Volume>, and <Voice Volume>.
<Phone>	Used to configure the settings for <Manage Devices>, <Phonebook/Recent Calls>, <Message>, <Change Device Name>, <Apple CarPlay>, and <Android Auto>.
<Radio>	Used to configure the settings for <FM>, <AM> and <SiriusXM>.

■ 11.6-inch display audio

Tab	Set item
<General>	• Configure the settings for <Clock>, <Display>, <Wi-Fi>, <Wi-Fi Hotspot>, <Reminder Screen>, <Meter Screen>, <Camera>, <Climate Control>, <Language>, <Tire Pressure Units>, <Home Screen Shortcuts>, <Welcome Screen>, <Goodbye Screen>, <Favorite Widgets>, <Birthday List>, <Anniversary List>, <SUBARU STARLINK Apps Recovery>, and <SUBARU STARLINK Auto Connect>. • <Software Update> setting and operation are available. • Used to operate <Factory Data Reset>. • <System Information> and <Free/Open Source Software Information> of Infotainment System can be displayed.
<Sound>	Used to configure the settings for <Audio>, <Notification Volume>, <Beep Sound Setting>, <Beep Sound Volume>, <Phone Ringtone Volume>, <Incoming Call Volume>, <Call Volume>, <SMS/MMS Ringtone Volume>, <SMS/MMS Read Out Volume>, and <Voice Volume>.
<Phone>	Used to configure the settings for <Manage Devices>, <Phonebook/Recent Calls>, <Message>, <Change Device Name>, <Apple CarPlay>, and <Android Auto>.
<Radio>	Used to configure the settings for <FM>, <AM> and <SiriusXM>.
<Car>	Used to operate the customizable items of each function provided in the vehicle.

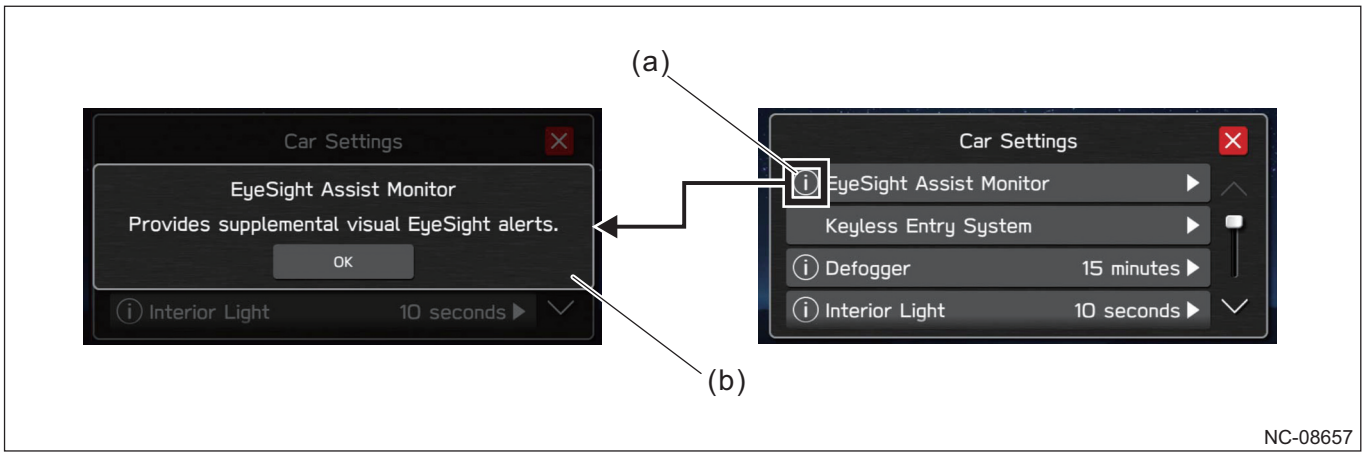
■ 11.6-inch display navigation

Tab	Set item
<General>	• Configure the settings for <Clock>, <Display>, <Wi-Fi>, <Wi-Fi Hotspot>, <Reminder Screen>, <Meter Screen>, <Camera>, <Climate Control>, <Language>, <Tire Pressure Units>, <Home Screen Shortcuts>, <Welcome Screen>, <Goodbye Screen>, <Favorite Widgets>, <Birthday List>, <Anniversary List>, <Periodic Rest Notification>, <SUBARU STARLINK Apps Recovery>, and <SUBARU STARLINK Auto Connect>. • <Software Update> setting and operation are available. • Used to operate <Factory Data Reset>. • <System Information> and <Free/Open Source Software Information> of Infotainment System can be displayed.
<Sound>	Used to configure the settings for <Audio>, <Navigation Guidance Volume>, <Beep Sound Setting>, <Beep Sound Volume>, <Phone Ringtone Volume>, <Incoming Call Volume>, <Call Volume>, <SMS/MMS Ringtone Volume>, <SMS/MMS Read Out Volume> and <Voice Volume>.
<Phone>	Used to configure the settings for <Manage Devices>, <Phonebook/Recent Calls>, <Message>, <Change Device Name>, <Apple CarPlay>, and <Android Auto>.
<Radio>	Used to configure the settings for <FM>, <AM> and <SiriusXM>.
<Navigation>	Used to configure the settings for <Show on Map>, <Show Along Route>, <Arrival Distance/Time>, <Freeway Exit Preview>, <Automatic Zoom>, <Auto-Hide Route Bar>, <Route Preference>, <Avoid>, <Traffic Warning Tone>, and <Map Update>.
<Car>	Used to operate the customizable items of each function provided in the vehicle.

Information function

For setting items with prefix information marks, operation guidance, etc. are displayed to assist setting operation by touching those marks.

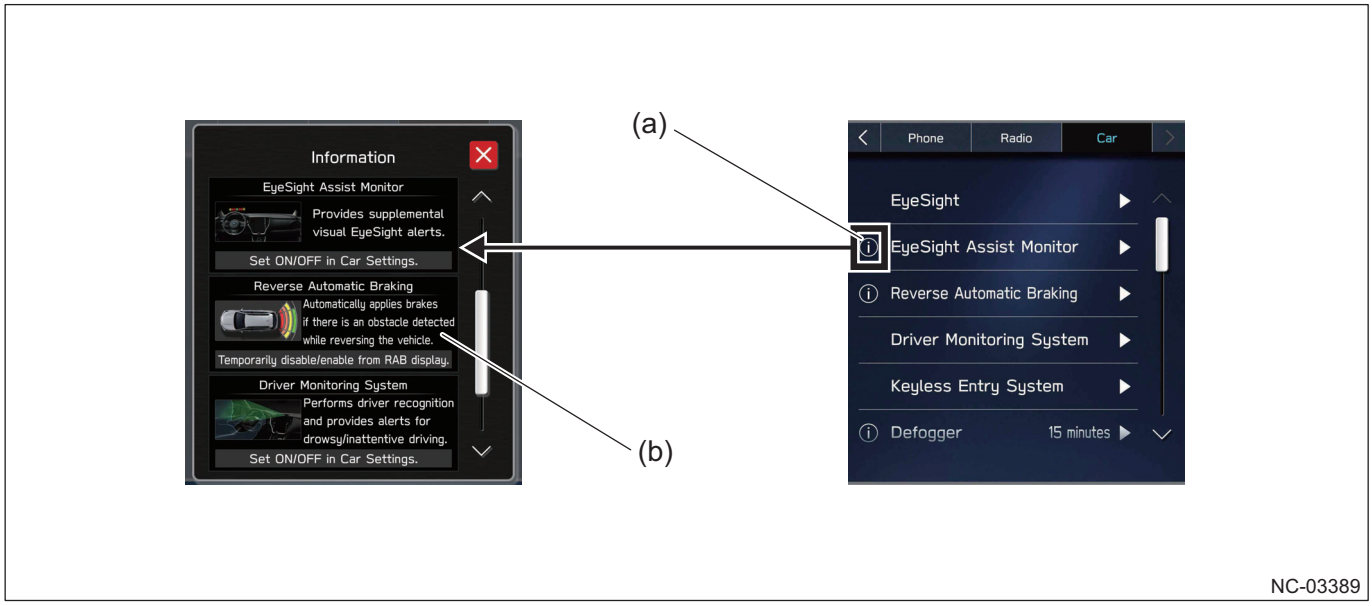
■ Example of guidance displayed on Dual 7.0-inch display



**The illustration shows a typical example that may differ from the actual display.*

(a) Information mark (b) Operation guidance display

■ Example of guidance displayed on 11.6-inch display



**The illustration shows a typical example that may differ from the actual display.*

(a) Information mark (b) Operation guidance display

Entertainment functions

The audio/navigation system is equipped with entertainment functions that support a wide range of media.

The entertainment functions are categorized by means of icons on the Home Screen.

■ Radio

- Select the <Radio> icon on the Home Screen to listen to the radio.

Dual 7.0-inch display audio

NC-08730

**The illustration shows a typical example that may differ from the actual display.*

Mode	Description
<FM>	• Used to listen to FM radio broadcasts. • Channels can be preset by using auto search or manually.
<AM>	• Used to listen to AM radio broadcasts. • Channels can be preset by using auto search or manually.
<SiriusXM>	• Used to listen to SiriusXM radio broadcasts. • Channels can be preset by using auto search or manually.

11.6-inch display audio/11.6-inch display navigation

NC-08731

**The illustration shows a typical example that may differ from the actual display.*

Mode	Description
<FM>	• Used to listen to FM radio broadcasts. • Channels can be preset by using auto search or manually.
<AM>	• Used to listen to AM radio broadcasts. • Channels can be preset by using auto search or manually.
<SiriusXM>	• Used to listen to SiriusXM radio broadcasts. • Channels can be preset by using auto search or manually.

■ Media

- Select the <Media> icon on the Home Screen to play audio from various media types.

Dual 7.0-inch display audio

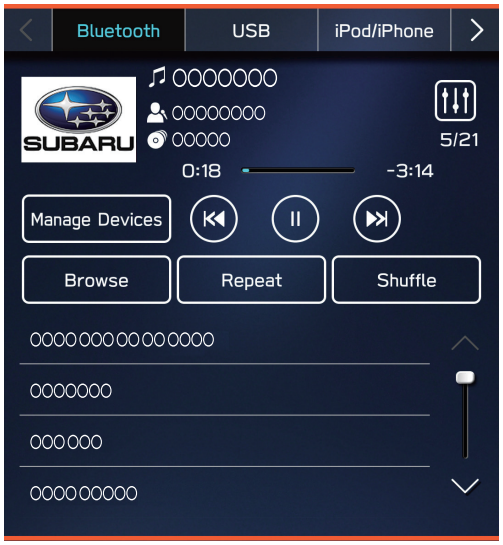
NC-08732

**The illustration shows a typical example that may differ from the actual display.*

Mode	Description
<Bluetooth>	• Used to operate a portable audio player that is connected by Bluetooth from the display. • The audio is output from the vehicle speakers.
<USB>	Used to play audio files that are recorded on the USB memory that is connected to the USB terminal.
<iPod/iPhone>*1	Used to play audio files that are recorded on the iPod or iPhone that is connected to the USB terminal.
<AUX>	Audio from the portable audio player that is connected to the AUX port is output from the vehicle speakers.
<Android Auto>*2	Used to play audio files that are recorded on the Android phone that is connected to the USB terminal.

**1: <Apple CarPlay> is displayed when the iPhone connected to the USB terminal uses Apple CarPlay.*
**2: <Android Auto> is displayed when an Android phone that supports Android Auto is connected to the USB terminal.*

11.6-inch display audio/11.6-inch display navigation



NC-08733

**The illustration shows a typical example that may differ from the actual display.*

Mode	Description
<Bluetooth>	• Used to operate a portable audio player that is connected by Bluetooth from the display. • The audio is output from the vehicle speakers.
<USB>	Used to play audio files that are recorded on the USB memory that is connected to the USB terminal.
<iPod/iPhone>*1	Used to play audio files that are recorded on the iPod or iPhone that is connected to the USB terminal.
<AUX>	Audio from the portable audio player that is connected to the AUX port is output from the vehicle speakers.
<Android Auto>*2	Used to play audio files that are recorded on the Android phone that is connected to the USB terminal.

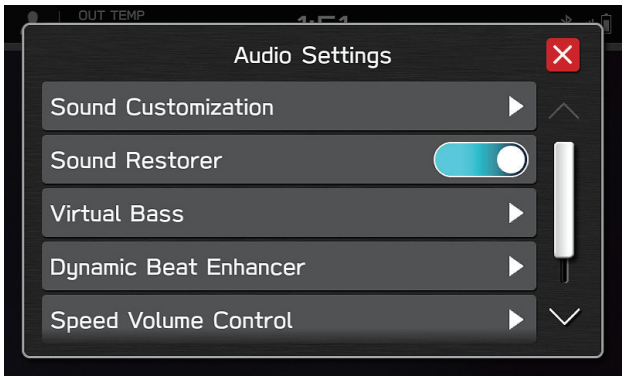
**1: <Apple CarPlay> is displayed when the iPhone connected to the USB terminal uses Apple CarPlay.*
**2: <Android Auto> is displayed when an Android phone that supports Android Auto is connected to the USB terminal.*

Sound quality adjustment functions

The sound quality can be adjusted from <Audio> on the <Sound> settings screen.

■ Audio settings

Dual 7.0-inch display audio



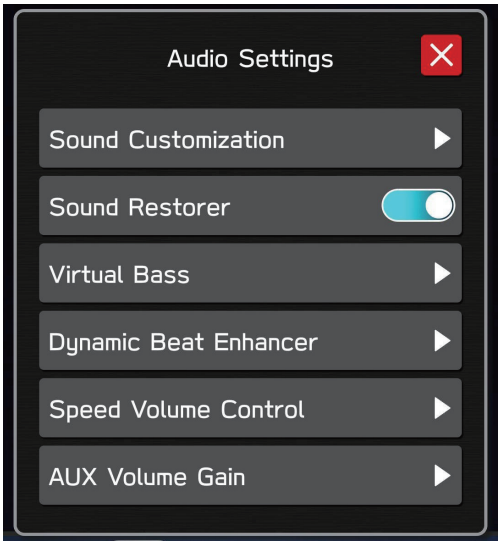
NC-08734

**The illustration shows a typical example that may differ from the actual display.*

Item		Description
<Sound Customization>*	<Equalizer>	Used to adjust the bass, mid-range, and treble sound quality.
	<Balance/Fader>	Used to adjust the volume balance at the front, rear, left, and right speakers.
	<Vocal Image Control>	• By controlling the volume balance in the sound range that includes human voice, it is possible to simulate movement of the vocal position in the forward, back, left, and right directions. • <Virtual Stage Enhancer> is used to adjust sound to create a greater sense of actually being there at the performance. (When <Virtual Stage Enhancer> is not OFF, it is not possible to adjust the <Vocal Image Control> forward/back setting.)
<Sound Restorer>		Used to turn treble range correction ON/OFF for compressed audio sources.
<Virtual Bass>		Used to set the correction level which adds harmonics to and amplifies the bass range.
<Dynamic Beat Enhancer>		Used to set the correction level for sound ranges that were lost due to data compression.
<Speed Volume Control>		Used to set the level of automatic adjustment for playback volume according to the vehicle speed.
<AUX Volume Gain>		Used to set the playback volume adjustment level when a portable audio device or similar device is connected to the AUX port.

**: The sound settings screen can be displayed by selecting the audio settings mark on any entertainment screen.*

11.6-inch display audio/11.6-inch display navigation



NC-08735

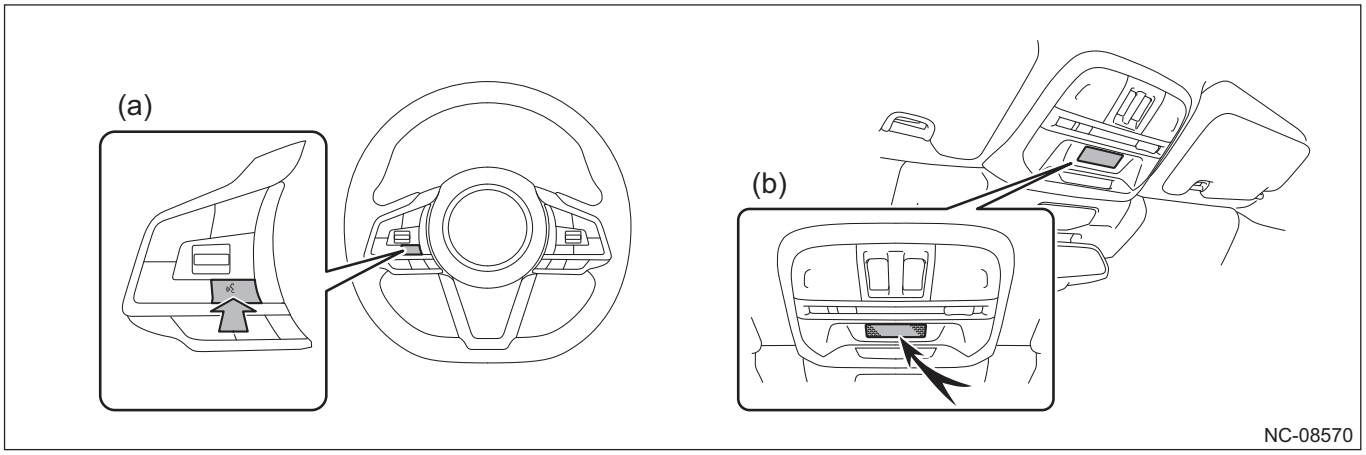
**The illustration shows a typical example that may differ from the actual display.*

Item		Description
<Sound Customization>*1	<Equalizer>	Used to adjust the bass, mid-range, and treble sound quality.
	<Balance/Fader>	Used to adjust the volume balance at the front, rear, left, and right speakers.
	<Vocal Image Control>*2	• By controlling the volume balance in the sound range that includes human voice, it is possible to simulate movement of the vocal position in the forward, back, left, and right directions. • <Virtual Stage Enhancer> is used to adjust sound to create a greater sense of actually being there at the performance. (When <Virtual Stage Enhancer> is not OFF, it is not possible to adjust the <Vocal Image Control> forward/back setting.)
<Sound Restorer>*2		Used to turn treble range correction ON/OFF for compressed audio sources.
<Virtual Bass>*2		Used to set the correction level which adds harmonics to and amplifies the bass range.
<Dynamic Beat Enhancer>*2		Used to set the correction level for sound ranges that were lost due to data compression.
<Speed Volume Control>*2		Used to set the level of automatic adjustment for playback volume according to the vehicle speed.
<AUX Volume Gain>		Used to set the playback volume adjustment level when a portable audio device or similar device is connected to the AUX port.

**1: The sound settings screen can be displayed by selecting the audio settings mark on any entertainment screen.*
**2: 6 speakers (standard audio system) only*

Voice recognition function

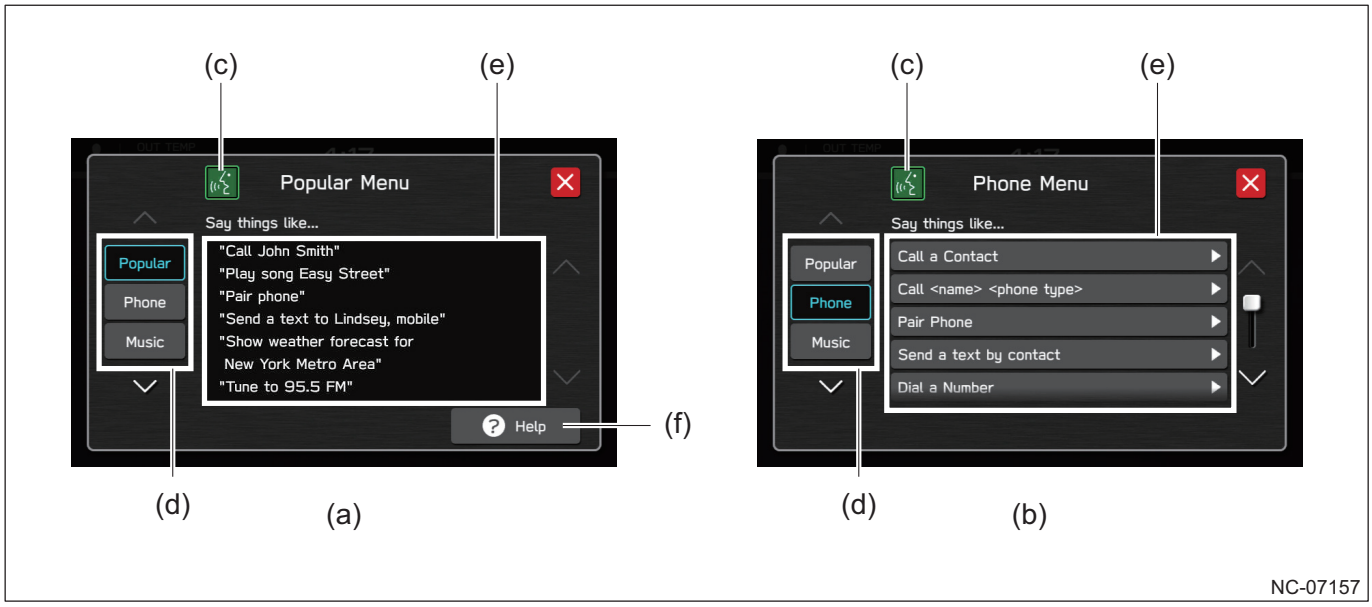
Pressing the talk switch on the steering wheel activates the voice recognition function. By following the example displayed on the Infotainment System screen and speaking to the microphone in the map light, the spoken command is executed. If the voice has not been recognized, you can also execute the command by touching the item displayed on the screen.



(a) Talk switch

(b) Microphone

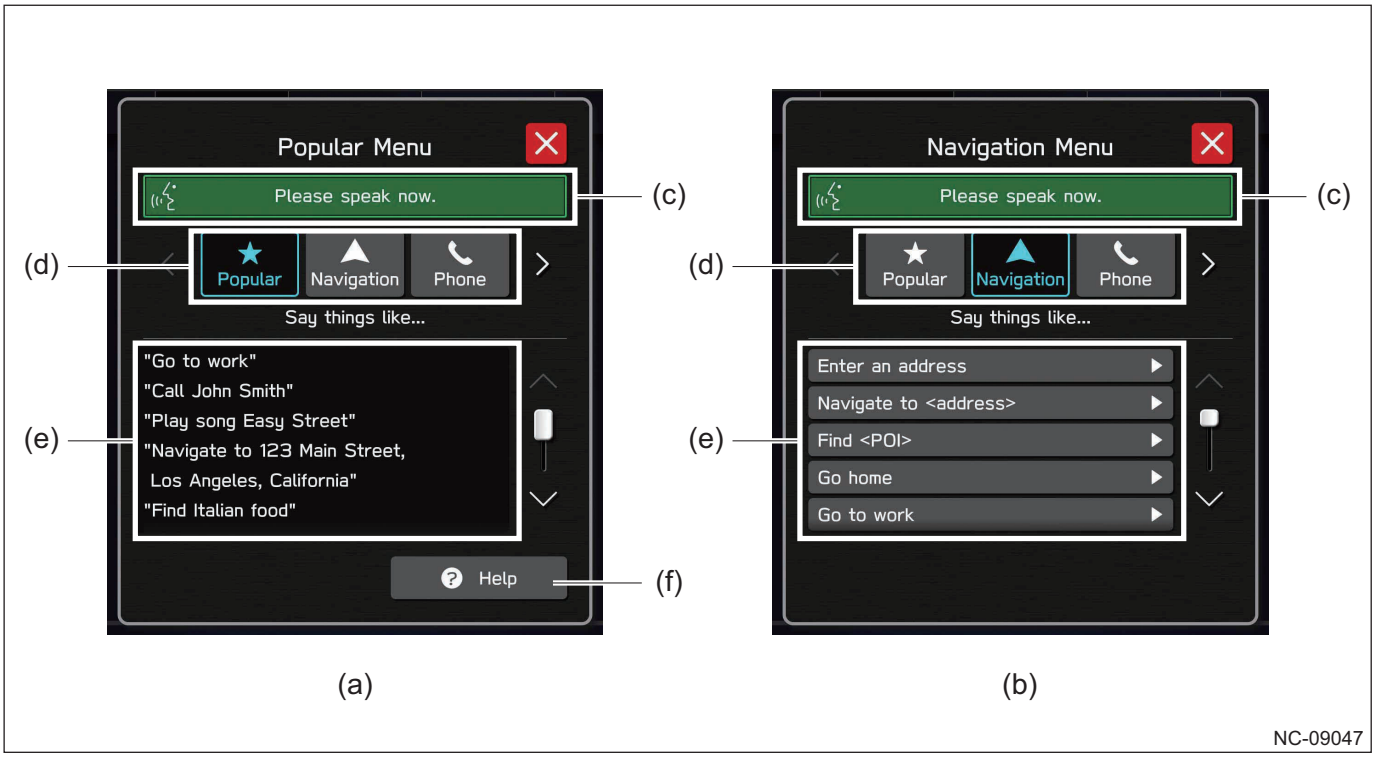
■ Dual 7-inch display audio



**The illustration shows a typical example that may differ from the actual display.*

Symbol	Item		Description
(a)	Voice recognition screen (when <Popular> category is displayed)		On the command window, speech examples for command execution are displayed.
(b)	Voice recognition screen (when a category other than <Popular> is displayed)		• On the command window, executable commands and speech examples are displayed. • Touching each command can also trigger its activation.
(c)	Voice recognition status display		The timing of starting speaking and voice recognition system status like "command being processed" are shown by icons.
(d)	Command category	<Popular>	Displays speech examples for voice recognition operation on the command window.
		<Phone>	Displays hands-free functions and message functions executable by voice recognition on the command window.
		<Music>	Displays audio functions executable by voice recognition on the command window.
		<Climate>	Displays air conditioning functions executable by voice recognition on the command window.
		<Apps>	Displays Apps functions executable by voice recognition on the command window.
(e)	Command window		Displays speech examples for voice recognition operation and commands that are executable via touch operation for each command category.
(f)	<Help>		Displays <Help> screen for voice recognition operation.

■ 11.6-inch display audio/11.6-inch display navigation



The illustration shows a typical example that may differ from the actual display.

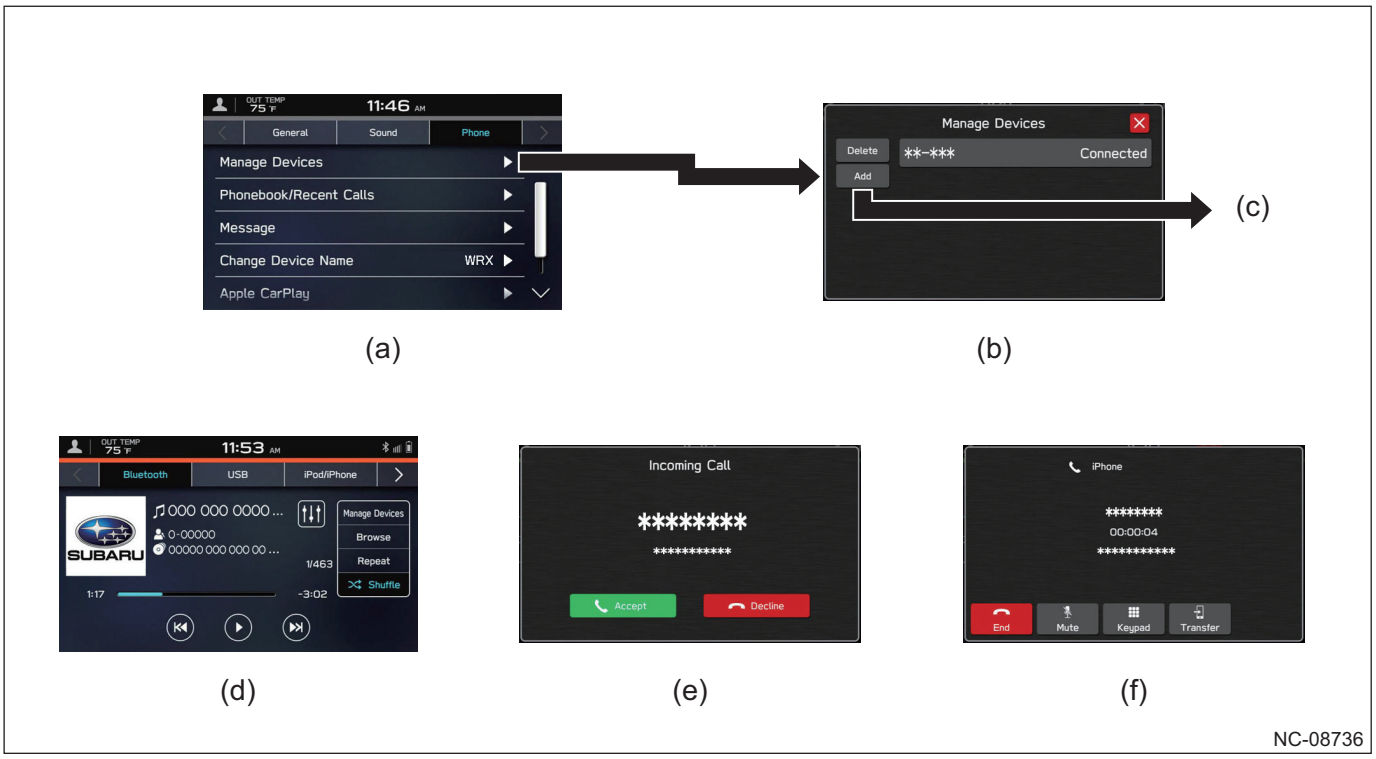
Symbol	Item		Description
(a)	Voice recognition screen (when <Popular> category is displayed)		On the command window, speech examples for command execution are displayed.
(b)	Voice recognition screen (when a category other than <Popular> is displayed)		• On the command window, executable commands and speech examples are displayed. • Touching each command can also trigger its activation.
(c)	Voice recognition status display		The timing of starting speaking and voice recognition system status like "command being processed" are indicated by icons.
(d)	Command category	<Popular>	Displays speech examples for voice recognition operation on the command window.
		<Navigation> (Only for 11.6-inch display navigation)	Displays navigation functions executable by voice recognition on the command window.
		<Phone>	Displays hands-free functions and message functions executable by voice recognition on the command window.
		<Music>	Displays audio functions executable by voice recognition on the command window.
		<Climate>	Displays air conditioning functions executable by voice recognition on the command window.
		<Apps>	Displays Apps functions executable by voice recognition on the command window.
(e)	Command window		Displays speech examples for voice recognition operation and commands that are executable via touch operation for each command category.
(f)	<Help>		Displays <Help> screen for voice recognition operation.

Bluetooth function

The built-in Bluetooth antenna of the Center Information Display (CID) enables Bluetooth compatible mobile phones or portable audio players to be connected to the in-vehicle device via wireless communication.

This enables a Bluetooth compatible mobile phone to be operated on the in-vehicle device to make a hands-free call, and music files stored on the Bluetooth compatible device to be played on the in-vehicle device.

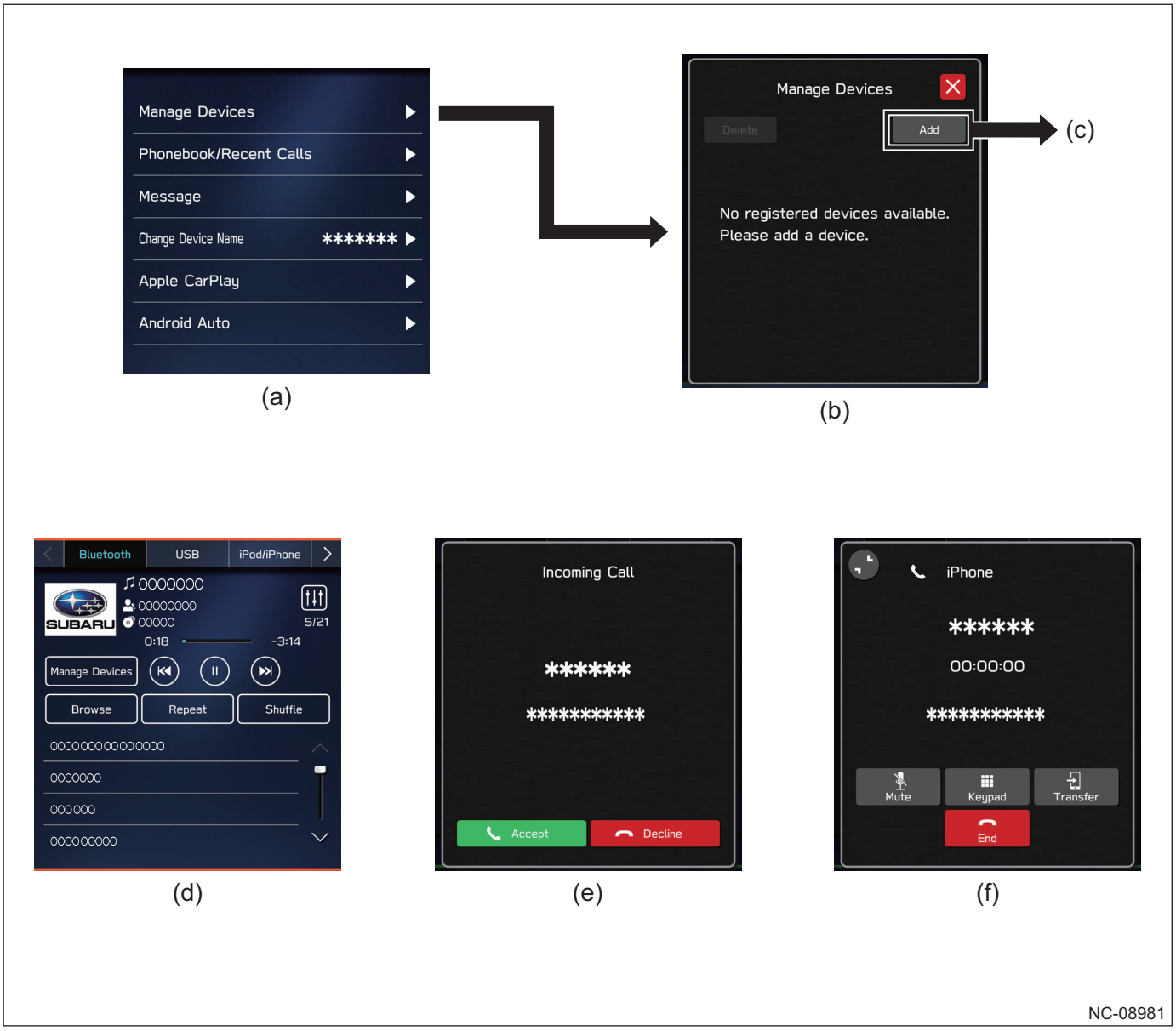
Dual 7.0-inch display audio



**The illustration shows a typical example that may differ from the actual display.*

(a)	Infotainment system setting screen	(d)	Bluetooth audio screen
(b)	Management screen for registered device	(e)	Bluetooth hands-free screen (when receiving call)
(c)	Starting device registration	(f)	Bluetooth hands-free screen (during call)

11.6-inch display audio/11.6-inch display navigation



**The illustration shows a typical example that may differ from the actual display.*

(a)	Infotainment system setting screen	(d)	Bluetooth audio screen
(b)	Management screen for registered device	(e)	Bluetooth hands-free screen (when receiving call)
(c)	Starting device registration	(f)	Bluetooth hands-free screen (during call)

■ Registration

- A Bluetooth compatible device is registered in the in-vehicle device by operating the display.
- A simple pairing function is available for Bluetooth devices compatible with Near Field Communication (NFC). Place the device near the NFC symbol on the in-vehicle device panel to skip the setting screen operations and start registration. (Only for 11.6-inch display audio/11.6-inch display navigation)
- Up to five Bluetooth compatible devices can be registered. Note that if two or more devices are registered, the device to actually be connected and used must be selected.

Reference

When a Bluetooth-capable device has been registered in the in-vehicle device, the following icons are displayed in the display status bar area.

- Bluetooth connection status
- Bluetooth-capable device signal strength
- Bluetooth-capable device battery charge state

■ Bluetooth audio

- Music files stored on a mobile phone or portable audio player that is compatible with the Bluetooth AV profile are shown on the in-vehicle device display.
- The displayed music files can be operated on the display and played using the vehicle speakers.
- The title and album jacket of the playing music file are displayed depending on the profile version of the connected Bluetooth compatible device.

■ Bluetooth hands-free

- A mobile phone connected via Bluetooth can be operated on the in-vehicle device to enable hands-free calls using the microphone and speakers mounted in the vehicle.
- Hands-free calls can be made with the following methods.

Method	Description
Calling from history	A call can be made from the history of making and receiving calls (including unanswered calls).
Calling from favorites list	A call can be made by selecting a telephone number preregistered in the favorites list.
Calling from phone book	A telephone number can be displayed from the phone book and called.
Calling a message sender*1	When a received message was sent using a telephone number, the sender can be called using this number.
Calling a facility*2	A call can be made from the facility information display screen registered in the navigation system. *3
Calling via a voice recognition operation	A call can be made with a voice recognition operation by pressing the talk switch on the satellite switch.

**1: Only when the Bluetooth mobile phone supports the message function*
**2: Only for 11.6-inch display navigation*
**3: Only when the registered facility information includes telephone number data*

- When the mobile phone receives a call, the ringtone sounds, and the incoming call screen is displayed. The call can be accepted or declined on the incoming call screen.
- The following operations are available during a hands-free call.

Reference

The incoming call screen is also displayed when a third-party interrupt call is received while a call is in progress. By accepting the call at this time, it is possible to speak with the interrupt call caller. (Only when the Bluetooth mobile phone supports interrupt calls)

Operation	Description
<End>	Ends the call.
<Mute>	Prevents the person on the other side of the call from hearing any sound.
<Keypad>	A numeric keypad can be used to send tone signals. *1
<Transfer/Transfer Back>	Transfers the hands-free call on the in-vehicle device to the mobile phone, or transfers a call on the mobile phone to a hands-free call on the in-vehicle device.
<Swap>*2	Displayed when an interrupt call was accepted and allows the opposite party to the call to be switched while the interrupt call is in progress.

**1: This cannot be operated while driving.*
**2: Only when the Bluetooth mobile phone supports interrupt calls*

- If the Bluetooth mobile phone supports the message function, received messages can be checked or replied to, and short messages can be sent.

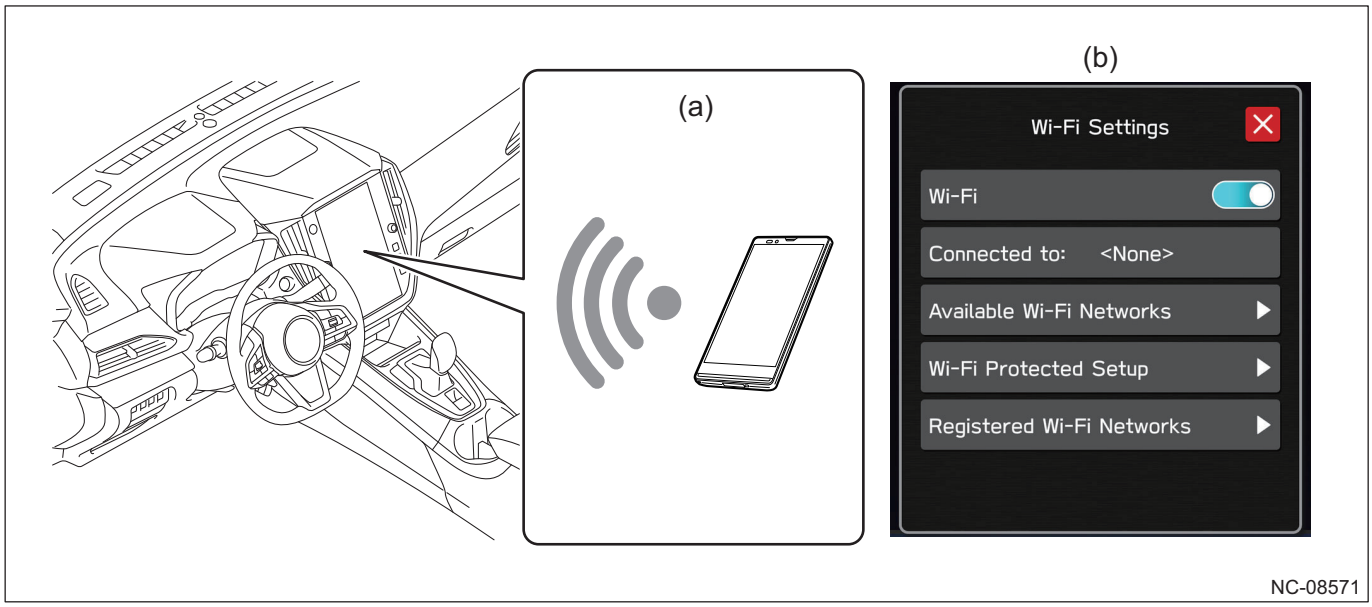
Wi-Fi function (11.6-inch display audio/11.6-inch display navigation)

The built-in wireless LAN antenna of the Center Information Display (CID) enables a wireless client (tethering mobile phone or mobile Wi-Fi router) to be connected to the in-vehicle device via Wi-Fi communication.

The Wi-Fi communication with the wireless client enables use of the following Over The Air (OTA) functions.

Function	Application	
	11.6-inch display audio	11.6-inch display navigation
Software updates	O	O
Map data updates	-	O

Function application list [symbol] O: Applicable, -: Not applicable



**The illustration shows a typical example that may differ from the actual display.*

(a) Wireless client (tethering mobile phone or mobile Wi-Fi router)

(b) Wi-Fi Settings screen

■ Registration

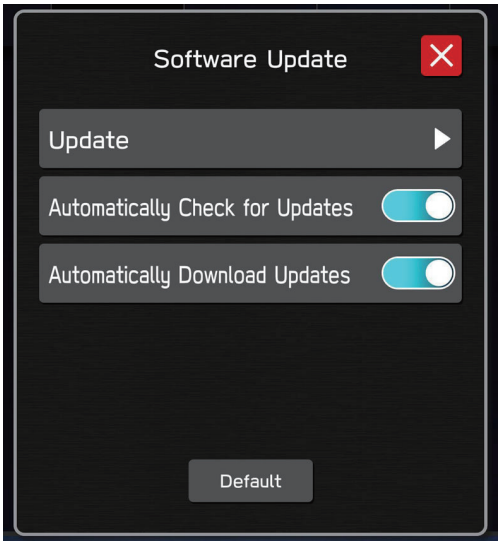
- A wireless client (tethering mobile phone or mobile Wi-Fi router) is registered in the in-vehicle device by operating the display.
- The registration operation is easier for wireless clients compatible with Wi-Fi Protected Setup (WPS).

Reference

When a wireless client has been registered in the in-vehicle device, an icon which indicates the signal strength between the in-vehicle device and wireless client is displayed in the display status bar area.

■ Software updates

- Update programs for the infotainment system can be downloaded and installed via Over The Air (OTA) communication with the server.



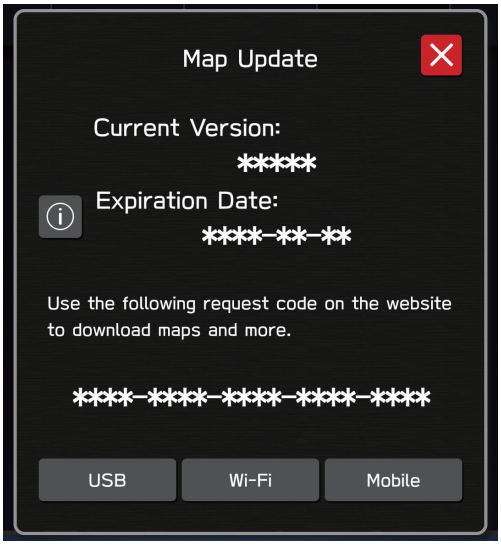
NC-06017

**The illustration shows a typical example that may differ from the actual display.*

Item	Description
<Update>	• Used to check whether there is an update program on the server. • If there is an update program, it can be downloaded from the server and installed.
<Automatically Check for Updates>	Used to turn automatic check for update programs ON/OFF.
<Automatically Download Updates>	Used to turn automatic download of update programs ON/OFF.

■ Map data updates

- The map data stored in the navigation system can be partially updated via Over The Air (OTA) communication with the server.
- The road data that has been changed from the recorded map data version is acquired from the server, and the map data is updated to the new information.
- Map data updates (differential update) can be used for free for 3 years from the vehicle purchase.



NC-08737

**The illustration shows a typical example that may differ from the actual display.*

Item	Description
<Current Version>	Displays the map data version of the in-vehicle device.
<Expiration Date>	Displays the free update license expiration date for the map data updates (differential update).
Request code	This code is required when acquiring the map data from the website.
<USB>	Select to perform a full update of the map data using USB memory.
<Wi-Fi>	• Select to update the map data (differential update) using Wi-Fi communication. • Displays the update map version before and after the update, and the size of the differential update data. • Map data automatic updates can be turned ON/OFF. • A differential update can be started manually.
<Mobile>	• Select to update the map data (differential update) using a smartphone on which the SUBARU STARLINK app is installed. • Map data automatic updates can be turned ON/OFF. • A differential update can be started manually.

Reference

After 3 years have elapsed since vehicle purchase, the free period for differential updates can be extended by purchasing the latest version of the map data for a full update.

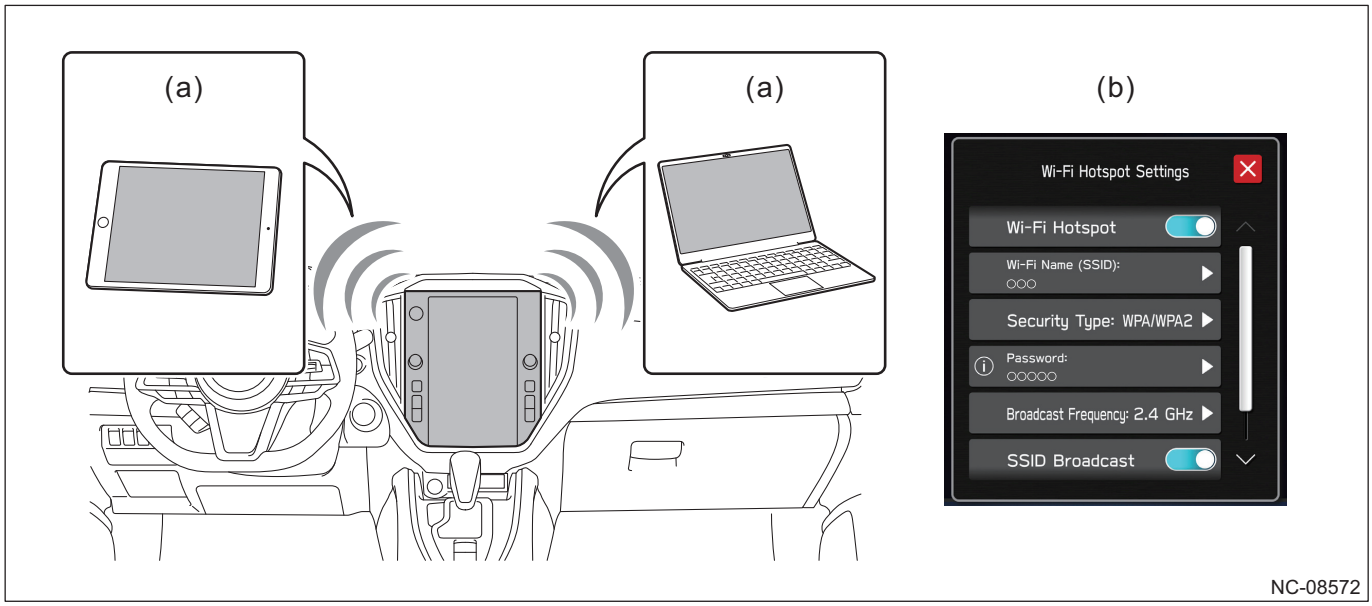
Wi-Fi Hotspot function (models for U4 with data communication module (DCM))

With the combination of external network communication using the data communication module (DCM) and the wireless LAN antenna installed inside the Center Information Display (CID), the vehicle can be used as a Wi-Fi Hotspot.

By connecting a Wi-Fi capable mobile device (tablet, notebook PC, etc.) to the Wi-Fi Hotspot, it is possible to enjoy services using the Internet from inside the vehicle.

Reference

SUBARU STARLINK registration is required in order to use the Wi-Fi Hotspot. For details about SUBARU STARLINK, refer to "Telematics System". {11-99}



**The illustration shows a typical example that may differ from the actual display.*

(a)	Wi-Fi capable device (tablet, notebook PC, or other mobile device)	(b)	Wi-Fi Hotspot Settings screen

■ Connected

- The connection to the Wi-Fi Hotspot is made from the Wi-Fi capable device (tablet, notebook PC, or other mobile device).
- A maximum of 8 devices can be connected to the Wi-Fi Hotspot. The connected Wi-Fi capable devices are displayed on the in-vehicle device display.

Reference

When a Wi-Fi capable device connects to the Wi-Fi Hotspot, an icon indicating the data communication module (DCM) signal strength is displayed in the display status bar area.

Smartphone link functions

A smartphone can be connected to the in-vehicle device to operate the installed applications on the display of the in-vehicle device.

■ Apple CarPlay

- Apple CarPlay can be used on the display of the in-vehicle device by connecting the iPhone and in-vehicle device with a USB cable.
- When an iPhone is connected to the in-vehicle device and Apple CarPlay becomes available for use, the <Apple CarPlay> icon is displayed on the Home Screen.

■ Android Auto

- To use Android Auto, the Android Auto application must be installed on an Android phone in advance.
- Android Auto can be used on the display of the in-vehicle device by connecting the Android phone and in-vehicle device with a USB cable or via Bluetooth.
- When an Android phone is connected to the in-vehicle device and Android Auto becomes available for use, the <Android Auto> icon is displayed on the Home Screen.

■ SUBARU STARLINK

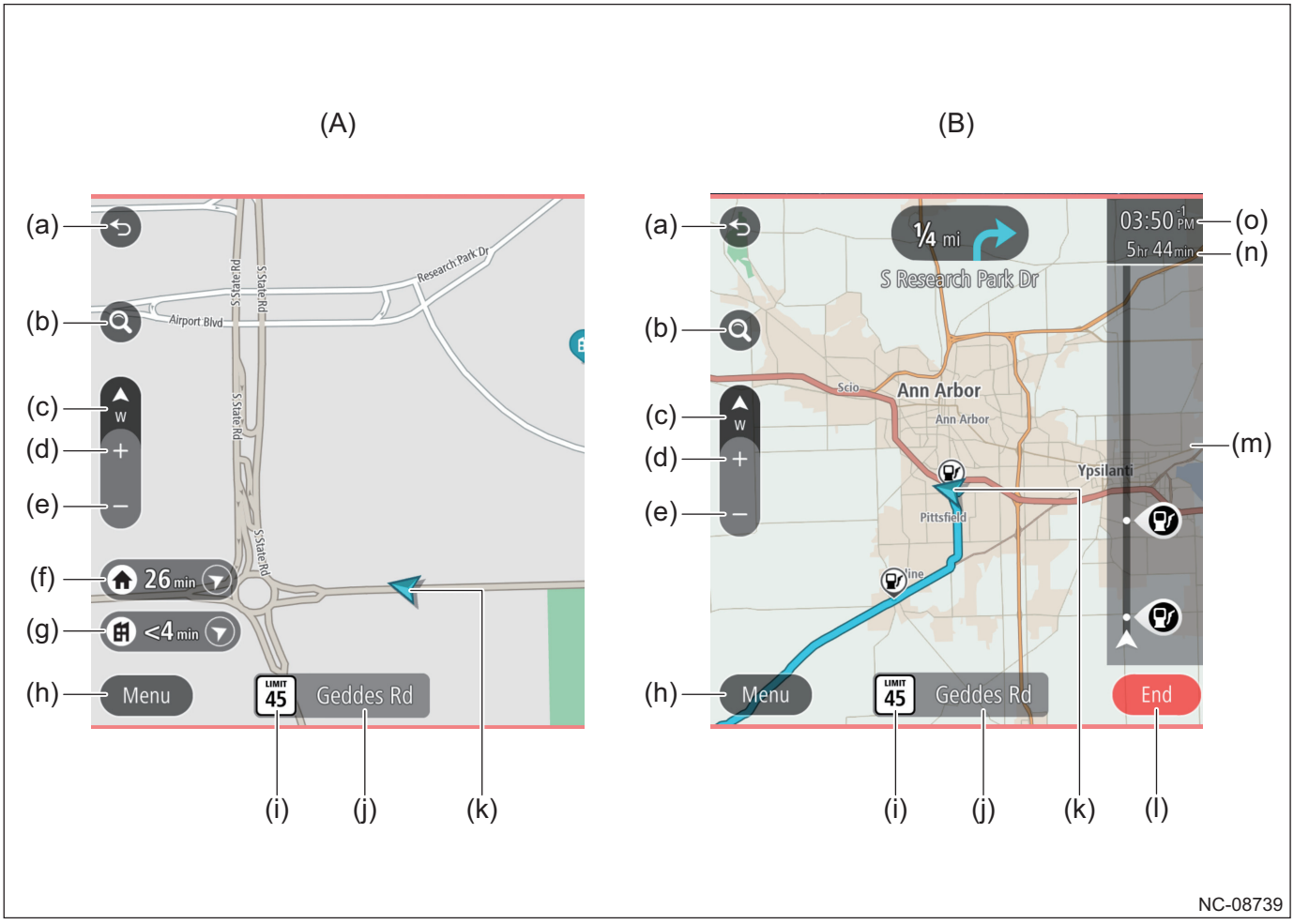
- To use SUBARU STARLINK, it is necessary to launch the SUBARU STARLINK application on the smartphone side in advance.
- When a smartphone is connected to the in-vehicle device with a USB cable or via Bluetooth, the <SUBARU STARLINK> icon can be selected on the in-vehicle device Home screen and SUBARU STARLINK can be used.

Navigation function (11.6-inch display navigation)

Select the <Map> icon on the Home Screen to display the map screen, where the navigation function can be used. It provides a detailed map display using a large display area and information that can be understood at a glance.

■ Map screen

- The map screen displays the current location, and various types of information and buttons according to the navigation conditions.



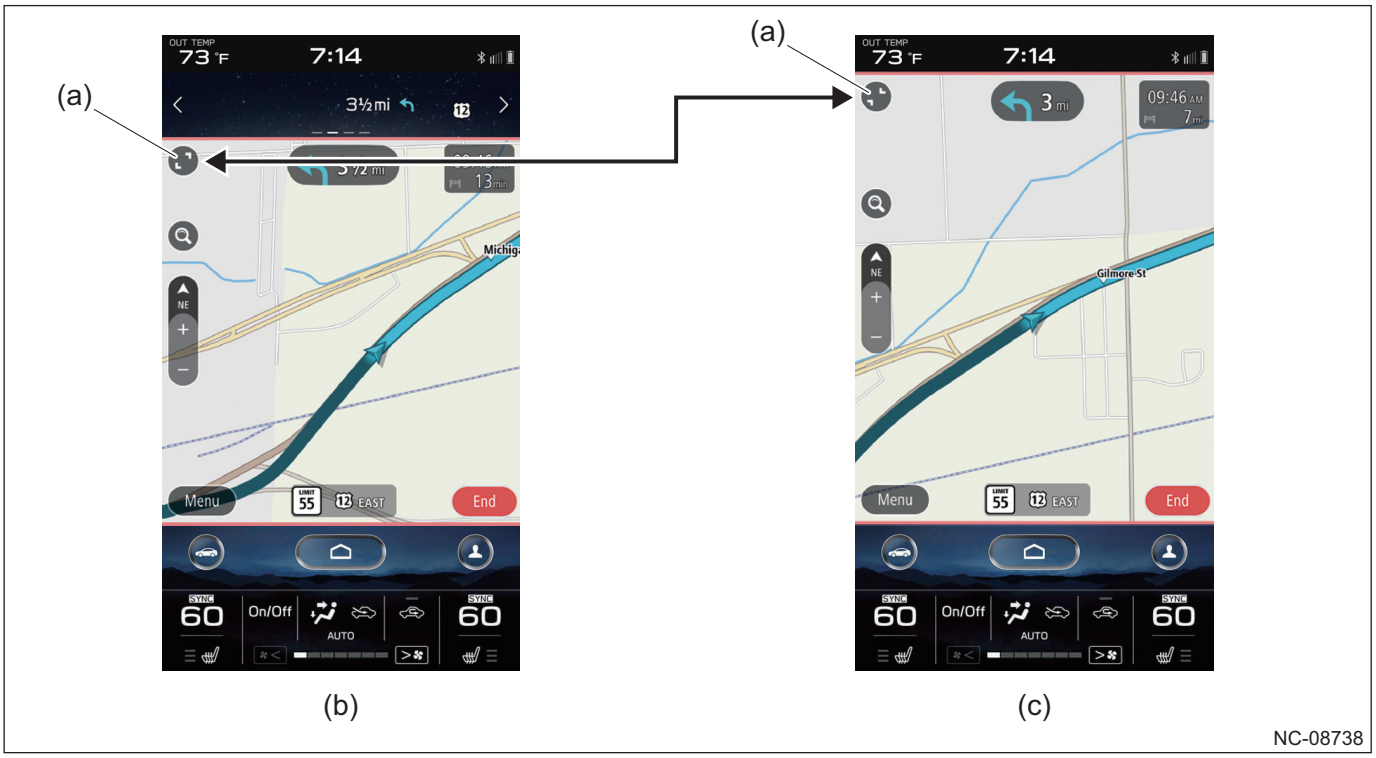
**The illustration shows a typical example that may differ from the actual display.*

Main display contents of map screen

Symbol	Display	Description
(A)	Current location display	Displayed when route guidance is not displayed.
(B)	Route guidance display	Displayed when the destination is set and the route guidance is started.
(a)	Current location display button	• Displayed when the map display is scrolled away from the current location. • Touch to return to the current location.
(b)	Destination search button	Displays the destination search screen.
(c)	Switch map orientation button (direction mark)	• Touch to switch the map orientation. • The mark indicates the north direction, and the direction display represents the travel direction of the vehicle.
(d)	<+> button	Switches the map scale.
(e)	<-> button	
(f)	Home shortcut display	• Displayed when home is registered in advance. • Displays the direction from the current location to home, and the required time. • Touch to search for the route home.
(g)	Work location shortcut display	• Displayed when the work location is registered in advance. • Displays the direction from the current location to the work location, and the required time. • Touch to search for the route to the work location.
(h)	<Menu> button	Displays the menu screen of the navigation function.
(i)	Speed limit mark	Displays the speed limit on the road of travel.
(j)	Road name display	• Displays the name of the road of travel. • Touch to register the current location. • Touch during route guidance to search for a route that avoids traffic congestion and closed roads.
(k)	Current location mark	Displays the current location of own vehicle.
(l)	<End> button	Ends the route guidance.
(m)	Route bar display	• Displayed when there are locations such as gas stations, parking lots, or rest areas along the route. • Touch to display the map for the corresponding location.
(n)	Remaining distance/remaining time display	• Displays the remaining distance and remaining time to the destination. • The setting can be changed to display the remaining distance only, remaining time only, or the remaining distance and remaining time alternately.
(o)	Estimated time of arrival display	• Displays the estimated time of arrival at the destination. • When multiple destinations are set, each time this is selected, the display switches between the estimated time of arrival at the next destination and the estimated time of arrival at the final destination. • Touch and hold to display or hide the route bar.

■ Switching the map screen display size

By selecting the zoom-in/zoom-out icons on the map screen, the display area of the map screen can be expanded to the information bar area.



**The illustration shows a typical example that may differ from the actual display.*

(a)	Zoom-in/zoom-out icon	(c)	Enlarged map screen (with information bar area not displayed)
(b)	Normal map screen (with information bar area displayed)		

■ Switching the map screen orientation

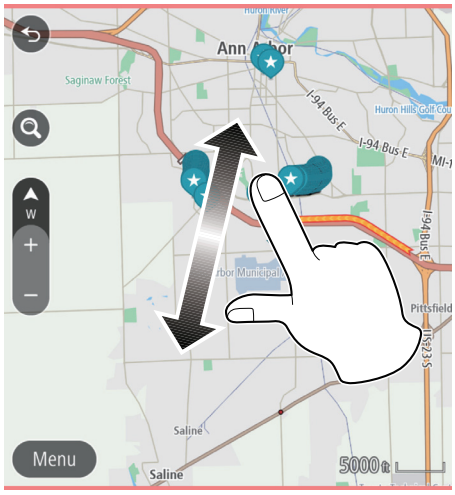
- The orientation of the displayed map can be switched.
- Switch the map orientation by touching the switch map orientation button on the map screen.

**The illustration shows a typical example that may differ from the actual display.*

Symbol	Map orientation	Description
(a)	2D north up	Always displays the map with north at the top regardless of the vehicle travel direction.
(b)	2D heading up	Always displays the map with the vehicle travel direction facing upward.
(c)	3D heading up	• Displays a 3D image of the map facing the vehicle travel direction. • Touch the map screen with 2 fingers and drag up or down to change the angle of the 3D display.

■ Map scale

- The map scale can be switched within a range of 2000 mi to 10 ft.
- Switch the scale by touching <-> or <+> on the map screen.
- In addition to the normal touch operation, the map scale can also be switched by pinching in or pinching out.



(a)

(b)

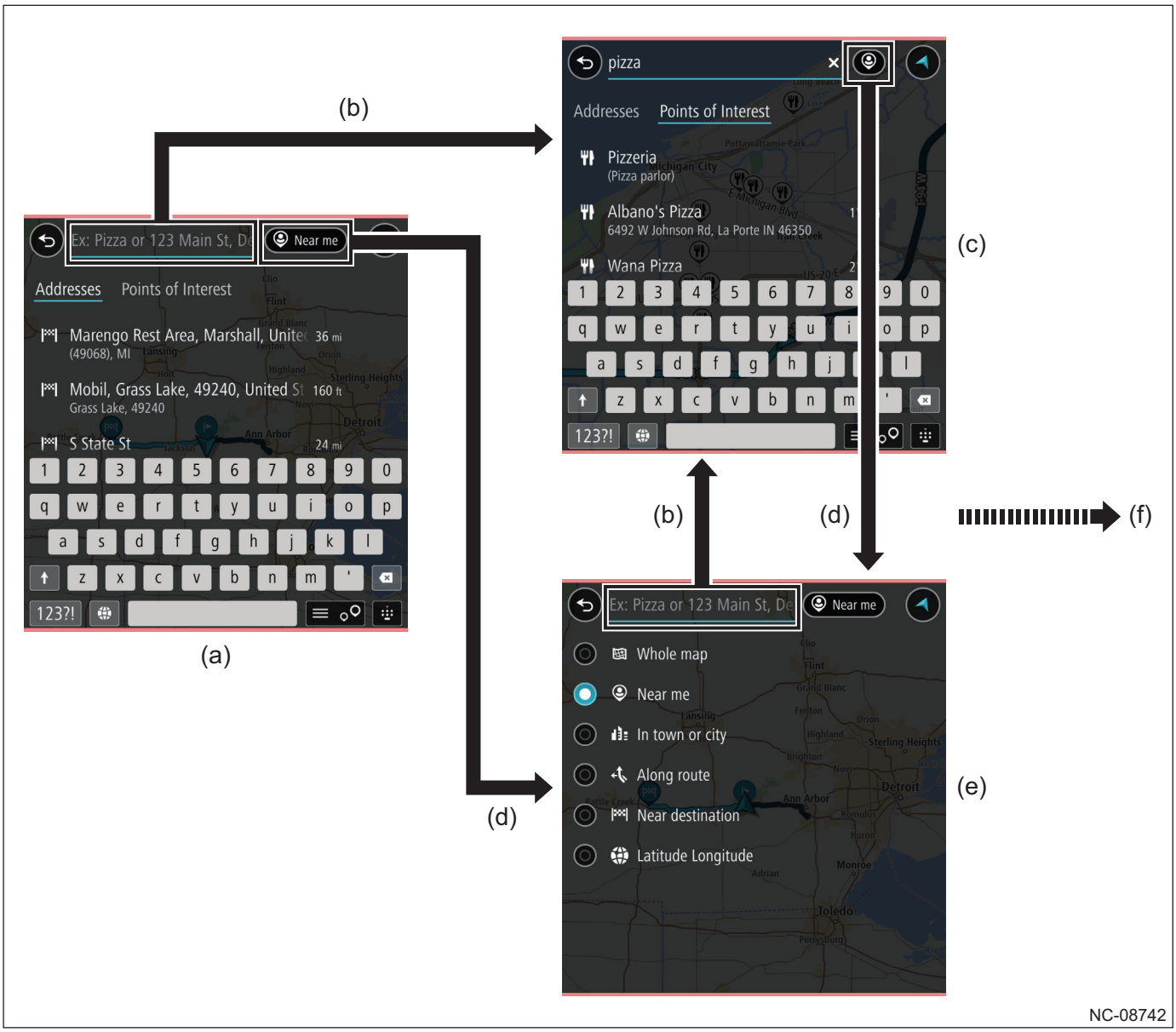
NC-08741

**The illustration shows a typical example that may differ from the actual display.*

Symbol	Operation	Overview
(a)	Pinch out	Touch with 2 fingers and widen them to enlarge the map scale.
(b)	Pinch in	Touch with 2 fingers and narrow them to shrink the map scale.

■ Destination setting

- The destination search can be started by entering a free word such as a facility name or place name, or by specifying a filter condition.
- After starting the destination search, set the destination according to the following flow.



**The illustration shows a typical example that may differ from the actual display.*

(a)	Destination search screen	(d)	Filter the search range
(b)	Enter a free word	(e)	Filter method selection screen
(c)	Search results screen	(f)	Destination setting

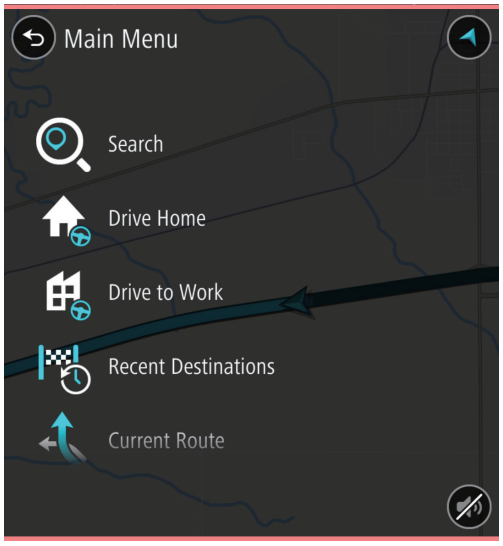
- The destination filter can be selected from the following conditions.

Filter condition list

Item	Description
<Whole map>	Used to search for the entered free word from all the recorded maps.
<Near me>	Used to search for the entered free word from locations near the current location.
<In town or city>	Used to search by entering the town or city name before entering the free word.
<Along route>	• Used to search during route guidance. • Only facilities along the route are searched.
<Near destination >	• Used to search during route guidance. • Used to search for facilities near the destination.
<Latitude Longitude>	Used to search by entering the latitude and longitude.

■ Navigation menu

- Various navigation function operations can be performed from the menu screen, such as setting the destination and changing the route.



NC-08743

**The illustration shows a typical example that may differ from the actual display.*

Menu screen display list

Item	Description
<Search>	Displays the destination search screen.
<Add Home>/<Drive Home>	• If home has not been registered, used to register home. • If home has been registered, used to search for the route home.
<Drive to Work>	• Displayed when the work location has been registered. • Used to search for the route to the work location.
<Recent Destinations>	Displays a list of locations set in the past as the destination.
<Current Route>	• Used to search during route guidance. • Used to display the route information, edit the route, and for other operations.
<Favorites>	Displays a list of registered locations.
<My Routes>	• Used to select a registered route. • When a route to a destination that was traveled in the past is registered in advance, the same route can be displayed at any time.
<Points of Interest>	• Displays the POI selection screen. • Used to search for POI by specifying a category or condition.
<Parking lot>	• Used to search for parking lots by specifying a condition. • The found parking lots are displayed on the map as icons.
<Gas Station>	• Used to search for gas stations by specifying a condition. • The found gas stations are displayed on the map as icons.
<Maps>	Displays the map update screen.
<Legal Information>	Displays the legal information screen, enabling confirmation of the map data copyrights and licenses.

Customization function

Vehicle settings

The infotainment system is equipped with a customization function for the vehicle settings that can be operated on the display. See the information section for details {11-226}.

Diagnosis

When an abnormality occurs in the system, the Cockpit Control Module (CCM) saves a Diagnostic Trouble Code (DTC) in the memory, and this code can be read with the SUBARU Select Monitor (SSM). For details, refer to the service manual.

Self check function

The Infotainment System has a self-check function (<Dealership Mode>) that can be carried out on the screen so that the user can check and display the system's operation status and confirm system information. See the information section for details {11-228}.

11.3 Telematics system

11.3.1 Overview

Overview

With some specifications, a data communication module (DCM) that can utilize the "SUBARU STARLINK" telematics system is available.

"Telematics" is a coined term derived from "Telecommunication" and "Informatics". The telematics system refers to the information, content service, and business that are provided by two-way communication with external networks, and also contains a communication user interface for the communication system in a mobile body such as vehicle.

SUBARU STARLINK registration

- SUBARU STARLINK is a subscription service. Before registering in SUBARU STARLINK, it is necessary to first create or update a MySubaru account on the MySubaru website (MySubaru.com (U4) or MySubaru.ca (C0)) that is the SUBARU owners' portal.
- The user can select the package of SUBARU STARLINK services that he or she wants to use by registering online from the MySubaru website (MySubaru.com (U4) or MySubaru.ca (C0)), the MySubaru smartphone app, a SUBARU dealer, or STARLINK Customer Care Advisor (1-855-753-2495).

Reference
Registration requires the vehicle identification number (VIN).

STARLINK Safety and Security

- Services are provided which support safe and enjoyable trips when the user drives the vehicle, and which support management and protection of the vehicle remotely when the user is away from it.

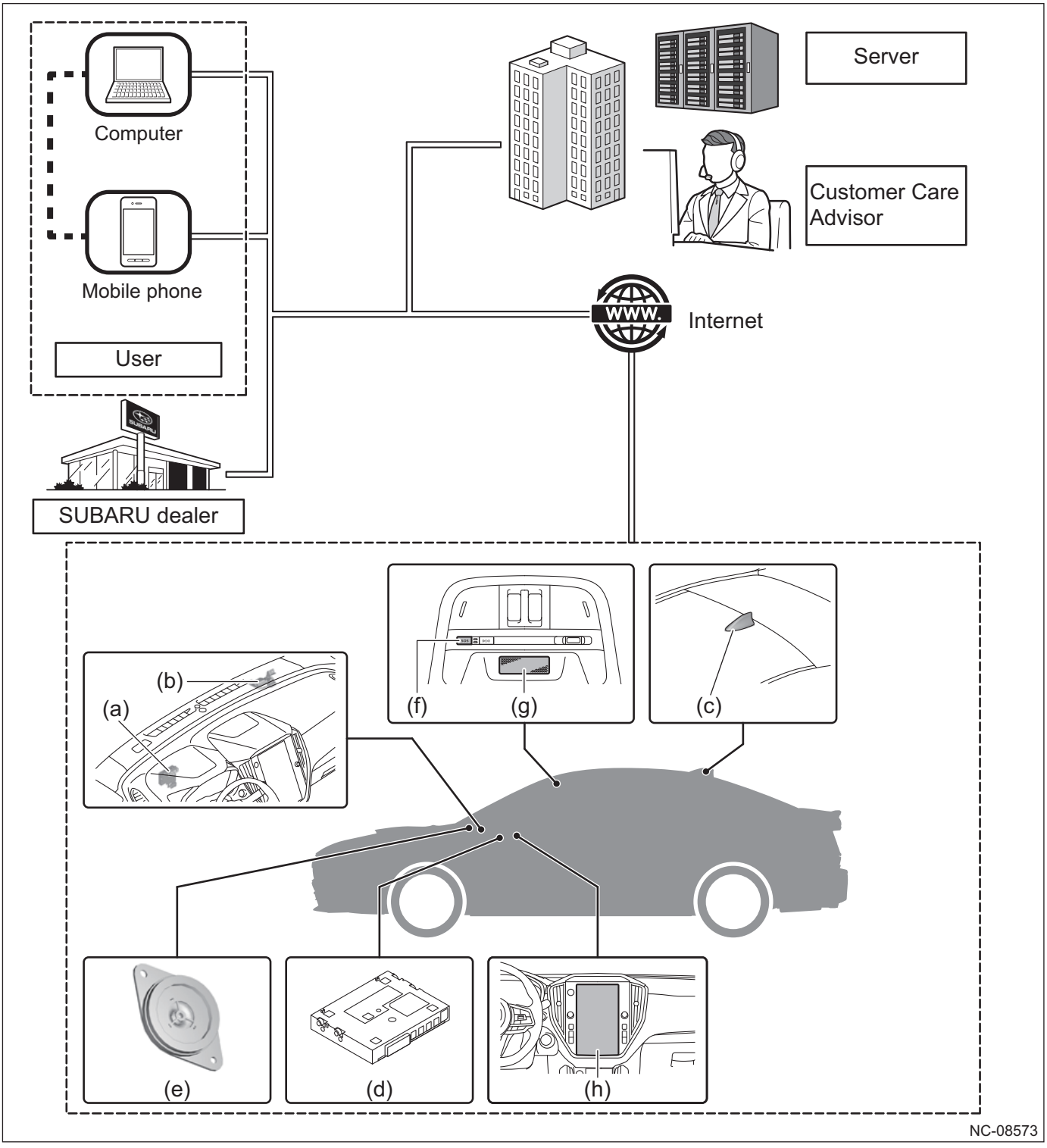
Wi-Fi Hotspot

- This service allows the user to use the vehicle as a wireless LAN access point. (U4 only)

STARLINK auxiliary functions

- The in-vehicle device program can be updated by wireless communication in order to keep the system up to date.
- The in-vehicle device allows vehicle trouble to be analyzed and corrections considered remotely by means of vehicle data transmission functions.
- In addition to English, French can also be selected for the audio guidance prompts. (C0 only)

SUBARU STARLINK service image



Communication system incorporated in the vehicle

Symbol	Display		Description
(a)	Telematics sub antenna		Communicates with the SUBARU STARLINK networks via an Internet connection when the telematics antenna cannot communicate due to damage or other problem.
(b)	GPS antenna		Receives signals from GPS satellites.
(c)	Roof antenna • Telematics antenna		Communication with the SUBARU STARLINK networks is performed via an Internet connection.
(d)	Data communication module (DCM)		This communication module is used to connect to the Internet by wireless communication. It supports high-speed data communication and ensures clear voice call quality, and is equipped with functions for transmitting the necessary signals to the server in an emergency or when an alert occurs.
(f)	Telematics button	SOS button	Press to connect to a Customer Care Advisor at the SUBARU STARLINK Call Center and request emergency assistance.
		i-button	Press to connect to a Customer Care Advisor at the SUBARU STARLINK Call Center and begin using Enhanced Roadside Assistance or Concierge services.
		LED status light	The LED status light indicates the system operation status.

Communication user interface incorporated in the vehicle

Symbol	Display	Description
(e)	Speaker	• Outputs the speech of the Customer Care Advisor at the SUBARU STARLINK Call Center or other call party. • The speakers that output the audio vary depending on the installed audio system.
(g)	Microphone	Collects the user speech when talking with a Customer Care Advisor at the SUBARU STARLINK Call Center and outputs it to the data communication module (DCM).
(h)	Center Information Display (CID)	Displays a screen when connecting to the SUBARU STARLINK Call Center.

Characteristics

SUBARU STARLINK services

The following services are provided by SUBARU STARLINK.

Reference
- Some services may not be available depending on the vehicle equipment.
- Some provided services may differ depending on the destination market. For details, please check the SUBARU STARLINK website.

Service		Description
STARLINK Safety and Security	Advanced Automatic Collision Notification	In the event of a collision that was severe enough to deploy the airbags, an emergency call to the SUBARU STARLINK Call Center is made automatically to request support from a Customer Care Advisor.
	SOS Emergency Assistance	In the event of an emergency, such as the driver experiencing sudden illness and being unable to drive, the user can press the SOS button and request assistance from a Customer Care Advisor at the SUBARU STARLINK Call Center.
	Enhanced Roadside Assistance	In the event of a flat tire or other issue that makes moving the vehicle difficult, the user can request roadside assistance from a Customer Care Advisor at the SUBARU STARLINK Call Center.
	STARLINK Concierge	A Customer Care Advisor at the SUBARU STARLINK Call Center searches information about the surrounding area, makes restaurant reservations, and provides other information to assist driving.
	Maintenance Notifications	Notifications of maintenance timing can be received based on vehicle driving mileage information.
	Vehicle Health Report	The vehicle health conditions can be managed by receiving notifications of diagnosis based on vehicle information.
	Vehicle Condition Check	Diagnosis data based on vehicle information can be checked with MySubaru.
	Diagnostic Alerts	Notification can be received when a vehicle warning light turned on.
	Service Appointment Scheduler	Reservations for servicing at the desired SUBARU dealer and recommendations for servicing appointments based on the vehicle conditions and other information can be received.

Service			Description
STARLINK Safety and Security	Remote Services	Remote Engine Start with Climate Control*1	The vehicle engine can be started and the air conditioning operated by remote operation.
		Remote Door Lock & Unlock	The vehicle door lock status can be operated by remote operation.
		Remote Horn & Lights	The vehicle horn and hazard lights can be operated by remote operation.
		Remote Vehicle Locator	The current vehicle location measured by the vehicle based on received GPS information can be checked with MySubaru.
	Vehicle Security Alarm Notification		Notification can be received when the vehicle security alarm was activated.
	Stolen Vehicle Recovery Plus	Stolen Vehicle Recovery	If the vehicle was stolen, the vehicle position information is provided to the police to assist with recovery of the stolen vehicle.
		Stolen Vehicle Flashing Light	Upon request from the police department, the vehicle hazard lights can be flashed by remote operation to help identify the stolen vehicle.
		Stolen Vehicle Immobilizer	Upon request from the police department, vehicle engine start can be prevented in order to help recover the stolen vehicle.
	Vehicle Alerts	Boundary Alert	When a boundary line is set with MySubaru, notification can be received if the driver using the vehicle crossed that boundary line.
		Speed Alert	When a speed is set with MySubaru, notification can be received if the driver using the vehicle exceeded the set speed.
		Curfew Alert	When a time is set with MySubaru, notification can be received if the driver using the vehicle used the vehicle during the set time.
	Destination to Vehicle*2		The user can depart for the destination immediately after entering the vehicle by searching for the destination on MySubaru and sending the result to the vehicle navigation system.
Wi-Fi Hotspot*3			The in-vehicle device communicates with a mobile phone network, allowing the user's vehicle to be used as a wireless LAN access point.
Quality Management	SUBARU STARLINK System Update		The system can be kept up to date by downloading update programs from the server via wireless communication and updating the data communication module (DCM).
	Driving Recorder		When considering the action to take in response to vehicle trouble, when the analysis file is received from the server, the data communication module (DCM) automatically collects the necessary data and sends it to the server.

**1: CVT only*
**2: Only for models with Navi & High grade audio*
**3: U4 only*

Data communication module (DCM)

The data communication module (DCM) is installed inside the cabin at the center of the vehicle (above the Cockpit Control Module (CCM) inside the instrument panel) where the effects of a collision are small. It can operate using the DCM internal battery (Back Up Battery (BUB)) even when power is not supplied from the battery of the vehicle at the time of a collision (front collision) or during an emergency call, allowing the emergency call to continue.

Call communication method and positioning method

- The call communication method uses 4G/LTE. A diversity type communication antenna is adopted, creating a structure that can ensure stable reception performance. The telematics antenna is installed on the roof antenna, and the telematics sub antenna is installed inside the instrument panel.
- The positioning method uses the Global Positioning System (GPS) that utilizes satellites (positioning satellites). The GPS antenna for receiving these signals is installed inside the instrument panel.

Links with MySubaru

- SUBARU STARLINK services such as vehicle remote operation, and receiving various notifications and alerts, utilize the SUBARU owner's portal MySubaru website (MySubaru.com (U4) or MySubaru.ca (C0)) or the smartphone MySubaru app.
- Notifications and alerts can be received by email, text message, or push notification by configuring the settings from MySubaru.

Reference
Installing the MySubaru app requires a smartphone operating on Android 8.0 or later, or Apple iOS 10.3.2 or later.

Handling precautions

Precautions when using SUBARU STARLINK services

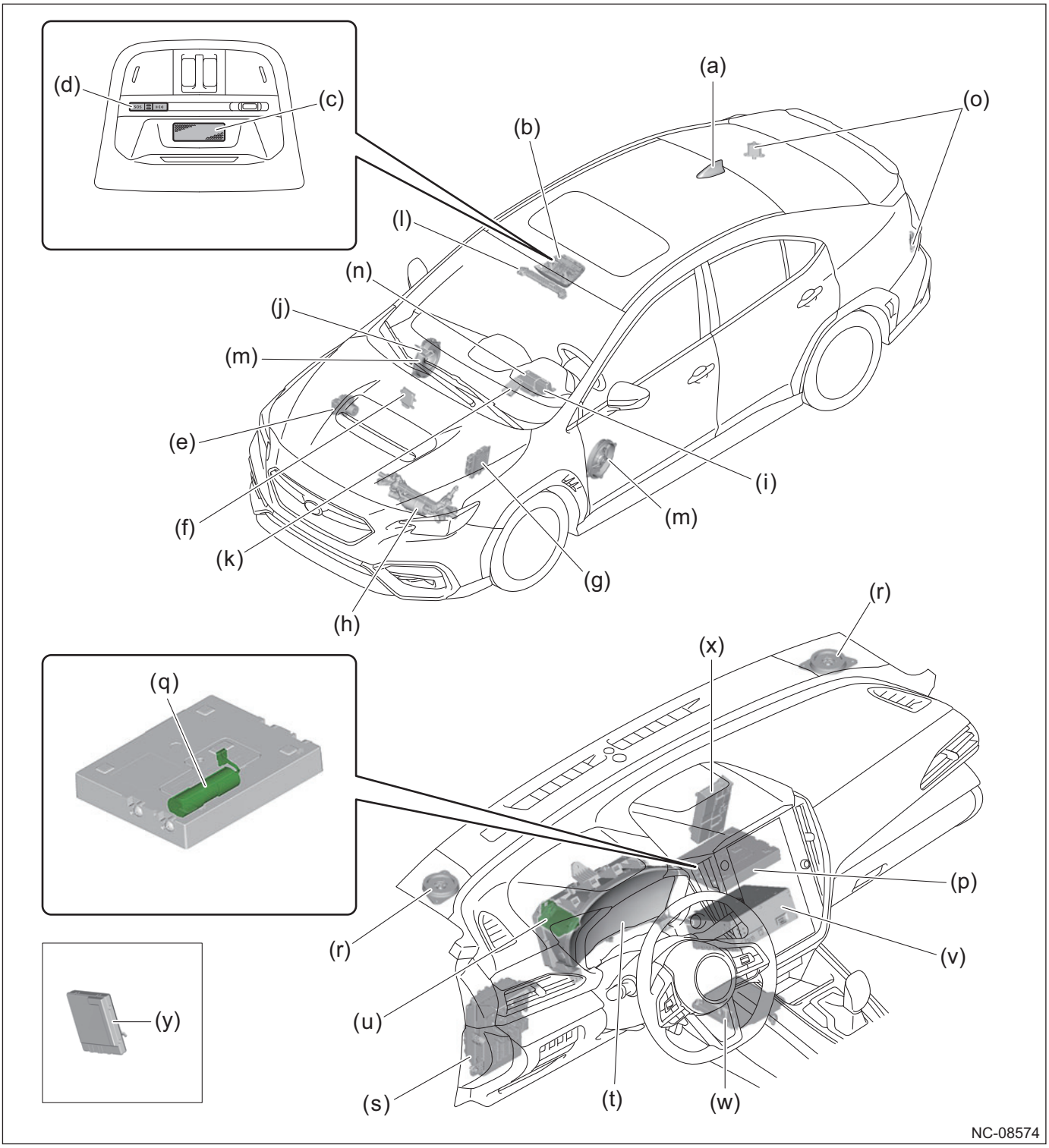
- If the signal environment is poor while driving or in the location where the vehicle is stopped, this will affect the communications of the data communication module (DCM) and may prevent SUBARU STARLINK services from being used or reduce the quality of those services.
- In order to protect the vehicle battery, if the ignition switch or engine switch is not turned ON for 14 days or longer after it was turned OFF, the data communication module (DCM) enters shutdown mode. Shutdown mode is canceled when the ignition switch or engine switch is turned ON.
- If aftermarket equipment (such as an anti-theft device or OBD monitor) was connected to the data link connector, there may be an effect on SUBARU STARLINK services and they may not function correctly.

Precaution when replacing the data communication module (DCM)

- A new data communication module (DCM) performs control that changes the specifications according to the vehicle model where it is installed. When the ignition switch or engine switch is turned ON for the first time after it was installed, it identifies and sets the vehicle model based on model information received via CAN communication. Therefore when replacing the module for repairs or other reason, do not install the new data communication module (DCM) into any vehicle other than the vehicle where it will be used.

11.3.2 Component

Component layout drawing



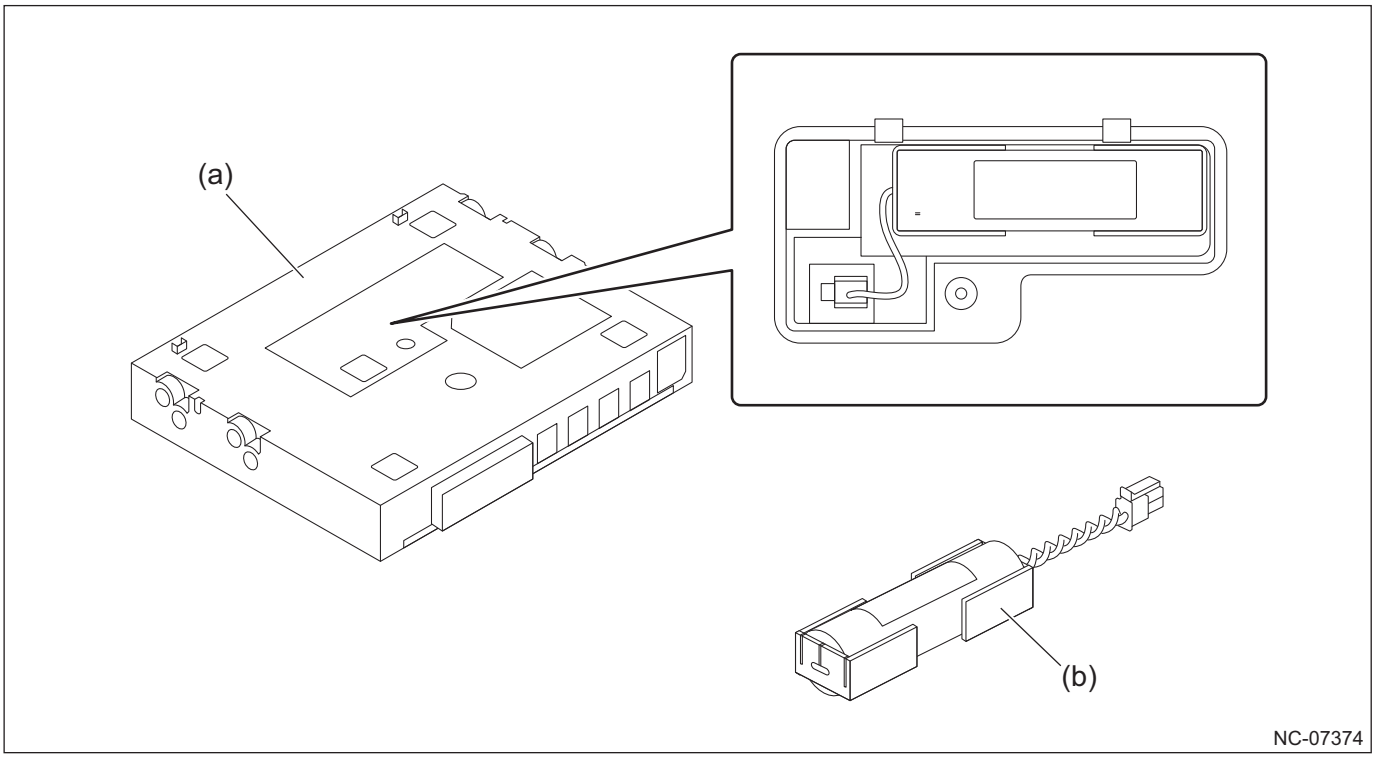
(a)	Roof antenna • Telematics antenna	(n)	Power Amplifier
(b)	Map light	(o)	Rear radar
(c)	Microphone	(p)	Data communication module (DCM)
(d)	Telematics button • LED status light • SOS button • i-button	(q)	Back up battery (BUB)
(e)	VDC CM & H/M	(r)	Side speaker
(f)	Transmission control module (TCM)	(s)	Body Integrated Unit
(g)	Engine Control Module (ECM)	(t)	Combination meter
(h)	Power steering CM	(u)	Auto headlight beam leveler CM
(i)	Telematics sub antenna	(v)	Cockpit Control module (CCM)
(j)	GPS antenna	(w)	Airbag CM
(k)	Central gateway CM (CGW)	(x)	A/C CM
(l)	Stereo camera	(y)	Keyless access CM
(m)	Front door speaker		

Component details

Data communication module (DCM)

Exchanges data with modules installed in various parts of the vehicle via CAN communication. For external communication, it communicates with the SUBARU STARLINK Call Center and server via the telematics antenna and telematics sub antenna to provide SUBARU STARLINK services.

A secondary battery is adopted for the Back Up battery (BUB), which is charged from the vehicle battery while the ignition switch or engine switch is ON. In addition, degradation of the secondary battery is monitored, and the specifications provide notice of the replacement timing via an LED status light before the battery fails to function as a backup power supply.



(a) Data communication module (DCM)

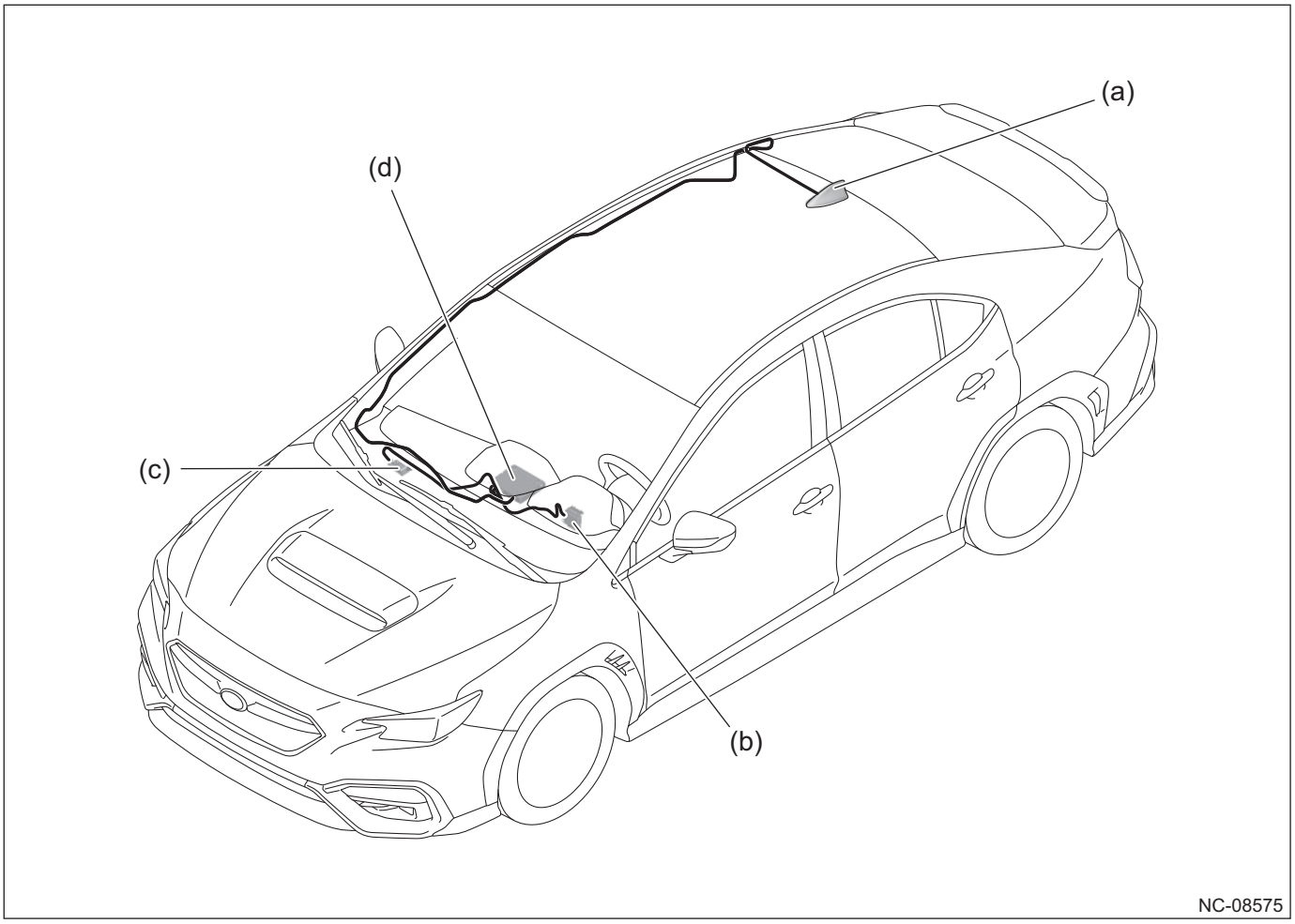
(b) Back up battery (BUB)

Antenna for telephone and positioning

A diversity type telematics antenna is used for telephone calls, and 4G/LTE are supported as the communication method.

A GPS antenna is used for positioning, and the Global Positioning System (GPS) that utilizes satellites (positioning satellites) is supported as the positioning method.

Antennas are placed on the vehicle front and rear (outside and inside the vehicle) so that even if one antenna is damaged in a collision or other accident, communication using the other antenna will still be possible.



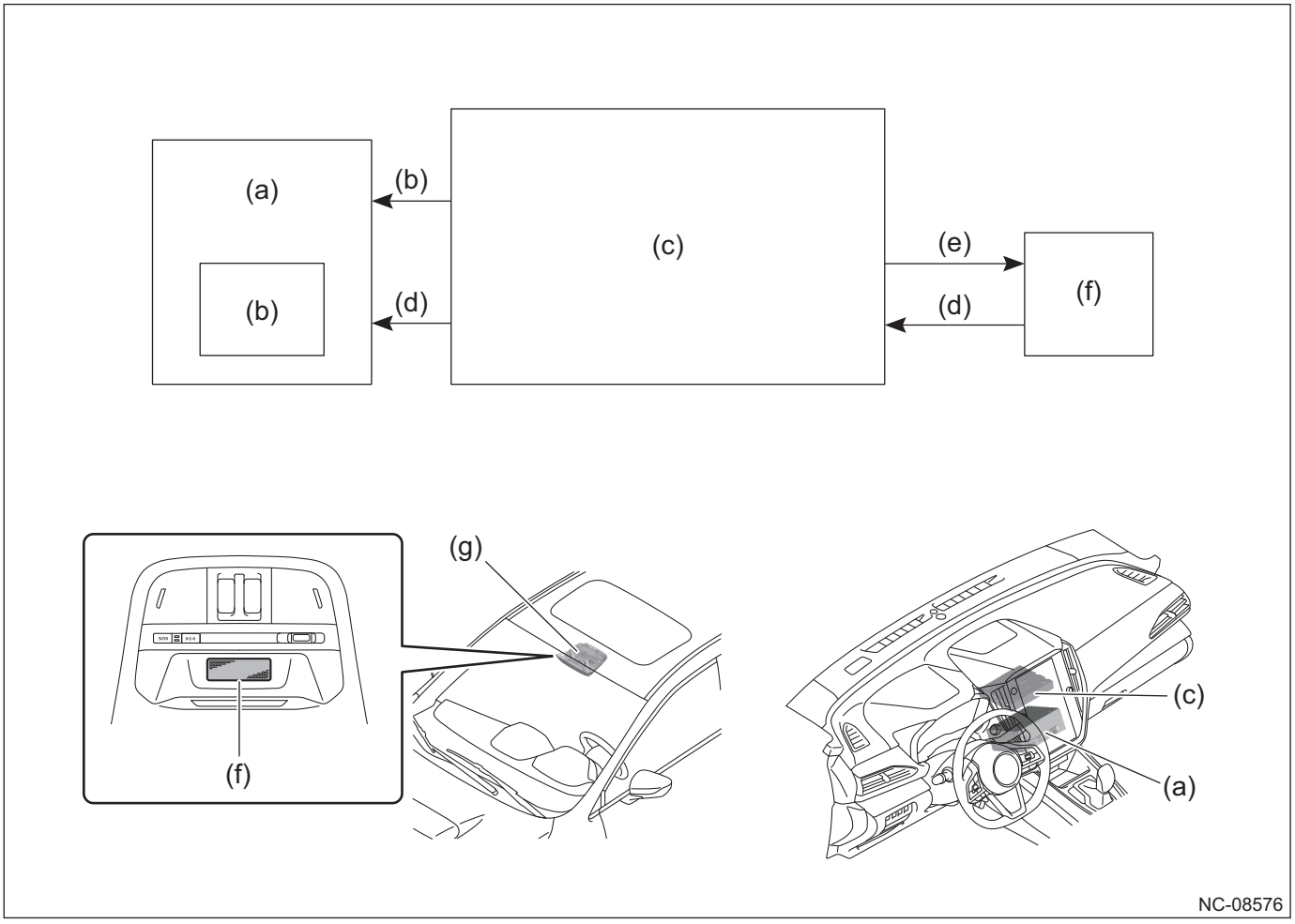
(a)	Roof antenna • Telematics antenna	(c)	GPS antenna
(b)	Telematics sub antenna	(d)	Data communication module (DCM)

Microphone and speaker

The data communication module (DCM) sends a mute signal to the Cockpit Control Module (CCM) when an emergency call is made, so only the audio for emergency call sounds inside the cabin.

■ Microphone connection configuration diagram

The microphone for talking with a Customer Care Advisor at the SUBARU STARLINK Call Center is also used as the microphone that is connected to the infotainment system.



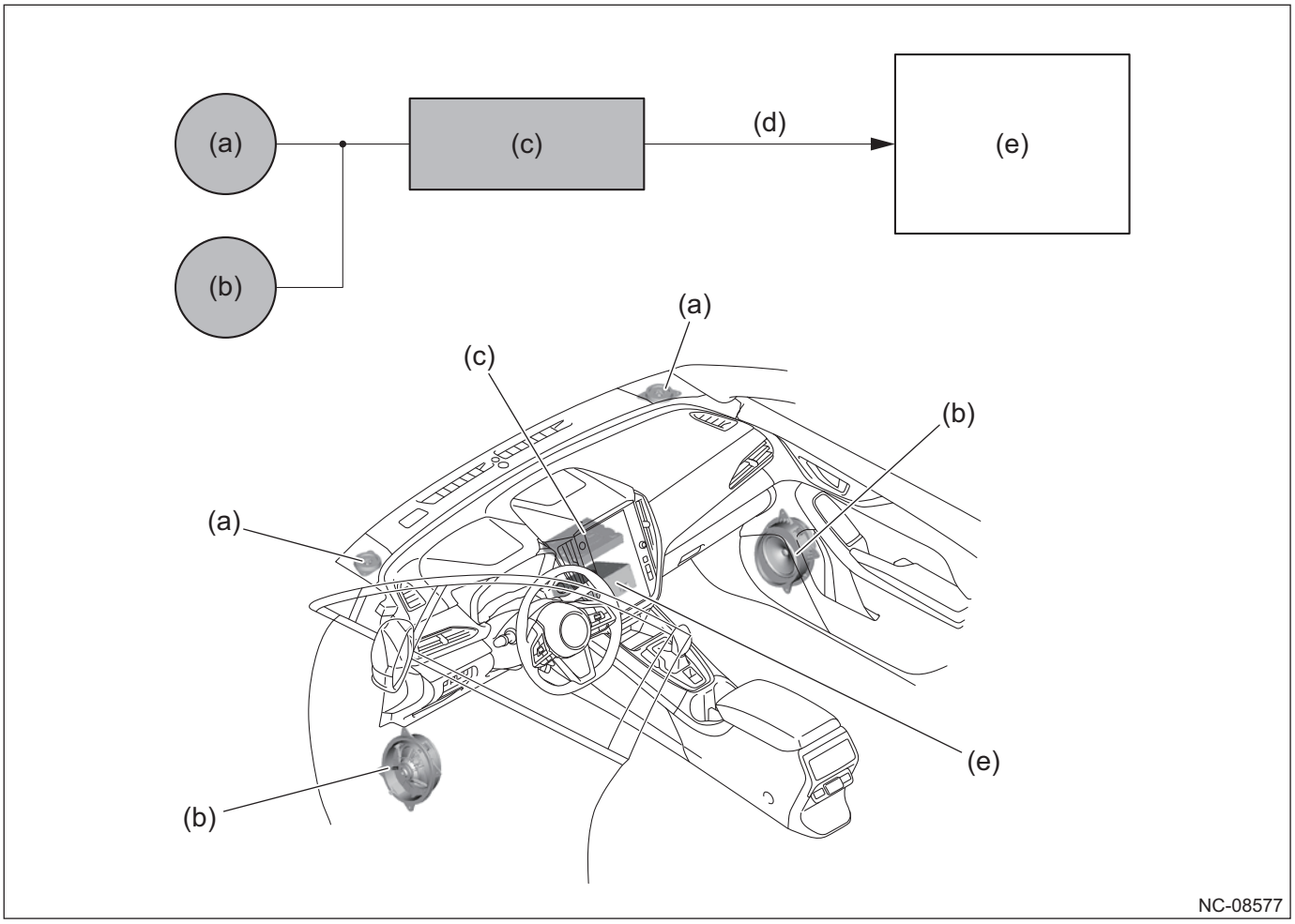
(a) Cockpit Control module (CCM)
(b) Mute signal
(c) Data communication module (DCM)
(d) Microphone signal
(e) Microphone power supply
(f) Microphone
(g) Map light

■ Speaker connection diagram

The structure uses speakers on the front side left and right so that in the event of a collision (side collision), even if one of the speakers is damaged, it will be possible to hear the call audio from the speaker on the opposite side. Note that the speakers that output the audio vary depending on the specification of the installed audio system.

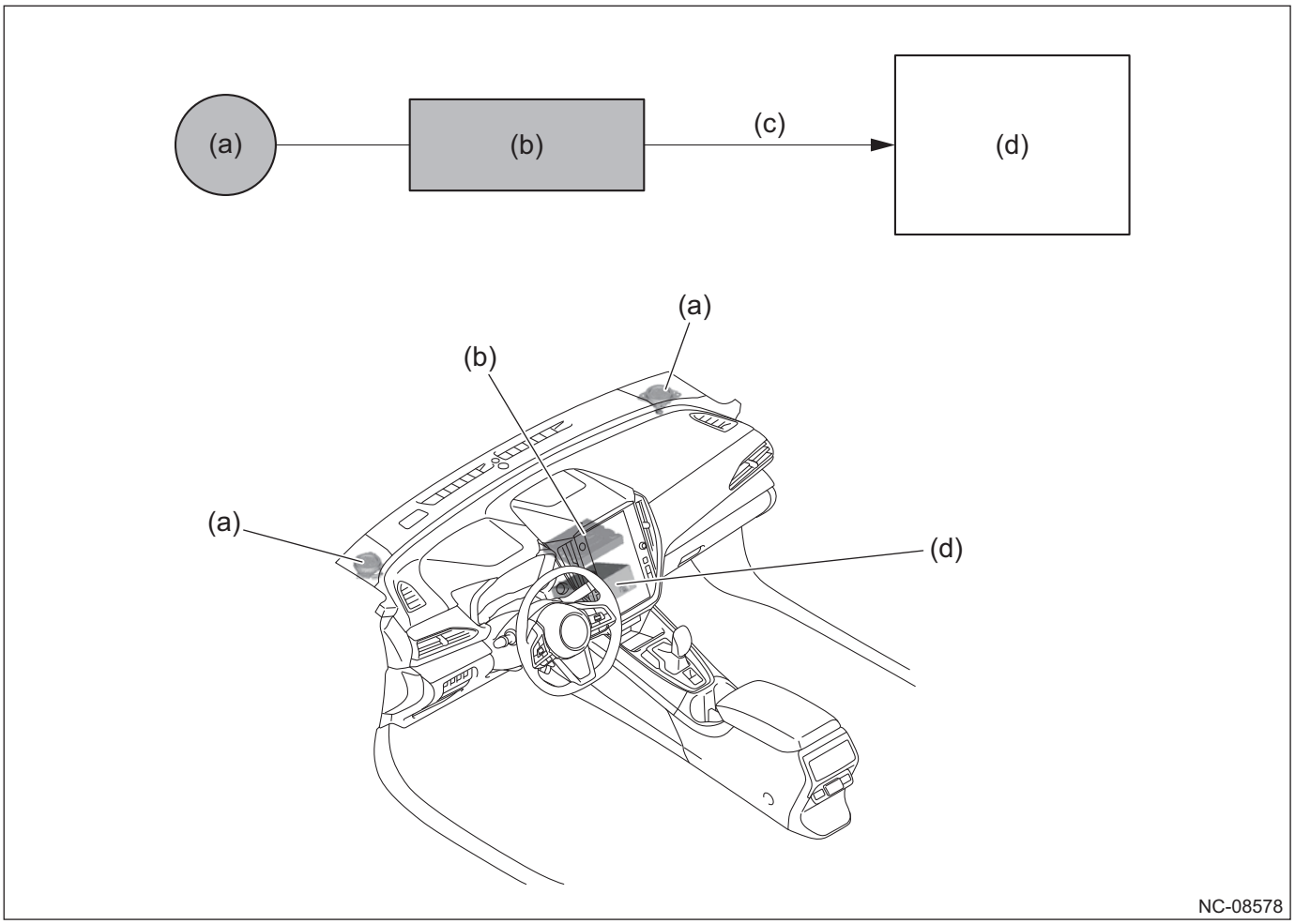
Because the specifications allow the voice of the Customer Care Advisor at the SUBARU STARLINK Call Center to be output from both the left and right sides, this also makes it easier to understand the other person during a call in the same way as when making a normal hands-free call. The call volume can be adjusted by means of the audio system volume knob.

6 speakers (standard audio system)



(a) Side speaker
(b) Front door speaker
(c) Data communication module (DCM)
(d) Mute signal
(e) Cockpit Control module (CCM)

11 speakers (Harman/Kardon® audio system)

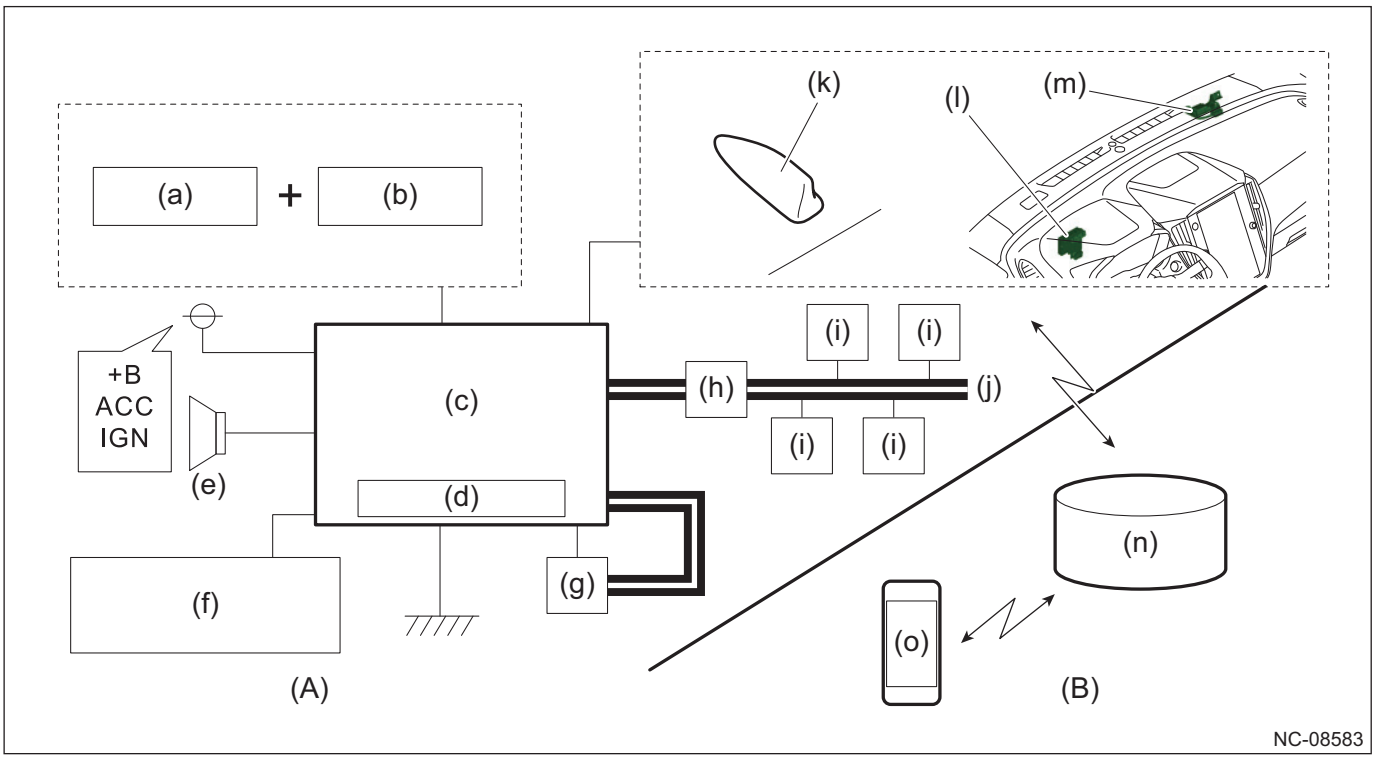


(a) Side speaker
(b) Data communication module (DCM)
(c) Mute signal
(d) Cockpit Control module (CCM)

11.3.3 Construction and Operation

System diagram

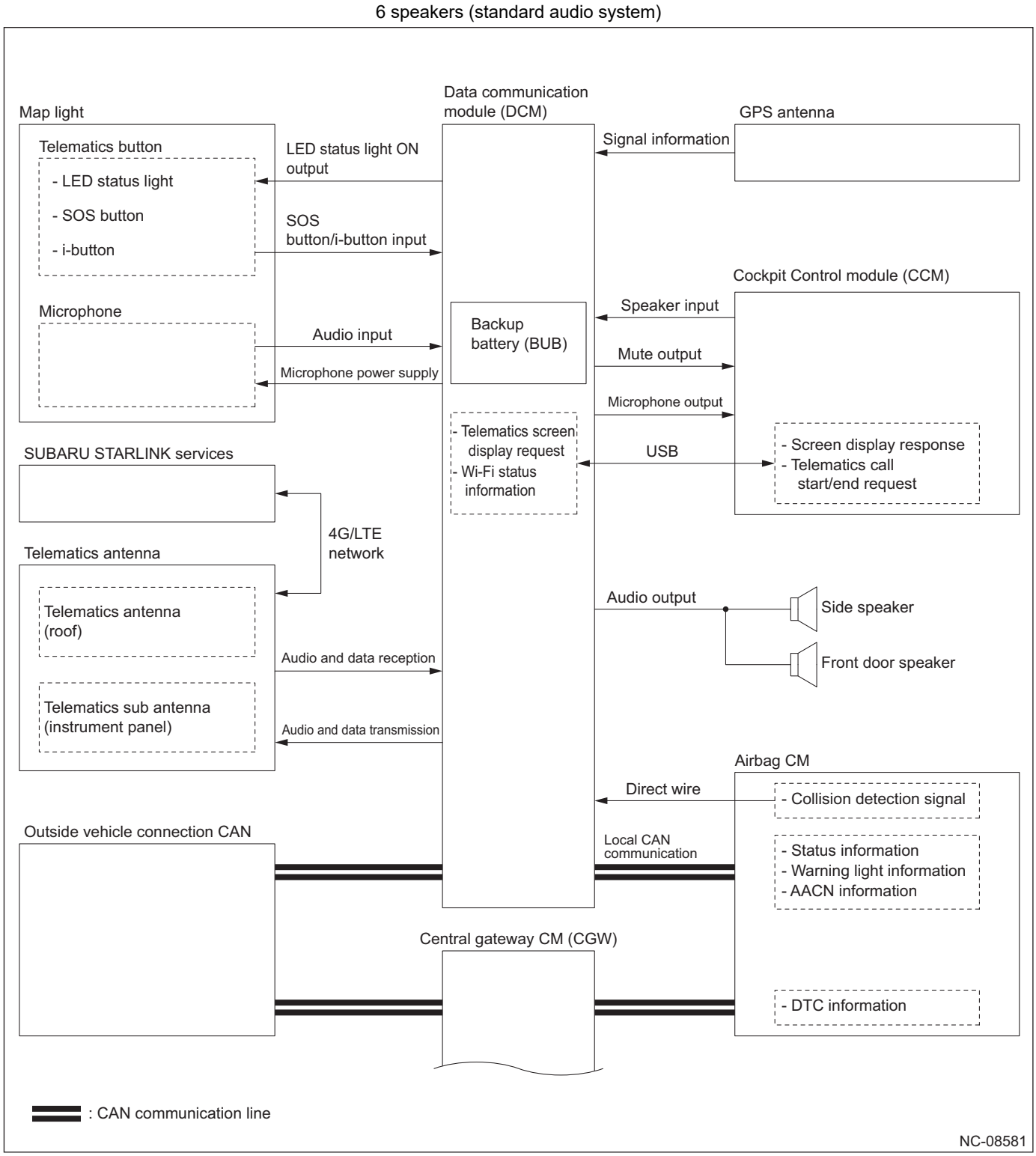
System configuration diagram

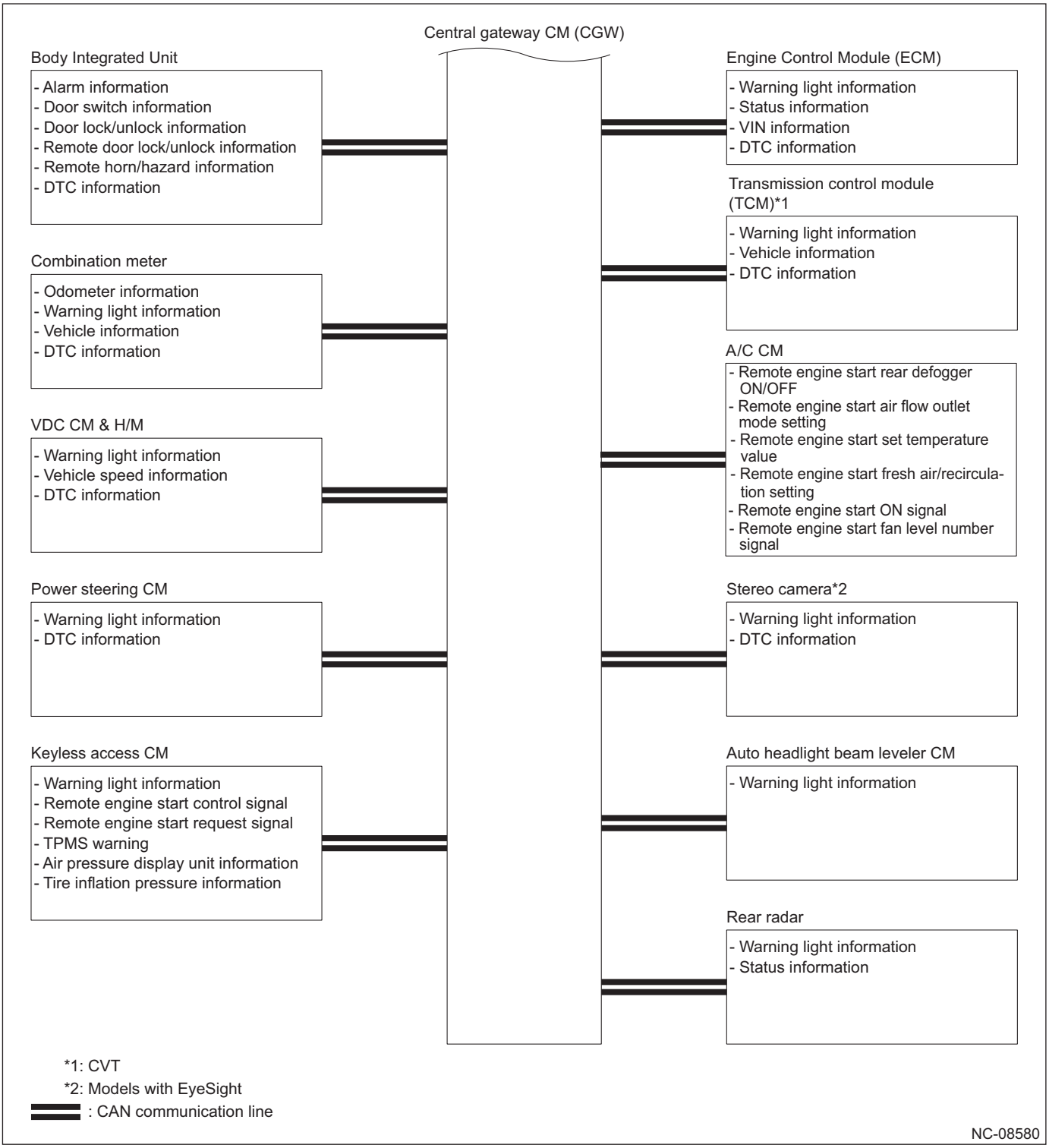


(A)	Vehicle	(B)	SUBARU of America (SOA) side
(a)	Microphone	(i)	Control computer of each device installed in vehicle
(b)	Telematics button	(j)	CAN communication
(c)	Data communication module (DCM)	(k)	Roof antenna (telematics antenna)
(d)	Back up battery (BUB)	(l)	Telematics sub antenna
(e)	Speaker	(m)	GPS antenna
(f)	Cockpit Control module (CCM)	(n)	External server
(g)	Airbag CM	(o)	Smartphone
(h)	Central gateway CM (CGW)		

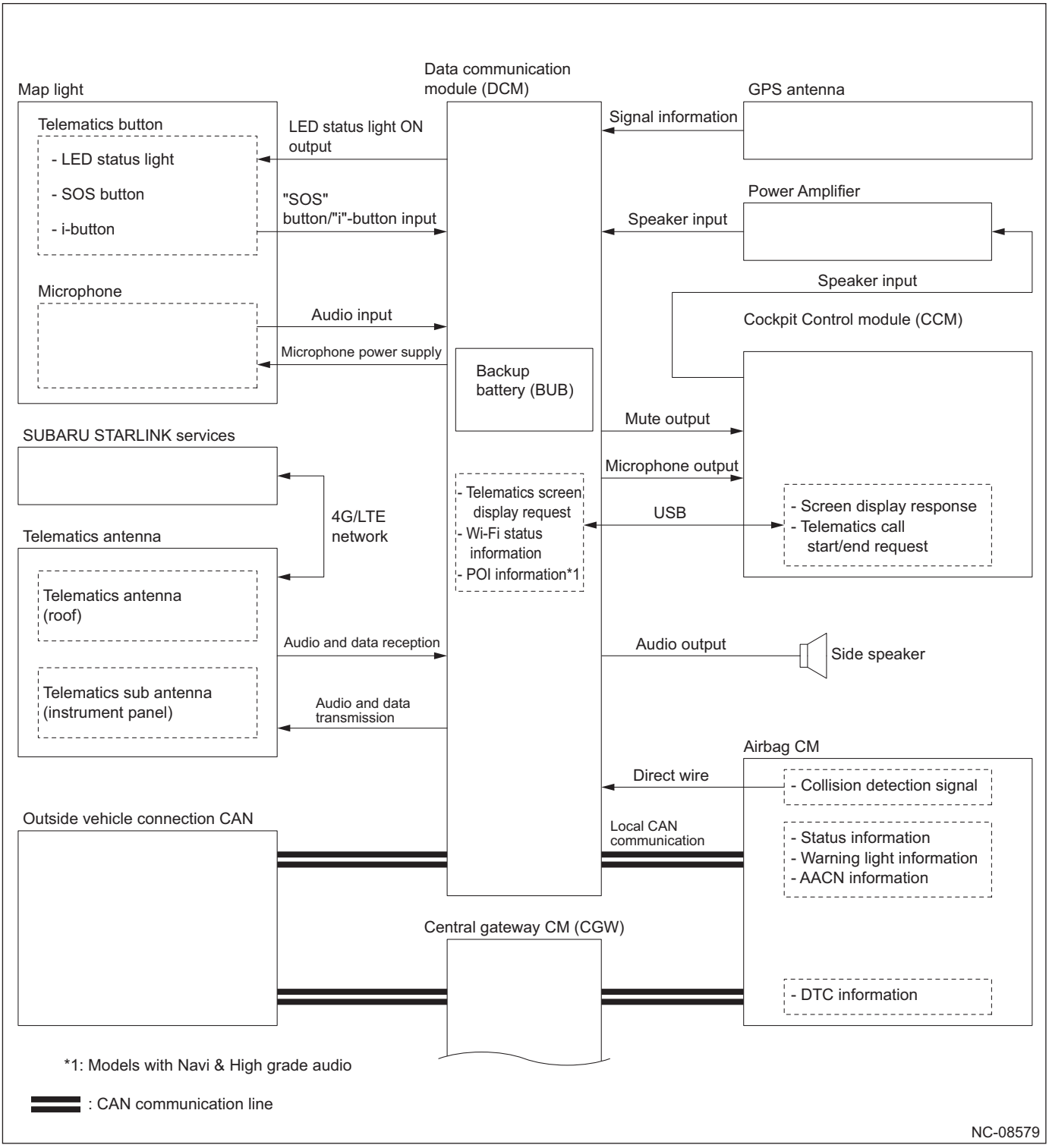
System block diagram

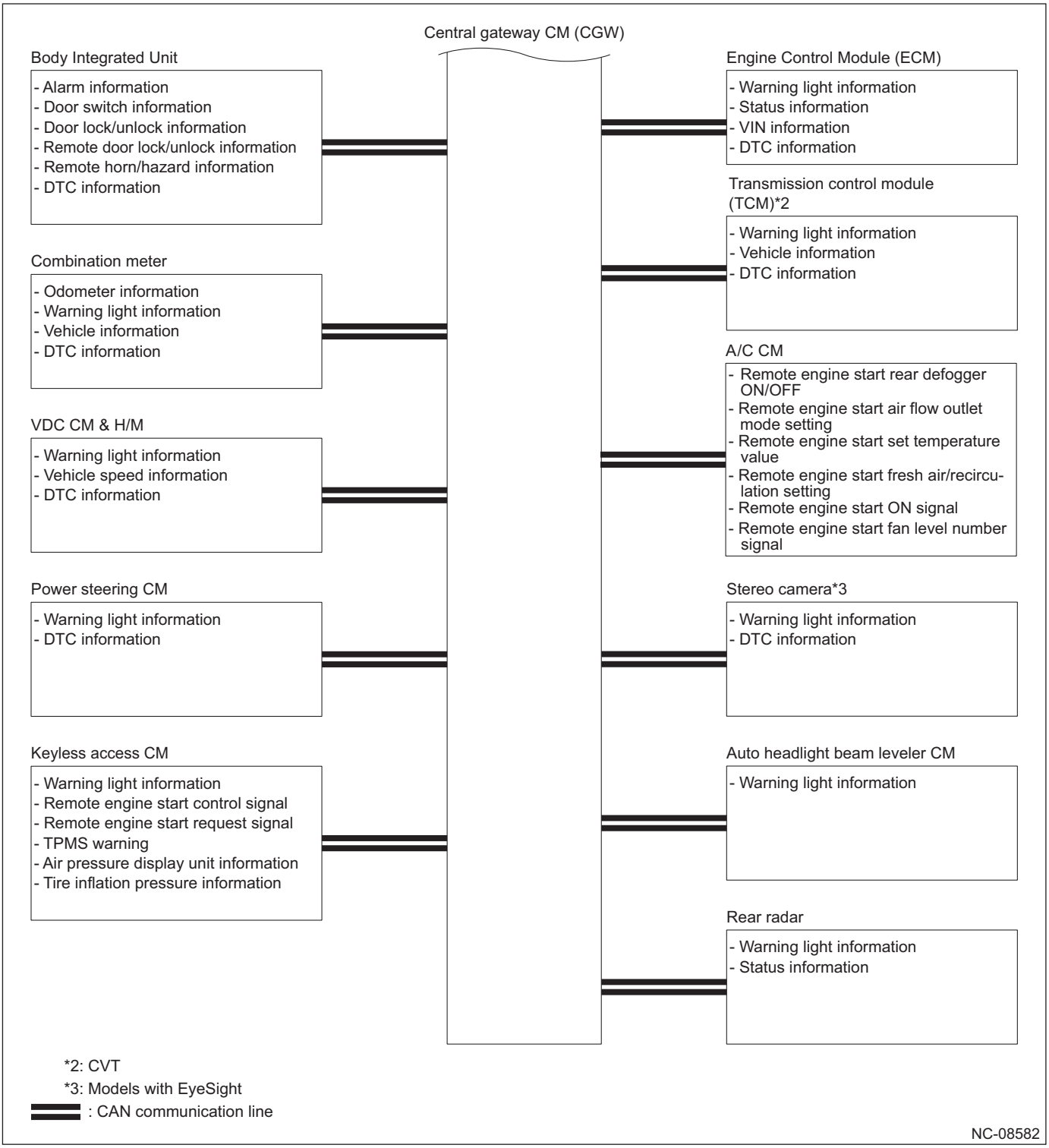
Main signals exchanged between the data communication module (DCM) and related parts and control modules




Central gateway CM (CGW)
Body Integrated Unit
- Alarm information
- Door switch information
- Door lock/unlock information
- Remote door lock/unlock information
- Remote horn/hazard information
- DTC information
Combination meter
- Odometer information
- Warning light information
- Vehicle information
- DTC information
VDC CM & H/M
- Warning light information
- Vehicle speed information
- DTC information
Power steering CM
- Warning light information
- DTC information
Keyless access CM
- Warning light information
- Remote engine start control signal
- Remote engine start request signal
- TPMS warning
- Air pressure display unit information
- Tire inflation pressure information
Engine Control Module (ECM)
- Warning light information
- Status information
- VIN information
- DTC information
Transmission control module (TCM)*1
- Warning light information
- Vehicle information
- DTC information
A/C CM
- Remote engine start rear defogger ON/OFF
- Remote engine start air flow outlet mode setting
- Remote engine start set temperature value
- Remote engine start fresh air/recirculation setting
- Remote engine start ON signal
- Remote engine start fan level number signal
Stereo camera*2
- Warning light information
- DTC information
Auto headlight beam leveler CM
- Warning light information
Rear radar
- Warning light information
- Status information
*1: CVT
*2: Models with EyeSight
: CAN communication line
NC-08580

11 speakers (Harman/Kardon® audio system)




Central gateway CM (CGW)
Body Integrated Unit
- Alarm information
- Door switch information
- Door lock/unlock information
- Remote door lock/unlock information
- Remote horn/hazard information
- DTC information
Combination meter
- Odometer information
- Warning light information
- Vehicle information
- DTC information
VDC CM & H/M
- Warning light information
- Vehicle speed information
- DTC information
Power steering CM
- Warning light information
- DTC information
Keyless access CM
- Warning light information
- Remote engine start control signal
- Remote engine start request signal
- TPMS warning
- Air pressure display unit information
- Tire inflation pressure information
Engine Control Module (ECM)
- Warning light information
- Status information
- VIN information
- DTC information
Transmission control module (TCM)*2
- Warning light information
- Vehicle information
- DTC information
A/C CM
- Remote engine start rear defogger ON/OFF
- Remote engine start air flow outlet mode setting
- Remote engine start set temperature value
- Remote engine start fresh air/recirculation setting
- Remote engine start ON signal
- Remote engine start fan level number signal
Stereo camera*3
- Warning light information
- DTC information
Auto headlight beam leveler CM
- Warning light information
Rear radar
- Warning light information
- Status information
*2: CVT
*3: Models with EyeSight
: CAN communication line
NC-08582

Main component functions

6 speakers (standard audio system)

<table>
<tr><th colspan="3">Part name</th><th>Function</th></tr>
<tr><td colspan="3">Map light</td><td>Contains the microphone and telematics button.</td></tr>
<tr><td colspan="3">Microphone</td><td>Converts the user's voice into an electrical signal and sends the signal to the data communication module (DCM).</td></tr>
<tr><td rowspan="4">Parts contained inside the telematics button</td><td colspan="2">SOS button</td><td>Press to connect to SOS Emergency Service.</td></tr>
<tr><td colspan="2">i-button</td><td>Press to start a connection to Enhanced Roadside Assistance or STARLINK Concierge.</td></tr>
<tr><td rowspan="2">LED status light</td><td>Green</td><td>• Turns on when the system is operating normally within a SUBARU STARLINK service area.
• Flashes during an emergency call, and turns off when an error occurred in the system or when registration for SUBARU STARLINK services has not been completed.</td></tr>
<tr><td>Red</td><td>• Turns on to warn the user when an error occurs in the system.
• Turns off when the system is operating normally or when registration for SUBARU STARLINK services has not been completed.</td></tr>
<tr><td colspan="3">Data communication module (DCM)</td><td>• Installed inside the cabin at the center of the vehicle (above the Cockpit Control Module (CCM) inside the instrument panel) where the effects of a collision are small.
• This is the communications device that connects to SUBARU STARLINK services via wireless communication using the internal mobile telephone module, and connects to the SUBARU STARLINK Call Center when the SOS button or i-button is operated.
• When a collision detection signal is received from the airbag CM, an emergency call starts automatically.
• In addition to functions for data communication with the control computers for various device installed in the vehicle, it also has control functions which send and receive information between the server and vehicle for SUBARU STARLINK services such as Remote Services and Vehicle Alerts.
• The microphone and speakers are connected to it, and when speaking with a Customer Care Advisor at the SUBARU STARLINK Call Center, it sends the user voice collected by the microphone and outputs the voice of the Customer Care Advisor from the speakers. The microphone and speakers are also used by the infotainment system, and are also connected to the Cockpit Control Module (CCM) via the data communication module (DCM).
• When connecting to a Customer Care Advisor at the SUBARU STARLINK Call Center for an emergency call or other reason, it sends a mute signal to the Cockpit Control Module (CCM) and sends a signal requesting display of the call screen.
• Controls the ON/OFF and flashing operation of the LED status light.</td></tr>
<tr><td colspan="3">Back up battery (BUB)</td><td>Built into the data communication module (DCM) to supply power to the data communication module (DCM) if power supply by the vehicle battery is not possible during an emergency call.</td></tr>
</table>

Part name	Function
Roof antenna • Telematics antenna	Communicates with the SUBARU STARLINK Call Center or server for SUBARU STARLINK services.
Telematics sub antenna	Communicates with the SUBARU STARLINK networks when the telematics antenna cannot communicate due to damage or other problem.
GPS antenna	A communication antenna that supports communication in the frequency bands used by mobile phones. It receives signals from GPS satellites and sends them to the data communication module (DCM).
Cockpit Control module (CCM)	• When connecting to the SUBARU STARLINK Call Center, this module mutes the currently playing audio source and displays the call status screen on the display when it received a signal from the data communication module (DCM). • Outputs the currently playing audio source front side audio signal to the data communication module (DCM).
Side speaker	Outputs the speech of the Customer Care Advisor at the SUBARU STARLINK Call Center or other call party.
Front door speaker	
Central gateway CM (CGW)	Relays CAN communication between the control computers for the various devices installed in the vehicle.
Airbag CM	• Deploys the airbags depending on the collision when an accident occurs, and sends emergency reporting data, airbag deployment information, and other information to the data communication module (DCM). • Sends airbag system status information, warning light information, DTC information, and other information via CAN communication to the data communication module (DCM).
Combination meter	Sends odometer information, warning light information, vehicle information, and DTC information via CAN communication to the data communication module (DCM).
Engine Control Module (ECM)	Sends engine warning light information, status information, VIN information, and DTC information via CAN communication to the data communication module (DCM).
Transmission control module (TCM)*1	Sends transmission warning light information, vehicle information, and DTC information via CAN communication to the data communication module (DCM).
VDC CM & H/M	Sends brake system warning light information, vehicle speed information, and DTC information via CAN communication to the data communication module (DCM).
Power steering CM	Sends EPS warning light information and DTC information via CAN communication to the data communication module (DCM).
Rear radar	Sends rear radar status information and warning light information via CAN communication to the data communication module (DCM).
Auto headlight beam leveler CM	Sends headlight control warning light information via CAN communication to the data communication module (DCM).

Part name	Function
Body Integrated Unit	• Sends the alarm signal to the data communication module (DCM) when the anti-theft system was activated. • Sends door switch information, door lock/unlock information, remote door lock/unlock information, remote horn and hazard light information, and DTC information via CAN communication to the data communication module (DCM).
Stereo camera*2	Sends EyeSight system vehicle information, warning light information, and DTC information via CAN communication to the data communication module (DCM).
Keyless access CM	• Receives the remote engine start request signal via CAN communication from the data communication module (DCM). • Sends the door lock system warning light information, remote engine start control signal, TPMS warning, air pressure display unit information, and tire inflation pressure information via CAN communication to the data communication module (DCM).
A/C CM	Receives the remote engine start ON signal, rear defogger ON/OFF signal, air flow outlet mode setting signal, set temperature value signal, fresh air/recirculation setting signal, fan stage signal via CAN communication from the data communication module (DCM) and controls the air conditioning system.

**1: CVT*
**2: Models with EyeSight*

11 speakers (Harman/Kardon® audio system)

Part name			Function
Map light			Contains the microphone and telematics button.
Microphone			Converts the user's voice into an electrical signal and sends the signal to the data communication module (DCM).
Parts contained inside the telematics button	SOS button		Press to connect to SOS Emergency Service.
	i-button		Press to start a connection to Enhanced Roadside Assistance or STARLINK Concierge.
	LED status light	Green	• Turns on when the system is operating normally within a SUBARU STARLINK service area. • Flashes during an emergency call, and turns off when an error occurred in the system or when registration for SUBARU STARLINK services has not been completed.
		Red	• Turns on to warn the user when an error occurs in the system. • Turns off when the system is operating normally or when registration for SUBARU STARLINK services has not been completed.
Data communication module (DCM)			• Installed inside the cabin at the center of the vehicle (above the Cockpit Control Module (CCM) inside the instrument panel) where the effects of a collision are small. • This is the communications device that connects to SUBARU STARLINK services via wireless communication using the internal mobile telephone module, and connects to the SUBARU STARLINK Call Center when the SOS button or i-button is operated. • When a collision detection signal is received from the airbag CM, an emergency call starts automatically. • In addition to functions for data communication with the control computers for various device installed in the vehicle, it also has control functions which send and receive information between the server and vehicle for SUBARU STARLINK services such as Remote Services and Vehicle Alerts. • The microphone and speakers are connected to it, and when speaking with a Customer Care Advisor at the SUBARU STARLINK Call Center, it sends the user voice collected by the microphone and outputs the voice of the Customer Care Advisor from the speakers. The microphone and speakers are also used by the infotainment system, and are also connected to the Cockpit Control Module (CCM) via the data communication module (DCM). • When connecting to a Customer Care Advisor at the SUBARU STARLINK Call Center for an emergency call or other reason, it sends a mute signal to the Cockpit Control Module (CCM) and sends a signal requesting display of the call screen. • Controls the ON/OFF and flashing operation of the LED status light.
Back up battery (BUB)			Built into the data communication module (DCM) to supply power to the data communication module (DCM) if power supply by the vehicle battery is not possible during an emergency call.
Roof antenna • Telematics antenna			Communicates with the SUBARU STARLINK Call Center or server for SUBARU STARLINK services.

Part name	Function
Telematics sub antenna	Communicates with the SUBARU STARLINK networks when the telematics antenna cannot communicate due to damage or other problem.
GPS antenna	A communication antenna that supports communication in the frequency bands used by mobile phones. It receives signals from GPS satellites and sends them to the data communication module (DCM).
Cockpit Control module (CCM)	• When connecting to the SUBARU STARLINK Call Center, this module mutes the currently playing audio source and displays the call status screen on the display when it received a signal from the data communication module (DCM). • Outputs the currently playing audio source audio signal to the power amplifier.
Power Amplifier	• Amplifies the audio input from the Cockpit Control Module (CCM). • Outputs the amplified audio signal for the side speakers to the data communication module (DCM).
Side speaker	Outputs the speech of the Customer Care Advisor at the SUBARU STARLINK Call Center or other call party.
Central gateway CM (CGW)	Relays CAN communication between the control computers for the various devices installed in the vehicle.
Airbag CM	• Deploys the airbags depending on the collision when an accident occurs, and sends emergency reporting data, airbag deployment information, and other information to the data communication module (DCM). • Sends airbag system status information, warning light information, DTC information, and other information via CAN communication to the data communication module (DCM).
Combination meter	Sends odometer information, warning light information, vehicle information, and DTC information via CAN communication to the data communication module (DCM).
Engine Control Module (ECM)	Sends engine warning light information, status information, VIN information, and DTC information via CAN communication to the data communication module (DCM).
Transmission control module (TCM)*1	Sends transmission warning light information, vehicle information, and DTC information via CAN communication to the data communication module (DCM).
VDC CM & H/M	Sends brake system warning light information, vehicle speed information, and DTC information via CAN communication to the data communication module (DCM).
Power steering CM	Sends EPS warning light information and DTC information via CAN communication to the data communication module (DCM).
Rear radar	Sends rear radar status information and warning light information via CAN communication to the data communication module (DCM).
Auto headlight beam leveler CM	Sends headlight control warning light information via CAN communication to the data communication module (DCM).

Part name	Function
Body Integrated Unit	• Sends the alarm signal to the data communication module (DCM) when the anti-theft system was activated. • Sends door switch information, door lock/unlock information, remote door lock/unlock information, remote horn and hazard light information, and DTC information via CAN communication to the data communication module (DCM).
Stereo camera*2	Sends EyeSight system vehicle information, warning light information, and DTC information via CAN communication to the data communication module (DCM).
Keyless access CM	• Receives the remote engine start request signal via CAN communication from the data communication module (DCM). • Sends the door lock system warning light information, remote engine start control signal, TPMS warning, air pressure display unit information, and tire inflation pressure information via CAN communication to the data communication module (DCM).
A/C CM	Receives the remote engine start ON signal, rear defogger ON/OFF signal, air flow outlet mode setting signal, set temperature value signal, fresh air/recirculation setting signal, fan stage signal via CAN communication from the data communication module (DCM) and controls the air conditioning system.

**1: CVT*
**2: Models with EyeSight*

Function

STARLINK Safety and Security

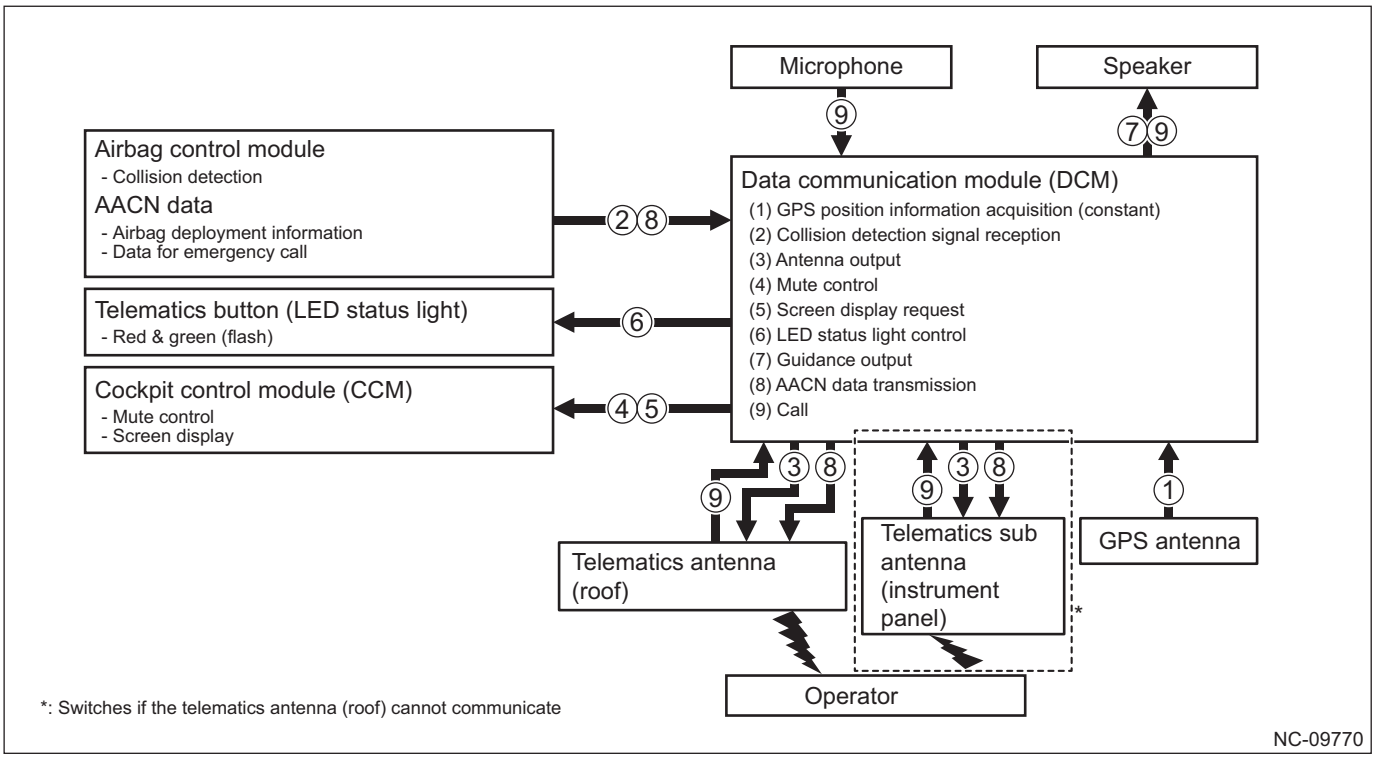
■ Advanced Automatic Collision Notification

- This is a function that automatically notifies the SUBARU STARLINK Call Center with higher priority than other services when there was an impact during an accident that was large enough to deploy the airbags and the data communication module (DCM) received the collision detection signal from the airbag CM.
- At the time of automatic notification, if power supply to the data communication module (DCM) was interrupted due to damage to the vehicle battery, disconnected power wire harness, or other reason, the data communication module (DCM) switches the power supply from the vehicle battery to the internal Back Up Battery (BUB).
- When automatic notification begins, the audio source is muted, the calling screen appears on the display, and the vehicle is connected to the SUBARU STARLINK Call Center. At this time, voice guidance informs the user that a connection has been established.
- The display continues during the call, and the telematics button LED status light flashes, providing visual notification to the user that he or she is connected to a Customer Care Advisor.
- The data communication module (DCM) collects position information and vehicle status information (collision type and number of collisions, etc.) from when the accident occurred, and sends this information to the server at the same time when automatic notification starts.
- Based on speaking with the user or on the information collected from the vehicle, the Customer Care Advisor estimates the size of the accident and provides appropriate services according to the conditions.

Reference

- Automatic notification cannot be canceled from the user side.
- The sound volume of the call with the Customer Care Advisor can be adjusted by means of the audio system volume knob.

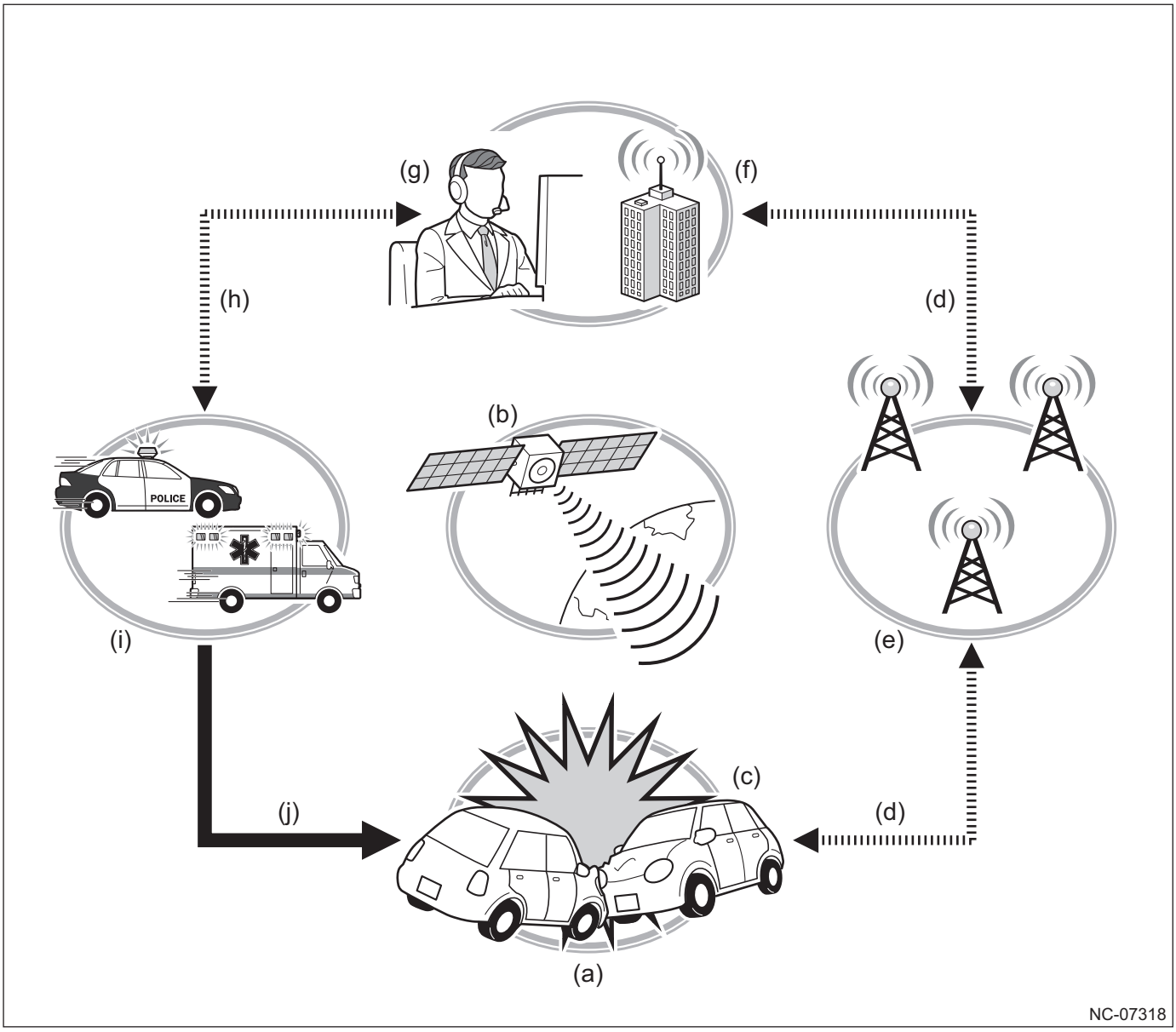
Vehicle side control flow



No.	Control description	Supported unit
(1)	Measures the vehicle position using GPS satellite signals.	• GPS antenna • Data communication module (DCM)
(2)	Sends the collision detection signal.	• Airbag CM • Data communication module (DCM)
(3)	Sends the collision notification (including result of (1)) to the server.	• Data communication module (DCM) • Telematics antenna • Telematics sub antenna*
(4)	Mutes the currently playing audio source.	• Data communication module (DCM) • Cockpit Control module (CCM)
(5)	Shows the automatic notification screen on the display.	• Data communication module (DCM) • Cockpit Control module (CCM)
(6)	Flashes the LED status light.	• Data communication module (DCM) • Telematics button
(7)	Outputs the voice guidance to speakers.	• Data communication module (DCM) • Speaker
(8)	Sends AACN data.	• Airbag CM • Data communication module (DCM) • Telematics antenna • Telematics sub antenna*
(9)	Communicates with the Customer Care Advisor using the microphone and speakers.	• Telematics antenna • Telematics sub antenna* • Data communication module (DCM) • Speaker • Microphone

**: Corresponds to when the telematics antenna cannot communicate due to damage or other problem*

Advanced Automatic Collision Notification service flow



** The illustration shows an example of the service flow that may differ from the actual service.*

(a)	Accident occurs	(f)	SUBARU STARLINK Call Center
(b)	GPS satellite	(g)	Customer Care Advisor
(c)	Automatic notification	(h)	Notification (fixed line)
(d)	Mobile phone line	(i)	Requests mobilization of emergency vehicles as necessary depending on the accident conditions.
(e)	Mobile phone base station	(j)	Rescue

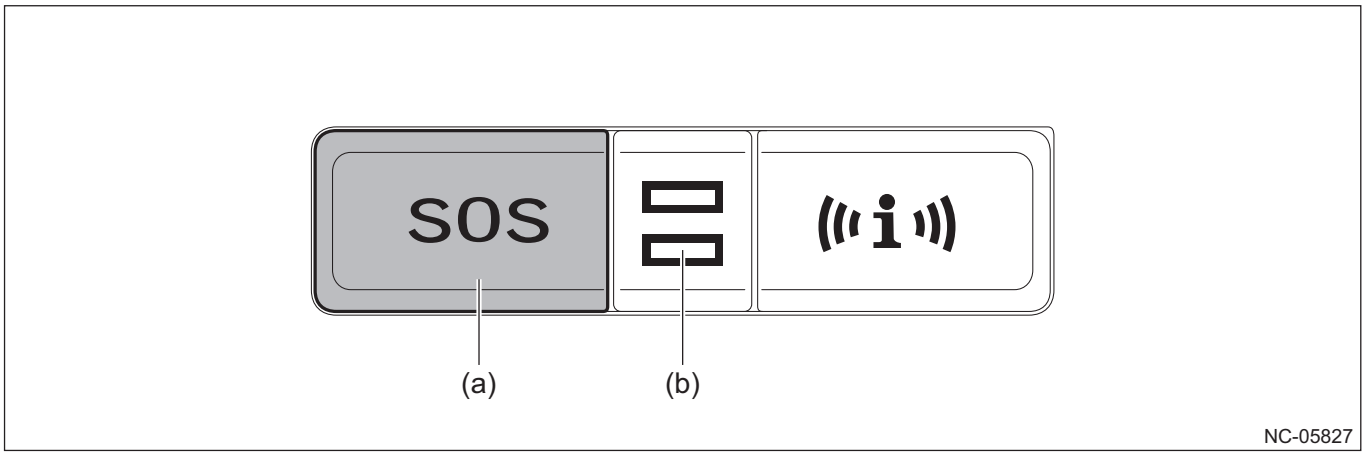
■ SOS Emergency Assistance

- In the event of an accident that does not result in airbag deployment or if the user experiences sudden illness and is unable to drive, or if there is another emergency, this function can send emergency notification to the SUBARU STARLINK Call Center when the user presses the SOS telematics button, allowing the user to obtain assistance.
- When emergency notification begins, the audio source is muted, the calling screen appears on the display, and the vehicle is connected to the SUBARU STARLINK Call Center. At this time, voice guidance informs the user that a connection has been established.
- The data communication module (DCM) collects vehicle data including position information, and sends it to the server at the same time when emergency notification starts.
- The display continues during the call, and the LED status light next to the SOS button flashes, providing visual notification to the user that he or she is connected to the SUBARU STARLINK Call Center.
- The Customer Care Advisor checks the degree of the emergency by speaking with the user, and provides appropriate services as necessary.
- The call with the Customer Care Advisor ends when the user presses and holds the SOS button for approximately 2 seconds or longer, or when he or she performs the operation that is displayed on the screen.

Reference

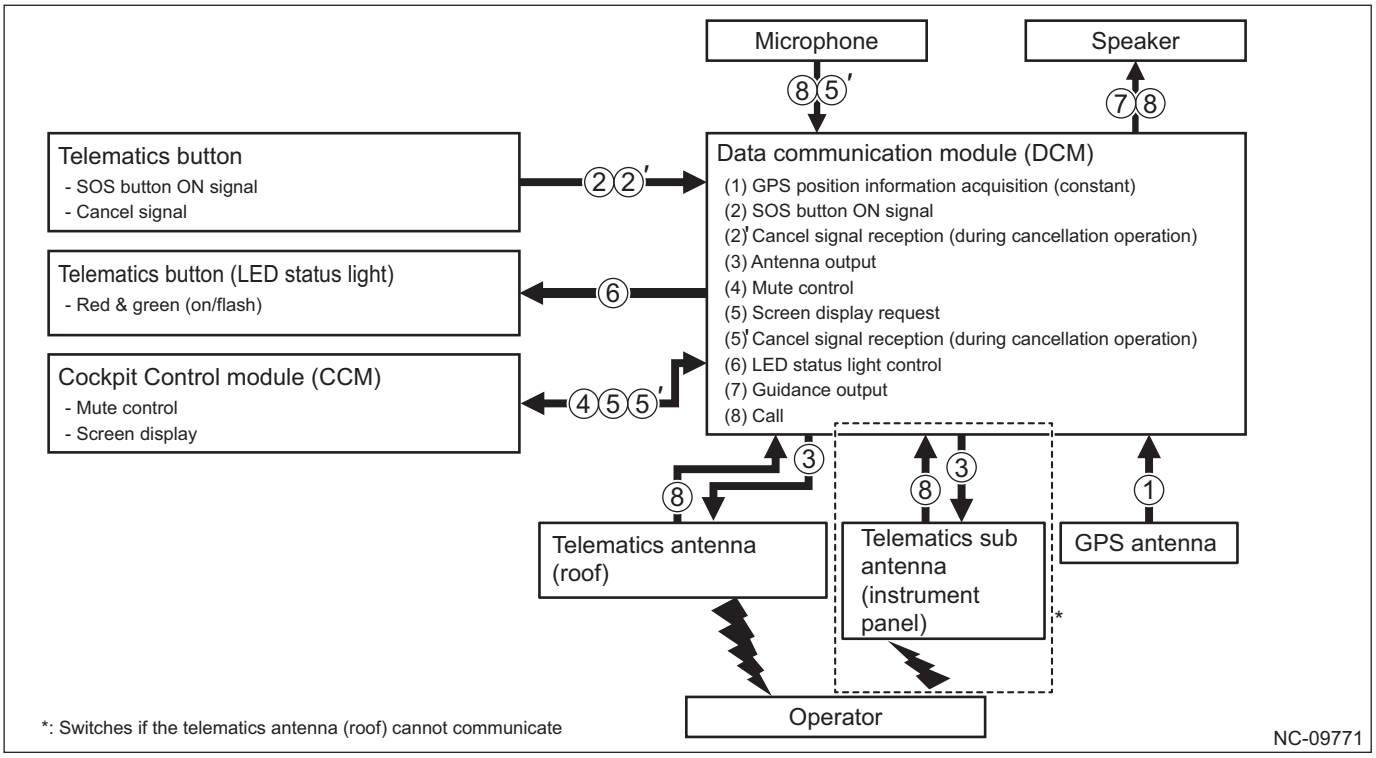
- If the user accidentally pressed the SOS button, the emergency call can be canceled by pressing and holding the SOS button again for 2 seconds or longer or by performing the operation displayed on the calling screen. The emergency call can also be canceled by an operation using voice recognition.
- The sound volume of the call with the Customer Care Advisor can be adjusted by means of the audio system volume knob.

Telematics SOS button



(a) SOS button
(b) LED status light (green)
(c) LED status light (red)

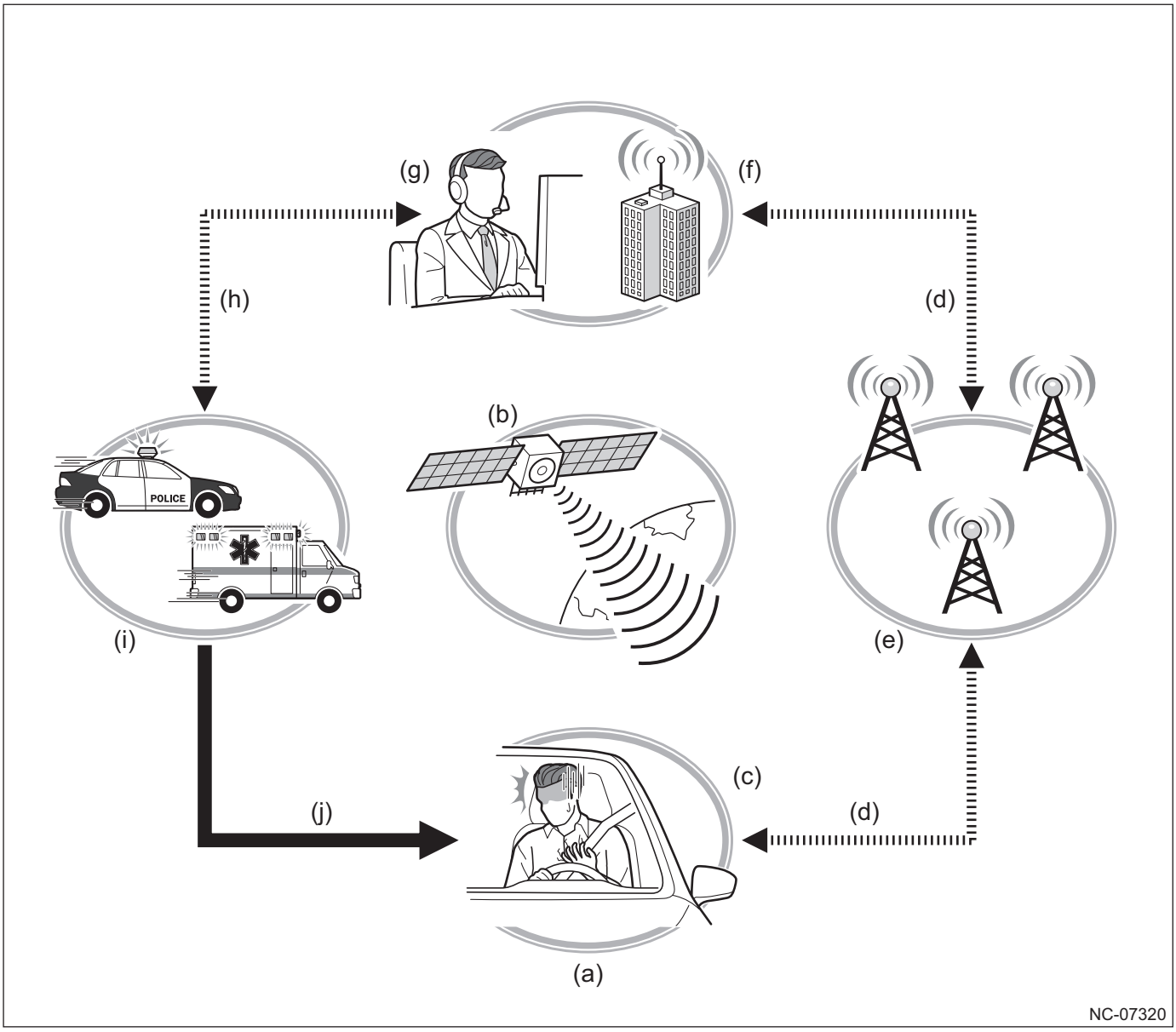
Vehicle side control flow



No.	Control description	Supported unit
(1)	Measures the vehicle position using GPS satellite signals.	• GPS antenna • Data communication module (DCM)
(2)	Turns ON when the SOS buttons is short pressed and cancels the call when pressed and held.	• Telematics button • Data communication module (DCM)
(3)	Sends vehicle information (including the result of (1)) to the server.	• Data communication module (DCM) • Telematics antenna • Telematics sub antenna*1
(4)	Mutes the currently playing audio source.	• Data communication module (DCM) • Cockpit Control module (CCM)
(5)	Shows the calling screen on the display, and cancels the call by the screen operation or voice recognition operation.	• Data communication module (DCM) • Cockpit Control module (CCM)
(6)	Illuminates/flashes the LED status light. *2	• Data communication module (DCM) • Telematics button
(7)	Outputs the voice guidance to speakers.	• Data communication module (DCM) • Speaker
(8)	Communicates with the Customer Care Advisor using the microphone and speakers.	• Telematics antenna • Telematics sub antenna*1 • Data communication module (DCM) • Speaker • Microphone

**1: Corresponds to when the telematics antenna cannot communicate due to damage or other problem*
**2: Flashes while emergency call is in progress, and returns to on after the cancel operation is performed.*

SOS Emergency Assistance service flow



** The illustration shows an example of the service flow that may differ from the actual service.*

(a)	An emergency occurs, such as the driver experiencing sudden illness and being unable to drive.	(f)	SUBARU STARLINK Call Center
(b)	GPS satellite	(g)	Customer Care Advisor
(c)	Emergency call by pressing the SOS button	(h)	Notification (fixed line)
(d)	Mobile phone line	(i)	Requests mobilization of emergency vehicles depending on the conditions.
(e)	Mobile phone base station	(j)	Rescue

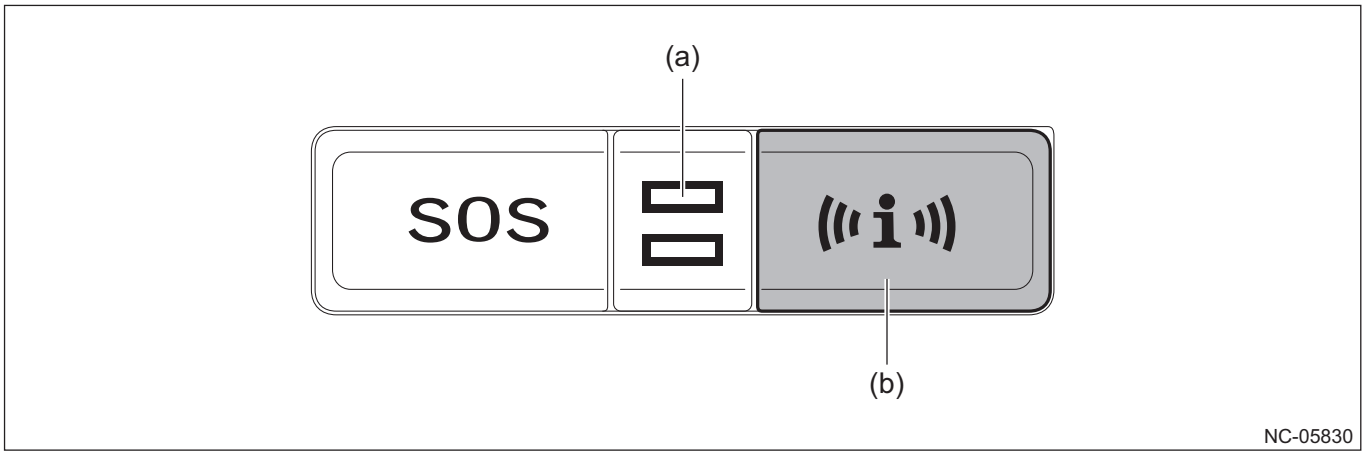
■ Enhanced Roadside Assistance

- When the customer is in trouble, for example if a sudden failure on the road prevents the vehicle from moving, he or she can press the telematics i-button to connect to the SUBARU STARLINK Call Center and obtain roadside assistance.
- Enhanced Roadside Assistance also allows the user to connect to the SUBARU STARLINK Call Center by operating the menu icon on the display.
- When the connection to the SUBARU STARLINK Call Center begins, the audio source is muted and the calling screen appears on the display. At this time, voice guidance informs the user that a connection has been established.
- The data communication module (DCM) collects vehicle data including position information, and sends it to the server at the same time when the connection to the SUBARU STARLINK Call Center starts.
- The display continues during the call, and the LED status light next to the i-button flashes, providing visual notification to the user that he or she is connected to the SUBARU STARLINK Call Center.
- The Customer Care Advisor checks the circumstances by speaking with the user and provides appropriate roadside assistance.
- The call with the Customer Care Advisor ends when the user presses and holds the i-button for approximately 2 seconds or longer, or when he or she performs the operation that is displayed on the screen.

Reference

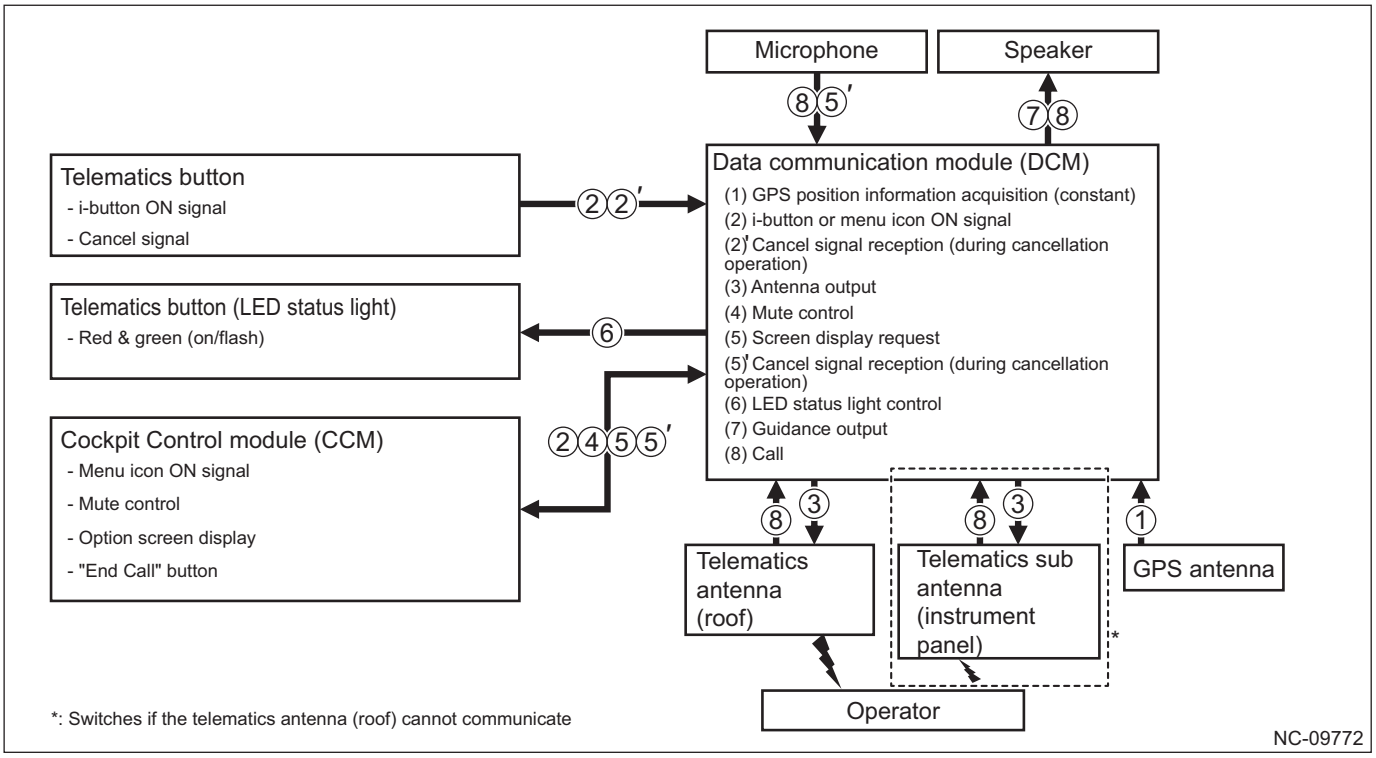
- If the user has registered for use of STARLINK Concierge, then he or she can display the options screen by pressing the i-button and can select either Enhanced Roadside Assistance or STARLINK Concierge. If no operation is performed for 10 seconds, Enhanced Roadside Assistance is automatically selected.
- If the user accidentally pressed the i-button, the connection to the SUBARU STARLINK Call Center can be canceled by pressing and holding the i-button again for 2 seconds or longer or by performing the operation displayed on the calling screen. The connection to the SUBARU STARLINK Call Center can also be canceled by an operation using voice recognition.
- The sound volume of the call with the Customer Care Advisor can be adjusted by means of the audio system volume knob.
- The user can also obtain roadside assistance from Enhanced Roadside Assistance by an operation from MySubaru.

Telematics i-button



(a) LED status light (green)
(b) LED status light (red)
(c) i-button

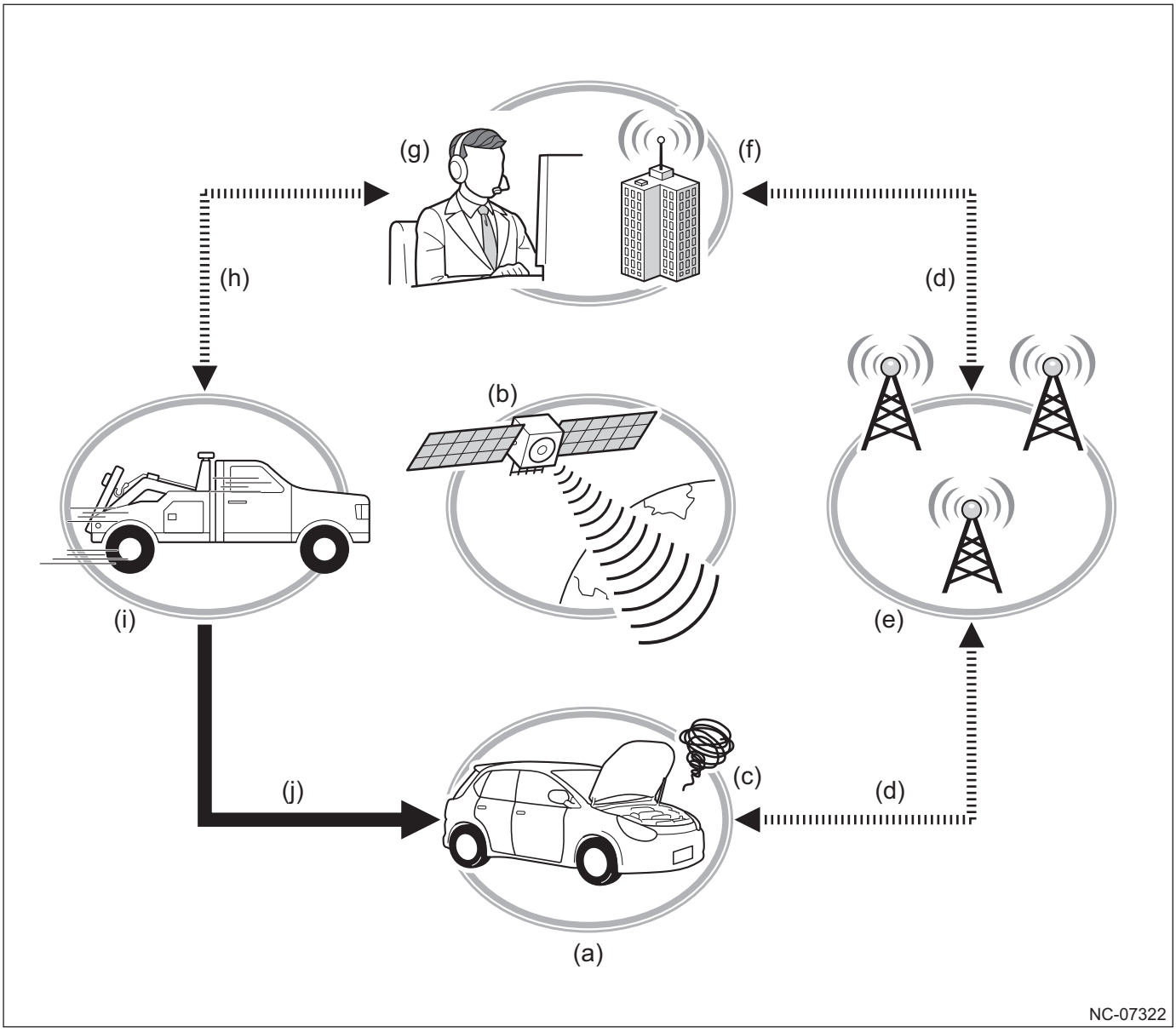
Vehicle side control flow



No.	Control description	Supported unit
(1)	Measures the vehicle position using GPS satellite signals.	• GPS antenna • Data communication module (DCM)
(2)	Turns ON when the i-buttons is short pressed and cancels the call when pressed and held. (It also turns ON by the menu icon operation on the display.)	• Telematics button • Data communication module (DCM) • Cockpit Control module (CCM)
(3)	Sends vehicle information (including the result of (1)) to the server.	• Data communication module (DCM) • Telematics antenna • Telematics sub antenna*1
(4)	Mutes the currently playing audio source.	• Data communication module (DCM) • Cockpit Control module (CCM)
(5)	Shows the calling screen on the display, and cancels the call by the screen operation or voice recognition operation.	• Data communication module (DCM) • Cockpit Control module (CCM)
(6)	Illuminates/flashes the LED status light. *2	• Data communication module (DCM) • Telematics button
(7)	Outputs the voice guidance to speakers.	• Data communication module (DCM) • Speaker
(8)	Communicates with the Customer Care Advisor using the microphone and speakers.	• Telematics antenna • Telematics sub antenna*1 • Data communication module (DCM) • Speaker • Microphone

**1: Corresponds to when the telematics antenna cannot communicate due to damage or other problem*
**2: Flashes while connecting to the SUBARU STARLINK Call Center, and returns to on after the cancel operation is performed.*

Enhanced Roadside Assistance service flow



** The illustration shows an example of the service flow that may differ from the actual service.*

(a)	Vehicle failure occurs while on the road.	(f)	SUBARU STARLINK Call Center
(b)	GPS satellite	(g)	Customer Care Advisor
(c)	Emergency call by pressing the i-button	(h)	Contact (fixed line)
(d)	Mobile phone line	(i)	Arranges for a tow truck if circumstances require.
(e)	Mobile phone base station	(j)	Roadside assistance

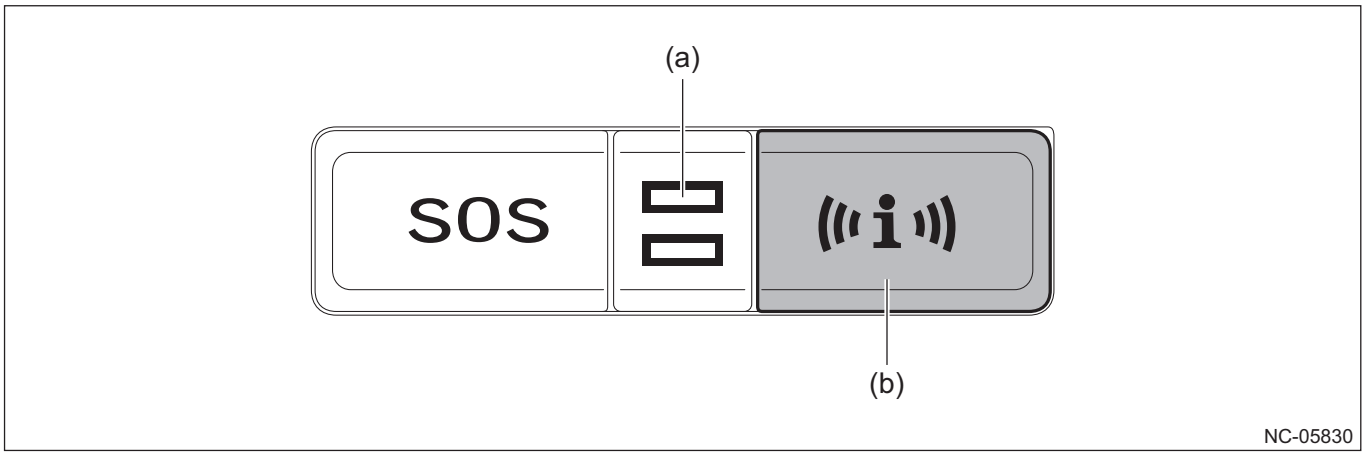
■ STARLINK Concierge

- With this function, pressing the telematics i-button connects to the SUBARU STARLINK Call Center, allowing the user to obtain drive assistance from the Customer Care Advisor.
- With STARLINK Concierge, the user can also connect to the SUBARU STARLINK Call Center by operating the menu icon on the display.
- When the i-button is pressed, the audio source is muted and the option screen appears on the display. The user selects STARLINK Concierge to initiate the connection. At this time, voice guidance informs the user that a connection has been established.
- The data communication module (DCM) collects vehicle data, and sends it to the server at the same time when the connection to the SUBARU STARLINK Call Center starts.
- The display continues during the call, and the LED status light next to the i-button flashes, providing visual notification to the user that he or she is connected to the SUBARU STARLINK Call Center.
- The Customer Care Advisor provides personal assistance according to user requests while driving, such as restaurant or hotel reservations or arranging for tickets.
- If the user selects a place to go to (destination) during the conversation with the Customer Care Advisor, the destination information is sent from the server. When the destination information is received, the destination is set automatically in the navigation. This enables the destination to be set safely even while the user is driving. (Models with navigation system)
- The call with the Customer Care Advisor ends when the user presses and holds the i-button for approximately 2 seconds or longer, or when he or she performs the operation that is displayed on the screen.

Reference

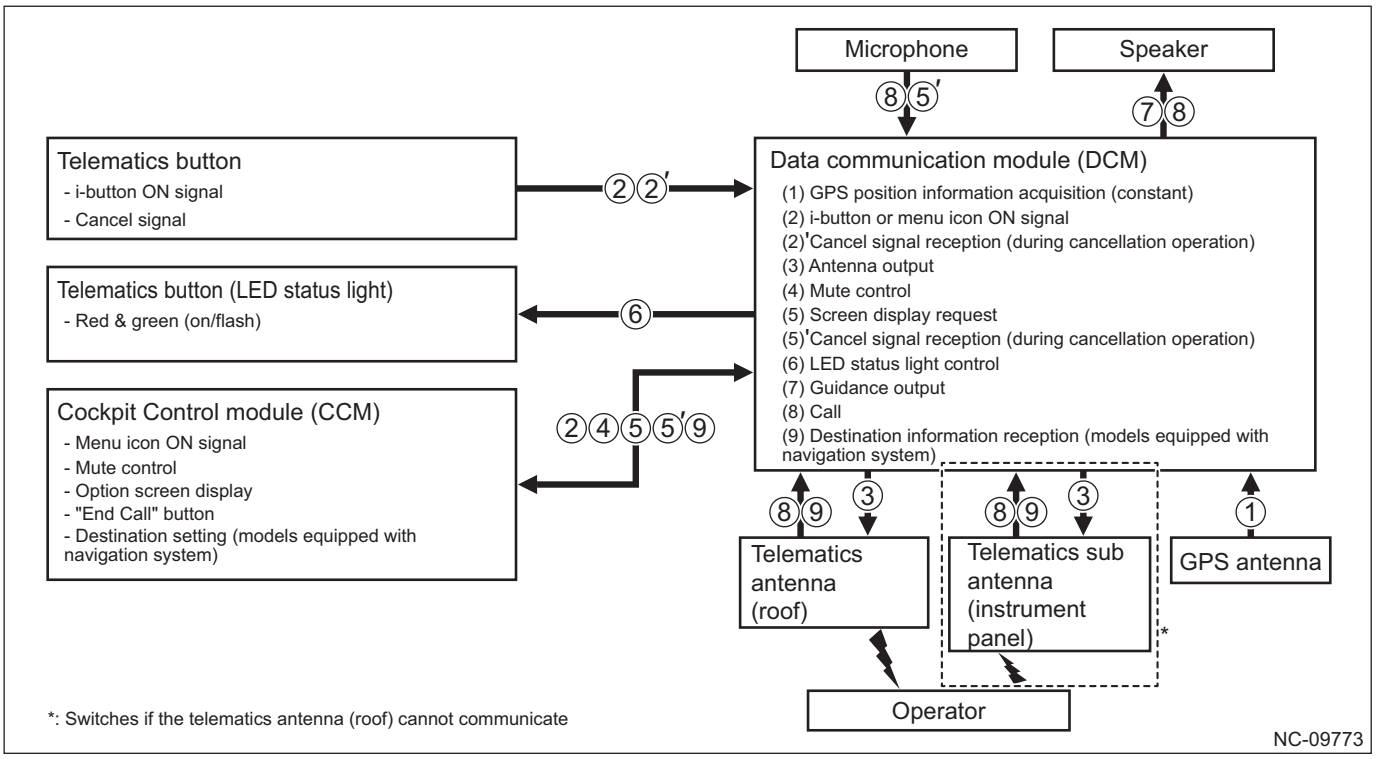
- In addition to STARLINK Concierge, Enhanced Roadside Assistance can also be selected from the option screen. If no operation is performed for 10 seconds, Enhanced Roadside Assistance is automatically selected.
- If the user accidentally pressed the i-button, the connection to the SUBARU STARLINK Call Center can be canceled by pressing and holding the i-button again for 2 seconds or longer or by performing the operation displayed on the calling screen. The connection to the SUBARU STARLINK Call Center can also be canceled by an operation using voice recognition.
- The sound volume of the call with the Customer Care Advisor can be adjusted by means of the audio system volume knob.

Telematics i-button



(a) LED status light (green)
(b) LED status light (red)
(c) i-button

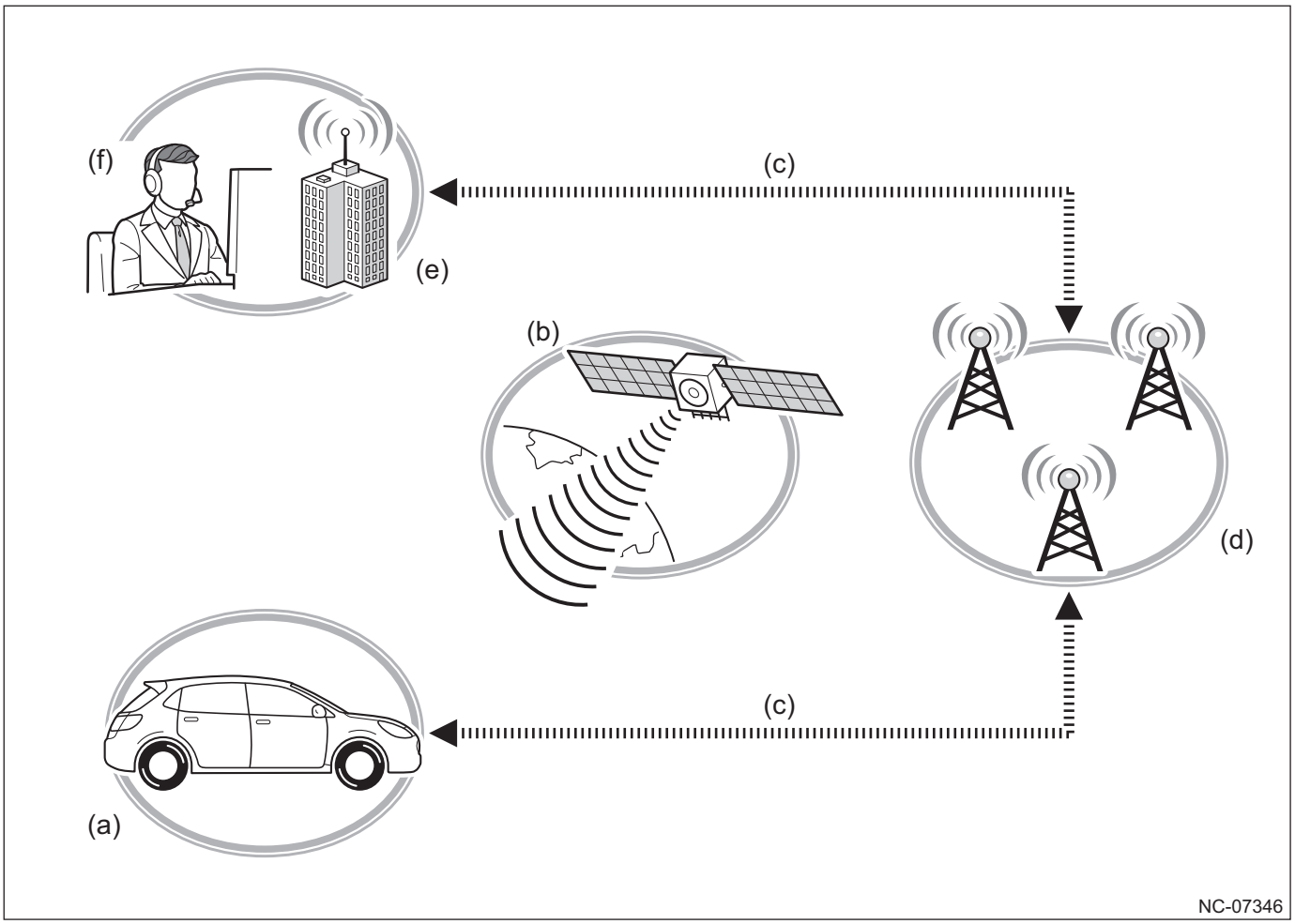
Vehicle side control flow



No.	Control description	Supported unit
(1)	Measures the vehicle position using GPS satellite signals.	• GPS antenna • Data communication module (DCM)
(2)	Turns ON when the i-buttons is short pressed and cancels the call when pressed and held. (It also turns ON by the menu icon operation on the display.)	• Telematics button • Data communication module (DCM) • Cockpit Control module (CCM)
(3)	Sends vehicle information (including the result of (1)) to the server.	• Data communication module (DCM) • Telematics antenna • Telematics sub antenna*1
(4)	Mutes the currently playing audio source.	• Data communication module (DCM) • Cockpit Control module (CCM)
(5)	Shows the calling screen on the display, and cancels the call by the screen operation or voice recognition operation.	• Data communication module (DCM) • Cockpit Control module (CCM)
(6)	Illuminates/flashes the LED status light. *2	• Data communication module (DCM) • Telematics button
(7)	Outputs the voice guidance to speakers.	• Data communication module (DCM) • Speaker
(8)	Communicates with the Customer Care Advisor using the microphone and speakers.	• Telematics antenna • Telematics sub antenna*1 • Data communication module (DCM) • Speaker • Microphone
(9)	Receives the destination information and sets the location as the navigation system destination. *3	• Telematics antenna • Telematics sub antenna*1 • Data communication module (DCM) • Cockpit Control module (CCM)

**1: Corresponds to when the telematics antenna cannot communicate due to damage or other problem*
**2: Flashes while connecting to the SUBARU STARLINK Call Center, and returns to on after the cancel operation is performed.*
**3: Models with navigation system*

STARLINK Concierge service flow



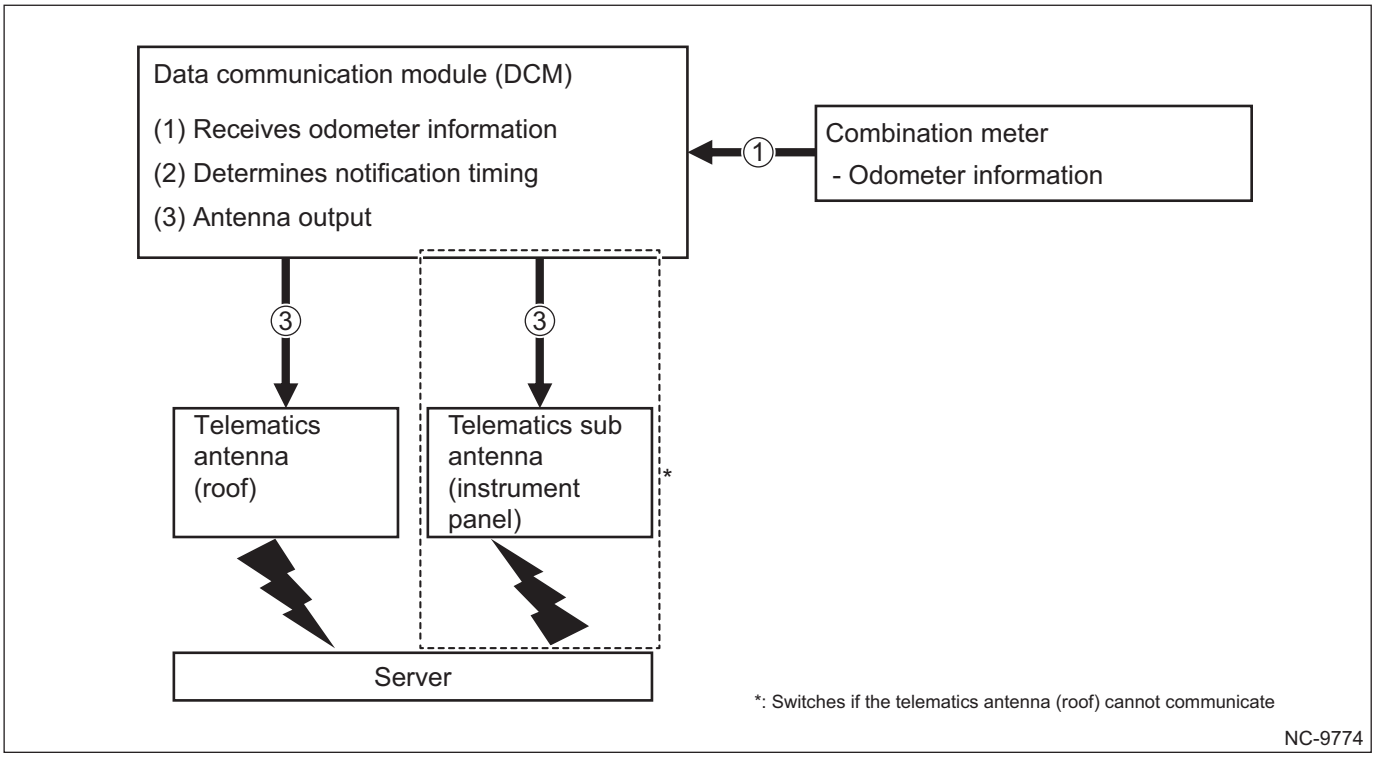
** The illustration shows an example of the service flow that may differ from the actual service.*

(a)	Calling by pressing the i-button	(d)	Mobile phone base station
(b)	GPS satellite	(e)	SUBARU STARLINK Call Center
(c)	Mobile phone line	(f)	The Customer Care Advisor provides driving assistance according to user requests.

■ Maintenance Notifications

- This function acquires vehicle driving mileage information and can provide the user with engine oil change, regular inspections, and other maintenance notifications.
- The user can receive notifications by email or other means that were set from MySubaru, so that vehicle maintenance can be carried out at suitable times.

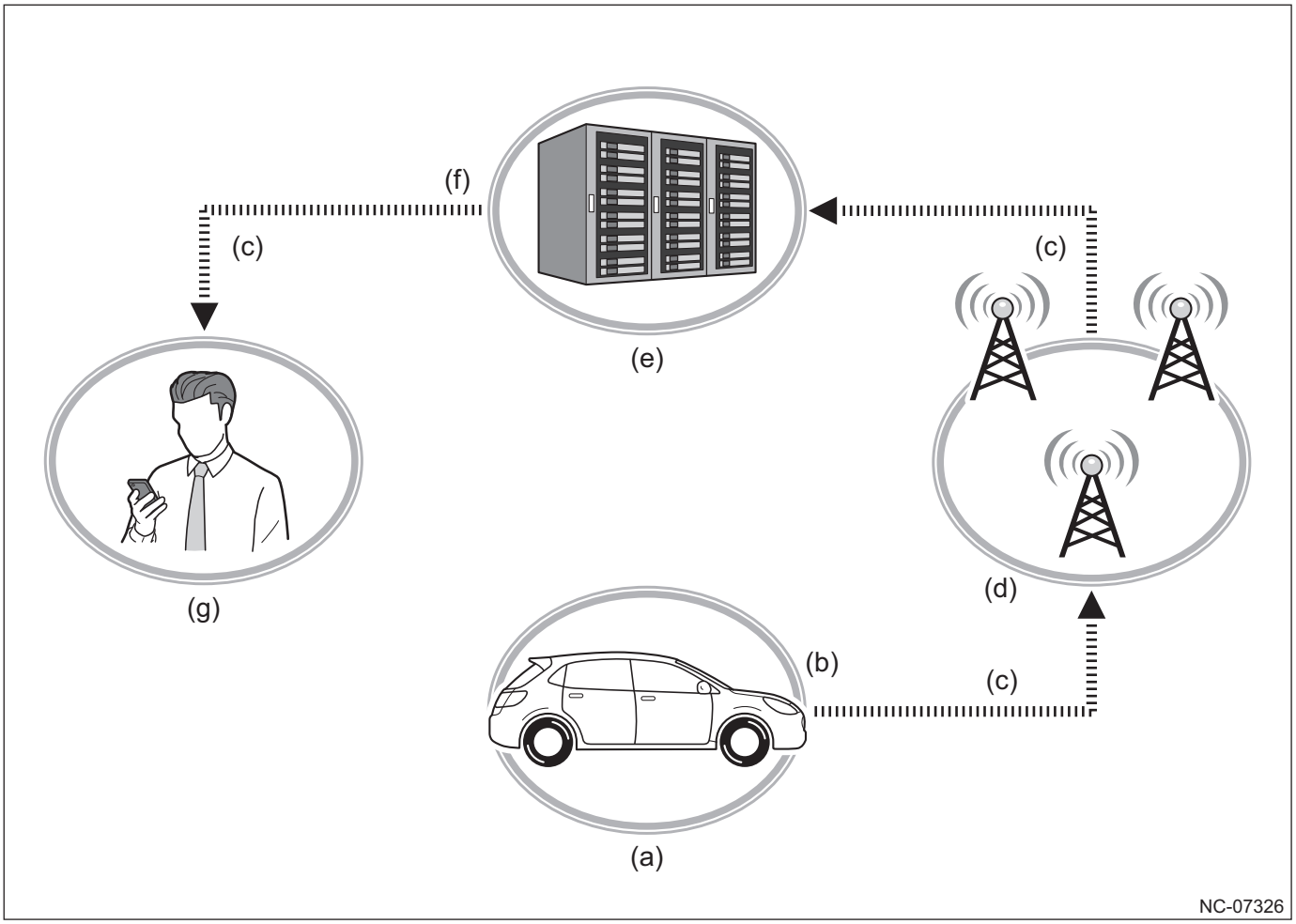
Vehicle side control flow



No.	Control description	Supported unit
(1)	Acquires odometer information from the combination meter.	• Combination meter • Data communication module (DCM)
(2)	Decides notification timing.	Data communication module (DCM)
(3)	Sends the notification timing decision results to the server.	• Data communication module (DCM) • Telematics antenna • Telematics sub antenna*

**: Corresponds to when the telematics antenna cannot communicate due to damage or other problem*

Maintenance Notifications service flow



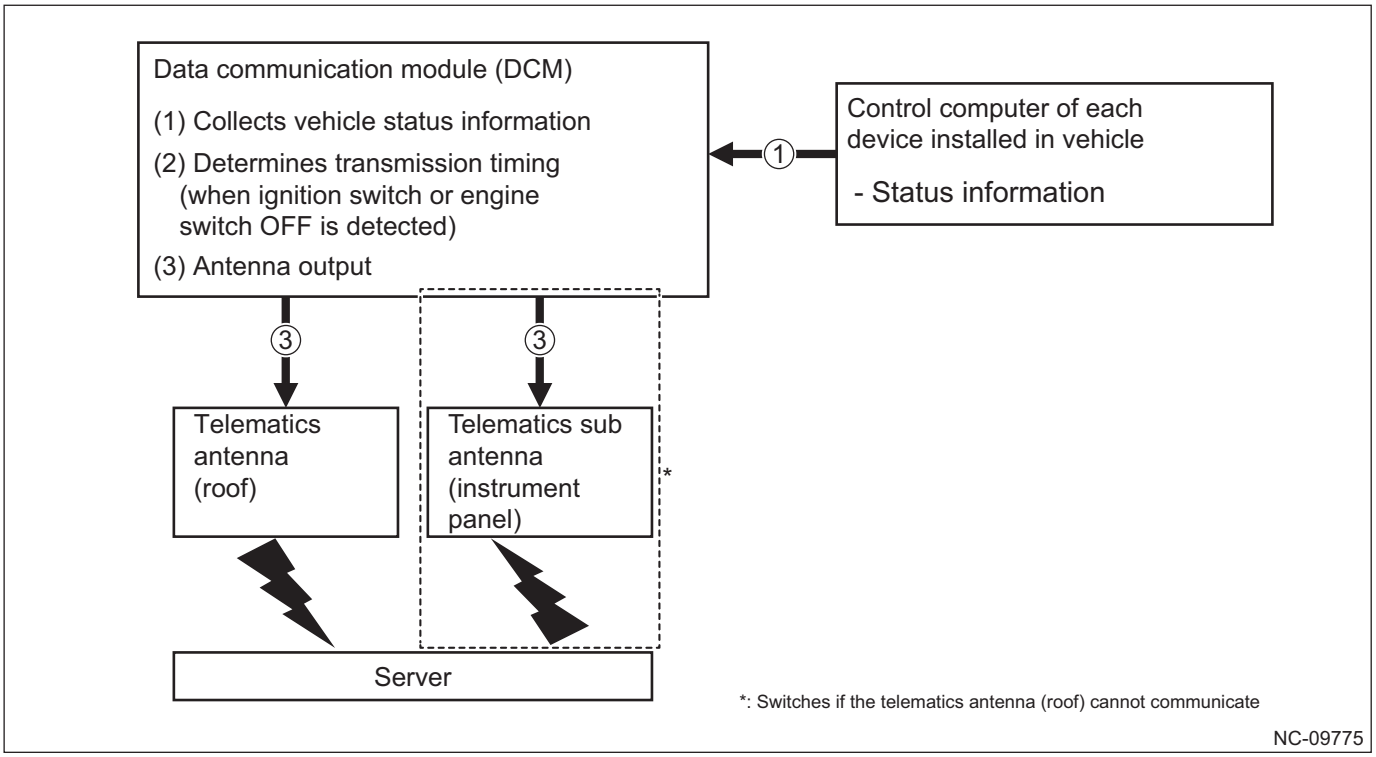
** The illustration shows an example of the service flow that may differ from the actual service.*

(a)	Decides notification timing from odometer information.	(e)	Server
(b)	Sends the identification results.	(f)	Sends maintenance notification.
(c)	Mobile phone line	(g)	Receives notifications by email or other means that were set from MySubaru.
(d)	Mobile phone base station		

■ Vehicle Health Report

- This function collects status information from the control computer of each device installed in the vehicle, and organizes it to create an overall diagnosis report that is easy to view.
- An email containing a link to the site where the user can view the overall diagnosis report is sent each month to the MySubaru account.

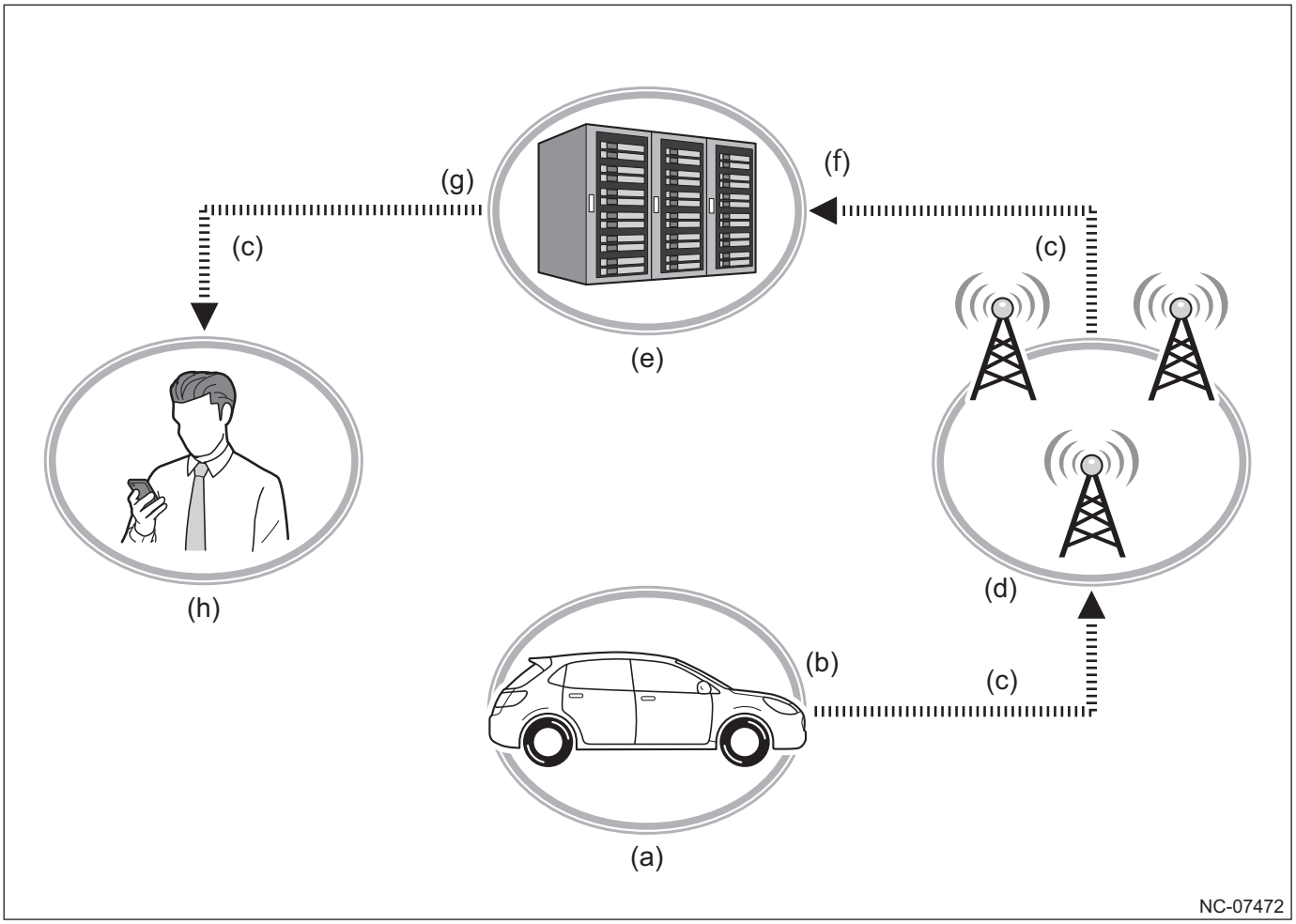
Vehicle side control flow



No.	Control description	Supported unit
(1)	Collects status information from the control computer of each device installed in the vehicle.	• Control computer of each device installed in vehicle • Data communication module (DCM)
(2)	Decides the timing for sending to the server. (When ignition switch or engine switch OFF is detected)	Data communication module (DCM)
(3)	Sends the collected status information to the server.	• Data communication module (DCM) • Telematics antenna • Telematics sub antenna*

**: Corresponds to when the telematics antenna cannot communicate due to damage or other problem*

Vehicle Health Report service flow



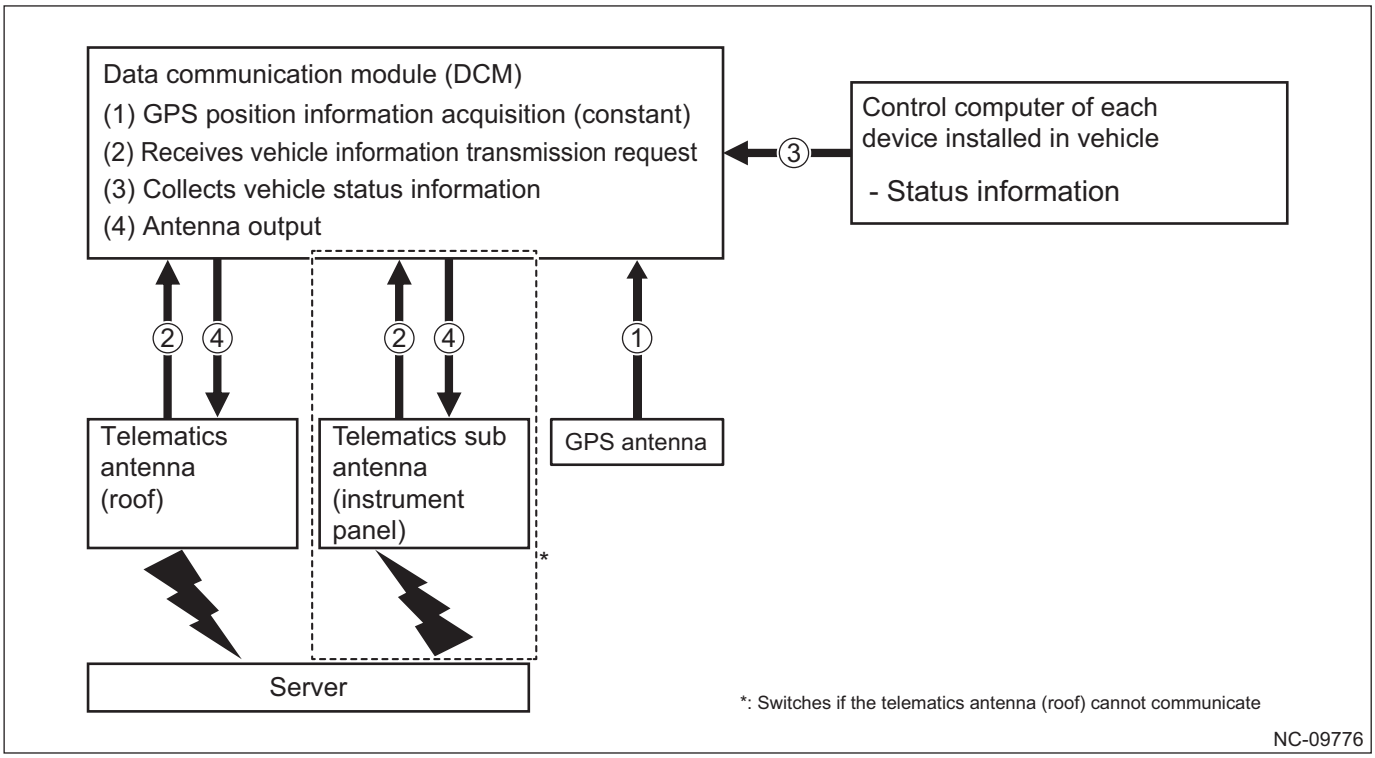
** The illustration shows an example of the service flow that may differ from the actual service.*

(a)	Collects vehicle status information.	(e)	Server
(b)	Sends the information when the ignition switch or engine switch is turned OFF.	(f)	Creates the overall diagnosis report and sends an email containing a link to the site where it can be viewed.
(c)	Mobile phone line	(g)	Sends the link email for the overall diagnosis report to the user MySubaru account.
(d)	Mobile phone base station	(h)	Checks the overall diagnosis report on the link page in the received email.

■ Vehicle Condition Check

- This function allows the user to acquire odometer, driving mileage, tire air pressure, and other vehicle diagnosis information by an operation from MySubaru.

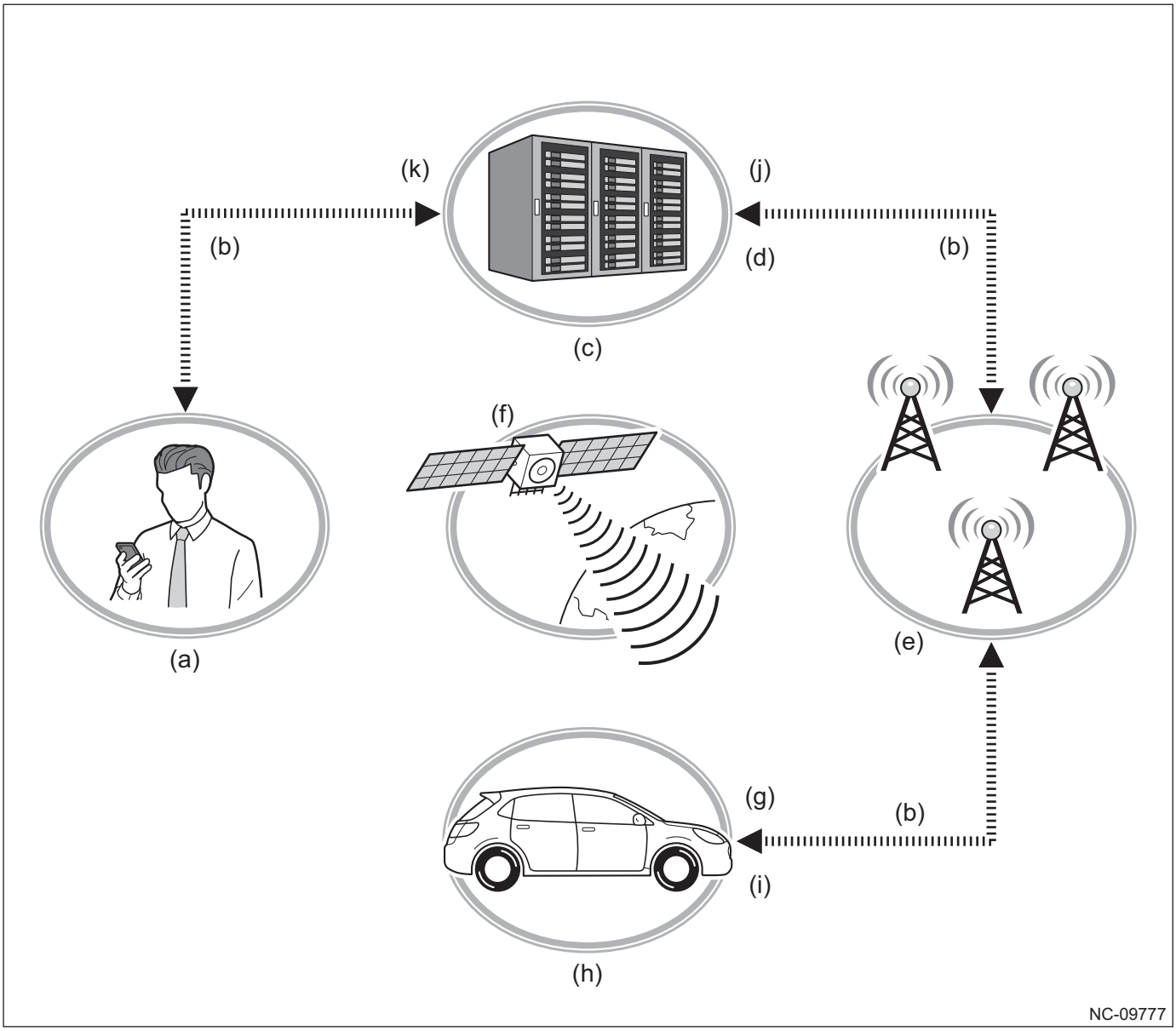
Vehicle side control flow



No.	Control description	Supported unit
(1)	Acquires the position information from the GPS satellite. (Continual)	• GPS antenna • Data communication module (DCM)
(2)	Receives a vehicle information request signal from the server.	• Telematics antenna • Telematics sub antenna* • Data communication module (DCM)
(3)	Based on the received signal, collects status information from the control computer of each device installed in the vehicle.	• Control computer of each device installed in vehicle • Data communication module (DCM)
(4)	Sends the collected status information (including the result of (1)) to the server.	• Data communication module (DCM) • Telematics antenna • Telematics sub antenna*

**: Corresponds to when the telematics antenna cannot communicate due to damage or other problem*

Vehicle Condition Check service flow



** The illustration shows an example of the service flow that may differ from the actual service.*

(a)	Operation from MySubaru for obtaining vehicle diagnosis information	(g)	Receives the vehicle information request signal and collects vehicle status information.
(b)	Mobile phone line	(h)	User vehicle
(c)	Server	(i)	Sends the collected status information.
(d)	Sends the vehicle information request signal to the user vehicle.	(j)	Performs vehicle diagnosis based on the collected status information.
(e)	Mobile phone base station	(k)	Displays vehicle diagnosis results on the user's MySubaru.
(f)	GPS satellite		

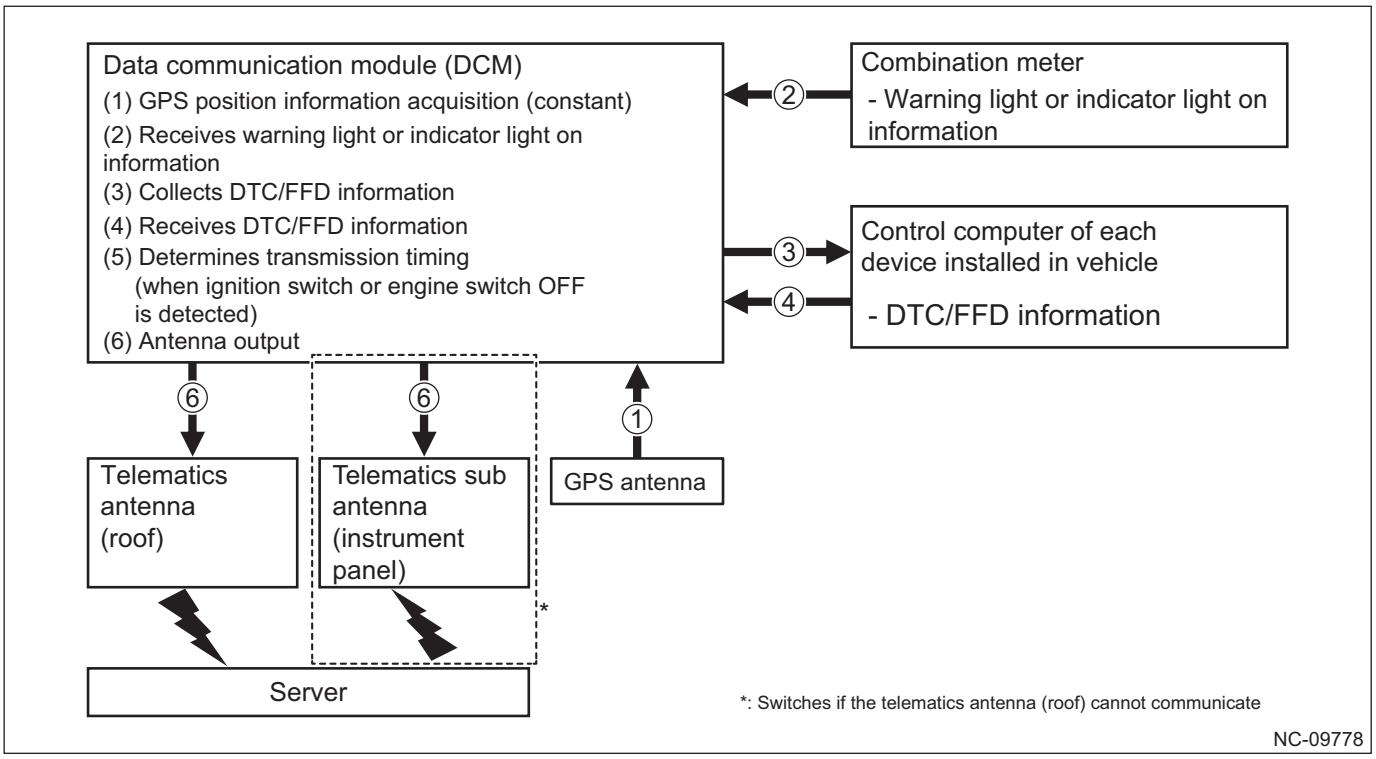
■ Diagnostic Alerts

- This function sends notification to the user about the problem that occurred and how to correct it when a combination meter warning light or other warning light turned on.
- When the data communication module (DCM) receives warning light or indicator light on information from the combination meter, or when the data communication module (DCM) collects DTC/FFD information from the control computer of each device installed in the vehicle, it sends this information to the server.
- The received information is analyzed on the server side, and the user is notified of the results by email or other means that were set by the user from MySubaru.

Reference

- In preparation for being able to rapidly send information when a vehicle failure occurs, the data communication module (DCM) regularly receives status information via CAN communication from the combination meter, and while the ignition switch or engine switch is ON, it continually collects DTC/FFD information from the control computer of each device installed in the vehicle.
- If the problem which occurred in the vehicle is serious, the SUBARU STARLINK Service Appointment Scheduler appears on the vehicle display, and the user can make an appointment for servicing at the preferred SUBARU dealer.

Vehicle side control flow



No.	Control description	Supported unit
(1)	Acquires the position information from the GPS satellite. (Continual)	• GPS antenna • Data communication module (DCM)
(2)	Receives warning light or indicator light on information. (Received by regular communication of status information.)	• Combination meter • Data communication module (DCM)
(3)	Sends an inquiry for whether DTC/FFD information exists to the control computer of each device installed in the vehicle. (Continual)	• Data communication module (DCM) • Control computer of each device installed in vehicle
(4)	Receives DTC/FFD information from the control computer of each device installed in the vehicle. (Continual)	• Control computer of each device installed in vehicle • Data communication module (DCM)
(5)	Decides the timing for sending to the server. (When ignition switch or engine switch OFF is detected)	Data communication module (DCM)
(6)	Sends the collected DTC/FFD information (including the result of (1)) to the server.	• Data communication module (DCM) • Telematics antenna • Telematics sub antenna*

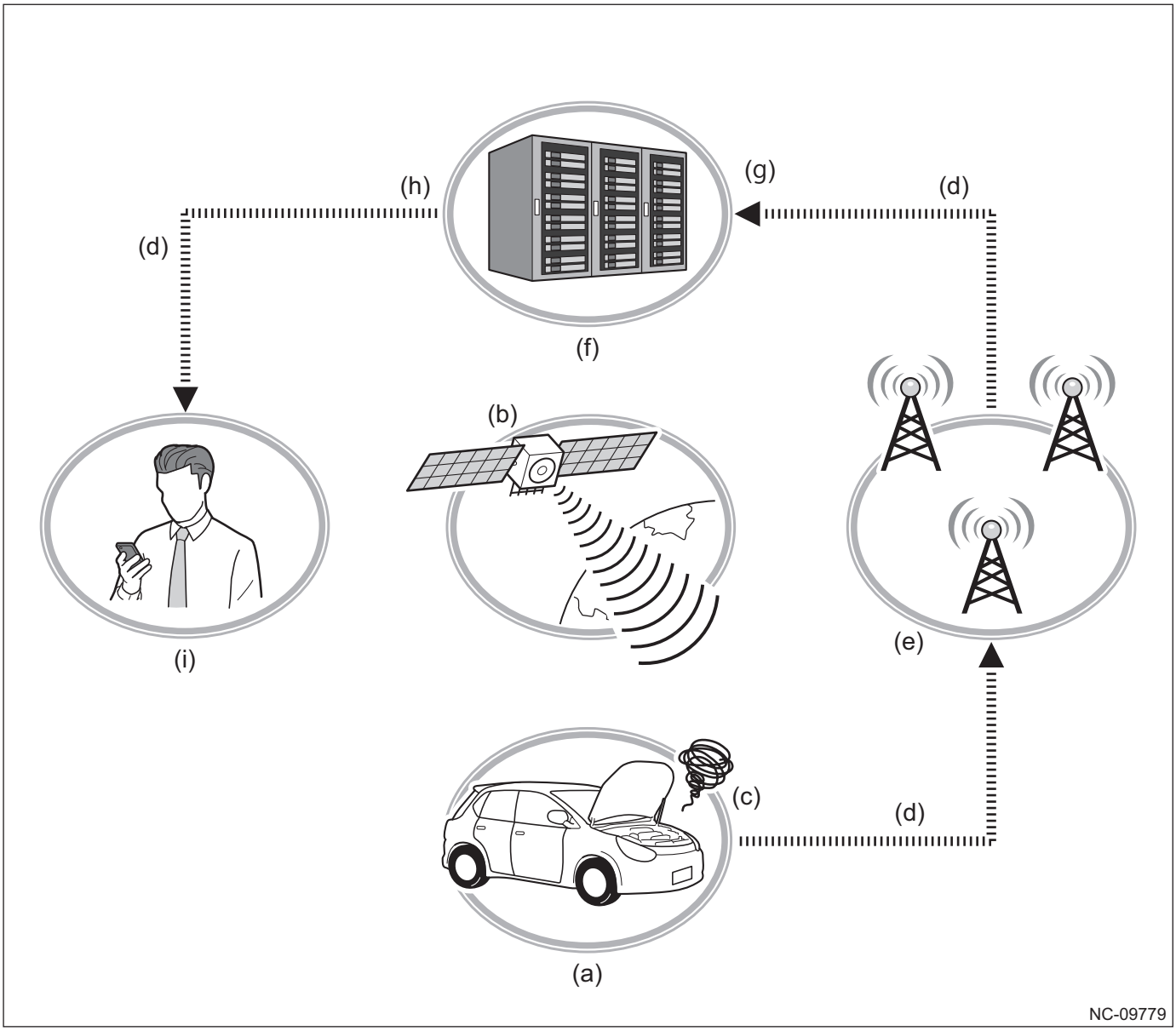
**: Corresponds to when the telematics antenna cannot communicate due to damage or other problem*

Control computers where DTC information is collected from

Engine Control Module (ECM)
Transmission control module (TCM)*1
VDC CM & H/M
Power steering CM
Combination meter
Stereo camera*2
Airbag CM
Body Integrated Unit
Data communication module (DCM)
Central gateway CM (CGW)

**1: CVT*
**2: Models with EyeSight*

Diagnostic Alerts service flow



** The illustration shows an example of the service flow that may differ from the actual service.*

(a)	Vehicle warning light turns on.	(f)	Server
(b)	GPS satellite	(g)	Analyzes the received DTC/FFD information.
(c)	Sends DTC/FFD information.	(h)	Sends the problem which occurred and way of correcting it to the user.
(d)	Mobile phone line	(i)	Receives notifications by email or other means that were set from MySubaru.
(e)	Mobile phone base station		

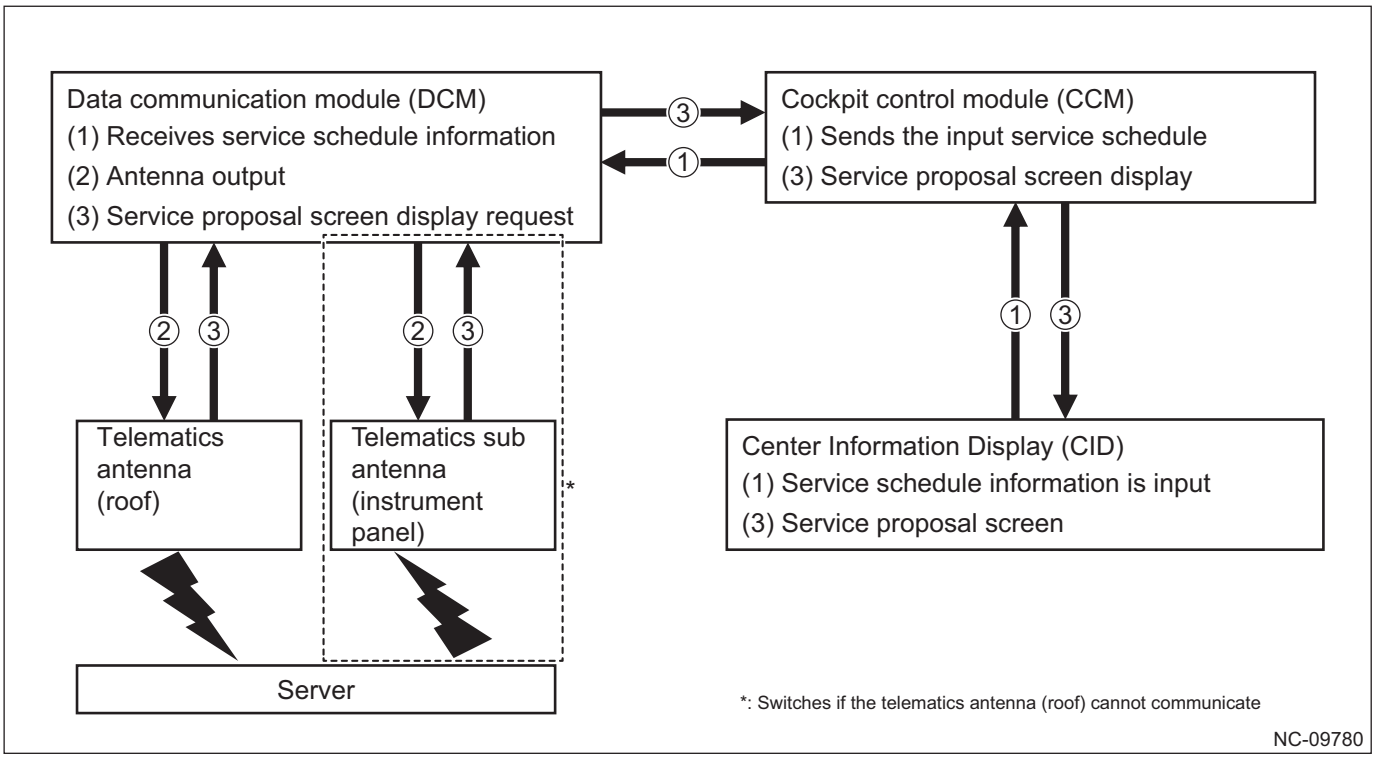
■ Service Appointment Scheduler

- This function allows the user to make a servicing appointment at the preferred SUBARU dealer by operations on the vehicle display.
- When the scheduled servicing appointment approaches, a reminder is displayed on the display. The user can also make a phone call to the SUBARU dealer where he or she wants servicing to be performed, and can receive suggestions for servicing appointments according to vehicle conditions and any active servicing campaigns.

Reference

- In order to call the SUBARU dealer, the user's mobile phone must be configured to allow hands-free calling using the in-vehicle device.
- Depending on the SUBARU dealer where the user wants to have the car serviced, it may not be possible to access the dealer from the Service Appointment Scheduler.
- Service Appointment Scheduler can also be used from MySubaru.
- When a failure occurs or when the time for regular maintenance arrives, the suggested servicing appointment screen is displayed based on communication from the server.
- Be aware that if the suggested servicing appointment screen of the Center Information Display (CID) is not operated within 3 minutes of being displayed, a timeout error occurs and the details cannot be displayed. The same information is sent in a notification by email or other means that was set by the user from MySubaru. Therefore, if the details display of the Center Information Display (CID) cannot be opened, check the information in the received notification.

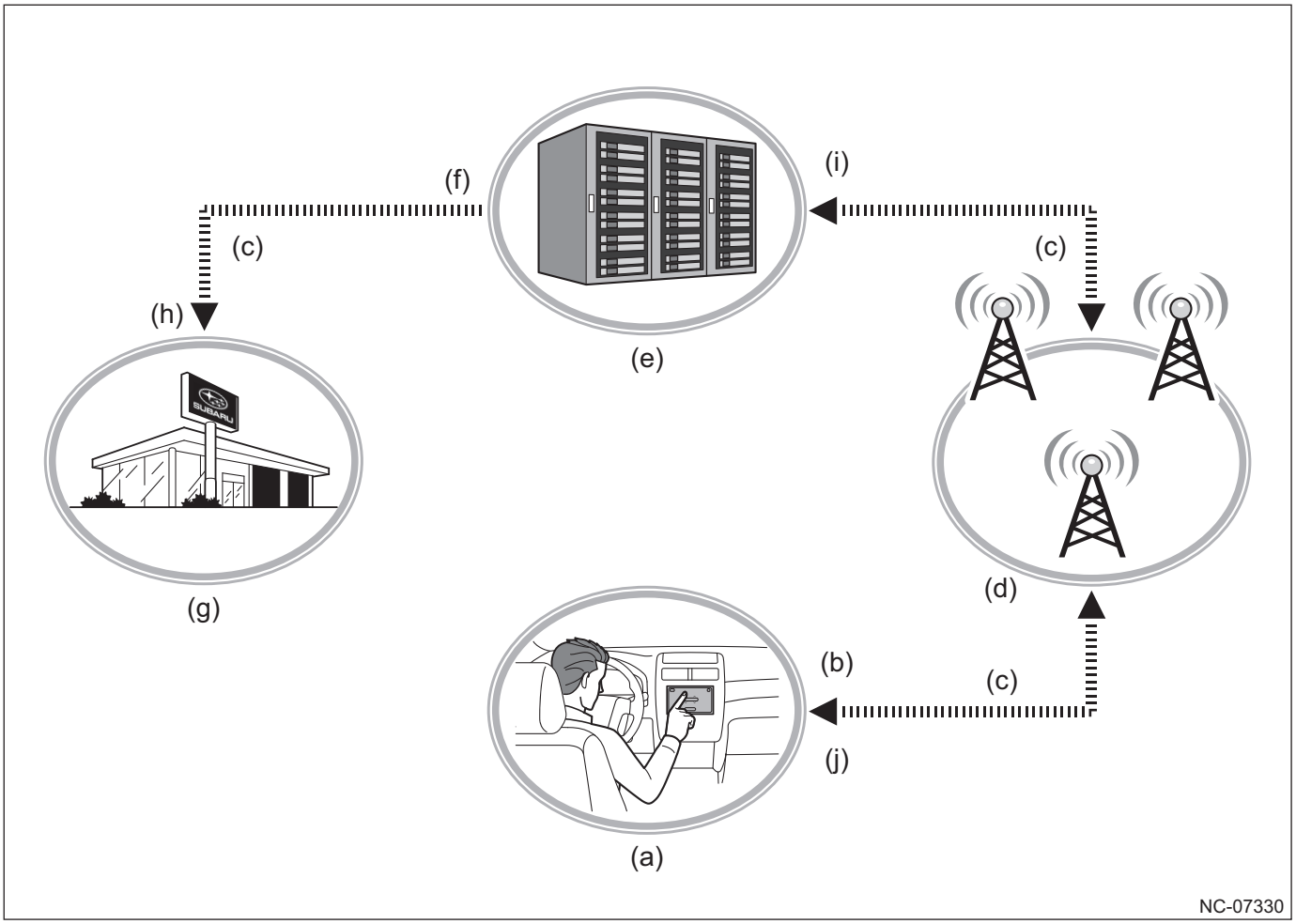
Vehicle side control flow



No.	Control description	Supported unit
(1)	Operates the display and makes an appointment for servicing at the preferred SUBARU dealer from the Service Appointment Scheduler.	• Center Information Display (CID) • Cockpit Control module (CCM) • Data communication module (DCM)
(2)	Sends the appointment servicing schedule information to the server.	• Data communication module (DCM) • Telematics antenna • Telematics sub antenna*
(3)	Receives the request to display the suggested servicing appointment screen from the server, and displays the screen.	• Telematics antenna • Telematics sub antenna* • Data communication module (DCM) • Cockpit Control module (CCM) • Center Information Display (CID)

**: Corresponds to when the telematics antenna cannot communicate due to damage or other problem*

Service Appointment Scheduler service flow



** The illustration shows an example of the service flow that may differ from the actual service.*

(a)	Makes an appointment for servicing at the preferred SUBARU dealer.	(f)	Sends servicing information to the SUBARU dealer where the appointment was made.
(b)	Sends servicing appointment information.	(g)	SUBARU dealer preferred by the user
(c)	Mobile phone line	(h)	Receives user servicing appointment information.
(d)	Mobile phone base station	(i)	Requests the display of the suggested servicing appointment screen according to the vehicle conditions and any active servicing campaigns.
(e)	Server	(j)	Displays the suggested servicing appointment screen.

■ Remote Services

- This service allows the user to remotely operate the vehicle from MySubaru when in a location away from the vehicle.

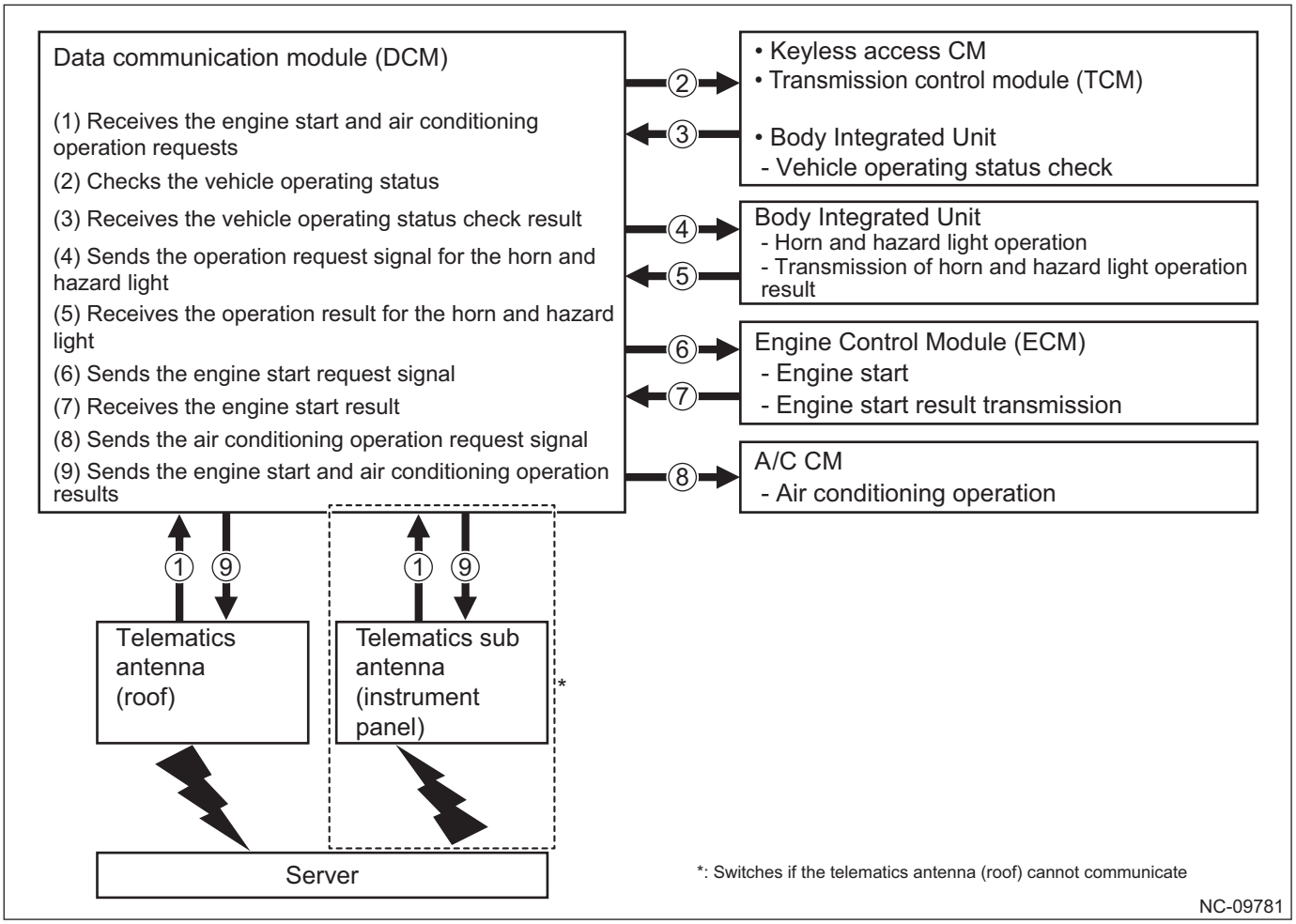
▮ Remote Engine Start with Climate Control (CVT only)

- This function can start the vehicle engine and activate the air conditioning system by remote operation from MySubaru when the user wants to prepare a comfortable vehicle interior temperature before boarding.
- Because detailed operation settings such as the timer from engine start to stop, and the air conditioning system temperature and fan settings, can also be operated from MySubaru. This makes it possible to prepare a comfortable interior environment before boarding the vehicle.
- After the vehicle engine is started by remote operation, the engine is stopped automatically by a timer. The engine can also be stopped by a MySubaru screen operation.

Warning
Do not use Remote Engine Start with Climate Control when the vehicle is located in a garage or other closed environment. If the engine is started in a closed environment, the level of carbon monoxide may build up to a level that can harm human health.

Reference
- Under some vehicle conditions, such as when the door, engine hood, or trunk is open, Remote Engine Start with Climate Control cannot be used.
- Depending on the signal conditions, there may be cases when Remote Engine Start with Climate Control cannot be used or when the actual vehicle conditions do not match those on the MySubaru notification screen.

Vehicle side control flow



No.	Control description	Supported unit
(1)	Receives the engine start and air conditioning operation requests from the server.	• Telematics antenna • Telematics sub antenna* • Data communication module (DCM)
(2)	Sends a request to check the open/closed status of the doors, engine hood, and trunk, vehicle speed, and other vehicle operation status.	• Data communication module (DCM) • Keyless access CM • Transmission control module (TCM) • Body Integrated Unit
(3)	Receives the vehicle operating status check result, and judges whether or not the engine can be started.	• Keyless access CM • Transmission control module (TCM) • Body Integrated Unit • Data communication module (DCM)
(4)	In order to provide notice that the engine was started by remote operation, sends a request signal for operation of the horn and hazard lights.	• Data communication module (DCM) • Body Integrated Unit
(5)	Receives the operation result for the horn and hazard lights.	• Body Integrated Unit • Data communication module (DCM)
(6)	Sends the engine start request signal.	• Data communication module (DCM) • Engine Control Module (ECM)
(7)	Receives the engine start result.	• Engine Control Module (ECM) • Data communication module (DCM)
(8)	Sends the air conditioning operation request signal and the temperature, air flow volume, and other operation setting signals.	• Data communication module (DCM) • A/C CM
(9)	Sends the engine start result to the server.	• Data communication module (DCM) • Telematics antenna • Telematics sub antenna*

**: Corresponds to when the telematics antenna cannot communicate due to damage or other problem*

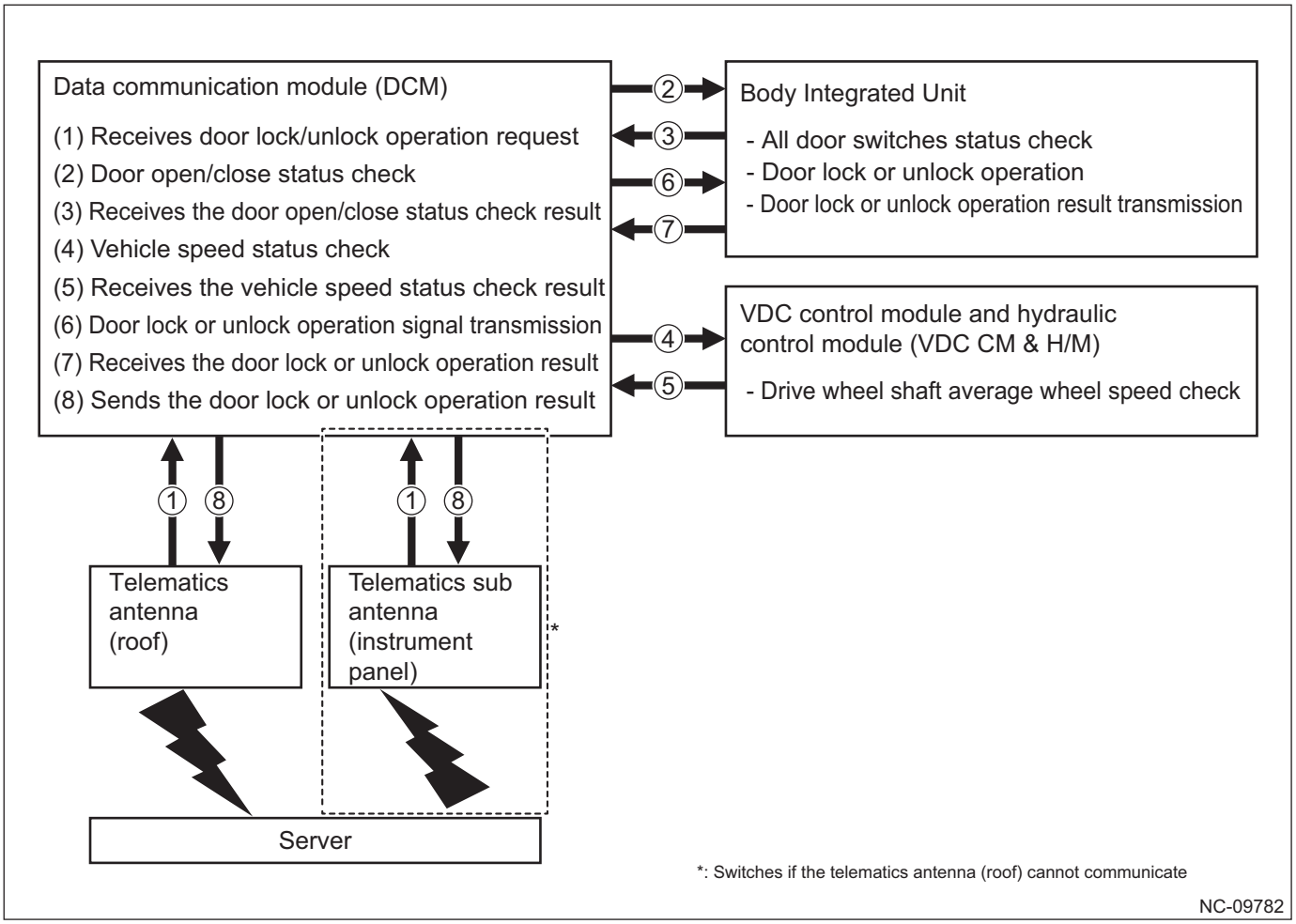
Remote Door Lock & Unlock

- This function allows door lock and unlock to be performed by remote operation from MySubaru in cases such as when the user forgot to lock the doors or when the smart key was locked inside.
- Being able to operate door lock and unlock remotely helps in resolving trouble caused by careless user errors such as forgetting to lock the doors or locking the smart key inside the car.
- The user can select whether to unlock the driver's door or all doors.
- Door lock and unlock by remote operation are not possible when the vehicle is driving. However door unlock operation only is accepted when the vehicle speed is 5 km/h or less.

Reference

- Door lock and unlock by remote operation also can also be used by contacting STARLINK Customer Care (1-855-753-2495).
- If a door is not opened within 60 seconds after remote door unlock, the doors are automatically locked. A beep sound occurs 5 seconds before the doors are automatically locked.
- Depending on the signal conditions, it may not be possible to use Remote Door Lock & Unlock.
- Depending on the signal conditions, there may be cases when Remote Door Lock & Unlock cannot be used or when the actual vehicle conditions do not match those on the MySubaru notification screen.

Vehicle side control flow



No.	Control description	Supported unit
(1)	Receives a door lock or unlock operation request from the server.	• Telematics antenna • Telematics sub antenna* • Data communication module (DCM)
(2)	Sends the door open/close status check request.	• Data communication module (DCM) • Body Integrated Unit
(3)	Receives the door open/close status check result.	• Body Integrated Unit • Data communication module (DCM)
(4)	Sends the vehicle speed status check request.	• Data communication module (DCM) • VDC CM & H/M
(5)	Receives the vehicle speed status check result and judges whether or not to start door lock or unlock operation.	• VDC CM & H/M • Data communication module (DCM)
(6)	Sends the door lock or unlock operation signal.	• Data communication module (DCM) • Body Integrated Unit
(7)	Receives the door lock or unlock operation result.	• Body Integrated Unit • Data communication module (DCM)
(8)	Sends the door lock or unlock operation result to the server.	• Data communication module (DCM) • Telematics antenna • Telematics sub antenna*

**: Corresponds to when the telematics antenna cannot communicate due to damage or other problem*

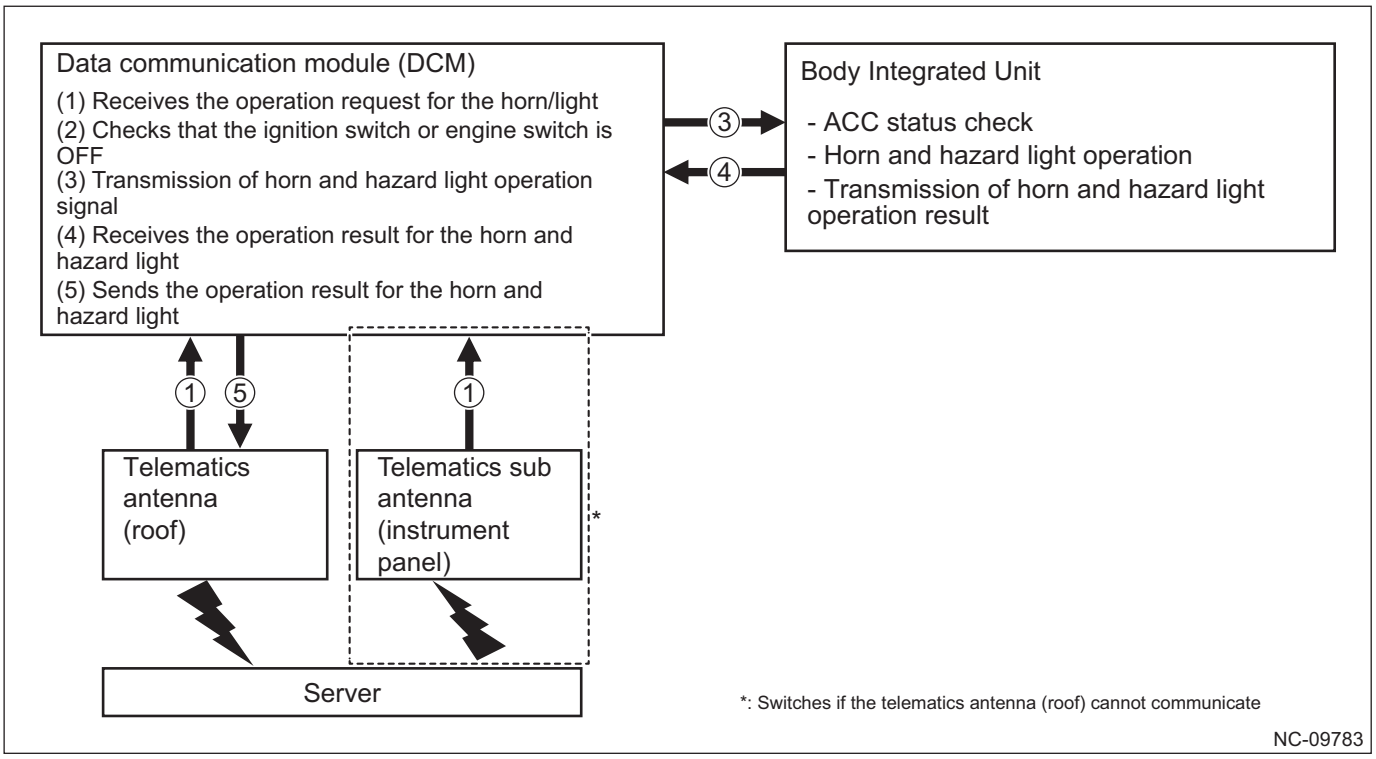
Remote Horn & Lights

- This function can activate the horn and hazard lights by remote operation from MySubaru when the user wants to check the location where the vehicle is parked.
- This helps the user identify the parking location by sounding the horn and flashing the hazard lights, making it easy to find the vehicle when he or she lost sight of it in a parking lot or other area.
- The user can select whether to operate the horn and hazard lights together or whether to operate only the hazard lights. Operating the hazard lights and horn is not possible when the vehicle is driving.

Reference

- Operation of the horn and hazard lights by remote operation can also be used by contacting STARLINK Customer Care (1-855-753-2495).
- The horn and hazard light operating time is 30 seconds. Operation stops during the operating time when the operation is canceled from MySubaru, the doors are unlocked, or the ignition switch or engine switch is turned ON.
- Depending on the signal conditions, it may not be possible to use Remote Horn & Lights.
- Depending on the signal conditions, there may be cases when Remote Horn & Lights cannot be used or when the actual vehicle conditions do not match those on the MySubaru notification screen.

Vehicle side control flow



No.	Control description	Supported unit
(1)	Receives the operation request for the horn and hazard lights from the server.	• Telematics antenna • Telematics sub antenna* • Data communication module (DCM)
(2)	Checks that the ignition switch or engine switch is OFF, and decides to start operation of the horn and hazard lights.	Data communication module (DCM)
(3)	Sends the horn and hazard light operation signals.	• Data communication module (DCM) • Body Integrated Unit
(4)	Receives the operation result for the horn and hazard lights.	• Body Integrated Unit • Data communication module (DCM)
(5)	Sends the operation result for the horn and hazard lights to the server.	• Data communication module (DCM) • Telematics antenna • Telematics sub antenna*

**: Corresponds to when the telematics antenna cannot communicate due to damage or other problem*

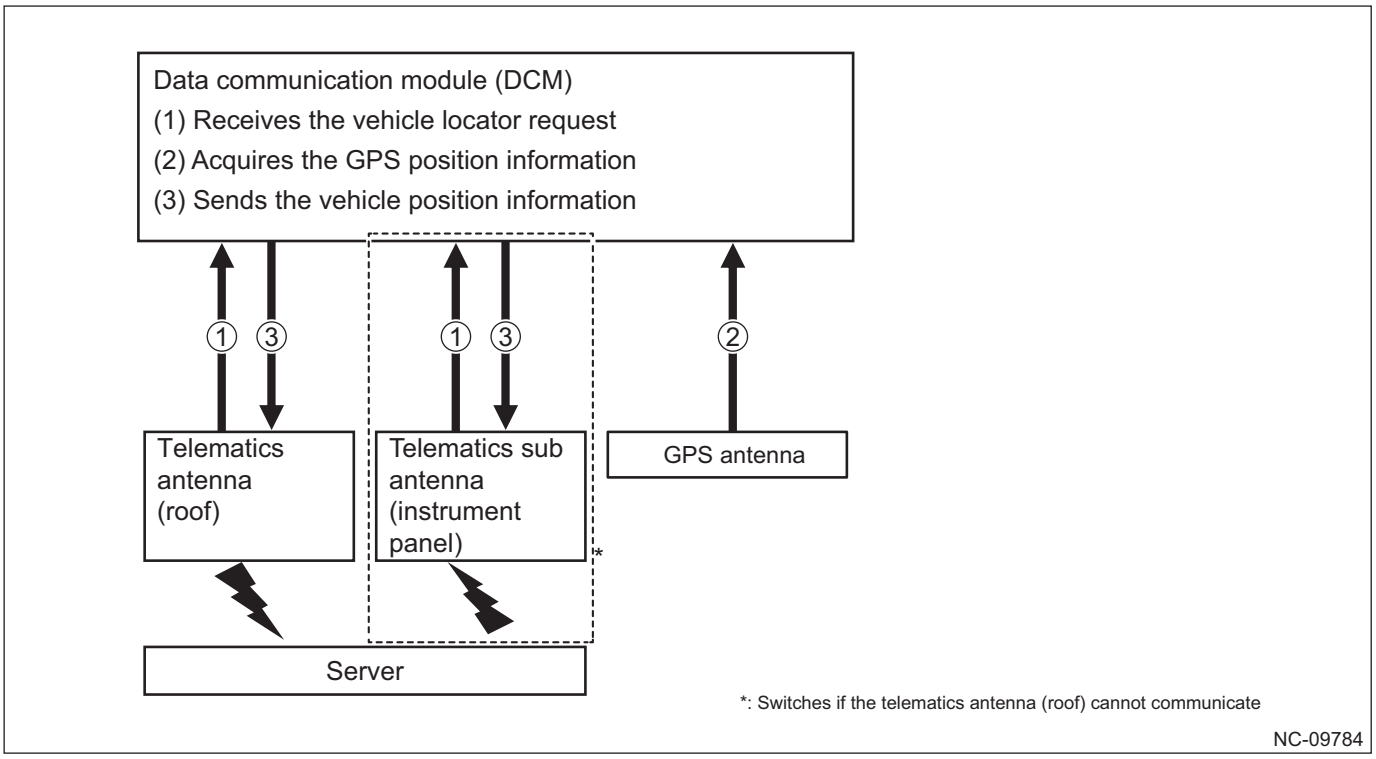
■ Remote Vehicle Locator

- This function can measure the vehicle position using GPS satellites to acquire position information and display the location in a map by remote operation from MySubaru when the user wants to check the location where the vehicle is parked.
- Displaying the vehicle position in the map makes it easy to find the vehicle when the user lost sight of it in a parking lot or other area.
- The acquired vehicle position information can be linked with a smartphone app or online map for use.

Reference

- Acquiring vehicle position information by remote operation can also be used by contacting STARLINK Customer Care (1-855-753-2495).
- Depending on the signal conditions, it may not be possible to use Remote Vehicle Locator.

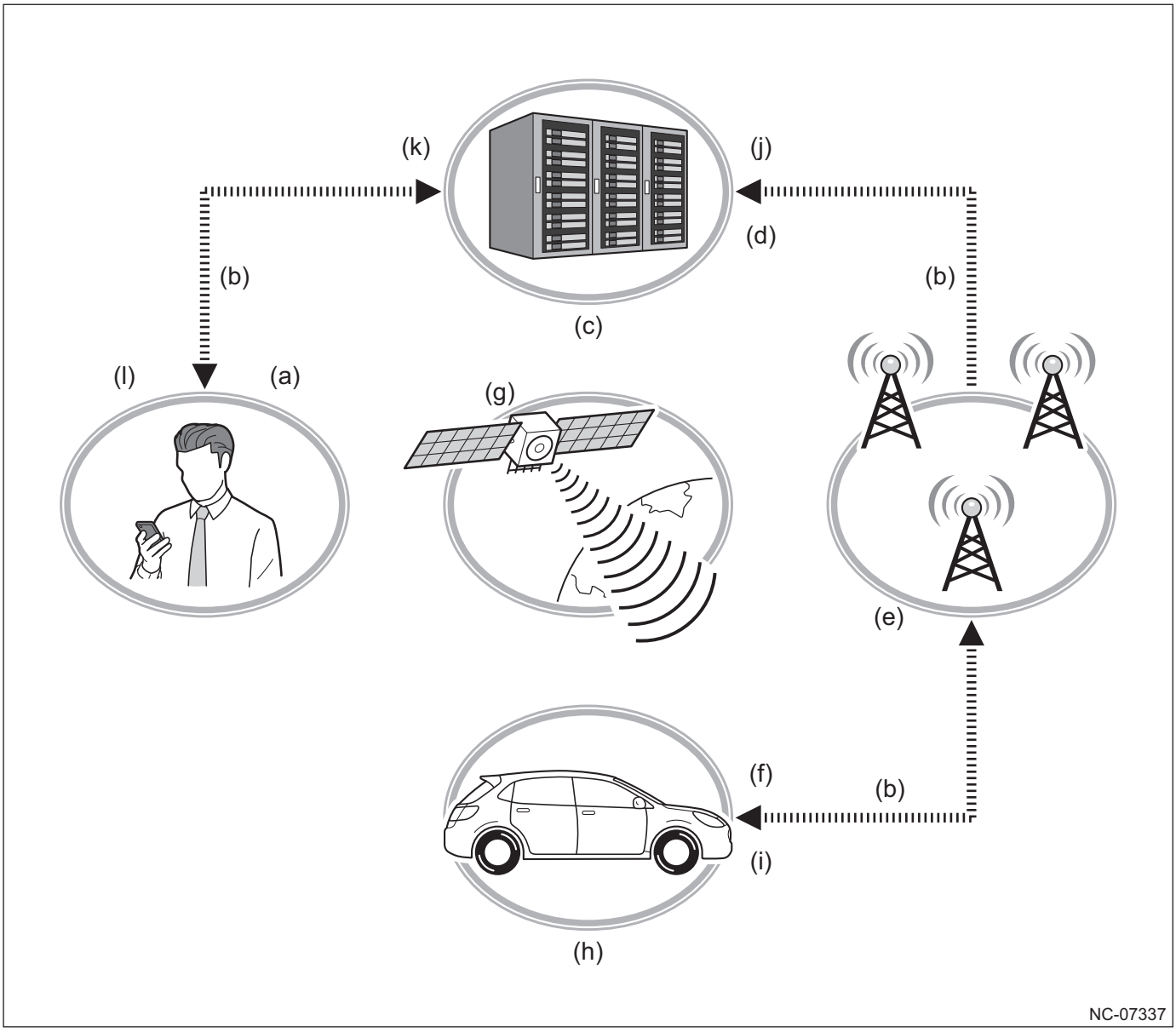
Vehicle side control flow



No.	Control description	Supported unit
(1)	Receives a vehicle position signal request from the server.	• Telematics antenna • Telematics sub antenna* • Data communication module (DCM)
(2)	Measures the vehicle position using GPS satellite signals.	• GPS antenna • Data communication module (DCM)
(3)	Sends the measured vehicle position information to the server.	• Data communication module (DCM) • Telematics antenna • Telematics sub antenna*

**: Corresponds to when the telematics antenna cannot communicate due to damage or other problem*

Remote Services service flow



** The illustration shows an example of the service flow that may differ from the actual service.*

(a)	Remote operation from MySubaru	(g)	GPS satellite
(b)	Mobile phone line	(h)	Executes control according to the remote operation request.
(c)	Server	(i)	Sends the remote operation result or vehicle position information to the server.
(d)	Sends the remote operation request signal to the vehicle.	(j)	Receives the remote operation result or vehicle position information.
(e)	Mobile phone base station	(k)	Sends the remote operation result or vehicle position information to MySubaru.
(f)	Receives the remote operation request signal.	(l)	Checks the remote operation result or vehicle position information on MySubaru.

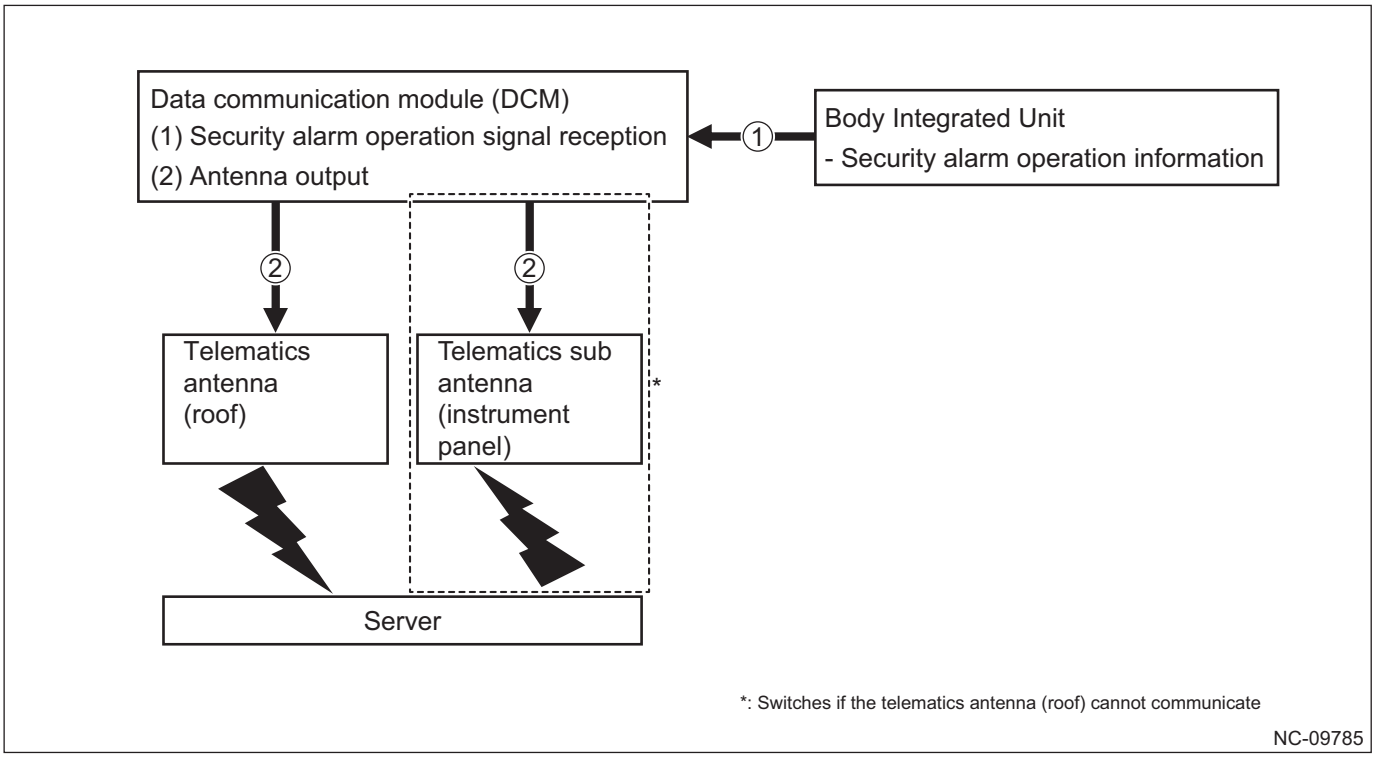
■ Vehicle Security Alarm Notification

- This function automatically sends notification to the email or other address set in advance by the user in MySubaru when the vehicle security alarm is activated.
- Sending notification to the user assists the user in managing the vehicle even when in a location distant from it.

Reference

- The notification address can be registered or changed from MySubaru.
- Depending on the signal conditions, it may not be possible to use Vehicle Security Alarm Notification.
- If the ignition switch or engine switch is not turned ON for 14 days or longer after it was turned OFF, the data communication module (DCM) enters shutdown mode and Vehicle Security Alarm Notification will not be sent. For details, refer to the handling precautions. {11-80}

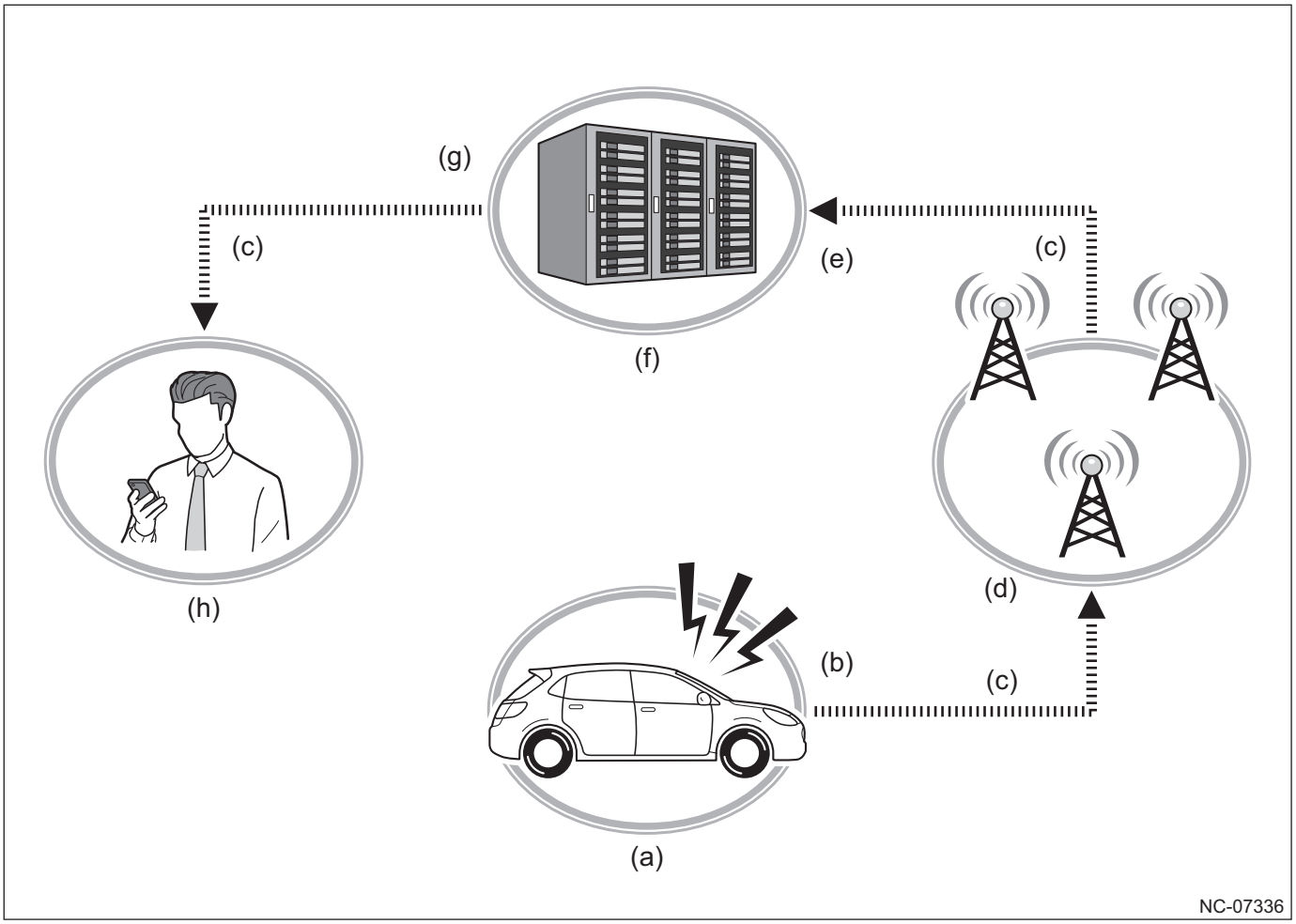
Vehicle side control flow



No.	Control description	Supported unit
(1)	Receives the vehicle security alarm activation signal.	• Body Integrated Unit • Data communication module (DCM)
(2)	Sends the security alarm activation signal to the server.	• Data communication module (DCM) • Telematics antenna • Telematics sub antenna*

**: Corresponds to when the telematics antenna cannot communicate due to damage or other problem*

Vehicle Security Alarm Notification service flow



** The illustration shows an example of the service flow that may differ from the actual service.*

(a)	The vehicle security alarm activates.	(e)	Receives the security alarm activation signal.
(b)	Sends the security alarm activation signal to the server.	(f)	Server
(c)	Mobile phone line	(g)	Sends notification of security alarm activation to the address registered by the user.
(d)	Mobile phone base station	(h)	Receives notifications by email or other means that were set from MySubaru.

■ Stolen Vehicle Recovery Plus

- If the vehicle was stolen, this service enables a STARLINK Customer Care Advisor to cooperate with the police department and help recover the stolen vehicle.
- In order to use this service, it is necessary to report the vehicle theft to the local police department.
- After reporting to the police, the user contacts a STARLINK Customer Care Advisor (1-855-753-2495) and communicates the case number which was received from the police. When this number is confirmed, Stolen Vehicle Recovery Plus is enabled.
- Notification is sent to the user by email or other means when the police were able to recover the stolen vehicle.
- After the vehicle was recovered by the police, and the user contacts a STARLINK Customer Care Advisor, Stolen Vehicle Recovery Plus is disabled.

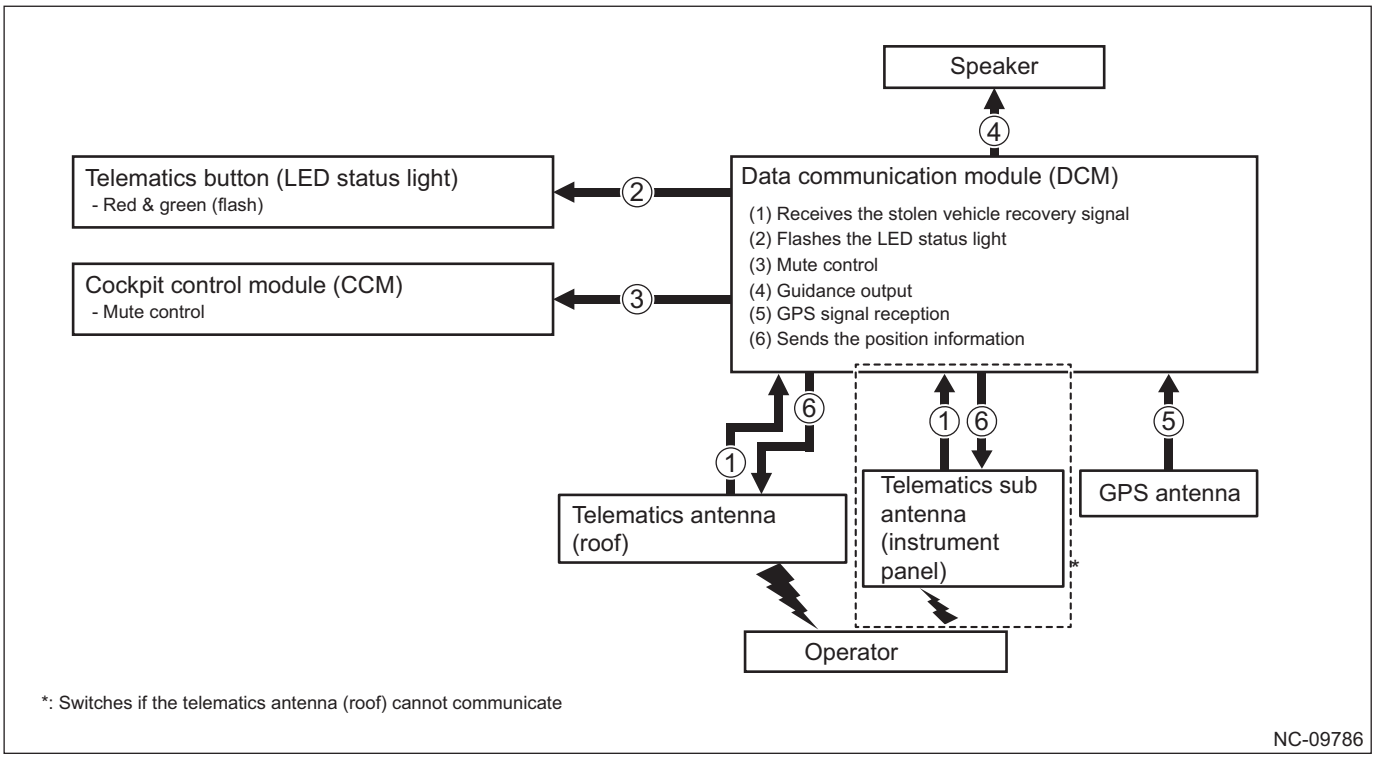
Warning
Attempting to search for and recover the stolen vehicle personally may expose the user to physical danger. Please use Stolen Vehicle Recovery Plus if the vehicle was stolen.

▮ Stolen Vehicle Recovery

- This function plays audio guidance inside the stolen vehicle to provide notice of service start and sends vehicle position information measured from GPS satellites to the server by remote operation from a Customer Care Advisor.
- A Customer Care Advisor sends the position information acquired from the stolen vehicle to the police department and cooperates in identifying its precise position to help recover the stolen vehicle. In order to protect the user from danger, the position information acquired from the vehicle is sent only to the police department and is not disclosed to the user.

Reference
Vehicle position information can be acquired even when the ignition switch or engine switch is OFF.

Vehicle side control flow



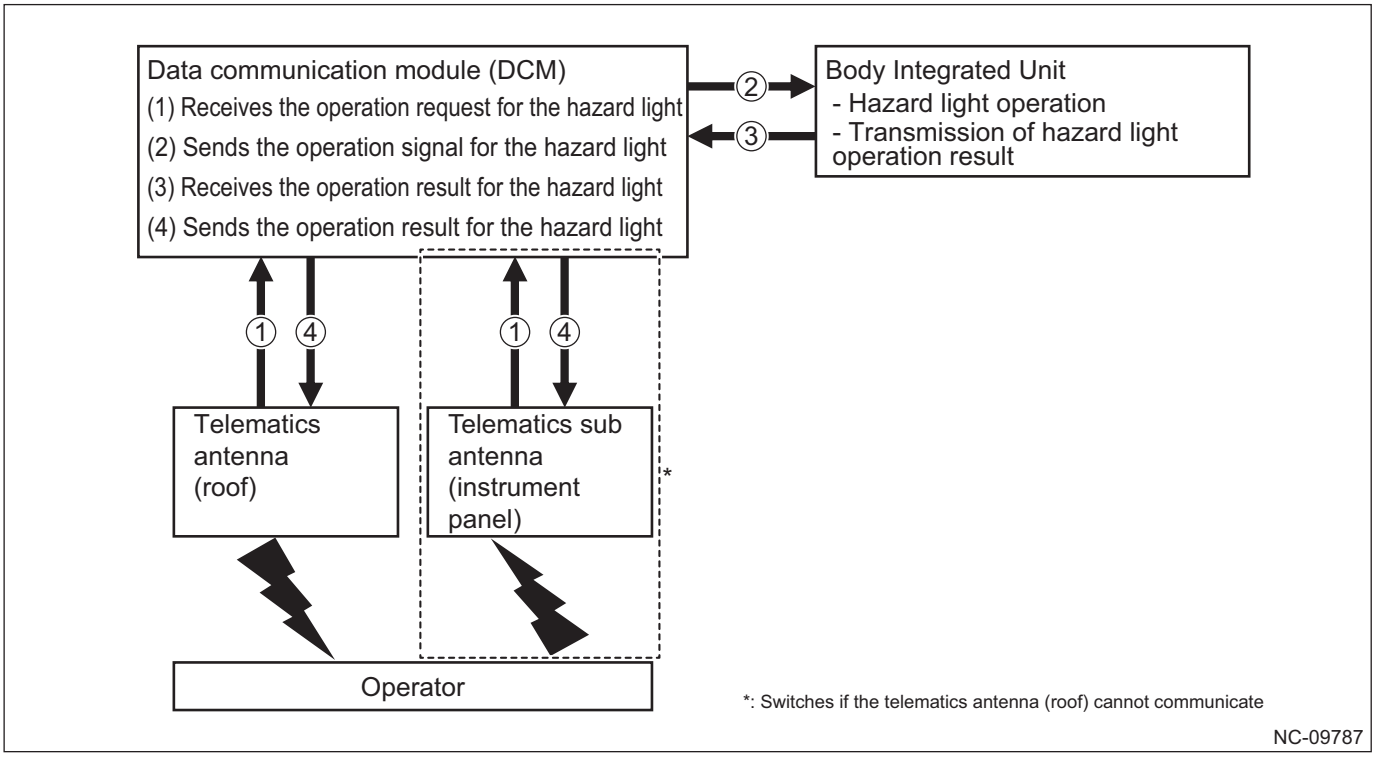
No.	Control description	Supported unit
(1)	Receives a stolen vehicle recovery request signal from the server.	• Telematics antenna • Telematics sub antenna* • Data communication module (DCM)
(2)	Flashes the LED status light.	• Data communication module (DCM) • Telematics button
(3)	Mutes the currently playing audio source.	• Data communication module (DCM) • Cockpit Control module (CCM)
(4)	Outputs the voice guidance to speakers.	• Data communication module (DCM) • Speaker
(5)	Measures the vehicle position using GPS satellite signals.	• GPS antenna • Data communication module (DCM)
(6)	Sends the measured vehicle position information to the server.	• Data communication module (DCM) • Telematics antenna • Telematics sub antenna*

**: Corresponds to when the telematics antenna cannot communicate due to damage or other problem*

▮ Stolen Vehicle Flashing Light

- Upon request from the police, this function allows the hazard lights of a stolen vehicle to be activated by remote operation from a STARLINK Customer Care Advisor.
- Activating the vehicle hazard lights helps the police to identify the stolen vehicle.

Vehicle side control flow



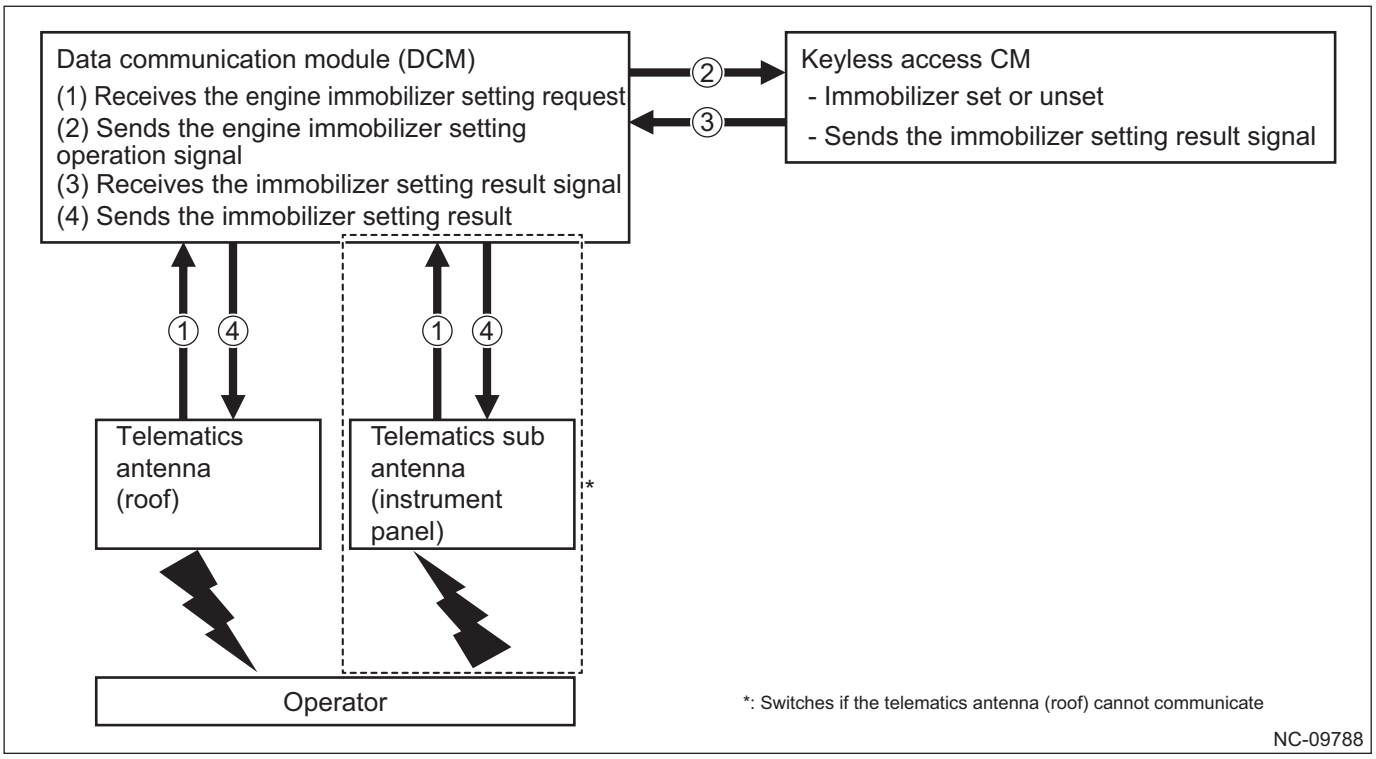
No.	Control description	Supported unit
(1)	Receives the hazard light activation request signal from the server.	• Telematics antenna • Telematics sub antenna* • Data communication module (DCM)
(2)	Sends the hazard light activation signal.	• Data communication module (DCM) • Body Integrated Unit
(3)	Receives the hazard light operation result.	• Body Integrated Unit • Data communication module (DCM)
(4)	Sends the hazard light operation result to the server.	• Data communication module (DCM) • Telematics antenna • Telematics sub antenna*

**: Corresponds to when the telematics antenna cannot communicate due to damage or other problem*

Stolen Vehicle Immobilizer

- Upon request from the police, this function allows a Customer Care Advisor to perform a remote operation that prevents the engine of a stolen vehicle from being started.
- Setting the activation restriction on the vehicle engine immobilizer by remote operation prevents the engine from being started. If the activation restriction is set while the engine is running, the restriction takes effect after the engine stops and prevents the engine from being restarted.
- When the engine cannot be started, the vehicle cannot be moved. This assists the police in recovering the stolen vehicle.

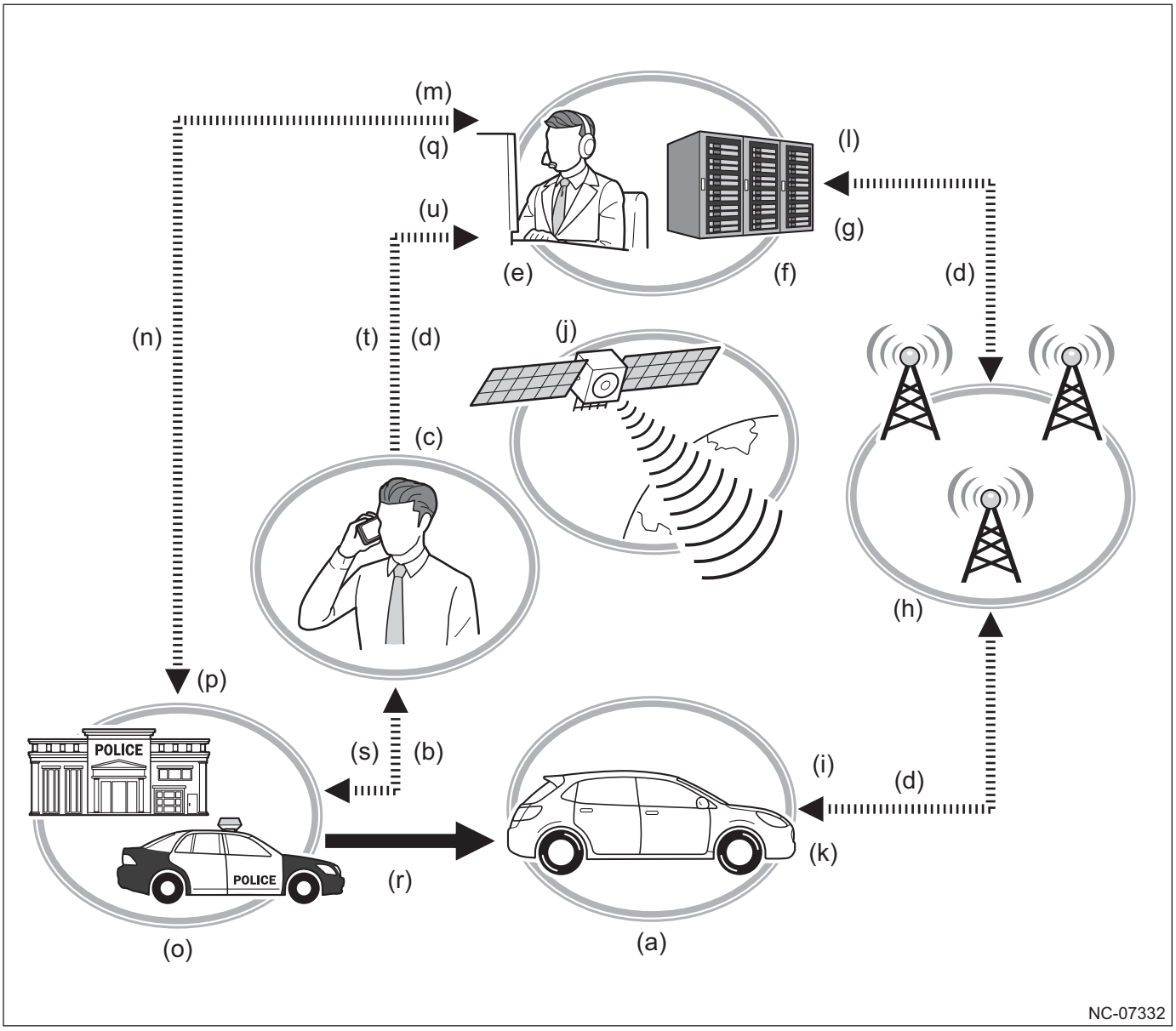
Vehicle side control flow



No.	Control description	Supported unit
(1)	Receives the engine immobilizer setting request signal from the server.	• Telematics antenna • Telematics sub antenna* • Data communication module (DCM)
(2)	Sends the engine immobilizer setting operation signal.	• Data communication module (DCM) • Keyless access CM
(3)	Receives the engine immobilizer setting result.	• Keyless access CM • Data communication module (DCM)
(4)	Sends the engine immobilizer setting result to the server.	• Data communication module (DCM) • Telematics antenna • Telematics sub antenna*

**: Corresponds to when the telematics antenna cannot communicate due to damage or other problem*

Stolen Vehicle Recovery Plus service flow



** The illustration shows an example of the service flow that may differ from the actual service.*

(a)	Stolen vehicle	(l)	Receives position information and remote operation results from the vehicle.
(b)	The user notices the vehicle theft and reports it to the police.	(m)	Notify the police of the vehicle position information or the operation result when there is a remote operation request of the stolen vehicle.
(c)	Reports the case number received from the police to the Customer Care Advisor at the SUBARU STARLINK Call Center.	(n)	Fixed line
(d)	Mobile phone line	(o)	Police department
(e)	Customer Care Advisor	(p)	Requests operation to support recovery of the stolen vehicle.
(f)	Server	(q)	Receives request from the police for remote operation of the stolen vehicle.

(g) Operates the vehicle remotely and starts Stolen Vehicle Recovery Plus, and as necessary requests the remote operations that are requested by the police.

(h) Mobile phone base station

(i) Receives the Stolen Vehicle Recovery Plus start signal and remote operation request signals from the server.

(j) GPS satellite

(k) Sends position information and remote operation results to the server.

(r) Go to the location indicated by the position information of the stolen vehicle and recover the vehicle.

(s) Send email to notify the user that the stolen vehicle was recovered and return the vehicle.

(t) Notifies a Customer Care Advisor at the SUBARU STARLINK Call Center that the vehicle was returned.

(u) Ends Stolen Vehicle Recovery Plus.

■ Vehicle Alerts

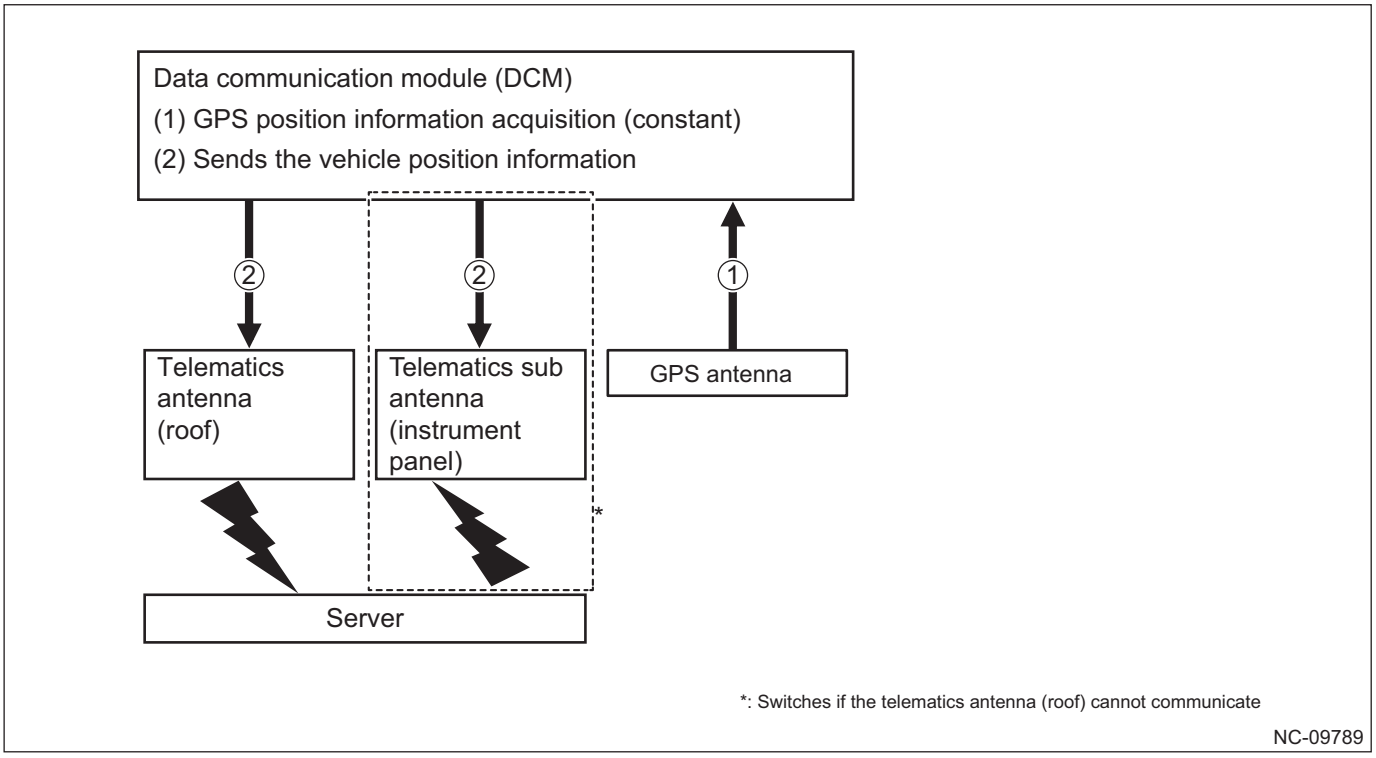
- This service allows limits to be set from MySubaru when the vehicle was loaned to someone, and allows the driver using the vehicle to be managed.

▮ Boundary Alert

- This function allows the user to set boundary lines in the map from MySubaru and receive an alert by email or other means (set by the user from MySubaru) when the vehicle crosses a boundary line.
- The boundary line can be set by drawing a circle or square in the map, creating a virtual fence.
- Alerts are sent either when the vehicle exits the area defined by a boundary lines or when it enters the area defined by the boundary lines. It is also possible to select which of these circumstances to receive notification in.
- These notifications can be used by the user to manage the driver using the vehicle.

Reference
Depending on the signal conditions, it may not be possible to use Boundary Alert.

Vehicle side control flow



No.	Control description	Supported unit
(1)	Measures the vehicle position using GPS satellite signals.	• GPS antenna • Data communication module (DCM)
(2)	Sends the measured vehicle position information to the server.	• Data communication module (DCM) • Telematics antenna • Telematics sub antenna*

**: Corresponds to when the telematics antenna cannot communicate due to damage or other problem*

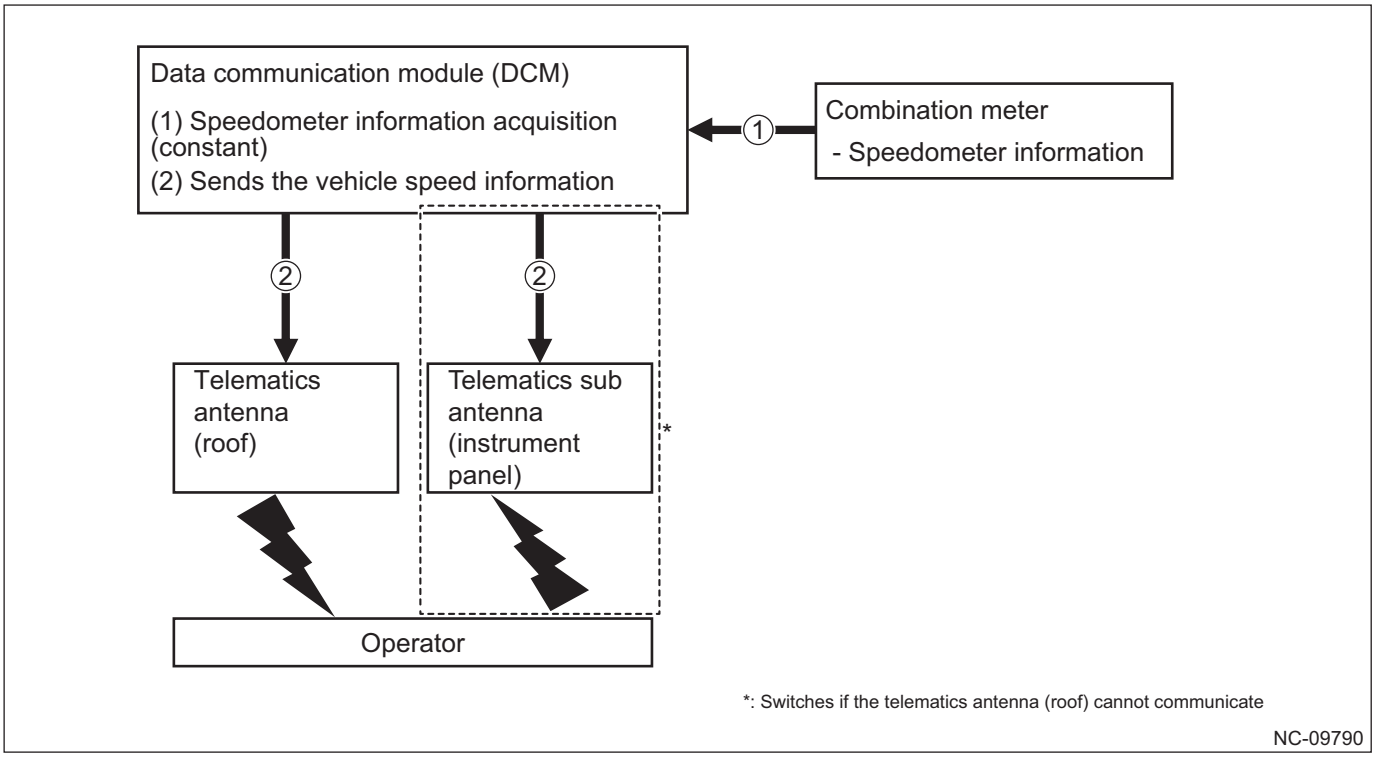
■ Speed Alert

- This function allows the user to set a vehicle speed from MySubaru and receive an alert by email or other means (set by the user from MySubaru) when the vehicle exceeds the set speed.
- In addition to speed, it is also possible to set an elapsed length of time, and receive notification if the vehicle exceeds either the set speed or set time.
- These notifications can be used by the user to manage the driver using the vehicle.

Reference

Depending on the signal conditions, it may not be possible to use Speed Alert.

Vehicle side control flow



No.	Control description	Supported unit
(1)	Receives speedometer information. (Continual)	• Combination meter • Data communication module (DCM)
(2)	Sends the vehicle speed information to the server.	• Data communication module (DCM) • Telematics antenna • Telematics sub antenna*

**: Corresponds to when the telematics antenna cannot communicate due to damage or other problem*

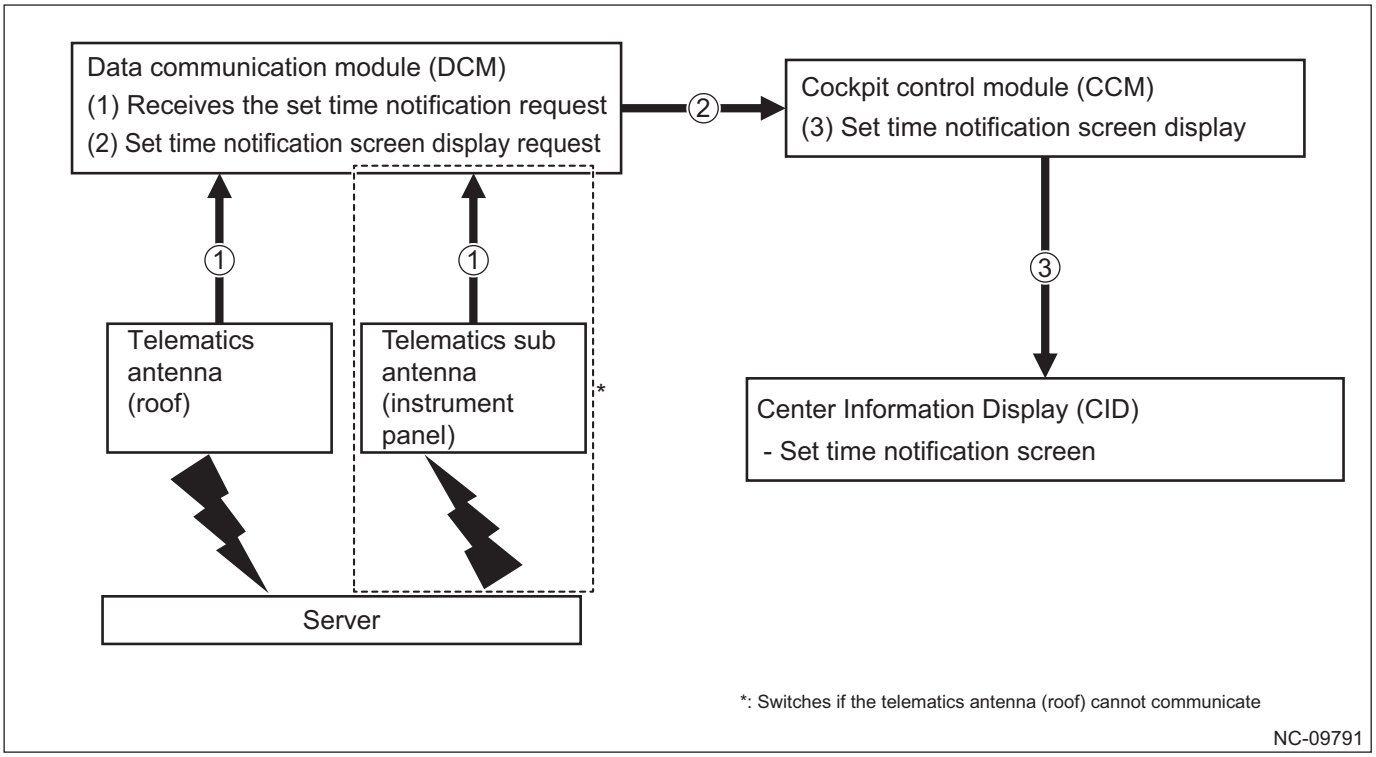
■ Curfew Alert

- This function allows the user to set clock times from MySubaru and receive an alert by email or other means (set by the user from MySubaru) when the vehicle was used within the set times.
- A message indicating that the set time is approaching can be displayed on the in-vehicle device display beginning 15 minutes before the set time in order to notify the driver using the vehicle.
- These notifications can be used by the user to manage the driver using the vehicle.

Reference

Depending on the signal conditions, it may not be possible to use Curfew Alert.

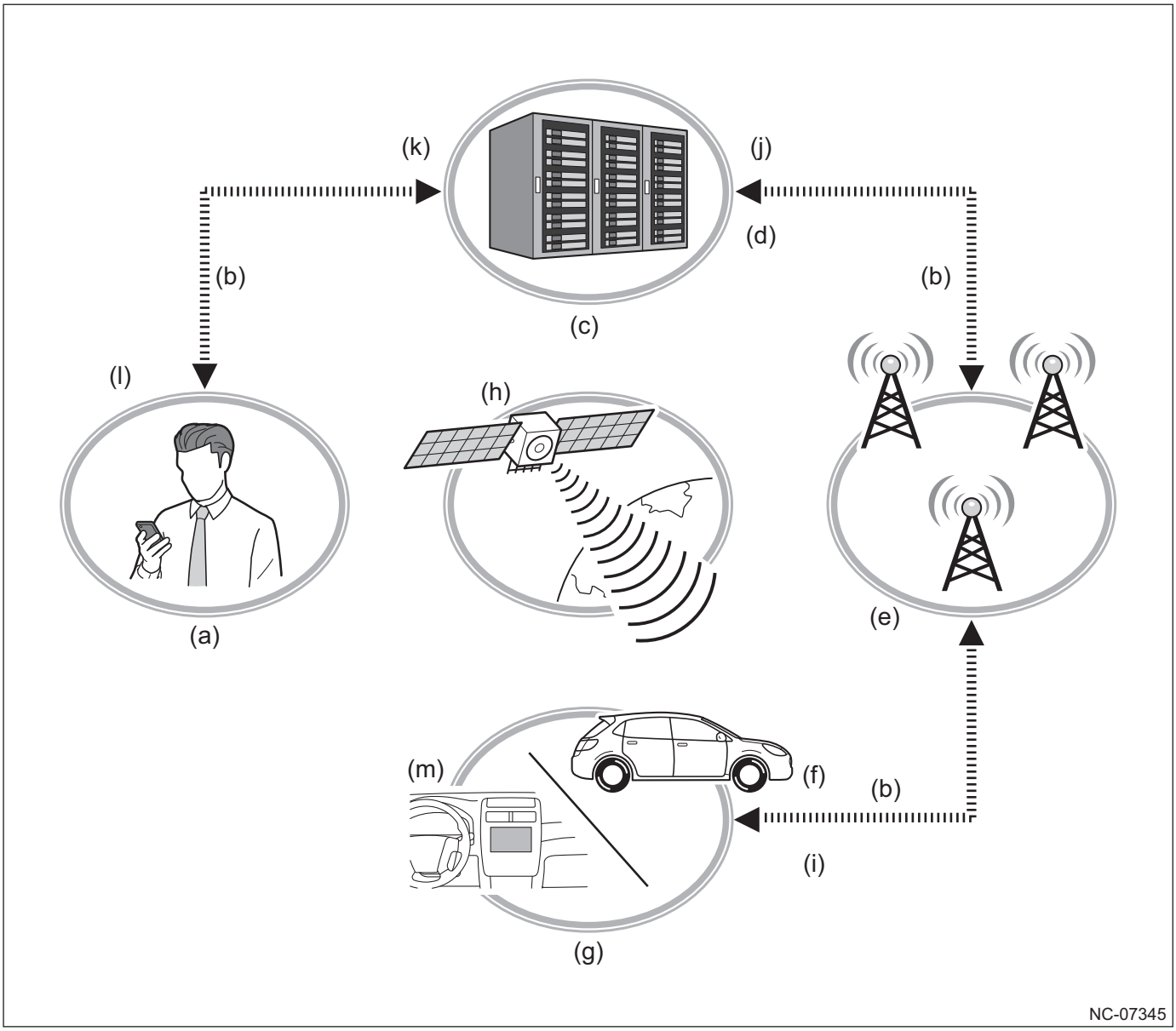
Vehicle side control flow



No.	Control description	Supported unit
(1)	Receives the set time notification request from the server.	• Telematics antenna • Telematics sub antenna* • Data communication module (DCM)
(2)	Sends the set time notification screen display request signal.	• Data communication module (DCM) • Cockpit Control module (CCM)
(3)	Shows a screen indicating that the set time is approaching on the display.	• Cockpit Control module (CCM) • Center Information Display (CID)

**: Corresponds to when the telematics antenna cannot communicate due to damage or other problem*

Vehicle Alerts service flow



** The illustration shows an example of the service flow that may differ from the actual service.*

(a)	Sets alert items from MySubaru.	(h)	GPS satellite
(b)	Mobile phone line	(i)	Sends the information requested by the request signal to the server.
(c)	Server	(j)	Receives information from the vehicle.
(d)	Requests the information necessary for alert items that were set with MySubaru.	(k)	Sends alert notifications which are judged necessary based on the set items to MySubaru.
(e)	Mobile phone base station	(l)	Checks the Vehicle Alerts received by email or other means (set by the user from MySubaru), and manages the driver using the loaned vehicle.
(f)	Receives the request signal for the information necessary for the alert items.	(m)	When the user has set Curfew Alert, shows a message indicating that the time is approaching on the display.
(g)	Loaned user vehicle		

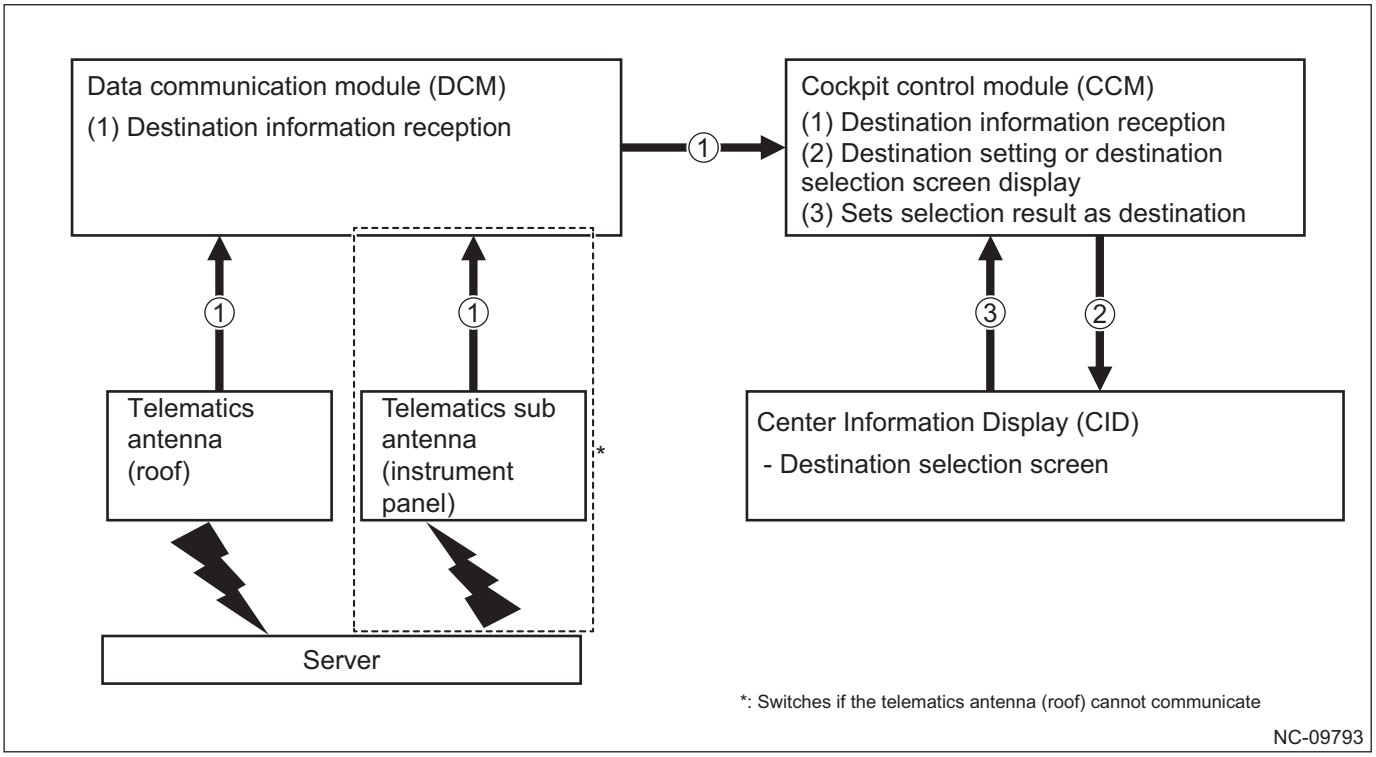
■ Destination to Vehicle

- The destination can be searched for and set on MySubaru, and then sent to the vehicle navigation system. The destination can be set in advance, which enables the user to depart for the destination immediately after entering the vehicle.
- Multiple destinations can also be set. 1 trip is established for the first destination to be set, and up to 5 destinations can be set within the trip, including the first destination.

Reference

If route guidance is already in progress on the navigation system that receives the destination information, the user can select how to handle the received destination on the display.

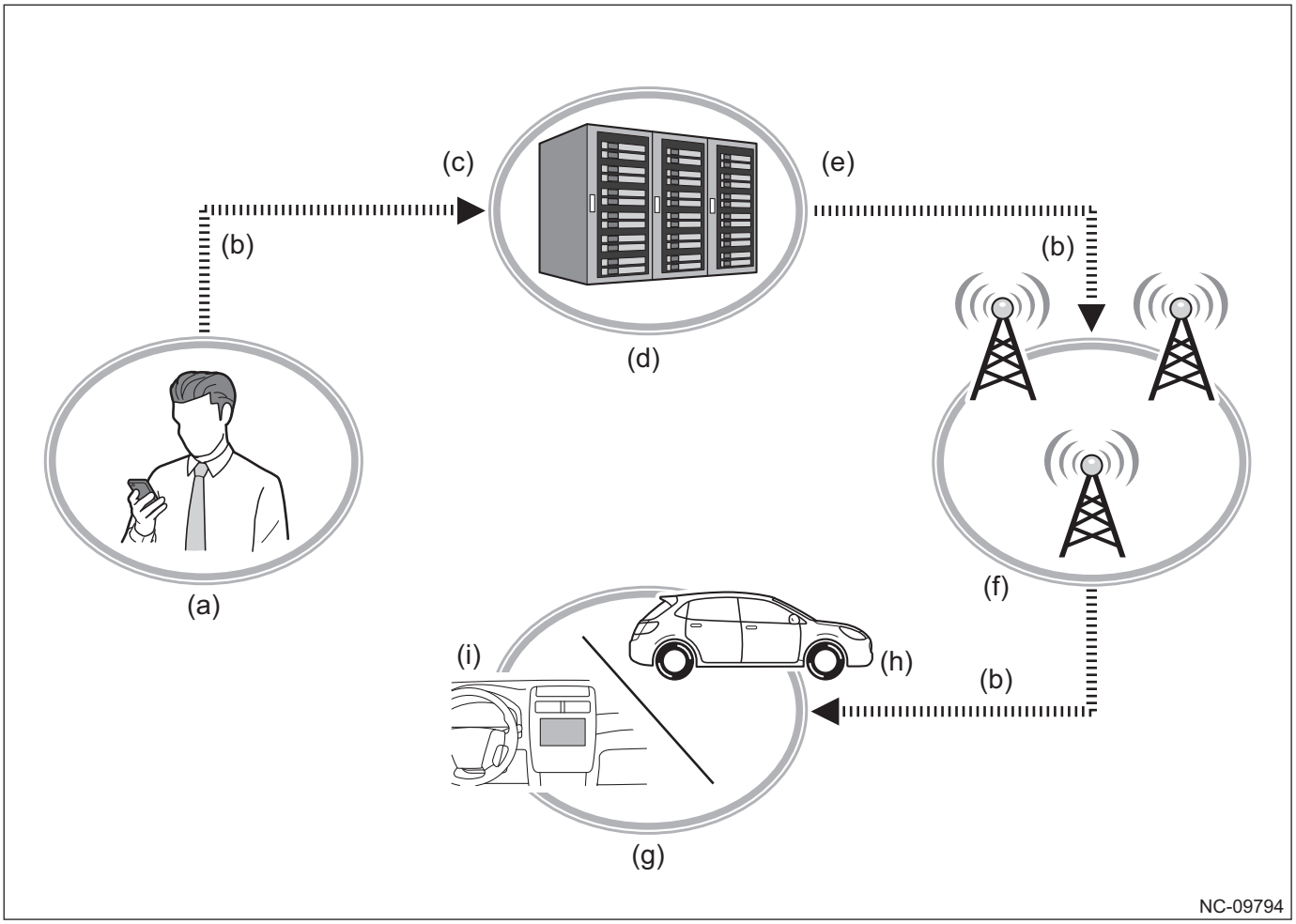
Vehicle side control flow



No.	Control description	Supported unit
(1)	Receives destination information from the server.	• Telematics antenna • Telematics sub antenna* • Data communication module (DCM) • Cockpit Control module (CCM)
(2)	Sets the received destination information as the destination (if route guidance is in progress, displays the destination selection screen)	• Cockpit Control module (CCM) • Center Information Display (CID)
(3)	Sets the destination according to the screen selection result	• Center Information Display (CID) • Cockpit Control module (CCM)

**: Corresponds to when the telematics antenna cannot communicate due to damage or other problem*

Destination to Vehicle service flow



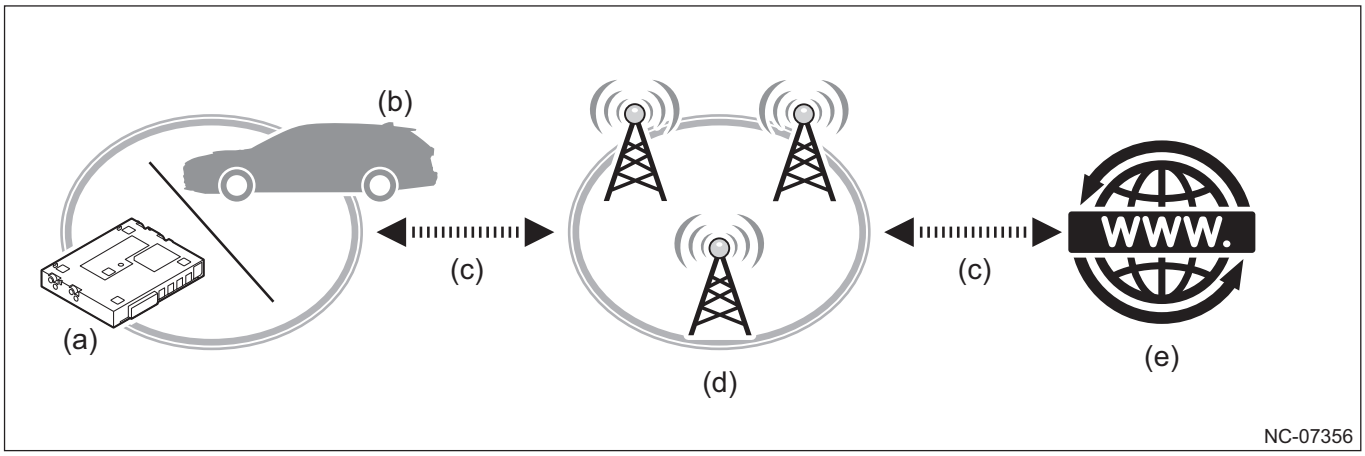
** The illustration shows an example of the service flow that may differ from the actual service.*

(a)	Sends destination searched for and set on MySubaru	(f)	Mobile phone base station
(b)	Mobile phone line	(g)	User vehicle
(c)	Receives destination information set by user	(h)	Receives destination information from server
(d)	Server	(i)	If route guidance is in progress, displays destination selection screen
(e)	Sends destination information set by user		

Wi-Fi Hotspot

- This function uses the 4G/LTE communication functions of the data communication module (DCM) and the Wi-Fi functions of the in-vehicle device to connect the in-vehicle device to a mobile phone network, allowing the vehicle to be used as a wireless LAN access point.
- In addition to the user, other occupants can each use Internet services from Wi-Fi capable mobile devices while inside the vehicle. For details about Wi-Fi Hotspot, refer to "Audio and Speaker System". {11-37}

Wi-Fi Hotspot service flow



(a)	Access from inside the vehicle using Wi-Fi	(d)	Mobile phone base station
(b)	Mobile phone network and 4G/LTE communication	(e)	Internet services
(c)	Mobile phone line		

Quality Management

- This service is prepared in order to maintain and manage quality so that there is no interference when the user uses the vehicle and the SUBARU STARLINK services.

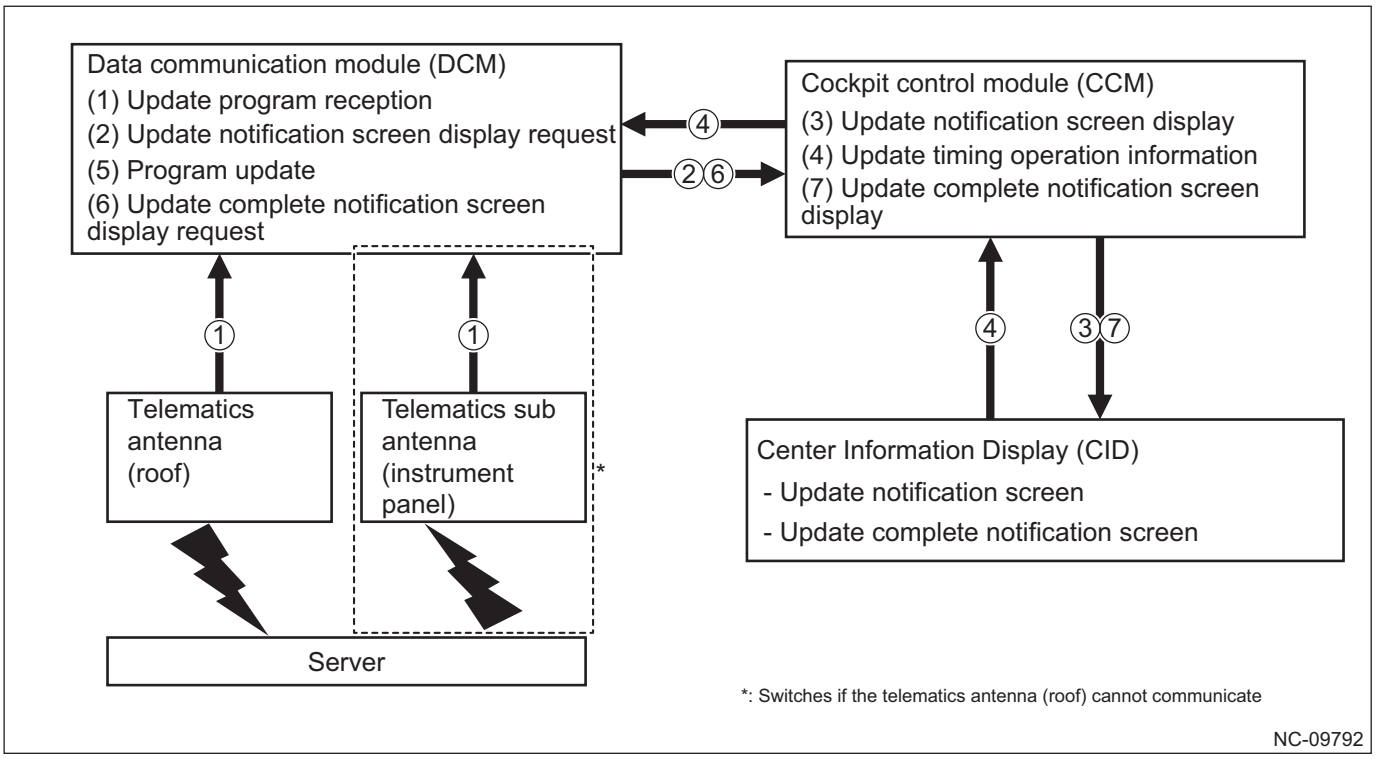
■ SUBARU STARLINK System Update

- This function updates the data communication module (DCM) program by Firmware Over The Air (FOTA) (update function using wireless communication) in order to update it to the latest version.
- When an update is available, a notification screen appears on the display when the ignition switch or engine switch is turned OFF, allowing the user to perform the update operation.
- Because the update takes place while the user is away from the vehicle, the user can use the system under the latest conditions when he or she next boards the vehicle.

Reference

- While update is in progress, all SUBARU STARLINK services that utilize the data communication module (DCM) are unavailable.
- When update is completed, the completion screen appears on the display.
- The update timing can be delayed a maximum of 2 times. However, the update is started automatically the third time the ignition switch or engine switch is turned OFF.

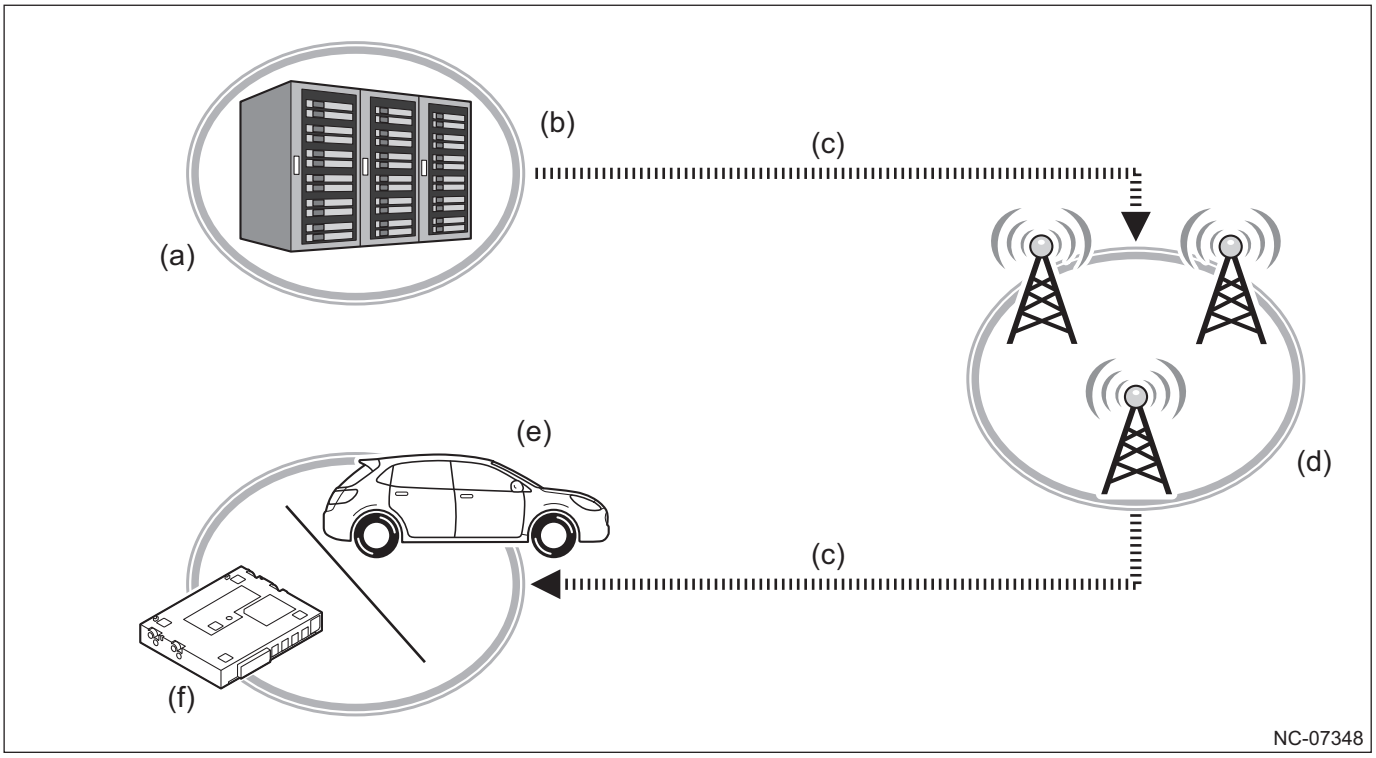
Vehicle side control flow



No.	Control description	Supported unit
(1)	Receives the update program from the server.	• Telematics antenna • Telematics sub antenna* • Data communication module (DCM)
(2)	Sends the software update screen display request signal.	• Data communication module (DCM) • Cockpit Control module (CCM)
(3)	Shows the software update screen on the display.	• Cockpit Control module (CCM) • Center Information Display (CID)
(4)	Sends the update timing operation signal.	• Cockpit Control module (CCM) • Data communication module (DCM)
(5)	Starts program update.	Data communication module (DCM)
(6)	Sends the display request signal for the program update complete screen.	• Data communication module (DCM) • Cockpit Control module (CCM)
(7)	Shows the program update complete screen on the display.	• Cockpit Control module (CCM) • Center Information Display (CID)

**: Corresponds to when the telematics antenna cannot communicate due to damage or other problem*

SUBARU STARLINK System Update service flow



** The illustration shows an example of the service flow that may differ from the actual service.*

(a)	Server	(d)	Mobile phone base station
(b)	Distributes the update program.	(e)	Receives the update program.
(c)	Mobile phone line	(f)	Updates the program.

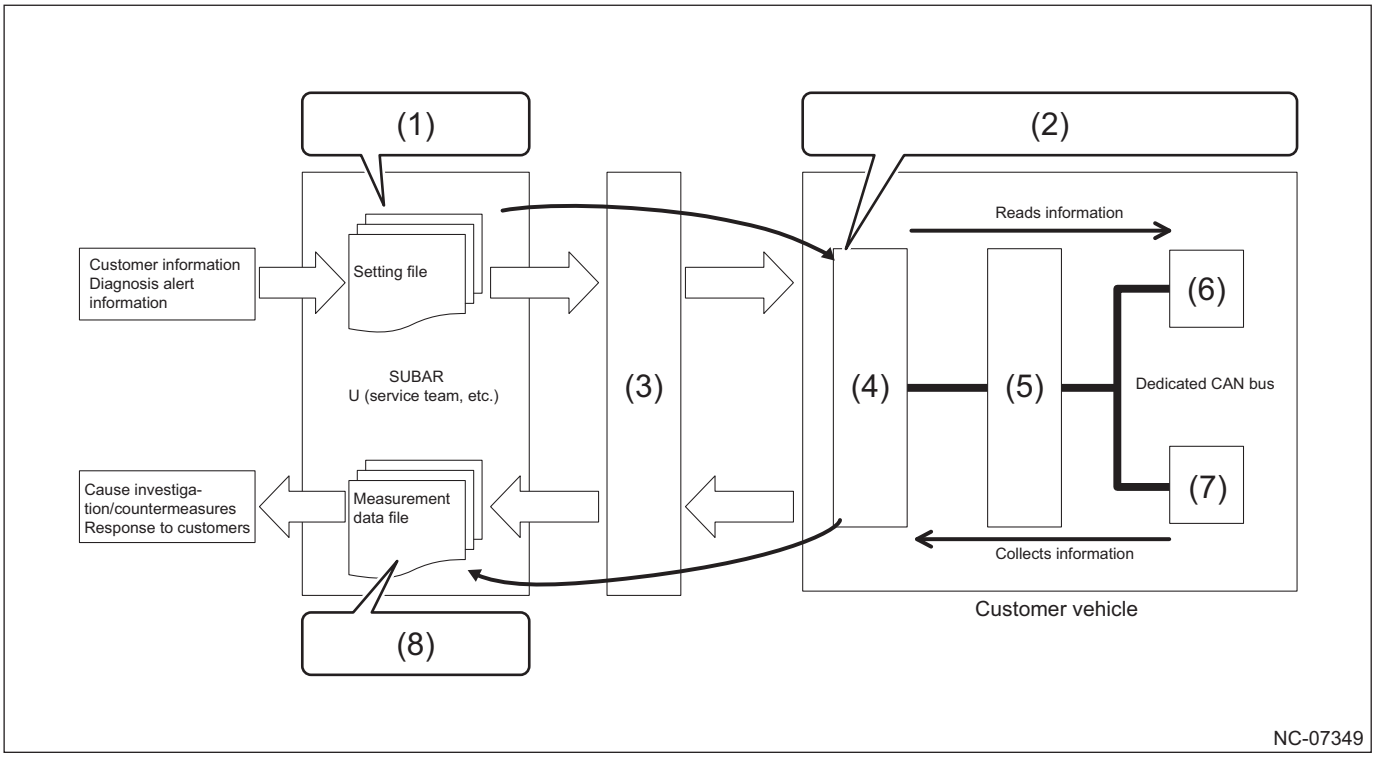
■ Driving Recorder Data Feed

- This function gives the data communication module (DCM) functions equivalent to a SUBARU Select Monitor (SSM) that allow a SUBARU service team to analyze data read from the vehicle by remote operation and identify the cause and correction when trouble occurs.
- Based on the analysis file received from the server, the data communication module (DCM) automatically collects the necessary information and sends it to the server.
- This reduces the burden on the user involved in bringing the vehicle to a SUBARU dealer, and also allows real-time trouble analysis to be conducted. This makes it possible to provide higher-quality service through effective corrections and rapid repairs.

Reference

Due to restrictions on vehicle internal communication performance, the modules which information is collected from are limited to the Engine Control Module (ECM) and transmission control module (TCM) (CVT only).

Image of Driving Recorder Data Feed service



** The illustration shows an example of the service image that may differ from the actual service.*

No.	Description
(1)	Creates and sends an analysis file based on user information and failure alert information.
(2)	Collects information in accordance with the received analysis file. Sends the information after collection is completed.
(3)	SOA (SUBARU of America)
(4)	Data communication module (DCM)
(5)	Central gateway CM (CGW)
(6)	Engine Control Module (ECM)
(7)	Transmission control module (TCM) (CVT only)
(8)	Analyzes the measurement data file that was sent from the vehicle, identifies the cause, and considers a correction.

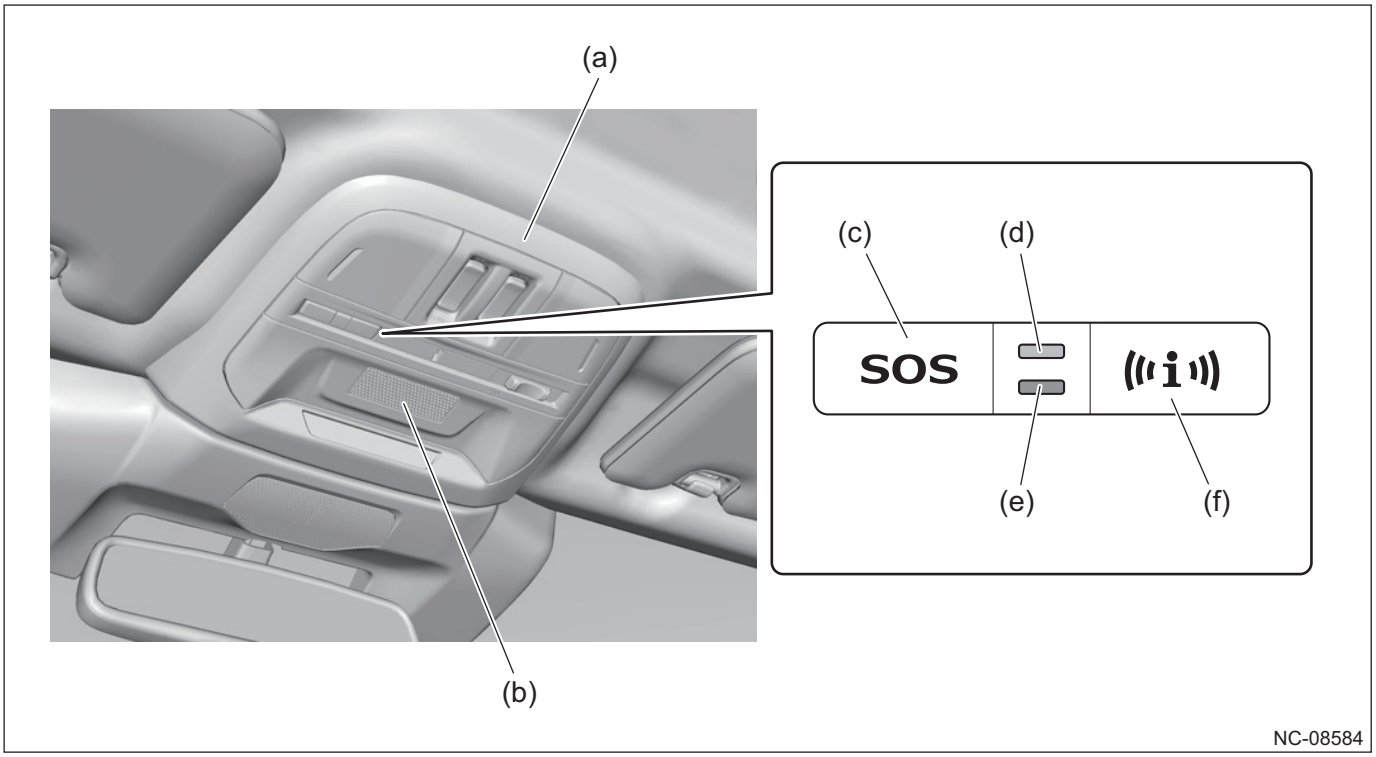
User interface

Equipped with screen display and voice guidance functions that serve as the SUBARU STARLINK user interface when contacting or notifying an external party after pressing a telematics button.

■ Telematics button

- The system operation status is displayed by turning on, turning off, or flashing the LED status lights (green and red).
- Rapid contact with the external party is possible when the button is operated. In consideration of operability in an emergency, the buttons are positioned inside the map light.
- The surface of each button is labeled, and the button colors are different, allowing the user to identify them in an instant without hesitation.

Reference
A short press of each button begins a connection to the corresponding service. A long press cancels the connection.



(a)	Map light	(d)	LED status light (green)
(b)	Microphone opening	(e)	LED status light (red)
(c)	SOS button	(f)	i-button

▮ SOS button (SOS Emergency Assistance)

- In an emergency, the user presses this button to connect to SOS Emergency Service.

▮ i-button (Enhanced Roadside Assistance or STARLINK Concierge)

- When the user wants to request roadside assistance or drive assist, the user presses this button to connect to Enhanced Roadside Assistance or STARLINK Concierge.

Reference

When the i-button is pressed, an option screen appears on the Center Information Display (CID) for the user to select either Roadside Assistance or STARLINK Concierge.

▮ LED status light

The system status indicated by the LED status lights is as follows.

Status light indication		System status
Green	Red	
Turns on	Off	All SUBARU STARLINK services can be used.
Off	Turns on	• Malfunction (Diagnostic Trouble Code (DTC) is present.) • Back Up battery (BUB) replacement
Flash	Off	Data communication module (DCM) communication in progress (no Diagnostic Trouble Code (DTC))
Off	Flash	Data communication module (DCM) communication in progress (Diagnostic Trouble Code (DTC) present)*
Off	Off	SUBARU STARLINK service contract not completed or system inactivated.

**: Operates when service is possible even if a Diagnostic Trouble Code (DTC) is present.*

■ Display screen

The contents displayed on the SUBARU STARLINK display vary depending on the service that is used.

▮ Display when connecting to the SUBARU STARLINK Call Center

- When connection starts and the mute signal is received from the data communication module (DCM), the currently playing audio source is muted, and the following screen is displayed to visually alert the user that connection is in progress.
- This screen continues to be displayed after the connection during the conversation with the Customer Care Advisor.

Examples of displays when connecting to the SUBARU STARLINK Call Center

**The illustration shows a typical example that may differ from the actual display.*

(a)	Connecting for Advanced Automatic Collision Notification	(c)	Connecting for Enhanced Roadside Assistance
(b)	Connecting for SOS Emergency Assistance	(d)	Connecting for STARLINK Concierge

▮ Display when not connecting to the SUBARU STARLINK Call Center

- When the Service Appointment Scheduler is used, the screen specifications use guide messages and screen displays such as different buttons for each purpose to allow the user to easily perform tasks such as searching for the preferred SUBARU dealer or scheduling servicing appointments by intuitive operations.
- When the user has set a Curfew Alert time, a screen indicating that the set time is approaching is shown on the display.
- With SUBARU STARLINK System Update, the system update consent screen is displayed so the customer can select the update timing.

Audio guidance

- The following guidance is played from the data communication module (DCM) according to the telematics system operation status.
- Either English or French can be selected as the guidance language when the subscription contract is concluded. (C0 only)

■ English guidance

Status	Audio guidance
When a collision that resulted in deployment of the airbag has occurred	"Call connecting to SUBARU STARLINK emergency services."
When calling manually by pressing the SOS button	"Connecting to SUBARU STARLINK emergency assistance."
When the i-button was pressed after activating Enhanced Roadside Assistance or STARLINK Concierge service	"Please use touch screen to select a STARLINK service."
When calling Enhanced Roadside Assistance	"Connecting to Subaru STARLINK Roadside Assistance."
When calling STARLINK Concierge	"Connecting to SUBARU STARLINK Concierge services."
When notifying the user that the conversation may be recorded before connecting to a Customer Care Advisor	"This call may be recorded or monitored for quality purposes."
When the SOS button or i-button was pressed however the user has not subscribed (U4)	"You're not currently subscribed to SUBARU STARLINK. Please visit MySubaru.com to upgrade your service."
When the SOS button or i-button was pressed however the user has not subscribed (C0)	"You are not currently subscribed to Subaru STARLINK. Please visit Mysubaru.ca to upgrade your service."
When retrying repeatedly to connect due to poor communication conditions of the mobile phone network	"Due to cellular network or hardware problems, your call cannot be connected at this time."
When the Stolen Vehicle Recovery service was activated in the stolen vehicle	"Stolen Vehicle Recovery Service has been activated."

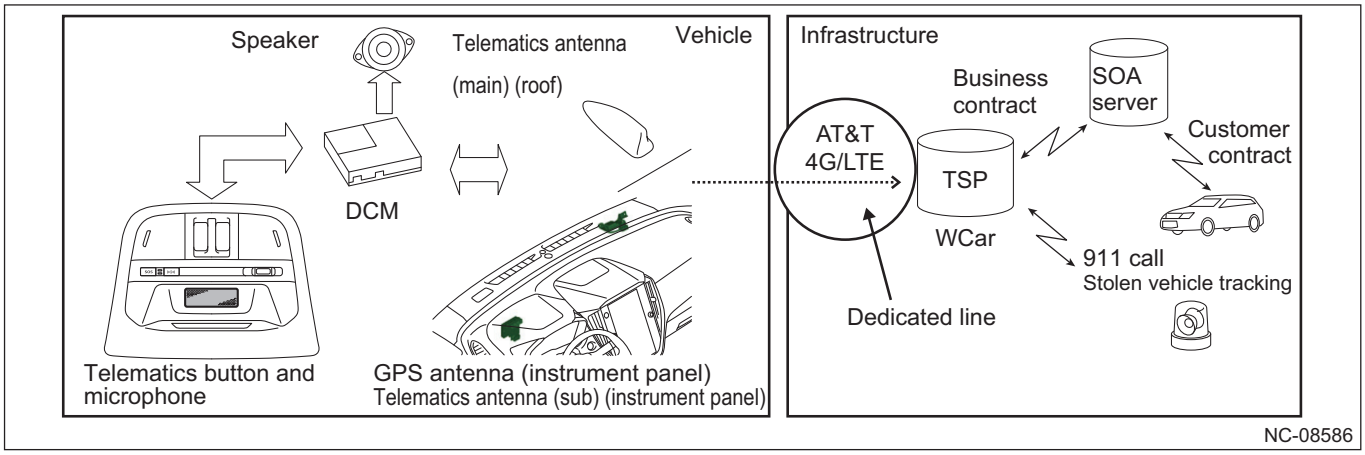
■ French guidance (C0 only)

Status	Audio guidance
When a collision that resulted in deployment of the airbag has occurred	"Connexion de l'appel avec les services d'urgence SUBARU STARLINK en cours."
When calling manually by pressing the SOS button	"Connexion avec l'assistance d'urgence SUBARU STARLINK en cours."
When the i-button was pressed after activating Enhanced Roadside Assistance or STARLINK Concierge service	"À l'aide de l'écran tactile, sélectionnez un service STARLINK"
When calling Enhanced Roadside Assistance	"Connexion avec l'assistance routière SUBARU STARLINK en cours."
When calling STARLINK Concierge	"Connexion avec les services de conciergerie SUBARU STARLINK en cours."
When notifying the user that the conversation may be recorded before connecting to a Customer Care Advisor	"Pour en assurer la qualité, cet appel peut être écouté ou enregistré."
When the SOS button or i-button was pressed when the user has not subscribed	"Vous n'êtes pas abonné à SUBARU STARLINK. Pour mettre votre service à jour, veuillez visiter MySubaru.ca."
When retrying repeatedly to connect due to poor communication conditions of the mobile phone network	"En raison du réseau cellulaire ou de problèmes avec l'équipement, il nous est impossible de connecter votre appel en ce moment."
When the Stolen Vehicle Recovery service was activated in the stolen vehicle	"Le service de récupération de véhicule volé a été activé."

Security

■ Data communication module (DCM)

- A dedicated emergency contact line is used for the communication protocol between the vehicle and the SUBARU STARLINK Call Center to prevent hacking from outside the vehicle.
- The data communication module (DCM) receives the VIN information that was written to the ECU on the automotive production line via CAN communication, and stores it in memory inside the data communication module (DCM). The vehicle and data communication module (DCM) are linked one-to-one, and the data communication module (DCM) will not operate when installed in another vehicle.



Diagnosis

The data communication module (DCM) supports the SUBARU Select Monitor (SSM), and the following work can be performed with it. For details, refer to the service manual.

Item	Description
DTC	If an error occurred in the data communication module (DCM), the data communication module (DCM) reads the Diagnostic Trouble Code (DTC) that was saved in memory.
Data monitor	The operating status of the data communication module (DCM), the vehicle information that is input to the data communication module (DCM) via CAN communication, and other information can be displayed.
Active test	This can be used to forcibly turn on, flash, and turn off the telematics button LED status lights, and check the conditions of output from the speakers connected to the data communication module (DCM).

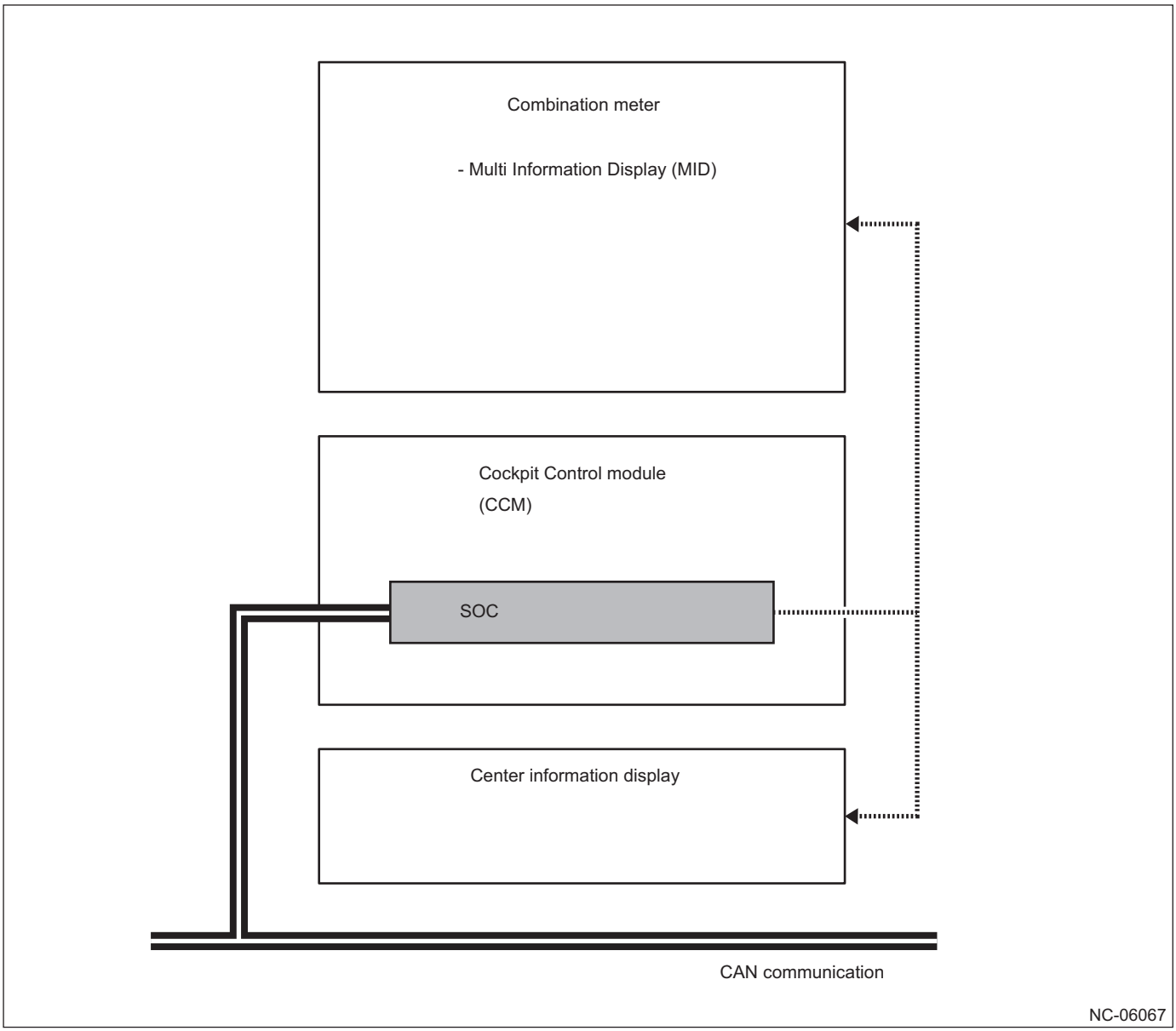
11.4 Combination Meter/MID

11.4.1 Overview

Overview

This system communicates various information about the vehicle to the driver by displaying icons, messages, and other communication on the meter and display. The icons, messages, and other communication are displayed based on display requests received from various systems related to meter displays, and are used to caution the driver or communicate information that is necessary for driving. This contributes to safe driving and produces an advanced feel and feel of unity between the driver and the vehicle.

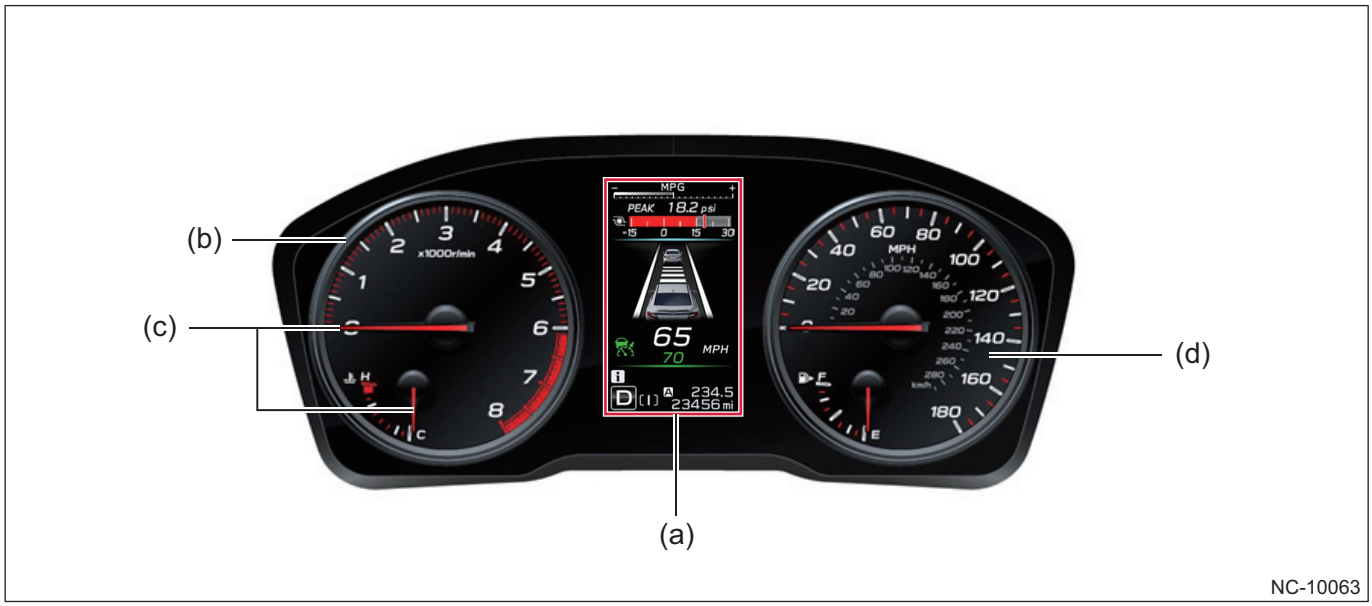
- A hypervisor system is adopted. Performing cooperation control of the combination meter and Center Information Display (CID) on one chip results in seamless display linkage between the combination meter and Center Information Display (CID).



Specifications

A meter with 4.2-inch display is adopted.

- A silver painted meter ring, black dial face, and red indicator needles are adopted in the meter design.



**The illustration shows a typical example that may differ from the actual display.*

(a) 4.2-inch Multi Information Display (MID)
(b) Meter ring
(c) Indicator needle
(d) Dial face

Display specifications

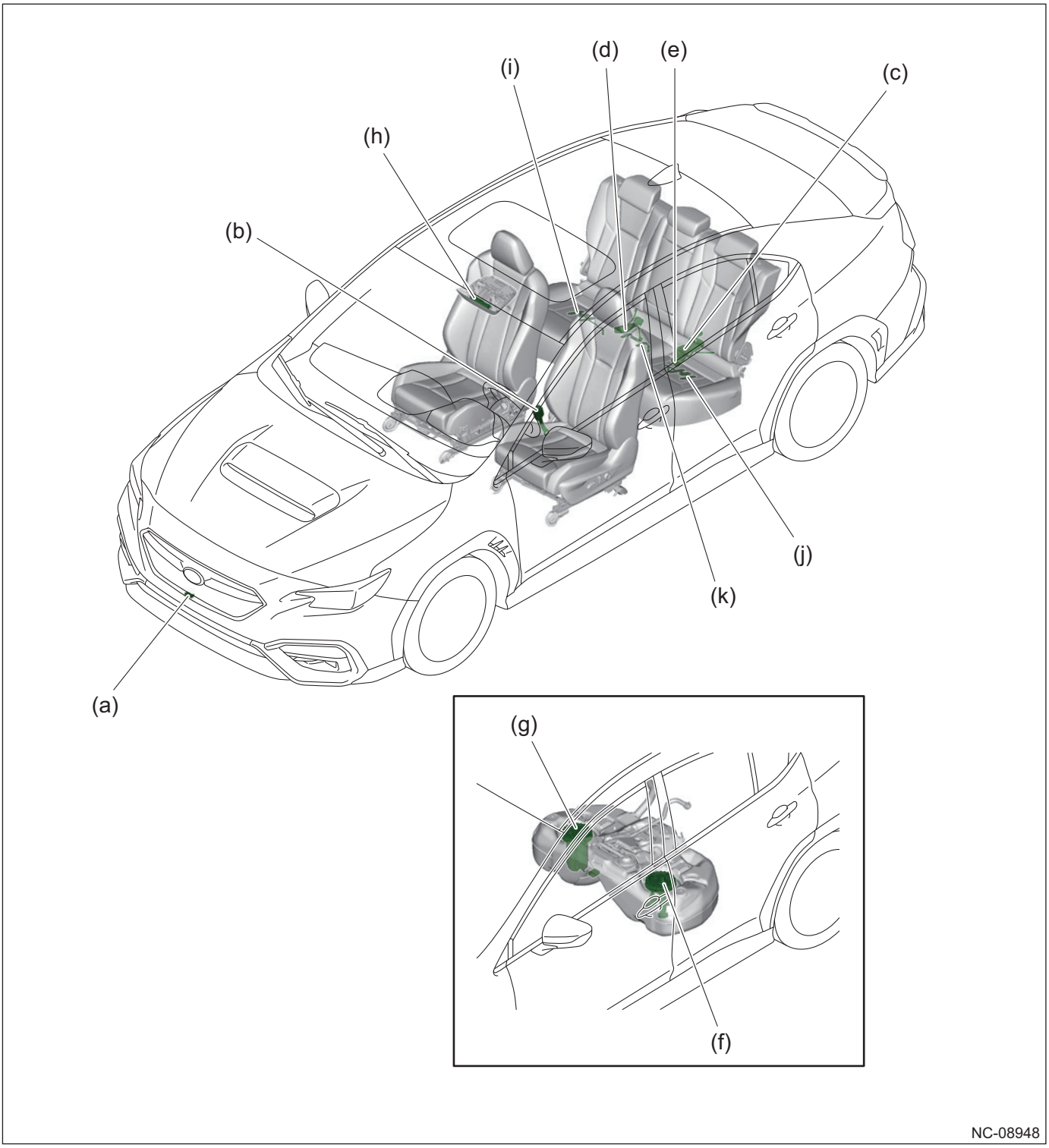
LCD	Color TFT
Pixel size	0.1935 mm
Number of pixels	480 x 272

Meter design

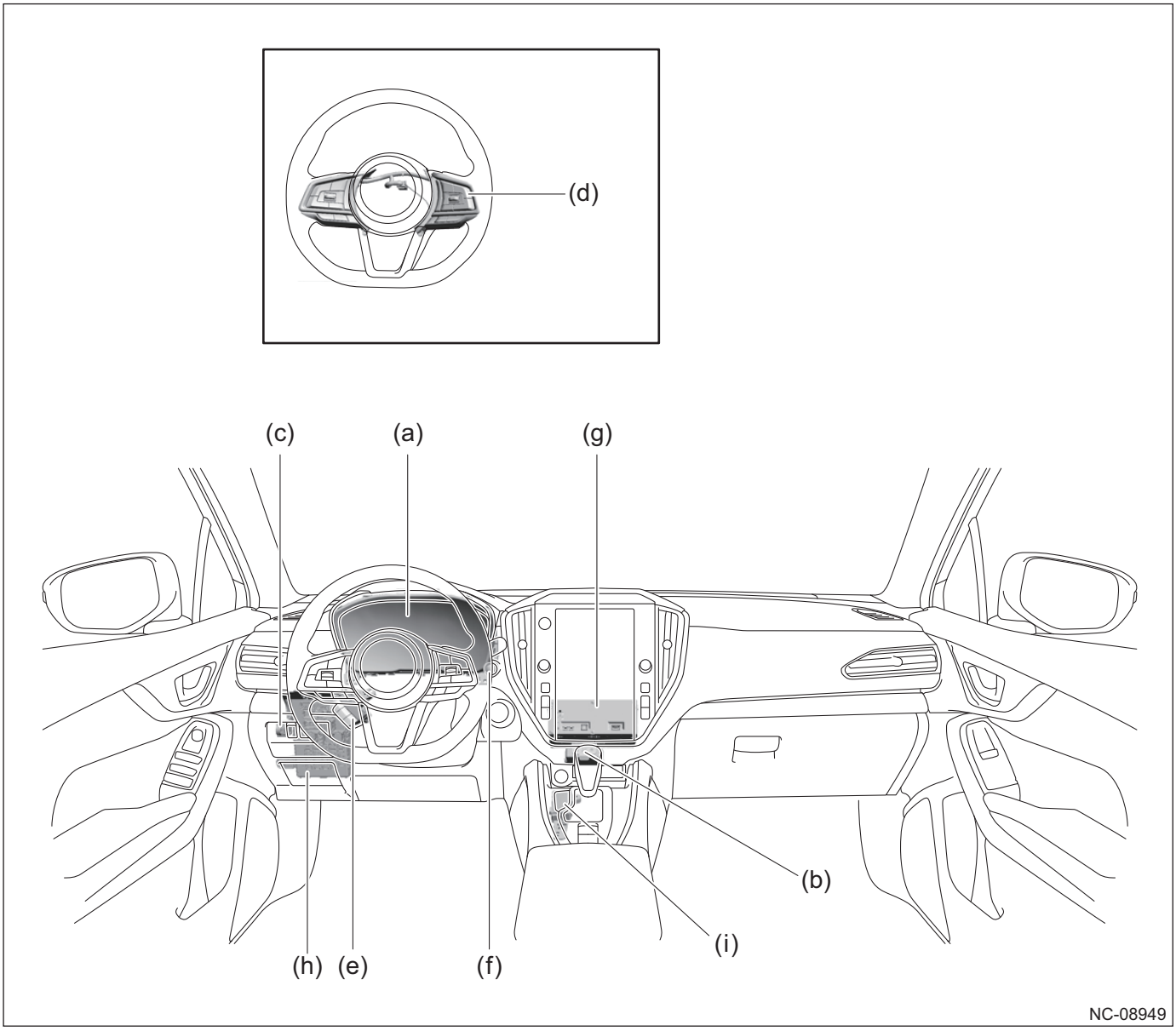
Meter ring	Silver (painted)
Indicator needle color	Red (overall length illumination)
Dial face	Black

11.4.2 Component

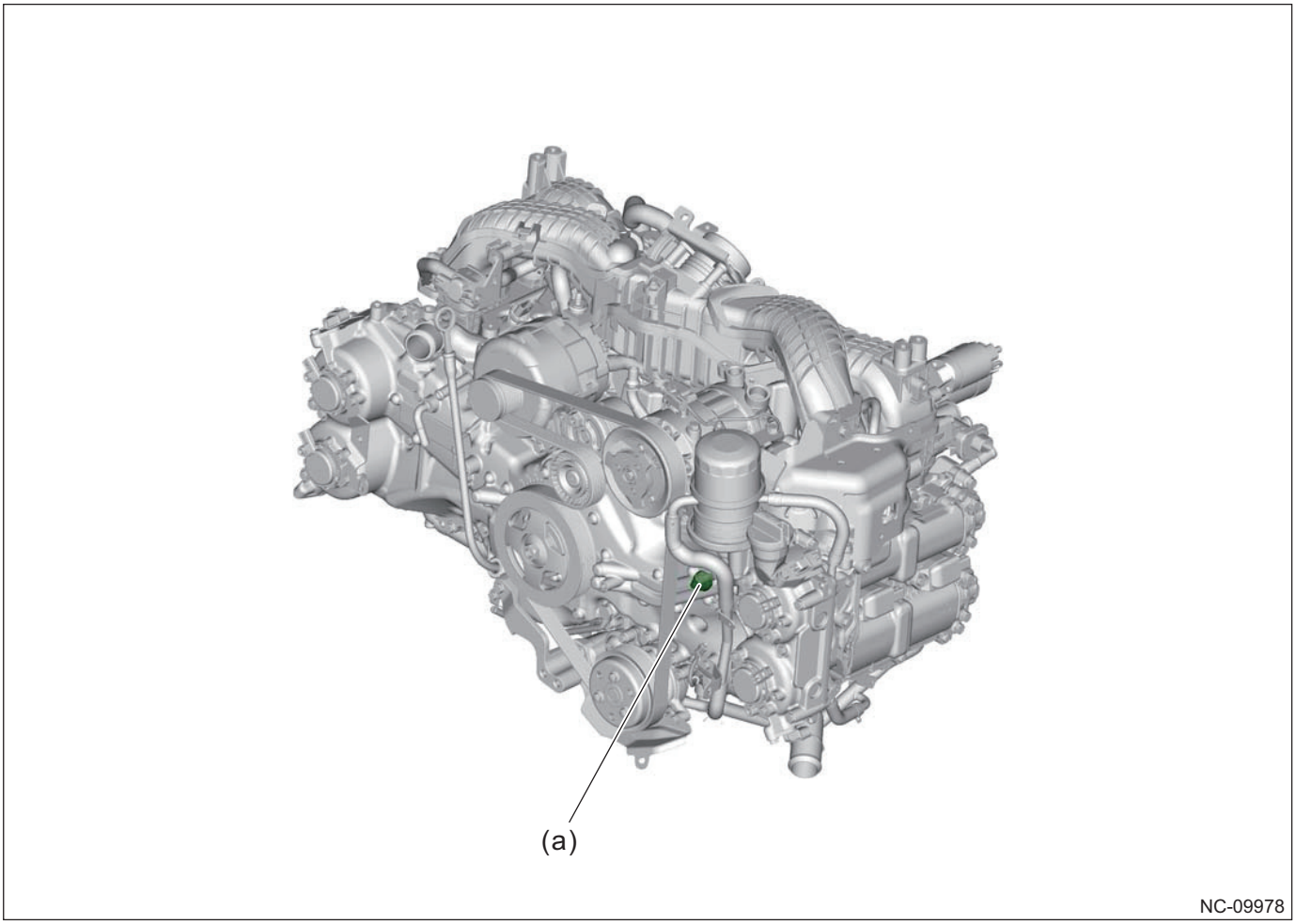
Component layout drawing



(a) Ambient sensor
(b) Front seat belt switch LH
(c) Rear seat belt switch LH
(d) Rear seat belt switch RH
(e) Rear seat belt switch center
(f) Fuel sub level sensor
(g) Fuel level sensor
(h) Warning box
(i) Rear seating switch RH
(j) Rear seating switch LH
(k) Rear seating switch center



(a) Combination meter
(b) Central gateway CM (CGW)
(c) Illumination control switch
(d) Steering satellite switch
(e) Multi information display switch
(f) TRIP/RESET switch
(g) Cockpit Control Module (CCM)
(h) Body Integrated Unit (BIU)
(i) Select indicator



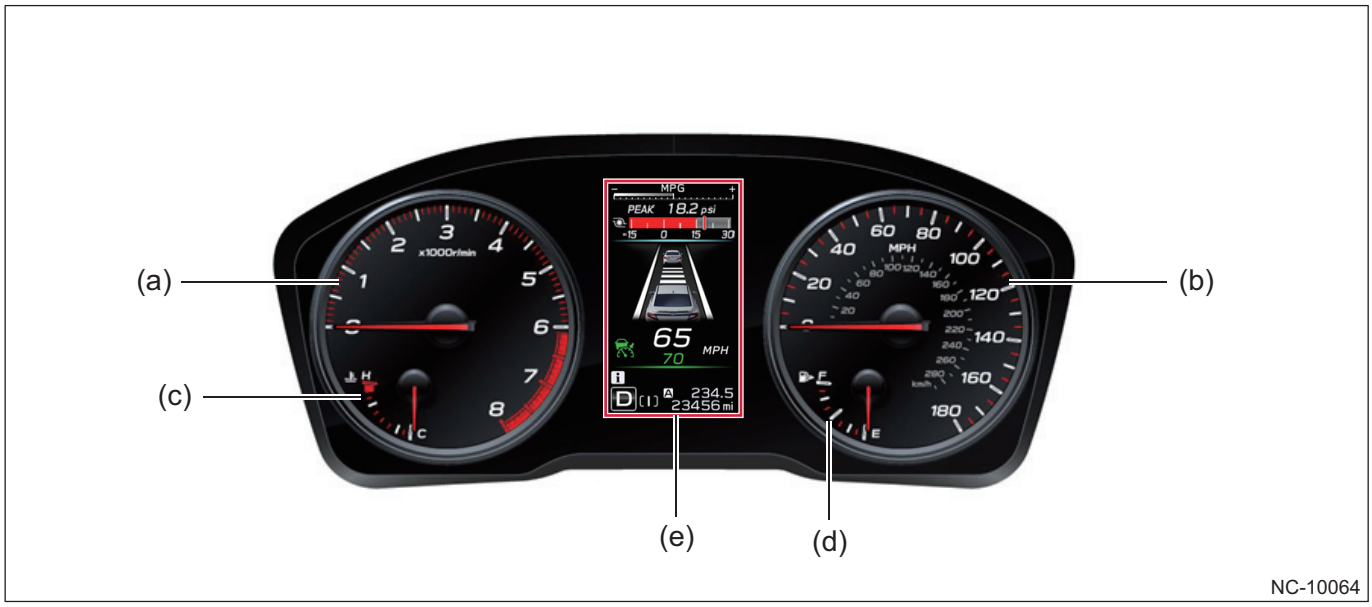
(a) Oil pressure switch

Component details

Combination meter

A meter with 4.2-inch display is adopted for all models.

- A 4.2-inch Multi Information Display (MID) with high resolution and colors that are easy to understand is adopted for the combination meter, which ensures high visibility under all environments from daytime to night, and provides the driver with the required information.

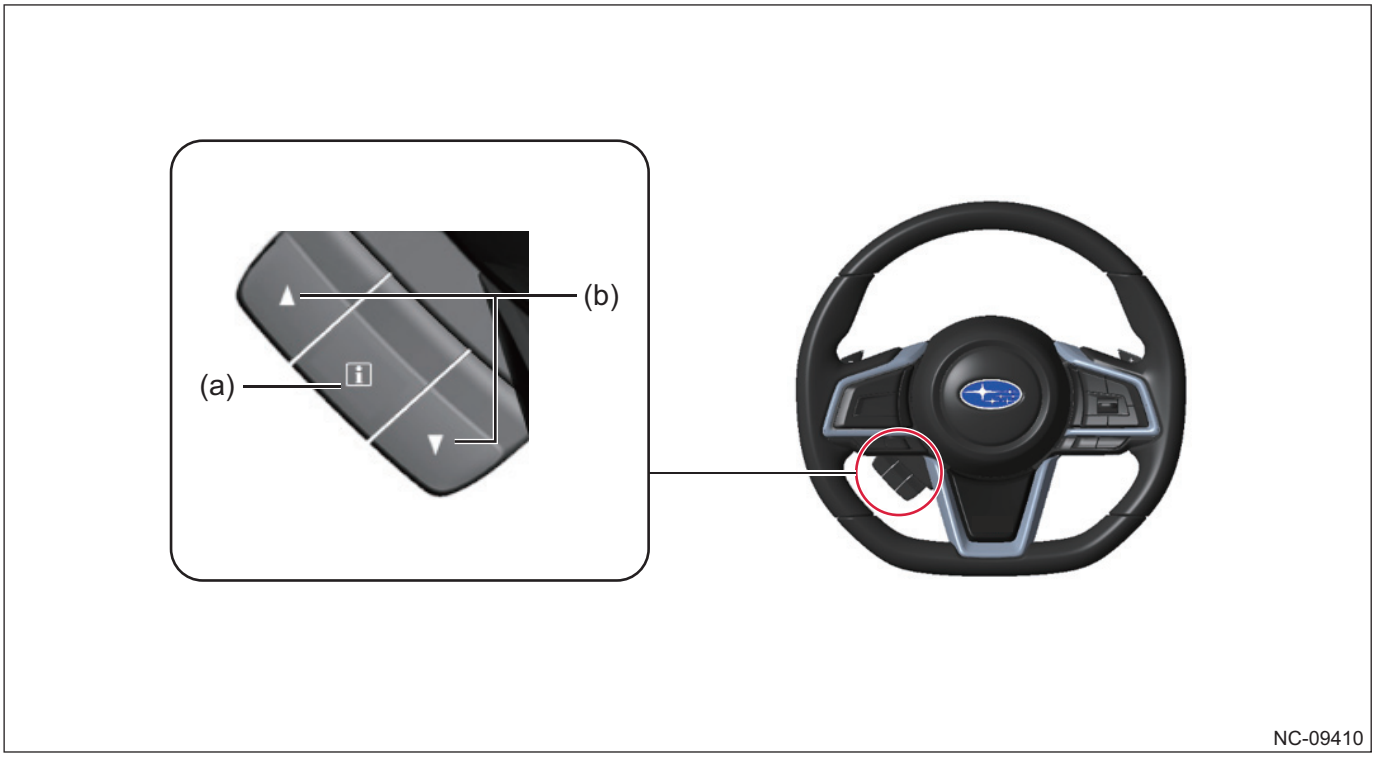


The illustration shows a typical example that may differ from the actual display.

(a) Tachometer
(b) Speedometer
(c) Coolant temperature gauge
(d) Fuel meter
(e) Multi Information Display (MID)

Multi information display switch

Multi information display switches that can switch the meter screen display are provided on the steering.

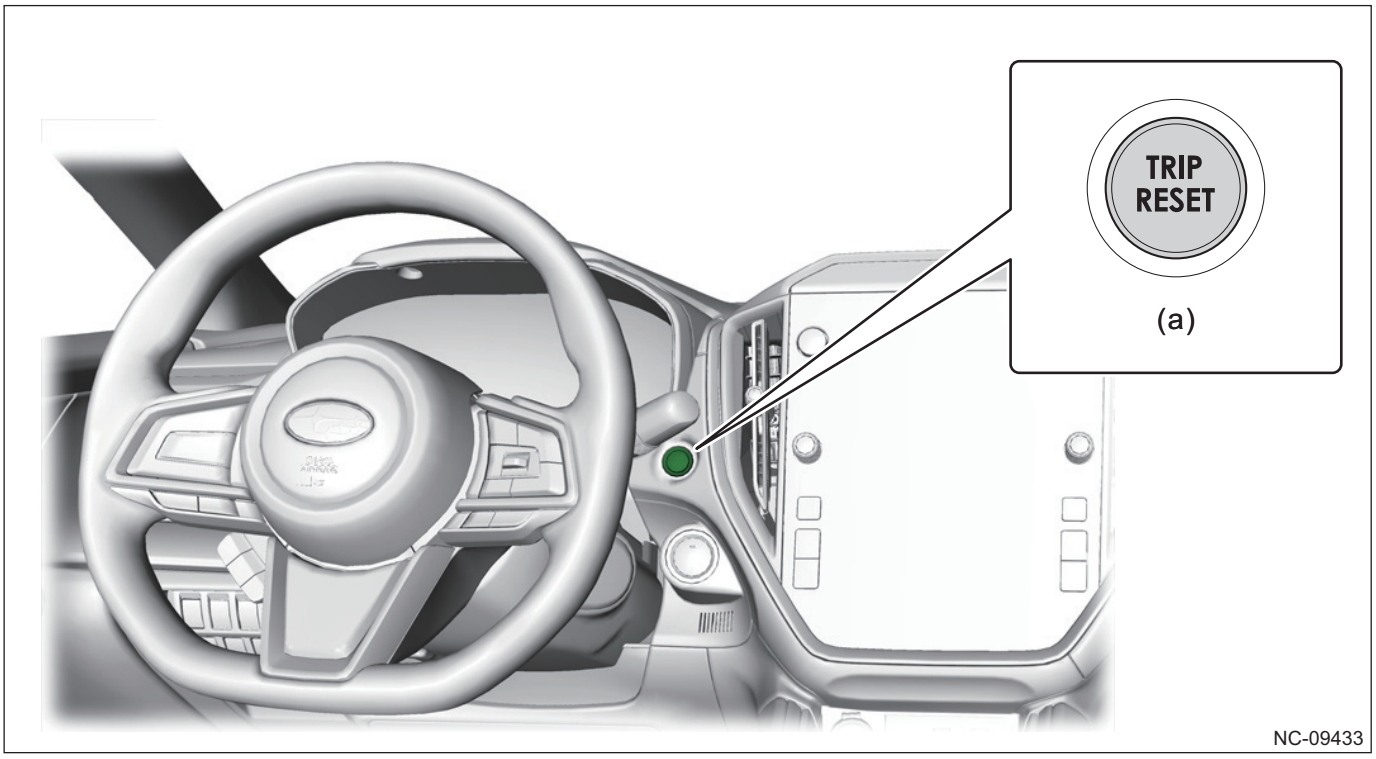


(a) Information switch

(b) △ (Previous) / ▽ (Next) switches

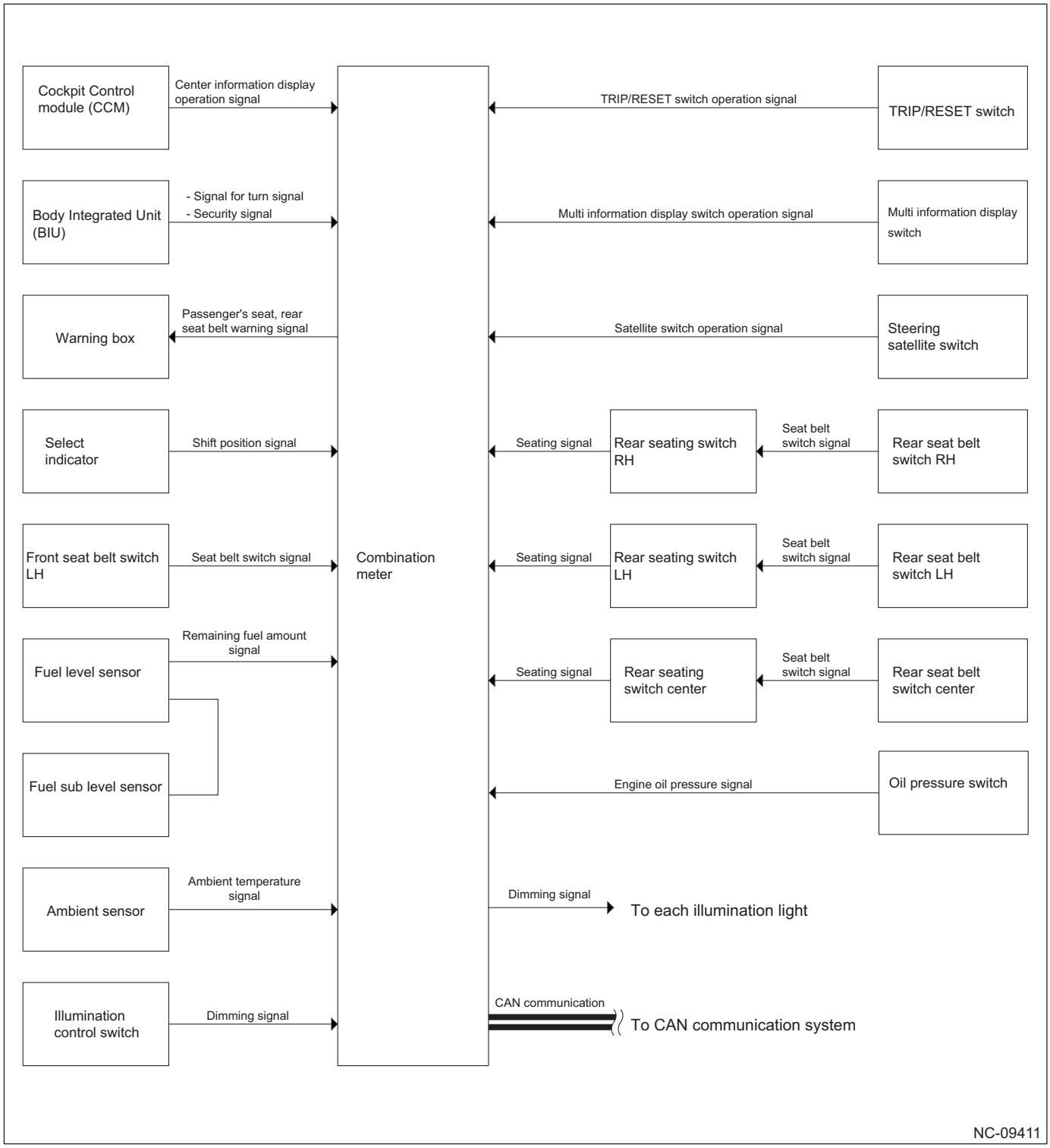
TRIP/RESET switch

The TRIP/RESET switch that changes between the odometer and trip meter is located on the instrument panel to the right side of the driver's seat.



11.4.3 Construction and Operation

System diagram



Main component functions

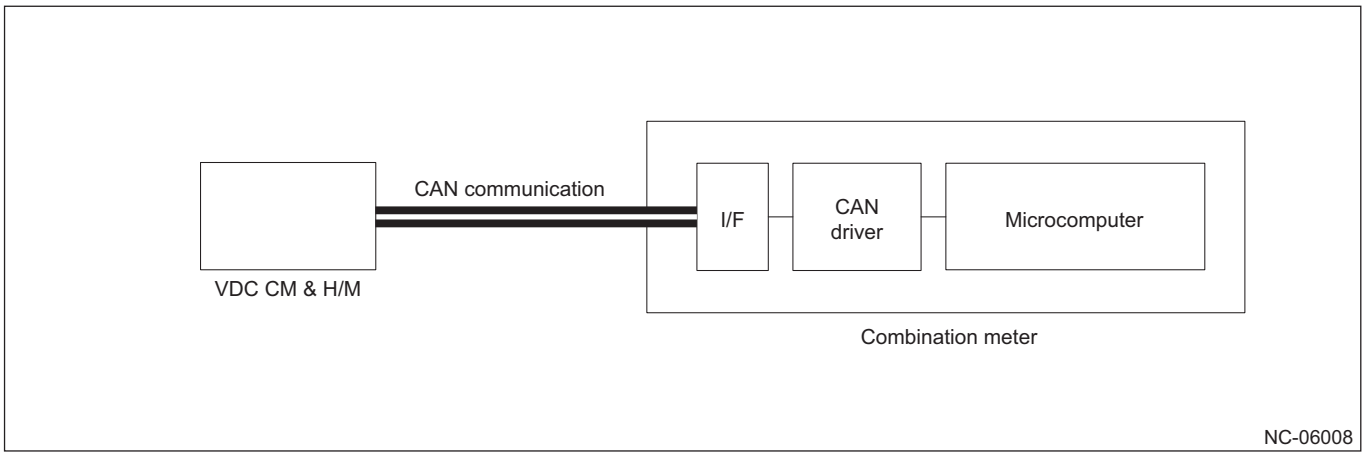
Component	Function
Combination meter	Receives signals from the sensors and switches that are wired directly to the combination meter and from the CM which are connected via CAN communication line, and displays vehicle information needed by the driver.
Steering satellite switch	Detects operation of the SI-DRIVE switch* or drive mode switch*, and sends satellite switch operation signals to the combination meter.
Multi information display switch	Detects operation of the meter operation switches, and sends multi information display switch operation signals to the combination meter.
Body Integrated Unit (BIU)	Sends the turn signal signals and security signals to the combination meter.
Cockpit Control Module (CCM)	Sends and receives display-linked signals between the combination meter and cockpit control module (CCM).
Front seat belt switch LH	Detects the driver's seat belt fastening status and sends the seat belt switch signal to the combination meter.
• Fuel level sensor • Fuel level sub sensor	Detects the level of fuel remaining in the fuel tank, and sends the remaining fuel level signal to the combination meter.
Oil pressure switch	Detects the engine oil pressure and sends the engine oil pressure signal to the combination meter.
Ambient sensor	Detects the ambient temperature and sends the ambient temperature signal to the combination meter.
Illumination control switch	Sends the dimming signal of each illumination light to the combination meter.
TRIP/RESET switch	Sends the TRIP/RESET switch operation signal to the combination meter.
Warning box	Receives passenger's and rear seat belt warning signals from the combination meter, and turns on, flashes, and turns off the warning light.
Select indicator	Sends the shift position signal to the combination meter.
• Rear seat belt switch RH • Rear seat belt switch LH • Rear seat belt switch center	Detects the fastening status of each rear seat and sends the seat belt switch signal to the combination meter.
• Rear seating switch RH • Rear seating switch LH • Rear seating switch center	Detects the presence of an occupant in each rear seat and sends the seating signal to the combination meter.

**: For some grades*

System details

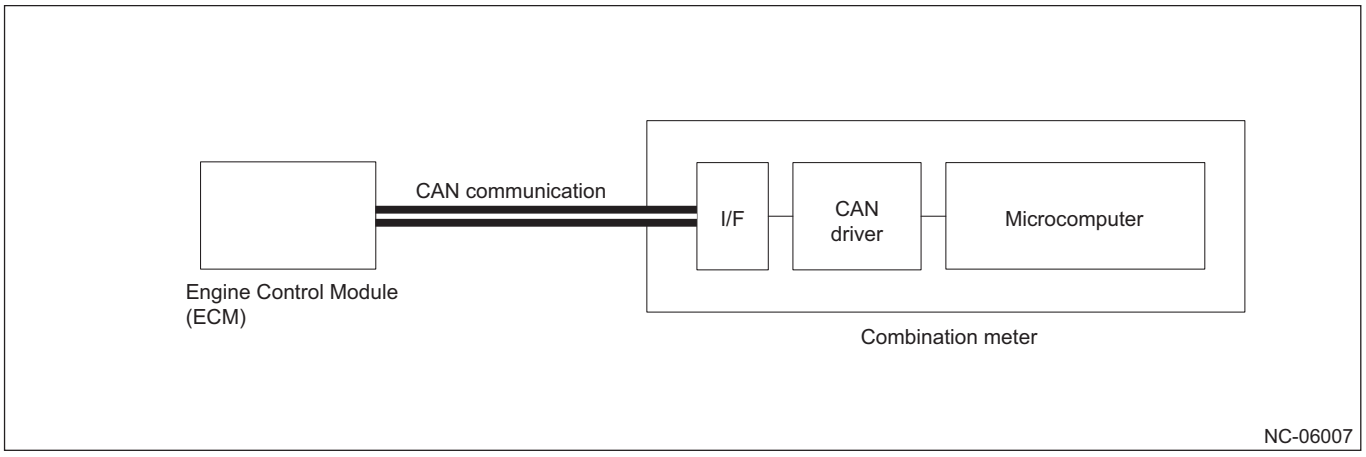
Speedometer operation

The combination meter microcomputer displays the speedometer based on the vehicle speed signal sent from the VDC CM & H/M via CAN communication.



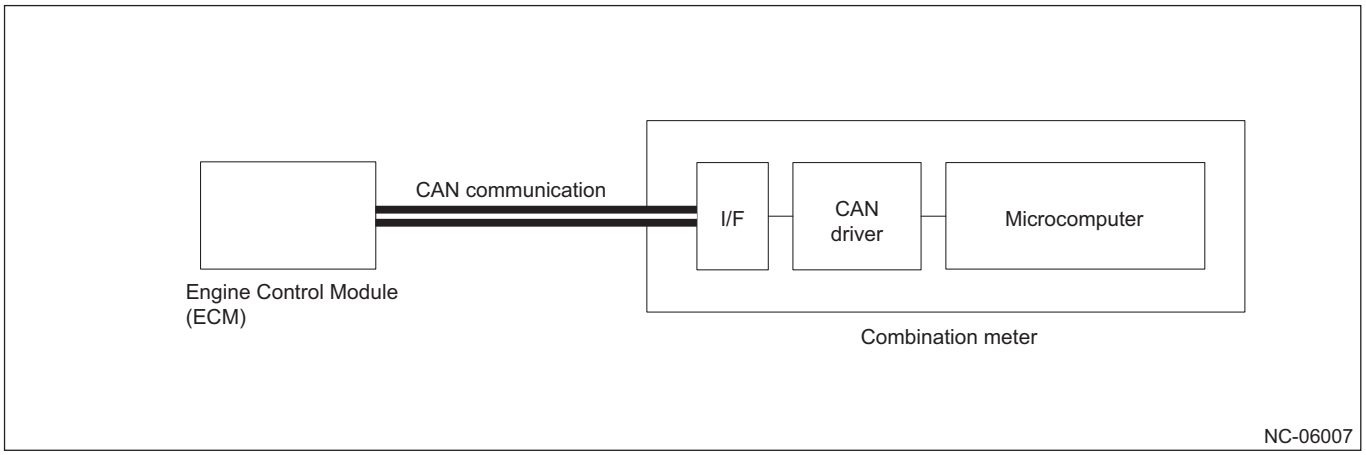
Tachometer operation

The combination meter microcomputer displays the tachometer based on the engine speed signal sent from the Engine Control Module (ECM) via CAN communication.



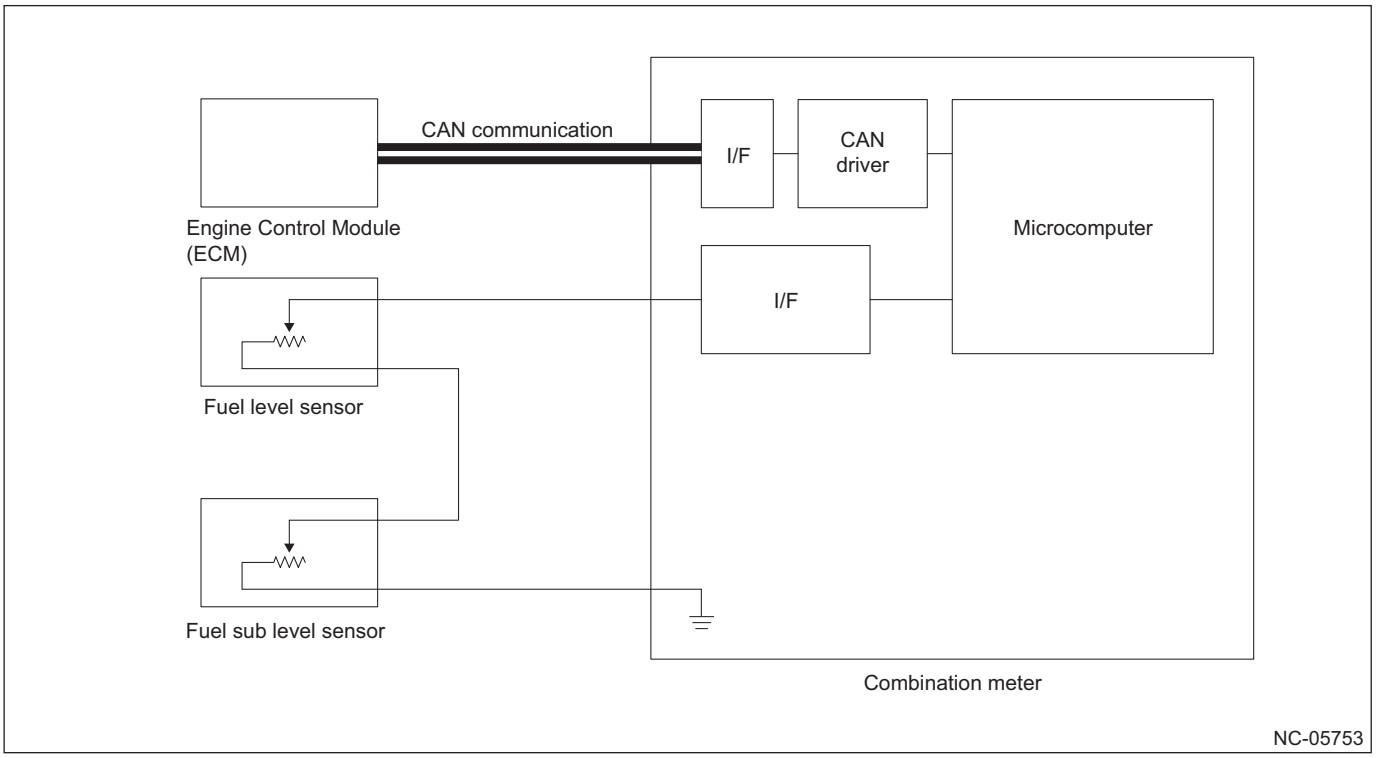
Coolant temperature gauge operation

The combination meter microcomputer displays the coolant temperature gauge based on the engine coolant temperature signal sent from the Engine Control Module (ECM) via CAN communication.



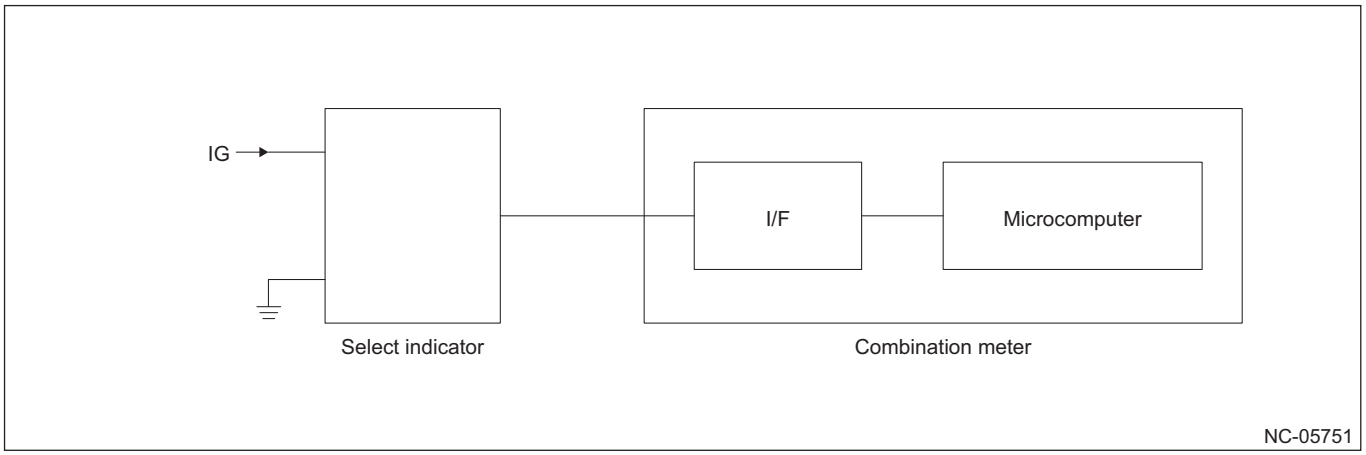
Fuel meter operation

The combination meter microcomputer displays the fuel meter based on the remaining fuel amount signal sent from the fuel level sensor and fuel sub level sensor, and on the fuel consumption signal sent via CAN communication from the Engine Control Module (ECM).



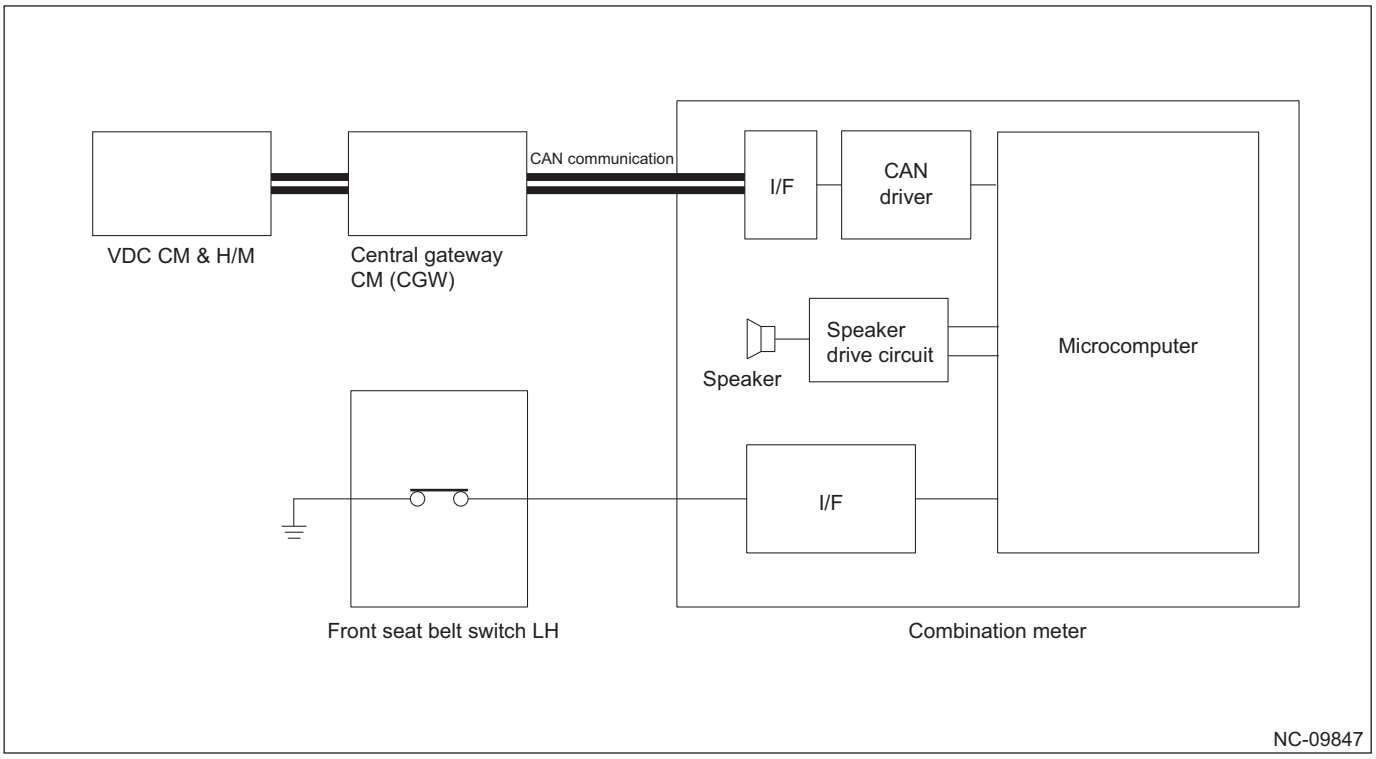
Select indicator operation

The combination meter microcomputer displays the selected shift position based on the shift position signal sent from the select indicator.



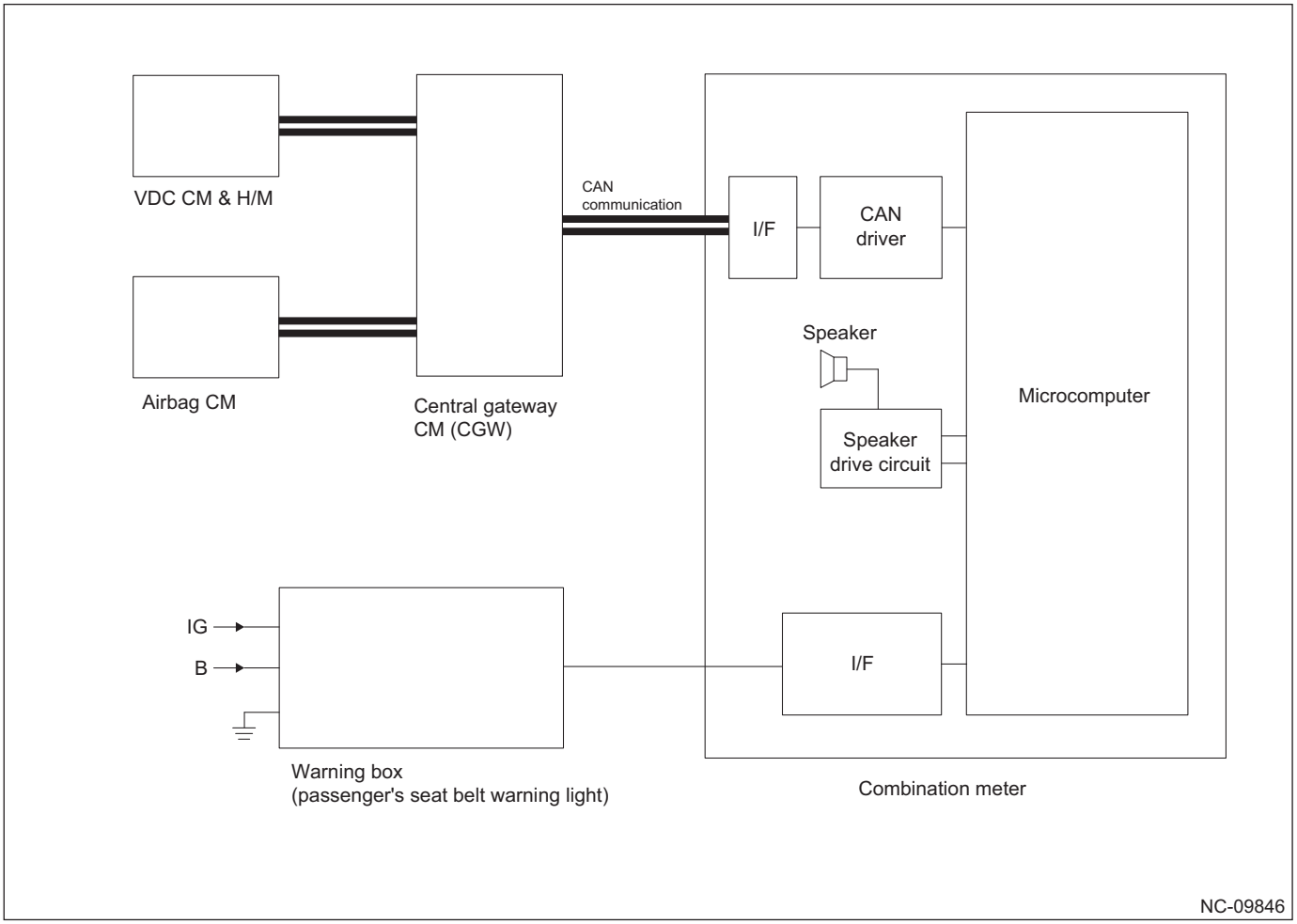
Driver's seat belt reminder operation

- When the combination meter microcomputer receives the seat belt not fastened signal from the front seat belt switch LH and detects that the vehicle speed is approximately 4 mph (6 km/h) or lower based on the vehicle speed signal that is sent from the VDC CM & H/M via CAN communication, it turns on the driver's seat belt warning located in the combination meter.
- When the combination meter microcomputer detects that the seat belt is not fastened and the vehicle speed is between approximately 4 mph (6 km/h) and 13 mph (20 km/h), it changes to flashing the driver's seat belt warning and sounds a warning buzzer. Further, when a certain length of time elapses or the vehicle speed exceeds approximately 13 mph (20 km/h), the warning buzzer becomes louder.
- When the combination meter microcomputer receives the seat belt fastened signal from the front seat belt switch LH, it turns off the driver's seat belt warning and stops the warning buzzer.



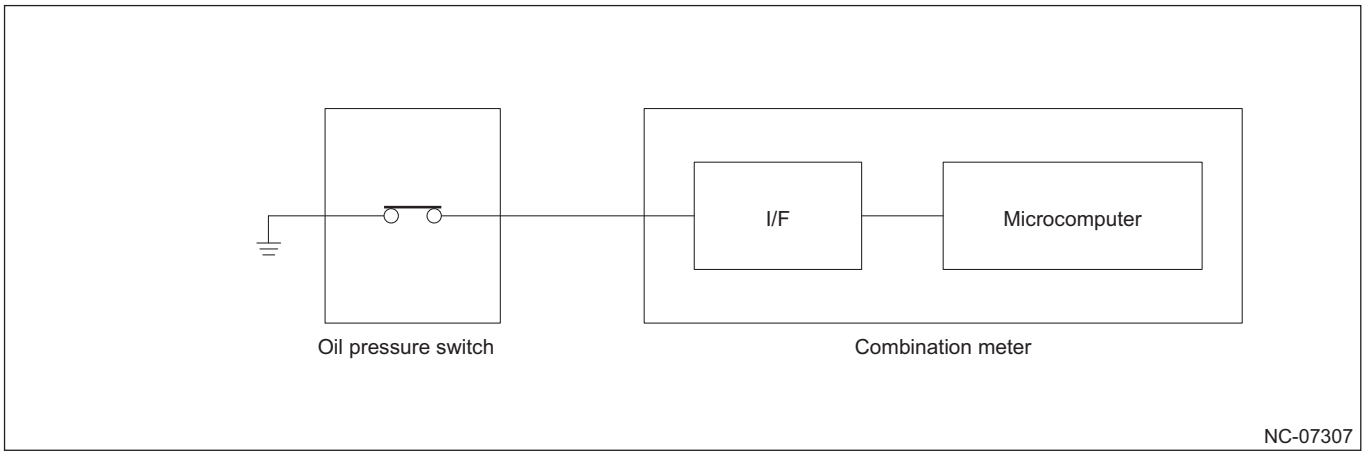
Passenger's seat belt reminder operation

- When the combination meter microcomputer receives the seat belt not fastened signal (indicating occupant present and seat belt not fastened) sent from the airbag CM via CAN communication and detects that the vehicle speed is approximately 4 mph (6 km/h) or lower based on the vehicle speed signal that is sent from the VDC CM & H/M via CAN communication, it turns on the passenger's seat belt warning located in the warning box.
- When the combination meter microcomputer detects that the occupant's seat belt is not fastened and the vehicle speed is between approximately 4 mph (6 km/h) and 13 mph (20 km/h), it changes to flashing the passenger's seat belt warning and sounds a warning buzzer. Further, when a certain length of time elapses or the vehicle speed exceeds approximately 13 mph (20 km/h), the warning buzzer becomes louder.
- When the combination meter microcomputer receives the seat belt fastened signal (indicating occupant present and seat belt fastened) sent from the airbag CM via CAN communication, it turns off the passenger's seat belt warning and stops the warning buzzer.



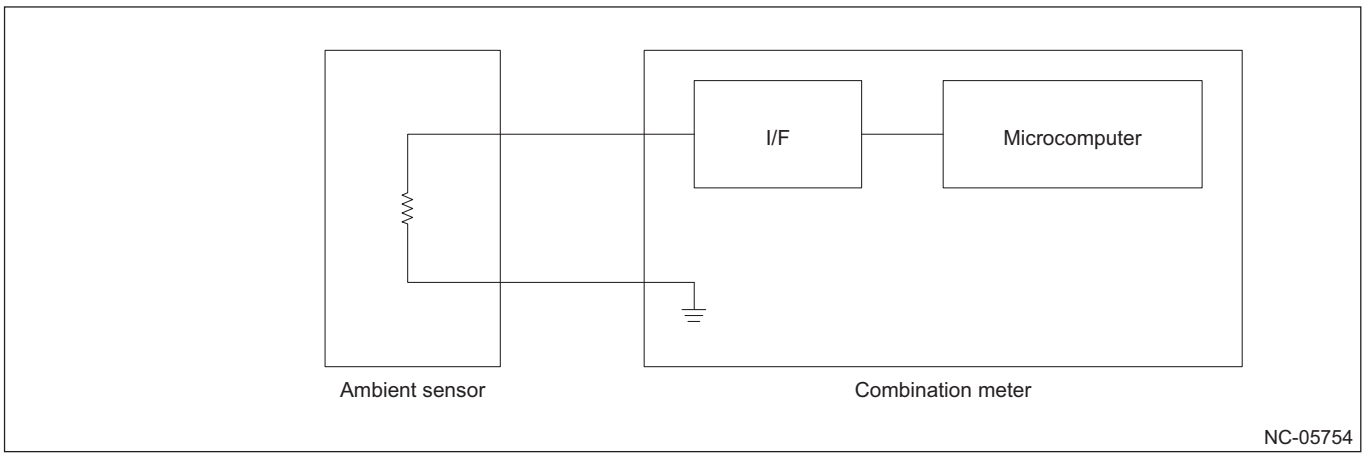
Oil pressure switch operation

The combination meter microcomputer turns on the oil pressure warning light based on the engine oil pressure signal sent from the oil pressure switch.



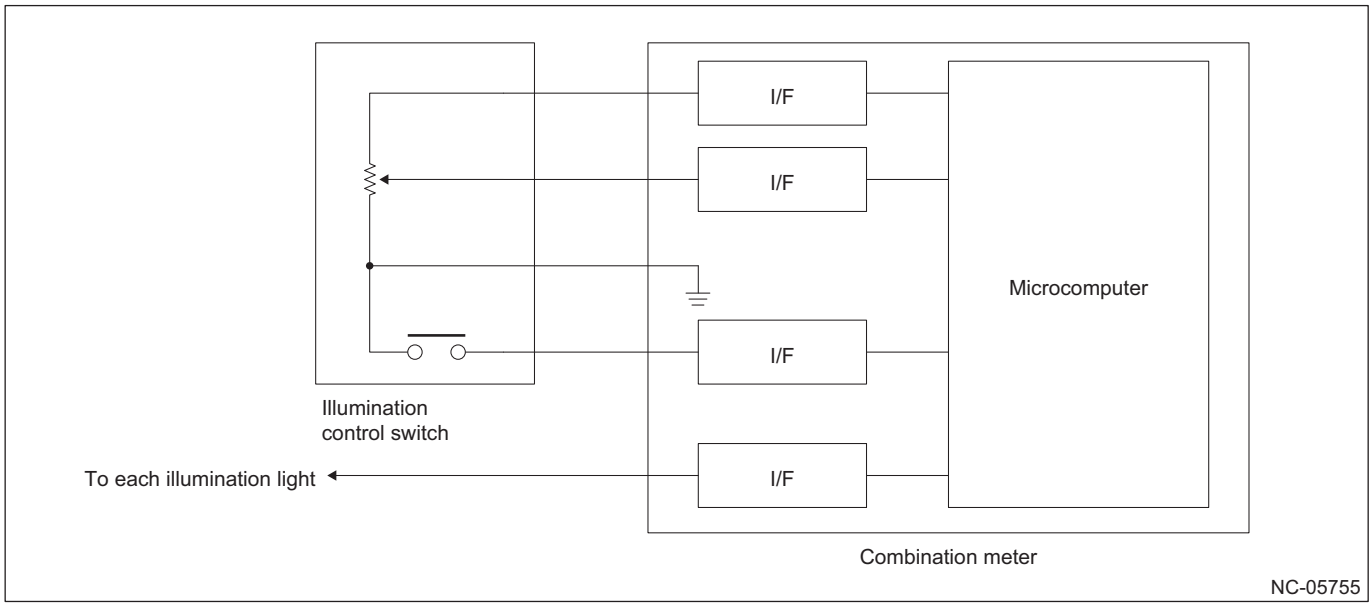
Ambient sensor operation

The combination meter microcomputer displays the current ambient temperature based on the ambient temperature signal sent from the ambient sensor.



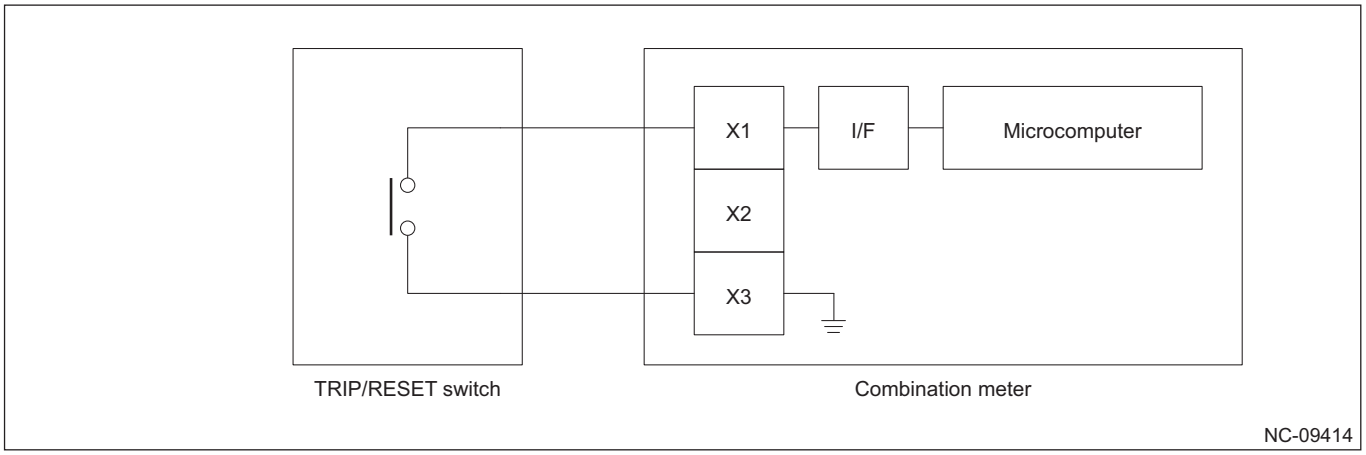
Illumination dimming operation

The combination meter microcomputer adjusts the illumination brightness of the combination meter, illumination lights, and other lights based on the dimming signal from the illumination control switch.



Trip meter/odometer operation

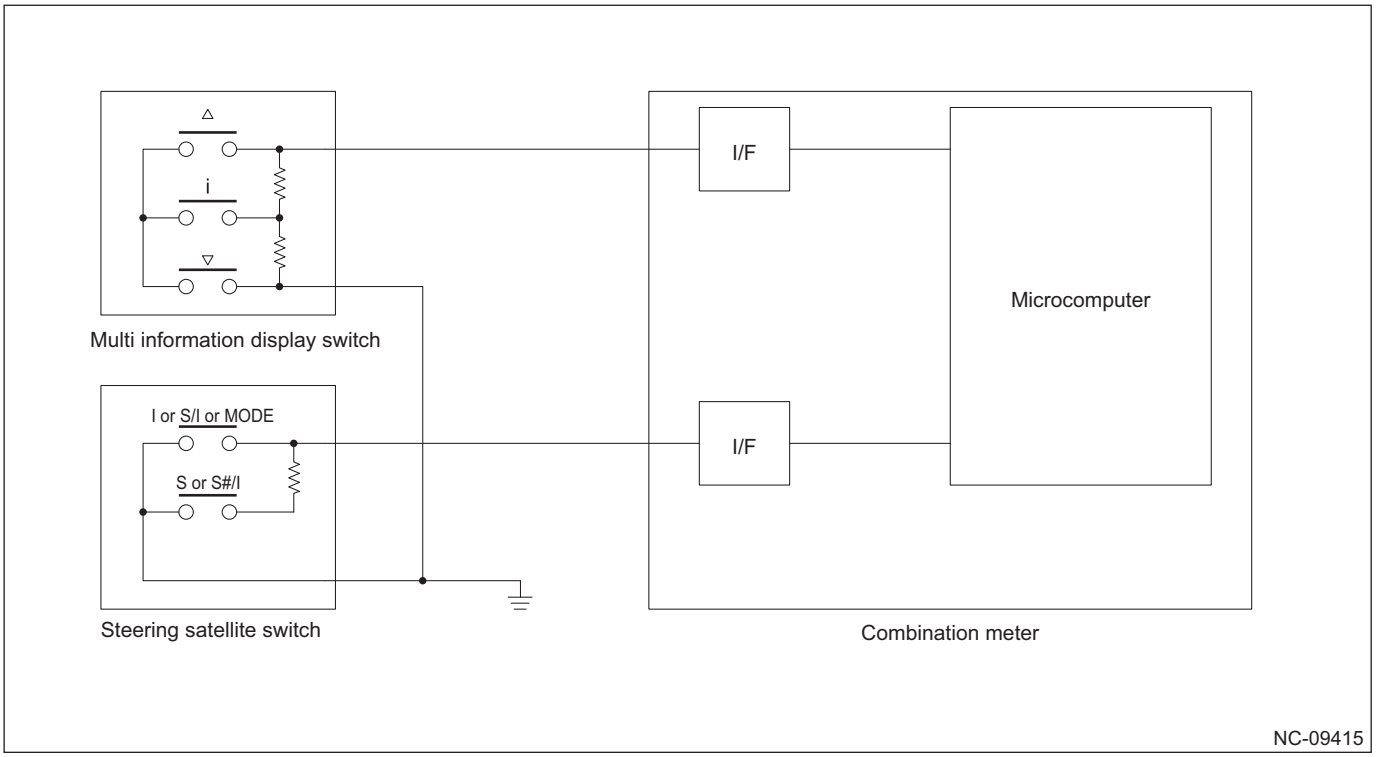
The combination meter microcomputer switches between odometer, trip A, and trip B based on the TRIP RESET switch operation signal.



Steering switch operation

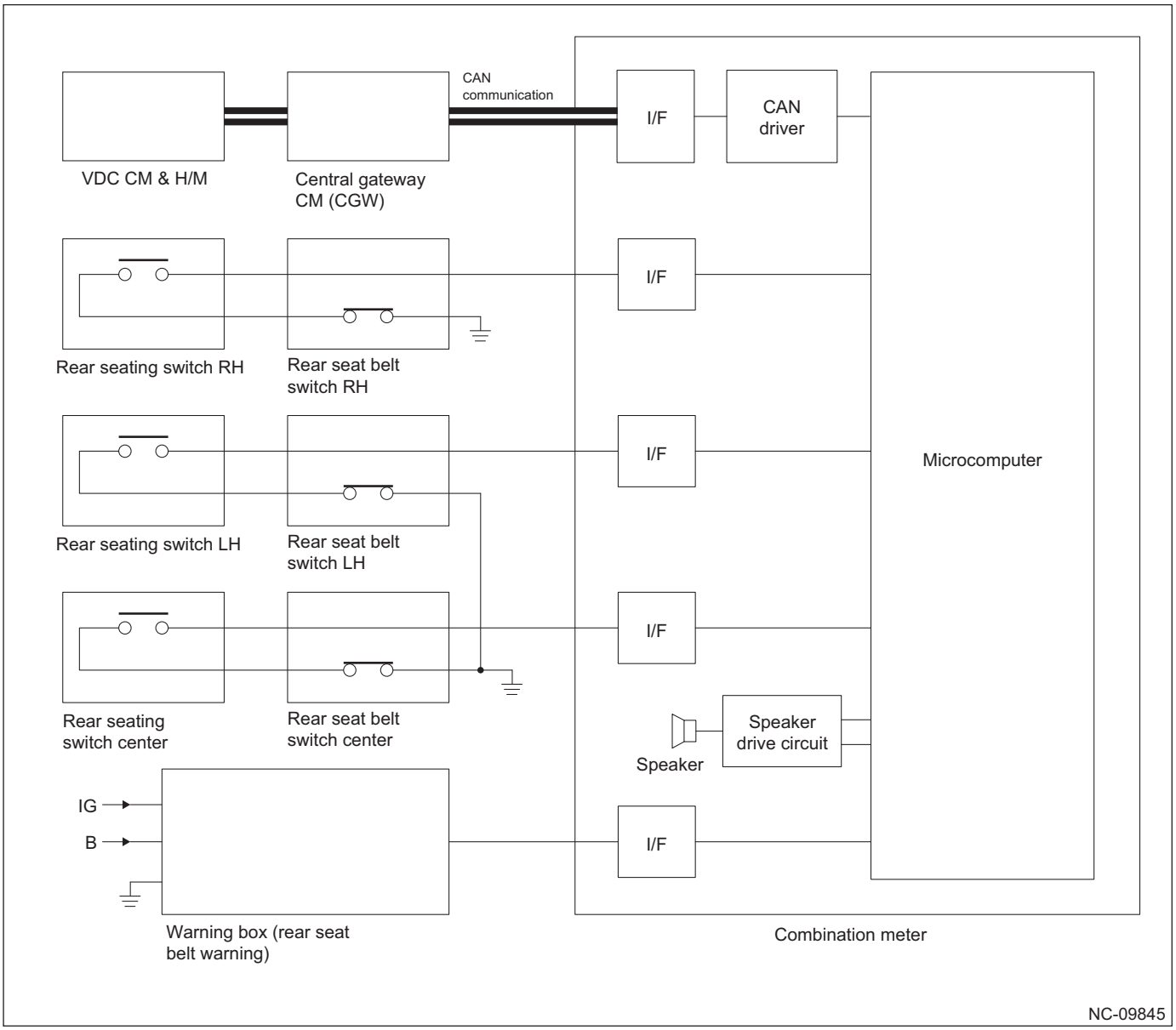
- The combination meter microcomputer changes the combination meter display based on the multi information display switch operation signal.
- The combination meter microcomputer displays the selected mode based on the operation signal of the SI-DRIVE switch* or drive mode switch*.

**: For some grades*



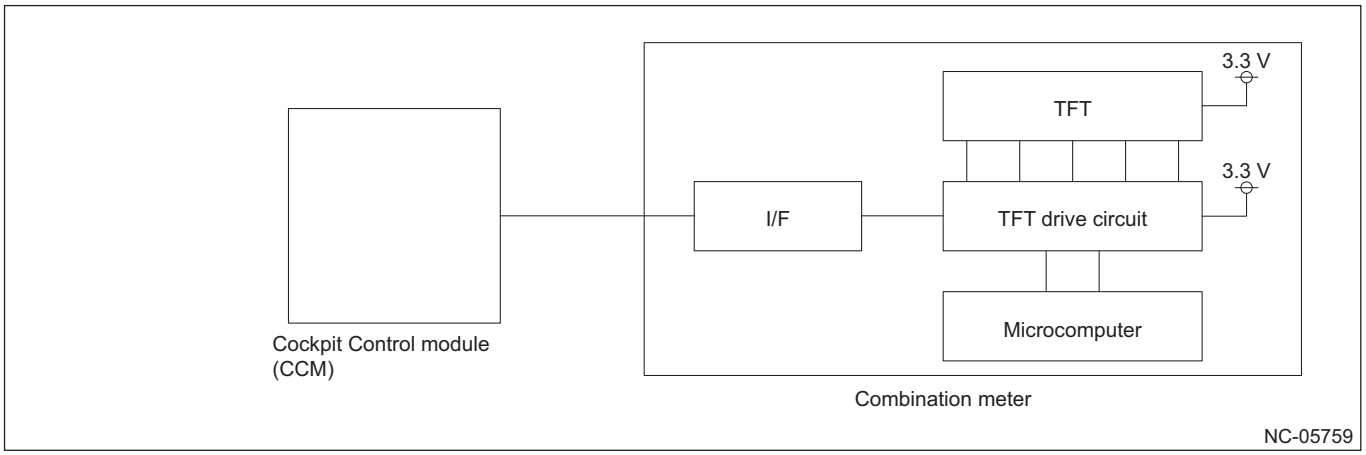
Rear seat belt reminder operation

- When the combination meter microcomputer detects the seating switch ON signal (indicating occupant present) and seat belt switch OFF signal (seat belt not fastened) for each rear seat and detects that the vehicle speed is approximately 4 mph (6 km/h) or lower based on the vehicle speed signal that is sent from the VDC CM & H/M via CAN communication, it turns on the rear seat belt warning in the warning box.
- When the combination meter microcomputer detects that the occupant's seat belt is not fastened and the vehicle speed is between approximately 4 mph (6 km/h) and 13 mph (20 km/h), after a certain length of time elapses, it changes to flashing the rear seat belt warning and sounds a warning buzzer. Then, the warning buzzer becomes louder, and after a certain length of time elapses, it changes the rear seat belt warning light to on and stops the warning buzzer.
- When the combination meter microcomputer detects that the occupant's seat belt is not fastened and the vehicle speed exceeds approximately 13 mph (20 km/h), it changes to flashing the rear seat belt warning and sounds a warning buzzer at a high volume. Then, after a certain length of time elapses, it changes the warning light to on and stops the warning buzzer.
- When the combination meter microcomputer receives the seating switch ON signal (indicating occupant present) and seat belt switch ON signal (seat belt fastened) for each rear seat, it turns off the rear seat belt warning.



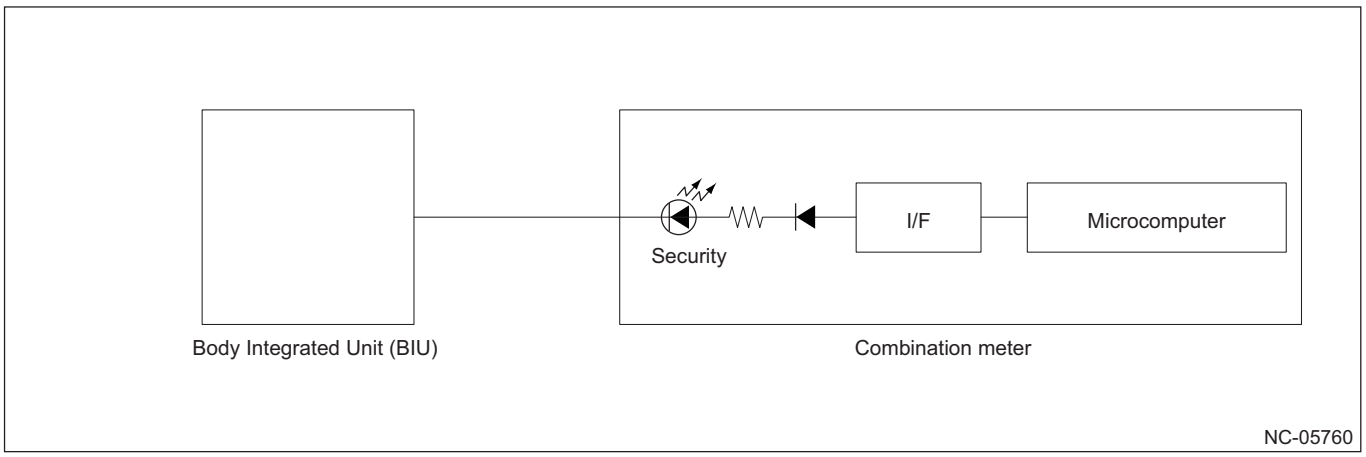
Cockpit Control Module (CCM) cooperative operation

The combination meter microcomputer displays the screen linked with the display of the Center Information Display (CID) based on the center information display operation signal from the Cockpit Control Module (CCM).



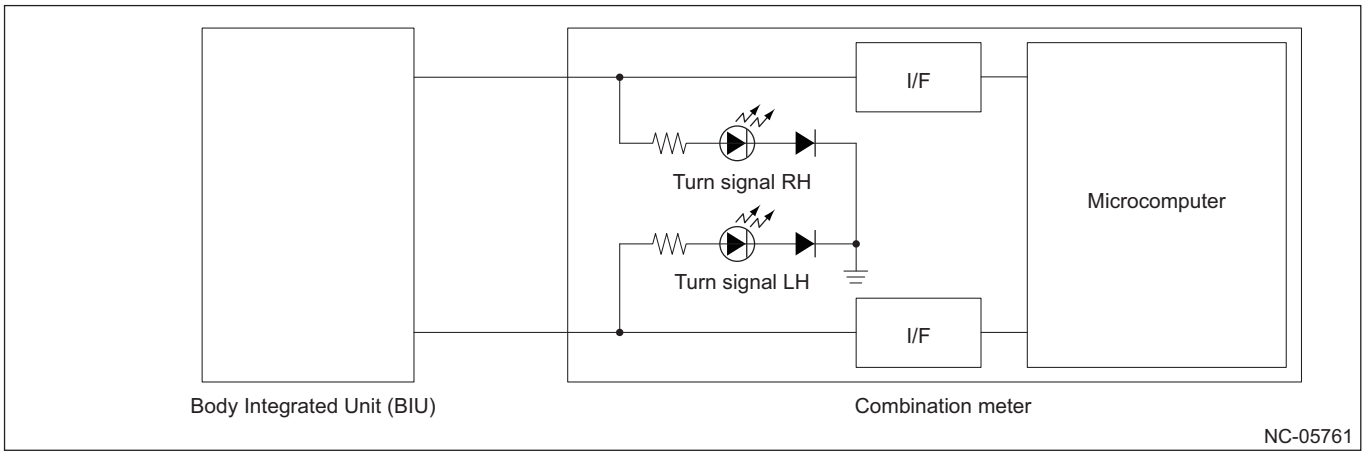
Immobilizer/security operation

The combination meter microcomputer flashes the security indicator light based on the security signal sent from the Body Integrated Unit (BIU).



Turn signal operation

The combination meter microcomputer flashes the turn signal switch indicator lights based on the turn signal sent from the Body Integrated Unit (BIU).

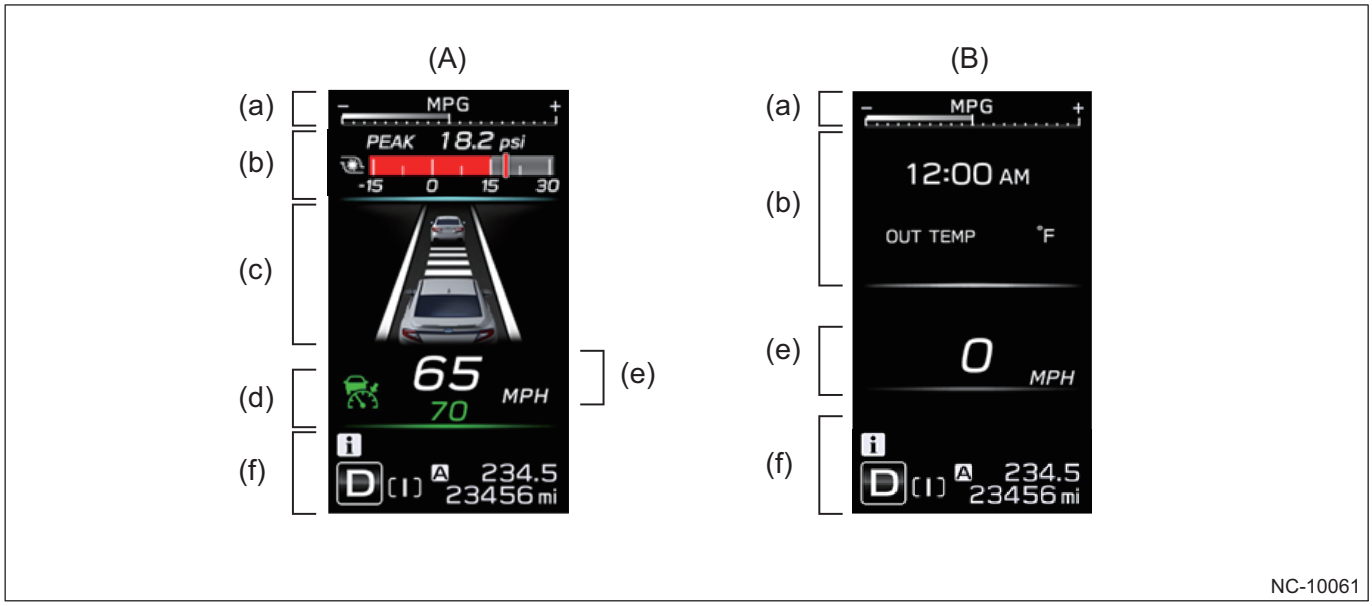


Display screen details

Multi Information Display (MID)

A Multi Information Display (MID) is adopted that displays the running condition and warning indications while EyeSight is in service and various driving information on its 4.2-inch screen.

■ Display area



**The illustration shows a typical example that may differ from the actual display.*

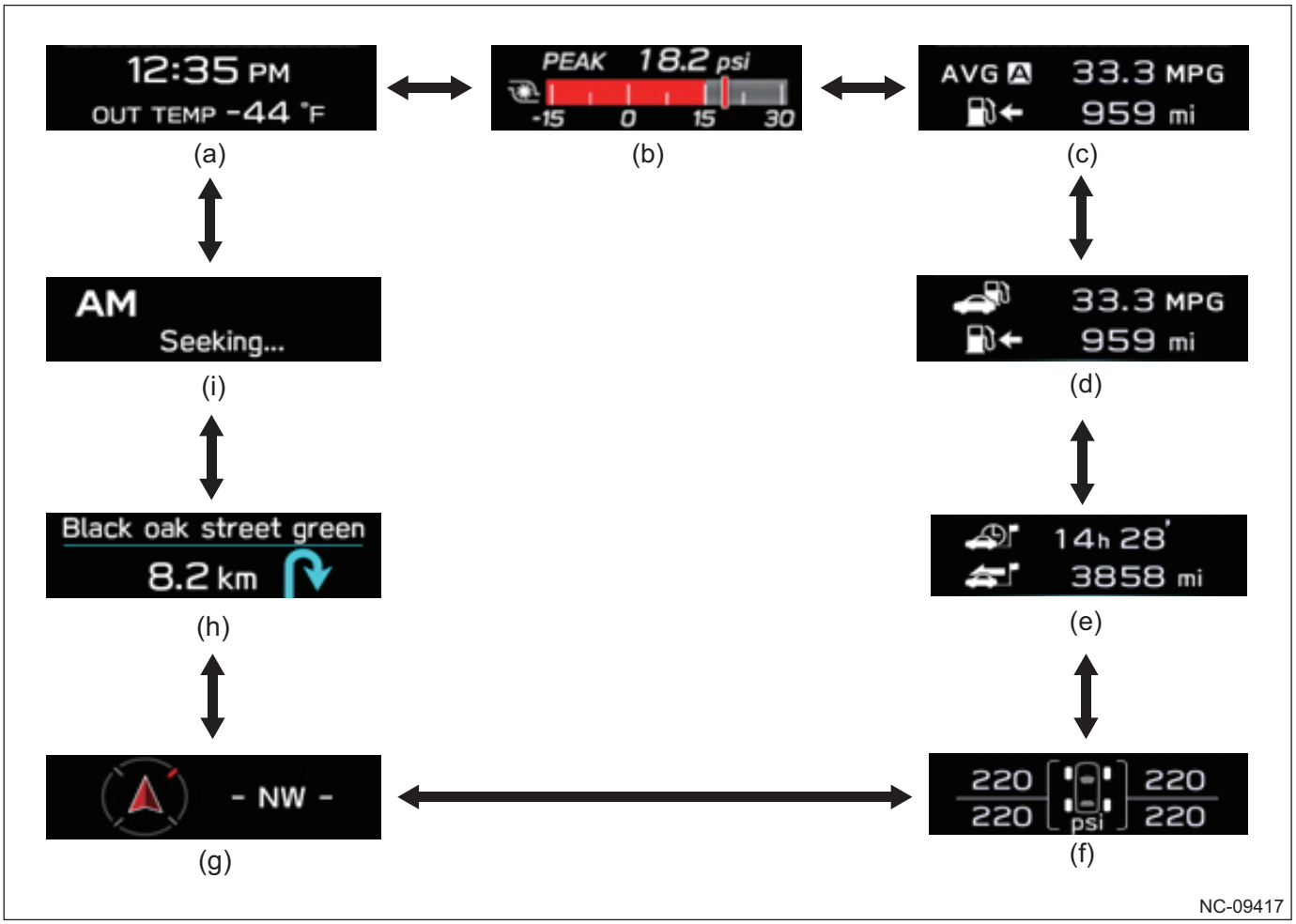
(A) When EyeSight or Conventional Cruise Control is operating

(B) When EyeSight and Conventional Cruise Control are not operating

Display area		Display contents
(a)	ECO gauge / Information display	• Momentary fuel consumption • Ambient temperature • Clock • Compass • Remaining fuel cruising distance
(b)	Basic screen	• Normal screen • Interrupt display
(c)	EyeSight	• EyeSight screen • Speed limit • Interrupt display
(d)	Cruise Control	Cruise Control display
(e)	Vehicle speed	Vehicle speed
(f)	Fixed display	• Information mark • Warning/indicator lights (LCD) • Shift position • SI-DRIVE/drive mode select • Trip meter/odometer

■ Screen transitions

The multi information display switches are used to switch screens from the basic screen. Normal screen and interruption screen are displayed by switching screens.



**The illustration shows a typical example that may differ from the actual display.*

(a) Clock/ambient temperature
(b) Boost gauge
(c) Average fuel consumption
(d) Momentary fuel consumption
(e) Driving information
(f) TPMS
(g) Compass
(h) Turn-by-turn
(i) Audio

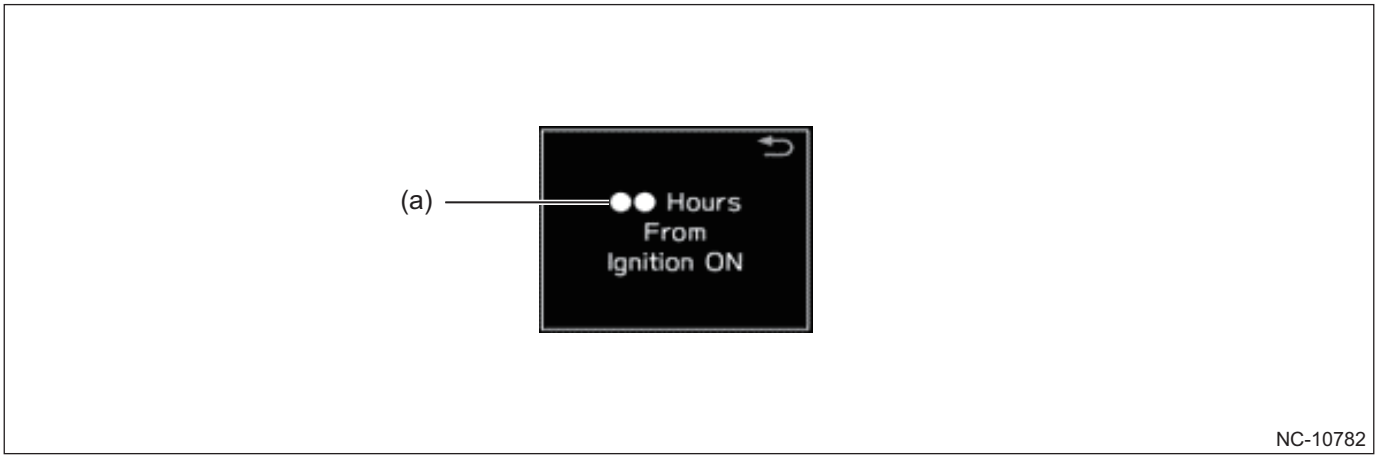
Reference
Presence and design of screen display differ by grade.

■ Interrupt display

▮ Driving time elapsed notification display

An interrupt display for a driving time elapsed notification is provided.

- This is displayed when 2 hours elapse after the ignition is turned ON.
- After the initial display, the notification is displayed when every hour elapses while the ignition remains ON.
- The notification is displayed for up to 99 hours. After 99 hours are exceeded, it is no longer displayed.



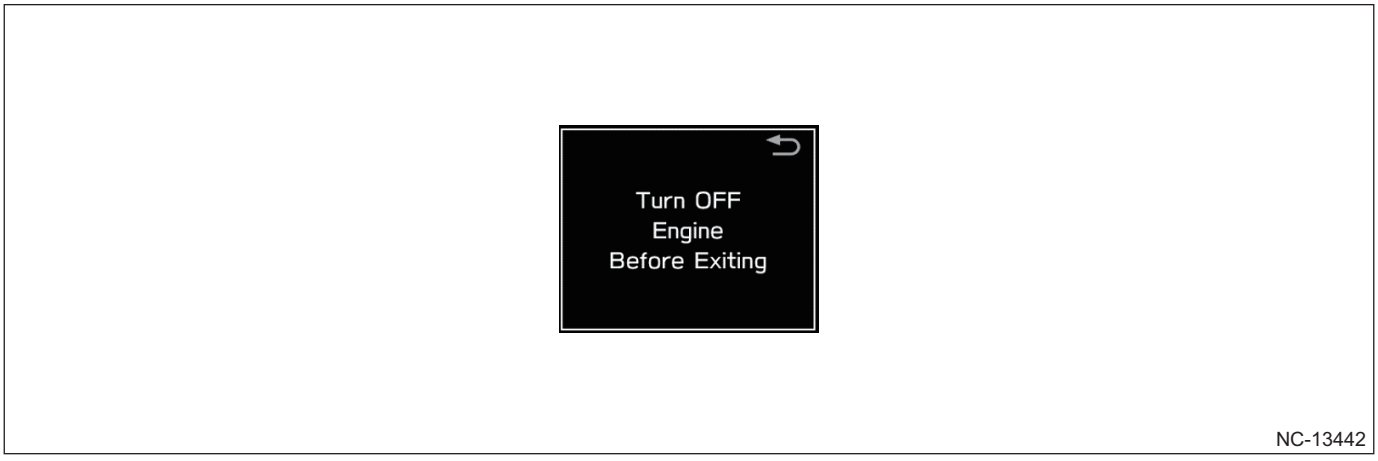
** The illustration shows a typical example that may differ from the actual display.*

(a) Displays the elapsed time

▮ Power off reminder warning display

An interrupt display for the power off reminder warning is provided.

- This is displayed and the buzzer sounds if the touch sensor (lock) of the door outer handle is pressed while carrying the access key when the vehicle power supply is in a position other than OFF and the select lever is in the P position.



** The illustration shows a typical example that may differ from the actual display.*

Function

Welcome screen/Goodbye screen

Animation is displayed to produce a feeling of hospitality when the user enters or exits the vehicle.

Function	Welcome screen	• When the user unlocks the doors, then opens the driver's door, enters the vehicle, and closes the door, the Welcome screen is displayed and the indicator needles of the combination meter turn on for a certain length of time. • When the engine switch is turned ON, the six-star emblem is displayed, and then all the indicator needles/gauges of the combination meter display their maximum values before quickly returning to their original positions.
	Goodbye screen	When the engine switch is turned OFF, the Goodbye screen is displayed.

Speedometer

Displays the own vehicle speed.

Display range	0 to 180 mph (0 to 280 km/h)

Tachometer

Displays the engine speed.

Display range	0 to 8000 r/min (red zone: 6100 to 8000 r/min)

Trip meter/odometer

Displays the total mileage driven.

The displayed item is changed by operating the TRIP/RESET switch.

Trip meter A/B	Display range	0.0 to 9999.9 mile
	Function	When the display reaches the upper limit, it returns from 9999.9 mile to 0.0 mile and continues counting.
Odometer	Display range	0 to 999999 mile
	Function	When the display reaches the upper limit, it maintains 999999 mile.

Ambient temperature gauge

Displays the ambient temperature.

Display range	-40 to 122°F (-40 to 50°C)
Function	Receives and processes the signal from the ambient sensor, and displays the ambient temperature.

Fuel meter

Displays the remaining fuel level.

Display details	• E: 5.3 L or less • Midpoint: 29.8 L • F: 55.8 L or more

Coolant temperature gauge

Displays the engine coolant temperature.

Display details	• C: 50°C or less • Mid stable point: 85 to 108 °C • Red zone: 120°C or more

Clock

Displays the current time.

Display details	The following 2 patterns can be selected for the display format. • 12 H display • 24 H display

Select indicator

Indicates the currently selected shift position.

CVT

Display details	Shift position	• P: Park (parked and engine start position) • R: Reverse (reversing position) • N: Neutral (neutral position) • D: Drive (normal driving position) • M: Manual (manual mode driving position)
	Shift range (Shift lever M position)	• 1: Gear position 1 • 2: Gear position 2 • 3: Gear position 3 • 4: Gear position 4 • 5: Gear position 5 • 6: Gear position 6
	Other	• △ : Upshift possible indicator light • ▽ : Downshift possible indicator light

MT

Display details	Shift position	• R: Reverse (reversing position) • 1: Gear position 1 • 2: Gear position 2 • 3: Gear position 3 • 4: Gear position 4 • 5: Gear position 5 • 6: Gear position 6
	Other	• △ : Upshift possible indicator light • ▽ : Downshift possible indicator light

Drive mode select (for some grades)

Indicates the currently selected drive mode.

Display details	• Norm: NORMAL mode • S: SPORT mode • S+: SPORT+ mode • ★ : INDIVIDUAL mode • C: COMFORT mode

Information function

Press the i (information) switch on the multi information display switches while the i (information) mark is displayed to display the interrupt display again.

Compass

Indicates the travel direction.

Display details	• N: North • E: East • S: South • W: West

S/I DRIVE indicator (for some grades)

Indicates the currently selected S/I DRIVE mode.

Display details	• I: Intelligent mode • S: Sports mode • S#: S# mode

Boost gauge

Displays the boost gauge that expresses the sporty driving of models equipped with turbo.

Display range	-15 to 30 psi

Driving time

Displays the elapsed driving time since the engine switch was turned ON.

Display range	00' to 99 h 59 (00 minutes to 99 hours 59 minutes)

Section distance

Displays the distance driven since the engine switch was turned ON.

Display range	0 to 99999 miles (km)

Average fuel consumption

Displays the average fuel consumption at each trip meter reset.

Display range	0 to 99.9 MPG (l/100 km)

Momentary fuel consumption

Displays the momentary fuel consumption during driving.

Display range	0 to 99.9 MPG (l/100 km)

ECO gauge

Displays the difference between the average fuel consumption and momentary fuel consumption.

Function	• + values indicate that the momentary fuel consumption exceeds the average fuel consumption. • - values indicate that the momentary fuel consumption is lower than the average fuel consumption.

Remaining fuel cruising distance

Displays the distance that can be driven with remaining amount of fuel.

Display range	10 to 2540 miles (km)
Minimum unit	10 miles (km)
Function	• Displays the calculated values in the combination meter based on various signals. • The display is blank when the value cannot be calculated.

Turn-by-turn

Links to the Center Information Display (CID) and displays the guidance to the destination.

Function	• Indicates the travel direction with an arrow. • Displays the distance to the next branching point. • Displays the name of the road of travel. • Displays the interchange/junction name when traveling on an expressway.

Audio

Displays the currently playing audio source, connection status, or related information.

Function	• AM/FM • DTV • CD/DVD • External connection device (USB, Bluetooth audio, iPod, etc.) • Traffic information

Dimming function

A dimming function has been adopted that allows the brightness of the combination meter and other lighting to be adjusted.

Dimming can be adjusted in 6 stages, and is performed by using the illumination control dial on the instrument panel on the driver's seat side.

Telltale

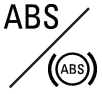
Warning lights that notify the user of various system trouble, and indicator lights that notify the user of the headlight status and the ON/OFF status of various functions have been adopted.

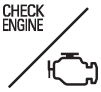
LED are used for the warning lights and indicator lights, reducing power consumption and extending the lifetime.

Reference

Whether or not a particular warning light or indicator light is present depends on the grade and options.

■ Warning light

Warning light	Name	Indication color	Details
	Brake system warning light	Red	Turns on when the engine switch is turned ON, then turns off after approximately 2 seconds. Turns on in the following cases when the engine is running. • The brake fluid level is significantly low. • There is trouble in the brake system. • There is trouble in the electronic control system of the EBD (Electronic Brakeforce Distribution). The ABS warning light also turns on at the same time when there is trouble in the EBD electronic control system.
	Electronic parking brake warning/ brake system warning light	Yellow	• Turns on when the engine switch is turned ON, then turns off after approximately 2 seconds. • Turns on when there is trouble in the electronic parking brake or brake booster.
	Seat belt warning light	Red	The warning light turns on when the engine switch is ON and the driver's seat belt is not fastened. The warning light on the overhead console also turns on when the seat belt is not fastened in the passenger's seat (when an occupant is present) and rear seats. It turns off when the seat belt is fastened. If the driver starts driving when the seat belt is not fastened, the warning light flashes or turns on and the buzzer sounds.
	Door open warning light	Red	Turns on when a door or the trunk is not fully closed, regardless of the engine switch status.
	Hood open warning light	Red	Turns on when the hood is not fully closed, regardless of the engine switch status.
	ABS warning light	Yellow	• Turns on when the engine switch is turned ON, then turns off after approximately 2 seconds. • Turns on when there is trouble in the electronic control system of the ABS (Anti-lock Brake System).
	AWD warning light	Yellow	Flashes when driving while a tire with a different diameter is installed on one of the wheels. This may also flash when driving while the inflation pressure of one of the 4 tires is significantly low.
	SRS airbag system warning light	Red	• Turns on when the engine switch is turned ON, then turns off after approximately 6 seconds. • Turns on when there is trouble in the system.
	Oil pressure warning light	Red	• Turns on when the engine switch is turned ON, then turns off after engine start. • Turns on when the pressure of the engine oil that lubricates the inside of the engine is abnormal while the engine is running.

Warning light	Name	Indication color	Details
	Low oil level warning light	Yellow	Turns on when there is trouble in the engine oil level.
	AT oil temperature warning light	Red	Turns on when the CVT transmission fluid temperature is high and flashes when there is trouble in the CVT.
	Charge warning light	Red	• Turns on when the engine switch is turned ON, then turns off after engine start. • Turns on when there is trouble in the charging system while the engine is running.
	Engine warning light	Yellow	• Turns on when the engine switch is turned ON, then turns off after engine start. • Turns on when there is trouble in the engine electronic control system while the engine is running. Flashes when the catalyst may be damaged while the engine is running.
	Low fuel warning light	Yellow	• Turns on when the engine switch is turned ON, then turns off after approximately 2 seconds. • Turns on when the amount of remaining fuel is approximately 9 L or less. • Flashes when there is trouble in the fuel meter (fuel gauge).
	VDC warning light	Yellow	• Turns on when the engine switch is turned ON, then turns off approximately 2 seconds after engine start. • Turns on when there is trouble in the VDC electronic control system.
	BSD/RCTA warning light	Yellow	Turns on when there is trouble in the BSD/RCTA system.
	Auto headlight beam leveler warning light	Yellow	Turns on when there is trouble in the electronic control system of the auto headlight beam leveler (automatic optical axis adjustment mechanism) while the engine is running.
	LED headlight warning light	Yellow	Turns on when there is trouble with the LED headlights.

Warning light	Name	Indication color	Details
	Coolant temperature warning light/ coolant temperature indicator light	Red/blue	Turns on in red for approximately 2 seconds and then turns off when the engine switch is turned ON, or turns on or flashes according to the coolant temperature. • Coolant temperature warning light (red): Flashes when the coolant temperature is approaching overheating and turns on when overheating occurs. • Coolant temperature indicator light (blue): Turns on when the coolant temperature is low. Turns off when the coolant temperature rises.
	Steering control warning light	Red	• Turns on when the engine switch is turned ON, then turns off approximately 2 seconds after engine start. • Turns on when there is trouble in the electronic control system of the power steering while the engine is running.
	SRH warning light	Yellow	Turns on when there is trouble in the SRH.
	RAB warning light	Yellow	Turns on when there is trouble in the RAB.
	Electronic control damper system warning light	Yellow	Turns on when there is trouble in the electronic control damper system.
	Low tire pressure warning light	Yellow	Turns on for a certain length of time when the engine switch is turned ON while the system checks that the Tire Pressure Monitoring System (TPMS) is functioning correctly. If the air pressure at all tires is correct, the low tire pressure warning light turns off. When the system detects trouble, the low tire pressure warning light flashes for approximately 1 minute and then stops flashing and remains on.
	Access key warning light	Yellow	The warning buzzer sounds and access key warning light turns on according to the operating status of keyless access.
	Low washer fluid level warning light	Yellow	Displays the low washer fluid level warning light when the washer fluid level drops to the specified value or less.
	EyeSight warning indicator light	Yellow	• Turns on or flashes when there is a malfunction in EyeSight. • When it is on or flashing, no EyeSight functions (including the Adaptive Cruise Control and Pre-Collision Braking) can be used.

■ Indicator lights

Indicator lights	Name	Indication color	Details
	Electronic parking brake operation light	Red	• Turns on when the engine switch is turned ON, and turns off after approximately 2 seconds when the electronic parking brake is released. • Turns on during operation. • When the switch is operated under conditions where operation is not possible, flashes for approximately 10 seconds to notify the user. • Flashes when there is trouble.
	Turn signal switch indicator lights	Green	Flashes when the turn signal or hazard lights are operating.
	Lighting switch indicator light	Green	• Turns on when the lights are illuminated. • Also turns on when the welcome lighting is activated.
	High beam/passing indicator light	Blue	Turns on when the high beam headlights are active. It also turns on when passing.
	Front fog light indicator light	Green	Turns on when the front fog lights are illuminated.
	High Beam Assist (HBA) indicator light	Green	Turns on when the headlights are illuminated and High Beam Assist (HBA) is active.
	Security indicator light	Red	Flashes according to the activation status of the immobilizer function and anti-theft system.
	VDC operation indicator light	Yellow	• Turns on when the engine switch is turned ON, then turns off approximately 2 seconds after engine start. • Flashes when the TCS function activates or when the VDC function activates.
	VDC OFF indicator light	Yellow	Turns on when activation of the TCS function is turned OFF.
	BSD/RCTA OFF indicator light	Yellow	Turns on when BSD/RCTA is temporarily stopped or when BSD/RCTA is turned OFF.

Indicator lights	Name	Indication color	Details
	AVH indicator light	Green	Turns on when AVH is turned ON.
	AVH operation indicator light		Turns on when the vehicle is stopped by an AVH operation.
	Hill Start Assist activation indicator light	Yellow	Turns on when Hill Start Assist is set. Also turns on when Hill Start Assist is activated.
	SRH OFF indicator light	Yellow	Turns on when SRH is turned OFF.
	Adaptive Cruise Control indicator light	White/ green	• Turns on when the cruise switch is pressed. • Changes from white to green when Adaptive Cruise Control is set. Returns to white when the driver depresses the accelerator pedal to accelerate while Adaptive Cruise Control is active.
	Conventional Cruise Control indicator light	White/ green	• Turns on when the cruise switch is pressed and the distance between vehicles setting switch is pressed and held. • Changes from white to green when Conventional Cruise Control is set.
	READY indicator light	-	Turns on when Cruise Control can be set.
	HOLD indicator light	-	Turns on during half-stop of Adaptive Cruise Control.
	Preceding vehicle indicator light	White	Turns on when Adaptive Cruise Control is set and a preceding vehicle is recognized.
	Own vehicle indicator light	White	The brake lights on the display illuminate red when the driver depress the brake pedal or brake control activates.
	Set distance between vehicles indicator light	-	• Displays the set distance between vehicles that was set with the distance between vehicles setting switch. • The distance between vehicles is displayed in 4 stages.
	Set vehicle speed display	White/ green	Displays the set vehicle speed.

Indicator lights	Name	Indication color	Details
NC-05945	Lane centering indicator light	White Green	• Turns on when the Lane Centering switch is pressed and the Lane Centering / Preceding Vehicle Following Steering function turns ON. (Only when Adaptive Cruise Control is ON) • Turns off when Adaptive Cruise Control is turned OFF. • The indicator light changes from white to green while the Lane Centering / Preceding Vehicle Following Steering function is operating.
NC-05947	Lane indicator light	Blue/gray/ white/ yellow	• Turns on in blue while the Lane Centering / Preceding Vehicle Following Steering function is operating. • Turns on in gray when the lane departure prevention function is turned ON. • Turns on in white when the lane departure prevention function enters the standby state. • The lane on the departure side turns on in yellow when the lane departure prevention function starts to operate.
NC-07123	EyeSight temporary stop indicator light	White	• Turns on if the cruise switch or Lane Centering switch is pressed within approximately 10 seconds after engine start, and turns off approximately 10 seconds after engine start. • Turns on when EyeSight is temporarily stopped. • While it is on, no EyeSight functions except for Conventional Cruise Control can be used.
NC-05950	Lane departure warning OFF indicator light	Yellow	• Turns on when the engine switch is turned ON, then either turns off or remains on approximately 10 seconds after engine start depending on the state before the engine switch was last turned OFF. • Turns on when the Lane Departure Warning and Lane Sway Warning are OFF.
NC-05951	Pre-collision brake OFF indicator light	Yellow	• Turns on when the engine switch is turned ON, then turns off approximately 10 seconds after engine start. • Turns on when Pre-Collision Braking and Pre-Collision Throttle Management are OFF.
NC-05953	Autonomous Emergency Steering OFF indicator light	Yellow	• Turns on when the engine switch is turned ON, then either turns off or remains on approximately 10 seconds after engine start depending on the BSD/RCTA state before the engine switch was last turned OFF. • Turns on when BSD/RCTA or Pre-Collision Braking cannot be used due to a failure or other reason, or when Pre-Collision Braking and BSD/RCTA are OFF.
NC-05954	Low temperature indicator light	Yellow	• Turns on when the ambient temperature is 3°C or below to notify the driver that there is the possibility of the road surface freezing. • Turns off when the ambient temperature rises to 5°C or higher.
NC-05955	RAB OFF indicator light / Temporary stop indicator light	Yellow	Turns on when the vehicle stops as a result of automatic (damage reduction) brake activation. Turns on when RAB is temporarily stopped or when automatic (damage reduction) brake is turned OFF.

Indicator lights	Name	Indication color	Details
NC-09431	Sonar warning buzzer OFF indicator light	Yellow	Turns on when RAB is temporarily stopped or when the sonar warning is turned OFF.

Customization function

A customization function has been adopted which allows the various combination meter displays to be turned ON/OFF and the displayed items to be changed.

Customization is set by operating the Center Information Display (CID).

Customization item		Details
Gauge Initial Movement		The initial operation of the combination meter at engine switch ON can be turned ON/OFF. • ON: Performs initial operation. • OFF: Does not perform initial operation.
Meter Information Screen	Eco Gauge	The items displayed in the ECO gauge/information display area can be selected from 4 patterns. • Eco Gauge: Displays the eco gauge. • OUT TEMP/Clock: Displays the ambient temperature and clock. • Compass: Displays the compass. • Gas Range: Displays the remaining fuel cruising distance.
	OUT TEMP/Clock	
	Compass	
	Gas Range	
Turn by Turn Screen Interruption		The turn-by-turn interrupt displays can be turned ON/OFF. • ON: Displays interrupts. • OFF: Does not display interrupts.
Peak Value Reset		The PEAK value of the boost gauge can be reset.

Diagnosis

Each CM can be accessed via the CAN communication line by connecting the Subaru Select Monitor to the connector on the vehicle (data link connector). This enables diagnosis codes to be output, as well as operations such as data monitoring (checking CM data, etc.), active tests (driving various actuators as desired), and customization (setting of control programs). For details, refer to the service manual.

11.5 Information

11.5.1 Overview

Overview

The Cockpit Gen.1.0 Infotainment System in which the Cockpit Control Module (CCM) performs integrated control of the Center Information Display (CID) and LCD display (built into the combination meter) is adopted to display information that links both displays.

The Center Information Display (CID) displays various types of vehicle information, such as maintenance information and the operation status of advanced safety functions. The user is able to understand the information intuitively from the graphical display.

Two types of Center Information Display (CID) are provided according to the specification of the infotainment system, and the display is combined with the Cockpit Control Module (CCM).

Type	Center Information Display (CID)
Base audio	Dual 7.0-inch display
High grade audio	11.6-inch display
Navi & High grade audio	

Specifications

Hardware

Specifications		Type		
		Base audio	High grade audio	Navi & High grade audio
Display	Specifications	Color LCD		
	Size/resolution	Dual 7.0-inch display/ WVGA (800x480)	11.6-inch/Full HD (1080x1920)	
	Touch panel	Resistive	Electrostatic	
CPU	Name	Intel Apollo Lake		
	Spec.	37,944 MIPS 4-Core 1.8 GHz		42,160 MIPS 4-Core 2.0 GHz
Main memory	Main	16 GB		64 GB
	RAM	3 GB		4 GB
USB terminal		USB2.0 x 2 (maximum 2.1 A each)		

Software

Specifications	Type	
	Dual 7.0-inch display	11.6-inch display
Time setting	Smartphone link/Manual	Smartphone link*1/Automatic (GPS link)*2/Manual
Display language	American English/North American French/North American Spanish	

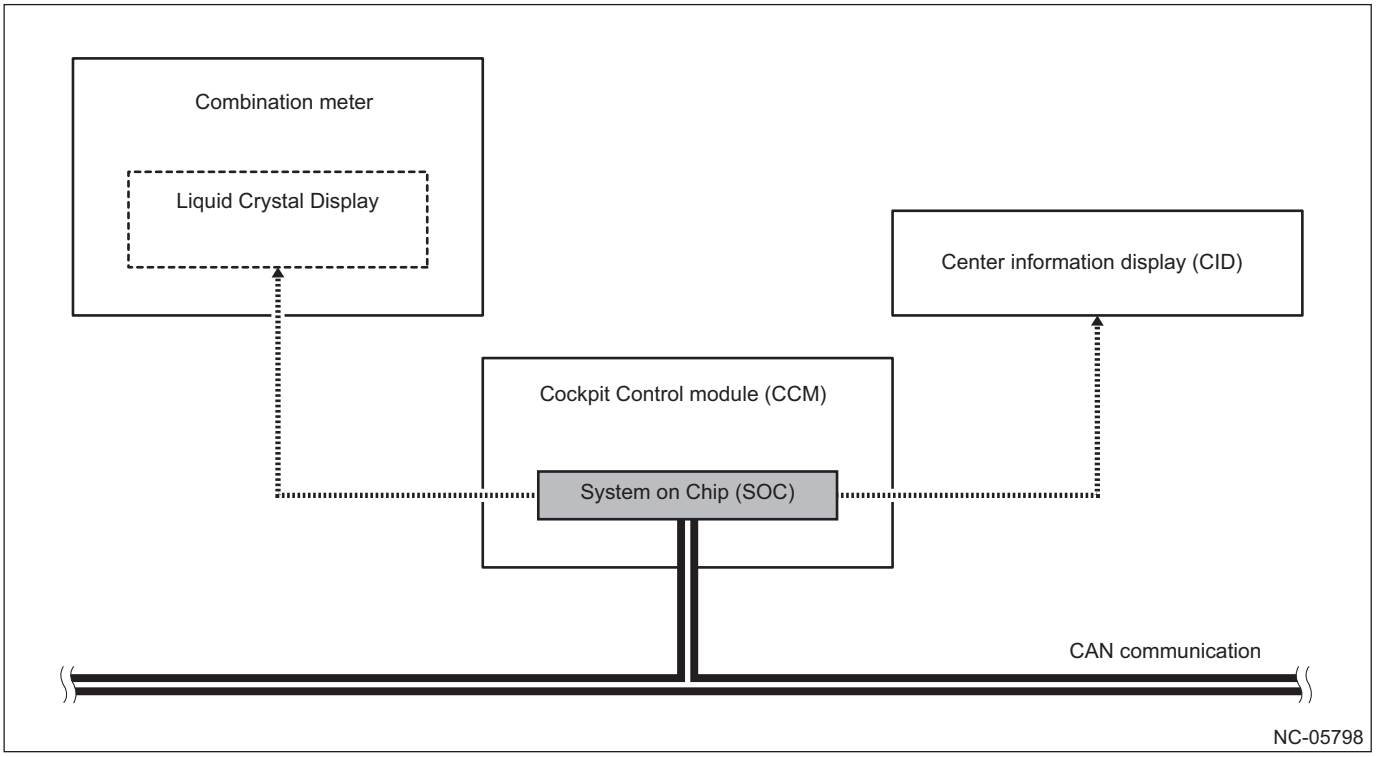
**1: Supported except for models with data communication module (DCM) and models with Navi & High grade audio*
**2: Supported only for models with data communication module (DCM) or models with Navi & High grade audio*

Characteristics

Information display link

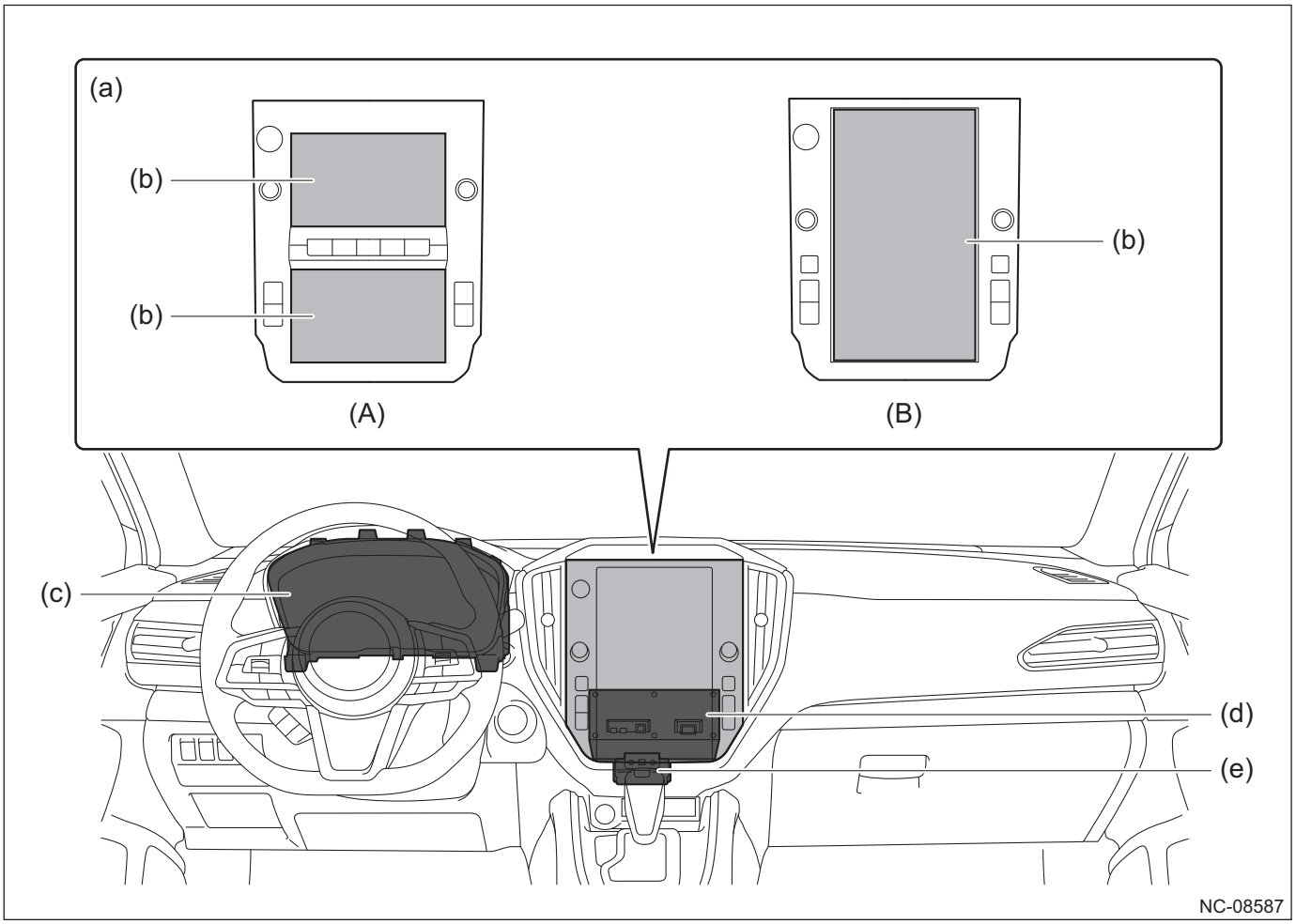
- Hypervisor system control using a System on Chip (SOC) method has been adopted for the infotainment system.
- The System on Chip (SOC) type controller that is installed inside the Cockpit Control Module (CCM) has a simple structure that controls the Center Information Display (CID) and LCD display (built into the combination meter).
- Because control of the overall contents on both displays is integrated, it provides seamless information display and coordinated displays without delay.

Infotainment system mechanism



11.5.2 Component

Component layout drawing



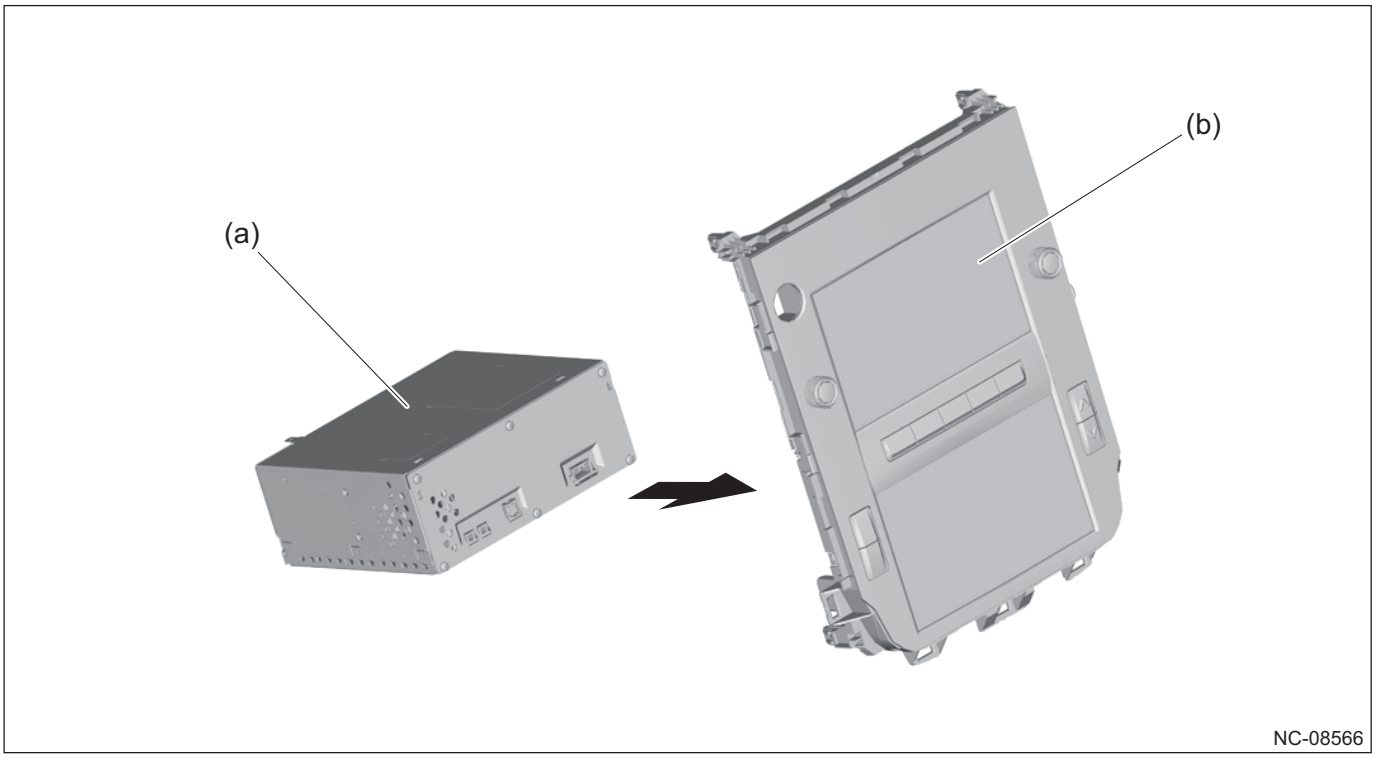
(A)	Base audio	(B)	High grade audio/Navi & High grade audio
(a)	Center Information Display (CID)	(d)	Cockpit Control module (CCM)
(b)	Display	(e)	Central gateway CM (CGW)
(c)	Combination meter • Multi information display		

Component details

Infotainment system hardware

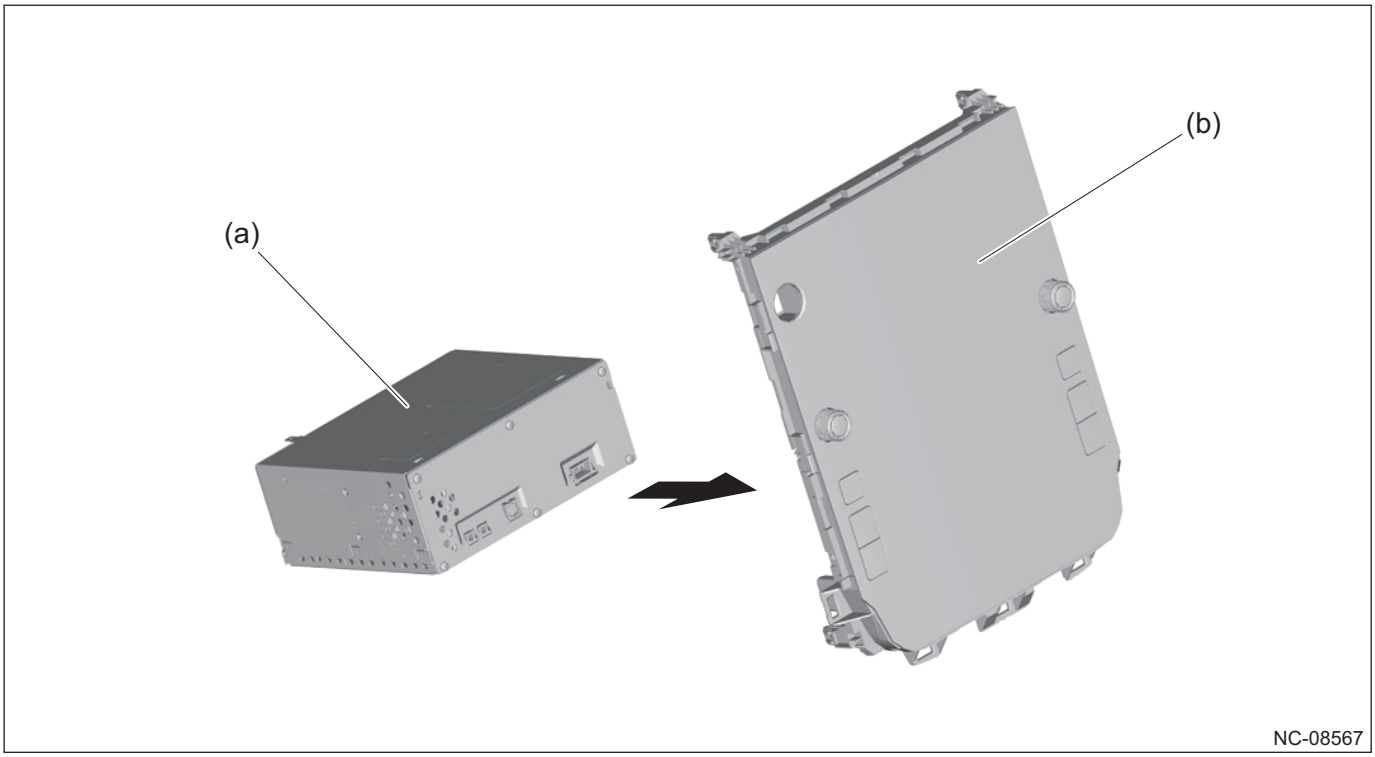
The Cockpit Gen.1.0 Infotainment System is composed of the Cockpit Control Module (CCM) that controls the system as a whole, the Center Information Display (CID) that provides the user interface, and the combination meter with a built-in LCD display.

■ Base audio



Symbol	Part name	Function
(a)	Cockpit Control module (CCM)	Adopts a System on Chip (SOC) method, and its hypervisor system achieves integrated control of the Center Information Display (CID) as well as the LCD display (built into the combination meter) with the help of one chip.
(b)	Center Information Display (CID)	• Equipped with a 7.0-inch WVGA liquid crystal display. • The display content is controlled by the Cockpit Control Module (CCM), providing a wide variety of information. • The operation information given by a resistive film type touch operation display as well as physical buttons arranged on the panel is sent to the Cockpit Control Module (CCM).

■ High grade audio/Navi & High grade audio

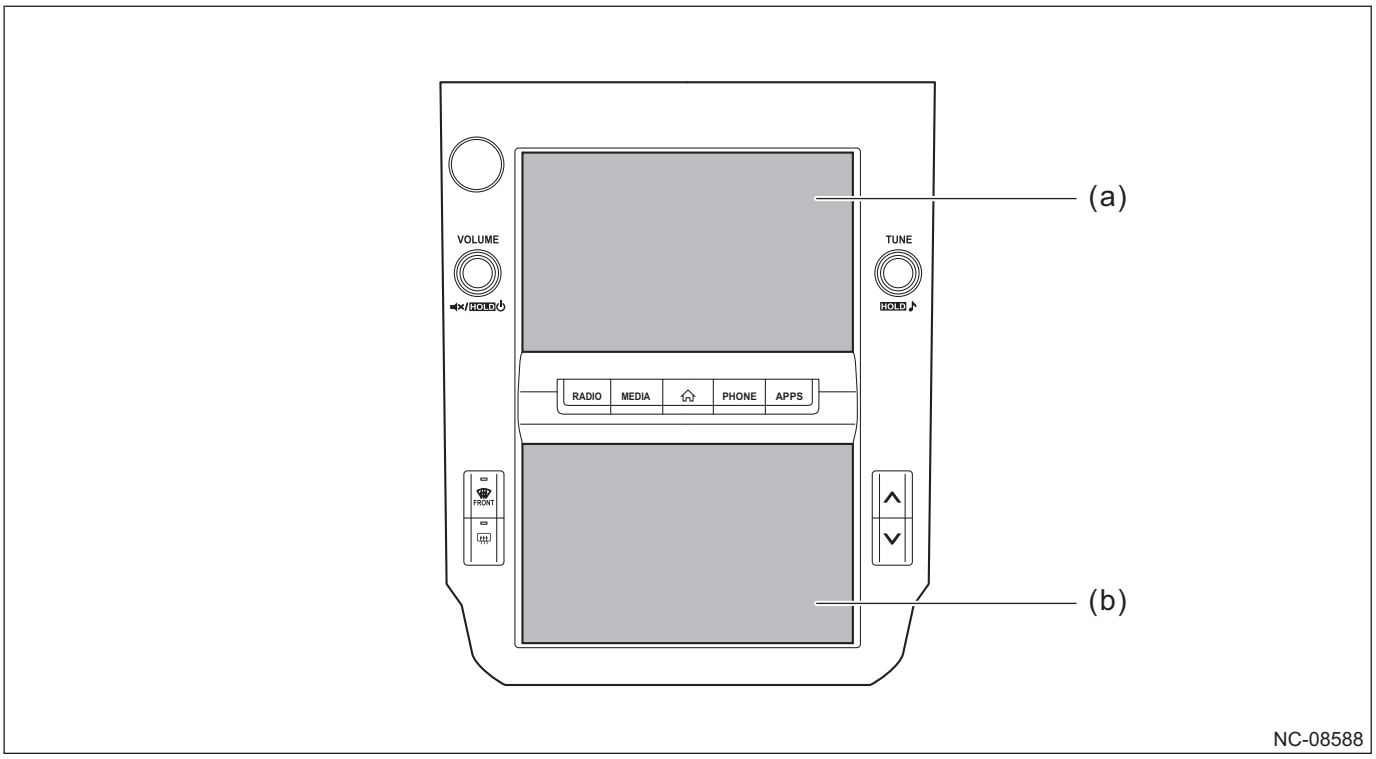


Symbol	Part name	Function
(a)	Cockpit Control module (CCM)	Adopts a System on Chip (SOC) method, and its hypervisor system achieves integrated control of the Center Information Display (CID) as well as the LCD display (built into the combination meter) with the help of one chip.
(b)	Center Information Display (CID)	• Equipped with an 11.6-inch Full HD liquid crystal display. • The display content is controlled by the Cockpit Control Module (CCM), providing a variety of information using a very wide screen. • The operation information given by an electrostatic touch operation display as well as dial knobs and physical buttons arranged on the panel is sent to the Cockpit Control Module (CCM).

Center Information Display (CID)

Two types of Center Information Display (CID) are available that are in tune with the vehicle grade; a Dual 7.0-inch display and 11.6-inch display.

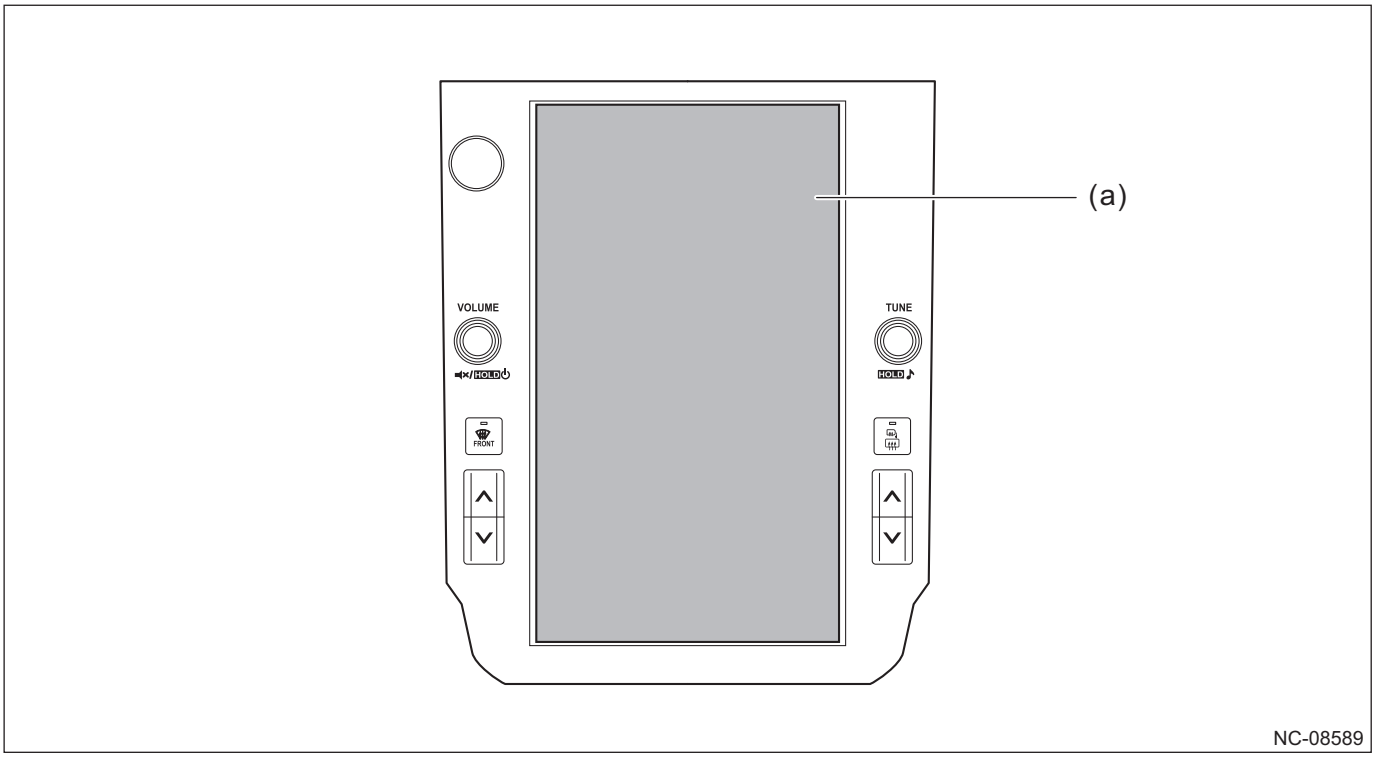
■ Dual 7.0-inch display



(a) Display (upper)

(b) Display (lower)

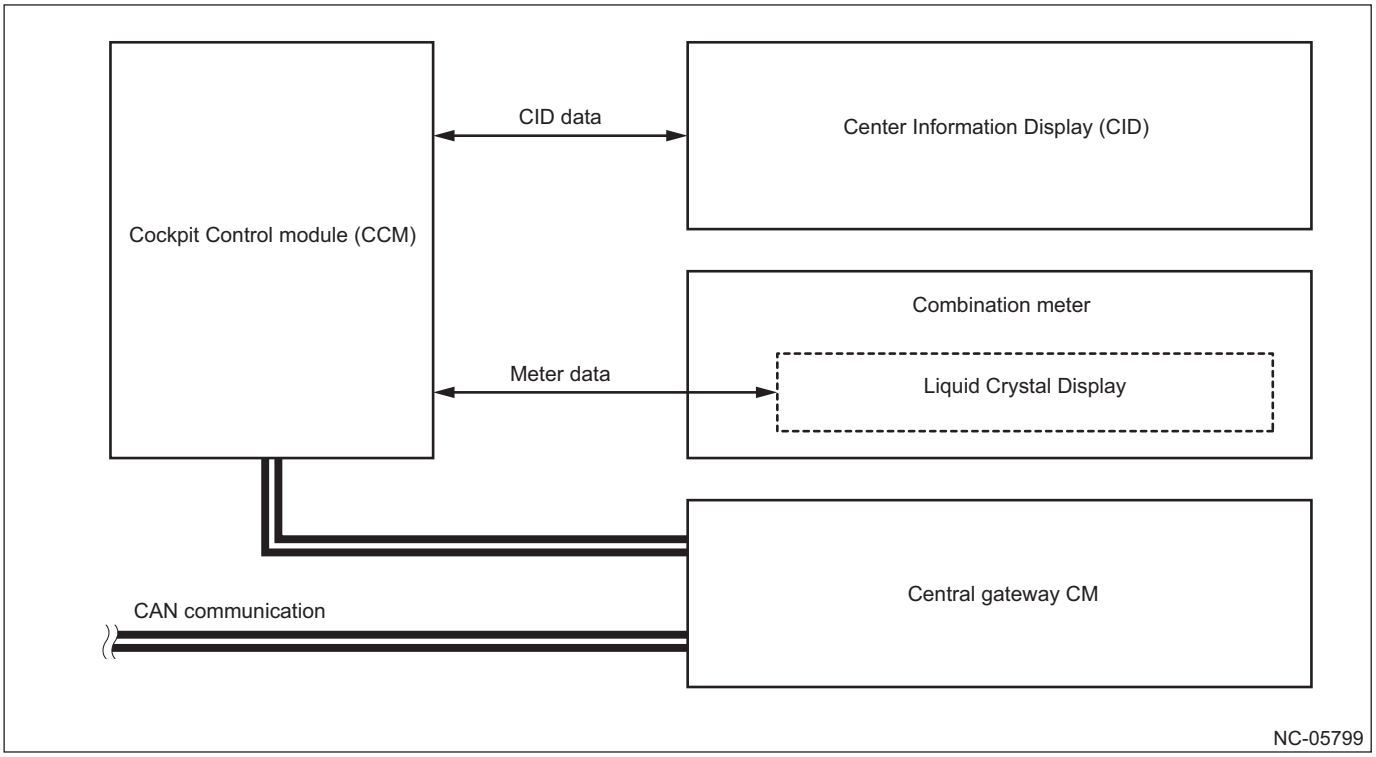
■ 11.6-inch display



(a) Display

11.5.3 Construction and Operation

System diagram



Main component functions

Part name	Function
Cockpit Control module (CCM)	• Adopts a System on Chip (SOC) method, and its hypervisor system achieves integrated control of the Center Information Display (CID) as well as the multi information display (with a built-in combination meter) with the help of one chip. • Receives various types of vehicle information, such as the control status and operation status of various in-vehicle systems, via CAN communication from each ECM installed in the vehicle. • Generates the information screen or reminder screen according to the user operation.
Center Information Display (CID)	• Sends the touch operation signals when the user touches the display to the Cockpit Control Module (CCM). • Displays the information screen or reminder screen generated by the Cockpit Control Module (CCM).
Combination meter • Multi information display	• Displays the information screen generated by the Cockpit Control Module (CCM). • See "Combination Meter / MID" for details on the multi information display {11-183}
Central gateway CM (CGW)	Relays CAN communication between the control computers for the various devices installed in the vehicle.

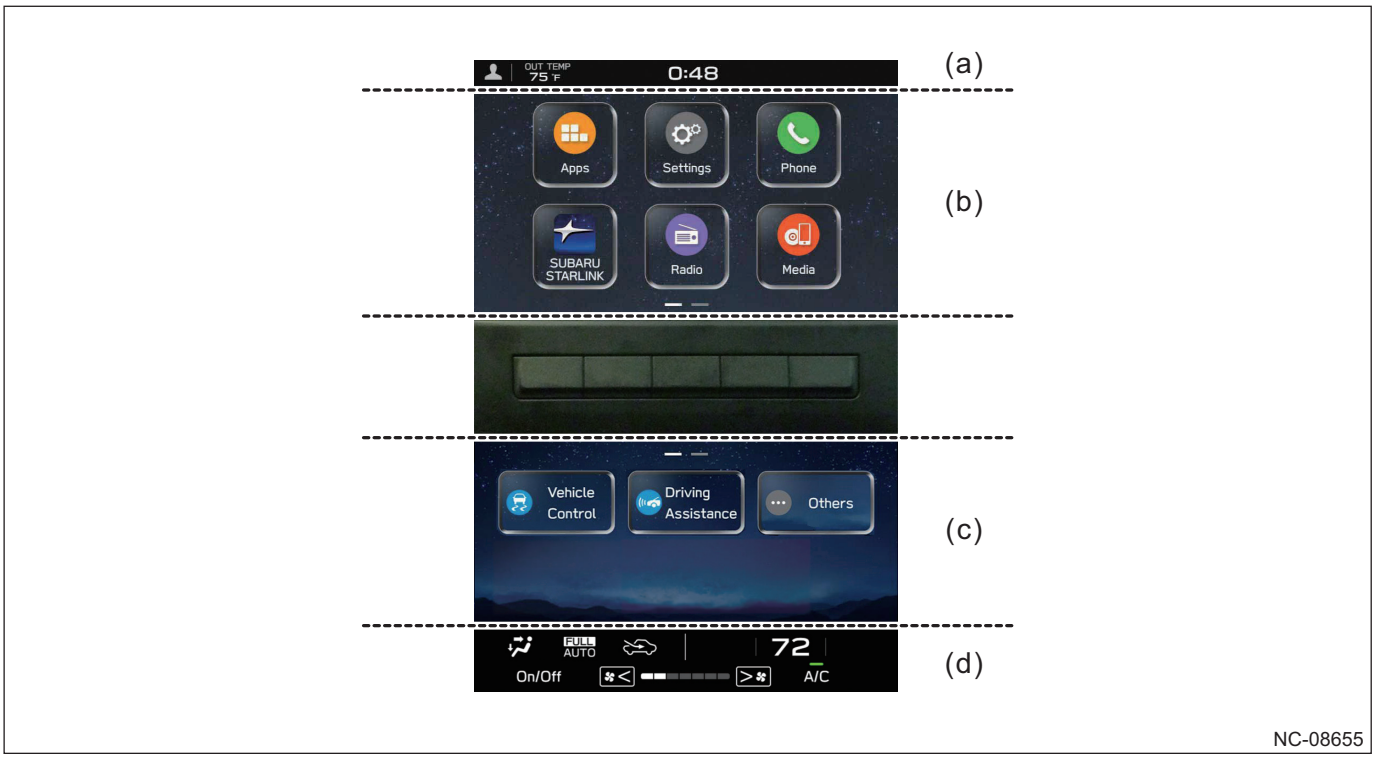
Display screen details

GUI

Installed with GUI that allows intuitive smartphone-like operation so users can easily use the various functions of the infotainment system. The unique GUI is designed so that the size, arrangement, and features of the display can be easily used.

■ Dual 7.0-inch display

- A Home Screen is provided that is composed of categorized icons that are designed to make it easy for the user to understand the main infotainment functions.
- Physical buttons are positioned between the upper and lower screens. A button can be pressed to return to the Home Screen.
- Touch operations such as drag and swipe can be used.
- The main operation buttons positioned in the instrument panel in existing model vehicles are integrated in the center information display, enabling operation from a switch on the screen.
- The Customize menu supporting customization of the vehicle functions is integrated in the center information display. The user can use all the customization functions by operating the screen.
- The status and operation panel of the air conditioner are displayed in the screen and the main operation buttons are integrated into in-screen switches.
- By setting the display area in the screen, simultaneous display of various information and operation of each function was made available without affecting visibility.
- The screens that are shown in the category area consist of three hierarchical displays and pop-ups to support Infotainment System operation with a simple GUI that focuses on visibility and operability. See "Audio/Navigation and Speaker System" for details on the display hierarchy {11-31}



**The illustration shows a typical example that may differ from the actual display.*

Symbol	Area name	Display contents
(a)	Status bar area	• Displays the driver profile button, ambient temperature, clock, and status icons (Bluetooth connected devices and status of volume mute, etc.). • The clock display area can be touched to directly display the time setting screen.
(b)	Category area	• Displays the selecting screens and screens provided to operate and select sources such as audio and those screens are in hierarchies some levels down from the Home Screen. • Main operations are done in this area. • See "Audio/Navigation and Speaker System" for details on the category area {11-37}
(c)	Setting area	• In addition to displaying the <Driving Statistics> contents and <Maintenance> contents, it displays the screens for setting the air conditioner and other functions provided in the vehicle. • See "Audio/Navigation and Speaker System" for details on the setting area {11-37}
(d)	Air conditioner operation bar area	• Displays the screen for air conditioning operation and its status. • See "Air Conditioning System" for details on the air conditioner operation bar area {10-24}

■ 11.6-inch display

- A Home Screen is provided that is composed of categorized icons that are designed to make it easy for the user to understand the main infotainment functions.
- The Home button is always displayed on the screen. The Home Screen can be displayed by operating the button.
- Touch operations such as drag and swipe can be used.
- The main operation buttons positioned in the instrument panel in existing model vehicles are integrated in the center information display, enabling operation from a switch on the screen.
- The Customize menu supporting customization of the vehicle functions is integrated in the center information display. The user can use all the customization functions by operating the screen.
- The status and operation panel of the air conditioner are displayed in the screen and the main operation buttons are integrated into in-screen switches.
- By setting the display area in the screen, simultaneous display of various information and operation of each function was made available without affecting visibility.
- The screens that are shown in the category area consist of three hierarchical displays and pop-ups to support Infotainment System operation with a simple GUI that focuses on visibility and operability. See "Audio/Navigation and Speaker System" for details on the display hierarchy {11-31}

NC-09768

**The illustration shows a typical example that may differ from the actual display.*

Symbol	Area name	Display contents
(a)	Status bar area	• Displays ambient temperature, clock, and status icons (Bluetooth connected devices and status of volume mute, etc.). • The clock display area can be touched to directly display the time setting screen.
(b)	Information bar area	Displays the simplified status of the selected audio source and frequently used functions, such as Favorite Widgets. This area also shows interrupt displays, such as a processing completion notification responding to the operation request, and notifications from the Infotainment System.
(c)	Category area	• Displays setting screens, screens for operating or selecting sources like audio, and setting screens for the function provided in the vehicle, which screens are in hierarchy some level down from the Home Screen. • In addition to the display and setting of <Car Info> contents and setting the display contents of <Favourite Widgets>, main operations are performed in this area. • See "Audio/Navigation and Speaker System" for details on the category area {11-37}
(d)	Home button area	Always displays the Home buttons, shortcut buttons for vehicle settings, and driver profile button.
(e)	Air conditioner operation bar area	• Displays the screen for air conditioning operation and its status. • See "Air Conditioning System" for details on the air conditioner operation bar area {10-24}

Screen buttons (Home Screen)

On the Home Screen, icons that serve as gateways to the main Infotainment System functions are displayed in such a way that the intended infotainment system operation can be executed intuitively. See "Audio/Navigation and Speaker System" for details on the icons displayed on the Home Screen {11-37}

Infotainment system settings

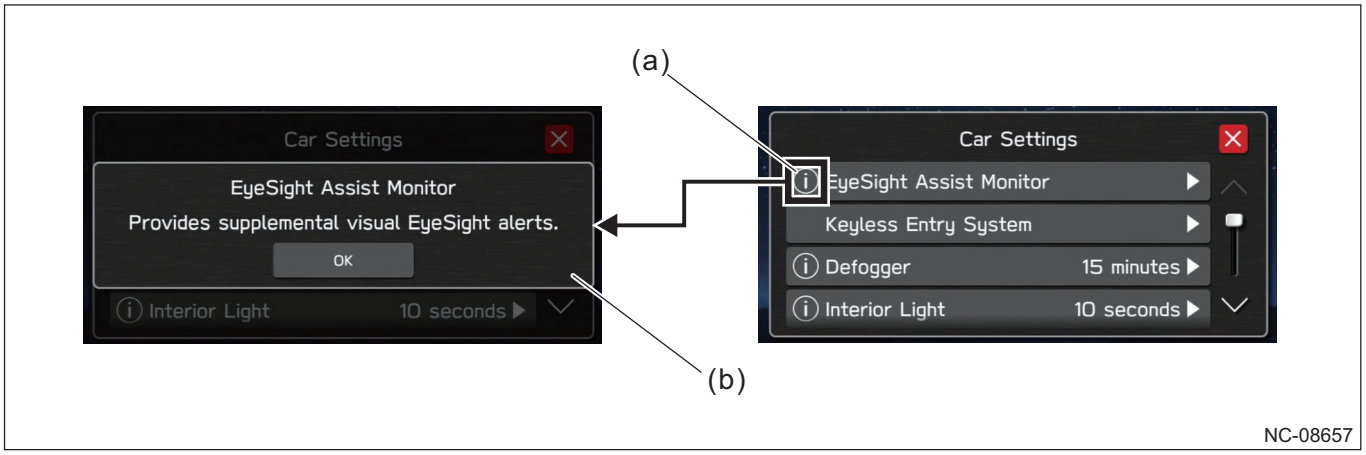
By touching the <Settings> button on the Home Screen, the setting items for the Infotainment System are displayed. See "Audio/Navigation and Speaker System" for details related to the setting items {11-37}

Function

Information function

For setting items with prefix information marks, operation guidance, etc. are displayed to assist setting operation by touching those marks.

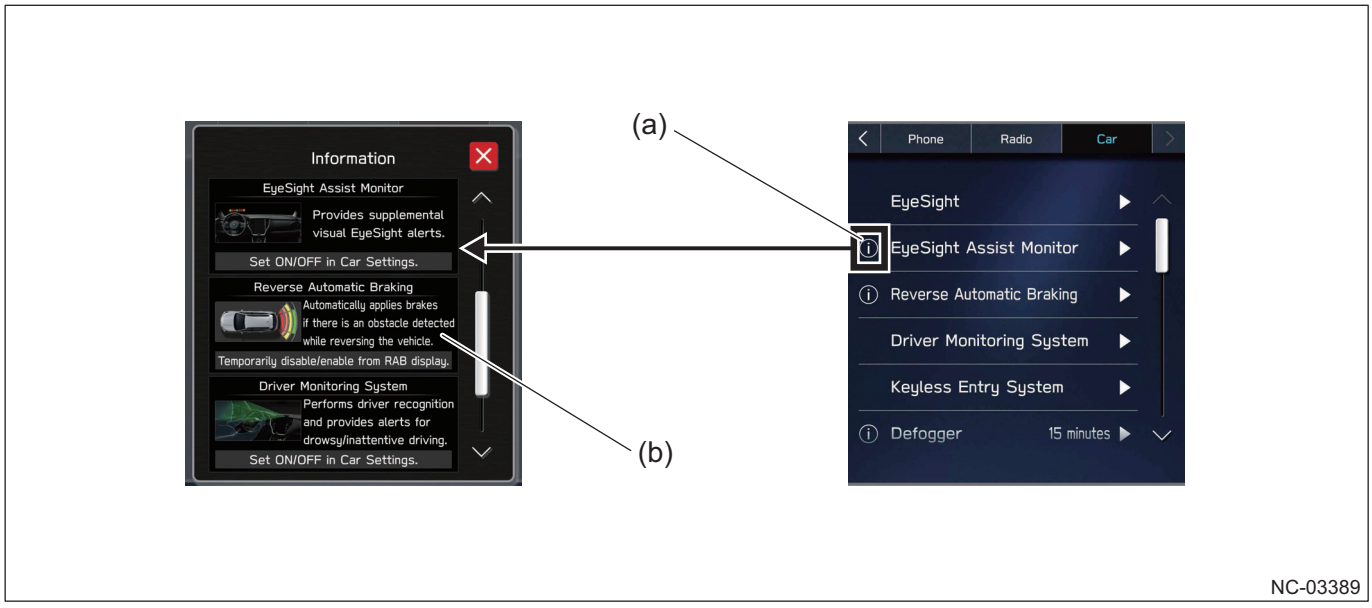
■ Example of guidance displayed on Dual 7.0-inch display



The illustration shows a typical example that may differ from the actual display.

(a) Information mark (b) Operation guidance display

■ Example of guidance displayed on 11.6-inch display



The illustration shows a typical example that may differ from the actual display.

(a) Information mark (b) Operation guidance display

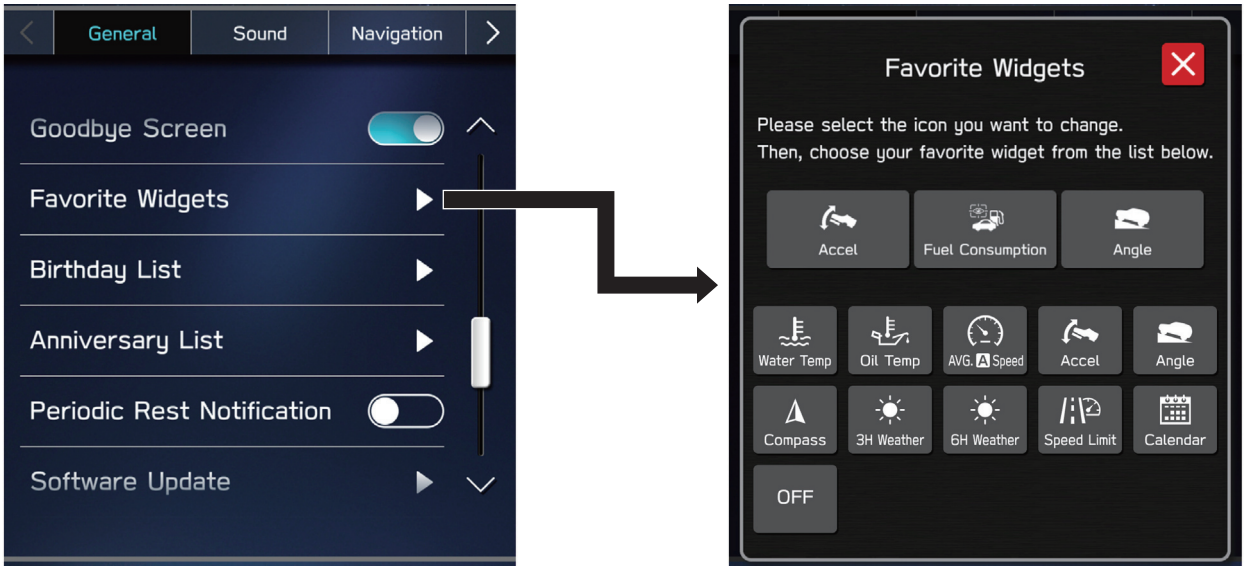
<Favorite Widgets> (11.6-inch display only)

- Displays the three selected favorite display contents selected in the information bar area.

NC-08658

**The illustration shows a typical example that may differ from the actual display.*

- The contents to display in <Favorite Widgets> can be set from <Settings> in the category area.



(a) (b)

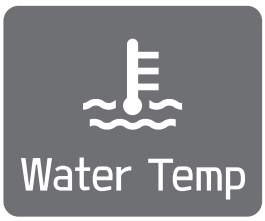
NC-08659

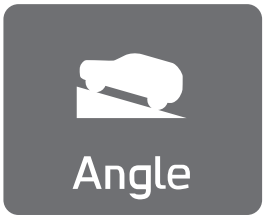
**The illustration shows a typical example that may differ from the actual display.*

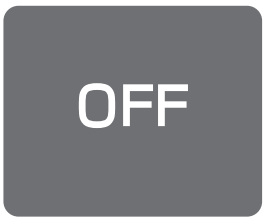
(a) Select Favorite Widgets in the General tab

(b) On upper side of the screen, select the position of the Favorite Widgets to be changed, and on the lower side of the screen, select the contents to be displayed

- The following contents can be selected for display. (Items may not be displayed depending on whether optional equipment is installed.)

Item	Icon	Display contents
Water temperature	 NC-05653	Displays the engine coolant temperature.
Oil temperature	NC-05654	Displays the engine oil temperature.
Average speed	NC-05655	Displays the average vehicle speed.
Acceleration opening angle	NC-05656	Displays the acceleration opening angle.

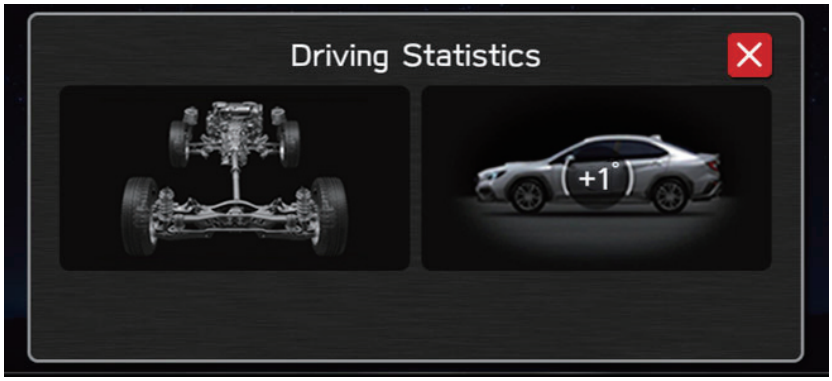
Item	Icon	Display contents
Gradient	 NC-05657	Displays the vehicle posture.
Compass	NC-05658	Displays the vehicle direction.
Weather information	NC-08660	Displays the weather information for 3 hours later.
Weather information	NC-08661	Displays the weather information for the next 6 hours.

Item	Icon	Display contents
Speed limit	NC-05659	Displays the speed limit on the current road of travel.
Calendar	NC-05660	Displays the calendar.
OFF	 NC-05662	The contents for the selected position are hidden.

<Driving Statistics> contents (Dual 7.0-inch display only)

In the left area of the screen, in addition to the steering angle display, the feeling of security from safety features of the vehicle operating is visualized by representing initial operating status of the Vehicle Dynamics Control (VDC) with changing the color of the tires. Also, when VDC is operating, flashing icons, as well as changing the color of the tires that are being controlled on the state of the oversteer, understeer, and traction control, it shows that the VDC is controlling the vehicle in a safe state.

In the right area of the screen, changes in the vehicle posture can be checked visually. Also, in the bottom area of the screen, operation status such as Vehicle Dynamics Control (VDC) or Auto Vehicle Hold (AVH) is displayed.



NC-08663

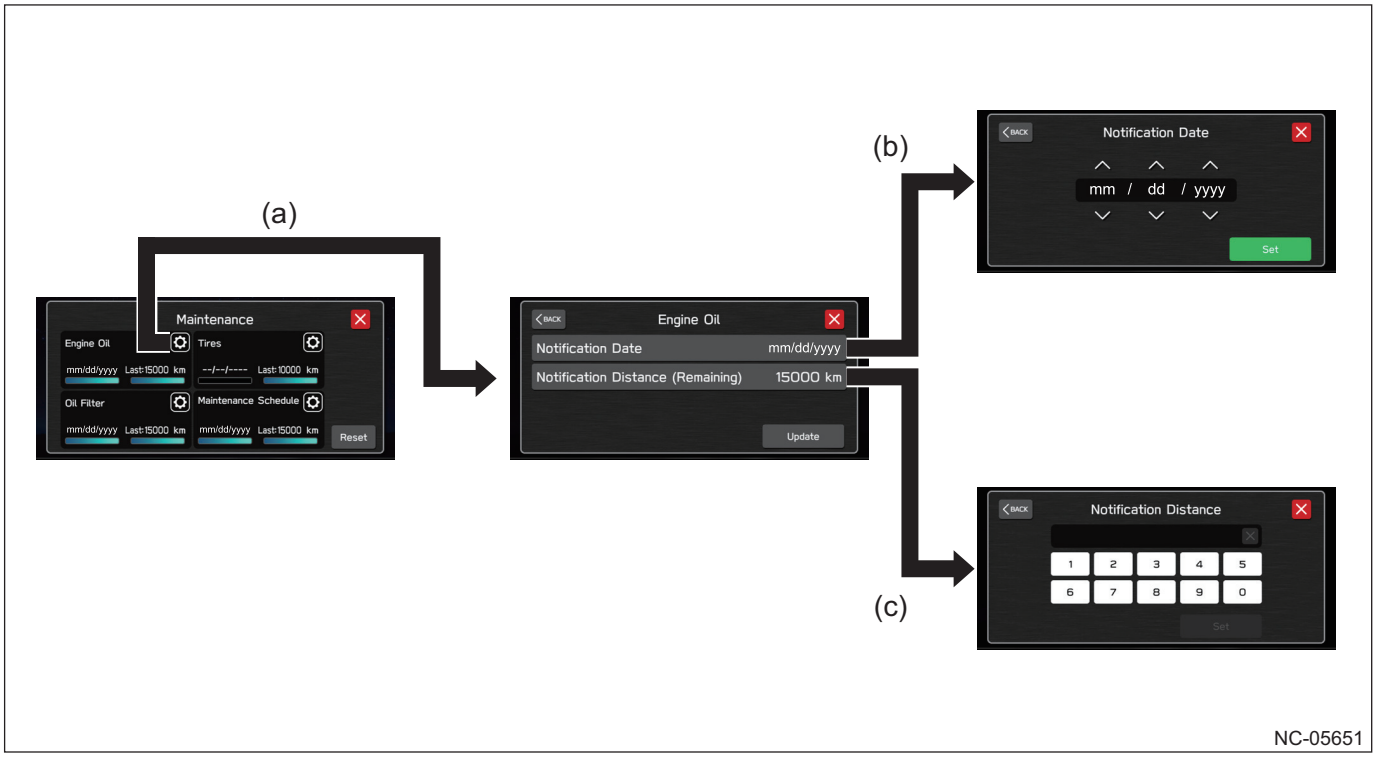
**The illustration shows a typical example that may differ from the actual display.*

<Maintenance> contents (Dual 7.0-inch display only)

Reminders can be set for replacing the engine oil, oil filter, and tires, and other maintenance schedule items.

Reminders can be set based on the date or distance. The set notification date and notification distance are displayed at the top of the <Maintenance> screen, and a notification is generated when the set date or distance approaches.

All reminders can be reset by touching the <Reset> button.



**The illustration shows a typical example that may differ from the actual display.*

(a)	Select the setting icon for the target item for the reminder	(c)	Set a notification date
(b)	Select the notification items to be set	(d)	Set the notification distance

<Car Info> contents (11.6-inch display only)

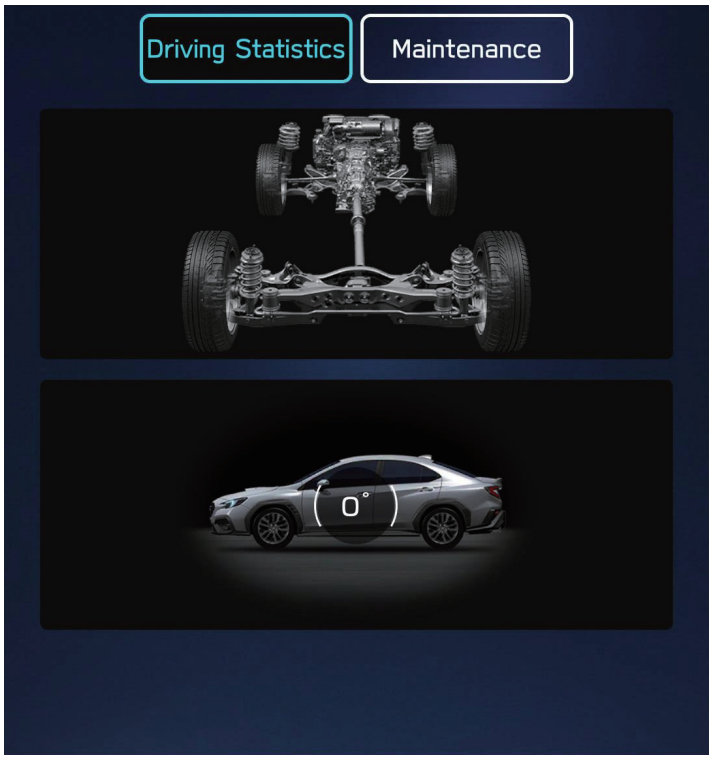
Used to display and operate the information screen categorized with the <Driving Statistics> and <Maintenance> buttons.

Category	Display contents
<Driving Statistics>	Displays operating conditions such as the steering wheel angle, the operating status of Vehicle Dynamics Control (VDC), the vehicle posture, and the Auto Vehicle Hold (AVH) status.
<Maintenance>	The display of maintenance items and reminders can be set.

■ <Driving Statistics>

In the top area of the screen, in addition to the steering angle display, the feeling of security from safety features of the vehicle operating is visualized by representing initial operating status of the Vehicle Dynamics Control (VDC) with changing the color of the tires. Also, when VDC is operating, flashing icons, as well as changing the color of the tires that are being controlled on the state of the oversteer, understeer, and traction control, it shows that the VDC is controlling the vehicle in a safe state.

In the center area of the screen, changes in the vehicle posture can be checked visually. Also, in the bottom area of the screen, operation status such as Vehicle Dynamics Control (VDC) or Auto Vehicle Hold (AVH) is displayed.



NC-08665

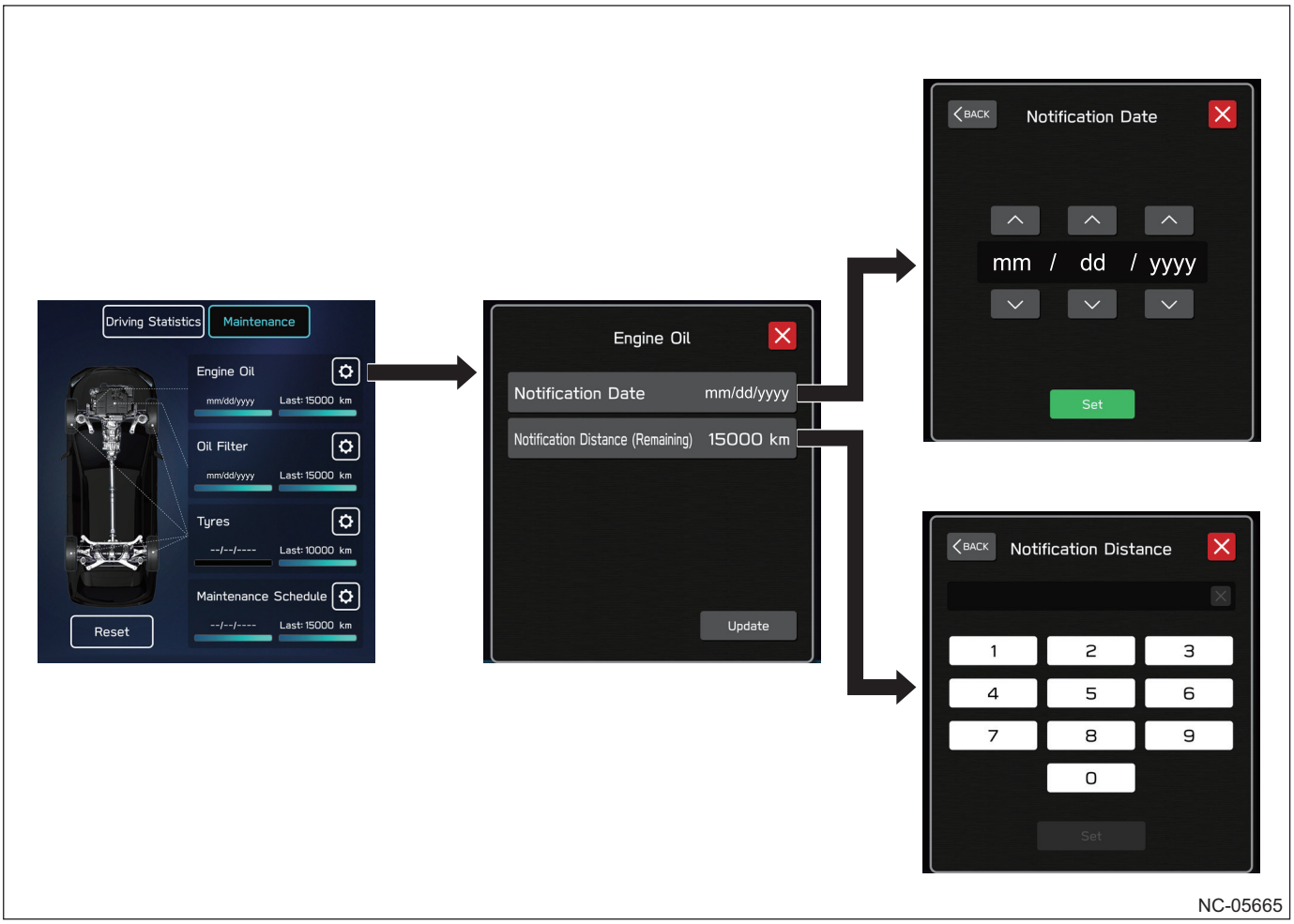
**The illustration shows a typical example that may differ from the actual display.*

■ <Maintenance>

Reminders can be set for replacing the engine oil, oil filter, and tires, and other maintenance schedule items.

Reminders can be set based on the date or distance. The set notification date and notification distance are displayed at the top of the <Maintenance> screen, and a notification is generated when the set date or distance approaches.

All reminders can be reset by touching the <Reset> button.



**The illustration shows a typical example that may differ from the actual display.*

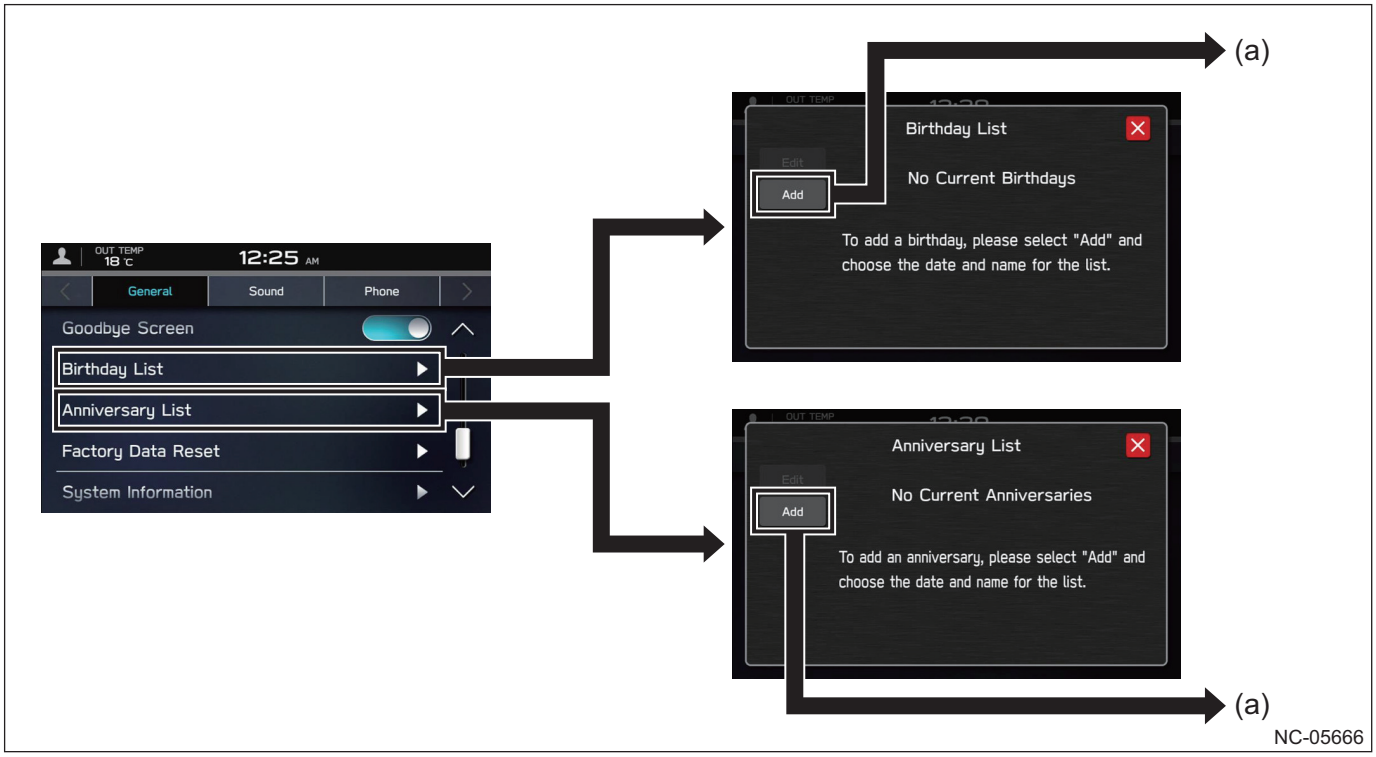
(a)	Select the setting icon for the target item for the reminder	(c)	Set a notification date
(b)	Select the notification items to be set	(d)	Set the notification distance

Event reminder contents

Reminders for events such as <Birthday> and <Anniversary> can be set.

Reminders are set from the setting items of <Settings> in the category area and can be registered with an event name and date. The registered event name and notification date are displayed in the list of setting items, and a notification is generated when the set date approaches.

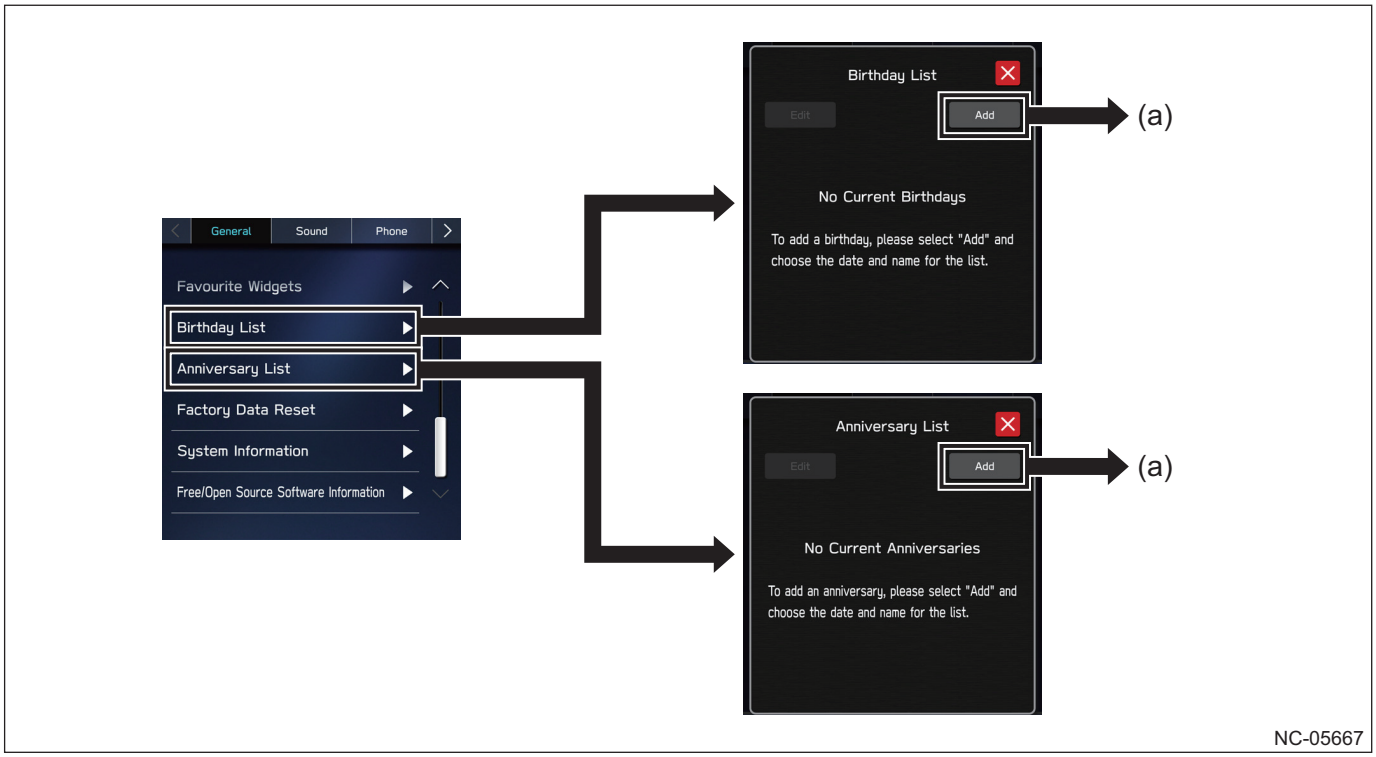
■ Dual 7.0-inch display



**The illustration shows a typical example that may differ from the actual display.*

(a) Select the event item to be set
(b) <Birthday List> screen
(c) Add a new birthday
(d) <Anniversary List> screen
(e) Add a new anniversary

■ 11.6-inch display



**The illustration shows a typical example that may differ from the actual display.*

(a) Select the event item to be set
(b) <Birthday List> screen
(c) Add a new birthday
(d) <Anniversary List> screen
(e) Add a new anniversary

Information settings

Used to set the information functions from the Infotainment System setting items.

■ Dual 7.0-inch display

When <Settings> is touched in the category area, the Infotainment System setting items are displayed, and the following information functions can be set. (See "Audio/Navigation and Speaker System" for details {11-37})

Tab	Setting item	Set item
<General>	<Reminder Screen>	The <Maintenance>, <Birthday>, and <Anniversary> notification functions can be turned ON/OFF.
	<Birthday List>	<Birthday> can be set. (See "Event reminder contents")
	<Anniversary List>	<Anniversary> can be set. (See "Event reminder contents")
	<Meter Screen>	The indicator needle behavior when starting the combination meter and the information displayed on the multi information display can be set.

When <Car Settings> is touched in the setting area, the customizable items of each function provided in the vehicle are displayed, and the following information functions can be set. (See "Audio/Navigation and Speaker System" for details {11-37})

Setting item	Set item
<Units>	The distance and volume units displayed on the Infotainment System can be set.

■ 11.6-inch display

When <Settings> is touched in the category area, the Infotainment System setting items are displayed, and the following information functions can be set. (See "Audio/Navigation and Speaker System" for details {11-37})

Tab	Setting item	Set item
<General>	<Reminder Screen>	The <Maintenance>, <Birthday>, and <Anniversary> notification functions can be turned ON/OFF.
	<Birthday List>	<Birthday> can be set. (See "Event reminder contents")
	<Anniversary List>	<Anniversary> can be set. (See "Event reminder contents")
	<Meter Screen>	• The indicator needle behavior when starting the combination meter, the information displayed on the multi information display, and turn by turn display interruption* can be set. • The PEAK value of the boost gauge can be reset.
<Car>	<Units>	The distance and volume units displayed on the Infotainment System can be set.

**: Models with Navi & High grade audio*

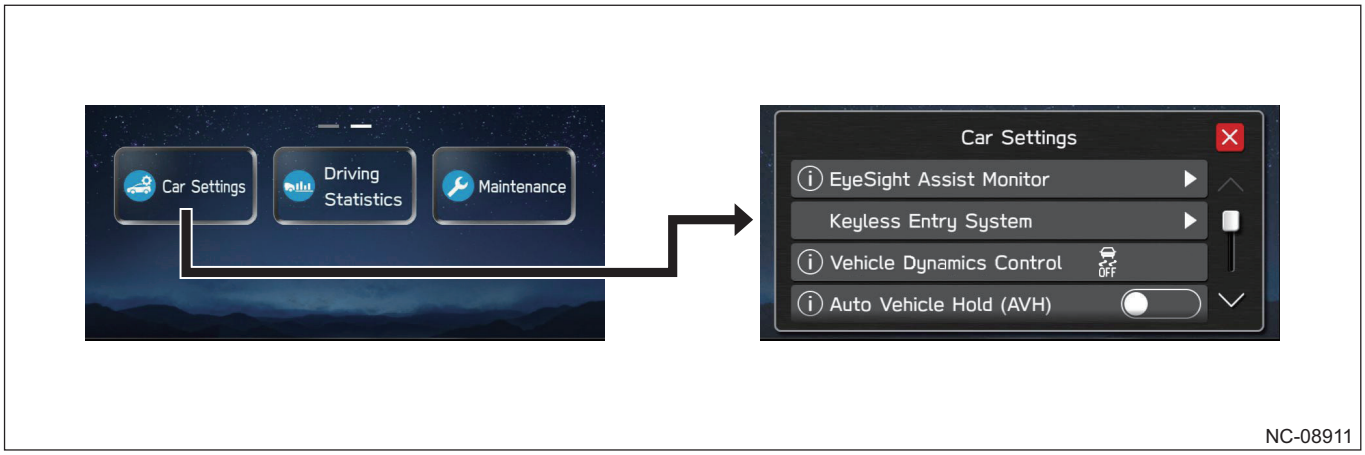
Customization function

Vehicle settings

The infotainment system is equipped with a function for customizing the vehicle settings that can be operated on the display.

■ Dual 7.0-inch display

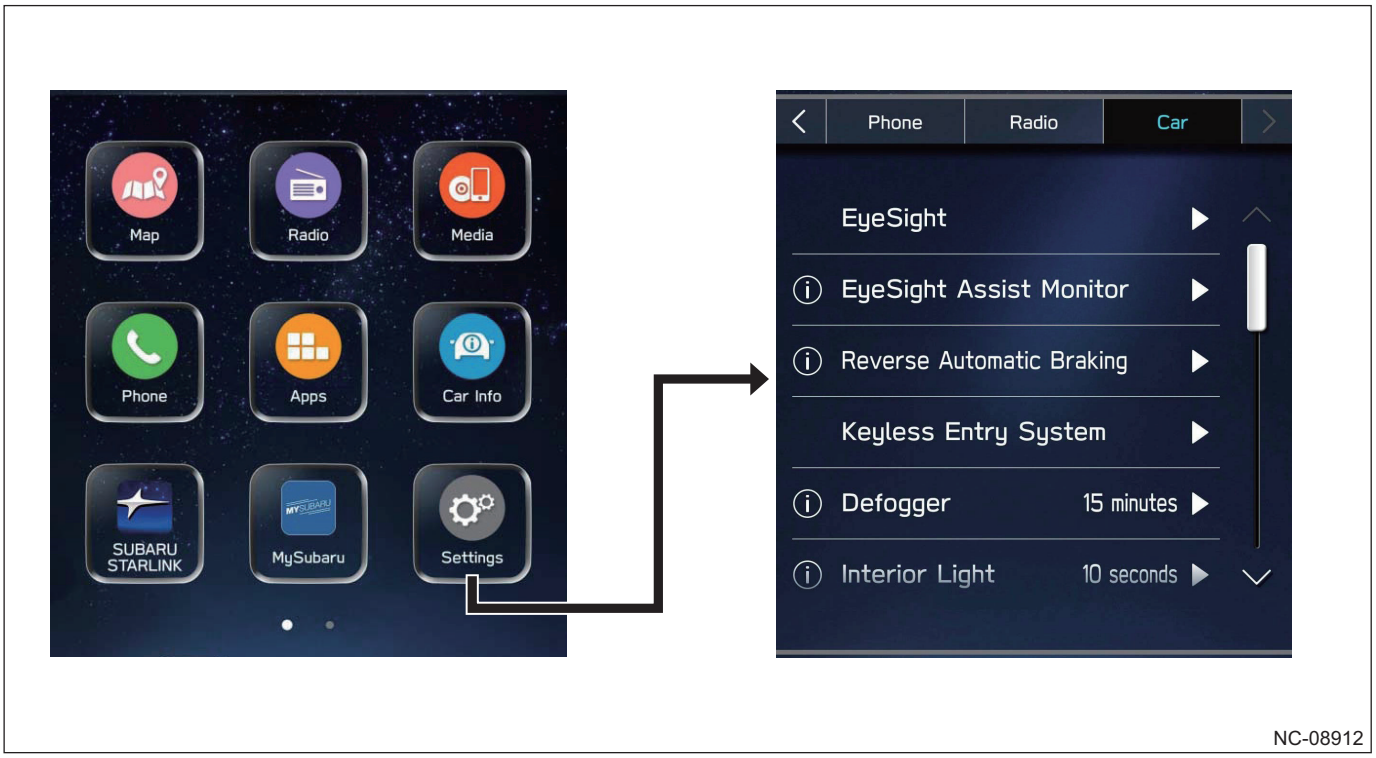
Select <Car Settings> on the Home Screen to display the car settings screen, where the settings of various vehicle functions can be customized.



**The illustration shows a typical example that may differ from the actual display.*

■ 11.6-inch display

Select <Settings> on the Home Screen and switch to the <Car> tab, where the settings of various vehicle functions can be customized.



**The illustration shows a typical example that may differ from the actual display.*

Diagnosis

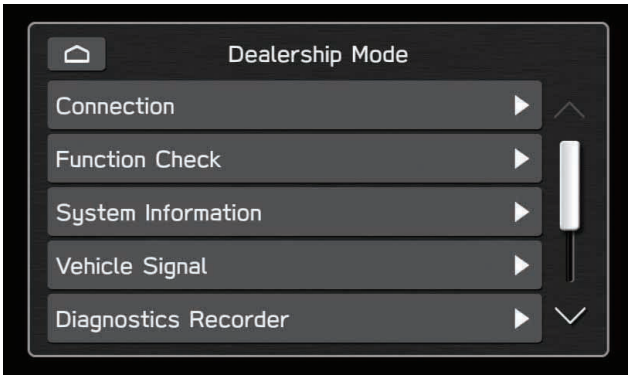
When an abnormality occurs in the system, the Cockpit Control Module (CCM) saves a Diagnostic Trouble Code (DTC) in the memory, and this code can be read with the Subaru Select Monitor. For details, refer to the service manual.

Self check function

The Infotainment System has a self-check function (dealership mode) that can be carried out on the screen so that the user can check and display the system's operation status and confirm system information.

Dealership mode	Operation
Start	While pressing both the air conditioner UP and DOWN switches on the passenger's seat side at the same time, press the dial knob ('TUNE') six times.
End	Touch the Home button on the screen.

■ Base audio (Dual 7.0-inch display)



NC-03393

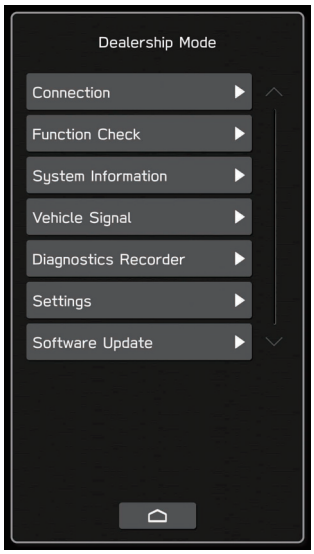
**The illustration shows a typical example that may differ from the actual display.*

(a) Home button

Item			Description
<Connection>			• Displays the connection status of the devices connected to the Cockpit Control Module (CCM). • AUX, USB1, and USB2 indicate the device connection status at each port.
<Function Check>	<Panel and Steering Switch>		Displays the operation condition of the switches and knobs on the Center Information Display (CID).
	<Touch Switch>		Displays the operation condition of the touch panel on the Center Information Display (CID).
	<Microphone>		Displays the operation status of the microphone installed inside the map light.
	<Navigation System Sensor>	<System Sensors Check>	• Displays the operation status of each sensor of the navigation module. • The value of each sensor can be reset.
<System Information>	<Product Information>		Displays the STARLINK connection ID and product information of the Cockpit Control Module (CCM).
	<Version Information>		Displays the version of the modules that are integrated in or connected to the Cockpit Control Module (CCM).
<Vehicle Signal>			Displays the status of the vehicle signals entered into the Cockpit Control Module (CCM).
<Diagnostics Recorder>	<Begin Recording>		Turns ON/OFF diagnostics recorder function.
	<Export Data to USB>		Outputs diagnostics recorder data to USB.
	<Clear Recorded Data>		Clear diagnostics recorder data.
<Settings>	<Memory Initialization>		Initialize built-in memory.
	<Camera Setting>	<Restore Default>	Restore the settings of <Static Guide Line> and <Caution> to the default values.
		<Static Guide Line>	Turns ON/OFF the guide lines shown in the rear view camera screen.
		<Caution>	Turns ON/OFF the caution display shown in the rear view camera screen.
		<Camera Setting>	Adjusts the position of guide lines shown in the rear view camera screen.
<Software Update>			Updates data stored in the Infotainment System using USB memory.

**: Items may not be displayed depending on whether optional equipment is installed.*

■ High grade audio/Navi & High grade audio (11.6-inch display)



NC-03394

**The illustration shows a typical example that may differ from the actual display.*

(a) Home button

Item			Description
<Connection>			• Displays the connection status of the devices connected to the Cockpit Control Module (CCM). • AUX, USB1, and USB2 indicate the device connection status at each port.
<Function Check>	<Panel and Steering Switch>		Displays the operation condition of the switches and knobs on the Center Information Display (CID).
	<Touch Switch>		Displays the operation condition of the touch panel on the Center Information Display (CID).
	<Microphone>		Displays the operation status of the microphone installed inside the map light.
	<Navigation System Sensor>	<System Sensors Check> (High grade audio)	• Displays the operation status of each sensor of the navigation module. • The value of each sensor can be reset.
		<System Sensors Check> (Navi & High grade audio)	• Displays the reception status of the GPS antenna, each sensor operation status of the navigation module, and a distance correction learning level. • The value of each sensor can be reset.
		<GNSS Information> (Navi & High grade audio)	Displays the reception information of the GPS antenna.
<System Information>	<Product Information>		Displays the STARLINK connection ID and product information of the Cockpit Control Module (CCM).
	<Version Information>		Displays the version of the modules that are integrated in or connected to the Cockpit Control Module (CCM).

Item			Description
<Vehicle Signal>			Displays the status of the vehicle signals entered into the Cockpit Control Module (CCM).
<Diagnostics Recorder>	<Begin Recording>		Turns ON/OFF diagnostics recorder function.
	<Export Data to USB>		Outputs diagnostics recorder data to USB.
	<Clear Recorded Data>		Clear diagnostics recorder data.
<Settings>	<Memory Initialization>		Initialize built-in memory.
	<Camera Setting>	<Restore Default>	Restore the settings of <Static Guide Line> and <Caution> to the default values.
		<Static Guide Line>	Turns ON/OFF the guide lines shown in the rear view camera screen.
		<Caution>	Turns ON/OFF the caution display shown in the rear view camera screen.
		<Camera Setting>	Adjusts the position of guide lines shown in the rear view camera screen.
<Software Update>			Updates data stored in the Infotainment System using USB memory.

**: Items may not be displayed depending on whether optional equipment is installed.*

11.6 Rearview camera

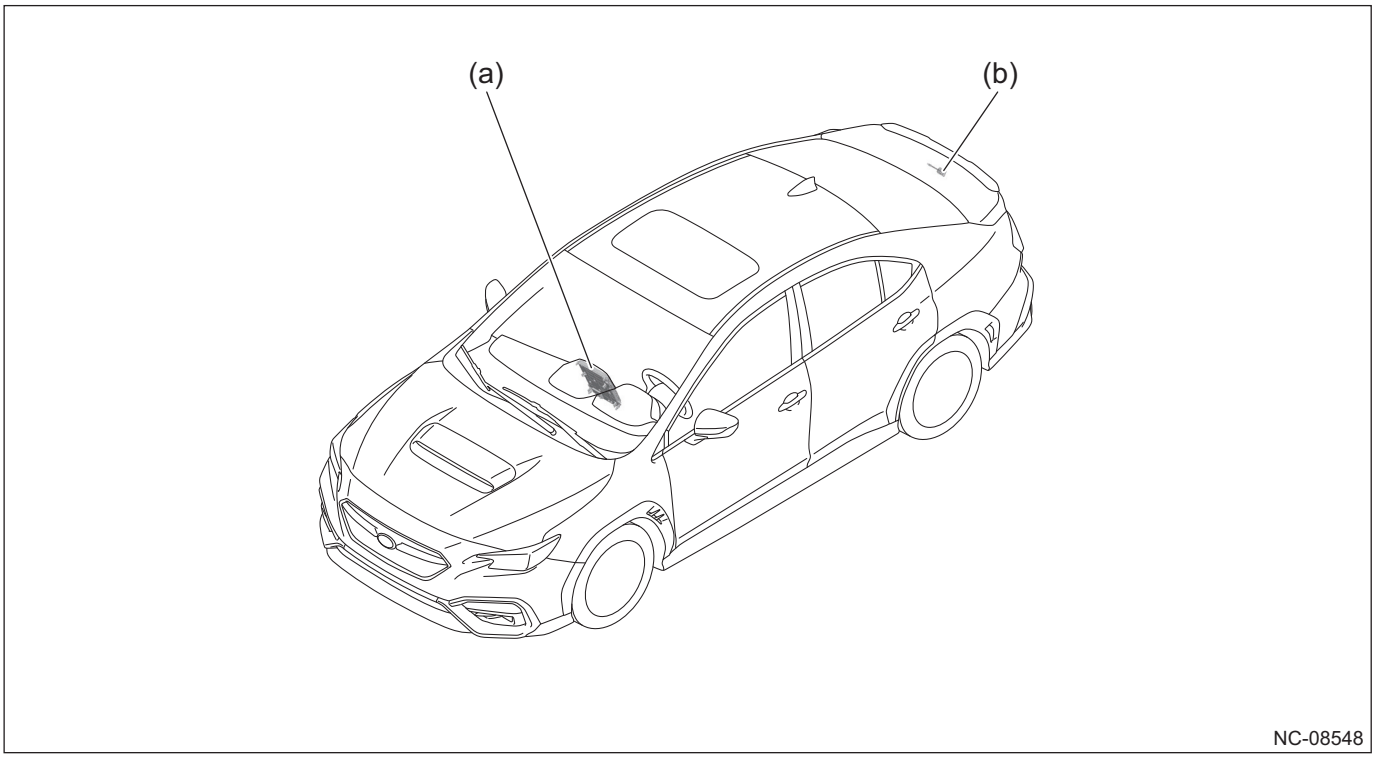
11.6.1 Overview

Overview

A safety function that displays the image from the rearview camera mounted in the trunk center on the Center Information Display (CID) is adopted.

11.6.2 Component

Component layout drawing



(a) Center Information Display (CID)

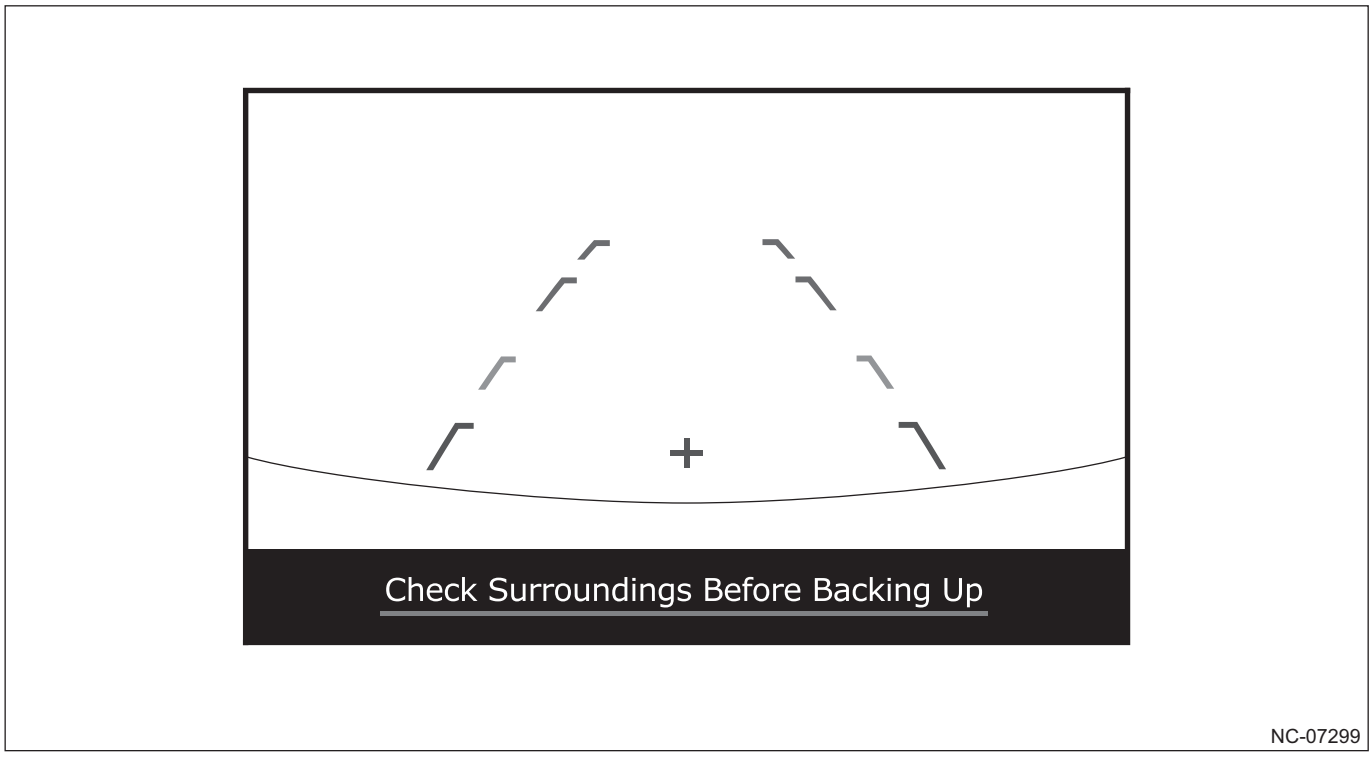
(b) Rearview camera

Component details

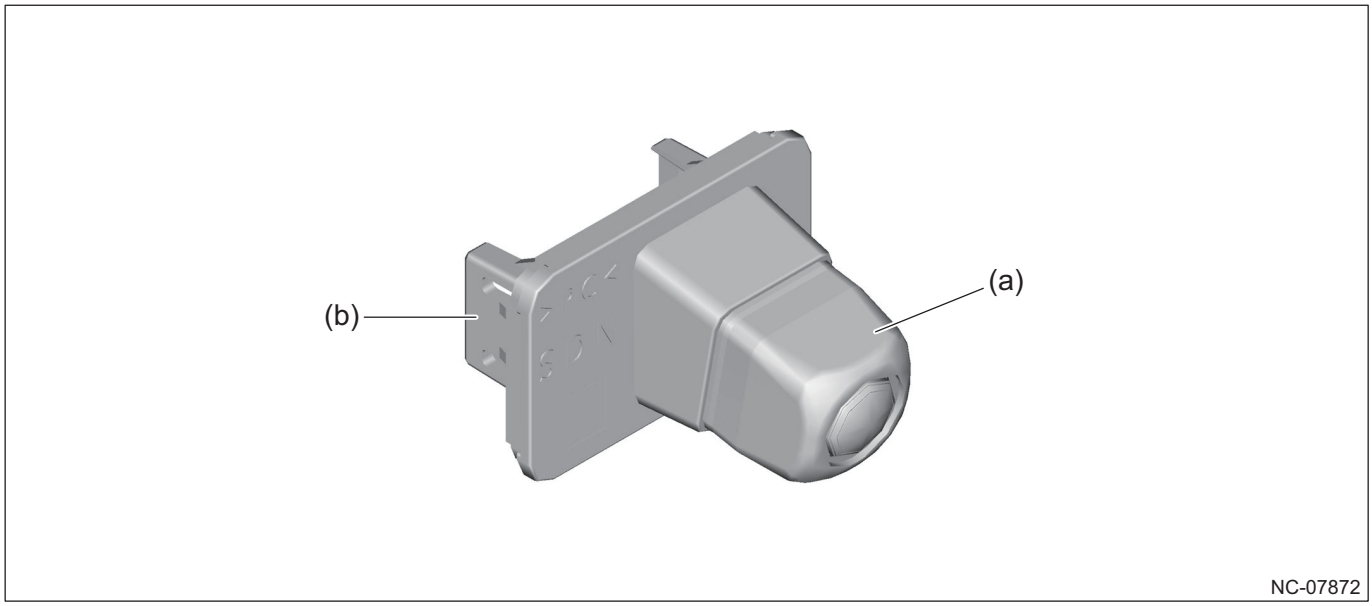
Rear view monitor

A rear view monitor is adopted that displays images from the camera mounted on the rear of the vehicle on the Center Information Display (CID).

The rear view monitor displays the area to the rear of the vehicle including the driver's blind spots together with guide lines to support driver operations when reversing.



Rearview camera

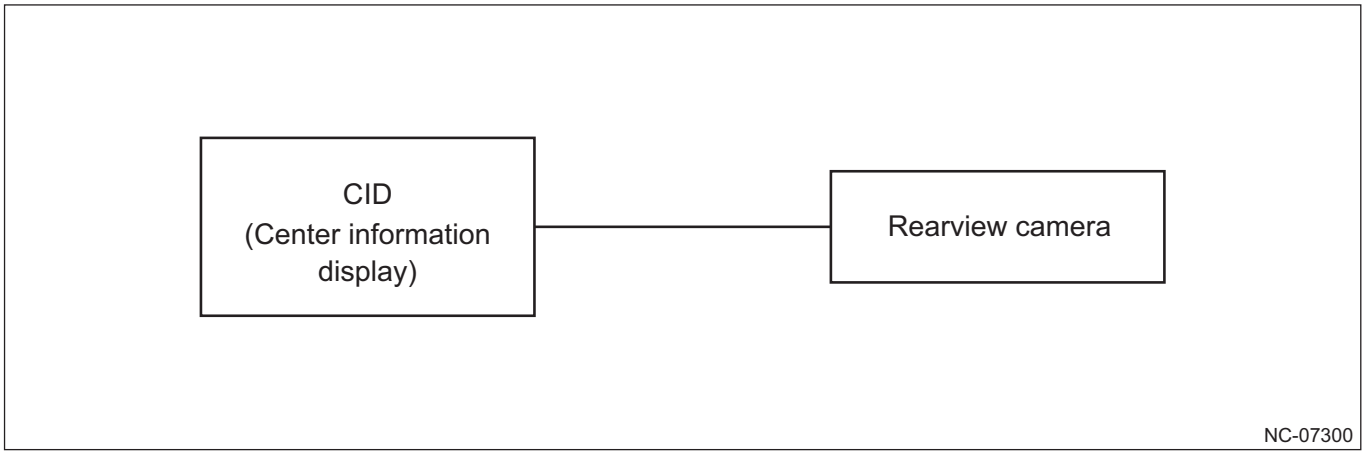


(a) Rearview camera

(b) Camera bracket

11.6.3 Construction and Operation

System diagram



Main component functions

Component	Function
Rearview camera	Mounted in the trunk center, and outputs a video image of the captured area of the rear of the vehicle to the CID.
CID	Displays a screen based on the video signal that was input from the rearview camera.

11.7 Antenna

11.7.1 Overview

Overview

The antennas used by the infotainment system and telematics system are positioned in different locations of the vehicle.

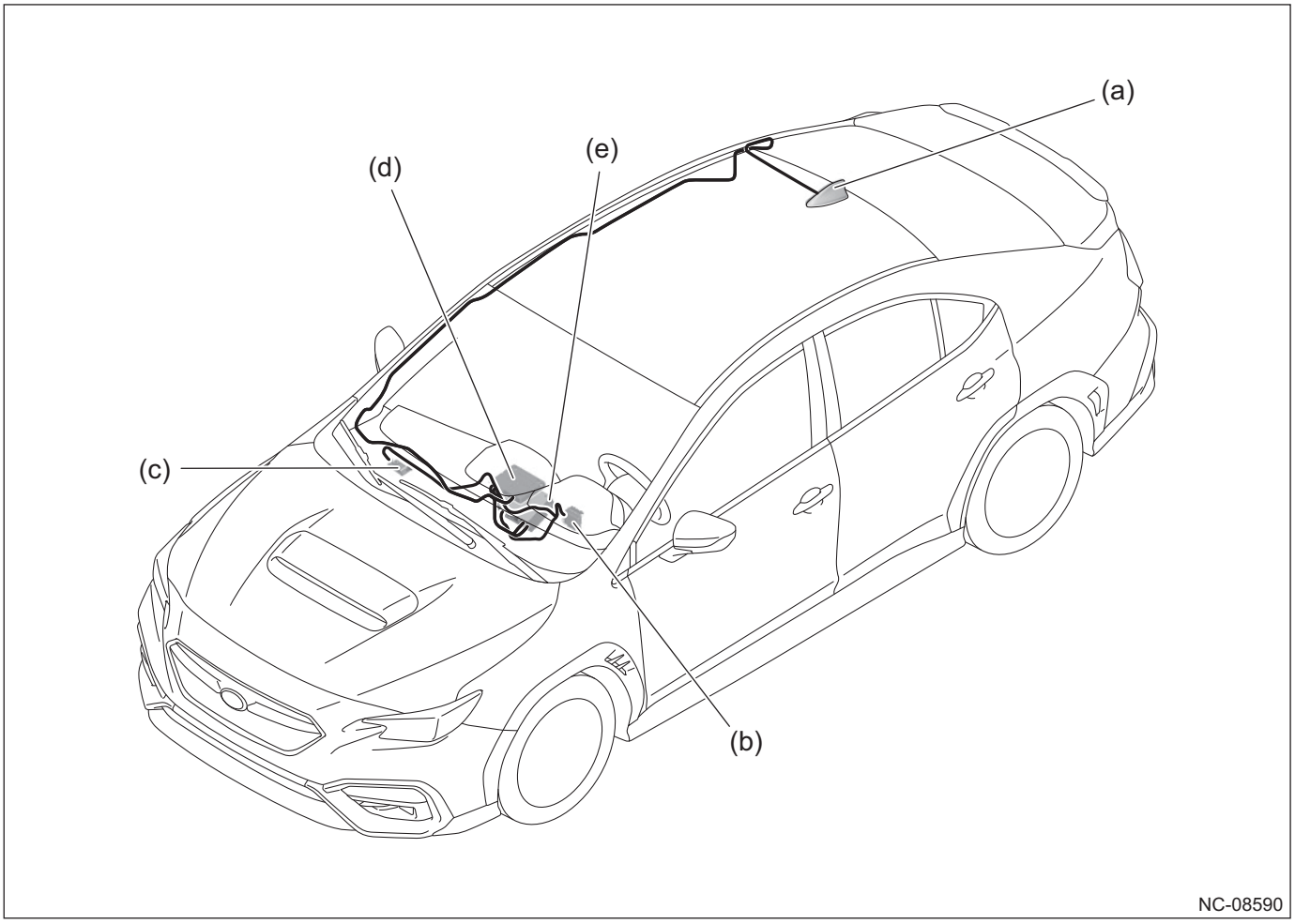
Antenna layout

Position	Type
Roof antenna	AM/FM/SXM
	Telematics antenna*1
Instrument panel antenna	Telematics sub antenna*1
	GPS antenna*2

**1: Models with data communication module (DCM)*
**2: Models with data communication module (DCM) or models with Navi & High grade audio*

11.7.2 Component

Component layout drawing



(a)	Roof antenna • AM • FM • SXM • Radio antenna amplifier • Telematics antenna	(d)	Data communication module (DCM)
(b)	Telematics sub antenna	(e)	Cockpit Control module (CCM)
(c)	GPS antenna		

Component details

Roof antenna

A shark fin type roof antenna is provided.

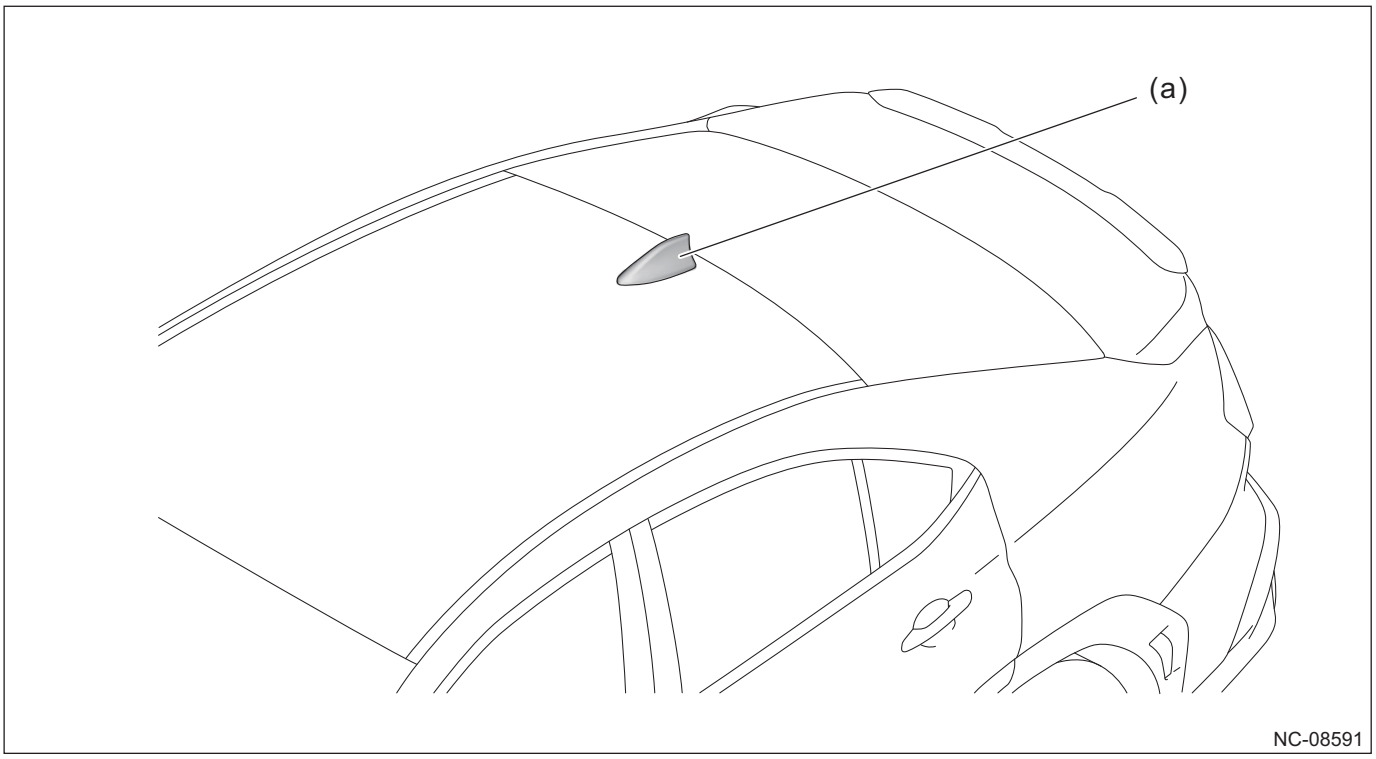
This design avoids wind noise while driving and eliminates the need for antenna removal or folding.

■ Radio antenna (AM/FM/SXM)

The radio antenna and radio antenna amplifier are contained internally. The received signal is amplified by the radio antenna amplifier and output.

■ Telematics antenna

Models with a data communication module (DCM) contain an internal telematics antenna that is used by the data communication module (DCM) for communication with the Call Center and other outside parties.



(a) Roof antenna
- AM
- FM
- SXM
- Radio antenna amplifier
- Telematics antenna

Instrument panel antenna

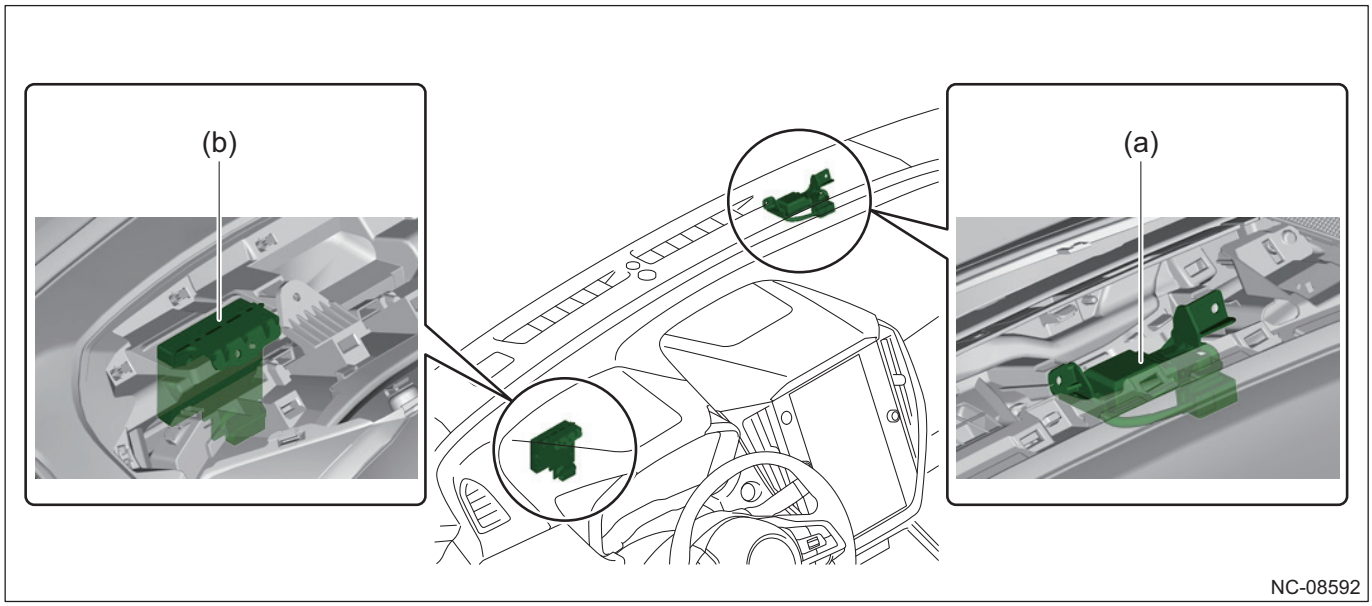
The Telematics sub antenna and GPS antenna are provided inside the instrument panel according to the specifications.

■ Telematics sub antenna

In models with a data communication module (DCM), a telematics sub antenna is installed inside the instrument panel on the driver's seat side, and is used by the data communication module (DCM) for communication with the Call Center and other outside parties.

■ GPS antenna

This antenna is positioned inside the instrument panel on the passenger's seat side and is installed in models with a data communication module (DCM).



(a) GPS antenna

(b) Telematics sub antenna

12 ADVANCED SAFETY SYSTEM

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12.1 General Overview

12.1.1 Overview

SUBARU categorizes safety measures into the following four processes to enhance the comprehensive safety performance of the vehicle. Each process is structured by linking various components and systems. Refer to chapters describing each measure for more details. This chapter describes the "preventive safety" utilizing the advanced safety system.

"Primary Safety"

Superior visibility from the driver seat is secured so the driver can rapidly detect the danger and visibility performance is ensured to safely drive during cornering, turning left or right, and backing up to enhance the safety of the vehicle even before starting to drive.

"Active Safety"

Prevents accidents by avoiding danger during driving. Safety during driving is ensured by a system that controls the vehicle in any condition regardless of the road conditions or weather. (For details, refer to "BRAKE SYSTEM - Vehicle Dynamics Control (VDC)")

"Passive Safety"

Secures safety of the passengers when the vehicle has collided and protects the passengers from impact of collision. (For details, refer to "BODY STRUCTURE - Subaru Global Platform (SGP)" and "INTERIOR TRIM - Airbag system")

"Preventive Safety"

The vehicle is equipped with an advanced system that forecasts the danger in advance and notifies the driver or assists driving, leading to safe driving. The system automatically intervenes when determined to be in dangerous state to realize accident prevention and damage reduction.

12.2 EyeSight

12.2.1 Overview

** EyeSight is installed for some grades.*

EyeSight is a driving assistant system that recognizes a vehicle, person, bicycle, obstacle, lane, road sign, etc. by processing the image from the stereo camera; recognizes a vehicle and obstacles from the radar and sensors; and cooperatively controls the Vehicle Dynamics Control, engine, transmission, and steering, etc. depending on conditions.

The operating status of the system and warnings are displayed on the Multi Information Display (MID) and Center Information Display (CID) in the combination meter.

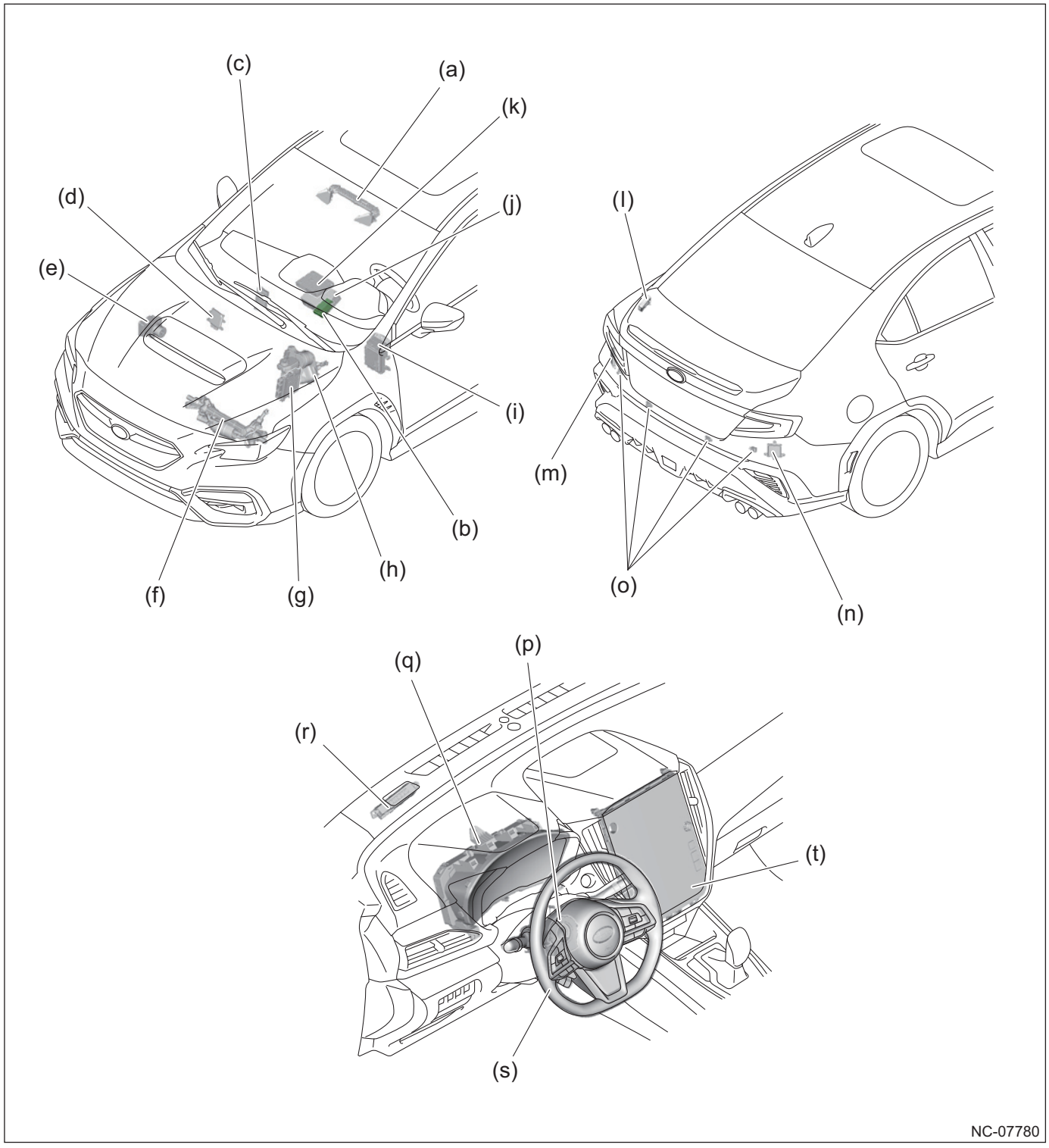
EyeSight is equipped with the following functions.

Pre-Collision Braking		
	Vehicle Distance Alarm	
	Pre-Collision Braking Assist	
	Pre-Collision Braking	
		When driving straight ahead
		When driving at an intersection
	Autonomous Emergency Steering	
Advanced Adaptive Cruise Control		
	Adaptive Cruise Control (ACC)	
	Conventional Cruise Control*	
	Lane Centering / Preceding Vehicle Following Steering	
Lane Departure Warning		
Lane Departure Prevention		
Lane Sway Warning		
Lead Vehicle Start Alert		
Pre-Collision Throttle Management		
Customization function		

**: For details, refer to "ADVANCED SAFETY SYSTEM - Conventional Cruise Control"*

12.2.2 Component

Component layout drawing



(a) Stereo camera
(b) Central gateway CM (CGW)
(c) Air conditioning CM (A/C CM)
(d) Transmission control module (TCM)
(e) VDC CM & H/M
(f) Power steering CM
(g) Engine control module (ECM)
(h) Electric brake booster
(i) Body Integrated Unit
(j) Cockpit control module (CCM)
(k) Data communication module (DCM)
(l) Sonar CM
(m) Radar sensor (LH) (master)
(n) Radar sensor (RH) (slave)
(o) Sonar sensor
(p) Steering angle sensor
(q) Combination meter
(r) EyeSight assist monitor
(s) Steering wheel
• EyeSight steering wheel switch
(t) Center information display (CID)

Component details

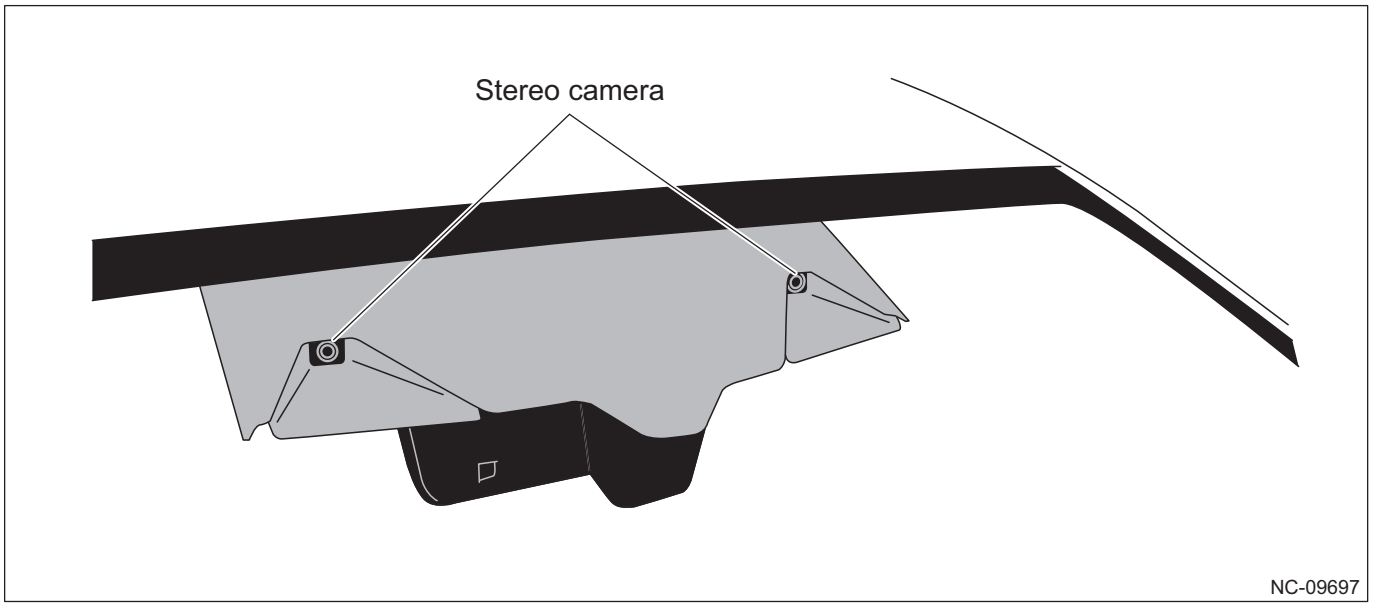
Main component functions

Component	Function
Stereo camera	Composed of a camera, image processor, and control MCM that performs calculations based on the image information from the camera and the signals from each computer. After calculation, it sends signals for control, alarms, or warnings, etc. to each computer or actuator.
Central gateway CM (CGW)	Relays CAN communication between the control computers for the various devices installed in the vehicle.
EyeSight steering wheel switch	Switches for turning each function ON/OFF. Sends the status of each switch to the stereo camera.
Radar sensor	Recognizes vehicles in the rear direction. Sends the rear vehicle recognition status to the stereo camera.
EyeSight assist monitor	Receives signals from the stereo camera and alerts the driver of the vehicle status by turning on or flashing the LEDs.
Sonar CM	Receives signals from the sonar sensor and each computer, and performs calculations. After calculation, it sends signals for control, alarms, or warnings, etc. to the stereo camera.
Sonar sensor	Measures the distance to objects to the rear of the vehicle. Sends the vehicle rear object recognition status to the sonar CM.
Power steering CM	Sends the power steering status to the stereo camera. Receives power steering control signals from the stereo camera and controls the power steering.
Electric brake booster	Controls the electric brake booster and operates the brake based on control signals from the stereo camera.
Steering angle sensor	Sends the steering angle status to the stereo camera.
Engine Control Module (ECM)	Sends the engine status (accelerator status) to the stereo camera. Receives engine control signals from the stereo camera and controls the engine.
Transmission control module (TCM)	Sends the shift lever position and auto start-stop status to the stereo camera. Receives transmission control signals from the stereo camera and controls the transmission.
VDC CM & H/M	Sends vehicle information (brake operation status, steering wheel angle recognition, yaw rate recognition, longitudinal G recognition, vehicle speed, forward and reverse judgment, VDC operating status, EPB status, etc.) to the stereo camera. Receives brake control, brake light on, and EPB control signals from the stereo camera and controls each of these.
Data communication module (DCM)	Sends the emergency call ON/OFF status to the stereo camera.
Combination meter	Receives the warning, alarm, and system ON/OFF status from the stereo camera and displays each of these.
Cockpit control module (CCM)	Sends the signals from the Center Information Display (CID) to the stereo camera.

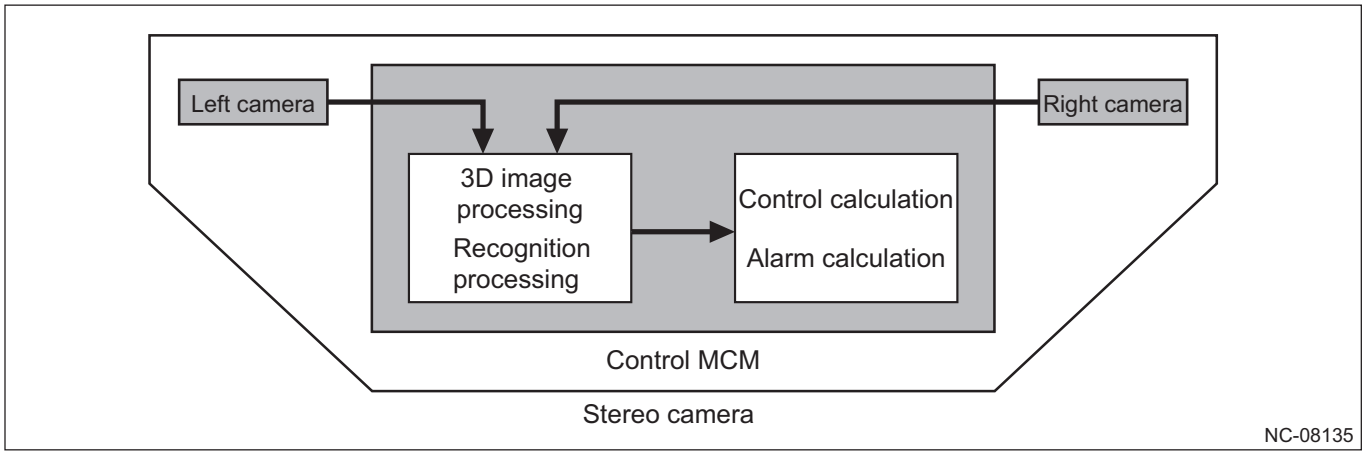
Component	Function
Center Information Display (CID)	Sends the function ON/OFF status to the Cockpit Control Module (CCM). Displays the warning alarm for the vehicle rear based on the alarm signals from the sonar CM.
Body Integrated Unit	Sends the status of the indicators, hazards, door opening/closing, etc. to the stereo camera. Receives the indicator and hazard ON/OFF signals and horn sounding signals from the stereo camera and controls each of these.
Air conditioning CM (A/C CM)	Sends the air conditioning status to the stereo camera.

Stereo camera

The stereo camera recognizes the distance and object using cameras mounted at left and right and performs preventive safety and driving load reduction by controlling each unit appropriately.



■ Construction / Operation

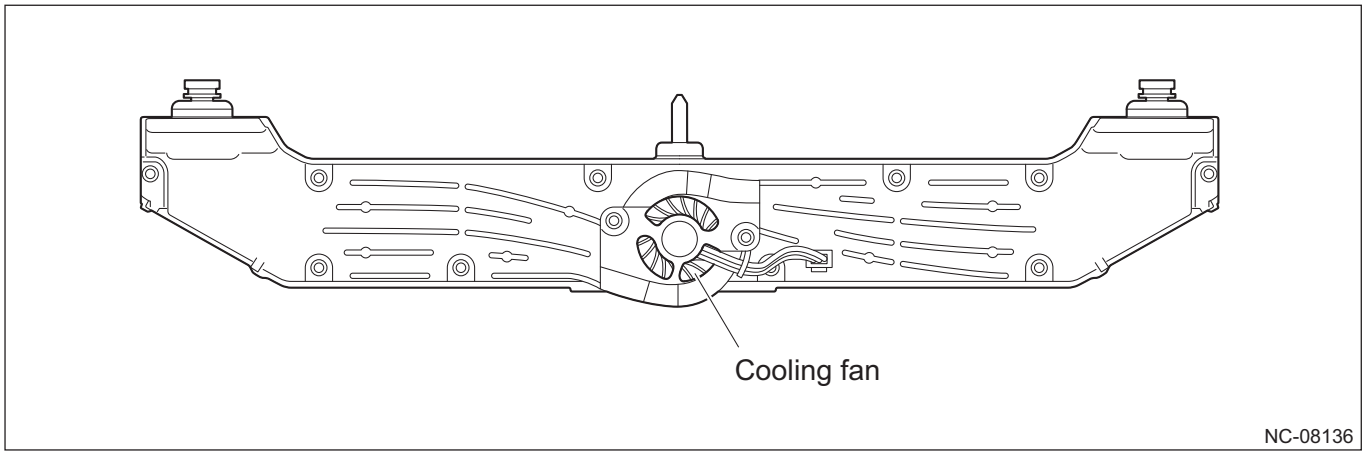


1. Performs 3D image processing/recognition processing for the camera images from the vehicle front.
2. Performs control calculation/alarm calculation based on the processed data.
3. Sends control signals and operation signals to each CM and actuator based on the calculation results.

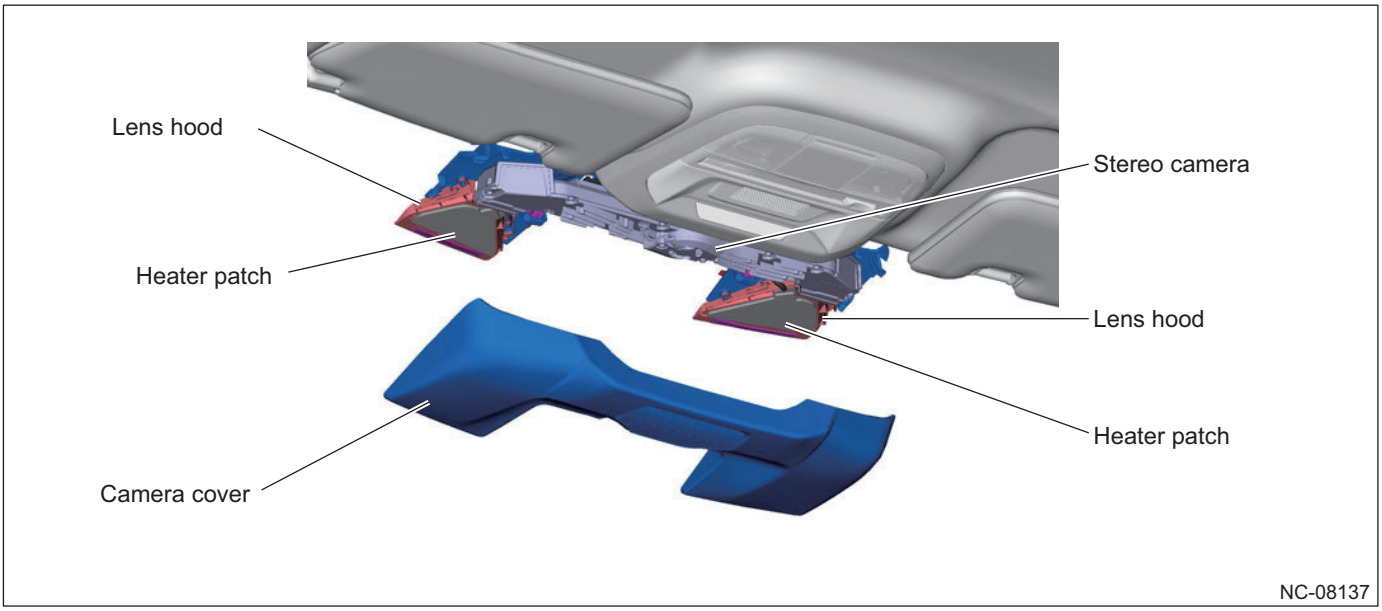
■ Cooling fan

A cooling fan is adopted to reduce heat generation from the Microcomputer built into the stereo camera.

Stereo camera view from underneath



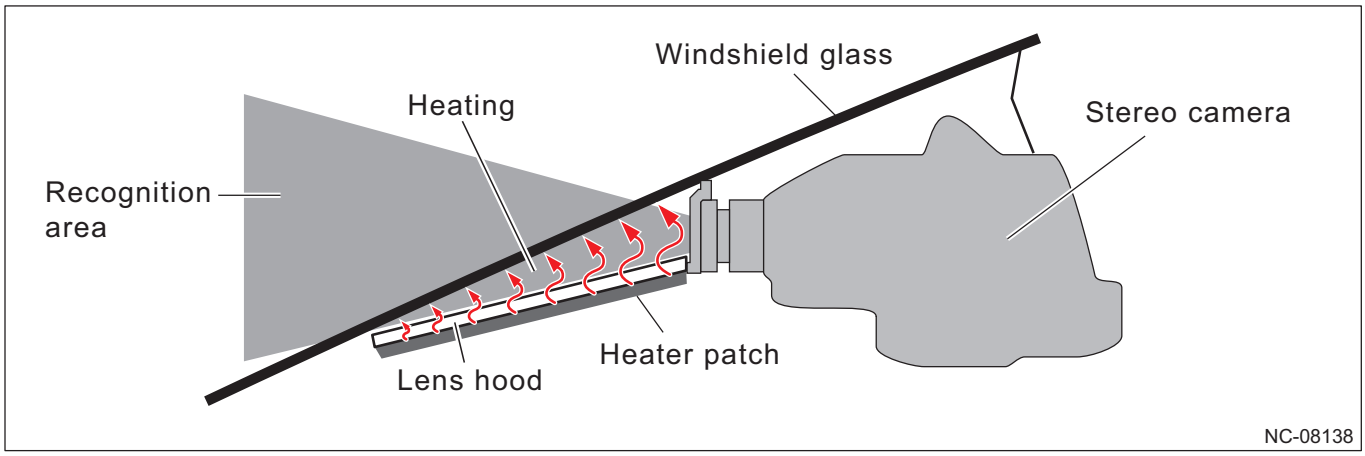
Stereo camera surrounding parts



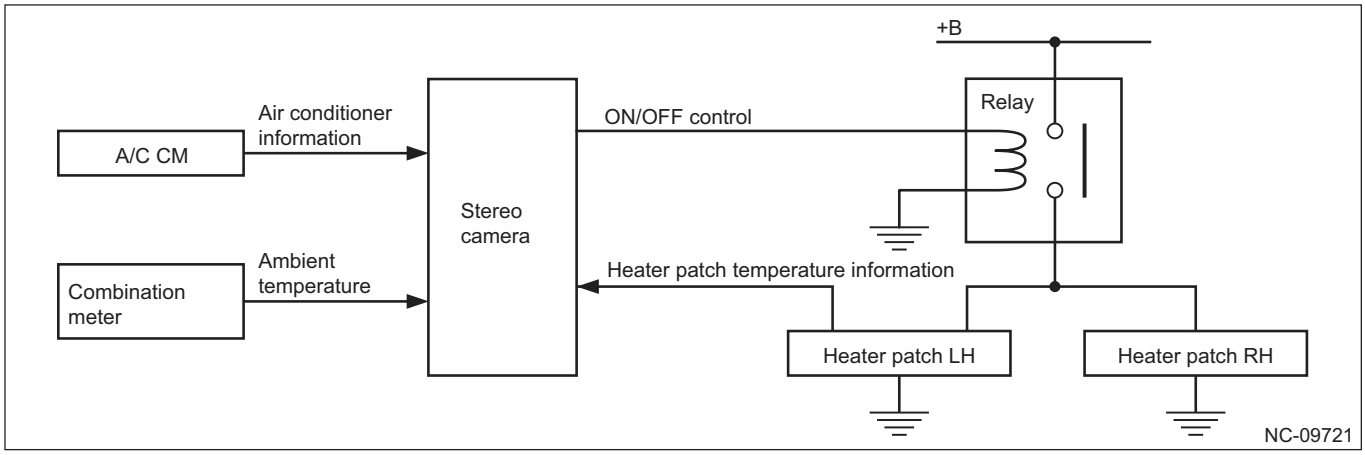
■ Heater patch

A heater patch is positioned (attached) on the bottom surface of the lens hood to heat and defog the front glass through the lens hood.

Operation image



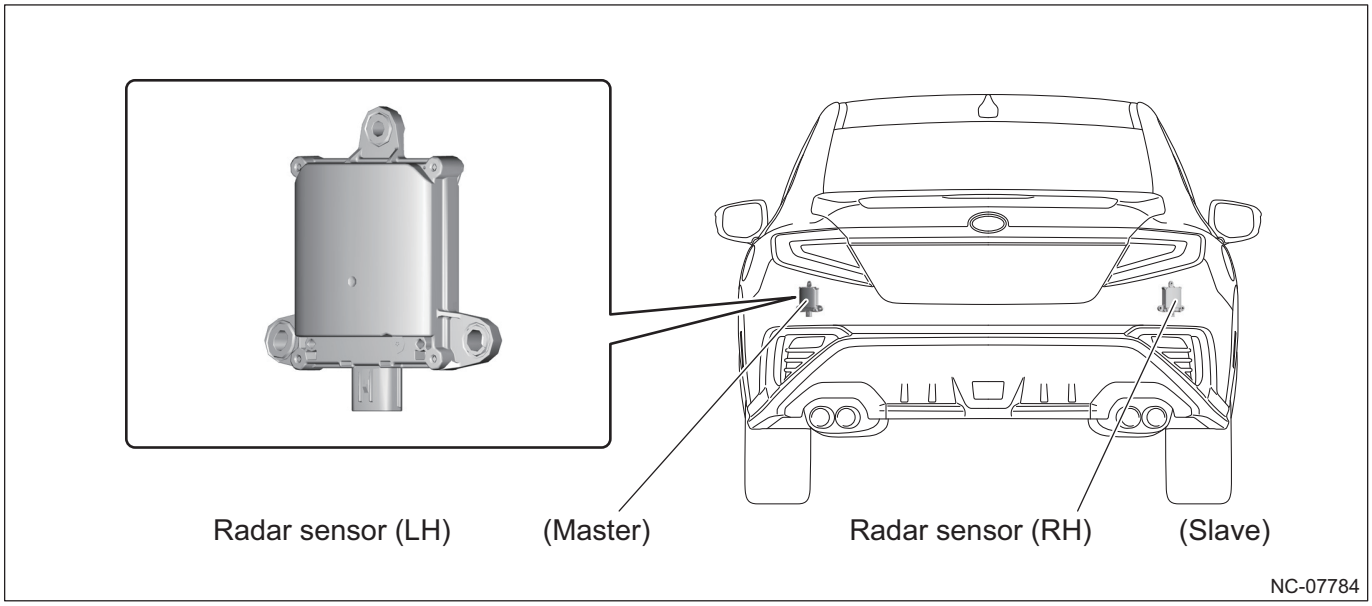
▮ System configuration



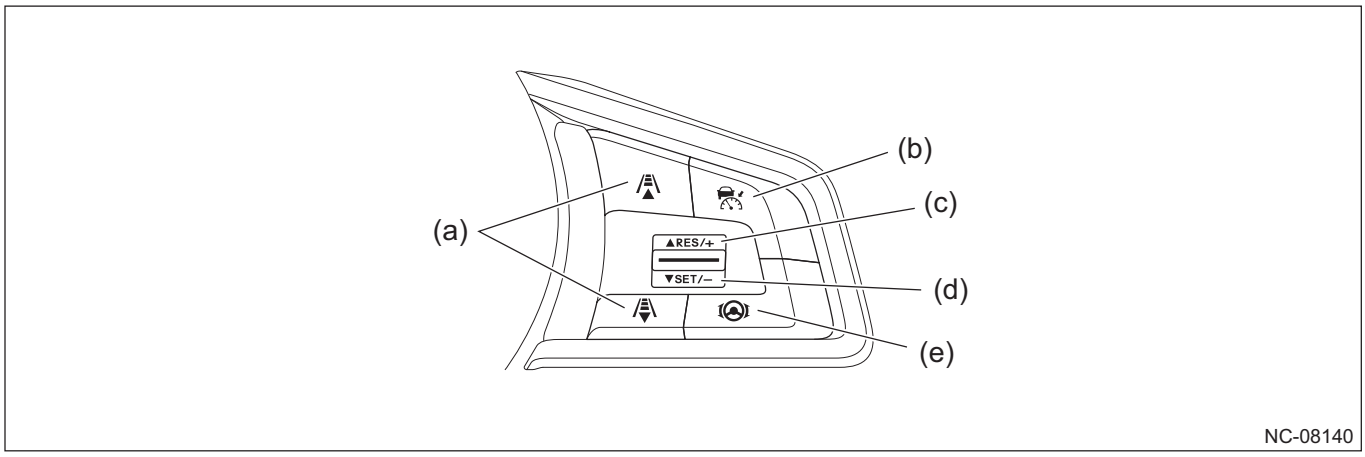
Component	Function
Stereo camera	Calculates how easily the front glass in front of the camera will fog based on the ambient temperature and air conditioning information, and controls the relay ON/OFF (heater patch ON/OFF).
Heater patch	• Defogs/prevents fogging of the front glass in front of the camera by generating heat to raise the ambient temperature in front of the camera. • Contains a temperature fuse that blows when the temperature rises to a certain temperature or higher, preventing overheating damage (including to the camera). • The heater patch is forcibly turned OFF before the temperature fuse blows based on the temperature information of the heater patch.
Lens hood	The lens section is covered with a hood to prevent accidental touching of the lens that may leave behind fingerprints and risks causing a malfunction.

Radar sensor

Each radar sensor detects vehicles on its installed side.



EyeSight steering wheel switch



Name	Function
(a) Distance between vehicles setting switch	Switches distance between vehicles in four levels during setting for Adaptive Cruise Control (ACC).
(b) Cruise switch	Turns on and off the Cruise Control*.
(c) RES/+ switch	Sets the Cruise Control* (re-sets a setting of set vehicle speed before cancellation after canceling the Cruise Control). Increases set vehicle speed (when the Cruise Control* is set).
(d) SET/- switch	Sets the Cruise Control*. Decreases set vehicle speed (when the Cruise Control* is set).
(e) Lane centering switch	ON/OFF of Lane Centering / Preceding Vehicle Following Steering

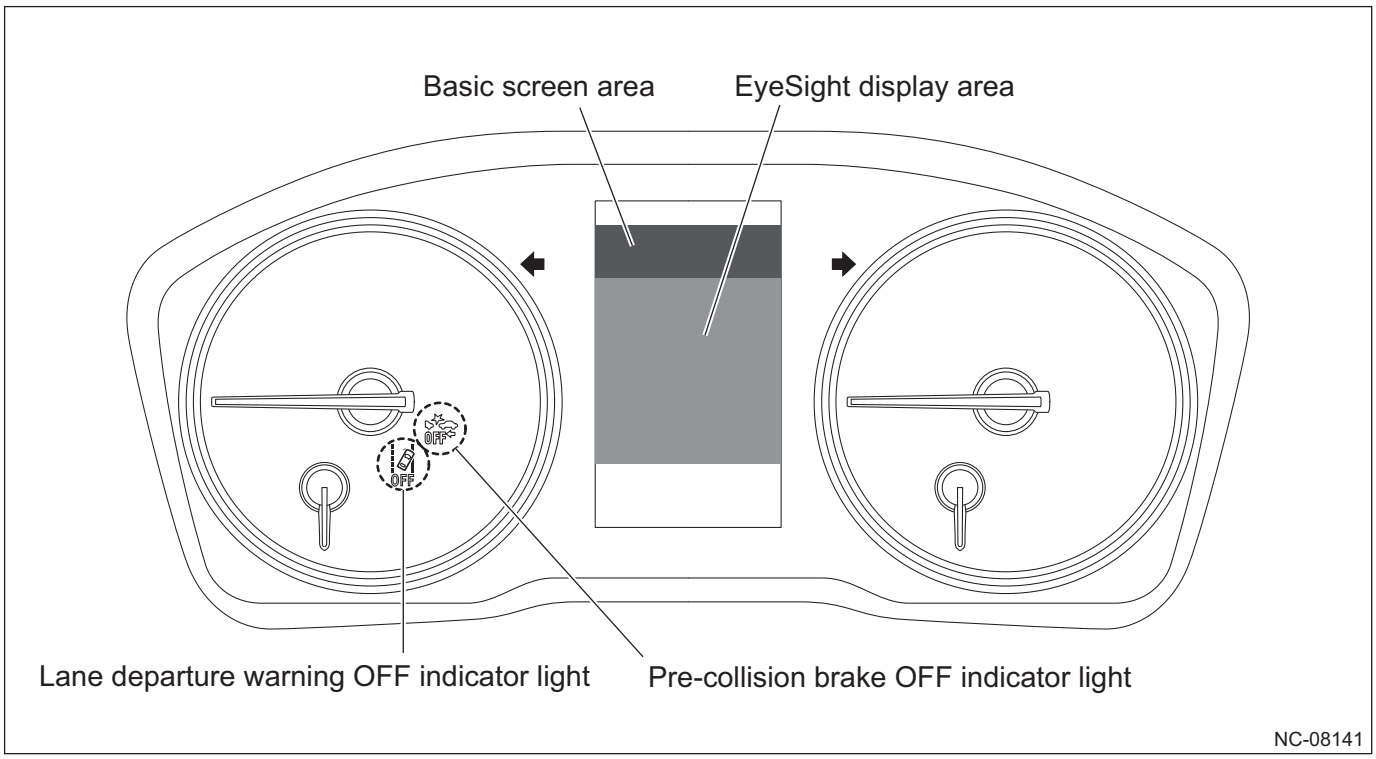
**: Adaptive Cruise Control (ACC) and Conventional Cruise Control*

Indicator lights

The Pre-collision brake OFF indicator light and lane departure warning OFF indicator light are arranged in the combination meter.

Fuel efficiency and audio are displayed on the basic screen area.

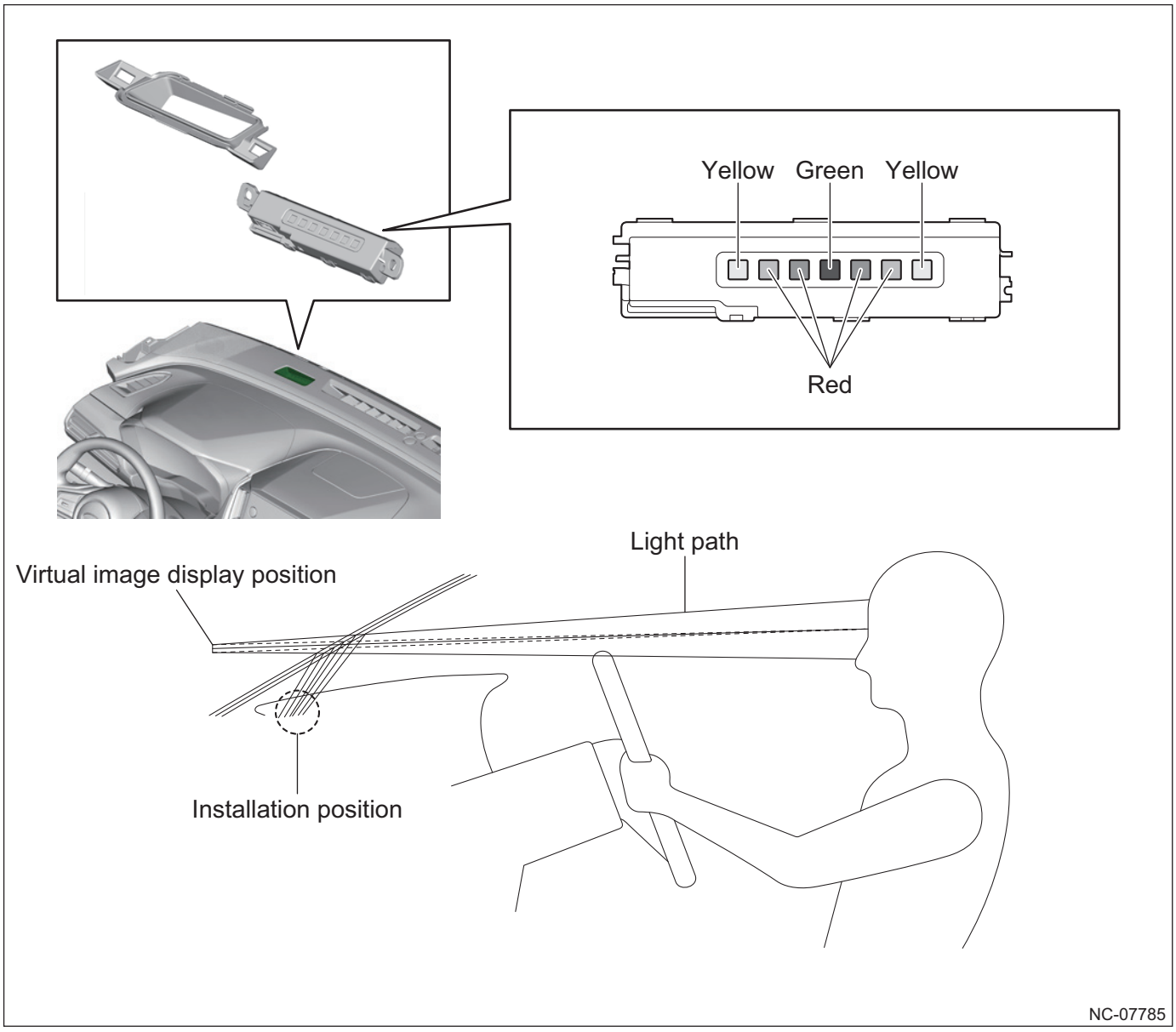
Also, information such as the EyeSight operating status, an alarm, or system failure is displayed in an interruption screen.



For details, refer to "ENTERTAINMENT - Combination meter"

EyeSight assist monitor

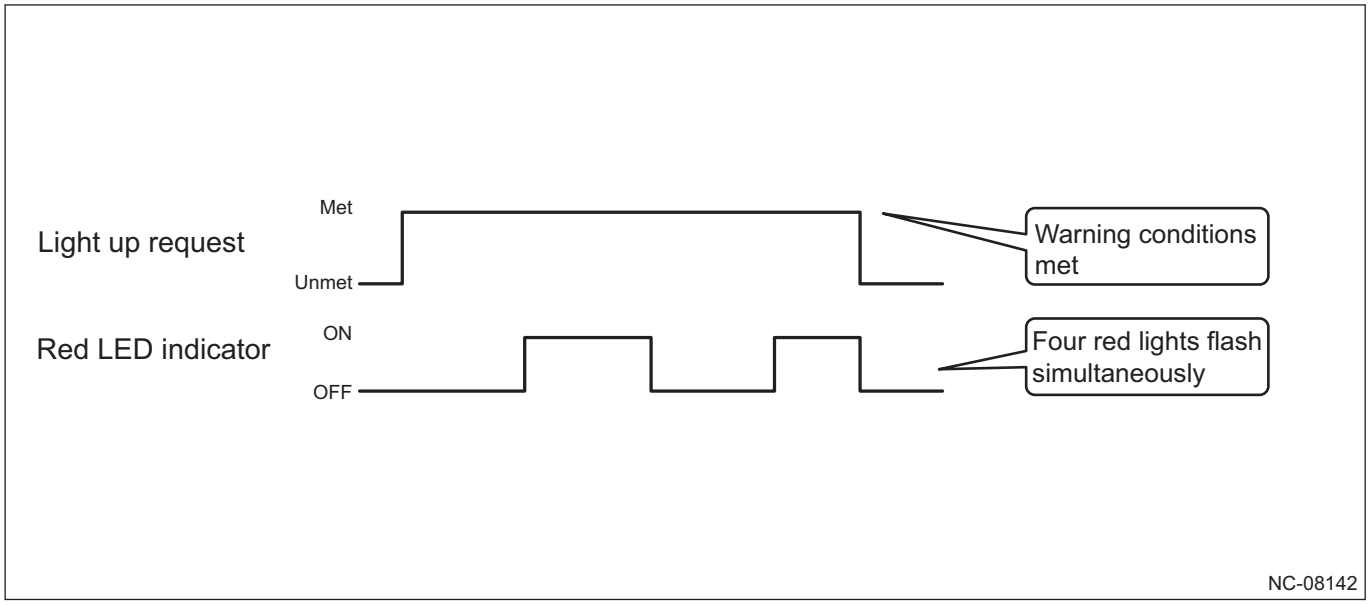
This provides an easy to understand warning to the driver by projecting LED light onto the windshield glass and flashes with a color corresponding to the level of danger.



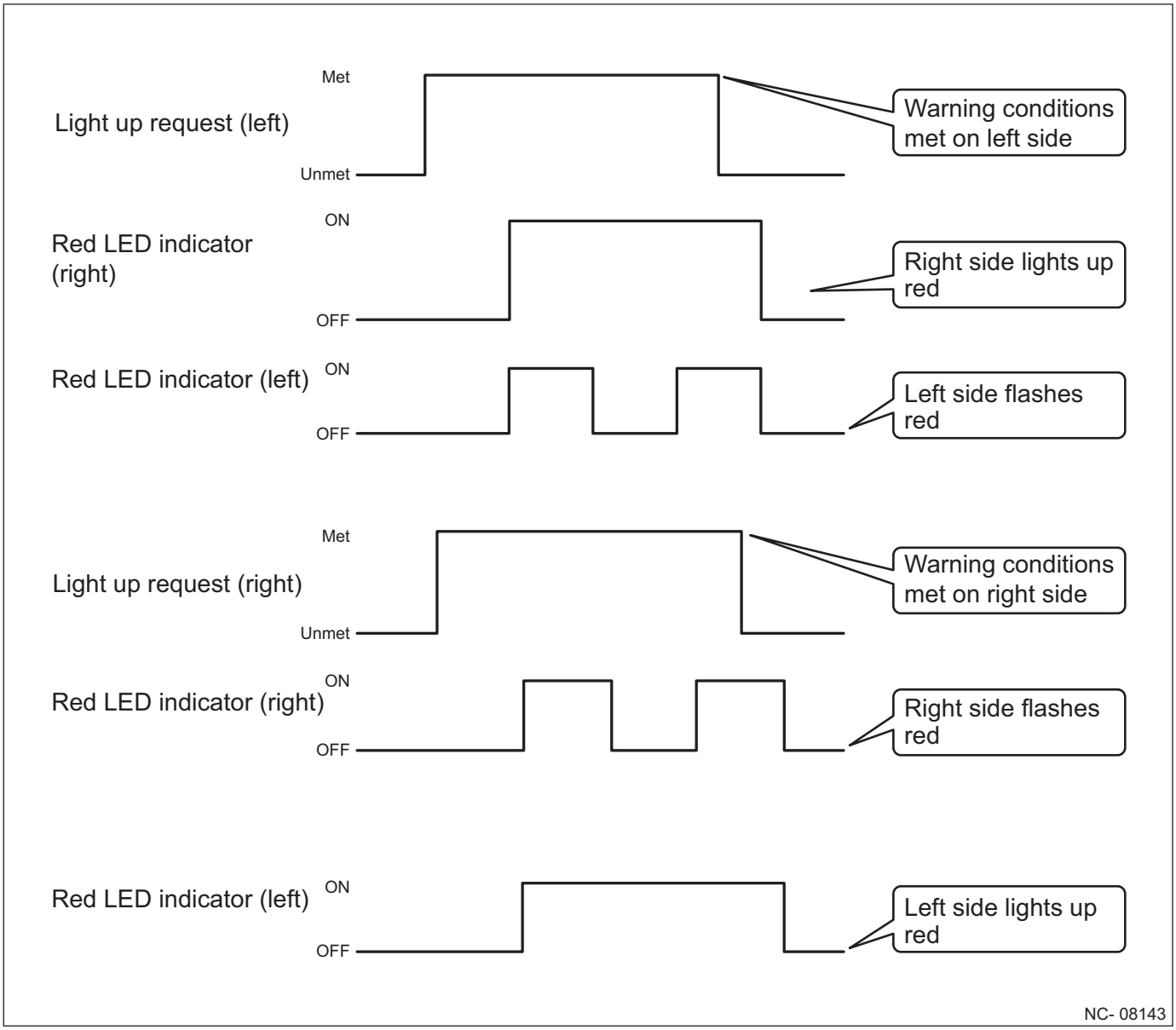
■ Operation indication

Color	Condition	Item	Overview
Red	Right and left flash simultaneously.	Pre-collision secondary brake, Pre-collision primary brake, Vehicle Distance Alarm, alarm for requiring more brake pedal force, Pre-Collision Throttle Management, Autonomous Emergency Steering	A warning will be issued if there is a possibility of collision.
	Right and left flash simultaneously.	Unoperated cancellation warning: Lane Centering / Preceding Vehicle Following Steering	A warning will be issued if Lane Centering / Preceding Vehicle Following Steering is canceled because the steering wheel has not been operated for a while.
	The departure side flashes, and the opposite side turns on.	Departure avoidance request warning	A warning will be issued if a departure from the lane is detected while Lane Centering / Preceding Vehicle Following Steering is in operation.
Yellow	The departure side flashes, and the opposite side turns on.	Lane Departure Warning	A caution will be issued if a departure from the lane is detected.
	Left and right flash alternately.	Lane Sway Warning	A caution will be issued if swerving is detected.
	Both sides flash.	Unoperated steering warning	A caution will be issued if the driver's hands are off the steering wheel for a long time while Lane Departure Prevention/ Lane Centering / Preceding Vehicle Following Steering is in operation.
	Both sides flash quickly.	Cancellation warning: Lane Centering / Preceding Vehicle Following Steering/ Lane Departure Prevention	A caution will be issued if Lane Centering / Preceding Vehicle Following Steering/ Lane Departure Prevention is canceled.
Green	Turns on	Capturing the preceding vehicle: Adaptive Cruise Control	A notification will be sent about the preceding vehicle recognition state.

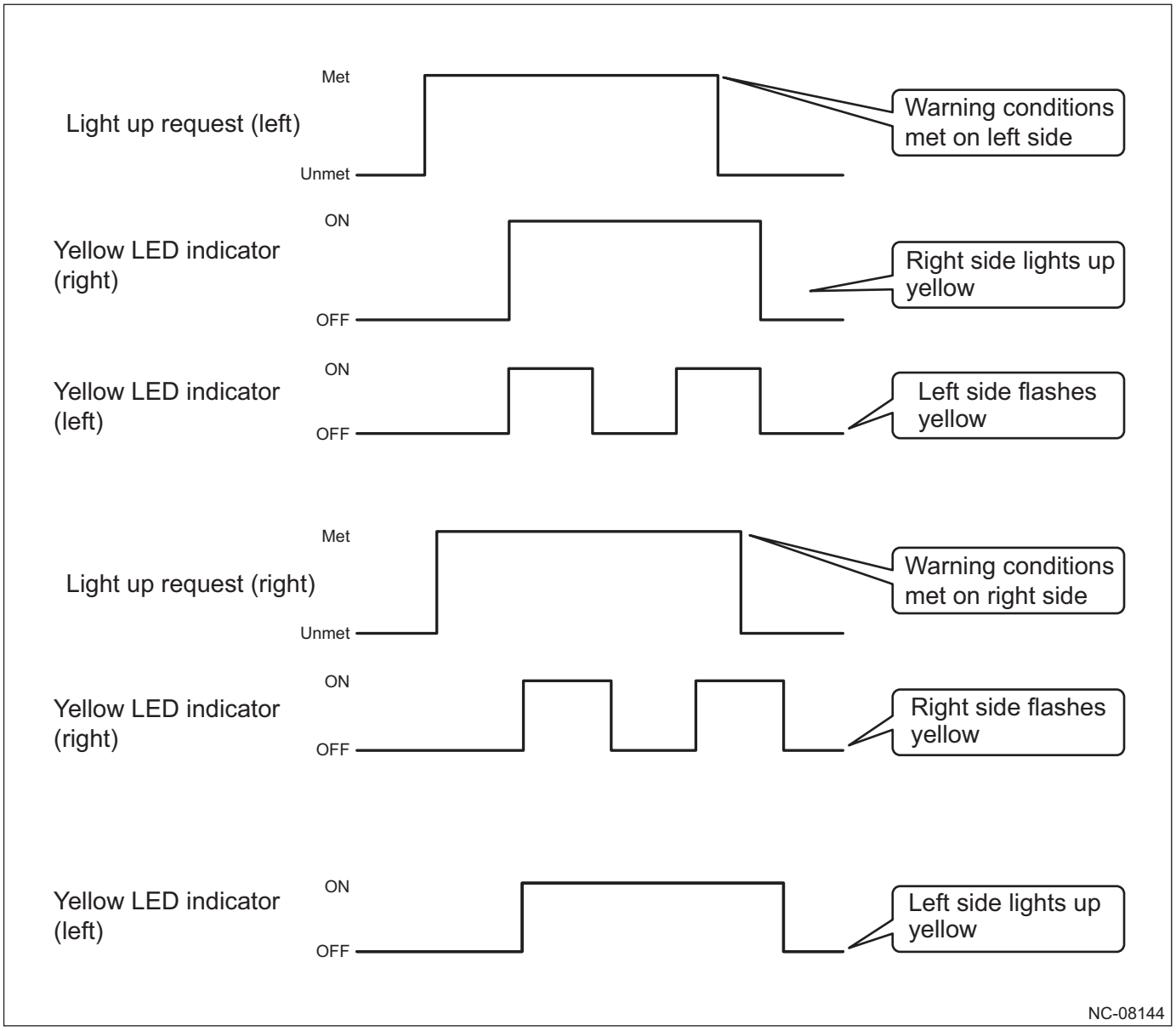
Red LED indicator flash pattern



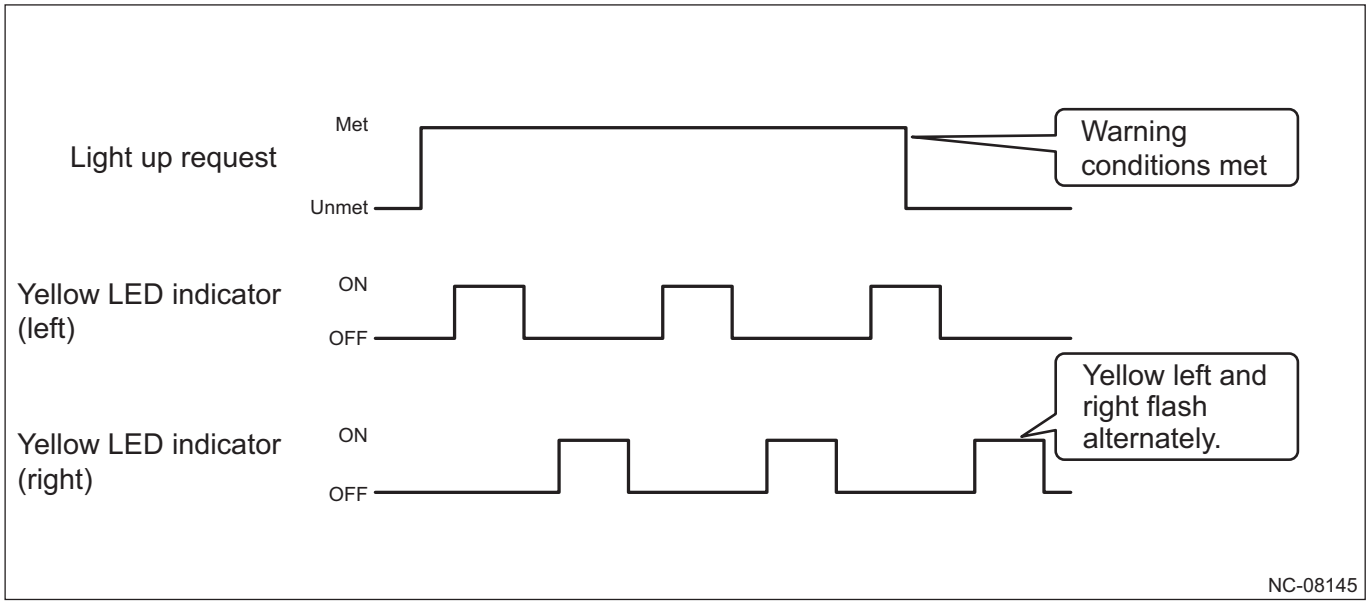
Red LED indicator one side flash pattern



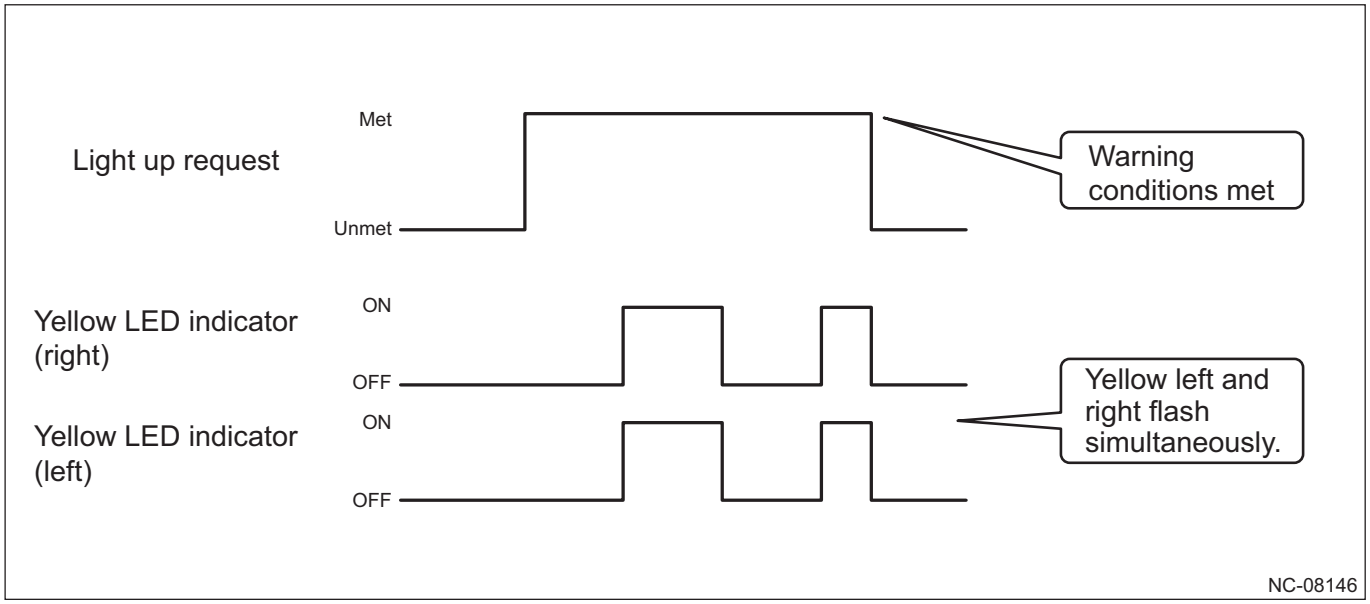
Yellow LED indicator one side flash pattern



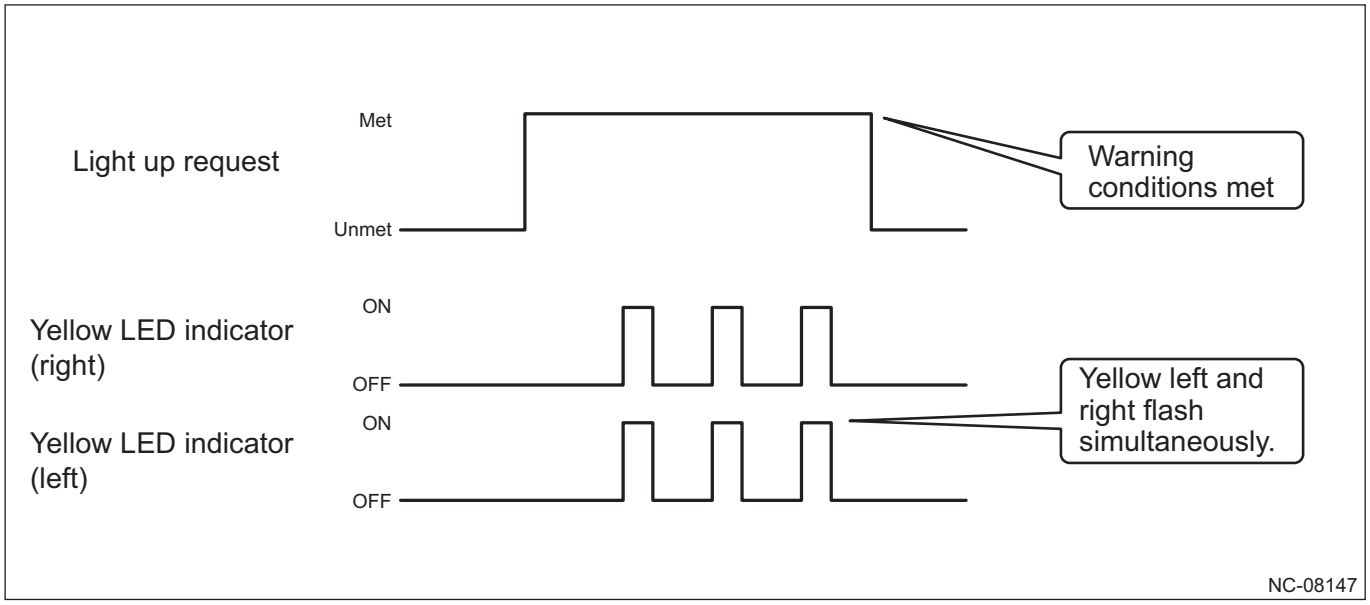
Yellow LED indicator left-right alternate flash pattern



Yellow LED indicator right/left simultaneous flash pattern (Unoperated steering warning)

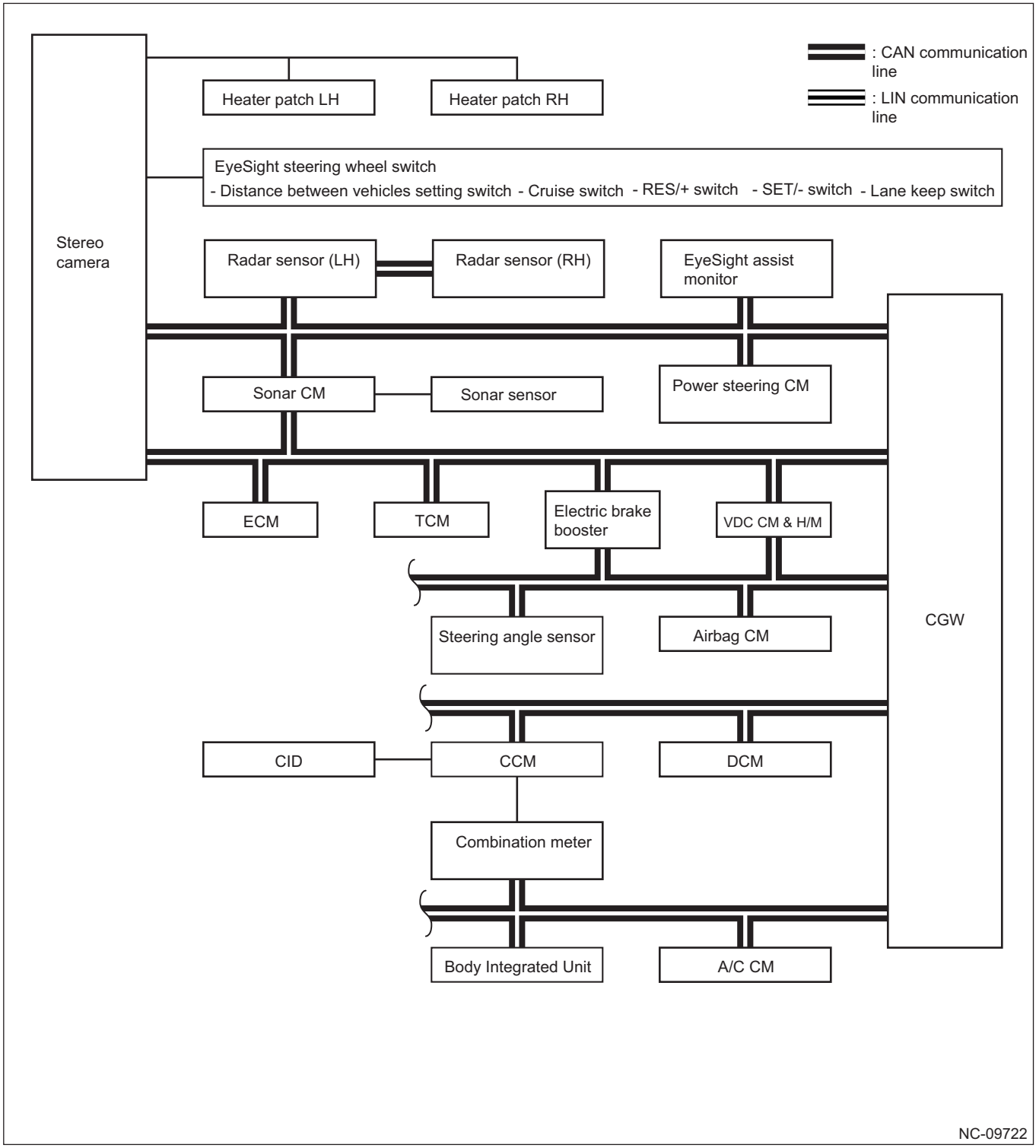


Yellow LED indicator right/left simultaneous flash pattern (Cancellation warning)



12.2.3 Construction and Operation

System diagram

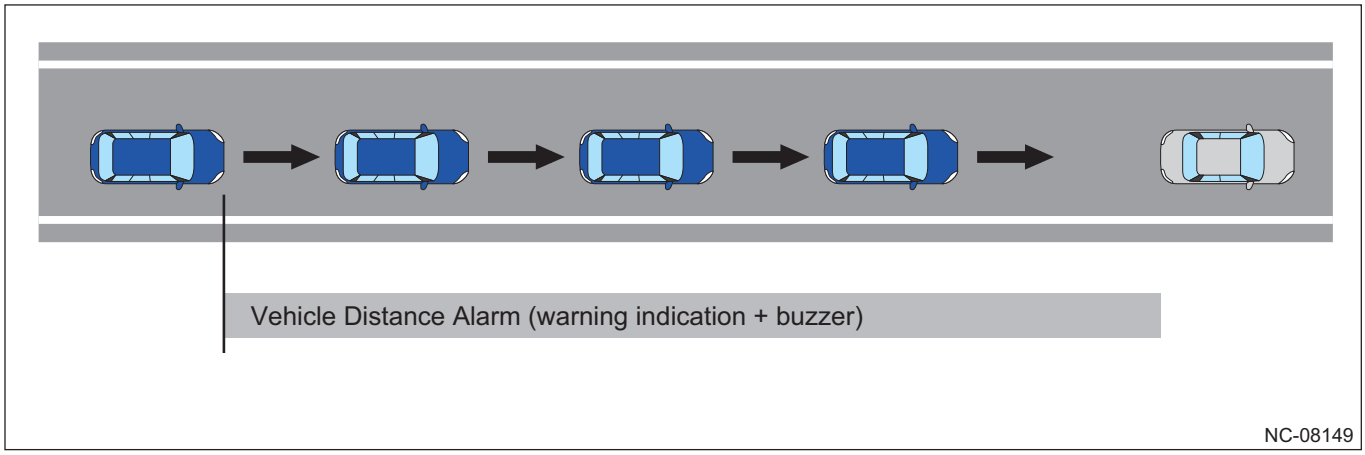


Pre-Collision Braking

Overview

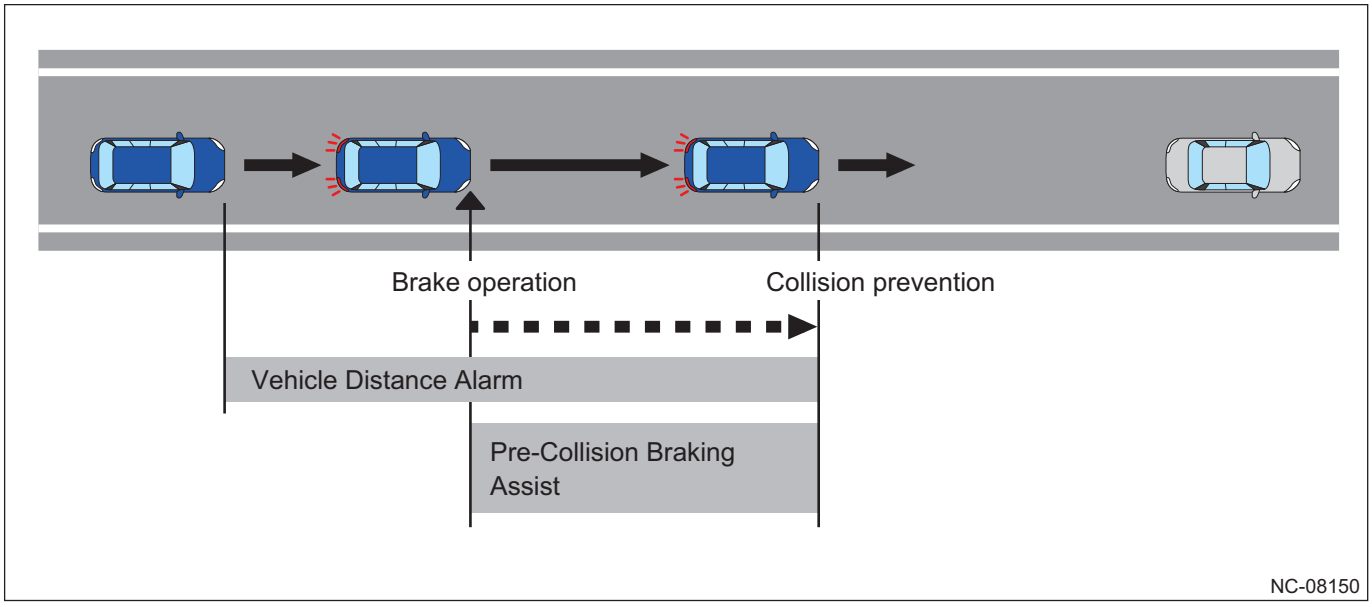
■ Vehicle Distance Alarm

When there is a possibility to collide to the preceding vehicle, it will assist the driver to prevent collision by warning the driver.



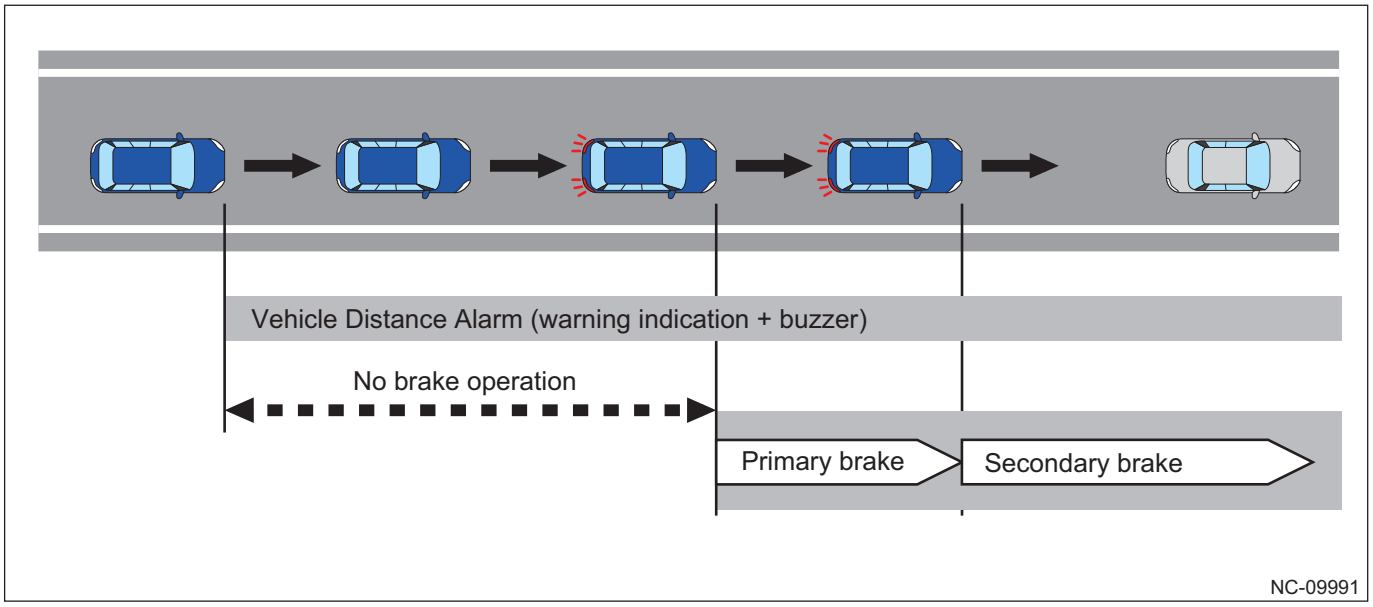
■ Pre-Collision Braking Assist

When there is a possibility of colliding with the preceding vehicle and the driver is warned, and then the driver performs an avoiding action, the system assists the driver to prevent collision by performing brake control.



■ Pre-Collision Braking

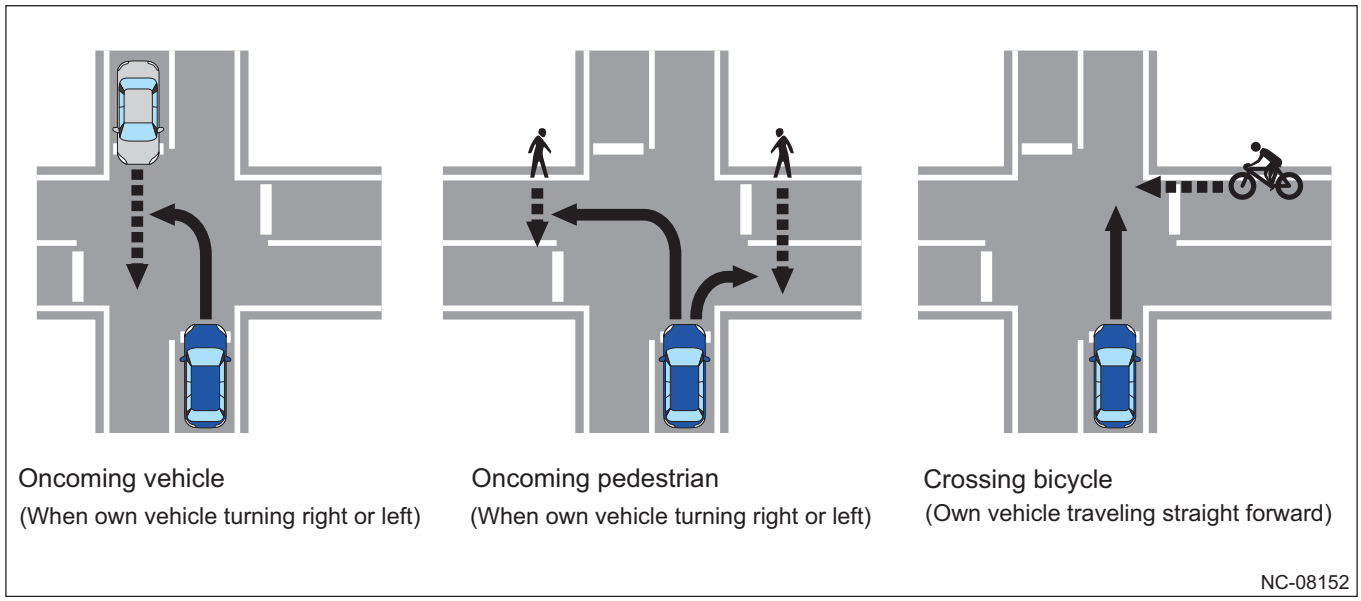
When there is a possibility of colliding with a vehicle, pedestrian, bicycle, or similar obstacle, and the driver is warned, and then the driver does not perform an avoiding action, the system applies the emergency brake immediately before the collision to reduce the collision damage or prevent the collision.



▮ When driving at an intersection

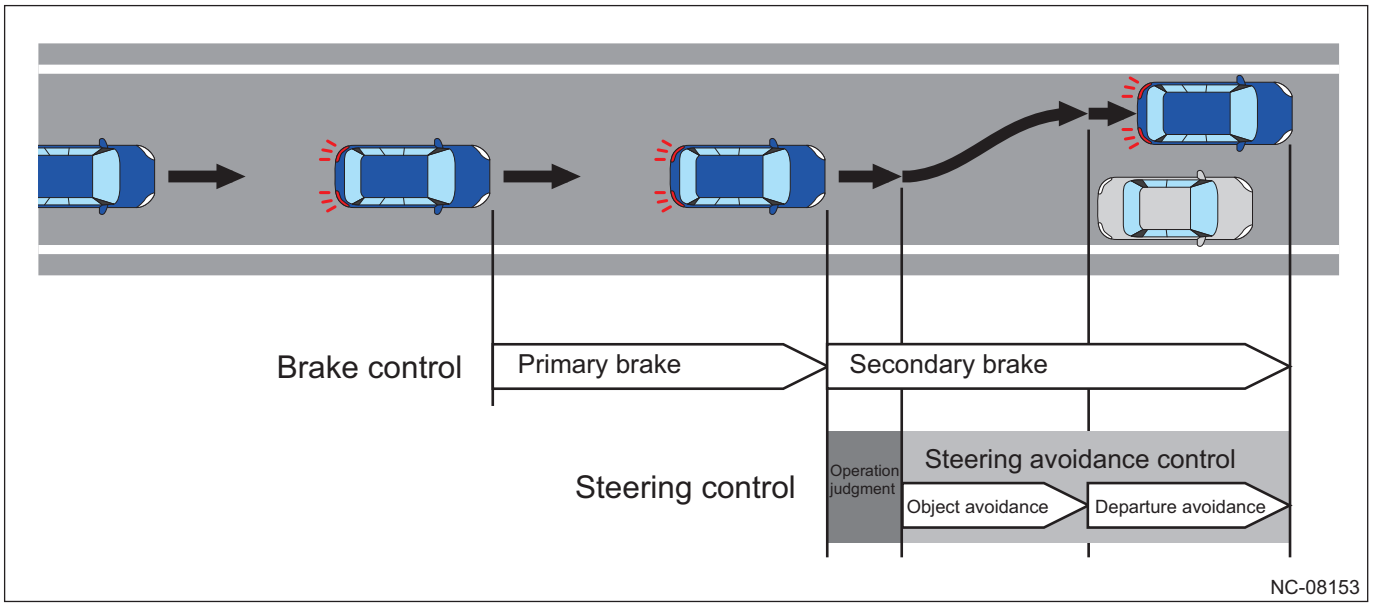
The system recognizes an oncoming vehicle or crossing pedestrian as its own vehicle turns right or left, judges the possibility of collision from the predicted path of the oncoming vehicle or crossing pedestrian and the turning path of its own vehicle, and operates the brake to reduce collision damage or prevent the collision.

The system recognizes a bicycle approaching from the side, judges the possibility of collision from the vehicle lateral relative speed difference and lateral distance, and operates the brake to reduce collision damage or prevent the collision.

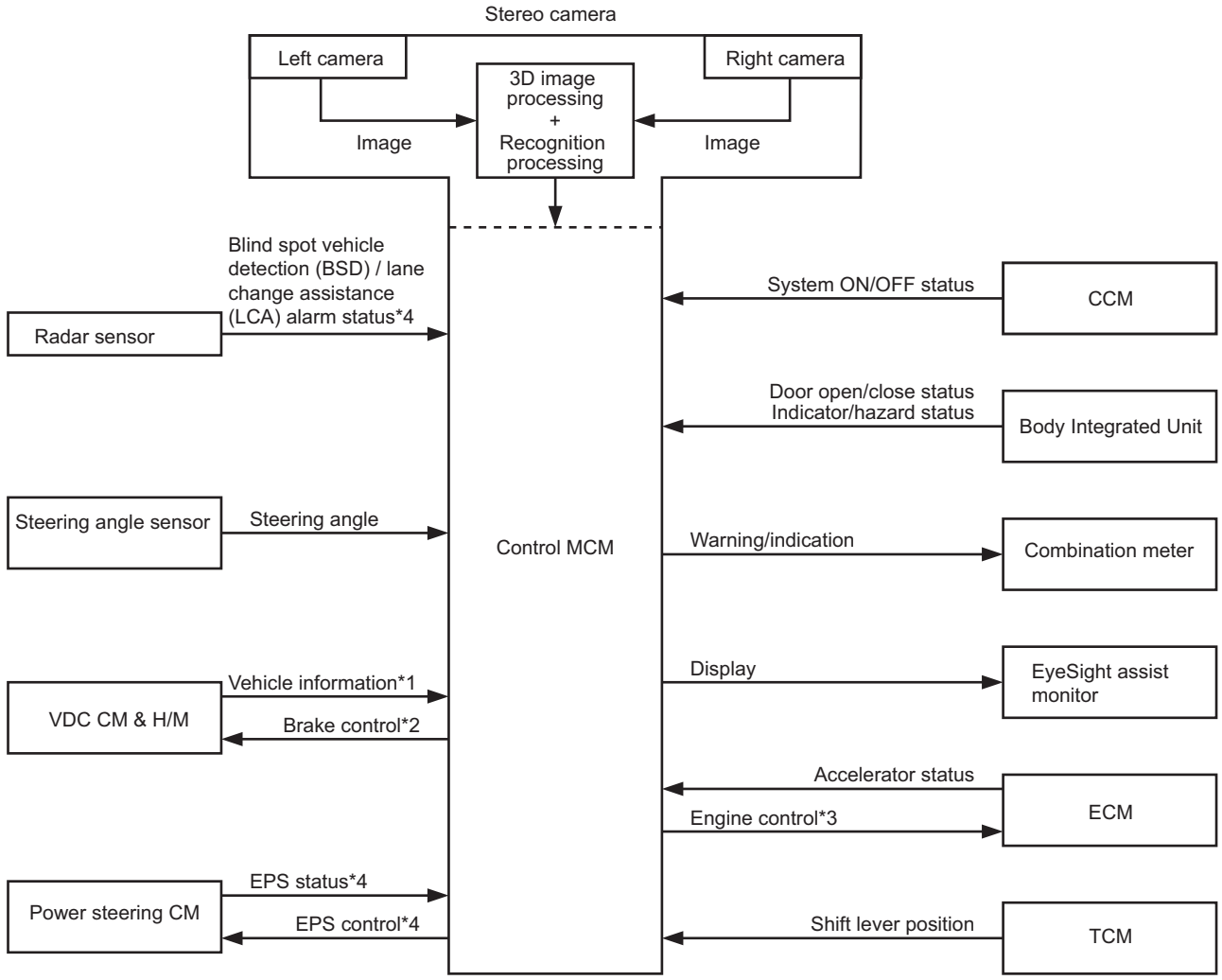


■ Autonomous Emergency Steering

This assists collision prevention for low overlap rear-end crashes that could not be prevented with the Pre-Collision Braking by automatically operating the steering in addition to brake control.



Block diagram



*1: Brake operation status, steering wheel angle recognition, yaw rate recognition, longitudinal G recognition, lateral G recognition, vehicle speed, VDC operating status, EPB status

*2: Brake control, brake light on, EPB control

*3: Except for Vehicle Distance Alarm

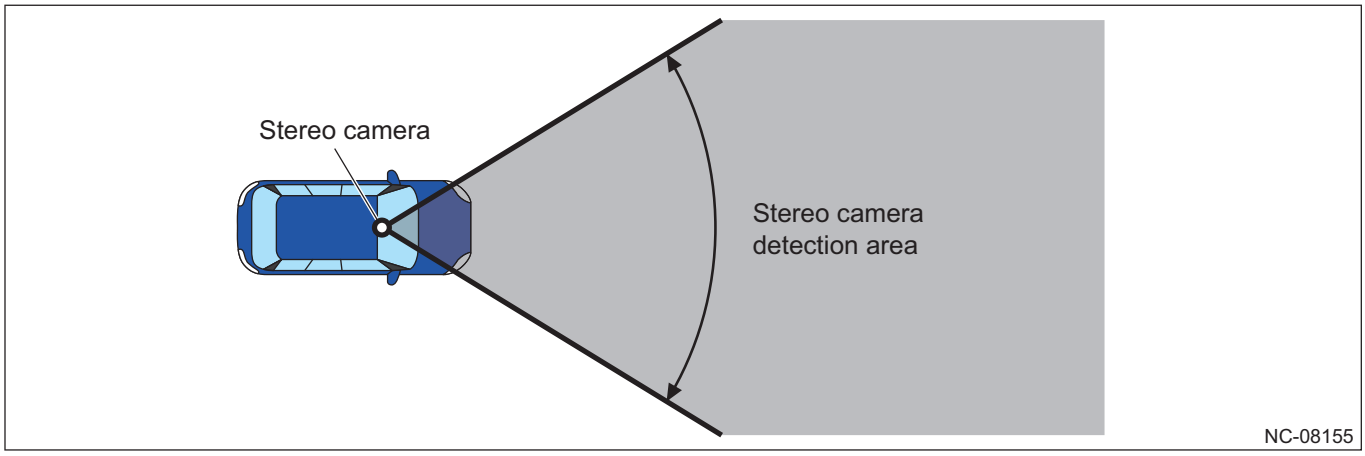
*4: Autonomous Emergency Steering

NC-10076

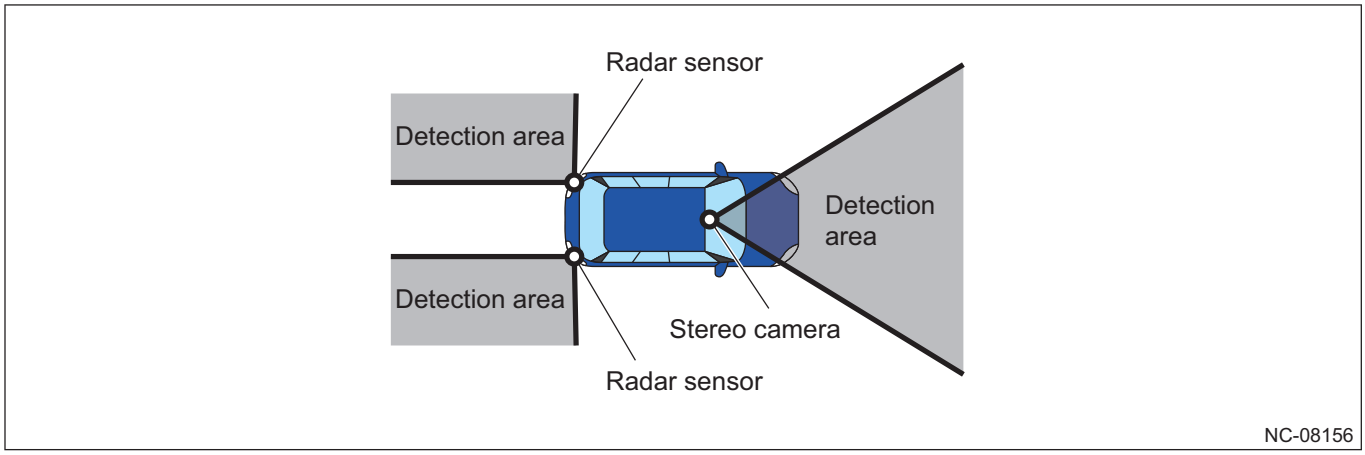
Operation

■ Detection area

Vehicle Distance Alarm, Pre-Collision Braking Assist, Pre-Collision Braking



Autonomous Emergency Steering



■ Vehicle Distance Alarm

When the system judges there is a possibility of collision with a preceding vehicle or forward obstacle while driving, it warns the driver with a buzzer sound and warning indication. The operation is canceled when the driver depresses the brake pedal, the vehicle decelerates, and an appropriate vehicle distance is maintained.

If the forward obstacle approaches further, the preload brake is applied to enable the quick operation of the Pre-Collision Braking (primary brake).

■ Pre-Collision Braking Assist

If the driver depresses the brake while driving with a forward obstacle within the specified distance, the brake assist further increases the braking force.

Operation vehicle speed condition

Driver’s vehicle speed is approximately 7 to 100 mph (approximately 10 to 160 km/h).

■ Pre-Collision Braking (against forward vehicle)

When the system judges that there is a high possibility of collision with a forward obstacle, it performs weak brake control to support collision prevention. When the system further judges that the possibility of collision is extremely high, it operates the secondary brake to perform stronger brake control.

When the system judges that the collision cannot be prevented, it continues brake control.

Operation vehicle speed condition

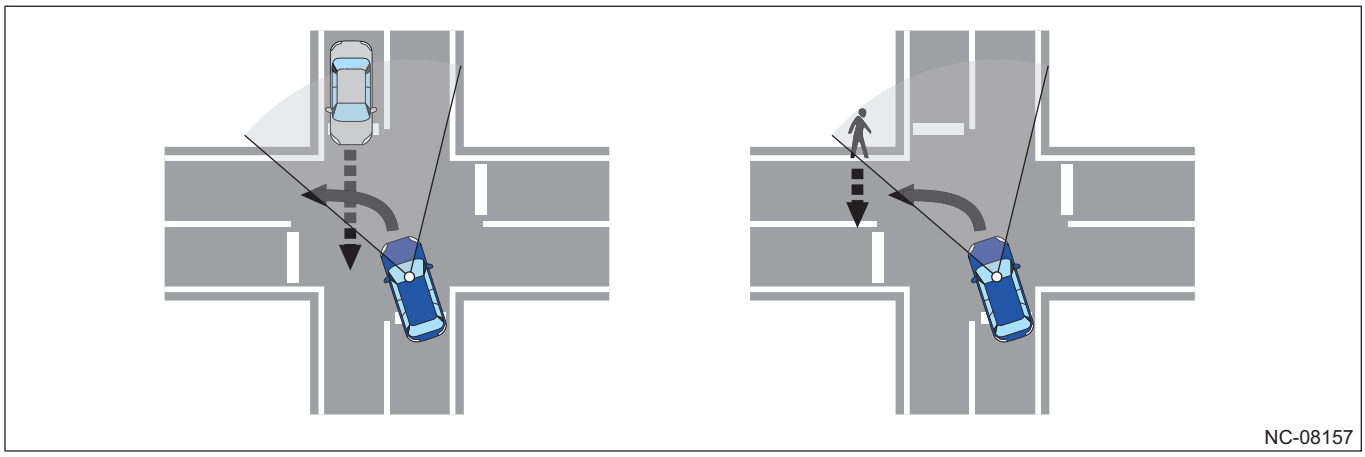
Driver’s vehicle speed is approximately 1 to 100 mph (approximately 1 to 160 km/h) or higher.

■ Pre-Collision Braking (when driver’s vehicle is turning right or left: oncoming vehicle/oncoming pedestrian)

The system judges the possibility of collision from the predicted path of the oncoming vehicle or crossing pedestrian and the turning path of its own vehicle, and operates the brake.

Operation vehicle speed condition

Driver’s vehicle speed is approximately 1 to 16 mph (approximately 1 to 25 km/h).

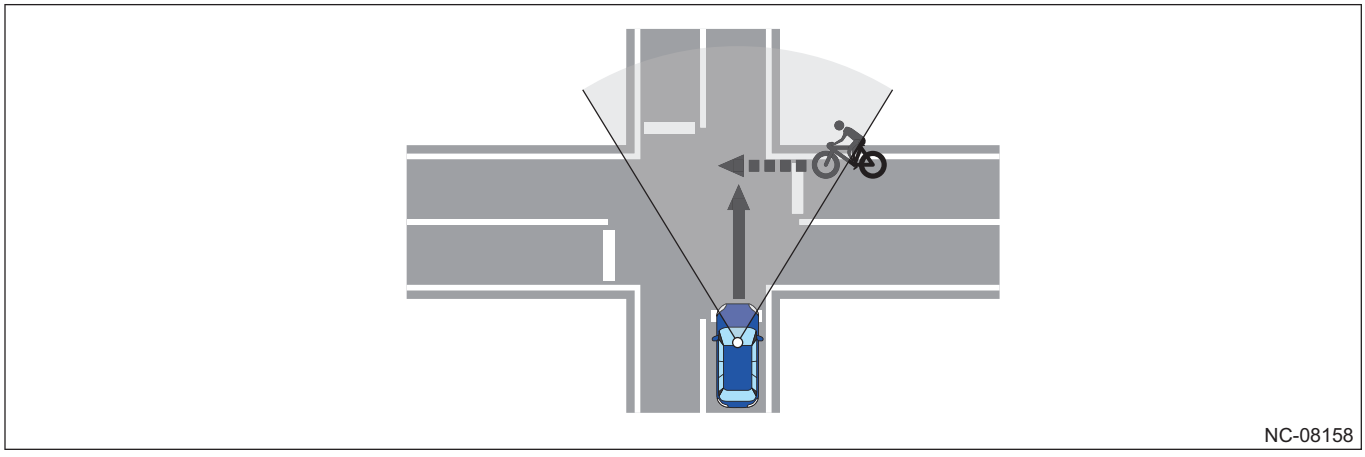


■ Pre-Collision Braking (when driver’s vehicle is traveling straight forward: crossing bicycle)

The system judges the possibility of collision for a bicycle crossing in front of own vehicle, and operates the brake.

Operation vehicle speed condition

Driver's vehicle speed is approximately 12 to 62 mph (approximately 20 to 100 km/h) (Minimum vehicle speed depends on bicycle speed.)



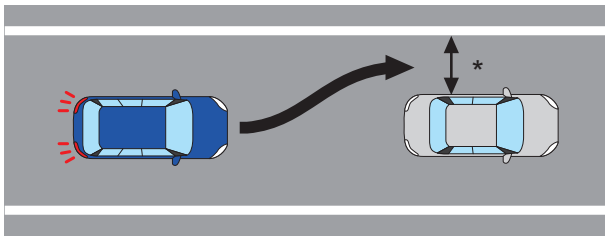
■ Autonomous Emergency Steering

▮ Operation image

1. Pre-Collision Braking (primary brake/secondary brake) operation

2. Operation judgment

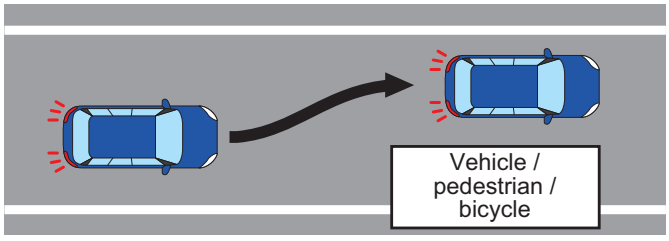
- Judges from the vehicle speed and positional relationship with the object that a collision will occur if only the Pre-Collision Braking is operated
- Judges from the vehicle speed, positional relationship with the object, and path of own vehicle that the collision can be prevented with steering control
- Performs lane detection/surrounding monitoring and rear monitoring (rear radar), and judges whether avoidance space can be secured within own vehicle lane



*: Does not operate if space cannot be secured

NC-08159

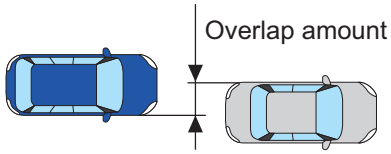
3. Avoids the object, and operates steering control after avoidance to prevent departure from own vehicle lane



NC-08160

Operating conditions

Operation is started when the following is satisfied.

Driver's vehicle speed is approximately 50 mph (approximately 80 km/h) or lower.	Pre-Collision Braking (secondary brake) is operating
Driver operation is detected (system judges that the driver has not let go of the vehicle controls)	Detected object is a vehicle, pedestrian, or bicycle
Enough space is available for avoidance	The lane lines are detected.
Overlap ratio is approximately 20% to 50%.  NC-08161	-

However, note that operation is not performed in the following cases.

When the AEB function is OFF	When Blind Spot Detection/Rear Cross Traffic Alert (BSD/RCTA) is OFF
When the detected object is an oncoming vehicle	When a vehicle, pedestrian, or bicycle crosses in front of own vehicle
When a moving object approaches from the front or rear of own vehicle	Not enough space is available for avoidance
Another object is detected near the avoidance space	Pre-Collision Braking is operating for a structural object, such as a guard rail
When the system judges that avoidance is not possible with steering control	When lane lines cannot be detected
A unit in the system is abnormal	Deceleration is insufficient
When driving on an uphill or downhill slope	-

Function cancellation

The function is canceled in the following cases.

A unit in the system is malfunctioning or paused	Driver operates the steering at a certain torque level or higher
Driver depresses the accelerator deeply (cancels the Pre-Collision Braking)	-

Display

**The illustration shows a typical example that may differ from the actual display.*

■ Indicator

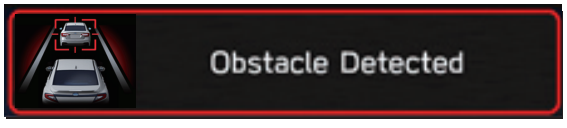
Display	Description	Display	Description
NC-08162	Pre-collision brake OFF indicator light	NC-08163	Autonomous Emergency Steering OFF indicator light

■ Alarm / warning / operating status

▮ Multi Information Display (MID)

Display	Description	Display	Description
NC-08164	Alarm • When there is a possibility of collision with a forward vehicle (forward vehicle and frame flash (red))	NC-08165	Warning • After activation of Pre-Collision Braking (frame turns on (yellow))
NC-08166	Fixed-duration notification display • After activation of Pre-Collision Braking	-	-

▮ Center Information Display (CID)

Display	Description
 NC-08167	Alarm • When there is a possibility of collision with a forward vehicle

Advanced Adaptive Cruise Control

Overview

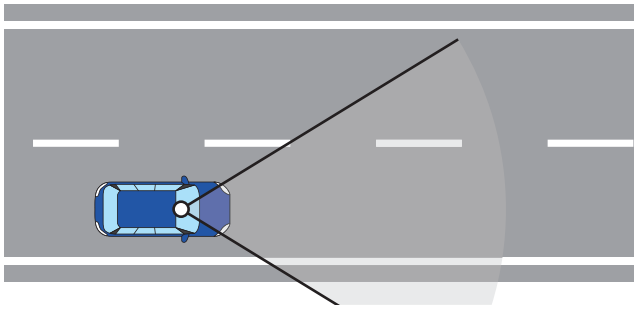
■ Adaptive Cruise Control (ACC)

When the stereo camera recognizes a preceding vehicle, the system follows the vehicle while automatically maintaining a vehicle distance appropriate for the vehicle speed, with the upper speed limit that was set by the driver.

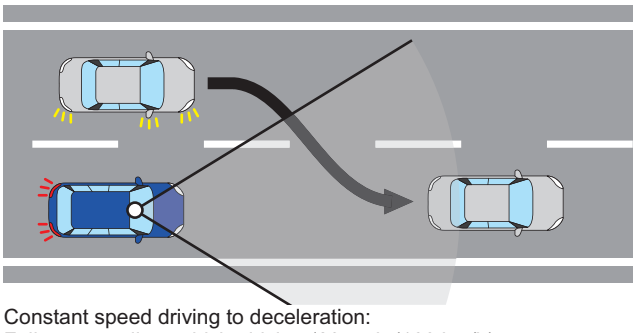
When the vehicle stops as it follows the preceding vehicle, the stopped condition is maintained by linking to the VDC. If the stopped condition cannot be maintained, the Adaptive Cruise Control (ACC) is canceled and the electronic parking brake activates.

When the cruise switch is turned ON, Adaptive Cruise Control (ACC) starts, and the driver can switch between Adaptive Cruise Control (ACC) and Conventional Cruise Control (CC).

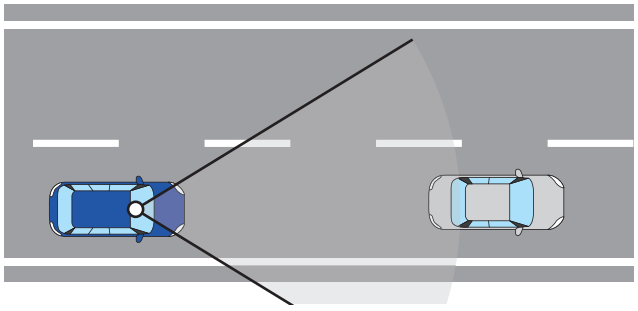
Image of operation when vehicle speed is set to 60 mph (100 km/h)



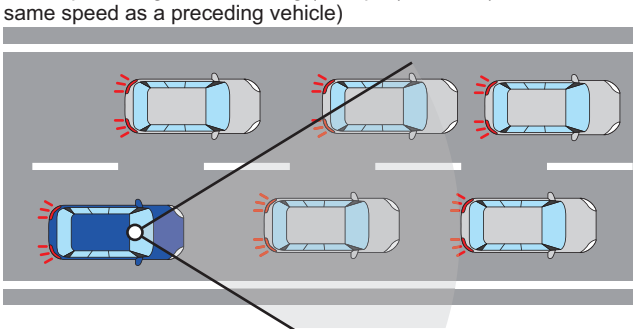
Constant speed driving (60 mph (100 km/h))



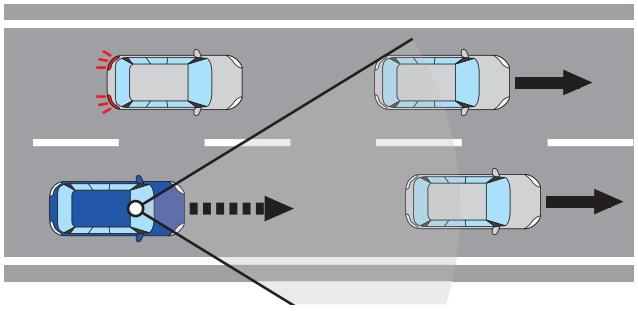
Constant speed driving to deceleration:
Follow preceding vehicle driving (60 mph (100 km/h) to same speed as a preceding vehicle)



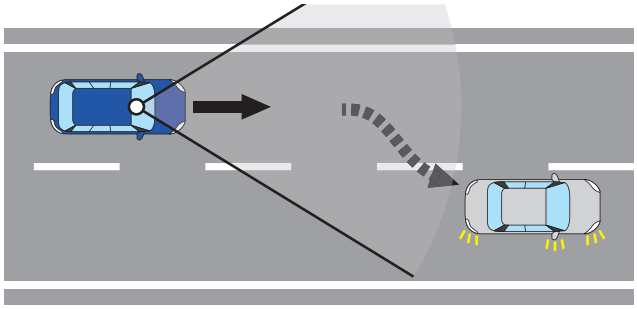
Follow preceding vehicle driving
(same speed as a preceding vehicle)



Follow preceding vehicle driving to deceleration:
Stop (same speed as a preceding vehicle to 0 mph (0 km/h))



Stop* to start: Follow preceding vehicle driving
(0 mph (0 km/h) to same speed as a preceding vehicle)
*: For 3 seconds after the vehicle stops following the preceding vehicle



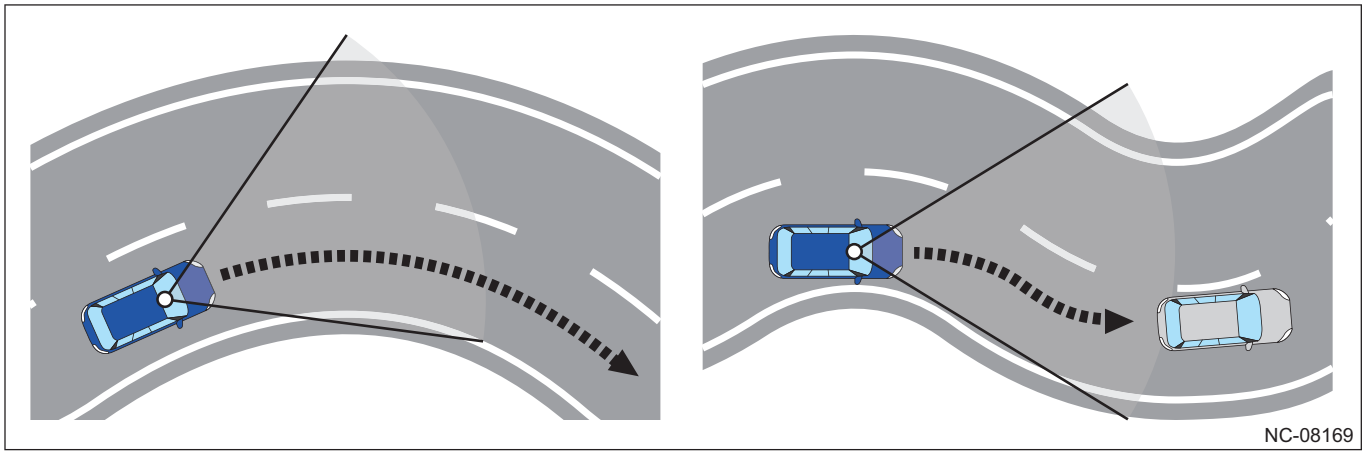
Follow preceding vehicle driving to acceleration:
Constant speed driving (same speed as a preceding vehicle to 60 mph (100 km/h))

NC-08168

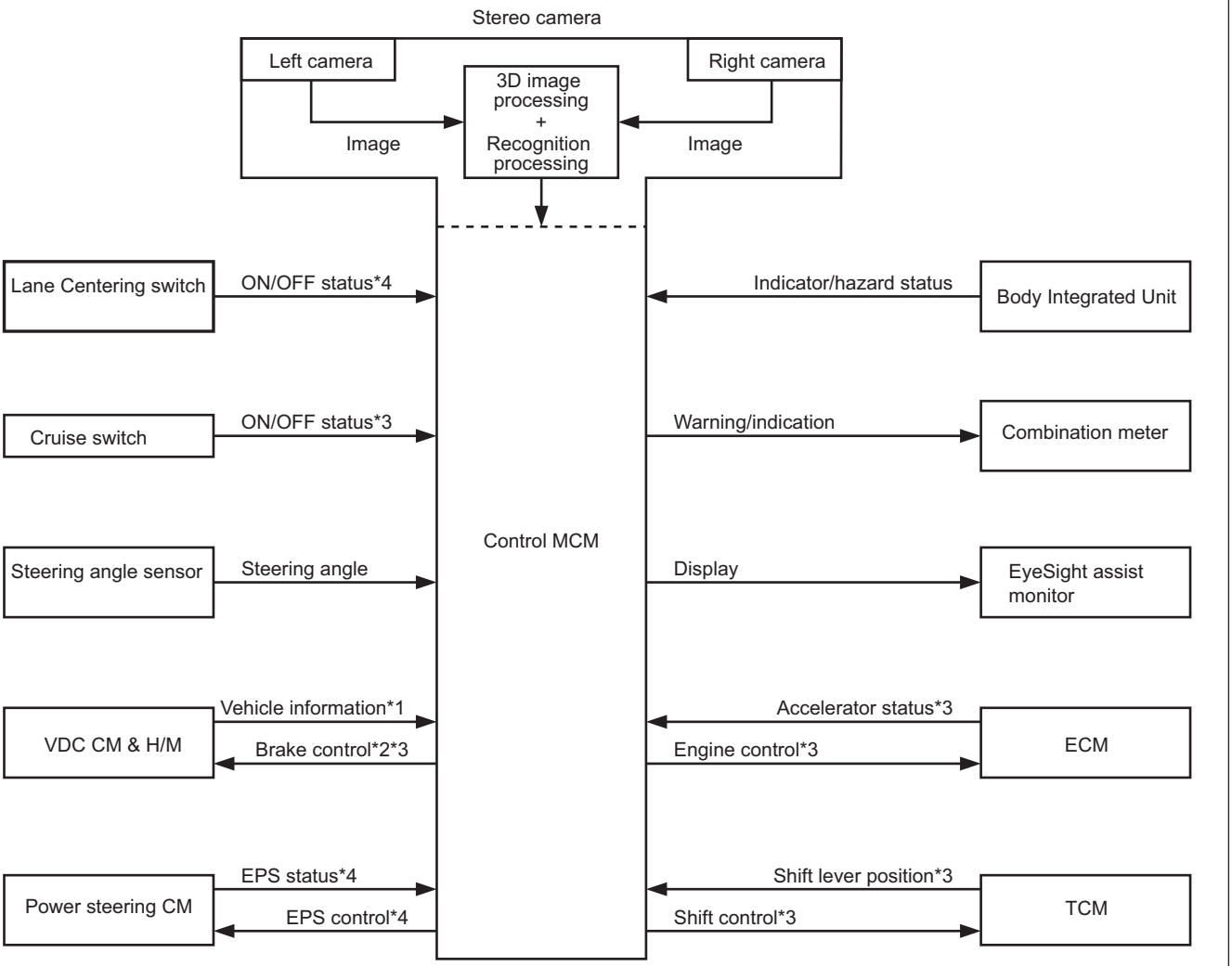
■ Lane Centering / Preceding Vehicle Following Steering

Lane Centering/Preceding Vehicle Following Steering is a mode that operates while driving in Adaptive Cruise Control (ACC) on a motorway, where the system recognizes the preceding vehicle and lane lines and assists the steering operations so that the vehicle is kept within the lane lines or following the preceding vehicle.

However, note that steering operation by the driver is required.



Block diagram



*1: Brake operation status, steering wheel angle recognition, yaw rate recognition, longitudinal G recognition, lateral G recognition, vehicle speed, forward and reverse judgment, VDC operating status, EPB status

*2: Brake control, brake light on, EPB control

*3: Adaptive Cruise Control (ACC) only

*4: Lane centering and preceding vehicle following steering only

Operation

■ Adaptive Cruise Control (ACC)

Constant speed driving	If there is no preceding vehicle in its own vehicle lane in front while in Adaptive Cruise Control (ACC), the vehicle is driven at a constant speed at the set vehicle speed.	
Settable vehicle speed	20 to 90 mph (30 to 145 km/h)	
Follow preceding vehicle driving	When a preceding vehicle is in its own vehicle lane in front, the vehicle is driven while automatically maintaining an appropriate vehicle distance with the set vehicle speed as the upper limit.	
Requiring more brake pedal force warning	During follow preceding vehicle driving, if the system judges that brake control may not be able to decelerate sufficiently to avoid a collision with the preceding vehicle, the driver is warned with the buzzer and a display in the combination meter.	
Half-stop	If the preceding vehicle stops while driving in Adaptive Cruise Control (ACC), the system's own vehicle also stops following from this. When the system judges that the stopped condition cannot be maintained, the Adaptive Cruise Control (ACC) is canceled and the electronic parking brake activates.	
Start reservation	If the preceding vehicle starts off within 3 seconds of a follow stop, the vehicle follows the preceding vehicle and starts off without needing to operate a switch.	
Cruise Control main status ON (settable status)	When the cruise switch is pressed, the Adaptive Cruise Control (ACC) enters the settable status.	
Start	Adjust to the target vehicle speed in the settable status, and press the RES/+ switch (when initially SET) or SET/- switch. • The vehicle speed when the switch is pressed becomes the set vehicle speed.	
Cancel	If the cruise switch is pressed once by the driver or the brake pedal is operated during operation, the set condition is canceled. If the system judges that normal control is not possible during operation, the set condition is automatically canceled.	
Restart	When the SET/- switch is pressed while the Adaptive Cruise Control (ACC) is in the ready status, the current vehicle speed is set within the settable vehicle speed range and control is restarted.	
Recovery	When the RES/+ switch is pressed while the Adaptive Cruise Control (ACC) is in the ready status, control recovers at the set vehicle speed that has been stored.	
Cruise Control main status OFF	Press the cruise switch while the control is canceled.	
Increase set vehicle speed	Press the RES/+ switch once	The set vehicle speed increases in 1 mph (1 km/h) increments each time the switch is pressed.
	Press and hold the RES/+ switch	The set vehicle speed increases in 5 mph (5 km/h) increments while the switch is held pressed.
	Depress the accelerator pedal	Depress the accelerator pedal, increase the vehicle speed to the level to be set, and press the SET/- switch. • The speed when the switch is pressed is reset as the set vehicle speed.

Decrease set vehicle speed	Press the SET/- switch once	The set vehicle speed decreases in 1 mph (1 km/h) increments each time the switch is pressed.
	Press and hold the SET/- switch	The set vehicle speed decreases in 5 mph (5 km/h) increments while the switch is held pressed.
	Depress the brake pedal	Depress the brake pedal, decrease the vehicle speed to the level to be set, and release the brake pedal. • When the brake pedal is depressed, the activated Cruise Control status is canceled temporarily. Press the SET/- switch. • The speed when the switch is pressed becomes the set vehicle speed.
Accelerate temporarily	Depress the accelerator pedal to accelerate. When the accelerator pedal is released, the vehicle speed returns to the set vehicle speed.	
Decelerate temporarily	Depress the brake pedal to decelerate. • When the brake pedal is depressed, the activated Cruise Control status is canceled temporarily. When the brake pedal is released and the RES/+ switch is pressed, the set vehicle speed before cancellation is set and the vehicle speed returns to the set vehicle speed.	
Adjust distance between vehicles setting	Set the distance level between the vehicle and the preceding vehicle during follow preceding vehicle driving by operating the distance between vehicles setting switch.	
Status notification	The driver is notified of the Cruise Control status, the presence of a preceding vehicle, the set vehicle speed, and the set distance between vehicles level by the Multi Information Display (MID).	

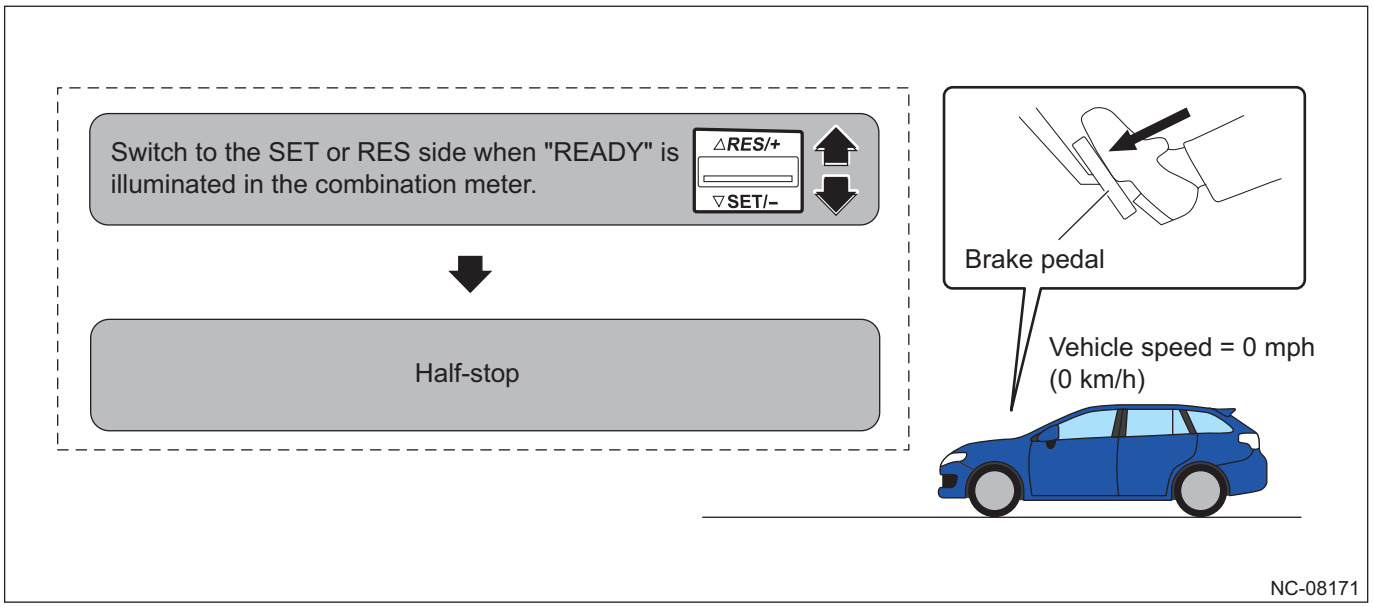
■ Settable conditions

The Adaptive Cruise Control (ACC) can be set (activated) while the vehicle is stopped by pressing the brake pedal.

If the control is set (activated) while the vehicle is stopped, the system transitions to half-stop. However, in order to secure fluid pressure necessary for the half-stop, the control cannot be set (activated) unless the brake pedal is firmly depressed.

It can be set (activated) even when the M range is used.

The control will be maintained even when the M range is selected during Adaptive Cruise Control.



Operation per situation

Status	Method
To set (activate) the control when the vehicle is stopped by the driver's brake operation from the Adaptive Cruise Control (ACC)	Since the system enters the half-stop if the control is set (activated) with the brake pedal depressed, the brake pedal can be released.
To set (activated) the control when the vehicle is stopped at the forefront of a line at red signal	

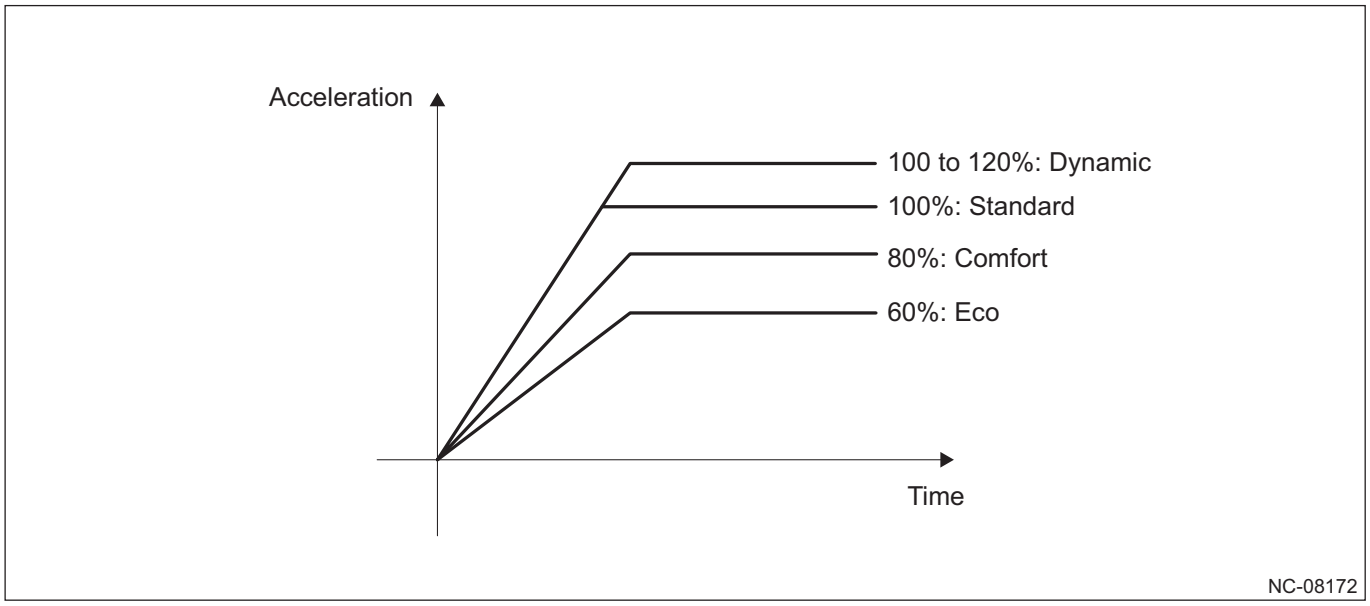
▮ Acceleration characteristics setting

The acceleration characteristics of the Cruise Control can now be switched in four levels by changing the setting using the customization function of the Center Information Display (CID). The acceleration mode can be selected according to preference and the driving conditions.

Acceleration characteristic

Level	Condition
Lv. 4 (Dynamic)	A mode for drivers preferring high acceleration. The maximum acceleration is 1.2 times the base (standard) value. Initial rise of the acceleration (jerk) is equivalent to standard.
Lv. 3 (standard) *Initial setting value	This is the standard setting.
Lv. 2 (comfort)	Maximum acceleration is 80 % of the standard.
Lv. 1 (eco)	A mode for drivers preferring low acceleration. Maximum acceleration is 60 % of the standard.

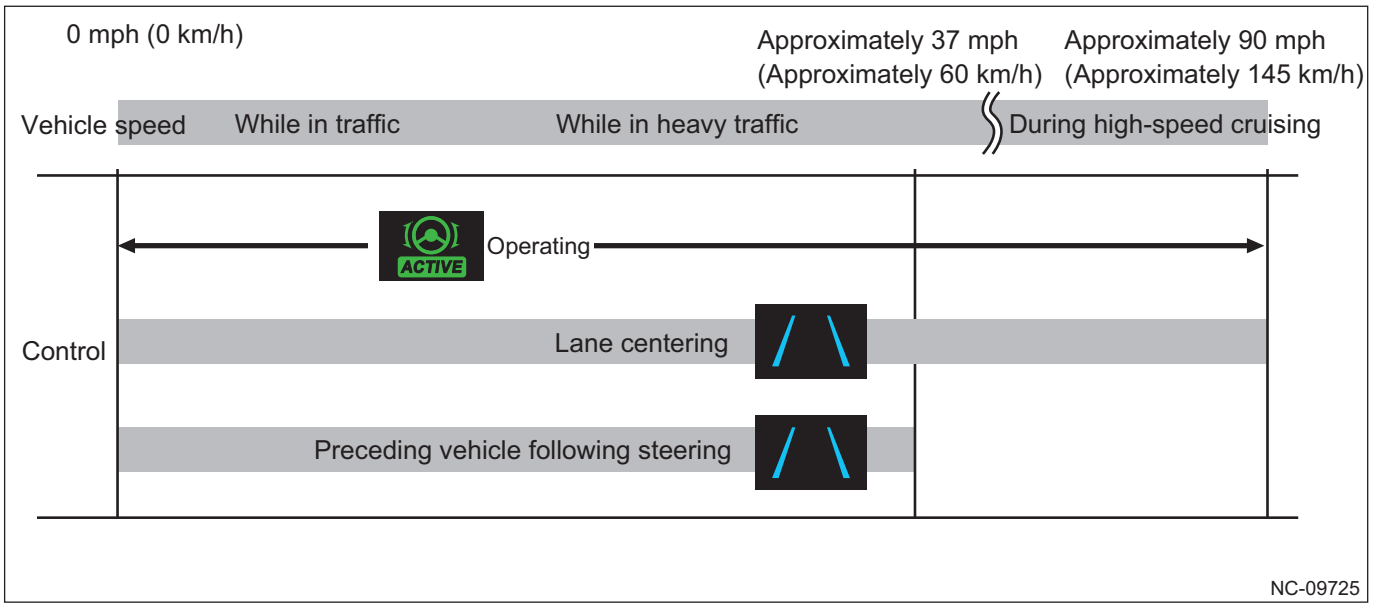
Acceleration characteristic chart



■ Lane Centering / Preceding Vehicle Following Steering

▮ Operation image

To assist the steering wheel operation over the whole speed range, the lane centering and the preceding vehicle following steering are automatically switched, or used in combination, depending on the vehicle speed and conditions.



▮ Operating conditions

Operation is started when the following is satisfied.

When using Adaptive Cruise Control (ACC)	Driving at the following speed • Approximately 0 to 90 mph (approximately 0 to 145 km/h).
When lane lines are recognized on both sides, or the preceding vehicle to be followed is recognized (Preceding vehicle following steering operates only at speeds of approximately 37 mph (approximately 60 km/h) or lower.)	The driver is operating the steering wheel.
Driving on a road with a lane width of approximately 10 to 15 ft (approximately 3 to 4.5 m) (Only applicable for Lane centering)	Driving straight or on a mild curve
Driving near the center of the lane (Only applicable for Lane centering)	Lane centering switch is ON

Display

**The illustration shows a typical example that may differ from the actual display.*

■ Indicator

Display	Description	Display	Description
NC-08174	Adaptive Cruise Control (ACC) indicator light • Green: Control in progress • White: Control standby state	NC-09876	Lane centering indicator light • White: Control standby state
NC-09877	Lane centering indicator light • Green: Control in progress	-	-

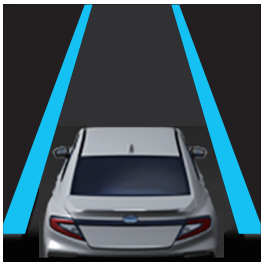
■ Alarm / warning / operating status

▮ Multi Information Display (MID)

Adaptive Cruise Control (ACC)

Display	Description	Display	Description
NC-08177	Preceding vehicle detected	NC-08178	Vehicle distance setting
NC-08179	Adaptive Cruise Control (ACC) • Notification when operation is canceled	-	-

Lane Centering / Preceding Vehicle Following Steering

Display	Description
 NC-08181	Lane Centering/Preceding Vehicle Following Steering is operating. • Lane lines are recognized and lane line icons (blue) turn on
NC-08182	Unoperated steering warning • While Lane Centering / Preceding Vehicle Following Steering is in operation, if the driver continues to drive without operating the steering wheel for approximately 13 seconds
NC-08183	Unoperated steering warning • While Lane Centering / Preceding Vehicle Following Steering is in operation, if the driver continues to drive without operating the steering wheel for a further 7 seconds after the above (total 20 seconds) (the warning buzzer also sounds)
NC-08184	Unoperated steering warning • While Lane Centering/Preceding Vehicle Following Steering is operating, and the driver continues to drive without operating the steering wheel for a further 25 seconds after the above (total 45 seconds) (the warning buzzer also sounds)* • Then, Lane Centering / Preceding Vehicle Following Steering is canceled
NC-08185	Departure avoidance request warning • While Lane Centering/Preceding Vehicle Following Steering is operating, and the system judges that vehicle steering control is insufficient and the vehicle will depart from the lane (the warning buzzer also sounds)* • The lane line icon in the direction of possible departure flashes in yellow
NC-08186	Lane Centering / Preceding Vehicle Following Steering • Notification when operation is canceled

**: The warning buzzer and warning screen display continue operating until the driver restarts steering operation*

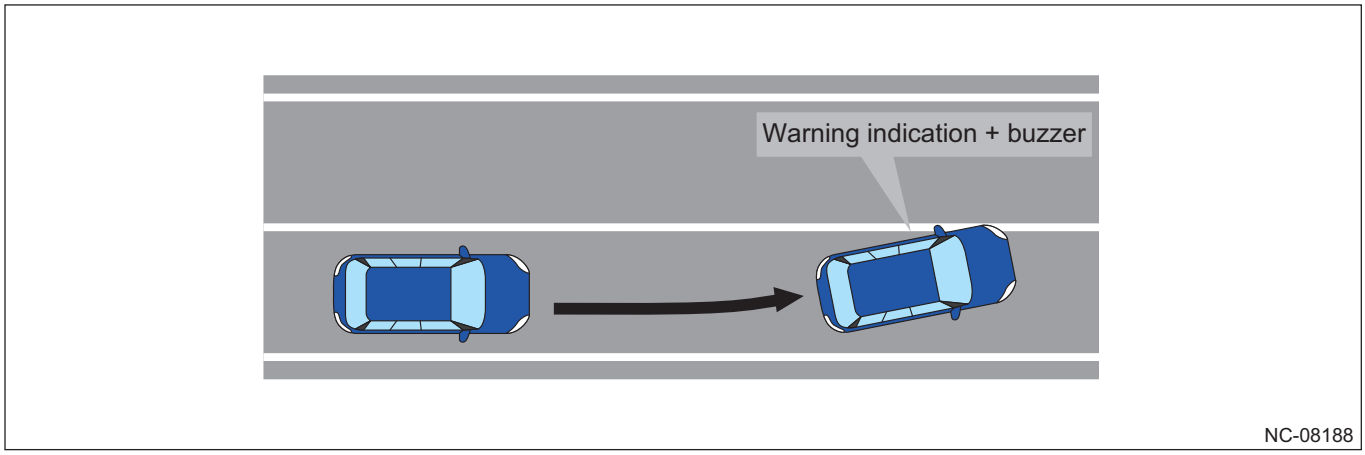
Center Information Display (CID)

Display	Description
 NC-08187	Unoperated steering warning • When Lane Centering / Preceding Vehicle Following Steering is in operation, the warning screen will also be displayed on the Center Information Display (CID) so that the information will be given to passengers as well.

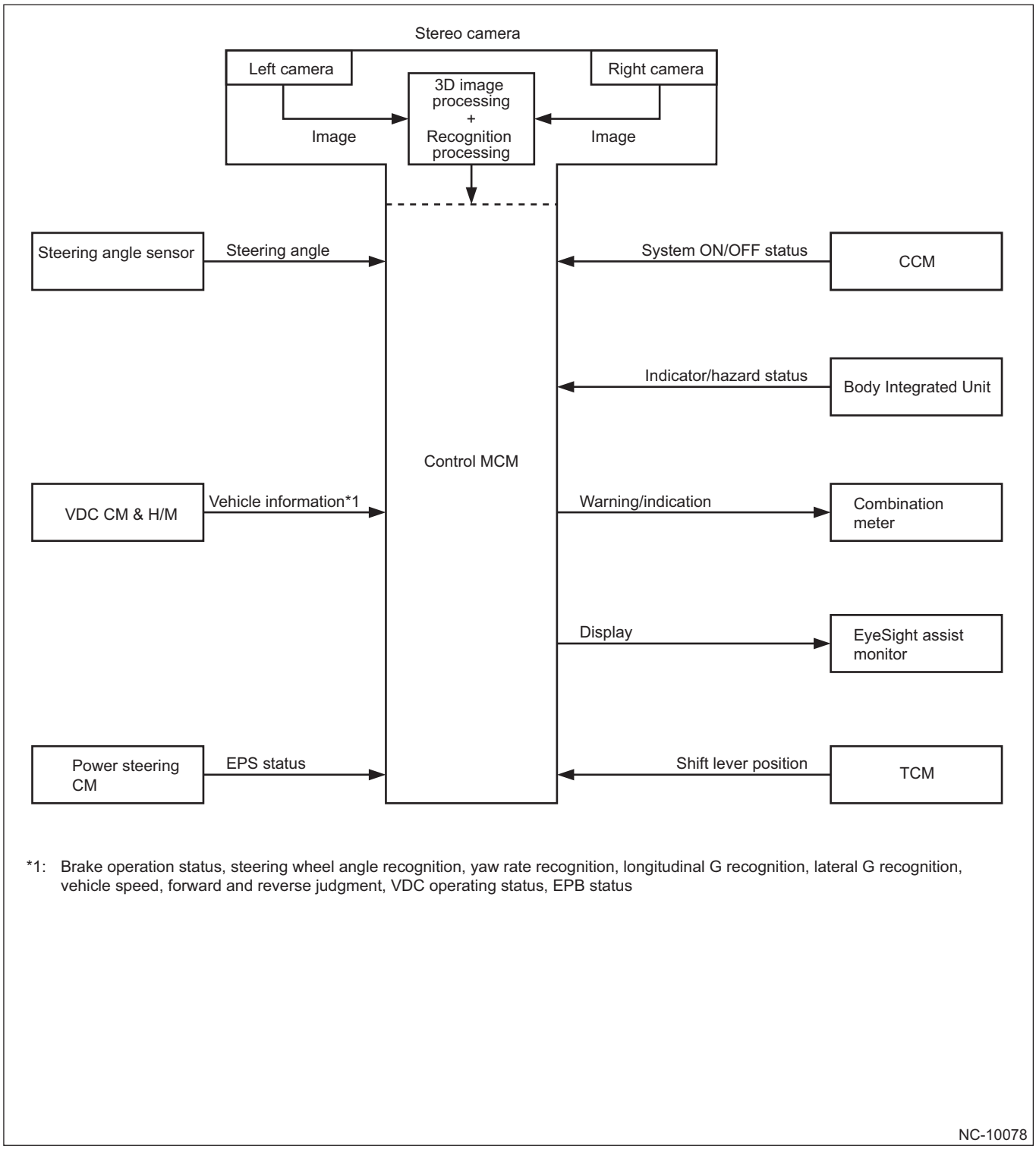
Lane Departure Warning

Overview

The white lines in front of the driver's vehicle are recognized by the stereo camera. The system judges the possibility of departure from the vehicle lane based on the position of the white lines, and the driver is warned using a display on the Multi Information Display (MID) and a buzzer.



Block diagram



*1: Brake operation status, steering wheel angle recognition, yaw rate recognition, longitudinal G recognition, lateral G recognition, vehicle speed, forward and reverse judgment, VDC operating status, EPB status

Operation

■ Operating conditions

Operation is started when the following is satisfied.

Driving at approximately 30 mph (approximately 50 km/h) or higher	Driving straight or on a mild curve
In Customize, "Lane departure prevention function" is set to "All ON" or "Warning buzzer only ON"	-

Display

**The illustration shows a typical example that may differ from the actual display.*

■ Indicator

Display	Description	Display	Description
NC-08190	Lane departure warning OFF indicator light	-	-

■ Alarm / warning / operating status

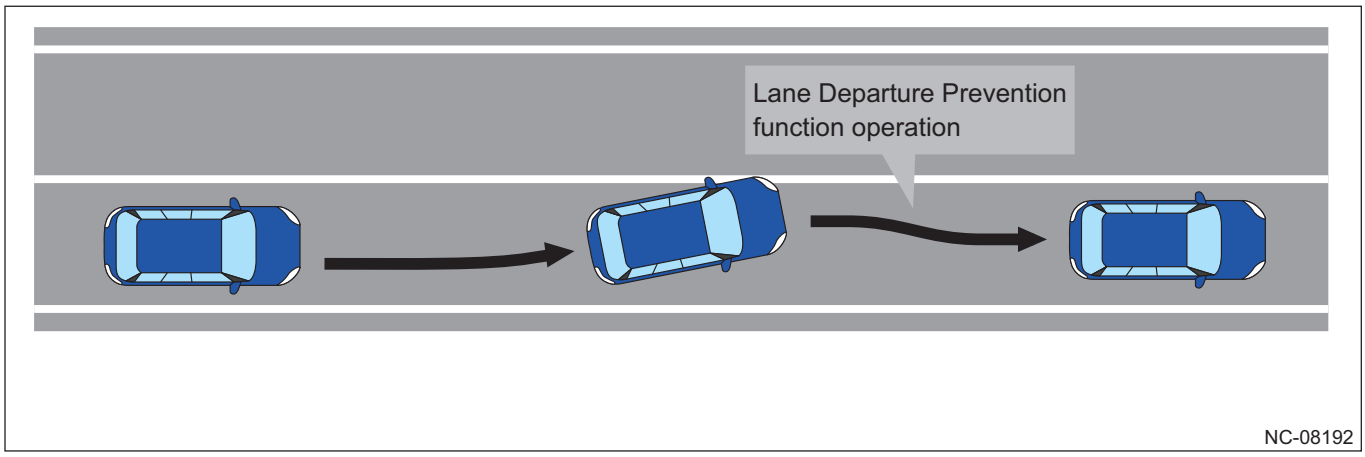
▮ Multi Information Display (MID)

Display	Description	Display	Description
NC-08191	Control in progress (lane line on control side flashes yellow, frame turns on (yellow))	-	-

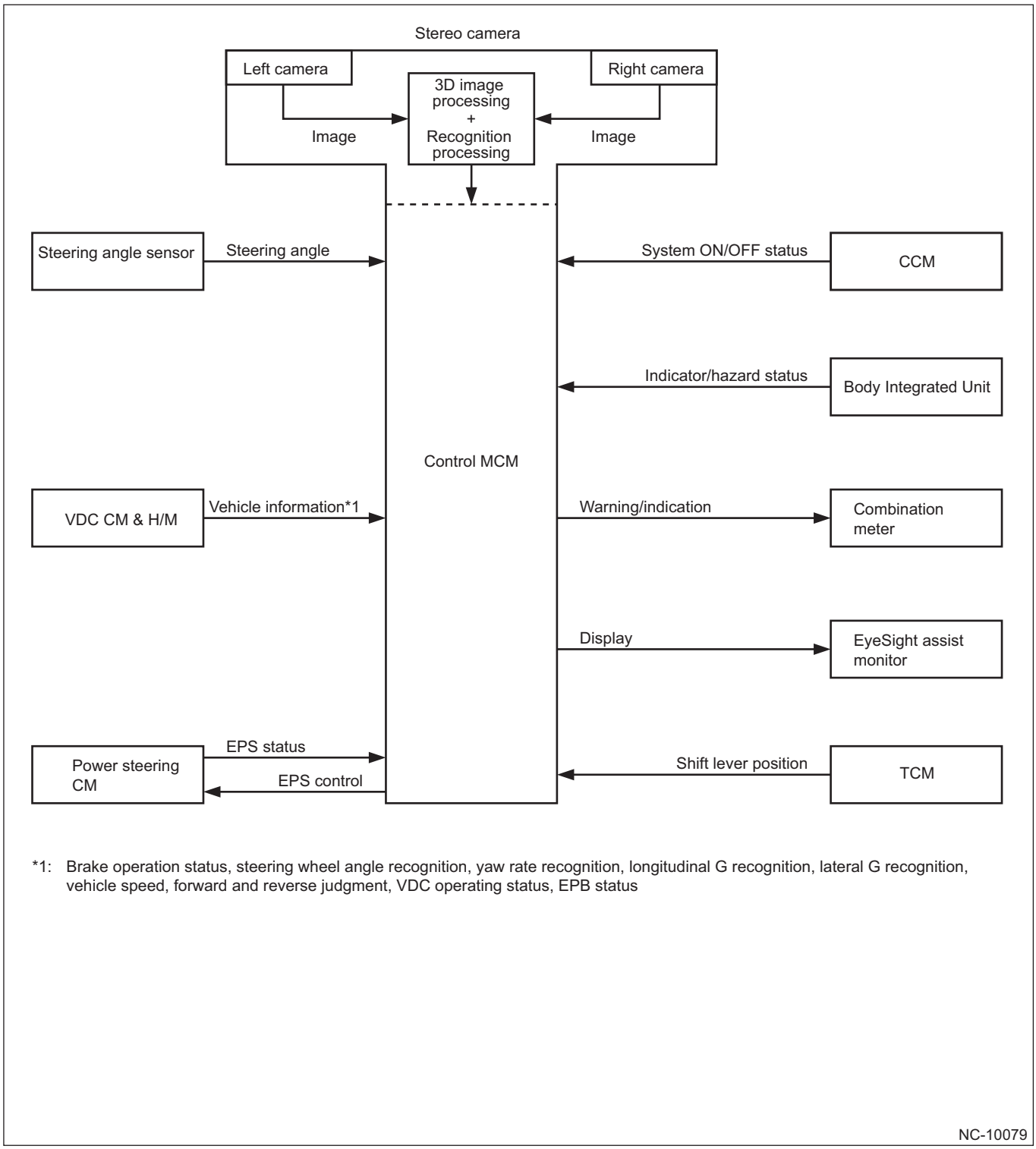
Lane Departure Prevention

Overview

If the system recognizes the lane lines and the vehicle is about to depart from the lane, then the system will assist the steering operation to the opposite direction to prevent departure from the lane.



Block diagram



*1: Brake operation status, steering wheel angle recognition, yaw rate recognition, longitudinal G recognition, lateral G recognition, vehicle speed, forward and reverse judgment, VDC operating status, EPB status

Operation

■ Operating conditions

Operation is started when the following is satisfied.

Driving at the following speed Lane Departure Prevention: • Approximately 37 to 90 mph (approximately 60 to 145 km/h)	Lane lines are recognized on both sides or one side.
Driving on a road with a lane width of approximately 10 to 15 ft (approximately 3 to 4.5 m)	Driving straight or on a mild curve
Driving near the center of the lane	In Customize, "Lane departure prevention function" is set to "All ON" or "Departure prevention only ON"

Display

**The illustration shows a typical example that may differ from the actual display.*

■ Alarm / warning / operating status

▮ Multi Information Display (MID)

Display	Description	Display	Description
 NC-08194	Lane Departure Prevention function: OFF • Lane lines not displayed	 NC-09730	Lane Departure Prevention function: ON • Lane lines displayed in gray (lane lines not recognized) • Lane lines displayed in white (lane lines recognized) • Lane lines on control side lit in yellow (lane lines recognized, control in progress)
 NC-08196	Lane Departure Prevention function • Notification when operation is canceled	-	-

Unoperated steering warning

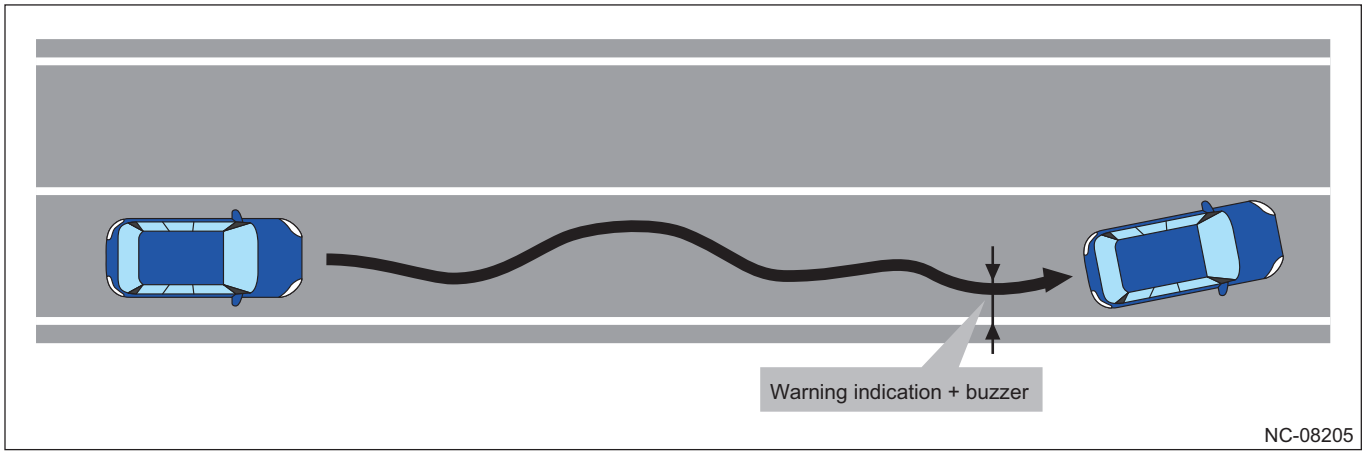
Display	Description
 NC-08197	Unoperated steering warning • If the Lane Departure Prevention control is performed with the steering wheel not being operated, and then if the driver has not been operating the steering wheel for approximately 7 seconds
 NC-08198	Long-period unoperated steering warning • If the Lane Departure Prevention control has been operating for approximately 10 seconds regardless of whether the steering wheel is operated (the warning buzzer also sounds)*
 NC-08199	Notification when operation is canceled • If the Lane Departure Prevention control is performed with the steering wheel not being operated, and then if the driver has not been operating the steering wheel for approximately 17 seconds

**: The warning buzzer and warning screen display continue operating until the driver restarts steering operation*

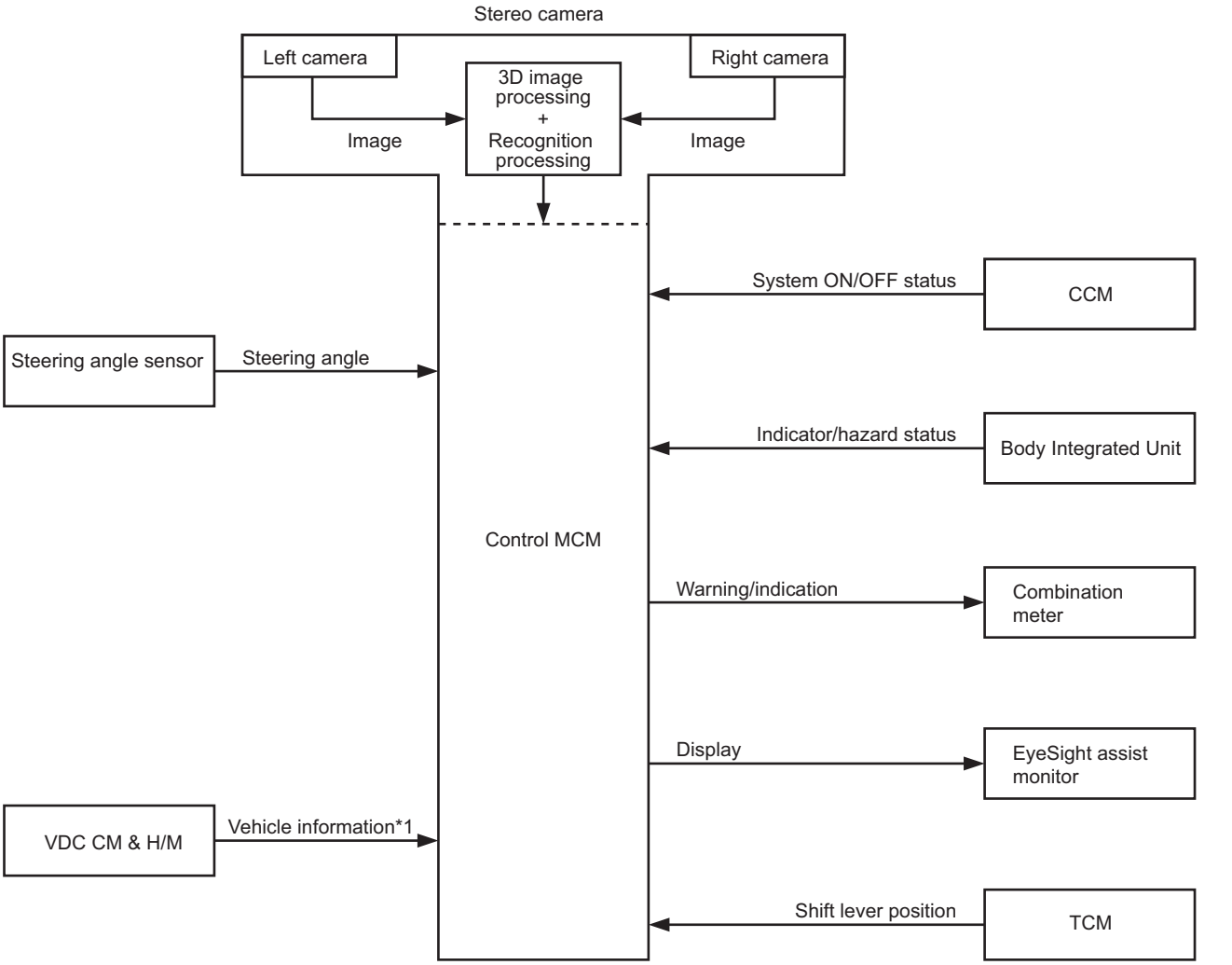
Lane Sway Warning

Overview

The white lines in front of the driver's vehicle are recognized by the stereo camera. The system judges swaying due to driver dozing or looking away based on the amount of deviation from the white line position, and the driver is warned using a display on the Multi Information Display (MID) and a buzzer.



Block diagram



*1: Brake operation status, steering wheel angle recognition, yaw rate recognition, longitudinal G recognition, lateral G recognition, vehicle speed, forward and reverse judgment, VDC operating status, EPB status

Operation

■ Operating conditions

Operation is started when the following is satisfied.

Driving at approximately 37 mph (approximately 60 km/h) or higher	Recognizes lane lines on both sides
Driving straight or on a mild curve	Driving on a road with a lane width of approximately 10 to 13 ft (approximately 3 to 4 m)
In Customize, "Lane departure prevention function" is set to "All ON" or "Warning buzzer only ON"	When Lane Centering/Preceding Vehicle Following Steering is not operating

Display

**The illustration shows a typical example that may differ from the actual display.*

■ Alarm / warning / operating status

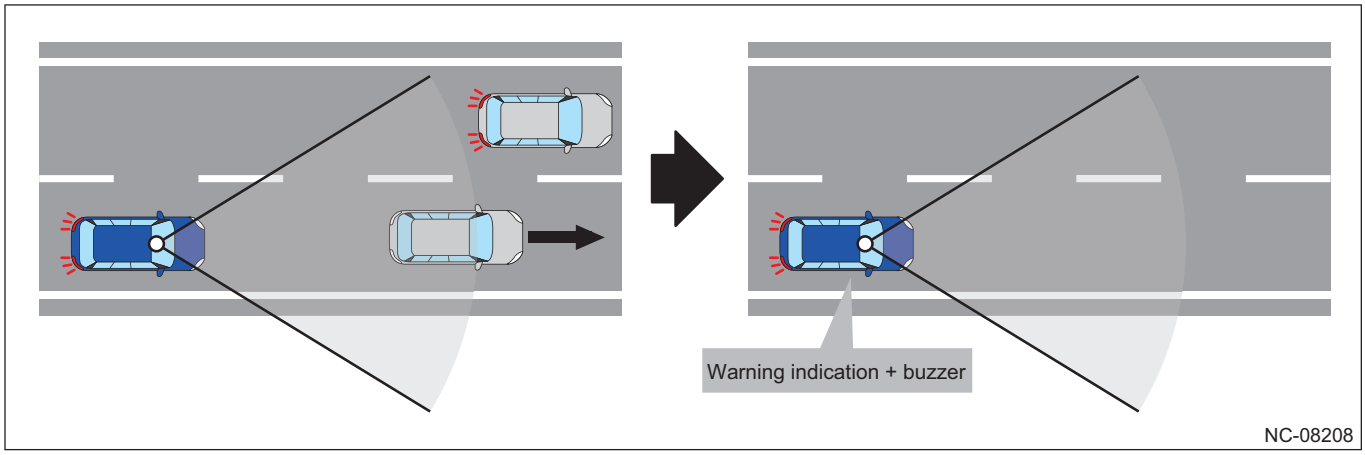
▮ Multi Information Display (MID)

Display	Description	Display	Description
NC-08207	Control in progress (left and right lane lines flash yellow alternately, frame turns on (yellow))	-	-

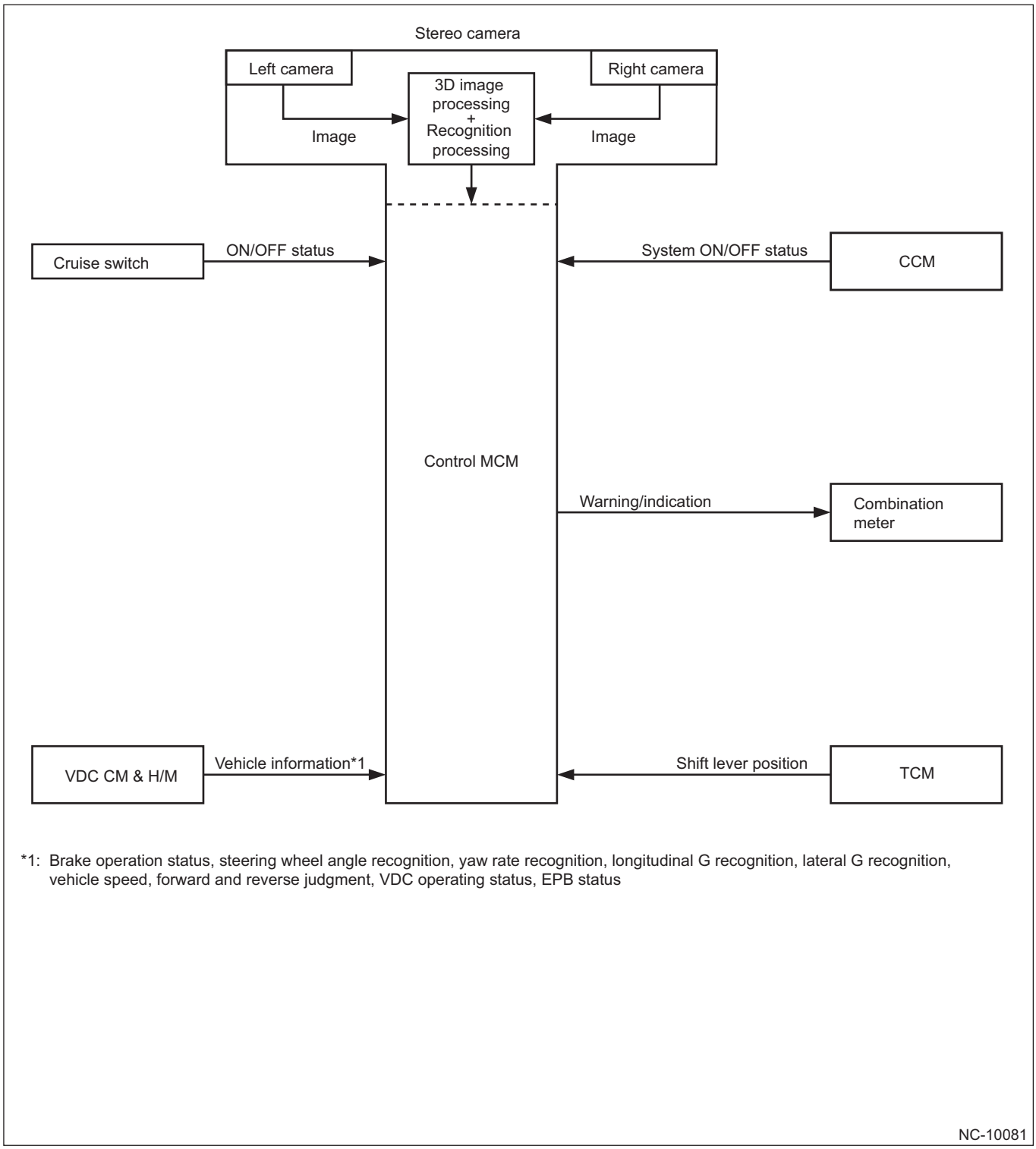
Lead Vehicle Start Alert

Overview

When a forward preceding vehicle is recognized by the stereo camera and the system's own vehicle that is following does not start off even though the preceding vehicle starts off, the driver is notified that the preceding vehicle has started off by using a display on the Multi Information Display (MID) and a buzzer sound.



Block diagram



*1: Brake operation status, steering wheel angle recognition, yaw rate recognition, longitudinal G recognition, lateral G recognition, vehicle speed, forward and reverse judgment, VDC operating status, EPB status

Operation

The function operates when the shift lever position is "D", "M", or "N".

1. When the vehicle stops following the preceding vehicle (own vehicle stops for a while with the vehicle distance within approximately 39 ft (approximately 12 m)), the stereo camera continues to recognize the preceding vehicle.

2. When the preceding vehicle starts off and travels approximately 13 ft (approximately 4 m) or more but the system's own vehicle does not start off, the driver is alerted via the buzzer and Multi Information Display (MID).

Display

**The illustration shows a typical example that may differ from the actual display.*

■ Alarm / warning / operating status

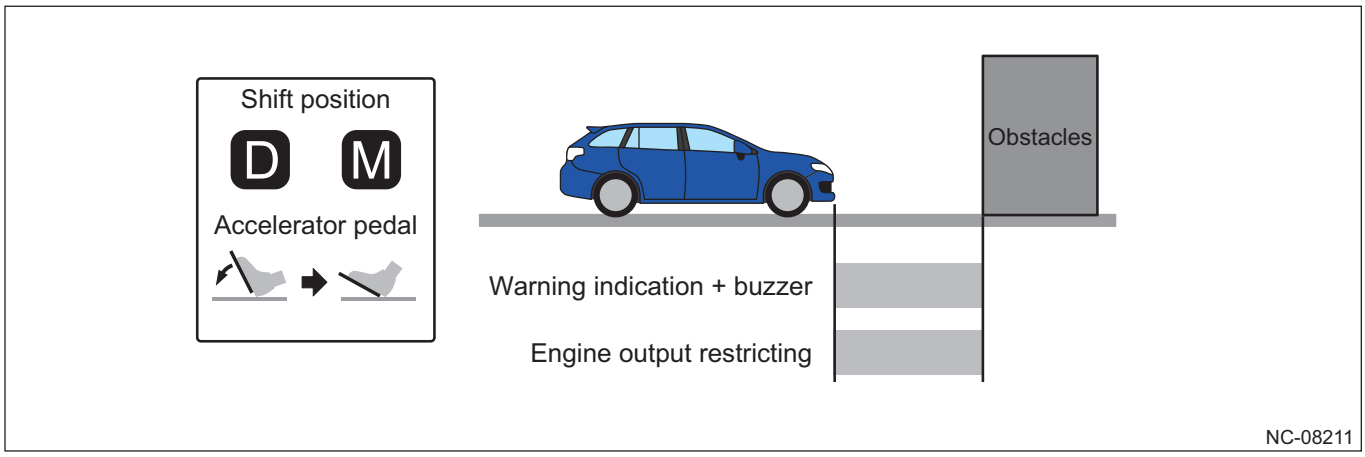
▮ Multi Information Display (MID)

Display	Description	Display	Description
NC-08210	Lead Vehicle Start Alert • When operated	-	-

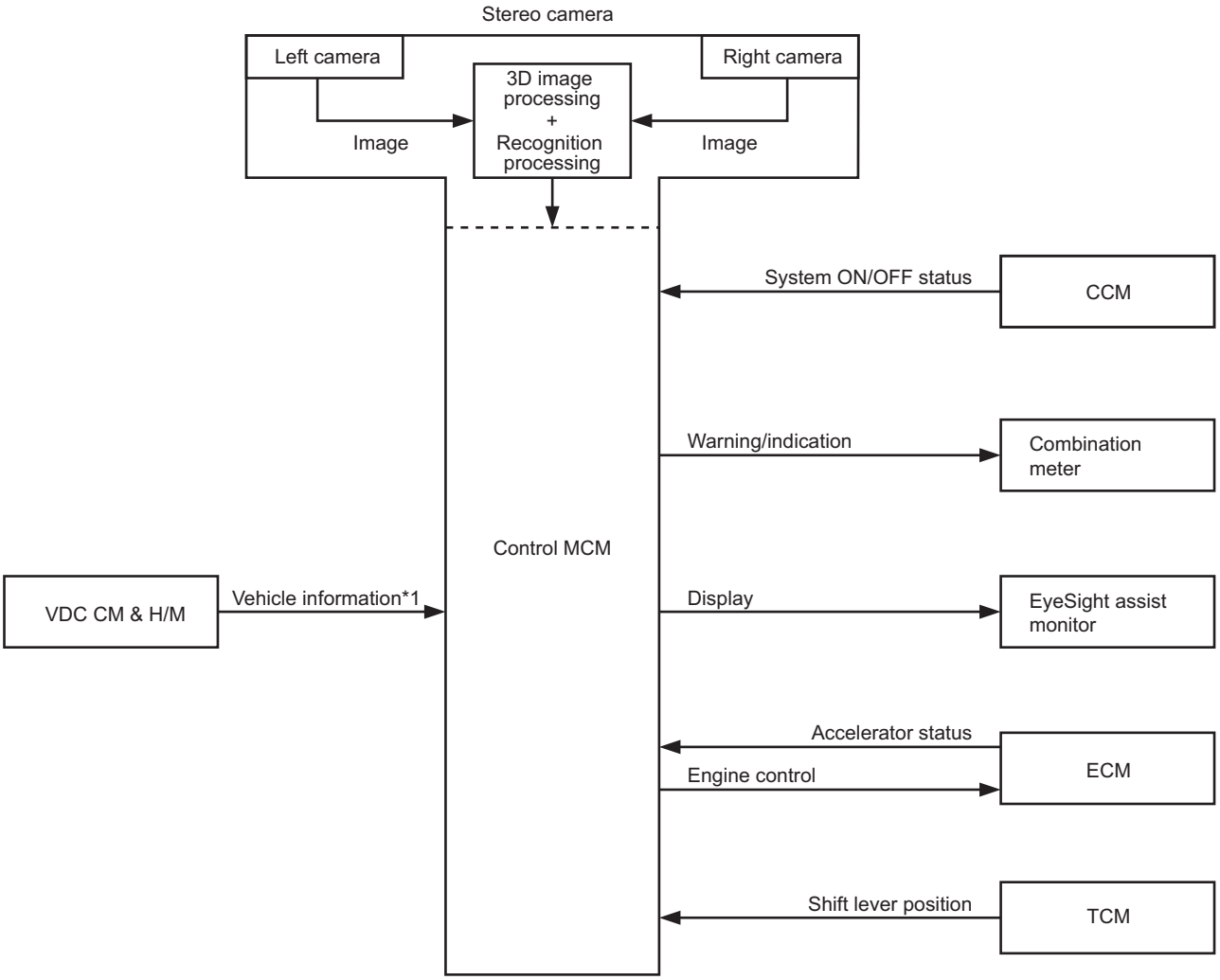
Pre-Collision Throttle Management

Overview

If the accelerator pedal is depressed more than necessary due to a mistaken pedal operation or other reason while a forward obstacle is present, the engine output is limited to slow the acceleration.



Block diagram



*1: Brake operation status, steering wheel angle recognition, yaw rate recognition, longitudinal G recognition, lateral G recognition, vehicle speed, VDC operating status, EPB status

NC-10082

Operation

The engine output is restricted to suppress forwarding movement together with warning the driver with warning display and warning buzzer, when the vehicle is in D range or M range and an obstacle in front of the vehicle is recognized by the EyeSight camera, and the system has determined that the accelerator pedal is depressed more than necessary by driver's mistake.

Display

**The illustration shows a typical example that may differ from the actual display.*

■ Alarm / warning / operating status

▮ Multi Information Display (MID)

Display	Description	Display	Description
NC-08164	Pre-Collision Throttle Management • When operated	-	-

Customization function

Selecting an item on the touch panel of the Center Information Display (CID) allows the driver to turn the functions ON/OFF and configure them.

Item		Setting
EyeSight	Pre-Collision Braking Setting	Setting ON / Setting OFF
	Lane Departure Prevention Function	All Functions / Lane Departure Prevention Function Only / Warning Buzzer Only / OFF
	Cruise Control Acceleration Characteristics	Lv.1 (Eco) / Lv.2 (Comfort) / Lv.3 (Standard) / Lv.4 (Dynamic)
	Lead Vehicle Acquisition Sound	ON/OFF
	Lead Vehicle Moving Monitor	ON/OFF
	Select Drive on Left / Drive on Right	Right Lane / Left Lane
EyeSight Assist Monitor	Red indicator	ON/OFF
	Yellow Indicator	ON/OFF
	Green Indicator	ON/OFF

12.3 Blind Spot Detection/Rear Cross Traffic Alert (BSD/RCTA)

12.3.1 Overview

** Blind Spot Detection/Rear Cross Traffic Alert (BSD/RCTA) is installed for some grades.*

To expand the preventive safety idea, the Blind Spot Detection/Rear Cross Traffic Alert is adopted to aim at full surrounding preventive safety. (Partly optional.)

The Blind Spot Detection/Rear Cross Traffic Alert (BSD/RCTA) is a collective term for blind spot vehicle detection (BSD), lane change assistance (LCA), and Rear Cross Traffic Alert (RCTA). The radar sensor installed at the rear of the vehicle detects vehicle behind.

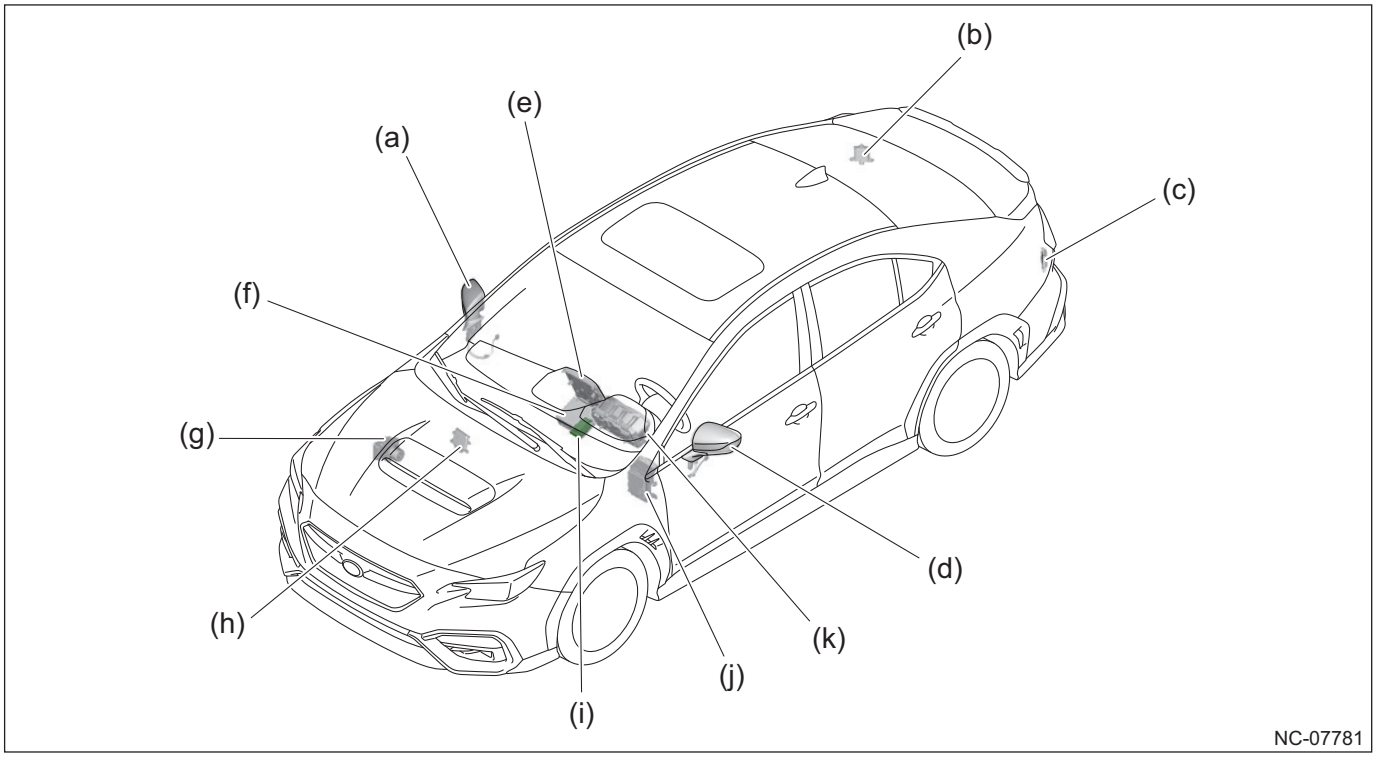
The system warns the driver with the BSD/RCTA approach indicator light (LED) on the door mirror or the warning buzzer from the combination meter.

This supports the "peace of mind and enjoyable driving" of the driver by calling attention and warning about the rear vehicle.

In order to "limit the movement of the driver's line of vision" and to "allow the mirror to function exclusively as a mirror", the BSD/RCTA approach indicator light (LED) is placed inside the door mirror. The BSD/RCTA OFF switch is placed on the Center Information Display (CID).

12.3.2 Component

Component layout drawing



(a) BSD/RCTA approach indicator light (outer mirror RH)
(b) Radar sensor (RH) (slave)
(c) Radar sensor (LH) (master)
(d) BSD/RCTA approach indicator light (outer mirror LH)
(e) BSD/RCTA OFF switch (Center Information Display (CID))
(f) Cockpit control module (CCM)
(g) VDC CM & H/M
(h) Transmission control module (TCM)
(i) Central gateway CM (CGW)
(j) Body Integrated Unit
(k) Combination meter

Component details

Main component functions

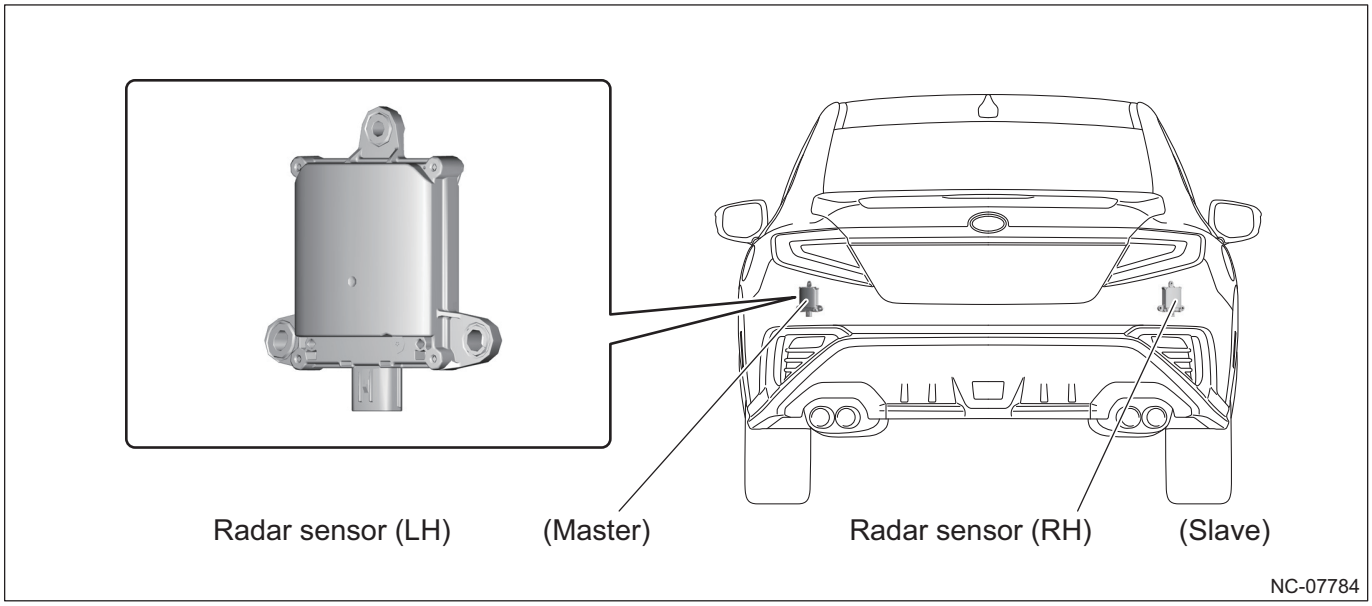
Component	Function
Central gateway CM (CGW)	Relays CAN communication between the control computers for the various devices installed in the vehicle.
Radar sensor (LH) (master) / (RH) (slave)	Recognizes vehicles in the rear direction and performs warning determination control. • The radar sensor (LH) (master) acquires the information required for control via CAN communication. • The radar sensor (LH) (master) and radar sensor (RH) (slave) communicate with each other while performing control. Drives the BSD/ RCTA approach indicator light directly according to the warning status.
Transmission control module (TCM)	Sends the shift lever position status to the radar sensor (LH) (master).
Cockpit control module (CCM)	Receives the system ON/OFF status from the Center Information Display (CID), and sends this information to the radar sensor (LH) (master).
BSD/RCTA OFF switch (Center Information Display (CID))	Sends the function ON/OFF status to the Cockpit Control Module (CCM).
Body Integrated Unit	Sends the lighting information to the radar sensor (LH) (master).
BSD/RCTA approach indicator light (outer mirror LH/RH)	The BSD/RCTA approach indicator light (outer mirror LH/RH) is operated according to the warning status of the radar sensor (LH) (master) and (RH) (slave).
VDC CM & H/M	Sends the vehicle speed, yaw rate, and steering angle information to the radar sensor (LH) (master).
Combination meter	Sends the indicator and lighting information to the radar sensor (LH) (master). Receives the RCTA alarm from the radar sensor (LH) (master) and sounds the warning buzzer.

Radar sensor

The radar sensors are attached with the vehicle body under the rear combination light via brackets, and each one of them is installed at both sides.

Each radar sensor detects vehicles on its installed side.

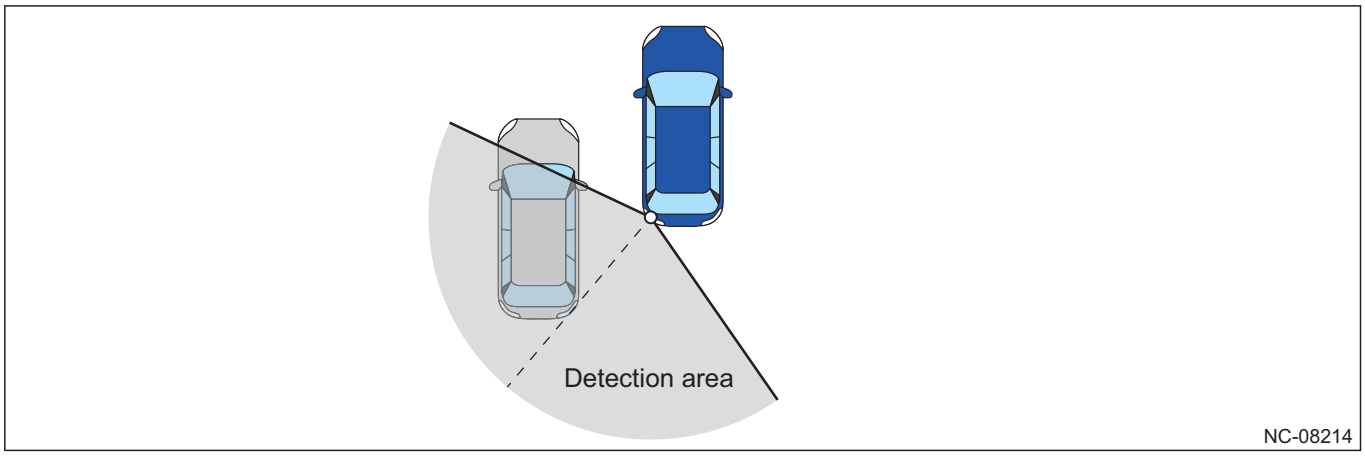
The radar sensors cannot also be seen from outside since they are covered with the rear bumper face.



Radar sensor specification

Detection distance	Approximately 230 ft (70 m)
Azimuth direction detection angle	±75°

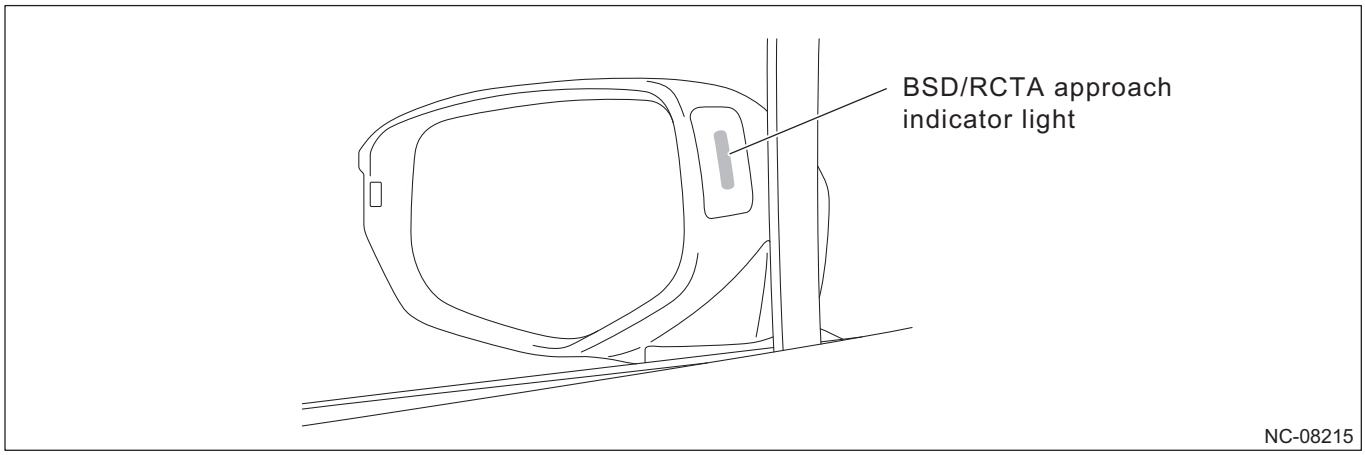
Radar sensor detection area (radar irradiation image)



**The illustration shows one side only.*

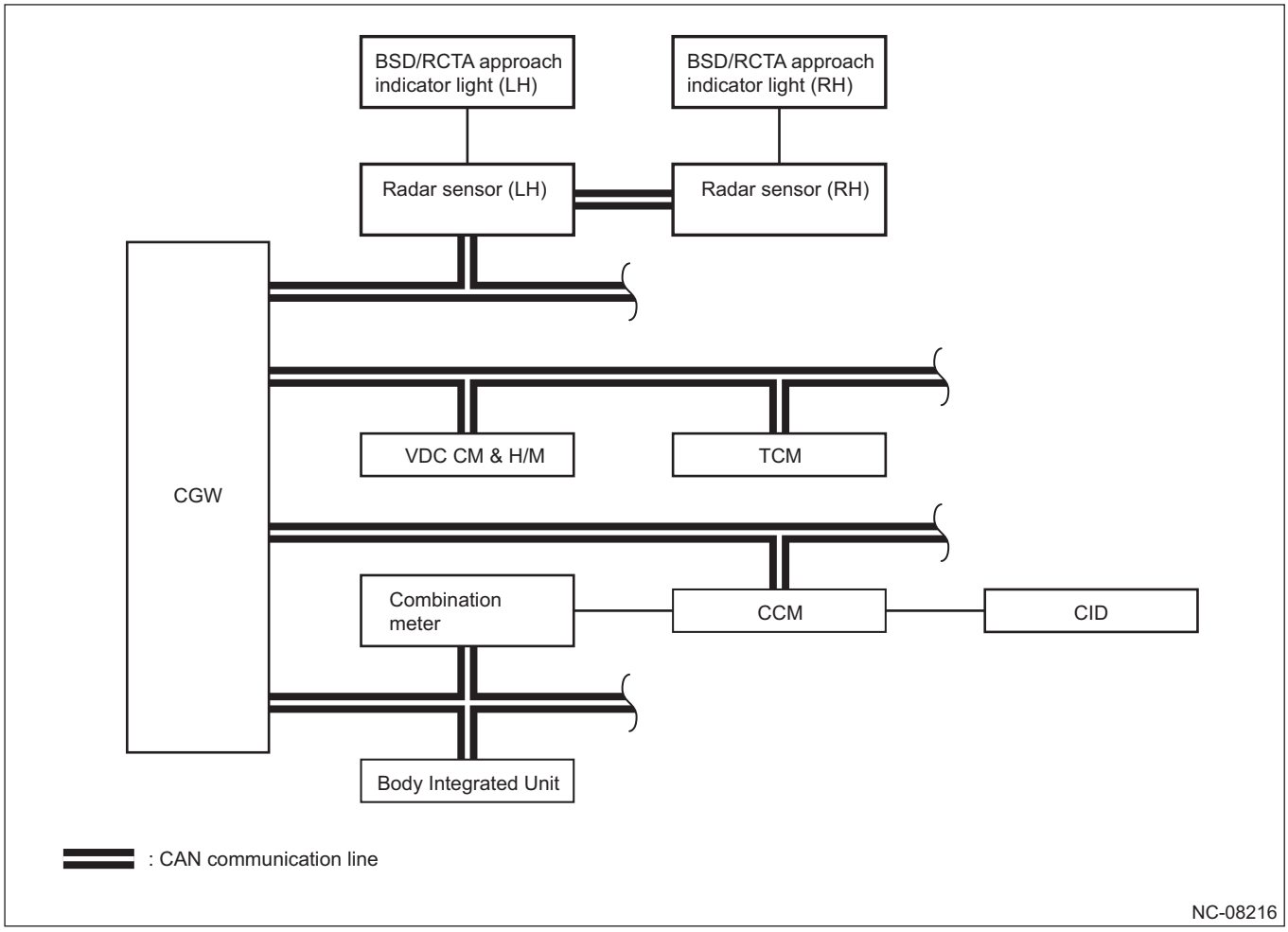
BSD/RCTA approach indicator light

Warning is issued without disrupting the movement of view when checking the rear side by illuminating/flashing the LED indicator set inside the outer mirror when there is a vehicle in the blind spot of the rear side.



12.3.3 Construction and Operation

System diagram



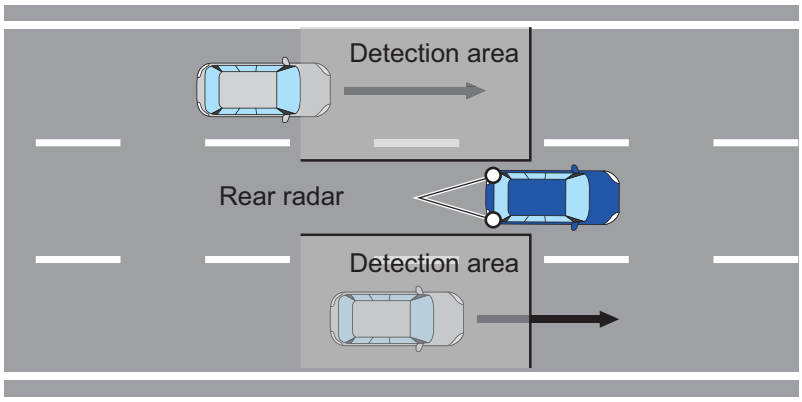
Blind spot vehicle detection (BSD)

Overview

This function warns the driver by illuminating the BSD/RCTA approach indicator light when it detects a (rear) vehicle in the blind spot created by the C pillar and the D pillar.

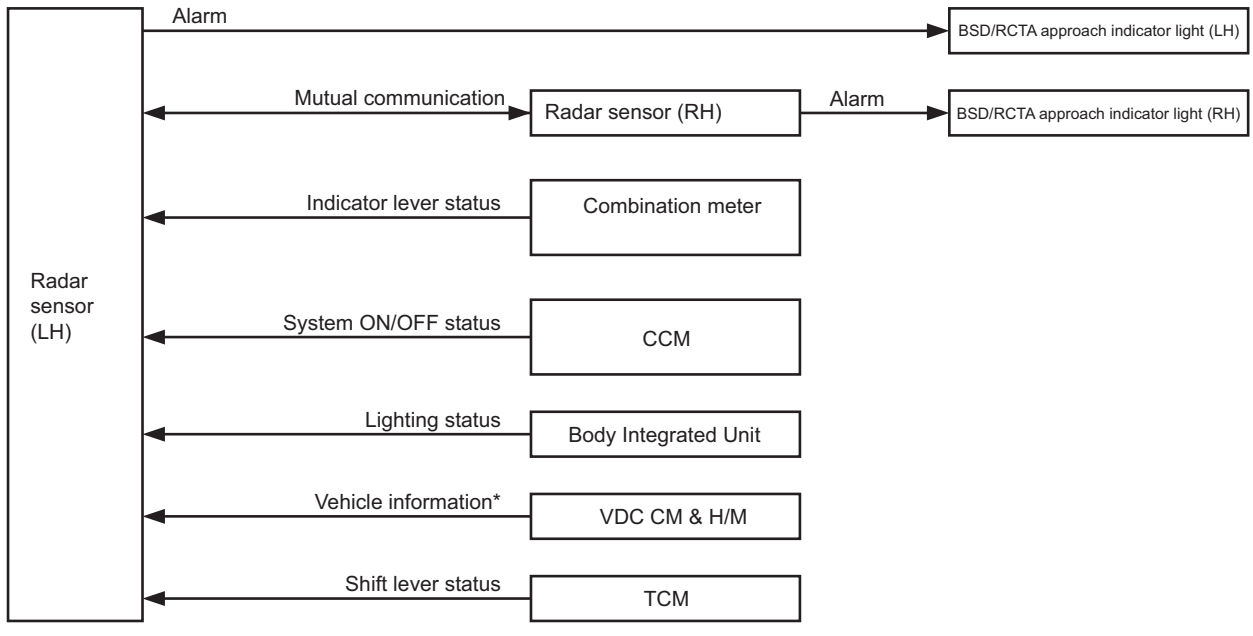
If the driver operates the turn light while a dangerous vehicle is detected, the system determines that the driver intends to change lanes and warns the driver by flashing the BSD/RCTA approach indicator light.

Control starts when the vehicle speed is approximately 7 mph (12 km/h) or higher.



NC-08217

Block diagram

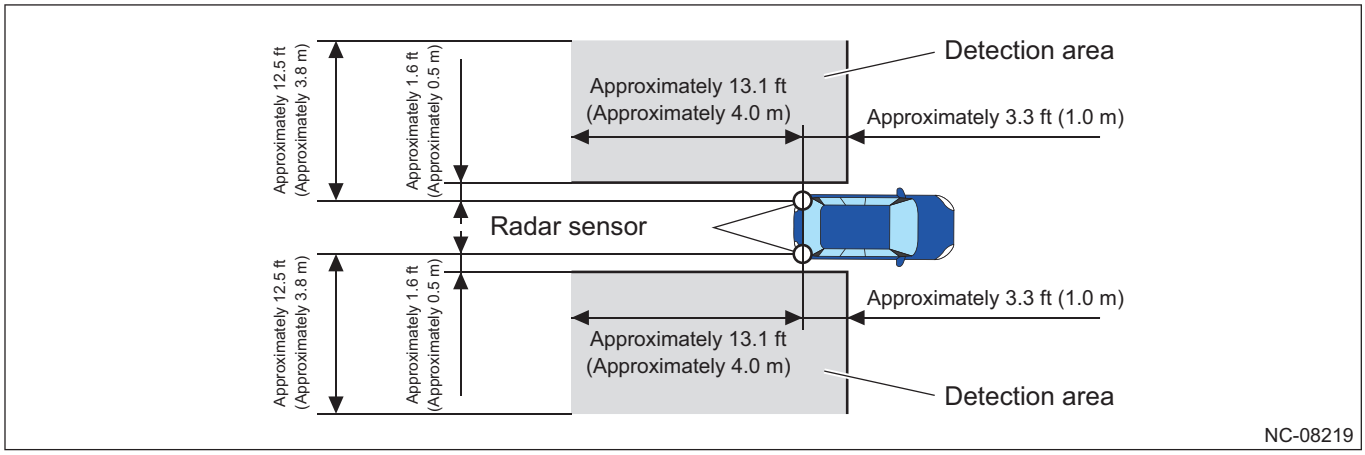


*: Vehicle speed, yaw rate recognition, steering wheel angle recognition

NC-09739

Operation

■ Detection area



■ Operating conditions

Operation is started when the following is satisfied.

BSD/RCTA function ON	When a dangerous vehicle is detected in the detection area
Vehicle speed is approximately 7 mph (12 km/h) or higher.	Shift lever is set to a position other than "R"

Display

**The illustration shows a typical example that may differ from the actual display.*

■ Indicator

Display	Description	Display	Description
NC-08220	BSD/RCTA OFF indicator light	NC-08221	BSD/RCTA warning light

Lane change assistance (LCA)

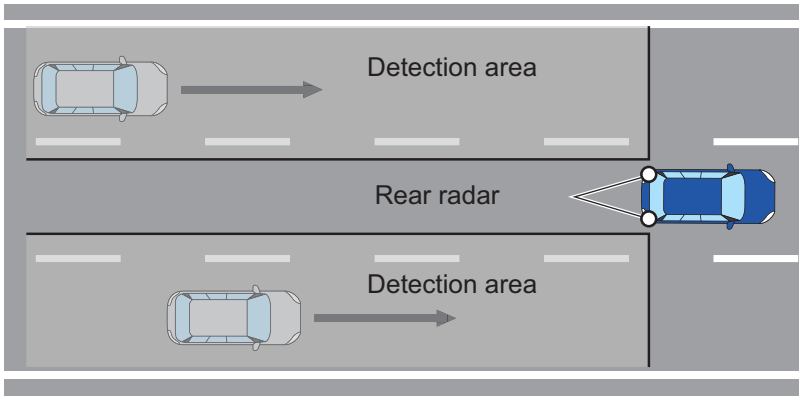
Overview

This function warns the driver by turning on the BSD/RCTA approach indicator light when there is a vehicle approaching from the rear in the neighboring lane and the system determines that there is a danger of collision if the driver changes lanes.

If the driver operates the turn light while a dangerous vehicle is detected, the system determines that the driver intends to change lanes and warns the driver by flashing the BSD/RCTA approach indicator light.

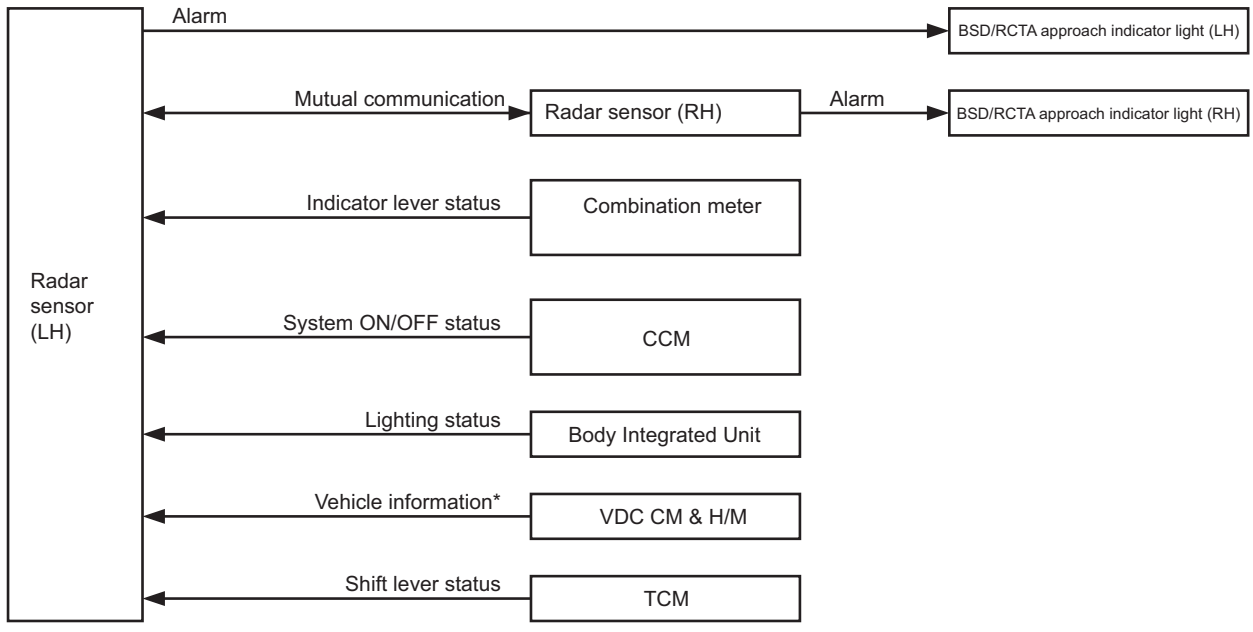
Control starts when the vehicle speed is approximately 6 mph (10 km/h) or higher.

- Vehicles in the neighboring lane approximately 230 ft (70 m) behind are detected.
- The vehicles with the predicted collision time of 4.0 seconds or less will be the target of warning.



NC-08222

Block diagram

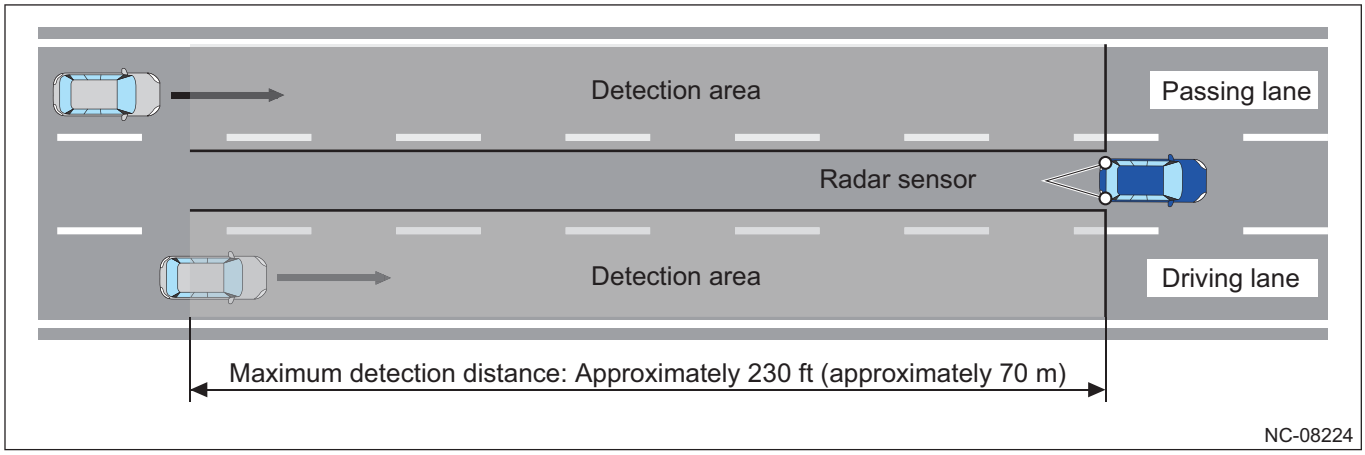


*: Vehicle speed, yaw rate recognition, steering wheel angle recognition

NC-09740

Operation

■ Detection area



■ Operating conditions

Operation is started when the following is satisfied.

BSD/RCTA function ON	When a dangerous vehicle is detected in the detection area
Vehicle speed is approximately 6 mph (10 km/h) or higher.	Shift lever is set to a position other than "R"

▮ Relationship between the relative speed difference and the distance with the target vehicle of warning

Relative speed difference	Distance
6 mph (10 km/h)	Within 36.4 ft (11.1 m)
12 mph (20 km/h)	Within 72.8 ft (22.2 m)
19 mph (30 km/h)	Within 109.3 ft (33.3 m)
25 mph (40 km/h)	Within 145.7 ft (44.4 m)

Display

**The illustration shows a typical example that may differ from the actual display.*

■ Indicator

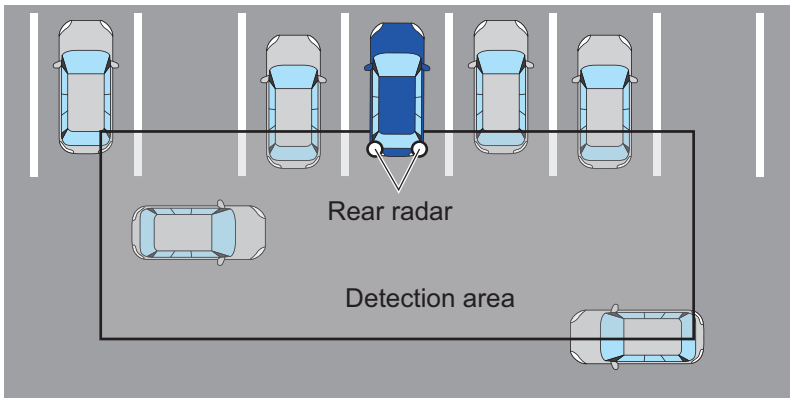
Display	Description	Display	Description
NC-08220	BSD/RCTA OFF indicator light	NC-08221	BSD/RCTA warning light

Rear Cross Traffic Alert (RCTA)

Overview

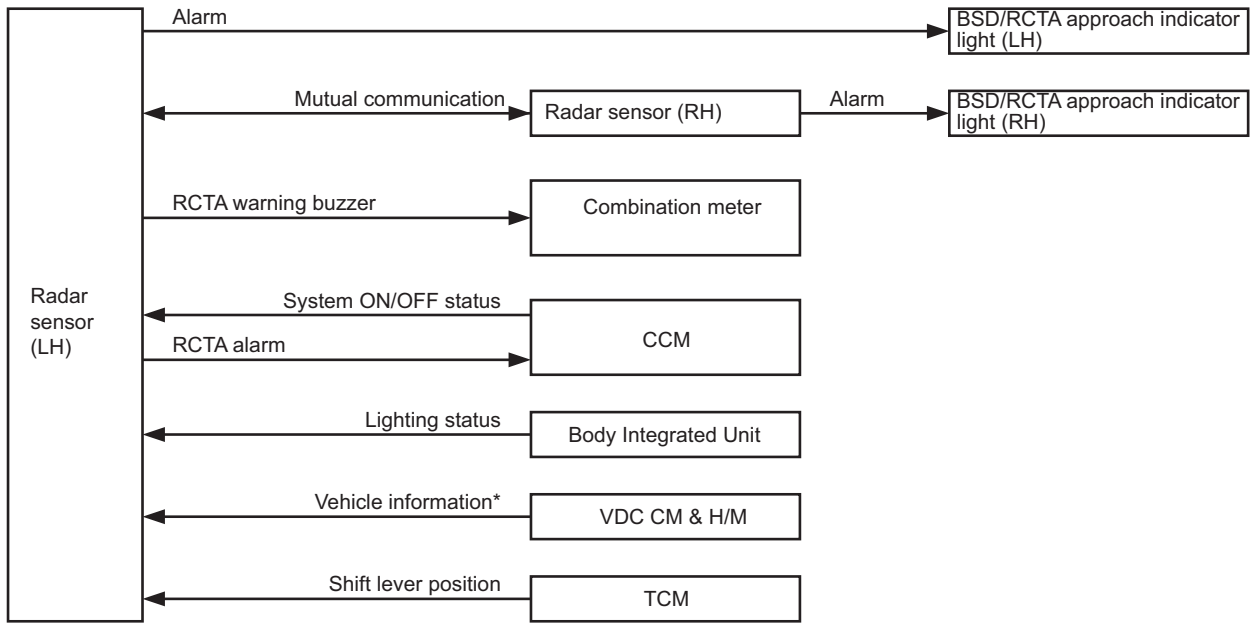
This function warns the driver by flashing the BSD/RCTA approach indicator light and sounding the warning buzzer when there is cross-traffic approaching from the left or right when the vehicle is reversing and the system determines that there is the danger of collision.

The vehicle that may collide within 3.5 seconds will be the target of warning.



NC-08225

Block diagram

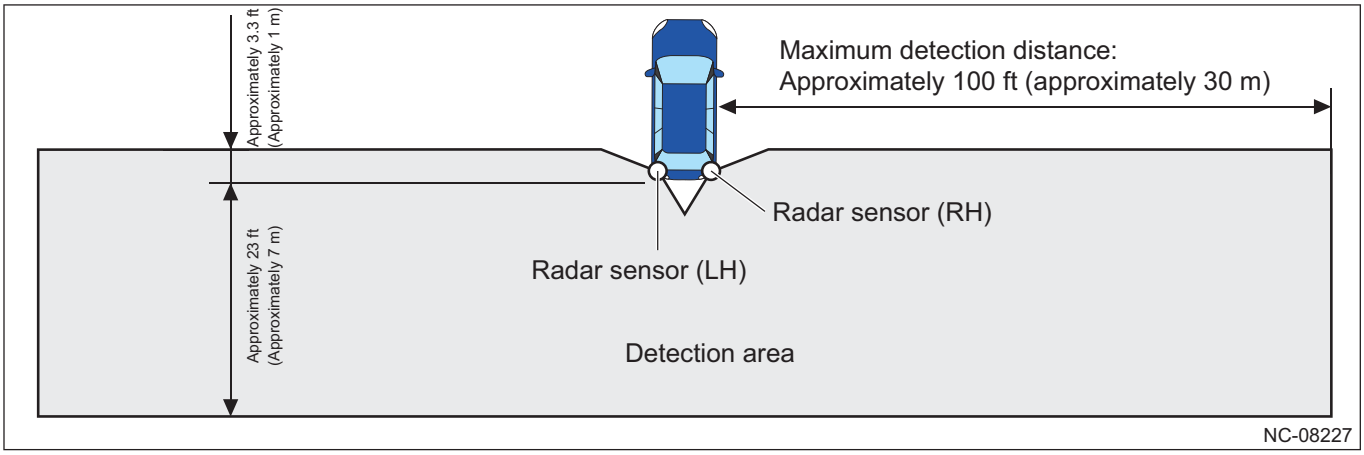


*: Vehicle speed, yaw rate recognition, steering wheel angle recognition

NC-09741

Operation

■ Detection area



■ Operating conditions

Operation is started when the following is satisfied.

BSD/RCTA function ON	When a dangerous vehicle is detected in the detection area
Shift lever position "R"	-

Display

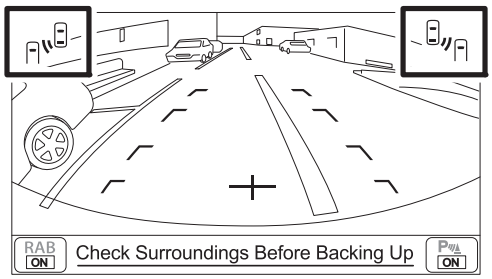
**The illustration shows a typical example that may differ from the actual display.*

■ Indicator

Display	Description	Display	Description
NC-08220	BSD/RCTA OFF indicator light	NC-08221	BSD/RCTA warning light

■ Alarm / warning / operating status

▮ Center Information Display (CID)

Display	Description
 NC-08228	RCTA alarm in progress

Customization function

Selecting an item on the touch panel of the Center Information Display (CID) allows the driver to turn the functions ON/OFF and configure them.

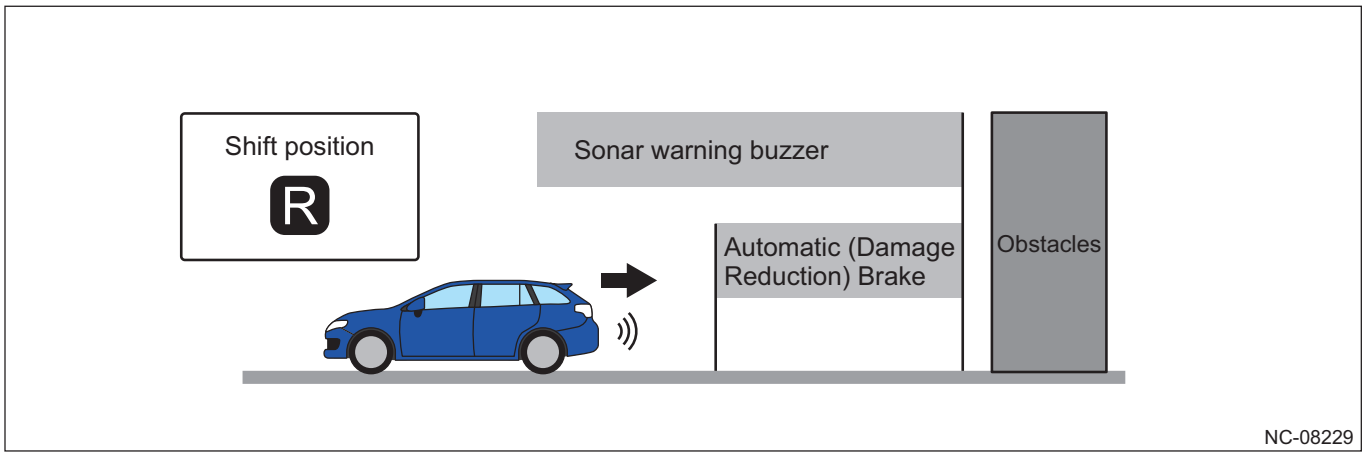
Item	Setting
BSD/RCTA	ON/OFF

12.4 Reverse Automatic Braking

12.4.1 Overview

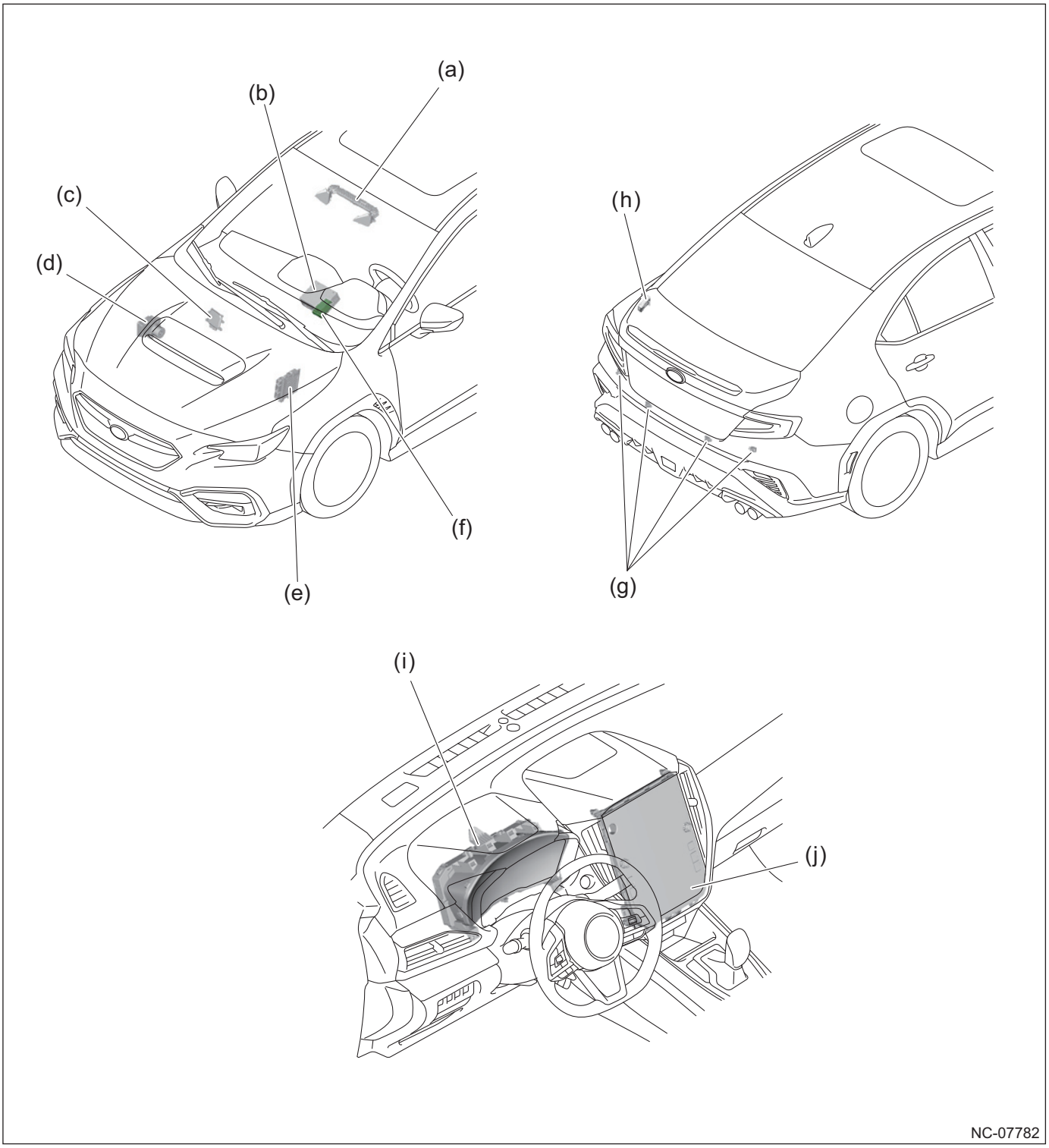
** Reverse Automatic Braking is installed for some grades.*

The Reverse Automatic Braking consists of "sonar warning buzzer" and "automatic (damage reduction) brake", and supports accident prevention during reversing by using a warning indication, warning buzzer, and automatic braking against an obstacle at the rear.



12.4.2 Component

Component layout drawing



(a) Stereo camera
(b) Cockpit Control Module (CCM)
(c) Transmission control module (TCM)
(d) VDC CM & H/M
(e) Engine control module (ECM)
(f) Central gateway CM (CGW)
(g) Sonar sensor
(h) Sonar CM
(i) Combination meter
(j) Center Information Display (CID)

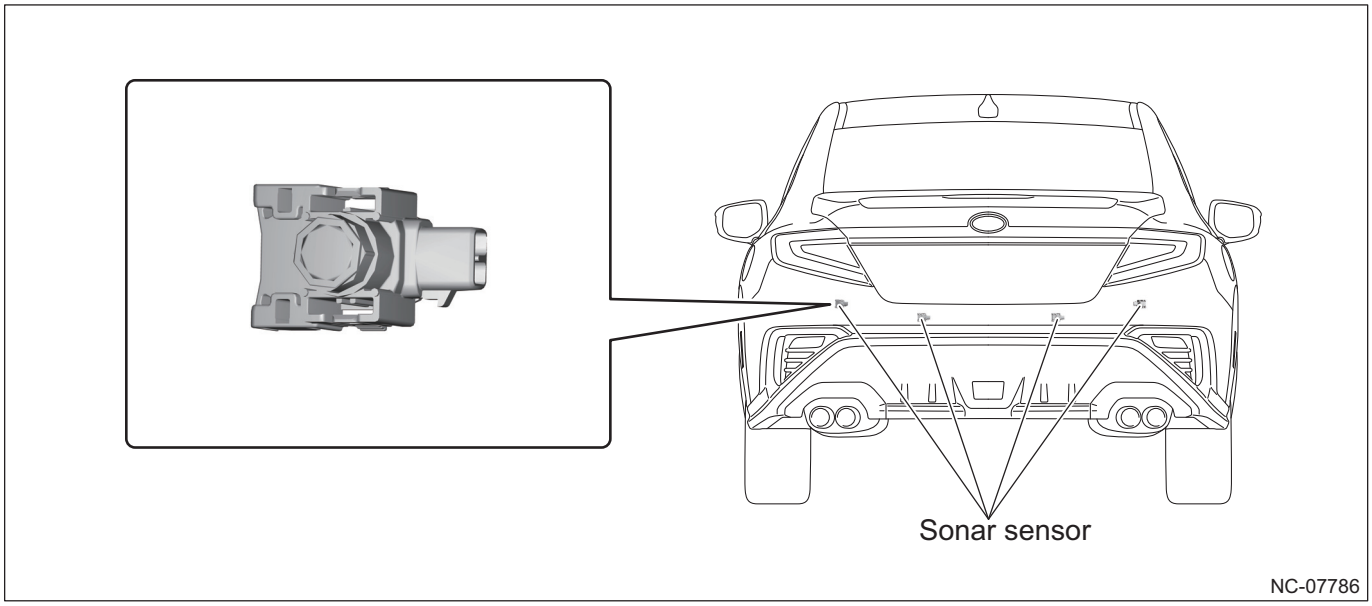
Component details

Main component functions

Component	Function
Stereo camera	Sends control permission signals to the sonar CM. Sends signals for control, alarms, warnings, etc. from the sonar CM to each computer or actuator.
Sonar CM	Receives signals from the sonar sensor and each computer, and performs calculations. After calculation, it sends signals for control, alarms, or warnings, etc. to the stereo camera.
Sonar sensor	Measures the distance to objects to the rear of the vehicle. Sends the vehicle rear object recognition status to the sonar CM.
Engine Control Module (ECM)	Sends the engine status (accelerator status) to the sonar CM. Receives engine control signals from the stereo camera and controls the engine.
Transmission control module (TCM)	Sends the shift lever position to the sonar CM.
VDC CM & H/M	Sends the vehicle speed to the sonar CM. Receives brake control, brake light on, and EPB control signals from the stereo camera and controls each of these.
Combination meter	Receives the warning, alarm, and system ON/OFF status from the stereo camera and displays each of these.
Cockpit control module (CCM)	Receives the system ON/OFF status from the Center Information Display (CID), and sends this information to the sonar CM. Receives the warning instructions from the stereo camera and controls the Center Information Display (CID).
Center Information Display (CID)	Sends the function ON/OFF status to the cockpit CM. Displays the warning alarm for the vehicle rear based on the warning instructions from the stereo camera.

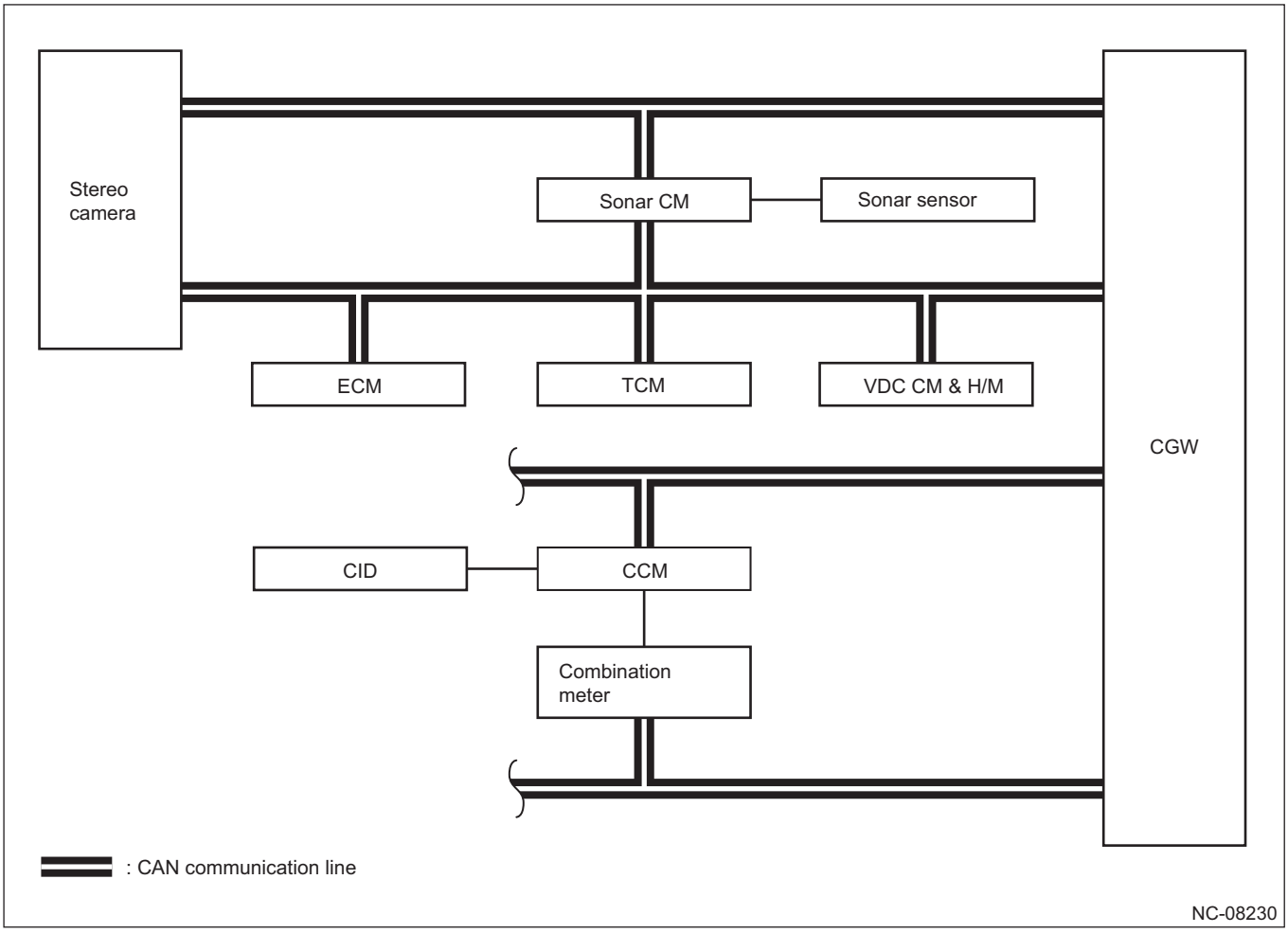
Sonar sensor

The sonar sensor measures the distance to objects to the rear of the vehicle.



12.4.3 Construction and Operation

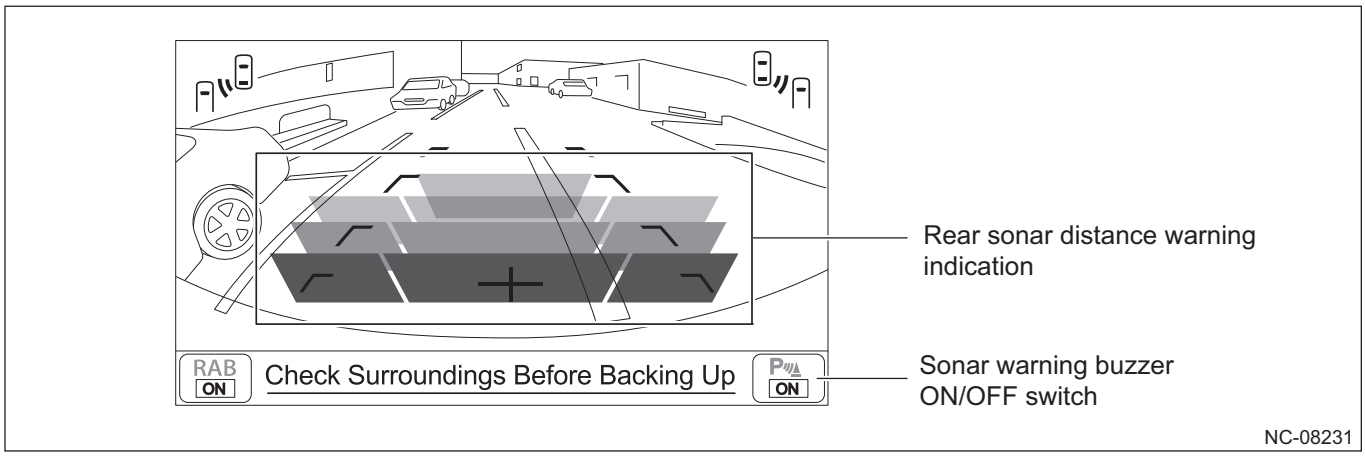
System diagram



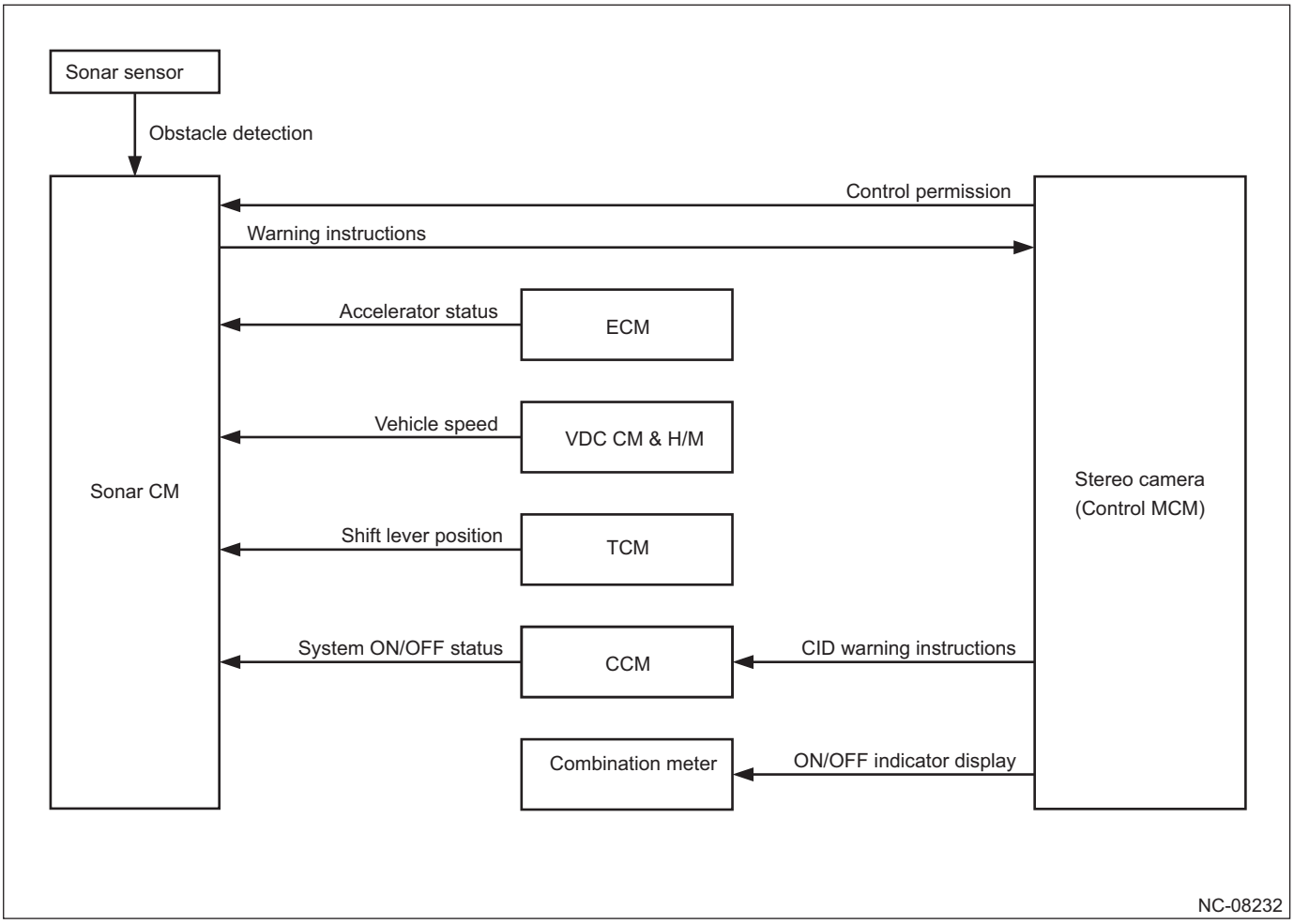
Sonar warning buzzer

Overview

If the sonar sensors detect an obstacle behind the vehicle, a warning indication corresponding to the distance from the obstacle will be displayed on the rear camera image to alert the driver in an intuitive and easy-to-understand manner.



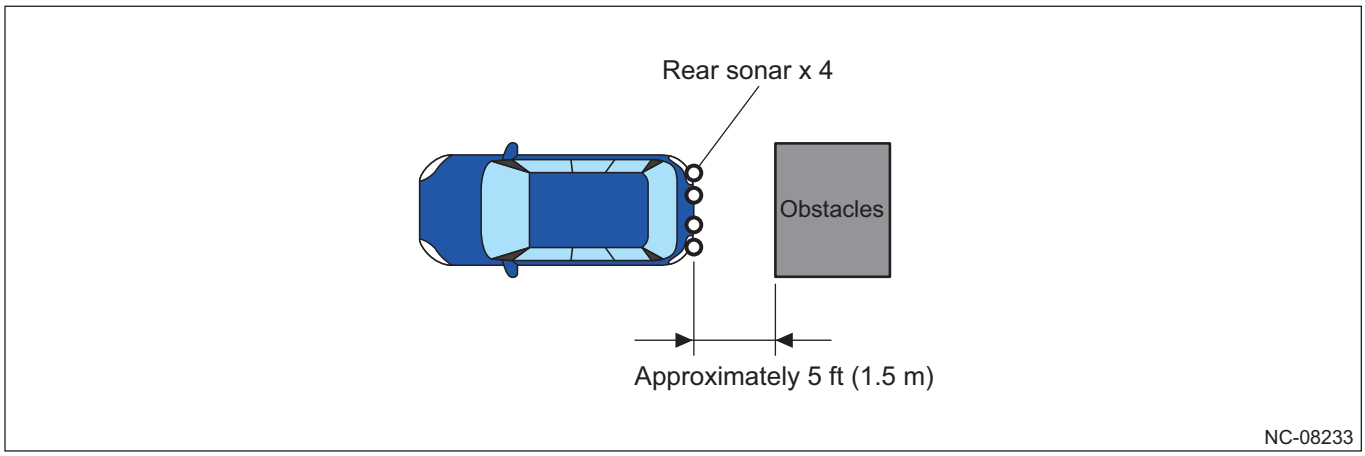
Block diagram



Operation

■ Detection area

An obstacle in the detection range of approximately 5 ft (approximately 1.5 m) from the bumper in the rear can be detected.



■ Operating conditions

Operation is started when the following is satisfied.

Sonar warning buzzer function ON	Shift lever position "R"
Reversing at a speed lower than approximately 9 mph (approximately 15 km/h)	-

Display

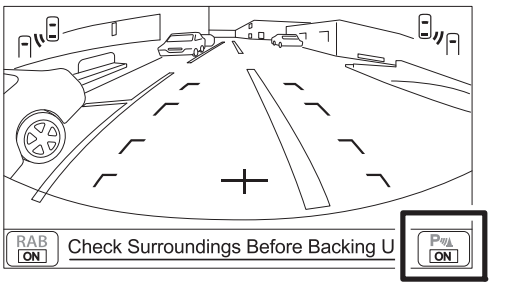
**The illustration shows a typical example that may differ from the actual display.*

■ Indicator

Display	Description	Display	Description
NC-08234	Sonar warning buzzer OFF indicator light	-	-

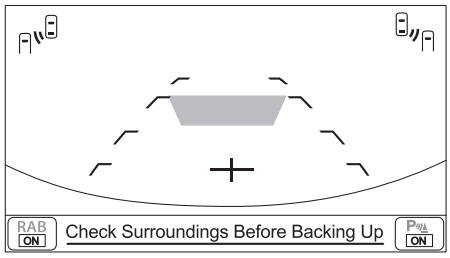
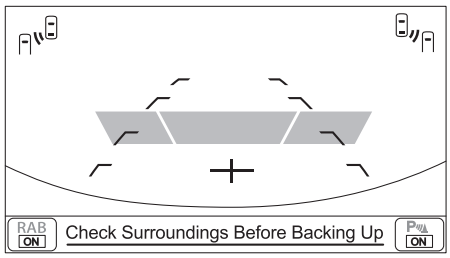
■ Alarm / warning / operating status

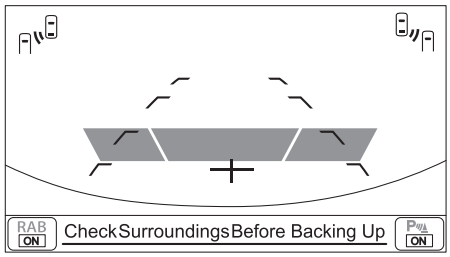
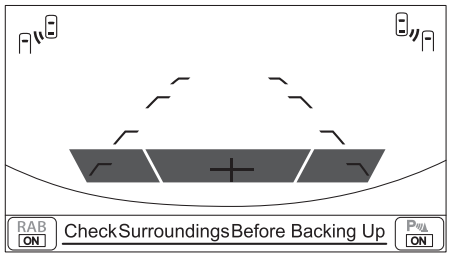
▮ Center Information Display (CID)

Display	Description
 NC-08235	Sonar warning buzzer ON/OFF switch

▮ Warning buzzer pattern

Depending on the distance between the rear of the vehicle and the obstacle, four warning indication patterns can be displayed so that the position and color of the indication will help the driver understand the situation intuitively. In addition, three warning sound patterns are used to notify the driver of the approximate distance to the obstacle.

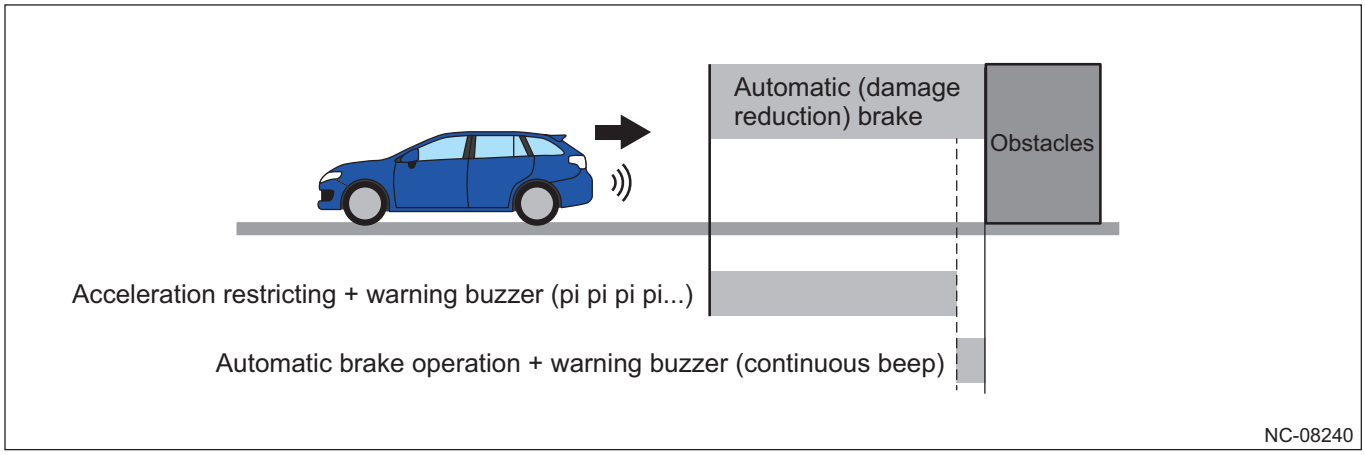
Warning buzzer pattern	Distance to the obstacle*	Rear sonar distance warning indication	Indication color	Warning buzzer
Long distance warning	3.0 ft (0.9 m) or more	 NC-08236	Green (Only the center section)	No
Mid-distance warning	2.3 ft (0.7 m) or more 3.0 ft (0.9 m) or less	 NC-08237	Yellow	Beep, beep, beep...

Warning buzzer pattern	Distance to the obstacle*	Rear sonar distance warning indication	Indication color	Warning buzzer
Proximity warning	1.6 ft (0.5 m) or more 2.3 ft (0.7 m) or less	 NC-08238	Orange	Beep, beep, beep, beep, beep....
Close proximity warning	1.6 ft (0.5 m) or less	 NC-08239	Red	Beep (continuous sound)

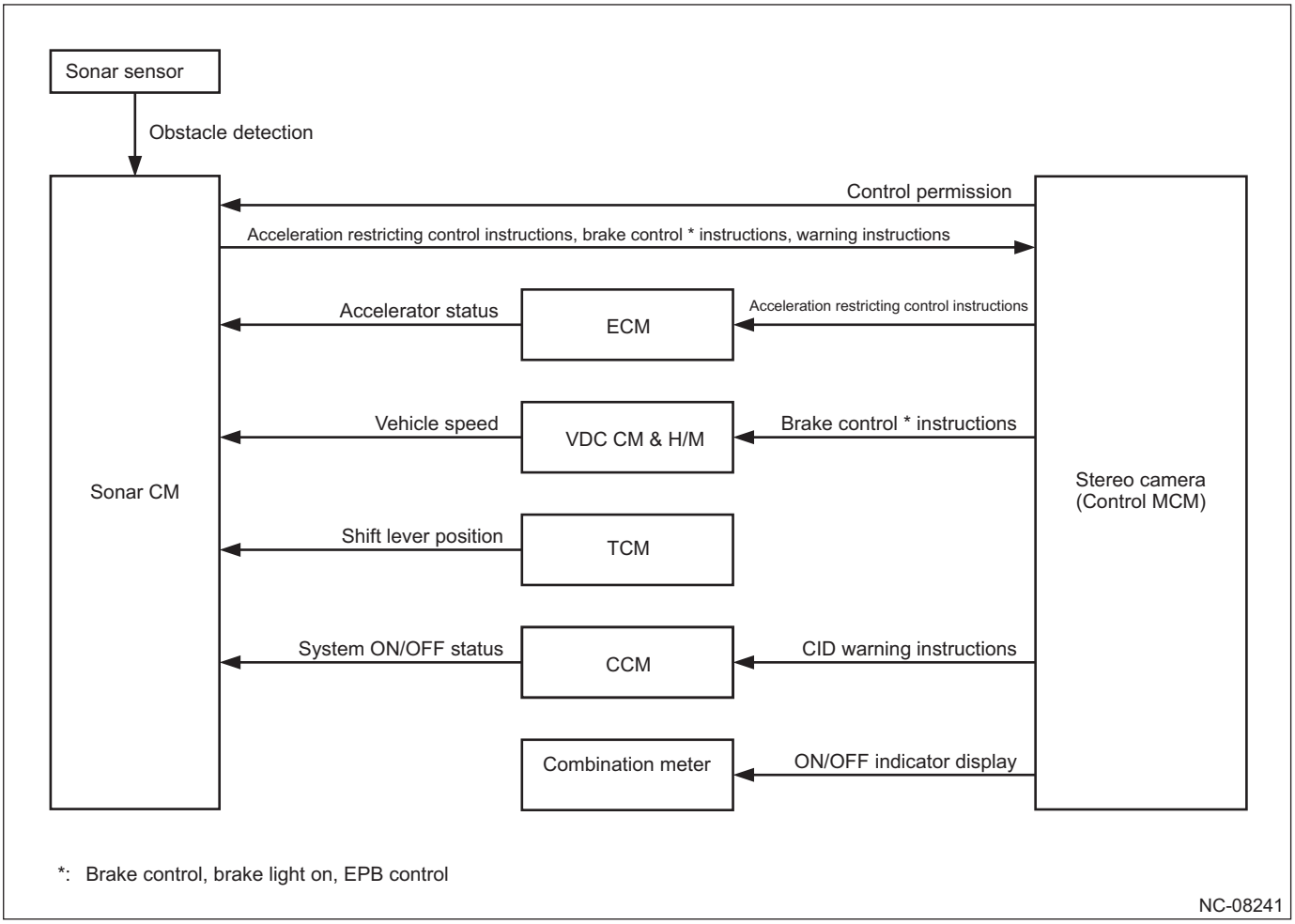
Automatic (Damage Reduction) Brake

Overview

When the system detects a relatively large obstacle, such as a wall, and determines that the possibility of a collision is high, it suppresses acceleration and automatically applies the brake to either avoid the collision or reduce the damage caused by the collision.



Block diagram



Operation

■ Operating conditions

Operation is started when the following is satisfied.

Automatic (damage reduction) brake operation	Shift lever position "R"
Reversing at approximately 1 to 9 mph (approximately 1.5 to 15 km/h)	The obstacle is approximately 1.6 ft (approximately 0.5 m) or more away from the bumper when the shift lever is shifted to "R"

■ Function cancellation

The function is canceled in the following cases.

When the driver presses the brake pedal after the automatic brake is activated	When the driver presses the accelerator pedal after the automatic brake is activated
When the obstacle is no longer detected	When the driver kept depressing the accelerator pedal while restricting the acceleration
When the shift lever is shifted to a position other than "R"	When 120 seconds have elapsed without any operation after the vehicle is stopped (with activation of the electronic parking brake (EPB))
When the door is opened after the vehicle is stopped (with activation of the electronic parking brake (EPB))	-

■ List of conditions for when there is or may be no operation

The system will not operate when the object has the following state	Narrow objects such as sharp object, narrow pole, fence, rope, etc.	
	Person or animal	
	Too close obstacle	
	Moving object	
The system may not operate for the following objects	Object that does not reflect the sound waves well such as cotton and fresh snow.	
	Wall with a slanted angle	
	Obstacles displaced laterally from the center of the vehicle	
	Obstacles not vertically facing the vehicle	
The system may not operate correctly in the following conditions (operates when no possibility of collision, or does not operate even though a collision is possible)	Change in vehicle	Seal is affixed, or paint or chemical is applied on the rear sonar or on the bumper near the rear sonar.
		Ice, snow, or dirt is attached on the rear sonar or on the bumper near the rear sonar.
		The rear bumper is modified or disassembled/assembled.
		The vehicle height has changed excessively due to cargo load or modification.
		When the vehicle posture has tilted excessively
		When the direction of the rear sonar sensor has shifted due to strong impact or deformation on the bumper, etc.
	Effect of the surrounding environment	When reversing over pebbles or grasses
		When reversing toward a banner, flag, drooping branch, or crossing bar
		When there is an obstacle at the side of the road (narrow tunnel, narrow iron bridge, narrow road, narrow garage)
		When there is track or hole in the ground
		When reversing over a metal cover (grating) of water drain
		When reversing a steep downhill
		When reversing a steep uphill
		When reversing toward a curb
		When reversing in a place with height differences
		When reversing in a low-ceiling garage or tunnel
		When there are lumps of snow in the reverse direction
		When there is a puddle of water in the reverse direction
		When there is another obstacle around the obstacle that needs to be detected
		When reversing along a wall
		At the border between the road and snow, earth, etc.
		Road cracks or repair marks
		When driving on a bumpy road

	Effect of weather	In heavy rain or when water is splashed
		Adverse weather condition such as fog, snow, spray of snow, sand storm, strong wind, etc.
		When the temperature is excessively high or low due to hot or cold weather
	Effect of other sound waves	When object that generates ultrasonic sound wave such as horn of another vehicle, engine sound, sound of air brake, vehicle detector, or sonar sensor of another vehicle is near by
	Attached objects around the rear sonar	When commercially available electric parts (fog light, fender pole, radio antenna, etc.), or accessories (trailer hitch, bicycle carrier, etc.) are attached close to the rear sonar in the rear bumper
In the following cases, the system may not fully stop even if it operates correctly	When the road surface is slippery	
	When the tires are not appropriate (air pressure, tread, size, brand, etc.)	
	When tire chains are attached	
	When driving is unstable	
	When the brake system is abnormal	
	When reversing downhill	

- When the vehicle is loaded onto free rollers or chassis dynamometer and driven, always turn the reverse automatic braking function off.
- When the vehicle is towing a trailer or similar and driven, always turn the reverse automatic braking function off.
- Do not expose the rear sonar to water from a high-pressure car washer for a long time.

Display

**The illustration shows a typical example that may differ from the actual display.*

■ Indicator

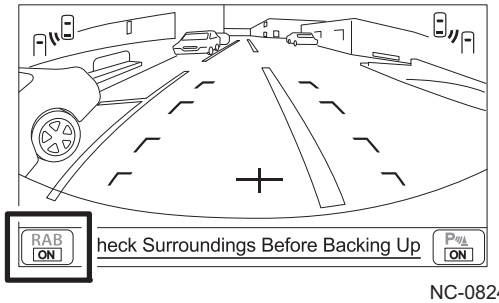
Display	Description	Display	Description
NC-08242	RAB OFF indicator light	NC-08243	RAB warning light

■ Alarm / warning / operating status

▮ Multi Information Display (MID)

Display	Description	Display	Description
NC-08244	Alarm • Automatic (damage reduction) brake is operating	NC-08245	Alarm • Brake instruction (displayed after the vehicle is stopped by the automatic (damage reduction) brake)

▮ Center Information Display (CID)

Display	Description
 NC-08246	Automatic (damage reduction) brake ON/OFF switch

Customization function

Selecting an item on the touch panel of the Center Information Display (CID) allows the driver to turn the functions ON/OFF and configure them.

Item		Setting
Reverse Automatic Braking	Sonar Audible Alarm	ON/OFF
Automatic Braking	-	ON/OFF

12.5 Conventional Cruise Control

12.5.1 Overview

Cruise Control that drives the vehicle at a constant speed while maintaining the set speed is adopted.

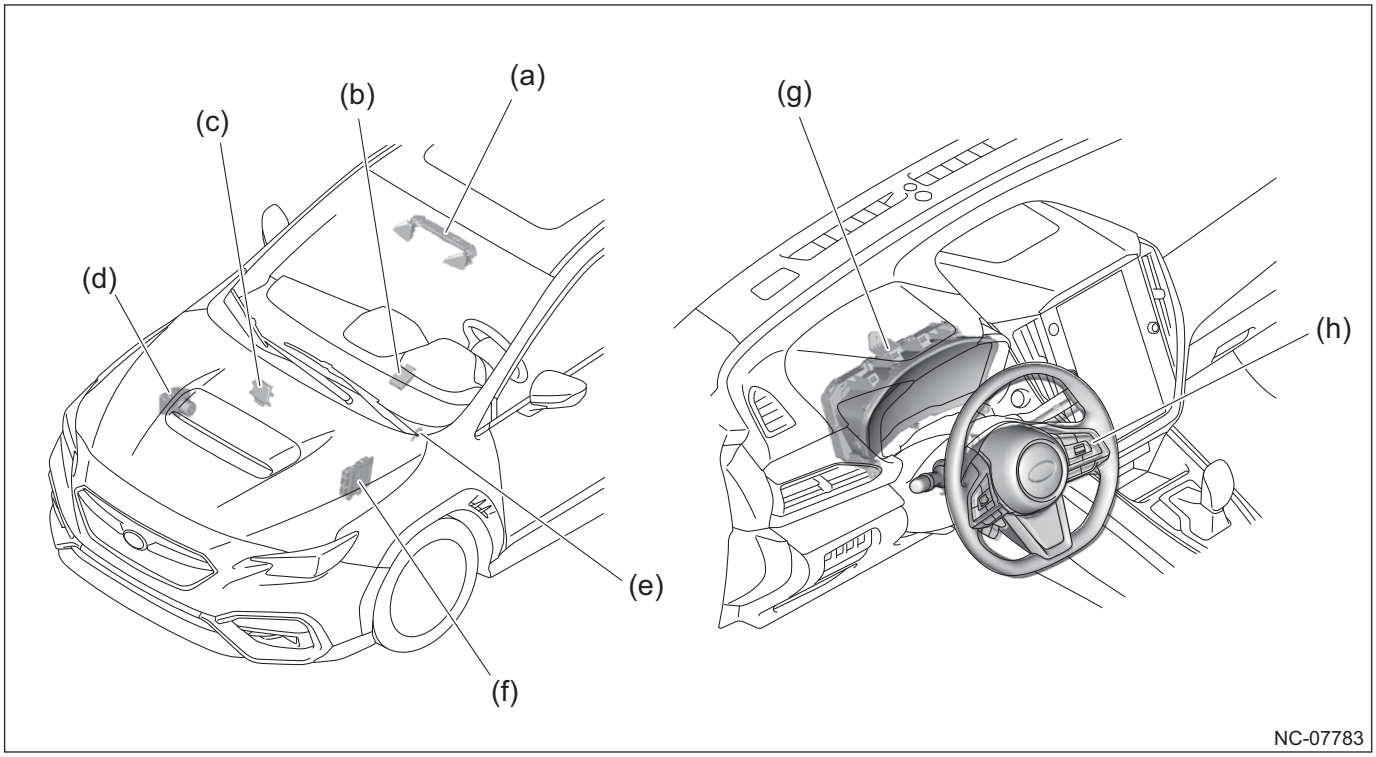
This is a driving assistant system that makes driving on a motorway or vehicle-only road more comfortable.

While the Cruise Control is set in a model with EyeSight, weak brake control will be performed to maintain the set speed when driving down a slope or when the set speed was decreased. In a model without EyeSight, engine braking is performed to decelerate in these circumstances.

*In models with EyeSight, this function is used by switching from the Adaptive Cruise Control (ACC) function.

12.5.2 Component

Component layout drawing



(a) Stereo camera*1
(b) Central gateway CM (CGW)
(c) Transmission control module (TCM)*1
(d) VDC CM & H/M
(e) Stop light switch
(f) Engine Control Module (ECM)
(g) Combination meter
(h) Steering wheel
- EyeSight steering wheel switch*1
- Steering Switch*2

1: Models with EyeSight
2: Models without EyeSight

Component details

Main component functions

Models with EyeSight

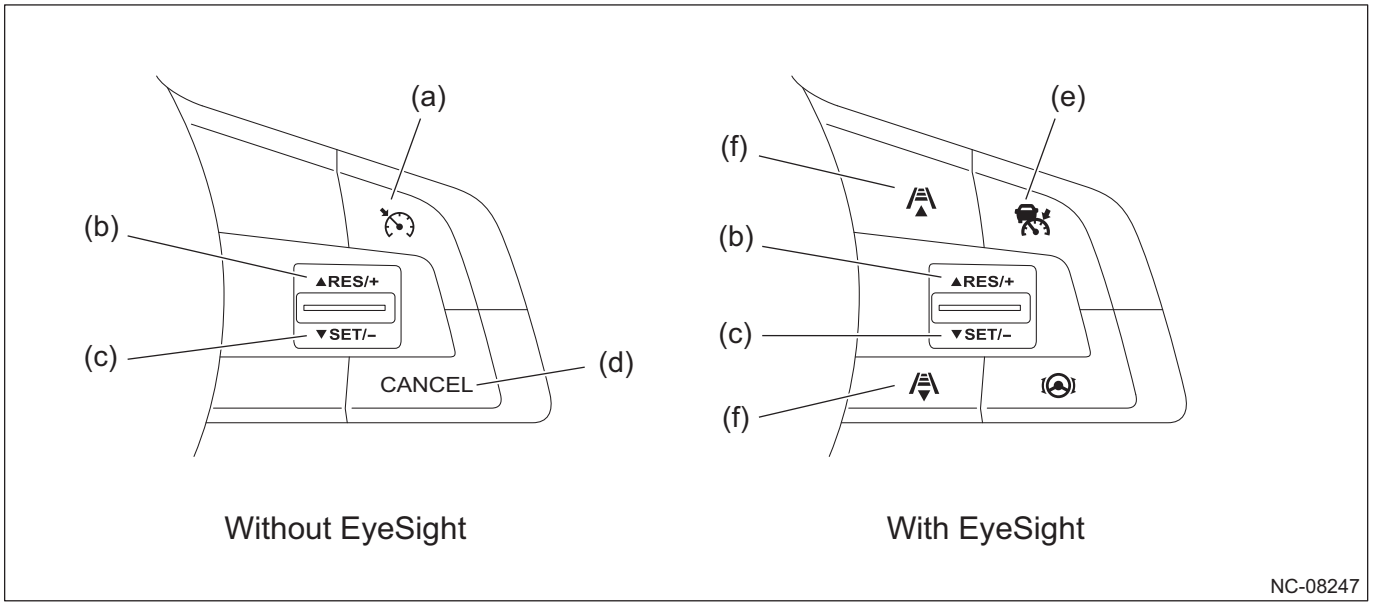
Component	Function
Engine Control Module (ECM)	Receives torque control signals from the stereo camera and controls the engine.
VDC CM & H/M	Sends vehicle speed signals to the stereo camera. Receives brake control signals from the stereo camera and controls the brakes.
Transmission control module (TCM)	Sends the shift lever position signal to the stereo camera. Receives transmission control signals from the stereo camera and controls the transmission.
Stereo camera	Controls the main functions of the Cruise Control system based on signals from the switches and computers.
Central gateway CM (CGW)	Relays CAN communication between the control computers for the various devices installed in the vehicle.
Combination meter	Receives the vehicle speed setting and system ON/OFF status from the stereo camera and displays each of these.
EyeSight steering wheel switch	Sends the operating information of each switch to the stereo camera.

Models without EyeSight

Component	Function
Engine Control Module (ECM)	Controls the main functions of the Cruise Control system based on signals from the switches and computers.
VDC CM & H/M	Sends the vehicle speed signals to the Engine Control Module (ECM).
Central gateway CM (CGW)	Relays CAN communication between the control computers for the various devices installed in the vehicle.
Combination meter	Receives the vehicle speed setting and system ON/OFF status from the Engine Control Module (ECM) and displays each of these.
Stop light switch	Detects depression of the brake pedal and outputs the signal to the Engine Control Module (ECM).
Steering Switch	Sends the operating information of each switch to the Engine Control Module (ECM).

Steering Switch

Turns on and off the Conventional Cruise Control, and switches the set vehicle speed.

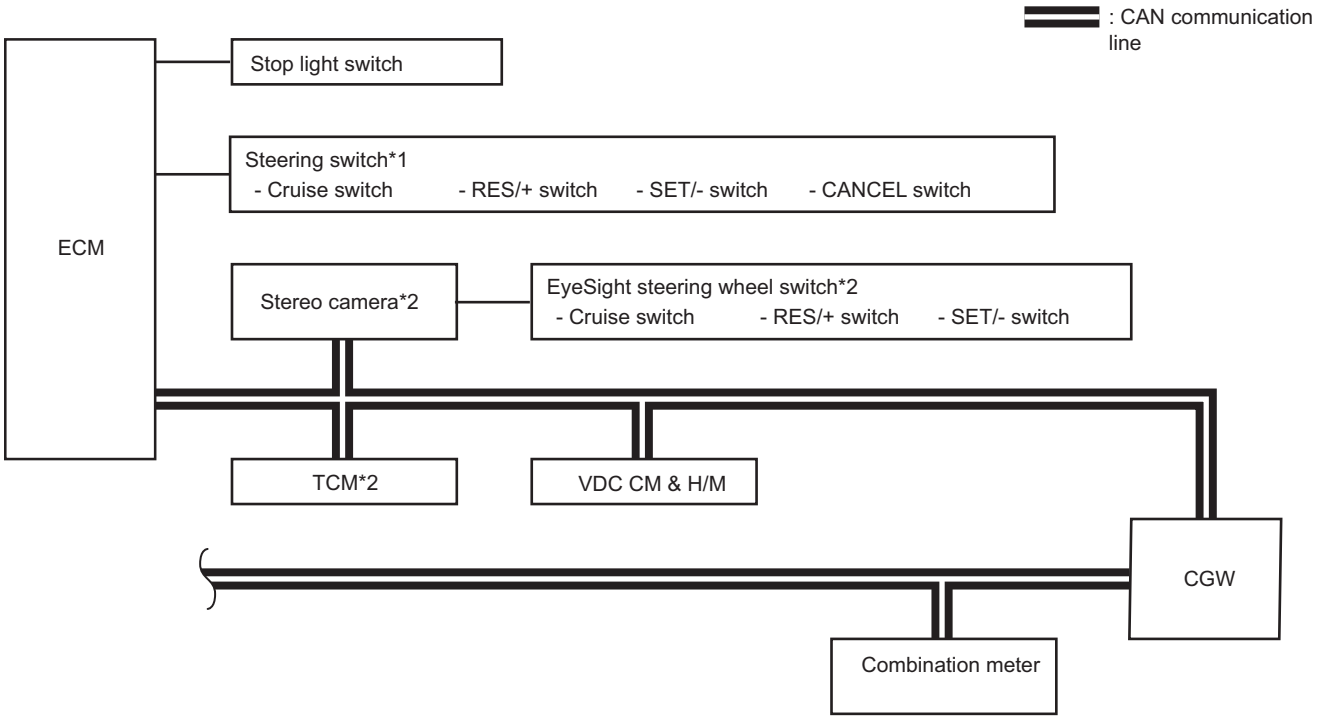


Name	Function
(a) Cruise switch*1	Main status ON/OFF
(b) RES/+ switch	Sets the Cruise Control (re-sets a setting of set vehicle speed before cancellation after canceling the Cruise Control). Increases set vehicle speed (when the Cruise Control is set).
(c) SET/- switch	Sets the Cruise Control. Decreases set vehicle speed (when the Cruise Control is set).
(d) CANCEL switch*1	Cancels the Cruise Control active status.
(e) Cruise switch*2	Turning on and off the Cruise Control
(f) Distance between vehicles setting switch*2	Used for switching between Adaptive Cruise Control (ACC) and Conventional Cruise Control (CC) *Used for setting the distance between vehicles during setting for Adaptive Cruise Control (ACC).

**1: Models without EyeSight*
**2: Models with EyeSight*

12.5.3 Construction and Operation

System diagram



*1: For models not equipped with EyeSight

*2: For models equipped with EyeSight

System details

Control

■ Vehicle speed control

When the actual vehicle speed is higher than the set vehicle speed	Performs deceleration control to reach the set vehicle speed. • The throttle valve of the electronic control throttle is moved in the closing direction for the amount equivalent to the difference between the actual vehicle speed and set vehicle speed.
When the actual vehicle speed is lower than the set vehicle speed	Performs acceleration control to reach the set vehicle speed. • The throttle valve of the electronic control throttle is moved in the opening direction for the amount equivalent to the difference between the actual vehicle speed and set vehicle speed.

■ Settable vehicle speed

20 to 90 mph (30 to 145 km/h)

Operation

Cruise Control main status ON (settable status)	Models with EyeSight	When the cruise switch is pressed, the Adaptive Cruise Control (ACC) enters the settable status. Then, when the distance between vehicles setting switch is pressed for approximately 2 seconds or longer, the mode switches to Conventional Cruise Control, and the Conventional Cruise Control enters the settable status.
	Models without EyeSight	When the cruise switch is pressed, the Conventional Cruise Control enters the settable status.
Start	Adjust the vehicle speed after setting, and press the RES/+ switch or SET/- switch. • The vehicle speed when the switch is pressed becomes the set vehicle speed.	
Cancel	If the cruise switch is pressed once by the driver or the brake pedal or clutch (MT models) is operated while cruise control is active, the activated Cruise Control status is canceled. If the system judges that normal control is not possible during operation, the set condition is canceled. Cancel by pressing the CANCEL switch. (Models without EyeSight)	
Restart	When the SET/- switch is pressed while the Conventional Cruise Control is in the ready status, the control is restarted.	
Recovery	When the RES/+ switch is pressed while the Conventional Cruise Control is in the ready status, control recovers at the set vehicle speed that has been stored.	
Conventional Cruise Control main status OFF	Models with EyeSight	Press the cruise switch while the control is canceled.
	Models without EyeSight	Press the cruise switch.
Increase set vehicle speed	Press the RES/+ switch once	The set vehicle speed increases in 1 mph (1 km/h) increments each time the switch is pressed.
	Press and hold the RES/+ switch	The set vehicle speed increases in 5 mph (5 km/h) increments while the switch is held pressed.
	Depress the accelerator pedal	Depress the accelerator pedal, increase the vehicle speed to the level to be set, and press the SET/- switch. • The speed when the switch is pressed is reset as the set vehicle speed.

Decrease set vehicle speed	Press the SET/- switch once	The set vehicle speed decreases in 1 mph (1 km/h) increments each time the switch is pressed.
	Press and hold the SET/- switch	The set vehicle speed decreases in 5 mph (5 km/h) increments while the switch is held pressed.
	Depress the brake pedal	Depress the brake pedal, decrease the vehicle speed to the level to be set, and release the brake pedal. • When the brake pedal is depressed, the Cruise Control activated status is temporarily canceled, however the set vehicle speed for Conventional Cruise Control remains in memory. Press the SET/- switch. • The speed when the switch is pressed becomes the set vehicle speed.
Accelerate temporarily	Depress the accelerator pedal to accelerate. When the accelerator pedal is released, the vehicle speed returns to the set vehicle speed.	
Decelerate temporarily	Depress the brake pedal to decelerate. • When the brake pedal is depressed, the Cruise Control activated status is temporarily canceled, however the set vehicle speed for Conventional Cruise Control remains in memory. When the brake pedal is released and the RES/+ switch is pressed, the set vehicle speed before cancellation is set and the vehicle speed returns to the set vehicle speed.	
Status notification	The driver is notified of the Conventional Cruise Control status and the set vehicle speed by the Multi Information Display (MID).	

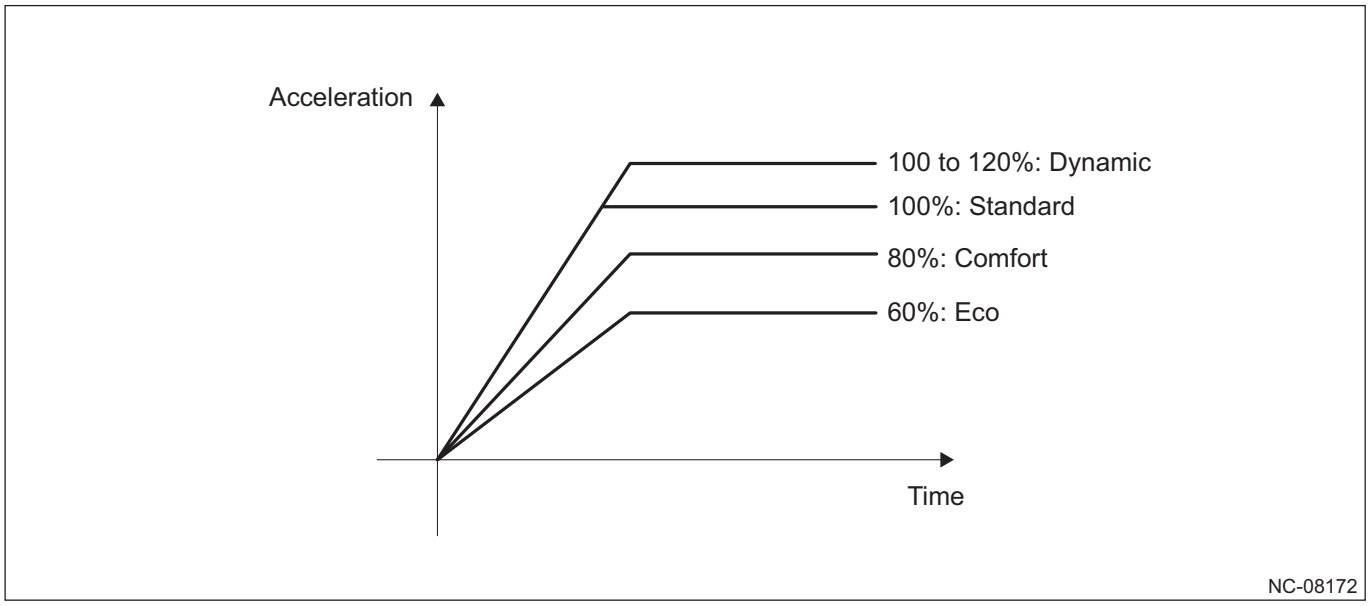
■ Acceleration characteristics setting (models with EyeSight)

The acceleration characteristics of the Cruise Control can now be switched in four levels by changing the setting using the customization function of the Center Information Display (CID). The acceleration mode can be selected according to preference and the driving conditions.

Acceleration characteristic

Level	Condition
Lv. 4 (Dynamic)	A mode for drivers preferring high acceleration. The maximum acceleration is 1.2 times the base (standard) value. Initial rise of the acceleration (jerk) is equivalent to standard.
Lv. 3 (standard) *Initial setting value	This is the standard setting.
Lv. 2 (comfort)	Maximum acceleration is 80 % of the standard.
Lv. 1 (eco)	A mode for drivers preferring low acceleration. Maximum acceleration is 60 % of the standard.

Acceleration characteristic chart



Display

**The illustration shows a typical example that may differ from the actual display.*

■ Indicator

Display	Description	Display	Description
NC-08250	Conventional Cruise Control indicator light (models with EyeSight) • Green: Control in progress • White: Control standby state	NC-09733	Conventional Cruise Control indicator light (models without EyeSight) • Green: Control in progress • White: Control standby state Conventional Cruise Control warning light (models without EyeSight) • Flashing white: Conventional Cruise Control failure

13 LAN SYSTEM

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13.1 General Overview

13.1.1 Overview

Overview

This chapter describes the following item which composes the LAN system.

- CAN communication system

13.2 CAN communication system

13.2.1 Overview

Overview

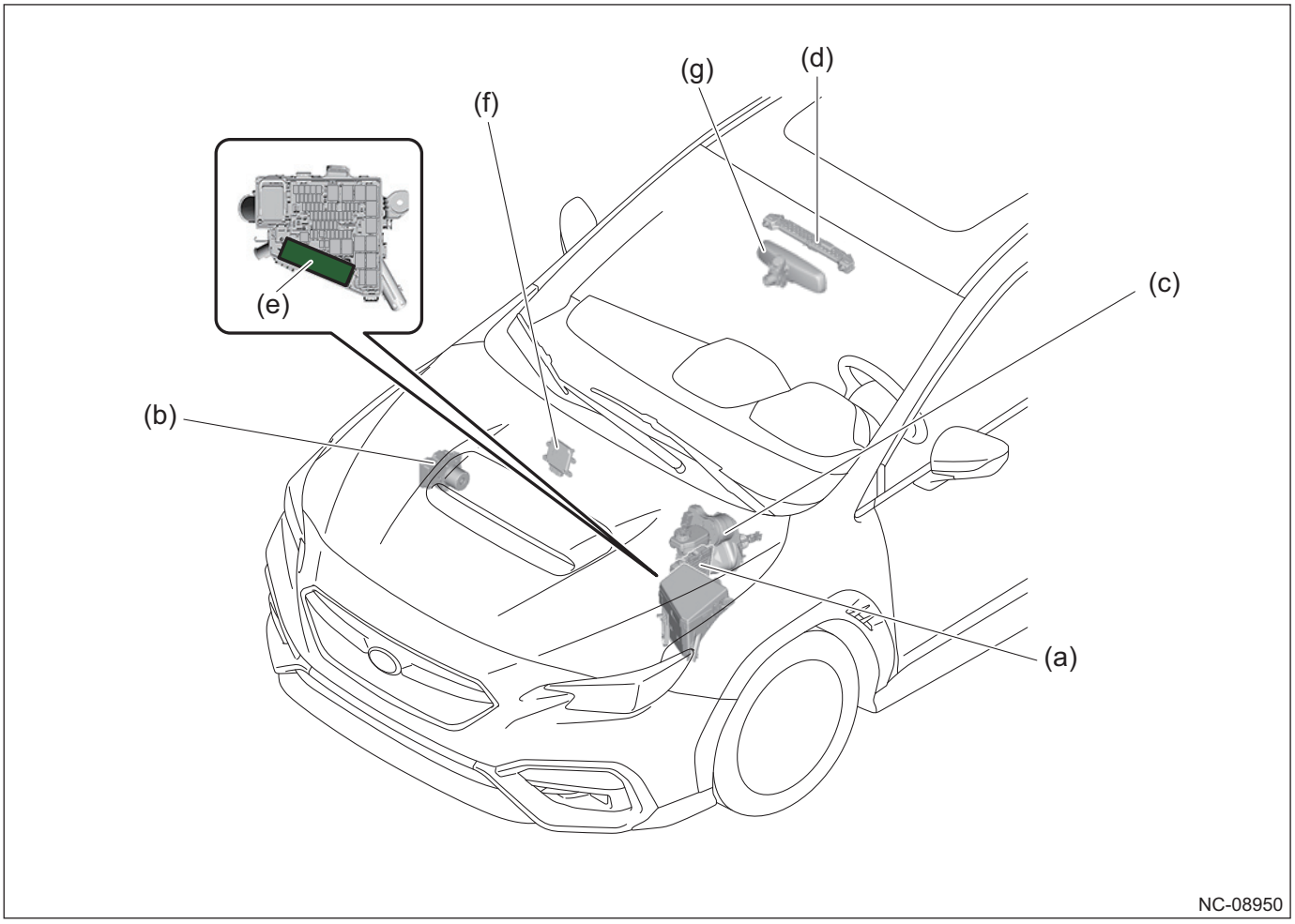
A CAN (Controller Area Network) communication system has been adopted and uses pairs of communication lines (twisted pair cables, shielded twisted pair cables) to transmit multiple sources of information and data that were converted to digital signals by the communication circuit. This makes it possible to reduce the number of wire harnesses and create a slimmer electronic control system for the communication system that connects the input system (sensors, switches, etc.), output system (motors, etc.), and control modules.

- CAN is serial communication that conforms to ISO standards (international standards).
- The communication speed is fast, and large volumes of data can be sent and received in a short time.

Communication speed	500 kbps
Communication lines	Twisted-pair cables
Type of electrical signal	Differential voltage
Data length	0 to 8 bytes (variable)

13.2.2 Component

Component layout drawing



(a) Engine Control Module (ECM)

(b) VDC CM & H/M

(c) Electric brake booster*1

(d) Stereo camera

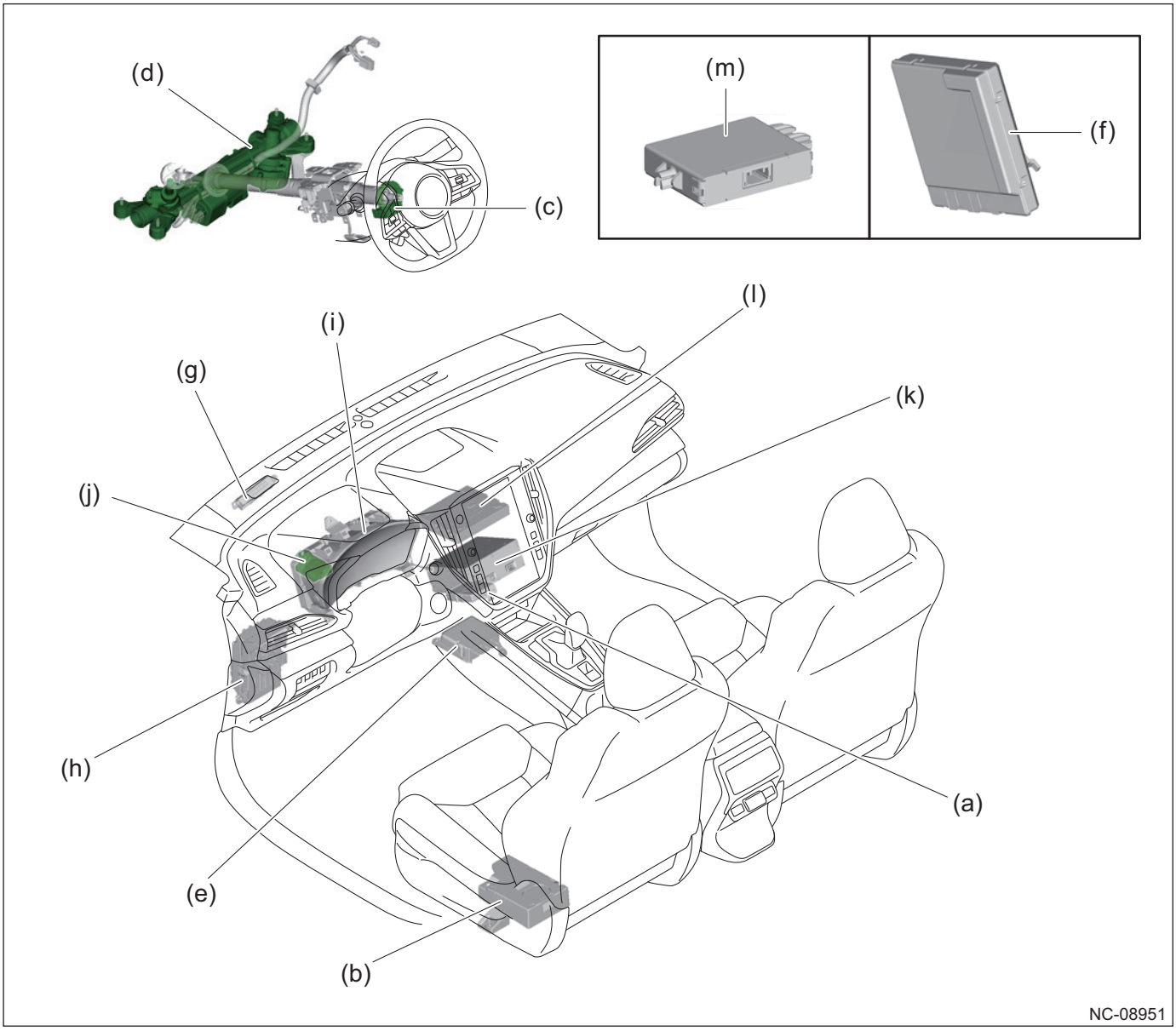
(e) Front relay control module (FRM) (in main fuse & relay box)

(f) Transmission control module (TCM)*1

(g) Inner mirror HBA unit assembly*2

*1: CVT

*2: Models without EyeSight



(a) Central gateway CM
(b) Electronic control damper CM*1
(c) Steering angle sensor
(d) Power steering CM
(e) Airbag CM
(f) Keyless access CM*4
(g) EyeSight assist monitor*2
(h) Body Integrated Unit
(i) Combination meter
(j) Auto headlight beam leveler CM
(k) Cockpit control module (CCM)
(l) Data communication module (DCM)*3
(m) Immobilizer CM*5

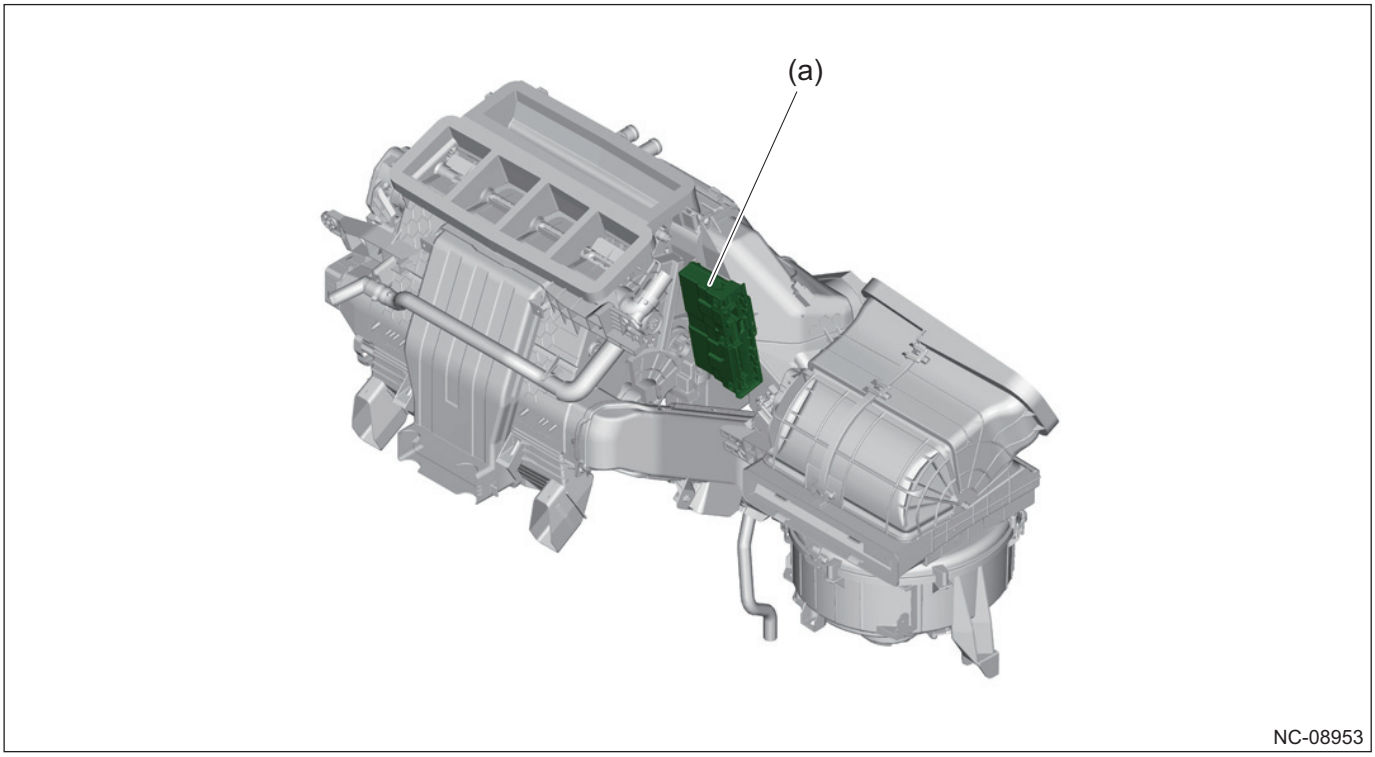
*1: Models with electronic control damper

*2: CVT

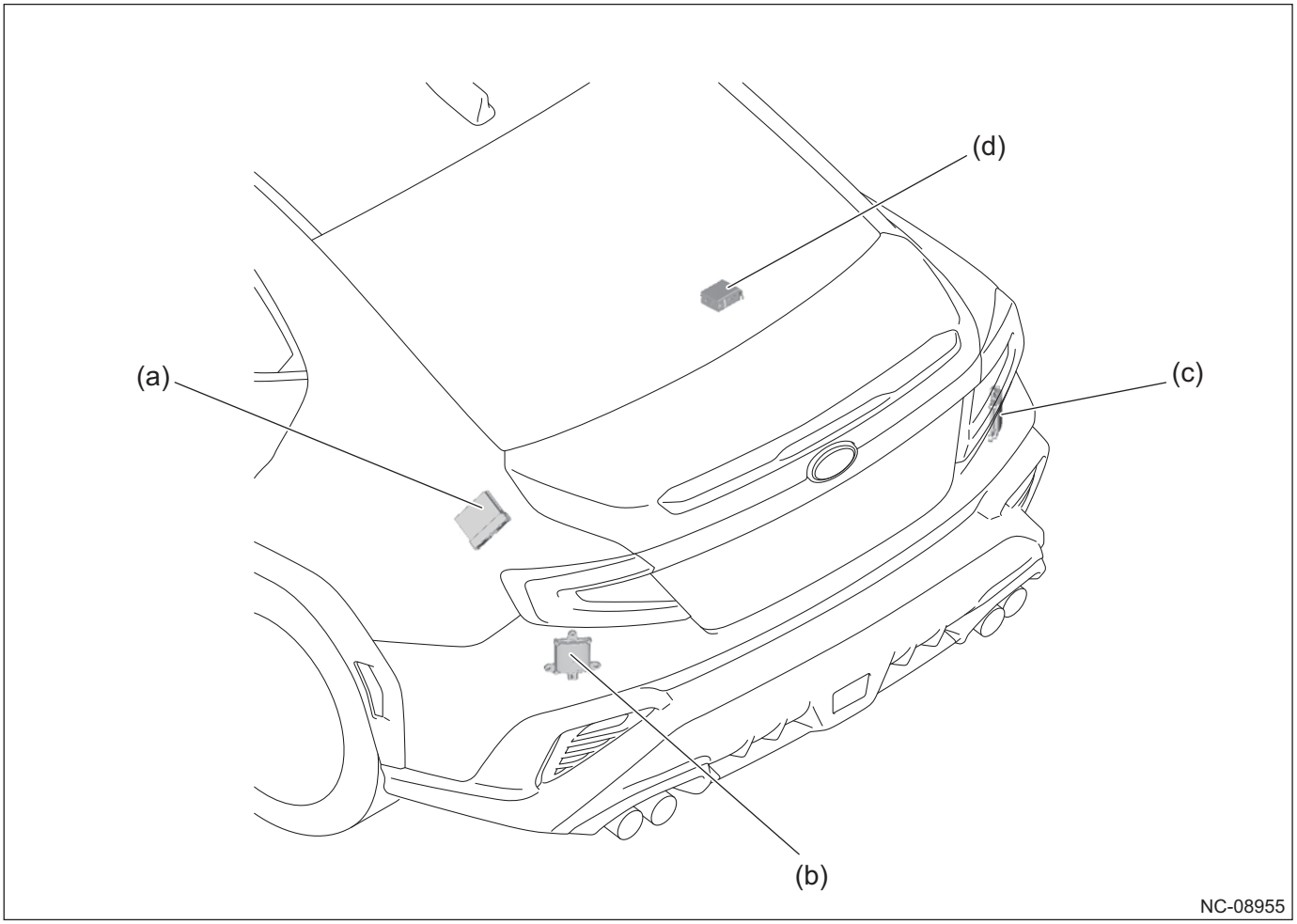
*3: Models with telematics system

*4: Models with keyless access & push button start system

*5: Models with keyless entry system



(a) A/C CM



(a) Sonar CM*1

(b) Rear radar LH*2

(c) Rear radar RH*2

(d) TPMS & keyless entry CM*3

*1: Models with Reverse Automatic Braking

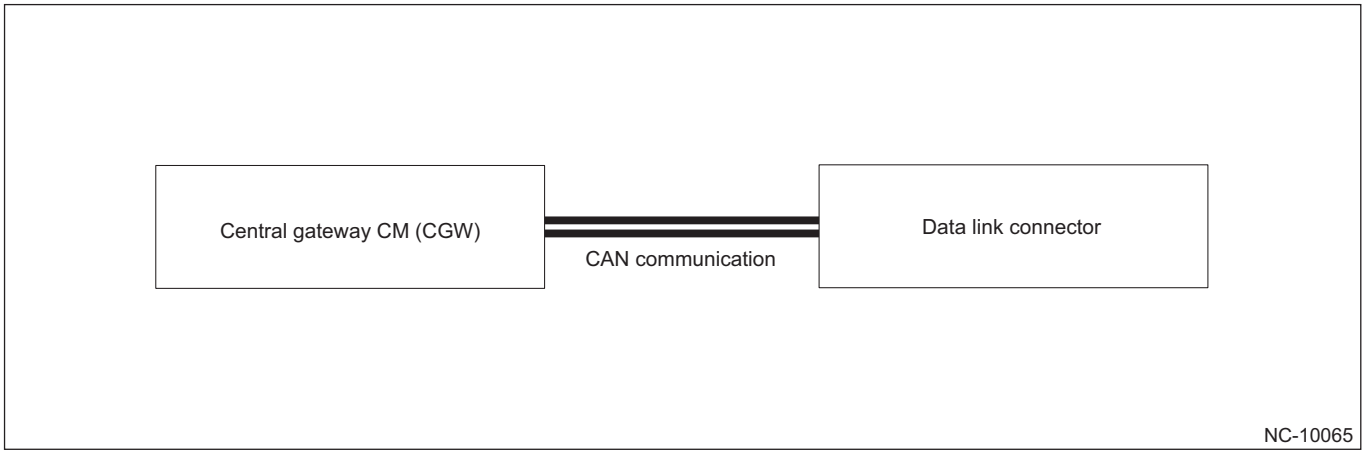
*2: Models with BSD/RCTA

*3: U4

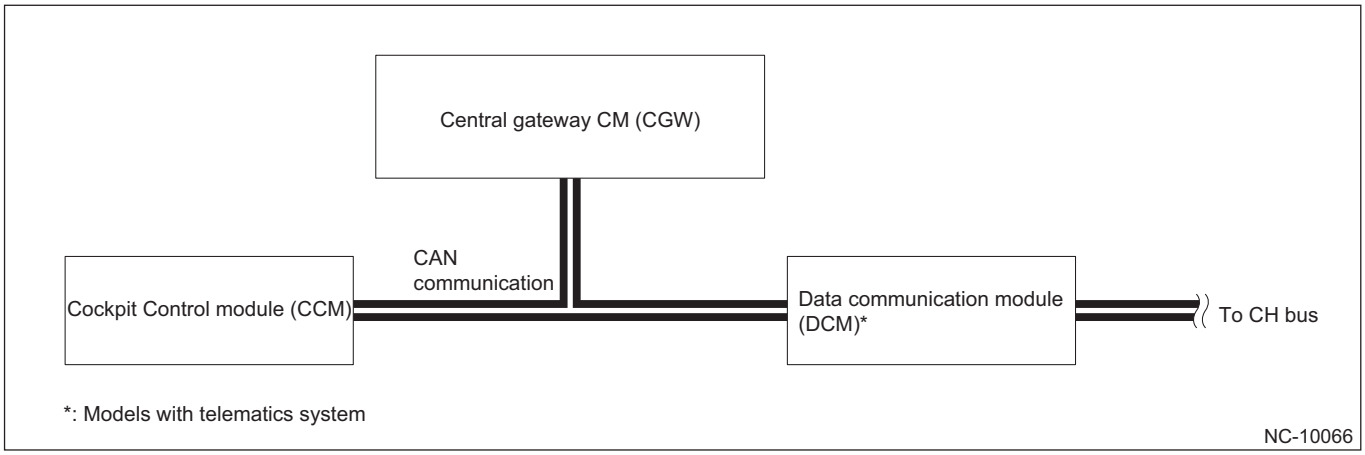
13.2.3 Construction and Operation

System diagram

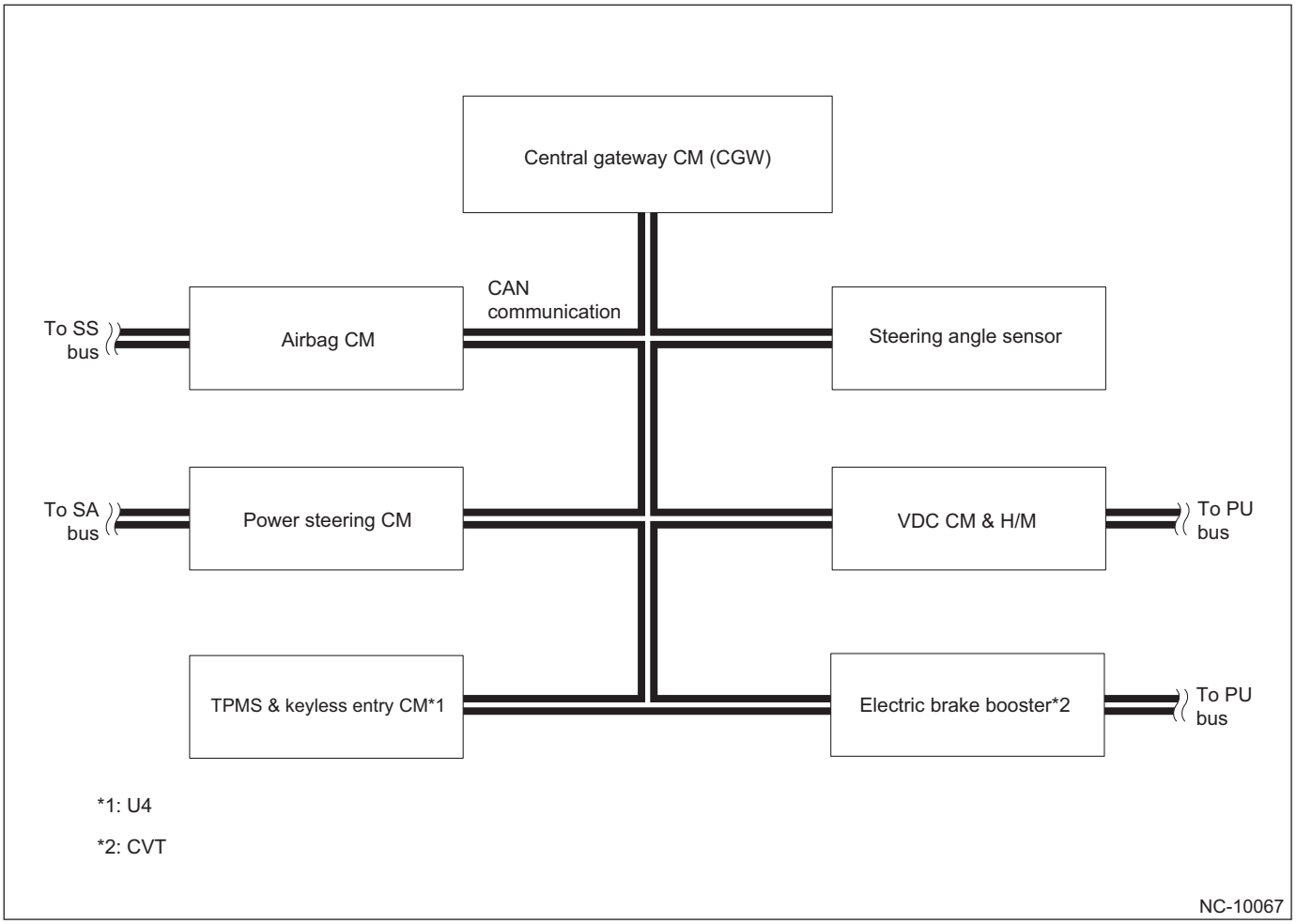
DIAG (failure diagnosis) bus



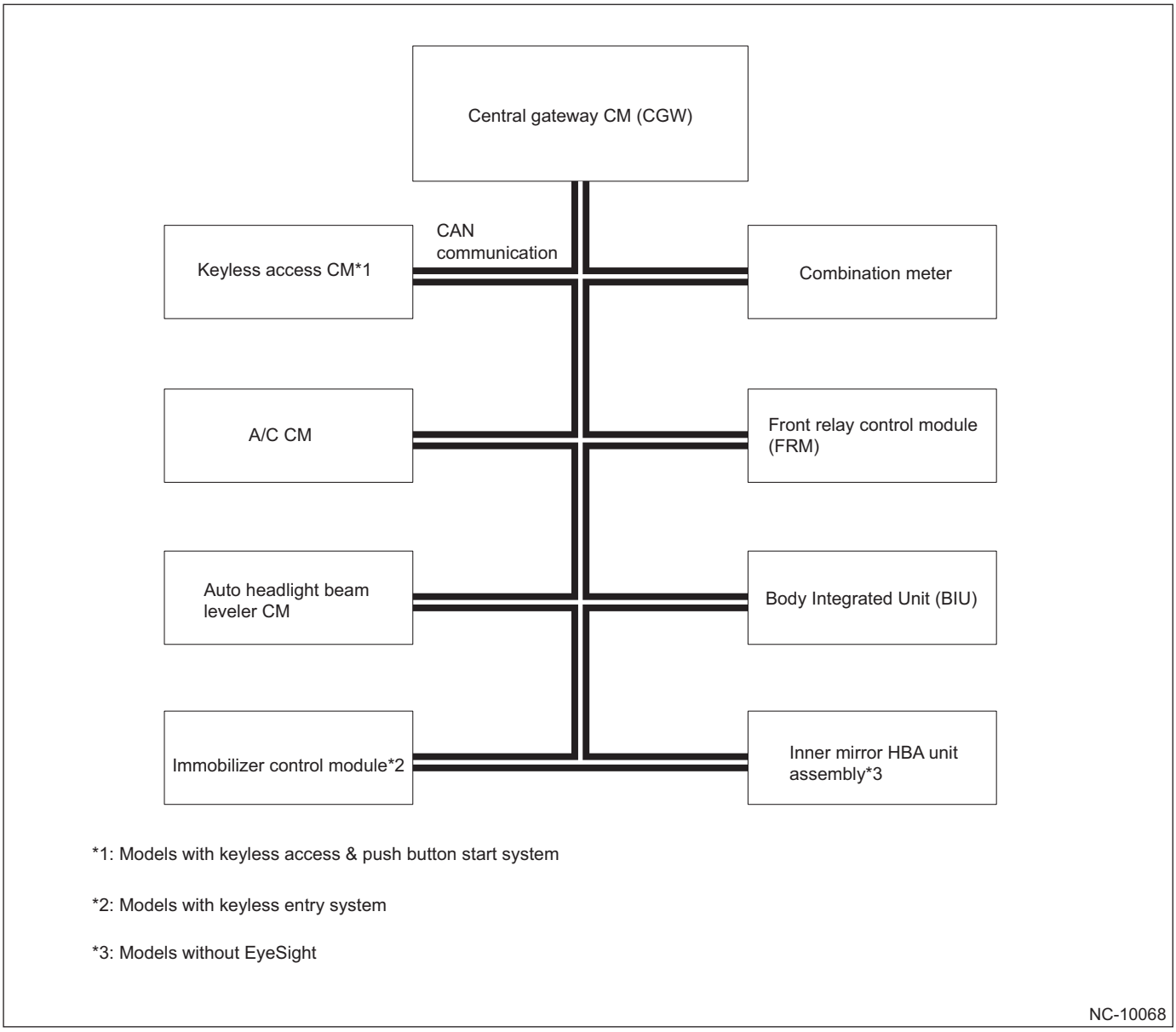
SS (vehicle external connection) bus



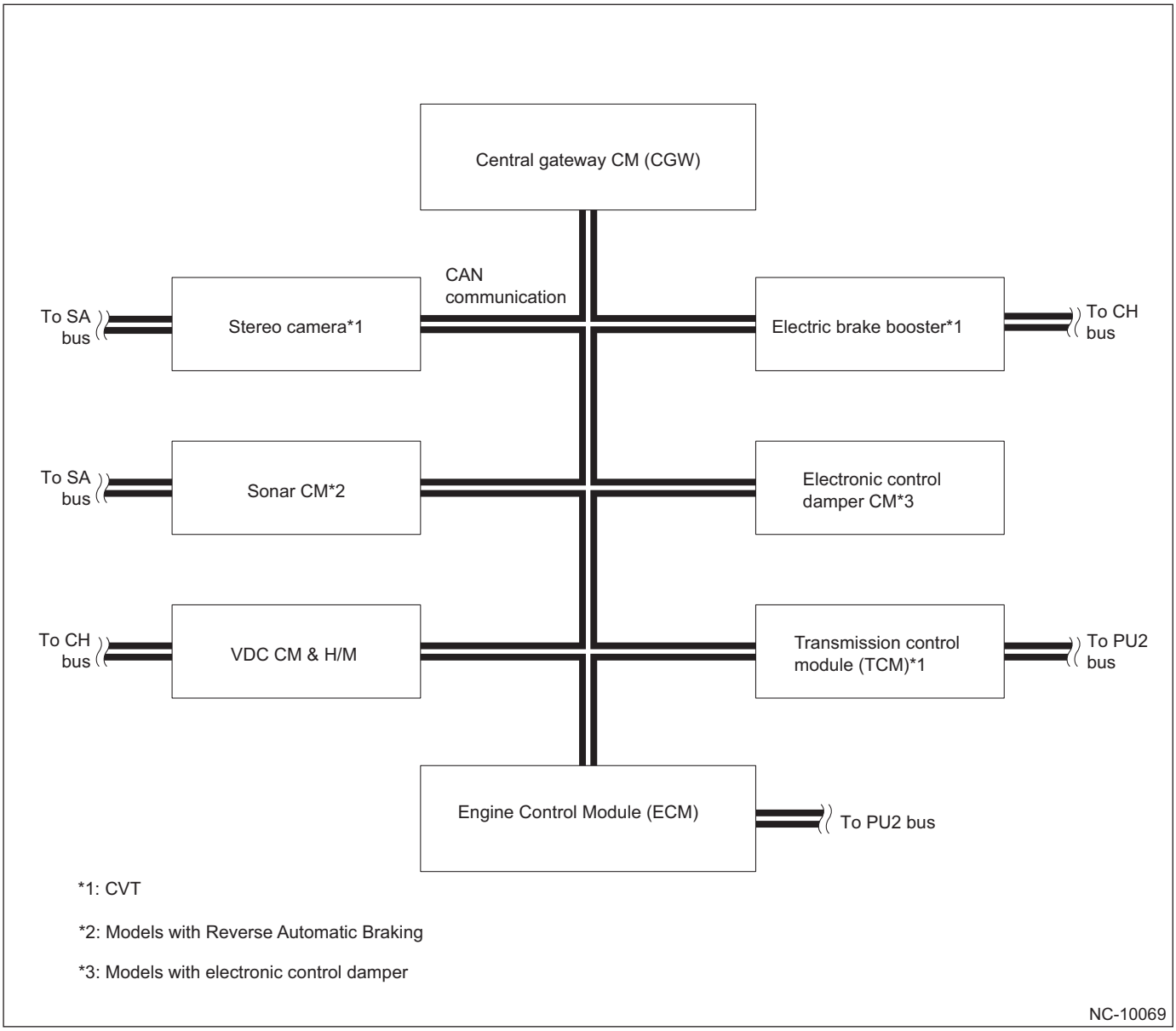
CH (chassis) bus



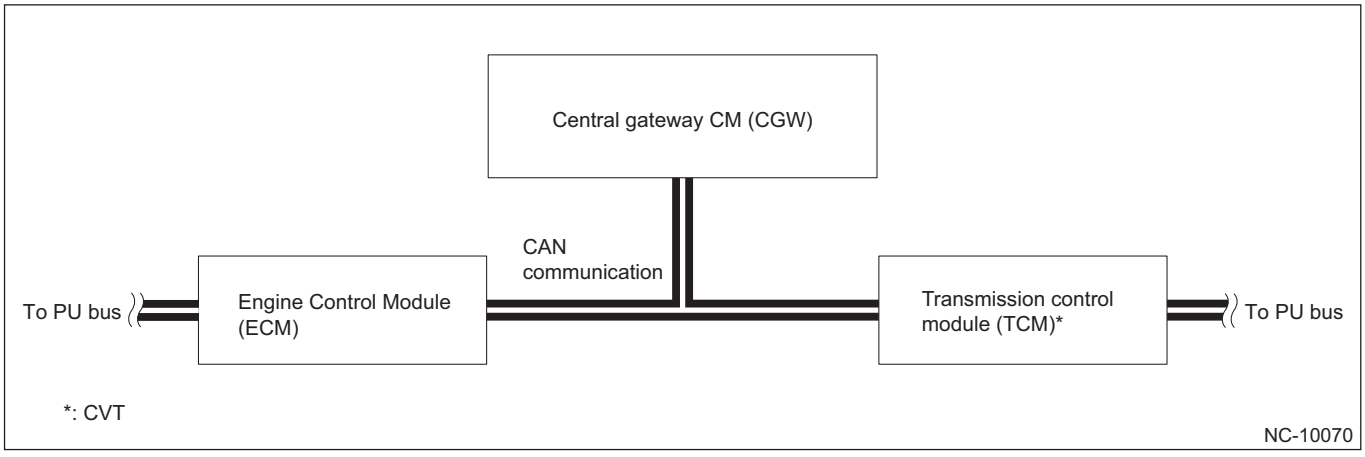
B (body) bus


Central gateway CM (CGW)
CAN communication
Keyless access CM*1
Combination meter
A/C CM
Front relay control module (FRM)
Auto headlight beam leveler CM
Body Integrated Unit (BIU)
Immobilizer control module*2
Inner mirror HBA unit assembly*3
*1: Models with keyless access & push button start system
*2: Models with keyless entry system
*3: Models without EyeSight
NC-10068

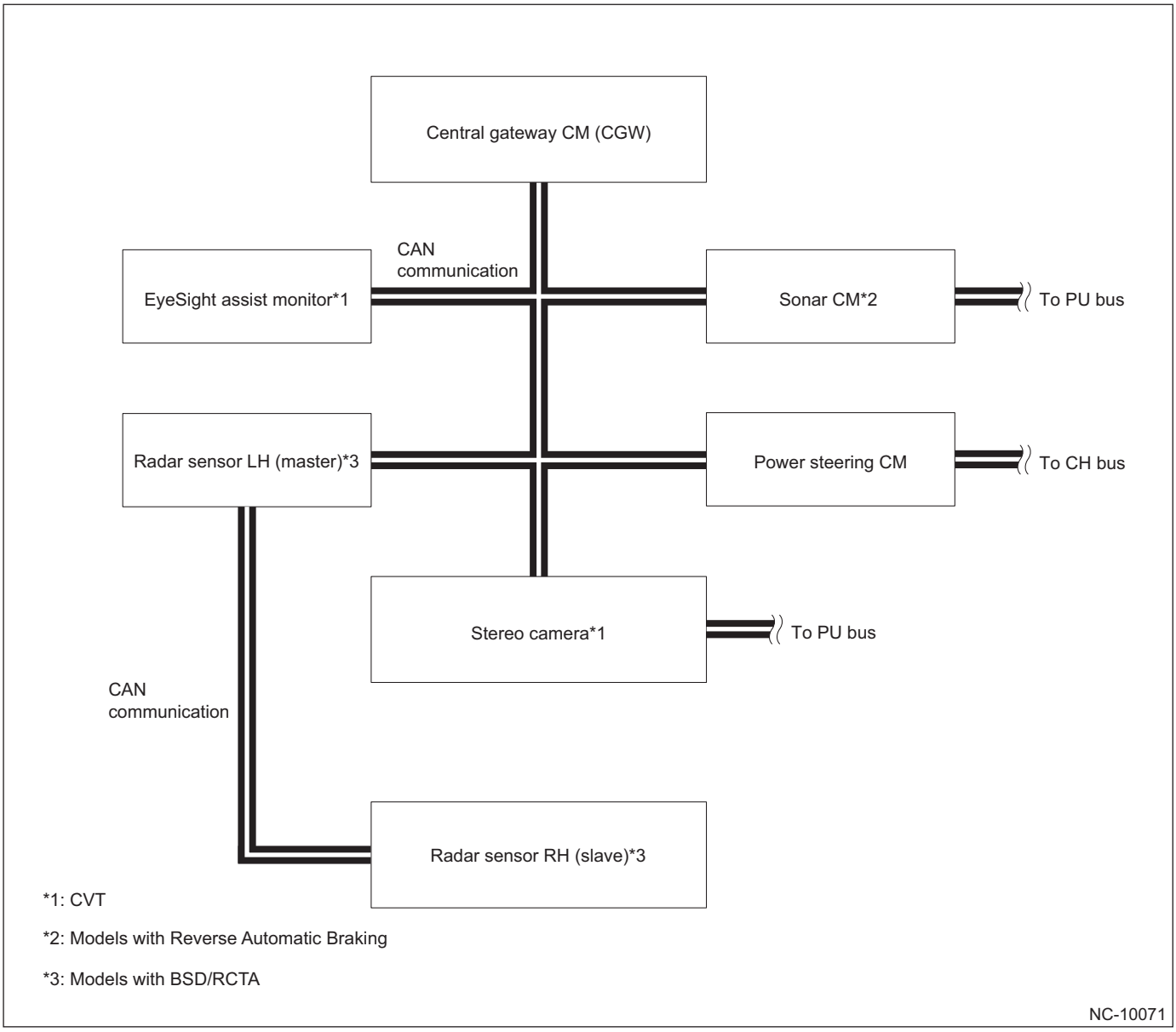
PU (power unit) bus



PU2 (power unit 2) bus



SA (advanced safety) bus



Main component functions

Component	Function
Central gateway CM (CGW)	• Relays data that is transmitted between the buses. • Receives the periodic connection check signals sent from the connected bus CM, allowing the central gateway CM to monitor the connected CM.
Engine Control Module (ECM)	Controls the engine control system.
Transmission control module (TCM)*1	Controls the transmission control system.
VDC CM & H/M	• Controls the brake system. • Controls the electronic parking brake system.
Electric brake booster*1	Reads the amount that the brake pedal is depressed and controls the brake fluid pressure using motor control and master cylinder drive.
Electronic control damper CM*2	Controls the electronic control damper system.
Sonar CM*3	Controls the Reverse Automatic Braking.
Stereo camera*1	• Controls EyeSight. • Recognizes objects in front of the vehicle.
Steering angle sensor	Detects the steering operation angle and steering direction.
Power steering CM	Controls the power steering system.
Airbag CM	Controls collision detection, airbag deployment, and related matters.
Keyless access CM*6	Controls the keyless access & push button start system.
Rear radar*4	• Controls BSD. • Detects other vehicles to the rear of the vehicle.
EyeSight assist monitor*1	Displays the EyeSight operation status.
Body Integrated Unit (BIU)	Controls the door lock and security system, the lighting system, and related matters.
Combination meter	Controls the combination meter system.
Auto headlight beam leveler CM	Controls the auto headlight beam leveler.
Front relay control module (FRM)	Controls the lighting system, etc.
A/C CM	Controls the air conditioning system.
Cockpit Control module (CCM)	Controls the infotainment system.
Data communication module (DCM)*5	Controls the telematics system.
TPMS & keyless entry CM*9	Controls the tire pressure monitoring system.
Immobilizer CM*7	Controls the immobilizer system.
Inner mirror HBA unit assembly*8	Controls the High Beam Assist (HBA) system.

*1: CVT
*2: Models with electronic control damper
*3: Models with Reverse Automatic Braking
*4: Models with BSD/RCTA
*5: Models with telematics system
*6: Models with keyless access & push button start system
*7: Models with keyless entry system
*8: Models without EyeSight
*9: U4

System details

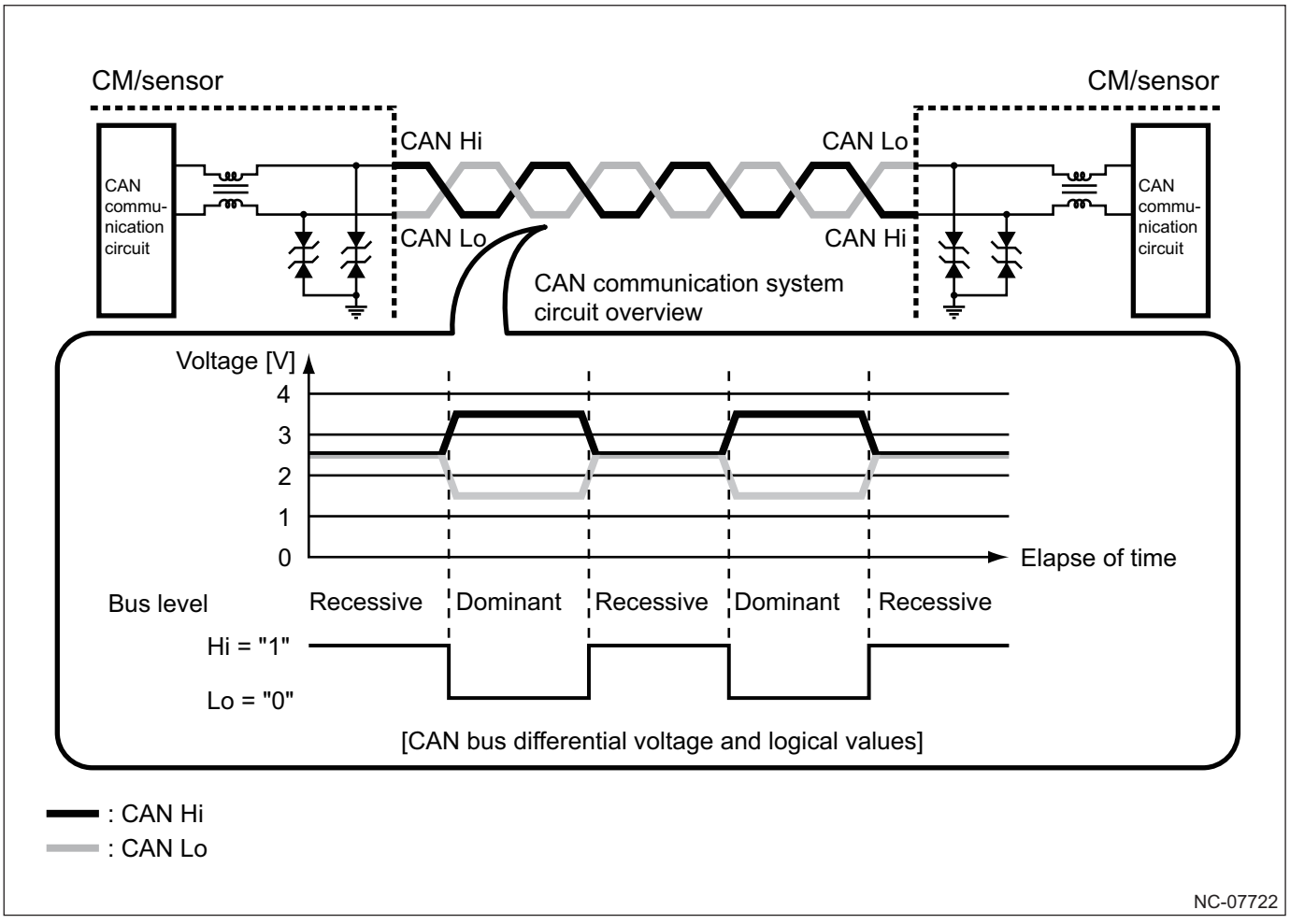
General

The CAN communication system uses pairs of 2 (CAN Hi and CAN Lo) communication lines (buses), and judges the bus level*1 from the differential voltage in them. This is transferred at a speed of 500 kbps*2 as a digital signal conforming to a special communication protocol (communication rules).

Reference

*1: The bus level can be the dominant level or recessive level. In the CAN communication system logic, the dominant level is judged "0" and the recessive level is judged "1".

*2: This is the unit that expresses signal transmission speed. "500 kbps" means that 500,000 bits of data are transmitted in 1 second.



This is composed of the PU (power unit) bus, PU2 (power unit 2) bus, CH (chassis) bus, SA (advanced safety) bus, B (body) bus, SS (vehicle external connection) bus, and DIAG (failure diagnosis) bus. A control module (CM) is provided for each bus and includes a terminal resistor and gateway functions.

Because an electric potential difference is generated between CAN Hi and CAN Lo in the CAN bus, stable communication is possible by installing the terminal resistor that is installed at the end of the communication line onto the endmost CM. When the length of the communication line to a CM that does not have a terminal resistor is longer, communication may become unstable.

■ CAN communication protocol (communication rules)

The CAN communication system is a time-division multiplexed bidirectional communication system that is capable of using pairs of communication lines (buses) to send data from all control modules (CM) and sensors that compose the network, with each sending at a different time. For this reason, each control module (CM) and sensor performs communication in accordance with the communication protocol (communication rules) so that communication can be performed smoothly and reliably.

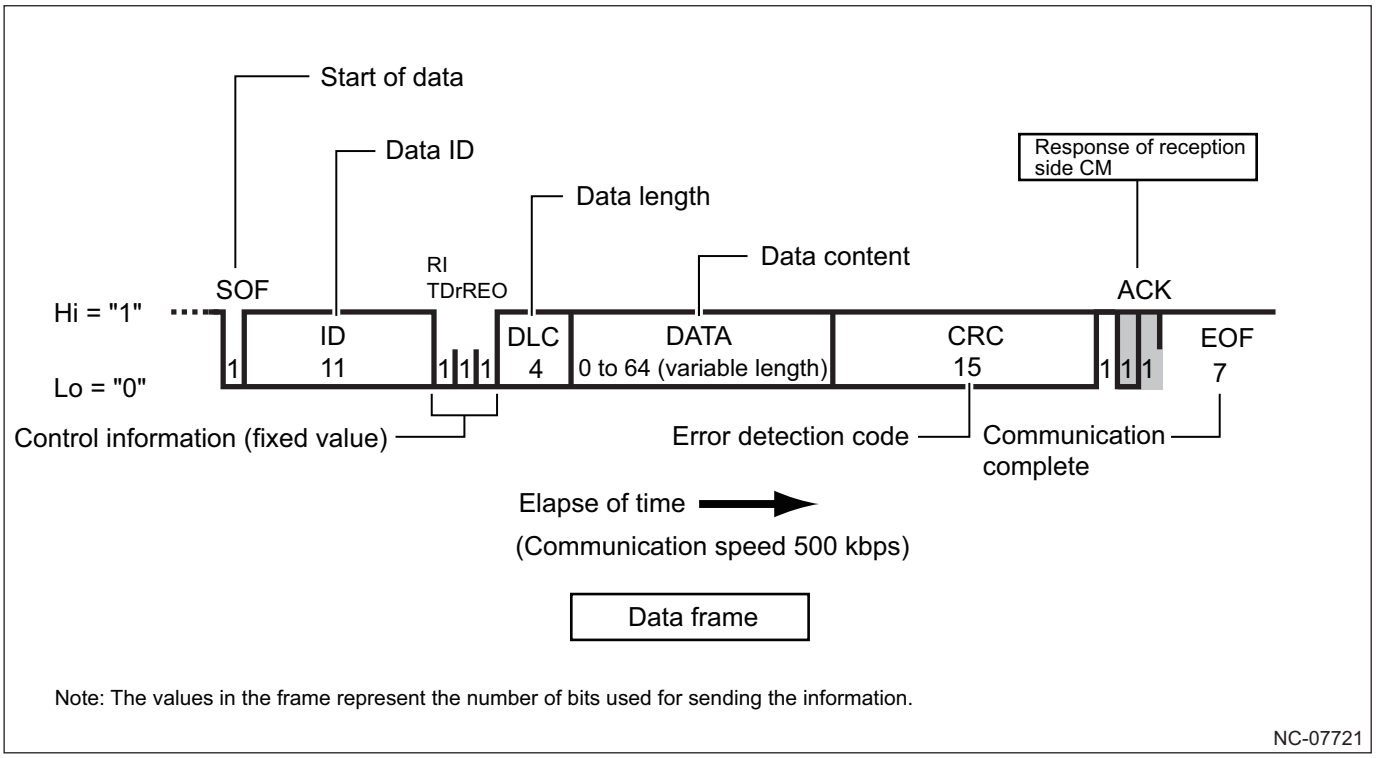
The CAN communication protocol uses a CSMA/CD (Carrier Sense Multiple Access with Collision Detection) type* that gives all control modules (CM) and sensors the authority to initiate data transmission, while restricting data transmission to the communication lines so that it is possible to share pairs of communication lines.

The control modules (CM) and sensors initiate data transmission when other data is not flowing on the CAN bus. However when 2 or more control modules (CM) or sensors initiate transmission at the same time, the system judges the transmission order of priority according to the ID information that is contained in the transmitted data itself.

A frame of the data used in the CAN communication system includes ID, DLC, DATA, CRC, and ACK.

Reference

*: Acronym for "Carrier Sense Multiple Access with Collision Detection". Communication access control is performed, with each CM continually detecting the communication line status (carrier wave), and only initiating data transmission when other data is not flowing on the communication line. In addition, when it detects a data collision (another CM transmitted data at the same time), it performs control that waits for a set length of time before transmitting the data again.



Note: The values in the frame represent the number of bits used for sending the information.

NC-07721

Diagnosis

Each CM can be accessed via the CAN communication line by connecting the Subaru Select Monitor to the connector on the vehicle (data link connector). This enables diagnosis codes to be output, as well as operations such as data monitoring (checking CM data, etc.), active tests (driving various actuators as desired), and customization (setting of control programs). For details, refer to the service manual.