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.

SUBARU CORPORATION

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

1 GENERAL DESCRIPTION

CONTENTS

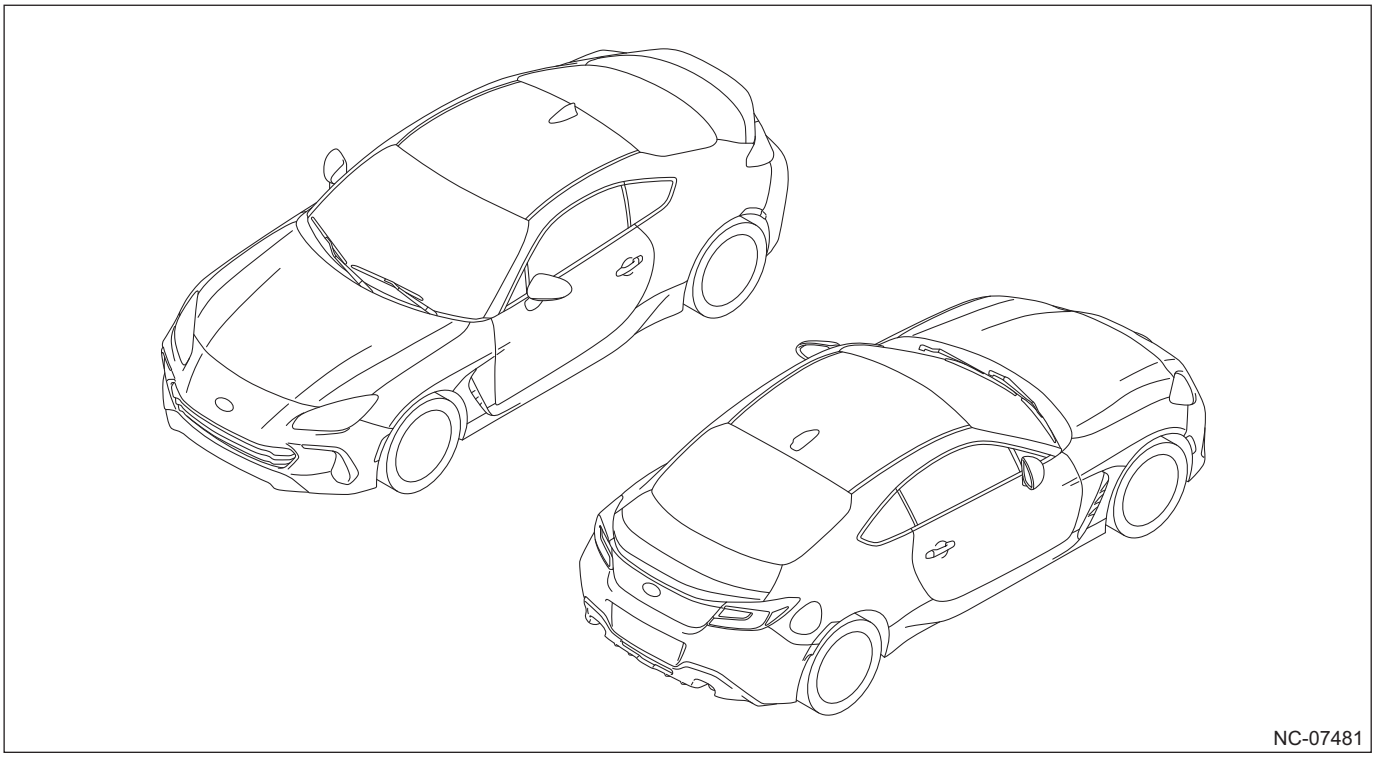
1.1 General Overview 1-2
1.1.1 Vehicle Composition List Table 1-2
1.1.2 Vehicle Appearance and Dimension 1-3
1.1.3 Identification Number and Label Locations 1-4
1.1.4 Vehicle Model Classification Symbol 1-5
1.2 List of Abbreviations 1-8
1.2.1 Table of Abbreviations 1-8

1.1 General Overview

1.1.1 Vehicle Composition List Table

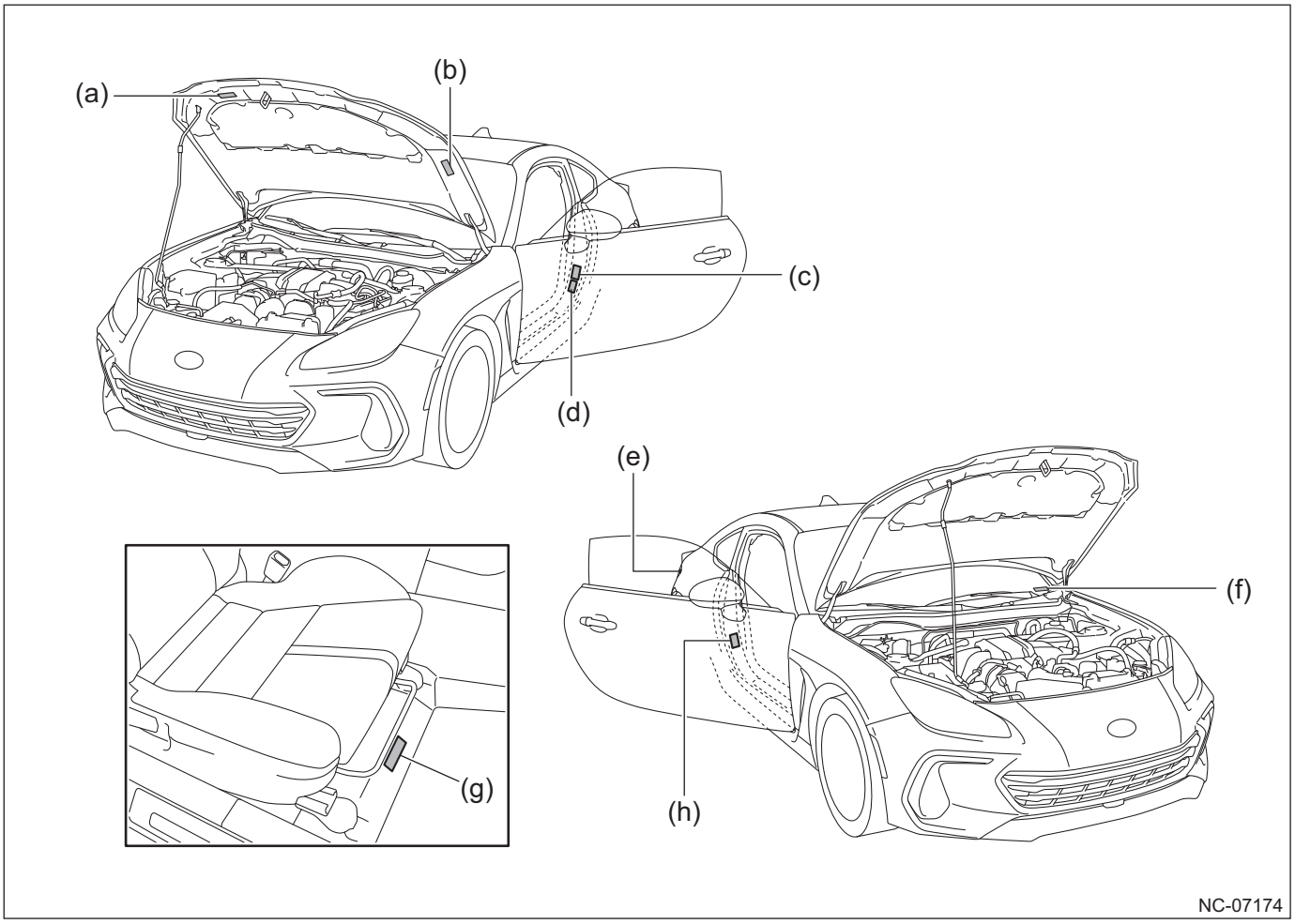
Vehicle shape	Type	Engine	Driving method	Steering wheel position	Destination code	Grade	Transmission
SUBARU BRZ	ZD	2.4 L DOHC NA	FR	LHD	U4, U7, C0	PREMIUM	TL70 (6MT)
						PREMIUM EyeSight	TX6A (6AT)
					U4, U7, C0, C4	LIMITED	TL70 (6MT)
						LIMITED EyeSight	TX6A (6AT)

1.1.2 Vehicle Appearance and Dimension



Overall length		in (mm)	167.9 (4,265)
Overall width		in (mm)	69.9 (1,775)
Overall height (in case of empty vehicle weight)		in (mm)	51.6 (1,310)
Wheel base		in (mm)	101.4 (2,575)
Tread	Front	in (mm)	59.8 (1,520)
	Rear	in (mm)	61.0 (1,550)
Minimum road clearance		in (mm)	5.1 (130)

1.1.3 Identification Number and Label Locations



(a) Air conditioner label
(b) Emission control label
(c) FMVSS or CMVSS label (applied to left side of vehicle)
(d) Tire inflation pressure label
(e) Fuel label
(f) VIN label
(g) VIN (vehicle identification number) (under the right front floor carpet)
(h) Model number label (applied to right side of vehicle)

1.1.4 Vehicle Model Classification Symbol

VIN

Display example:]JF1ZDB###########[

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	Z: SUBARU BRZ
5	Body classification	D: COUPE
6	Displacement class	B: 2.4 L NA 4-CYLINDERS GASOLINE 288HP
7	Grade	B: Premium C: Premium EyeSight E: Limited F: Limited EyeSight
8	Restraints system or GVWR class	: Manual belt + dual A/B + side A/B + curtain A/B + knee A/B (driver's seat)
9	Check number	0 through 9 and X
10	Model year	N: 2022MY
11	Transmission type & manufacturing plant	8: FR 6AT (Gunma Main Plant) 9: FR 6MT (Gunma Main Plant)
12 to 17	Serial number	700001 to 749999

Vehicle model classification

Applied model

Display example: ZD8AY##

#: Differs for each vehicle model

Digits	Meaning	Details
1	Series	Z: SUBARU BRZ
2	Body type	D: SUBARU COUPE
3	Total engine displacement/ Drive system	8: 2.4 L FR (NA)
4	Model year	A: 2022MY
5	Destination	Y: USA
6	Grade	B: PREMIUM C: PREMIUM EyeSight E: LIMITED F: LIMITED EyeSight
7	Fuel feed system/ Transmission	8: 6MT 7: 6AT

Engine

Display example: FA24DXW###

#: 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	D: DOHC MPI + DI NA (LH)
6	Exhaust regulations	X: Tier 3/LEV3
7	Intake/exhaust system	W: Intake AVCS, exhaust AVCS
8	Mounted transmission	B: 6MT U: 6AT
9 and 10	Detailed specifications	Used when ordering parts. For details, refer to the parts catalog.

Transmission

■ MT

Display example: TL701V8A0A (MT)

Digits	Meaning	Details
1	Transmission symbol	T: Transmission
2	Basic transmission system	L: FR
3 and 4	Distance between gear centers	70: 2.8 in (70 mm)
5	Model series	1: 6MT
6	Transmission basic specifications	V: Without Auto Start-Stop, single range 6MT
7	Mounted engine	8: 2.4 L DOHC NA
8 to 10	Detailed specifications	Used when ordering parts. For details, refer to the parts catalog.

■ AT

Display example: TX6A8G8A0A (AT)

Digits	Meaning	Details
1	Transmission symbol	T: Transmission
2	Basic transmission system	X: FR
3 and 4	Transmission type series	6A: 6AT
5	Model series	8: Small system
6	Transmission basic specifications	G: Without Auto Start-Stop, with ATF cooler (with warmer feature), without ATF cooler (air cooler)
7	Mounted engine	8: 2.4 L DOHC NA
8 to 10	Detailed specifications	Used when ordering parts. For details, refer to the parts catalog.

Rear Differential

Identification	Reduction speed ratio	LSD
Y38	4.100	With
Y59	3.909	With

1.2 List of Abbreviations

1.2.1 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
D-4S	Direct injection 4 stroke gasoline engine Superior version
DCCD	Driver's Control Center Differential (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
FR	Front engine rear drive
Ft	Front
FWD	Front Wheel Drive
GPS	Global Positioning System
HBA	High Beam Assist (HBA)
HI	High
HID	High-Intensity Discharge
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
RWD	Rear wheel drive
SDI	Subaru Diagnostic Interface
SGP	Subaru Global Platform
SI	Subaru Intelligent
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
VIN	Vehicle Identification Number
ViS-C	Viscous Coupling
VSC (VDC)	Vehicle Stability Control (Vehicle Dynamics Control)
VSV	Vacuum Switching Valve
VTD	Variable Torque Distribution
W/H	Wiring Harness

2 ENGINE (FA24)

CONTENTS

2.1 Engine Mechanical 2-3
2.1.1 Overview 2-3
2.1.2 Component 2-5
2.2 Fuel System 2-24
2.2.1 Overview 2-24
2.2.2 Component 2-25
2.2.3 Construction and Operation 2-39
2.3 Emission Control System 2-43
2.3.1 Overview 2-43
2.3.2 Component 2-44
2.3.3 Construction and Operation 2-47
2.4 Intake and Exhaust System 2-54
2.4.1 Overview 2-54
2.4.2 Component 2-55
2.4.3 Construction and Operation 2-62
2.5 Cooling System 2-63
2.5.1 Overview 2-63
2.5.2 Component 2-64
2.5.3 Construction and Operation 2-70
2.6 Lubrication System 2-74
2.6.1 Overview 2-74
2.6.2 Component 2-75
2.6.3 Construction and Operation 2-79
2.7 Engine Control System 2-80
2.7.1 Overview 2-80
2.7.2 Component 2-81
2.7.3 Construction and Operation 2-98

2.8 Ignition 2-116
2.8.1 Overview 2-116
2.8.2 Component. 2-117
2.8.3 Construction and Operation. 2-120
2.9 Starting/Charging System 2-121
2.9.1 Overview 2-121
2.9.2 Component. 2-122
2.9.3 Construction and Operation. 2-125

2.1 Engine Mechanical

2.1.1 Overview

Overview

- Based on the development concept of "perfecting a sports car", SUBARU adopted a newly developed 2.4 L D-4S NA engine that is focused on being "an engine with a good rev that drivers want to run fast".
- It is an engine that "runs stress-free up to high speed ranges" and is "lightweight, compact, and has a low center of gravity". With a displacement of 2.4 L, it was also designed for excellent dynamic performance and high engine response. It responds quickly and precisely to the driver's accelerator work, and delivers the necessary engine performance for a sports car that handles exactly as the driver wants it to.
- Utilizing the advantages of the fuel system, it achieves excellent intake and exhaust performance and low friction, delivering both a 2.4 L displacement and high levels of output and environmental performance.
- Improvements to the basic engine structure and individual components have resulted in a smaller required amount of engine oil. While providing the displacement and high output of a 2.4 L engine, it maintains the same overall engine length, width, and height as the current model. Reducing the engine weight contributes to delivering the ultimate in handling performance.

Specifications

Power unit

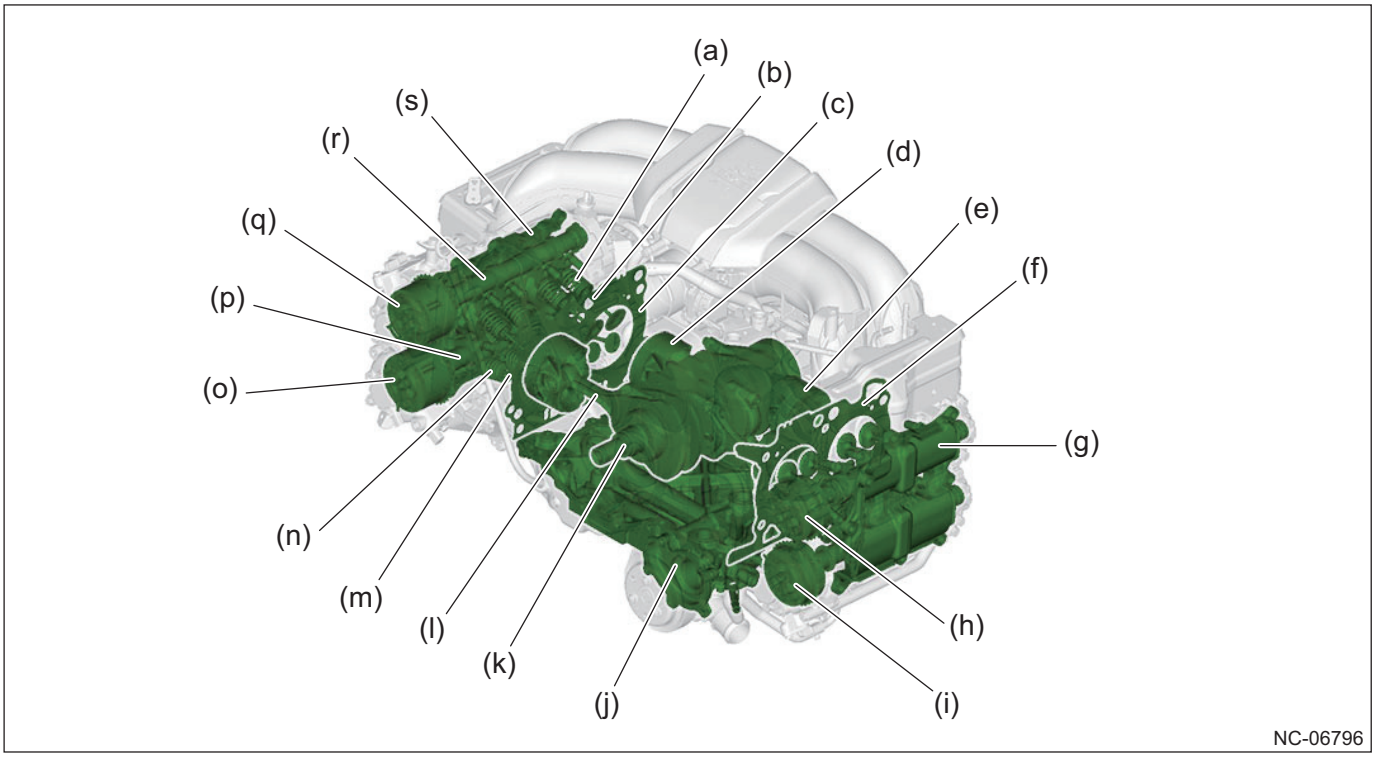
Engine	Transmission type	Maximum output [HP (kW)/(r/min)]	Maximum torque [lb-ft (N-m, kgf-m)/(r/min)]
2.4 L DOHC NA	MT	228 (170)/7,000	184 (250, 25.5)/3,700
	AT	228 (170)/7,000	184 (250, 25.5)/3,700

Major specification

Engine classification		2.4 L DOHC NA
Engine type		FA24
Cylinder arrangement		Horizontally opposed, water-cooled 4-cylinder, 4-stroke gasoline engine
Fuel supply system		Cylinder direct fuel injection method + port injection method
Fuel used		Premium unleaded gasoline
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		12.5
Compression pressure (at 200 to 300 r/min) [psi (kPa, kgf/cm^2)]		202 to 252 (1,390 to 1,735, 14 to 18)
Idling speed (select lever in [P] or [N] range) [r/min]	No load	MT: 650±50 AT: 700±50
	A/C ON	MT: 700 to 870±50 AT: 700 to 870±50
Ignition timing (BTDC) [r/min]		MT: 12°/650 AT: 13°/700
Valve train		Timing chain driven
		Double overhead camshaft
		Roller rocker system
		Shim-adjusted valve clearance system
		Intake/exhaust AVCS
Intake system		Natural aspiration

2.1.2 Component

Component layout drawing

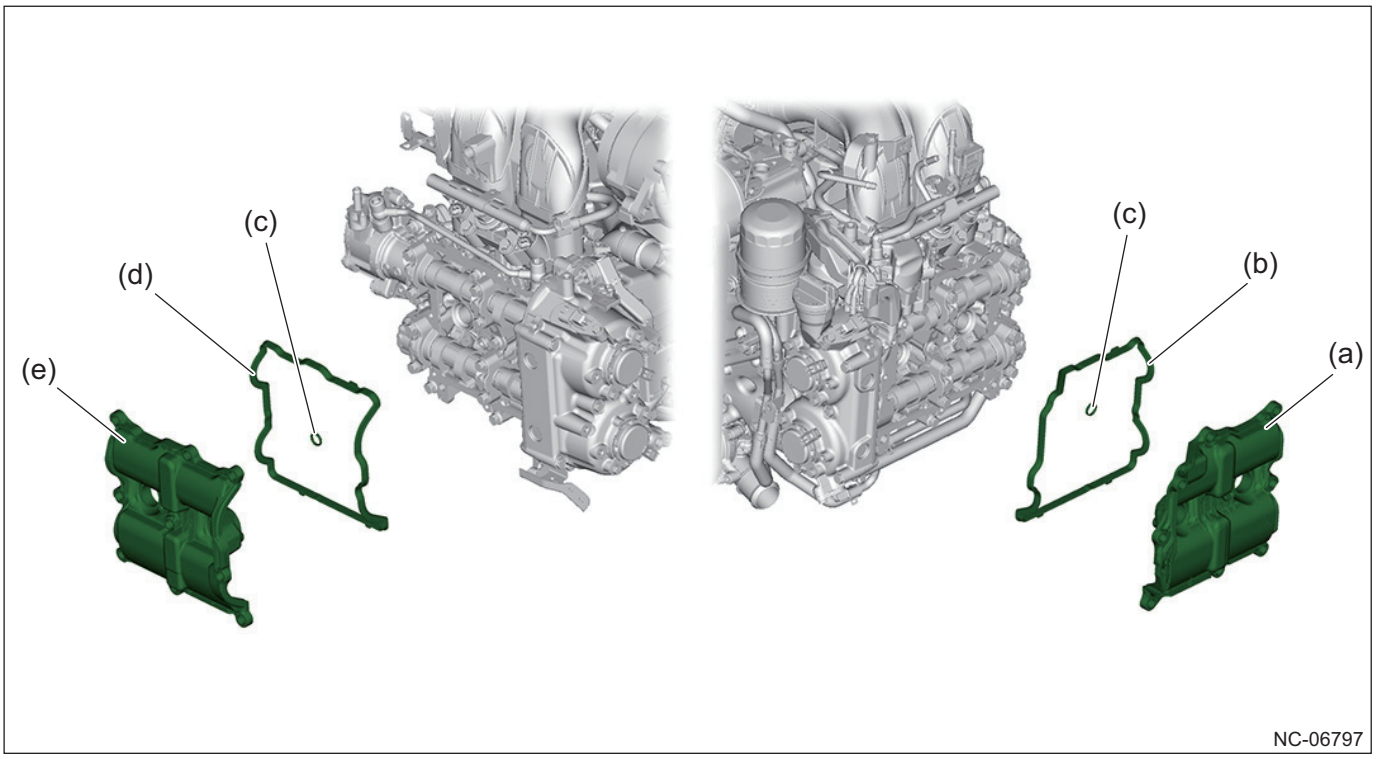


(a) Valve spring (intake)
(b) Intake valve
(c) Cylinder head gasket RH
(d) Piston RH
(e) Piston LH
(f) Cylinder head gasket LH
(g) Rocker cover LH
(h) Intake cam sprocket LH
(i) Exhaust cam sprocket LH
(j) Oil pan upper
(k) Crankshaft
(l) Connecting rod
(m) Exhaust valve
(n) Valve spring (exhaust)
(o)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

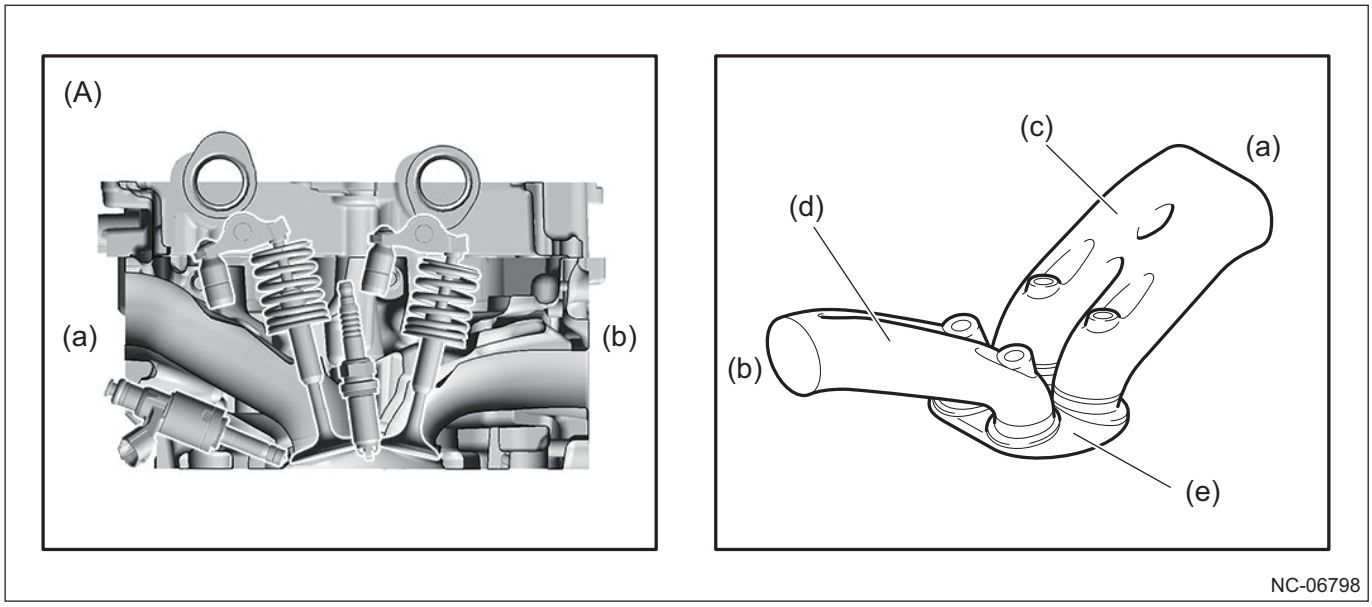


(a) Rocker cover LH
(b) Rocker cover gasket LH
(c) Rocker cover gasket
(d) Rocker cover gasket RH
(e) Rocker cover RH

Cylinder head

The shape of the intake port has been enlarged to support higher output and the intake airflow has been increased from all directions around the valve to provide a smooth torque curve all the way to the output peak.

A material with superior wear resistance was adopted for the intake-side valve seat.

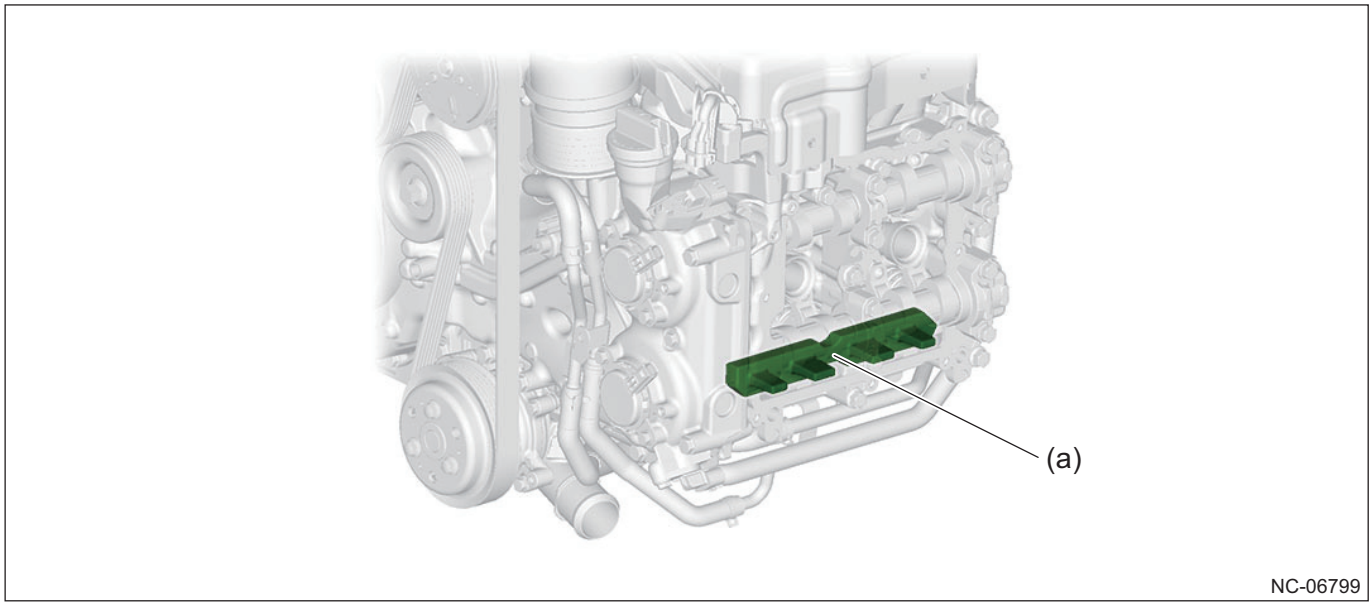


(A) Cylinder head cross section

(a) Intake side
(b) Exhaust side
(c) Intake port
(d) Exhaust port
(e) Combustion chamber

Oil spacer

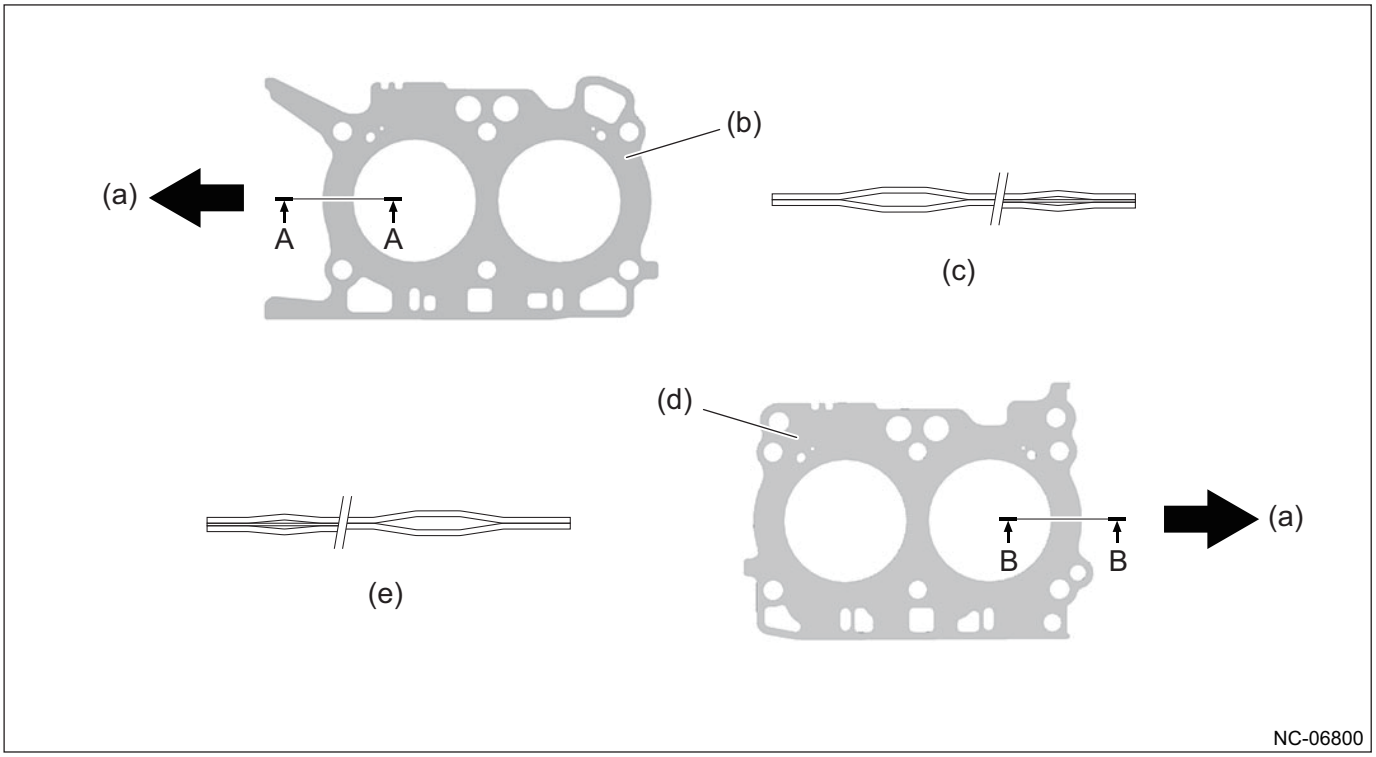
An oil spacer was adopted to reduce the amount of dead space inside the cylinder head. This prevents engine oil from accumulating on one side when turning, and allows the required amount of engine oil to be reduced. Reducing the amount of engine oil and lowering its thermal capacity improves warm-up performance and delivers improved fuel economy.



(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 bore diameter was set to 3.70 in (94 mm) in order to support higher output.

The shape of the cylinder liner surface was 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 support higher engine speeds, the shape of the ribs on the rear of the cylinder block was optimized and their rigidity was increased. The rear oil seal yield strength has also been increased.

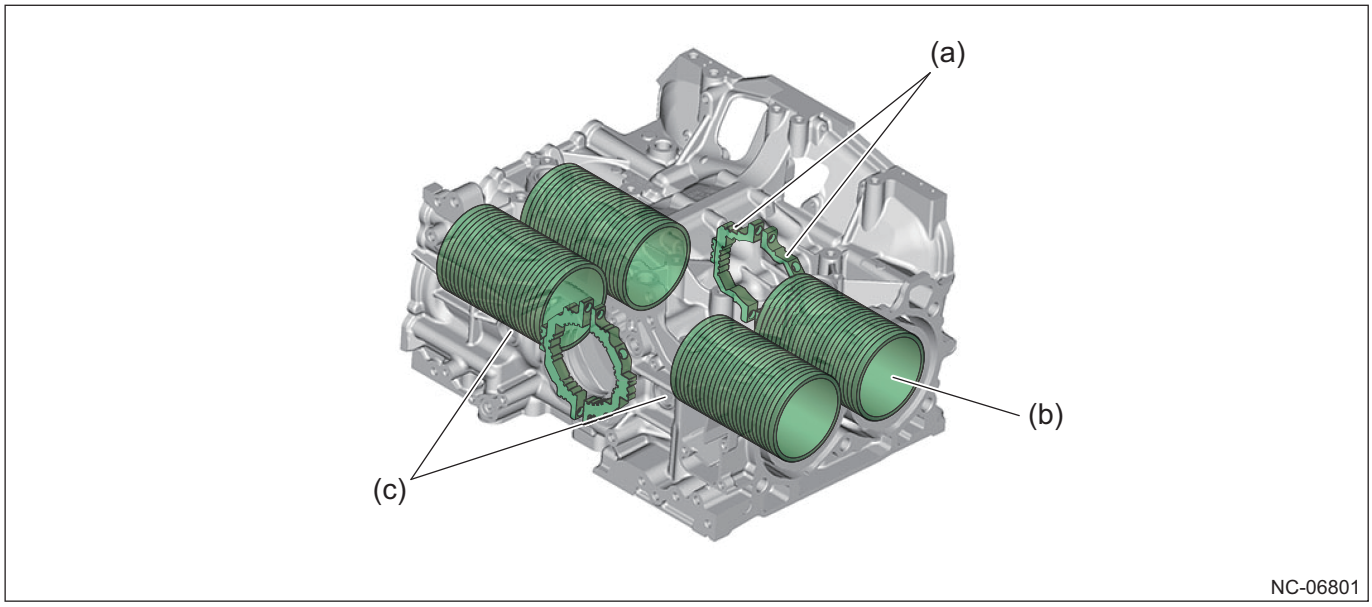
A service hole was added in order to ensure assembly performance of the piston onto the horizontally split connecting rod.

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.

Ribs were added to the cylinder block chain chamber surface to reduce oil accumulation on one side when turning.

In order to support the increase in pressure inside the crank case resulting from higher output, the blow-by inflow area of the front separator chamber was increased, improving the blow-by gas processing capacity.

The overall length of the cylinder liner was increased to reduce piston slap and reduce friction.



(a) Journal piece
(b) Cylinder liner
(c) Service hole

Oil pan upper, oil pan

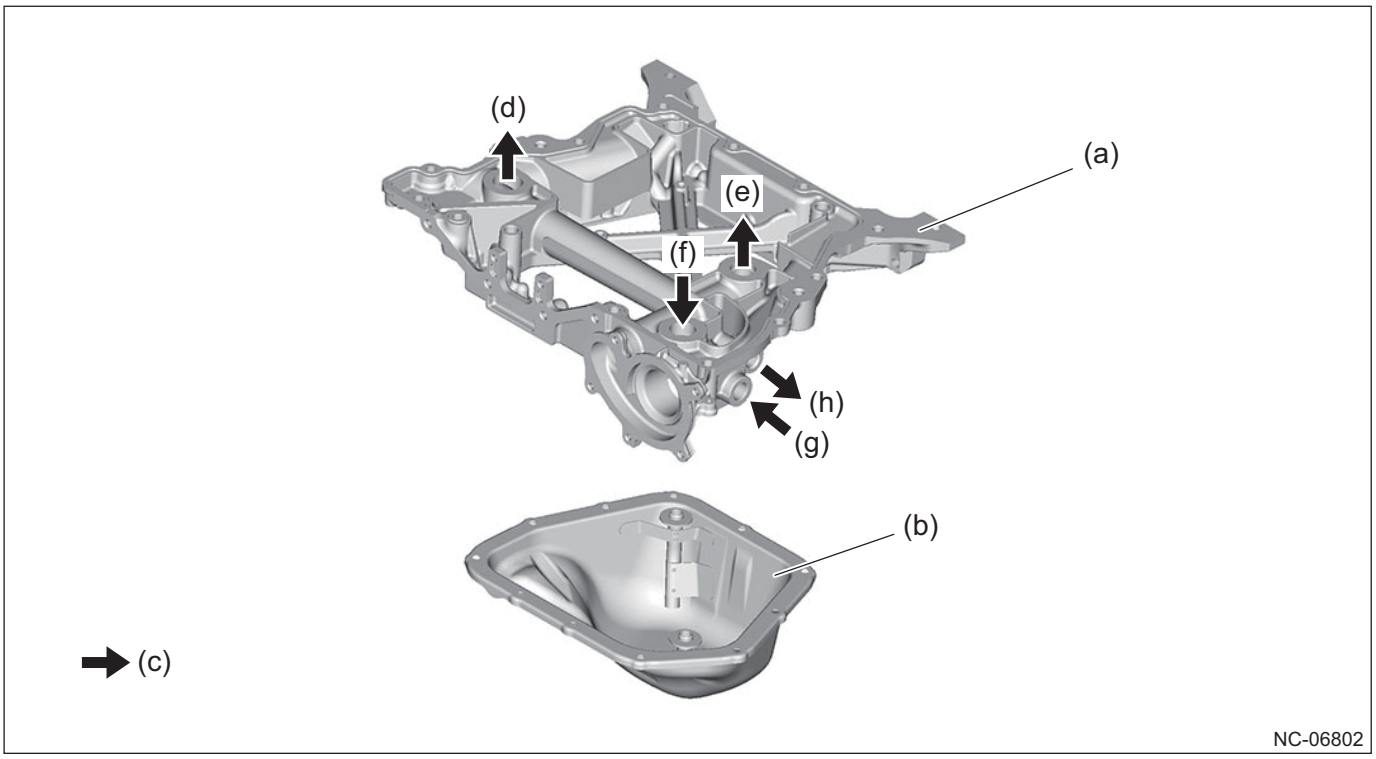
A circuit was created in the oil pan upper that distributes coolant to the cylinder block and cylinder head. The 50:50 flow allocation to the left and right banks improves knock resistance and contributes to improved output.

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

Ribs were added inside the chain chamber to reduce oil accumulation on one side when turning.

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.

A stamped iron plate oil pan has been adopted, and a recessed shape has been added to secure a gap with the exhaust system that supports the higher output.



(a) Oil pan upper
(b) Oil pan
(c) Flow of coolant
(d) To cylinder block RH
(e) To cylinder block LH
(f) From bottom by-pass
(g) From heater core/engine oil cooler
(h) To ATF warmer (AT)

Piston

Piston

- Surface treatment was applied to the crowns to increase crown strength and support higher output.
- 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.

Piston pin

- Optimizing the end shape ensures insertion performance during assembly while also improving reliability in order to support increased input resulting from high output and high engine speeds.
- The circlip shape was optimized for installation of the piston pin from the service hole.

Top ring

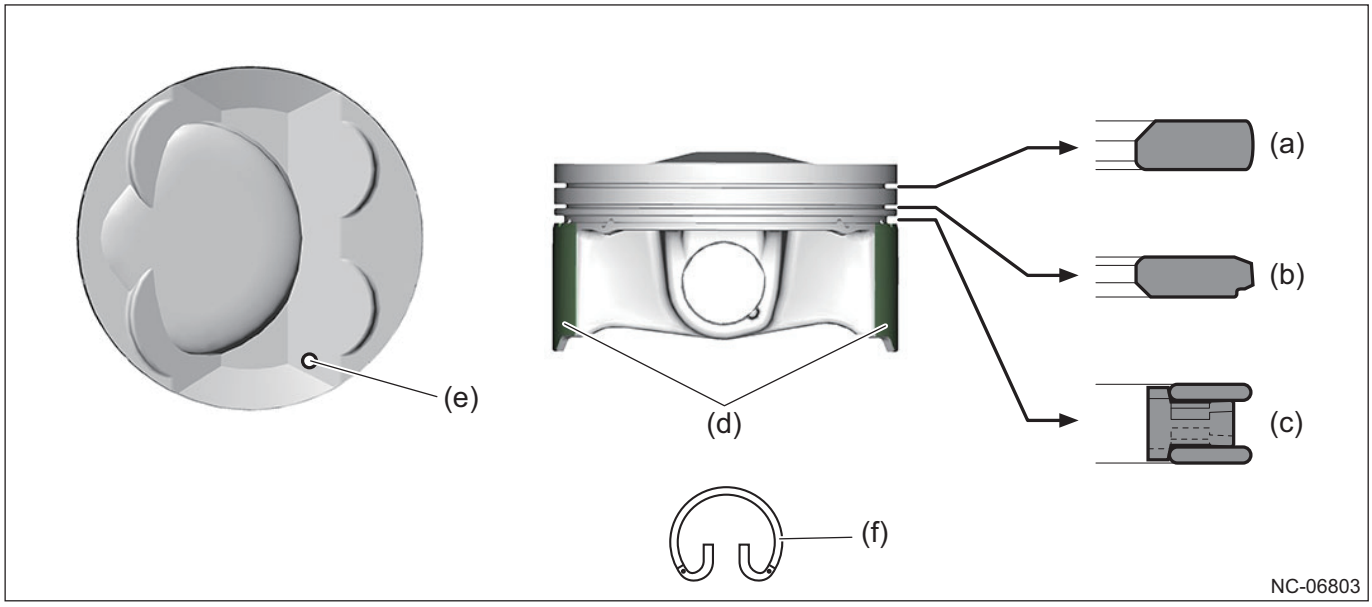
- The adoption of high-thermal conducting material has improved the knock limit. The ring gap interval and tension were optimized in order to reduce blow-by gas and friction loss resulting from higher output and high engine speeds. A PVD coating is applied to the outer peripheral surface, reducing friction and ensuring wear resistance.

Second ring

- The ring gap interval and tension were optimized in order to reduce blow-by gas and friction loss resulting from higher output and high engine speeds, and a balance cut was added to the bottom of the outer periphery, improving oil removal performance.

Oil ring

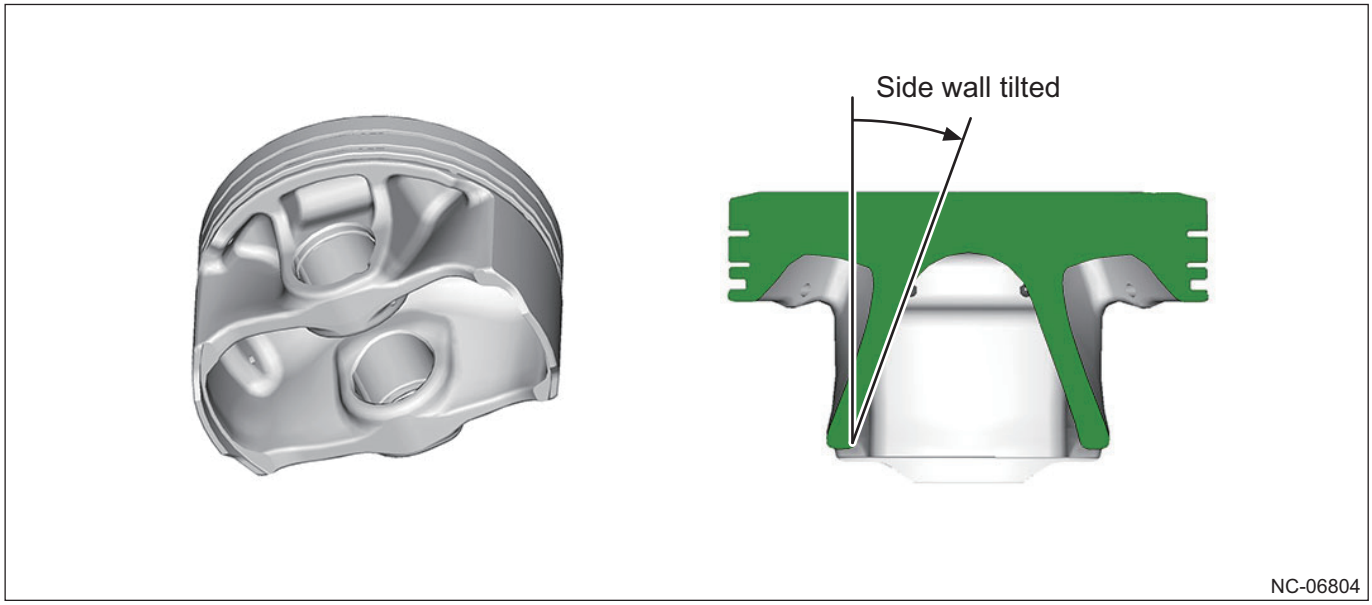
- The tension was optimized and a high-barrel shape was adopted for the outer peripheral surface in order to reduce the blow-by gas and friction loss resulting from higher output and high engine speeds. A PVD coating is applied to the outer peripheral surface, reducing friction and ensuring wear resistance. The oil ring was changed to a single tab 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
(f) Circlip

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-tension 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.

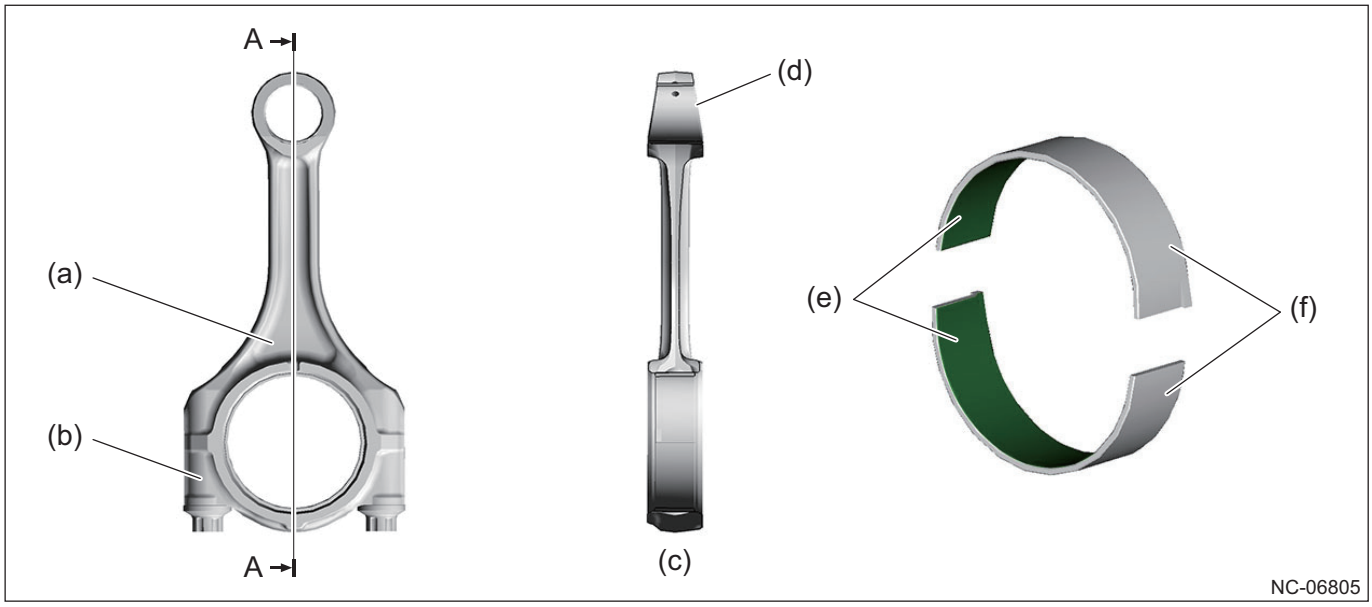
Machined micro-grooves on the inside of the connecting rod bearing reduce friction and ensure reliability.

A connecting rod big end inner diameter of Φ2.17 in (55 mm) has been adopted to support the Φ2.05 in (52 mm) diameter of the crankshaft pin. The use of a connecting rod with a horizontally split large end supports higher output and also ensures reliability.

The connecting rod bolts were changed in order to withstand higher output and high engine speeds. The bolt head shape was changed to support the increase in tightening torque.

The oil relief on the connecting rod bearing was shortened in order to allow the use of a horizontally split connecting rod.

The crush relief of the connecting rod bearing was expanded, improving the resistance to foreign substances.

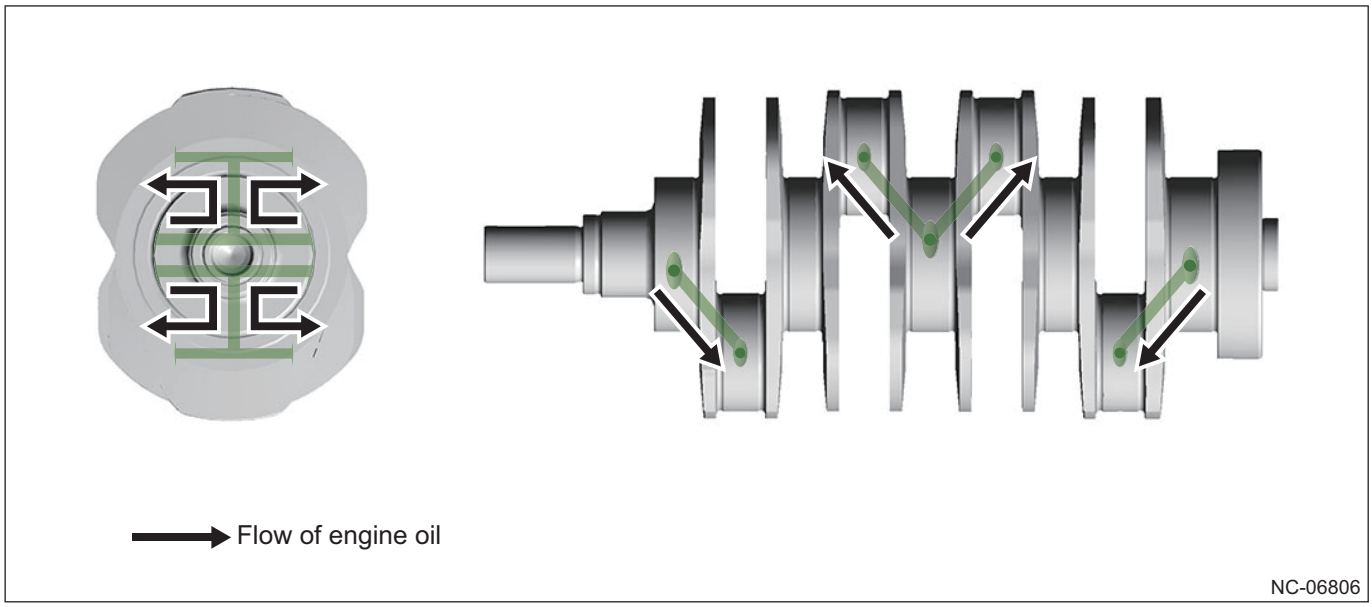


(a) Connecting rod
(b) Connecting rod cap
(c) A-A cross section
(d) Taper cut shape
(e) Micro-groove machining
(f) Connecting rod bearing

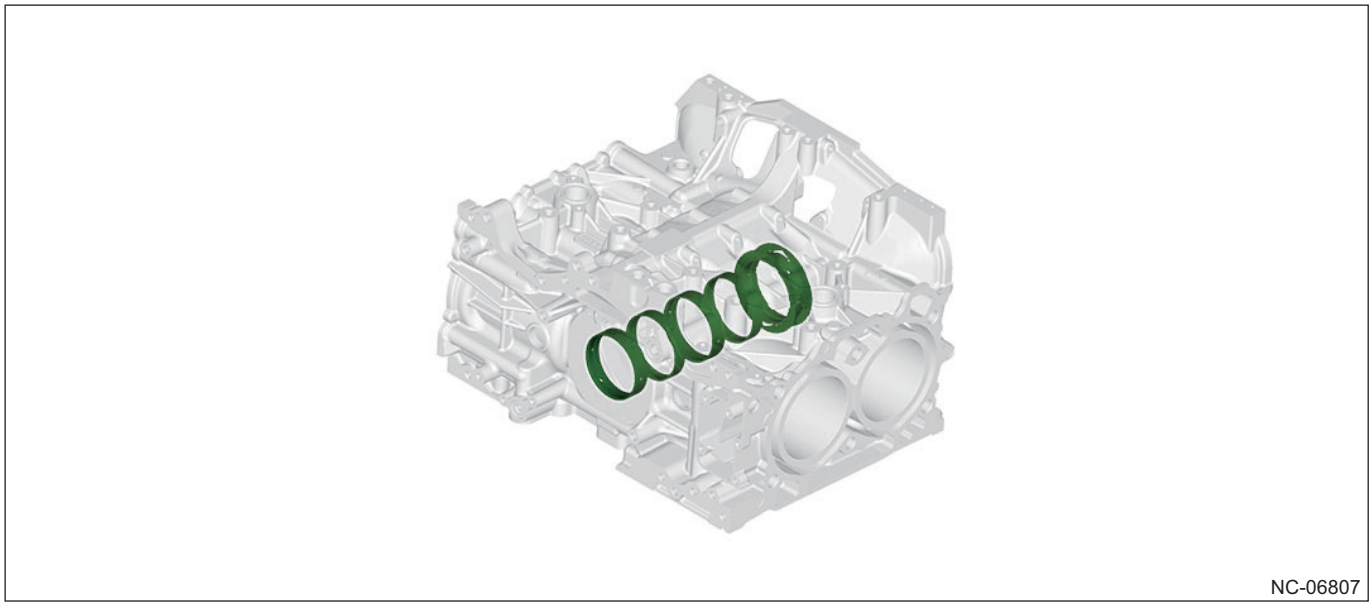
Crankshaft

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

The crankshaft pin diameter has been enlarged to Φ2.05 in (52 mm) to support higher output and high engine speeds, ensuring reliability. Improvements to crankshaft rigidity and strength and to crankshaft bearing lubrication reliability were enacted to reduce engine vibration and noise. The shape of the oil holes inside the crankshaft was optimized.



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.



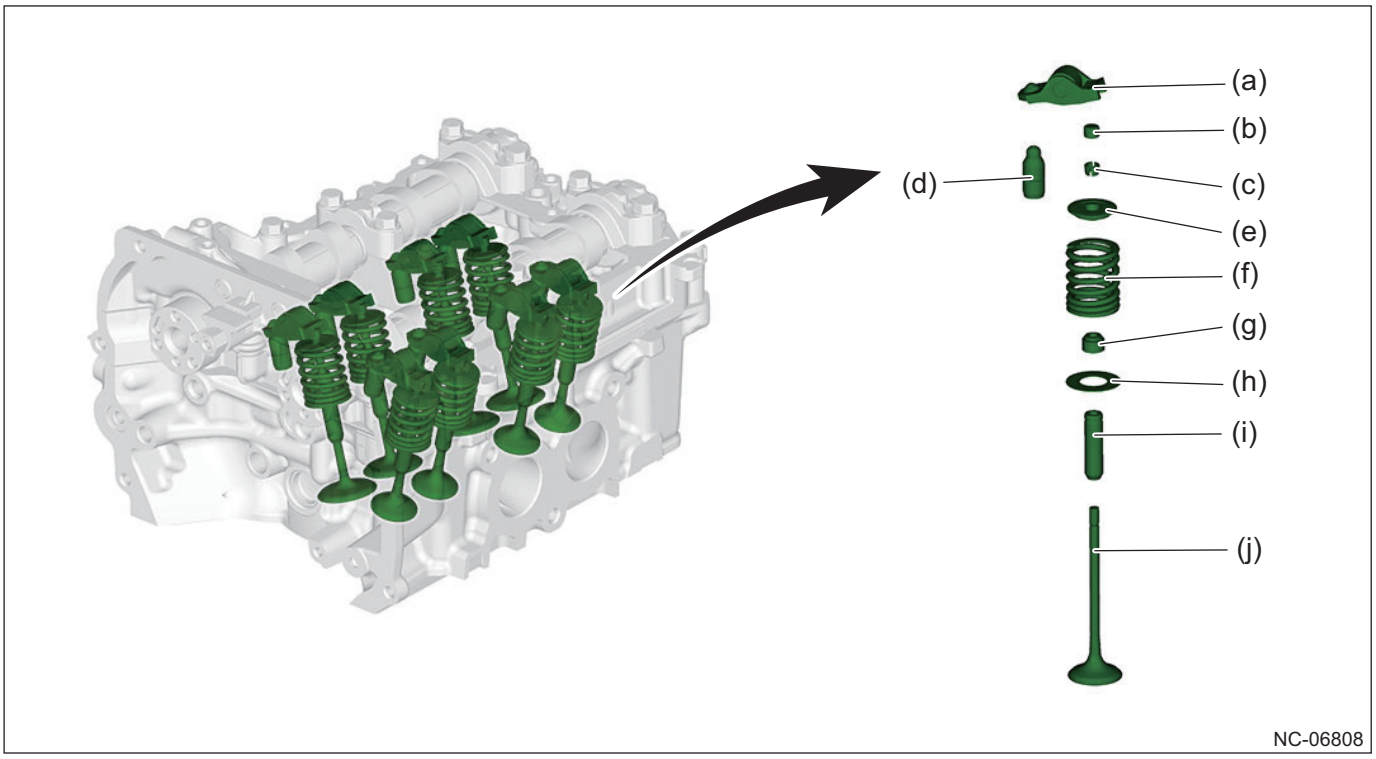
Intake and exhaust valves

In order to ensure the intake airflow necessary to support higher output, the diameter of the intake valve head was optimized. In order to reduce the increase in mass resulting from the larger valve head diameter, weight was reduced with a hollow shaft and recessed head underside shape. This contributes to the creation of a high-output engine that runs smoothly all the way up to high speed ranges.

A hollow exhaust valve shaft is used, and the valve is filled with a combination of sodium + getter material that provides excellent cooling performance. Knocking resistance performance is improved by the improved cooling effects, achieving improvements in both fuel economy and output.

A 3-step variable pitch spring was adopted in order to withstand the high-load environment resulting from higher engine speeds and output.

The adoption of a roller rocker in the valve train reduces friction and improves fuel economy.



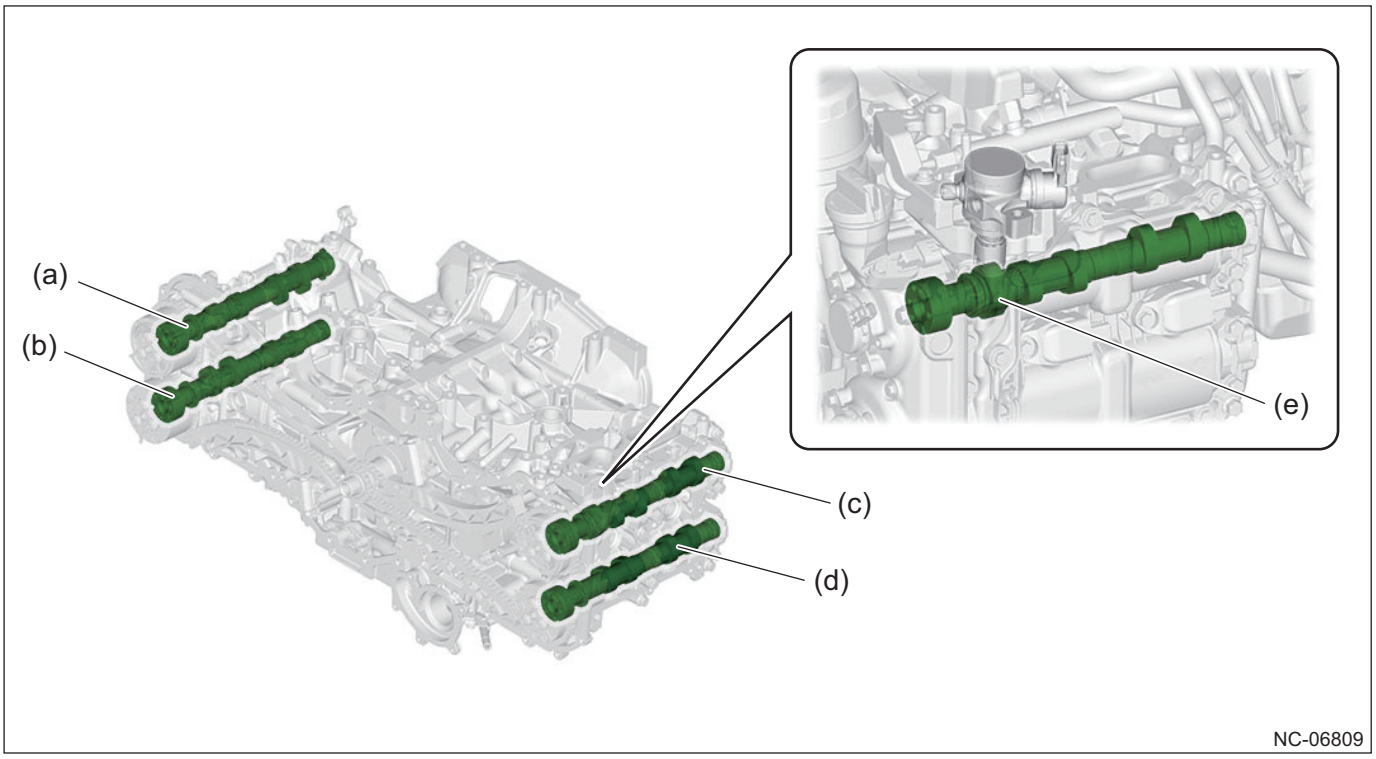
(a) Roller rocker arm
(b) Valve shim
(c) Valve collet
(d) Roller rocker arm pivot
(e) Valve spring retainer
(f) Valve spring
(g) Valve oil seal
(h) Valve spring seat
(i) Valve guide
(j) Valve

Camshaft

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

The cam profile was optimized in order to ensure smooth rotation up to high engine speeds while taking in a large flow of air in order to achieve a high-output, high-speed engine.

The cam that drives the high-pressure fuel pump was placed on the intake camshaft LH front end. The pump drive cam has 4 peaks, and the pump fuel pressure feed and injector fuel injection are synchronized to reduce pressure fluctuation in the fuel delivery pipe when starting and when the throttle valve is wide open.



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

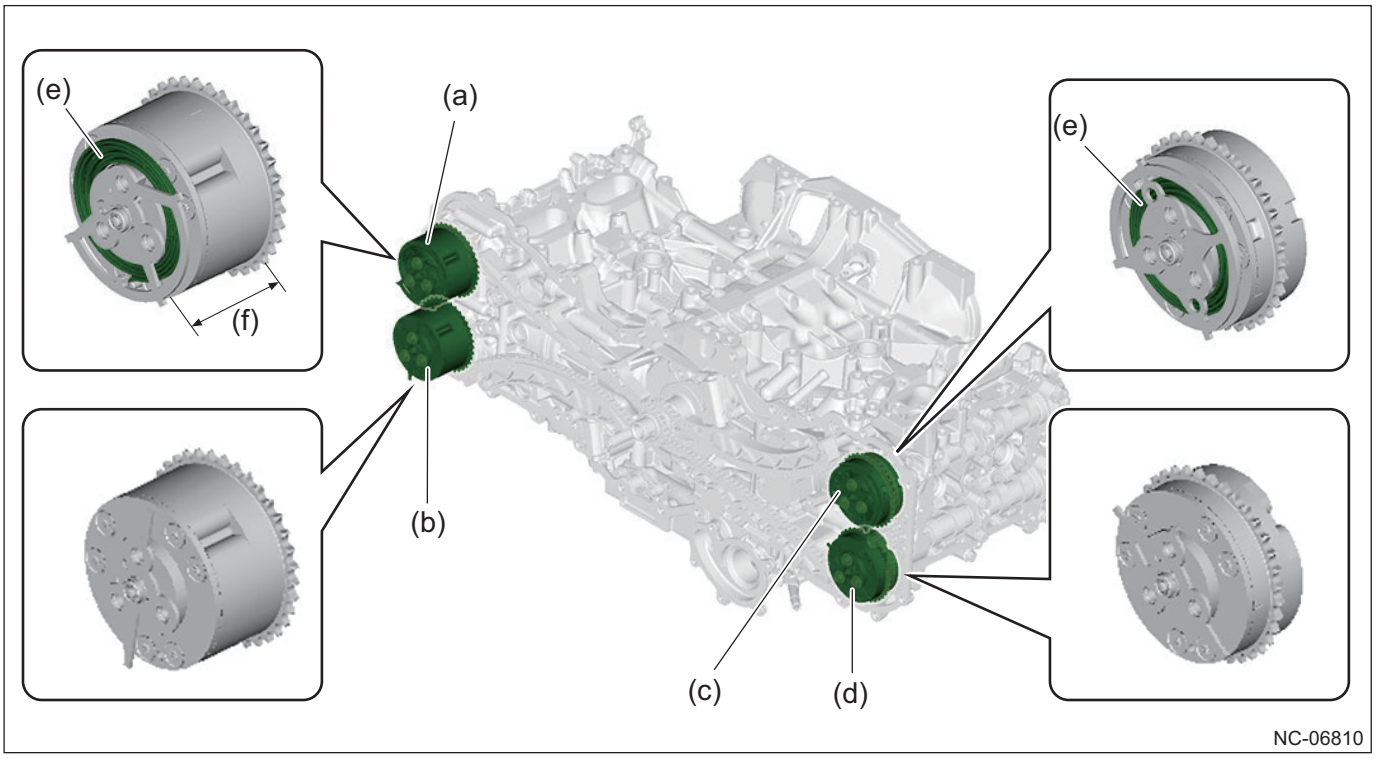
Cam sprocket

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.

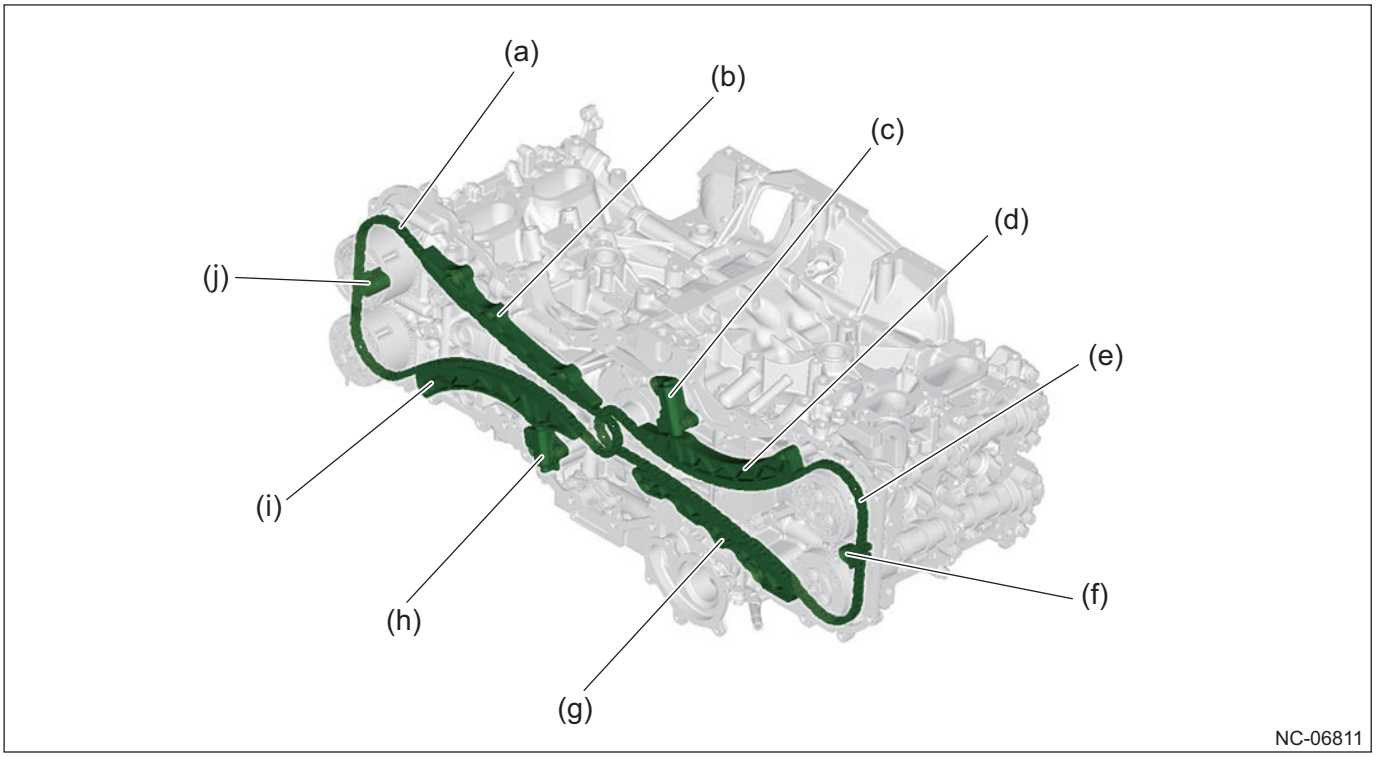
In order to ensure AVCS response on the intake side, an assist spring was adopted that improves engine response.



(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

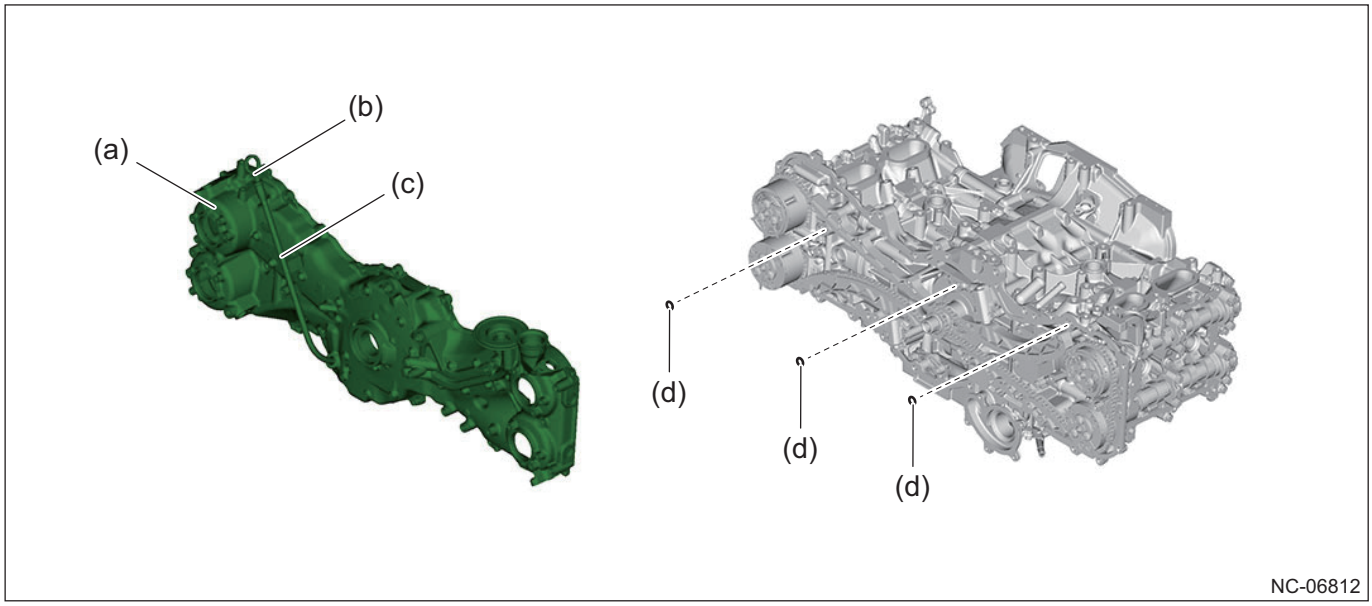
A ratchet-type hydraulic tensioner has been adopted. The chain tensioner LH structure uses an inner sleeve structure, and oil is retained inside the chain tensioner. For the chain tensioner RH, the structure of sealing with the cylinder block has been revised to retain the oil of the oil passages. This 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 LH
(e) Timing chain
(f) Side chain guide LH
(g) Chain guide LH
(h) Chain tensioner RH
(i) Chain tension lever RH
(j) Side chain guide RH

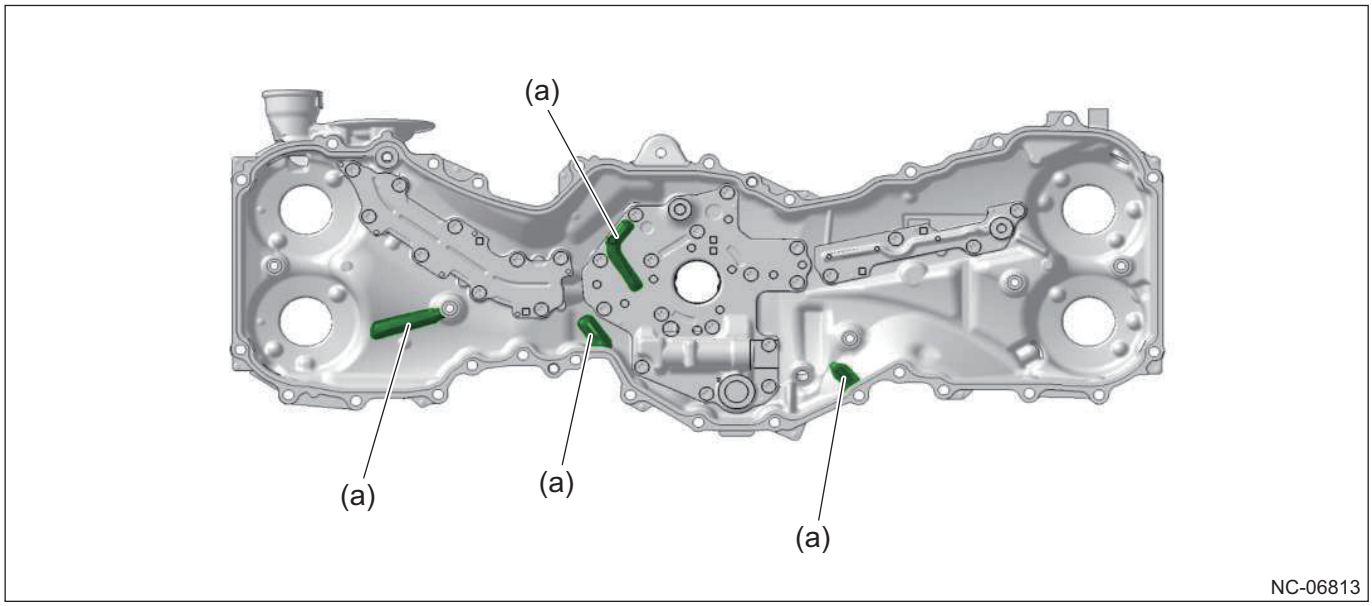
Chain cover

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

Ribs were added inside the chain chamber to reduce oil accumulation on one side when turning and to reduce the total amount of oil.

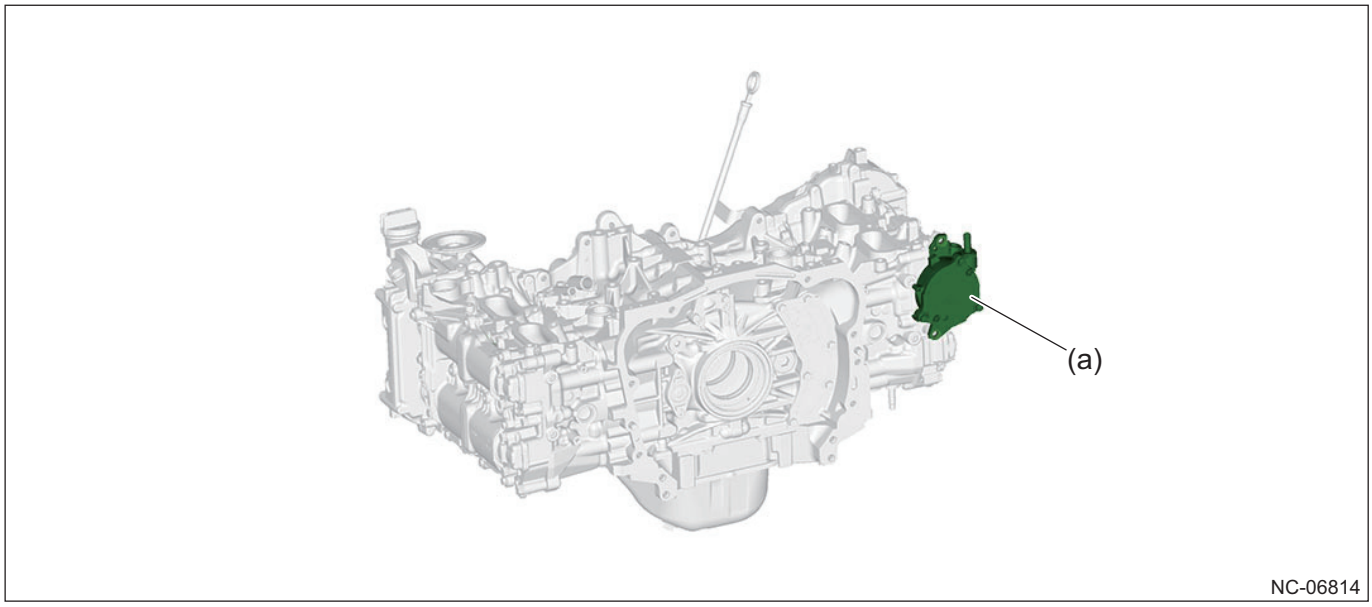


(a) Rib

Vacuum pump

The vacuum pump that was previously only used in AT models has now also been adopted for MT models to provide a stable supply of brake vacuum when starting and when at high elevations.

The vacuum pump is mounted on the rear end of the engine, and is driven by the intake camshaft RH.

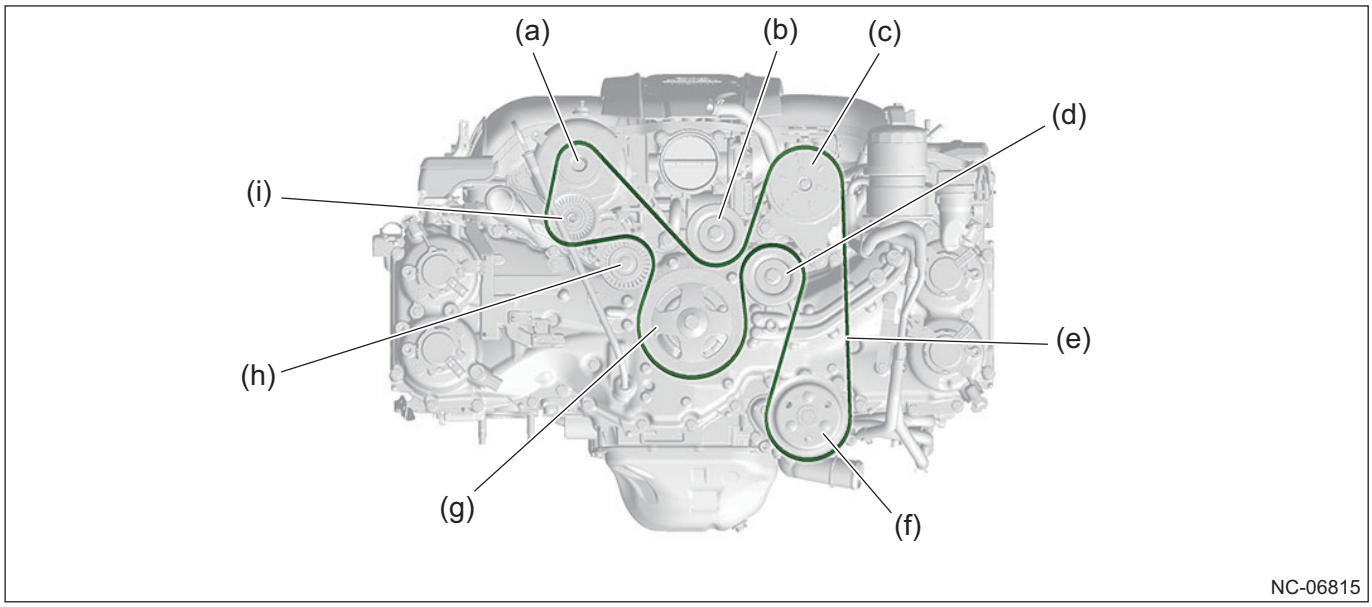


(a) Vacuum pump

Belt system

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

The adoption of an auto-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 auto-tensioner.

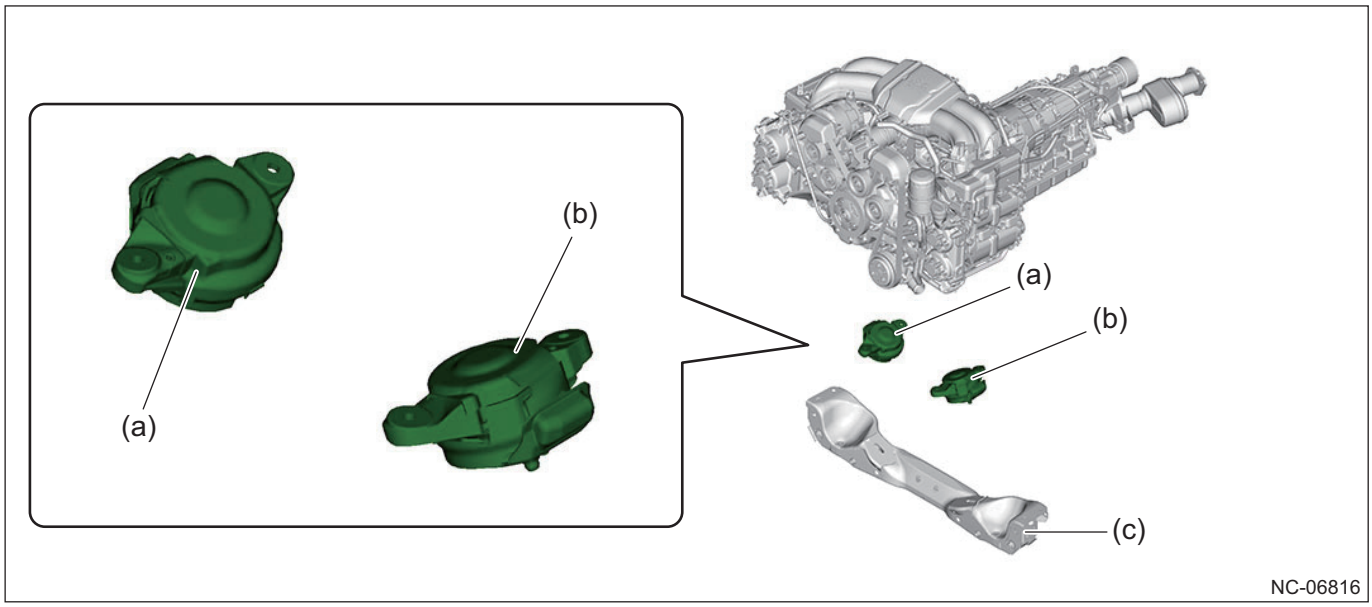


(a) Generator
(b) Idler pulley No. 2
(c) Compressor assembly
(d) Idler pulley No. 3
(e) V-belt
(f) Water pump
(g) Crank pulley
(h) V belt tensioner assembly
(i) Idler pulley No. 1

Engine mount

A liquid-filled mount has been adopted for the front cushion rubber, and the structure mounts the engine onto the suspension crossmember.

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) Suspension crossmember

2.2 Fuel System

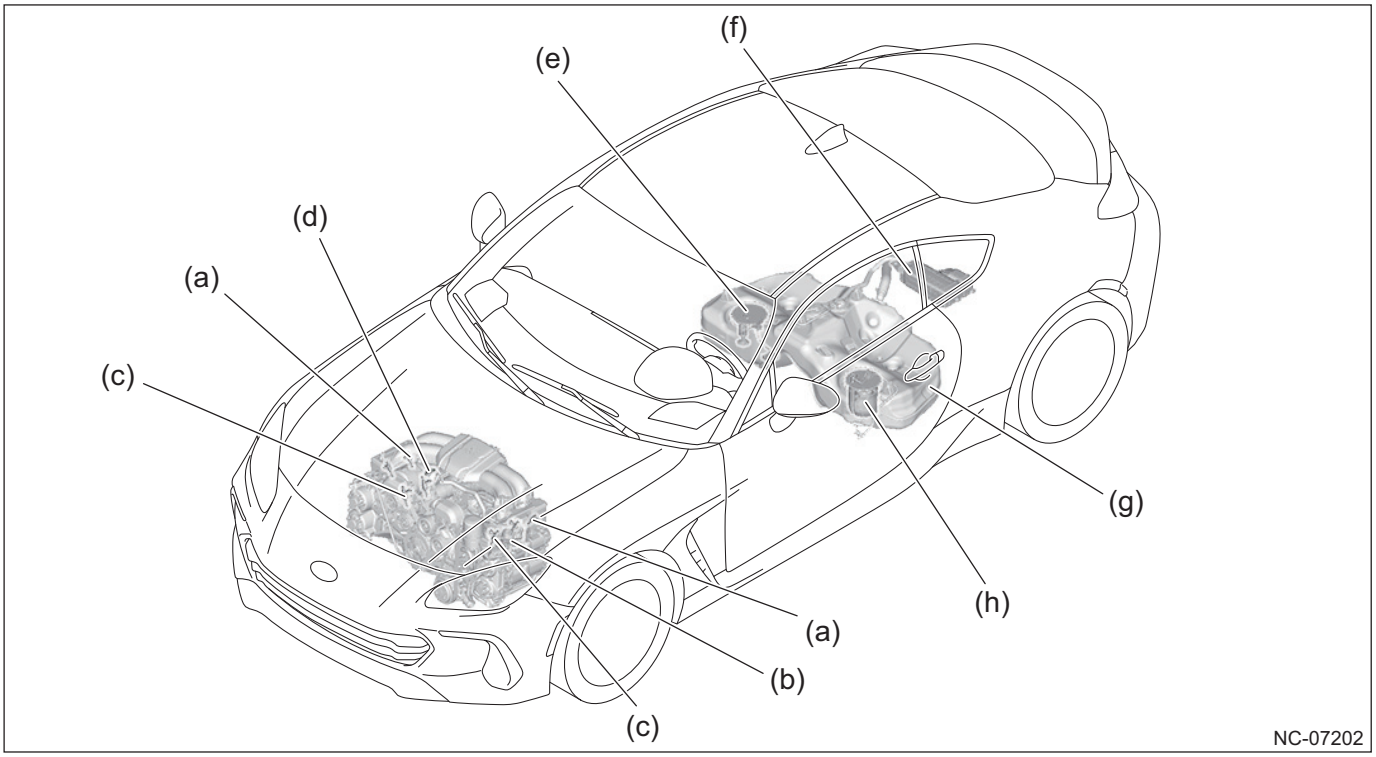
2.2.1 Overview

Overview

- A D-4S (Direct injection 4-stroke gasoline engine Superior version) system equipped with two fuel injection methods, cylinder injection and port injection, has been adopted. The fuel which is supplied under pressure from the fuel tank is sent to the low-pressure fuel system and high-pressure fuel system. The fuel that was sent to the low-pressure fuel system is injected into the intake port from the fuel injector assembly (for port injection). The fuel that was sent to the high-pressure fuel system is pressurized by the high-pressure fuel pump and injected into the combustion chamber from the fuel injector assembly (for cylinder direct injection).
- A fuel return less system is used where fuel pressure control in the low-pressure fuel system is performed by a pressure regulator that is installed inside the low-pressure fuel pump assembly.
- Fuel pressure control for the high-pressure fuel system uses a return-less structure where control is performed by a solenoid spill valve installed in the high-pressure fuel pump. This greatly simplifies the structure and reduces fuel evaporation gas emissions.
- A resin straddle-type fuel tank has been adopted.
- The structure covers the high-pressure 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 was adopted which protects the fuel pipe with plate protectors and a cast iron fuel pipe protector.

2.2.2 Component

Component layout drawing



(a) Fuel injector assembly (for port injection)
(b) High-pressure fuel pump
(c) Fuel injector assembly (for cylinder direct injection)
(d) Fuel pressure sensor (high pressure side)
(e) Fuel sub level sensor
(f) Canister
(g) Fuel tank
(h) Fuel pump assembly

Component details

Fuel tank

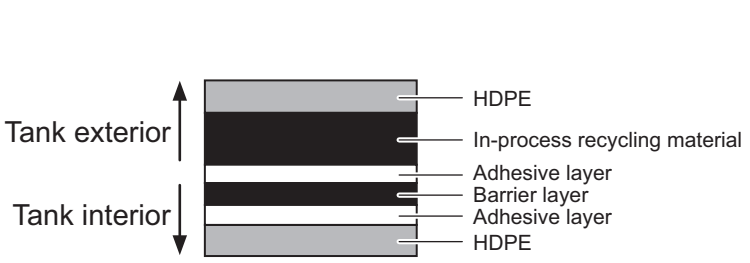
A resin fuel tank has been adopted in order to reduce vehicle weight. It uses a 6-layer resin structure to achieve low fuel permeability.

The fuel tank capacity is 13.2 US gal (50 liters, 11 Imp gal).

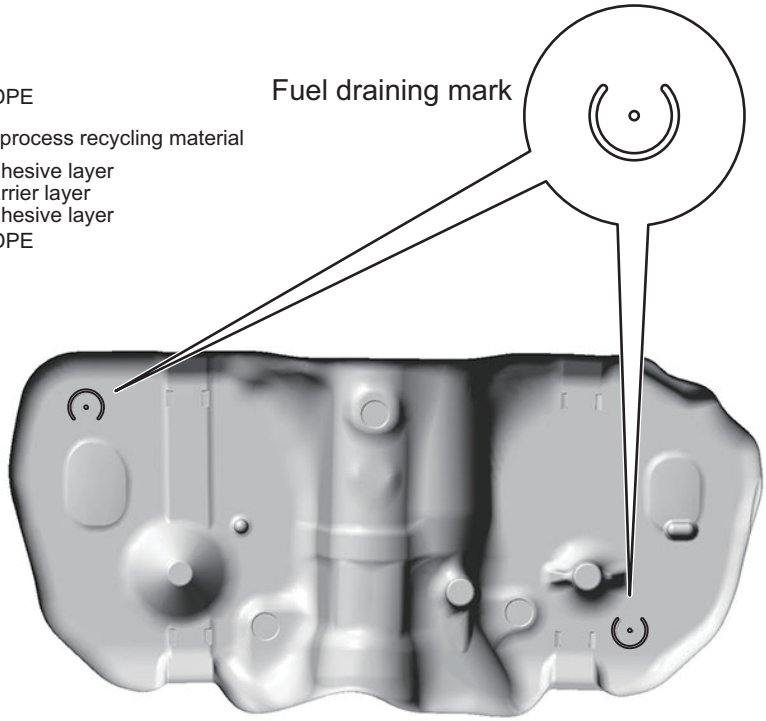
A straddle type tank shape is used so that the propeller shaft and other parts can pass through the center portion of the fuel tank assembly. As a result, a jet pump for fuel transport is adopted for the fuel chamber on the low-pressure fuel pump side.

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.

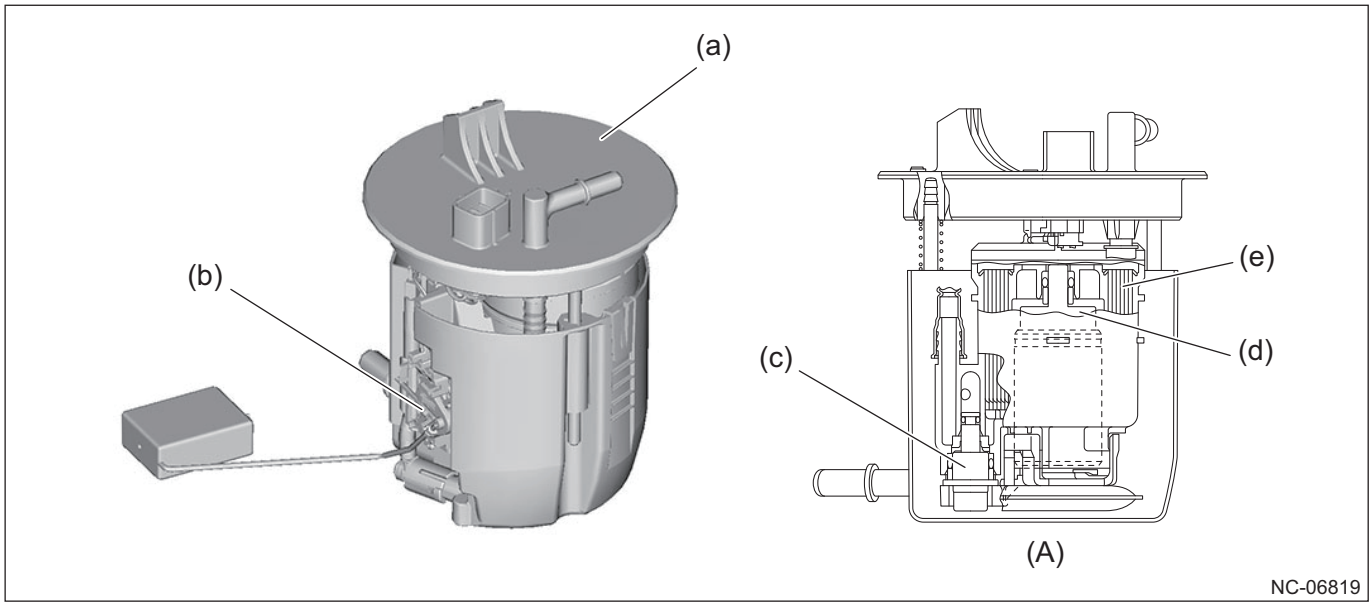
NC-06818

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 and low-pressure fuel system.

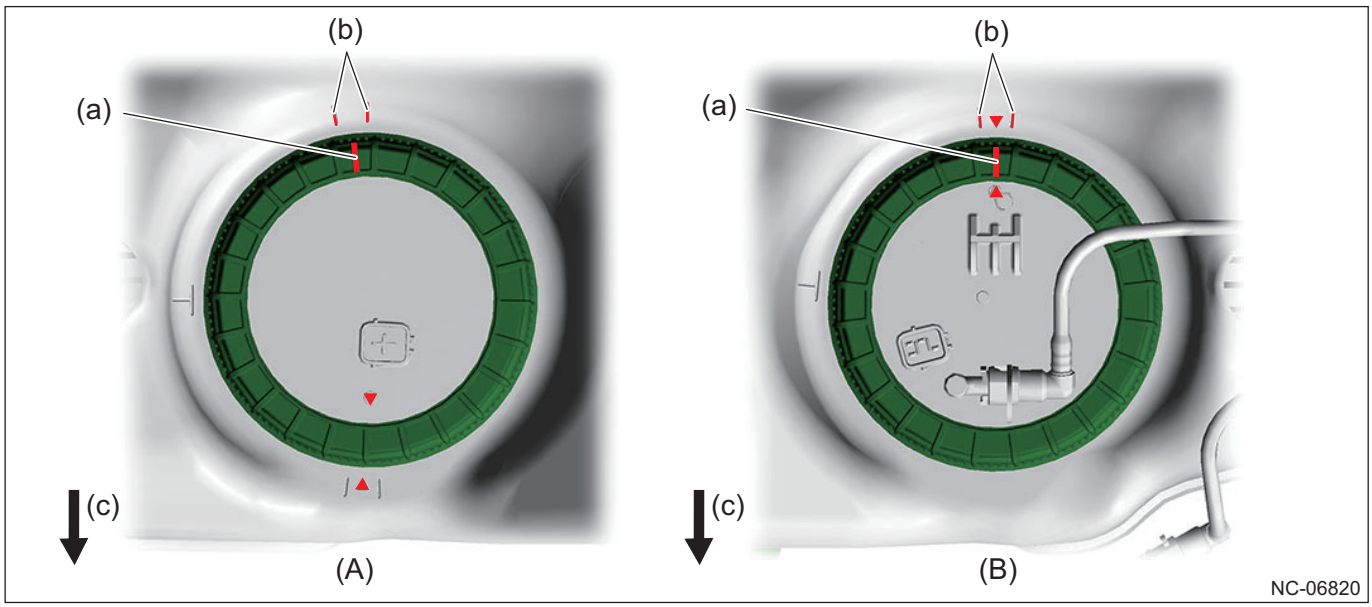
In order to ensure safety in the event of a front collision, side collision (when airbags are deployed), or rear-end collision (when airbags are not deployed), a system is adopted that turns OFF the circuit opening relay in response to the signal transmitted from the airbag CM, preventing fuel leaks.



(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 sub level sensor

(B) Fuel pump assembly

(a) Ring nut mark

(c) Vehicle front side

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

High-pressure fuel pump

■ Construction

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

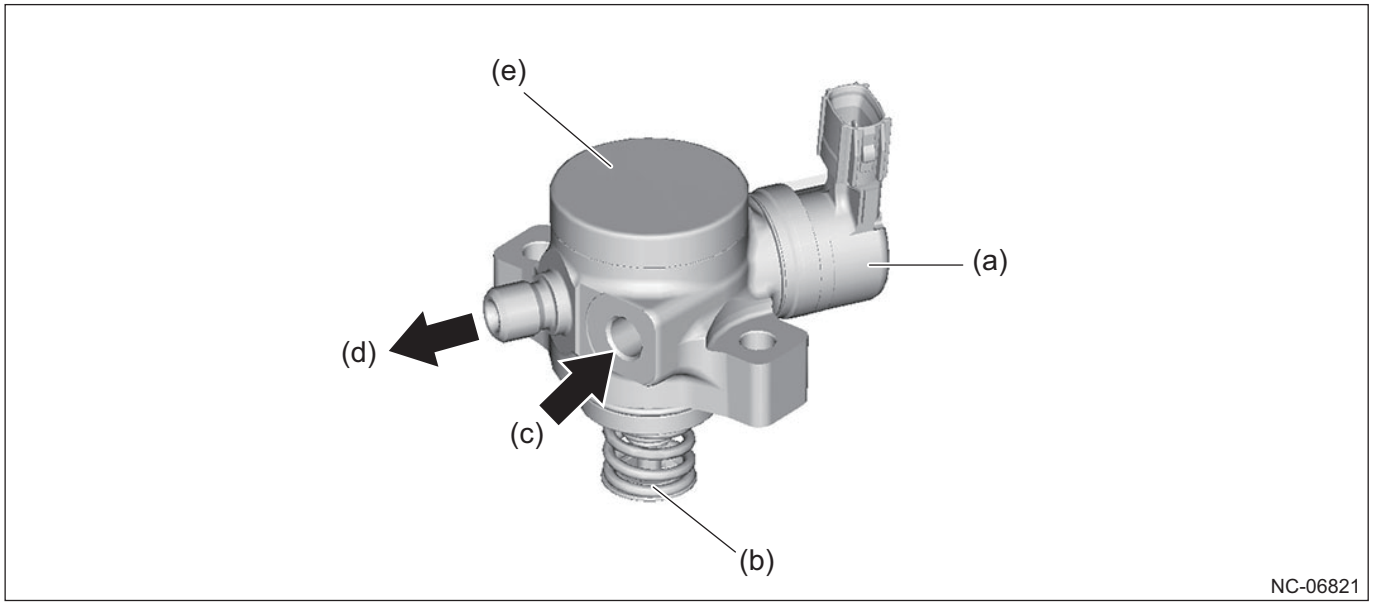
The fuel pump is composed of a solenoid spill valve that regulates the volume of high-pressure fuel discharged, a plunger driven by the intake camshaft LH that pressurizes the fuel, a check valve that mechanically opens and closes the passage to the high-pressure fuel delivery pipe, and a relief valve 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.

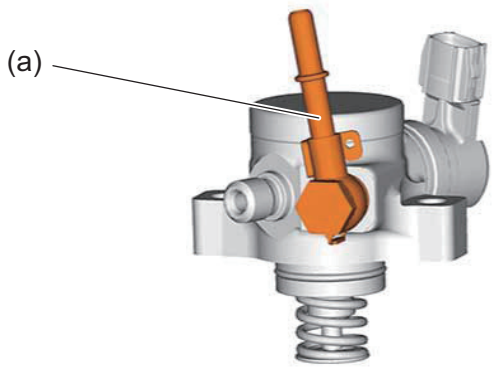
Friction loss is reduced by varying the high-pressure fuel pressure in the range of 2.4 to 20 MPa according to the driving conditions.

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



(a) Solenoid spill valve
(b) Plunger
(c) Fuel inlet
(d) Fuel outlet
(e) Damper

Caution
When working, be aware that the high-pressure fuel pump and banjo bolt cannot be separated. If they were separated, the assembly must be replaced.



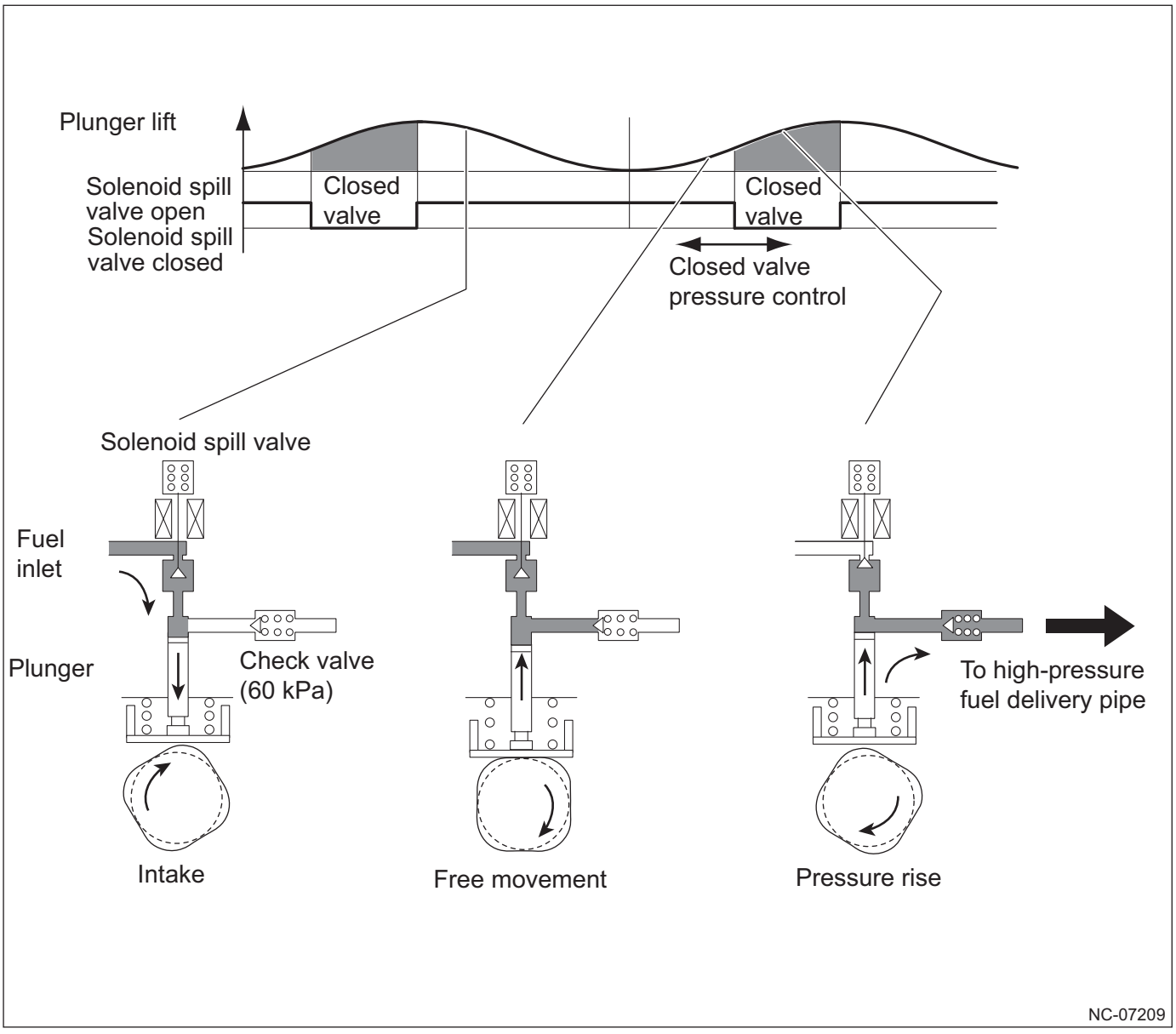
NC-08452

(a) Banjo

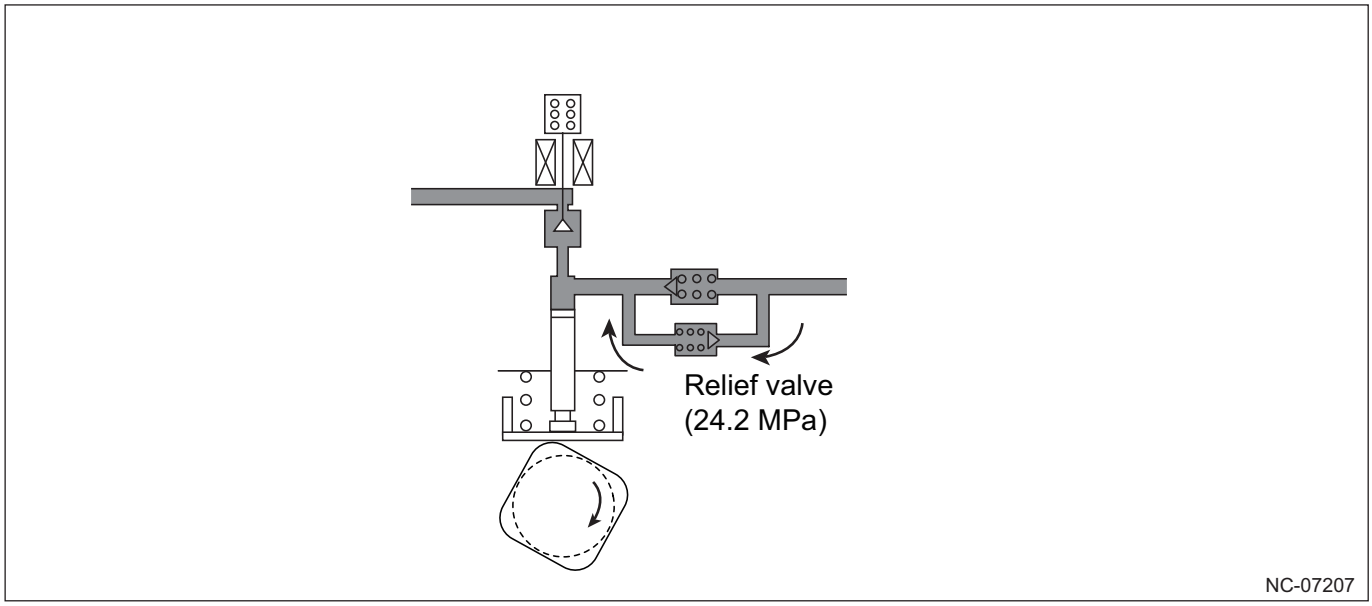
■ Operation

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 pressurized by the plunger presses open the check valve (60 kPa) and is sent under pressure to the high-pressure fuel delivery pipe. Its pressure is controlled within the range of 2.4 to 20 MPa.

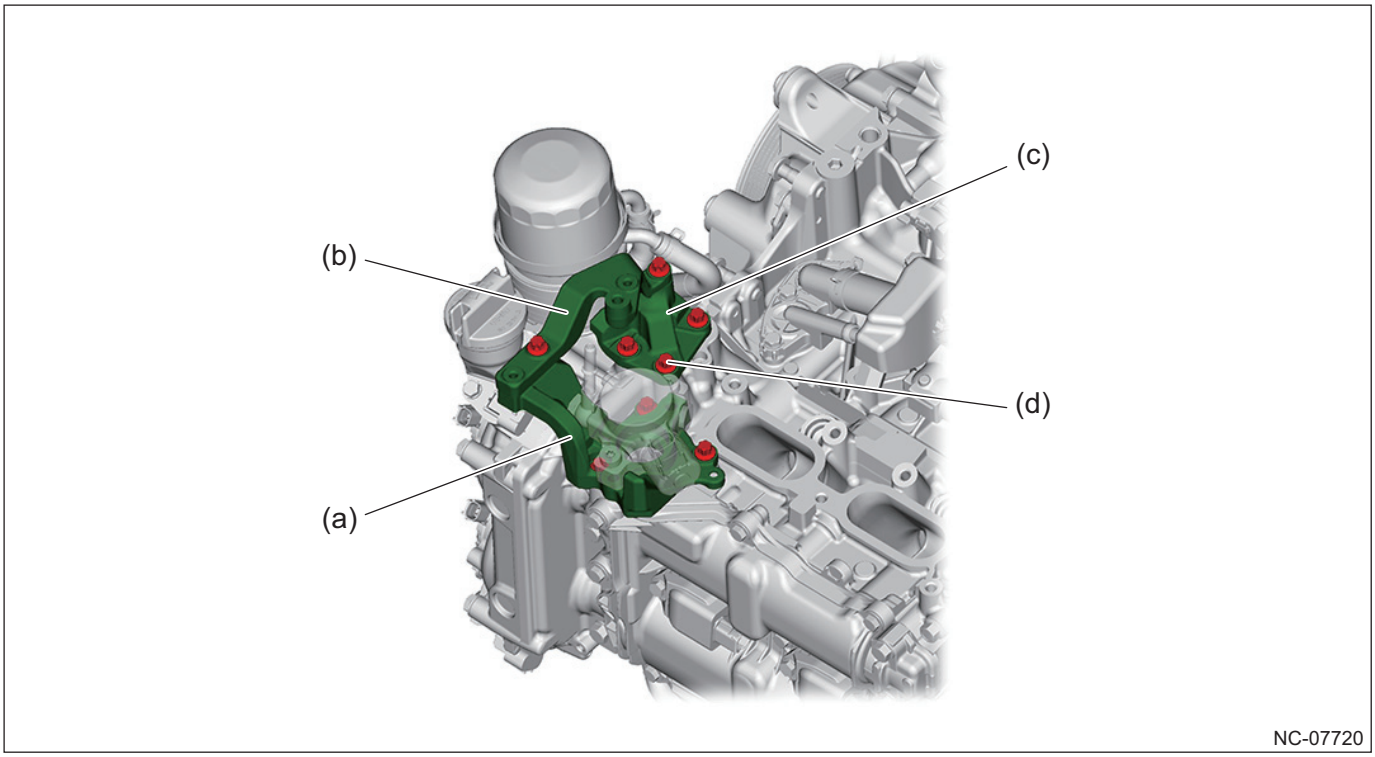


When the fuel pressure in the fuel delivery pipe rises to a specific value (24.2 MPa), the fuel is returned to the high-pressure fuel pump.



High-pressure fuel pump case

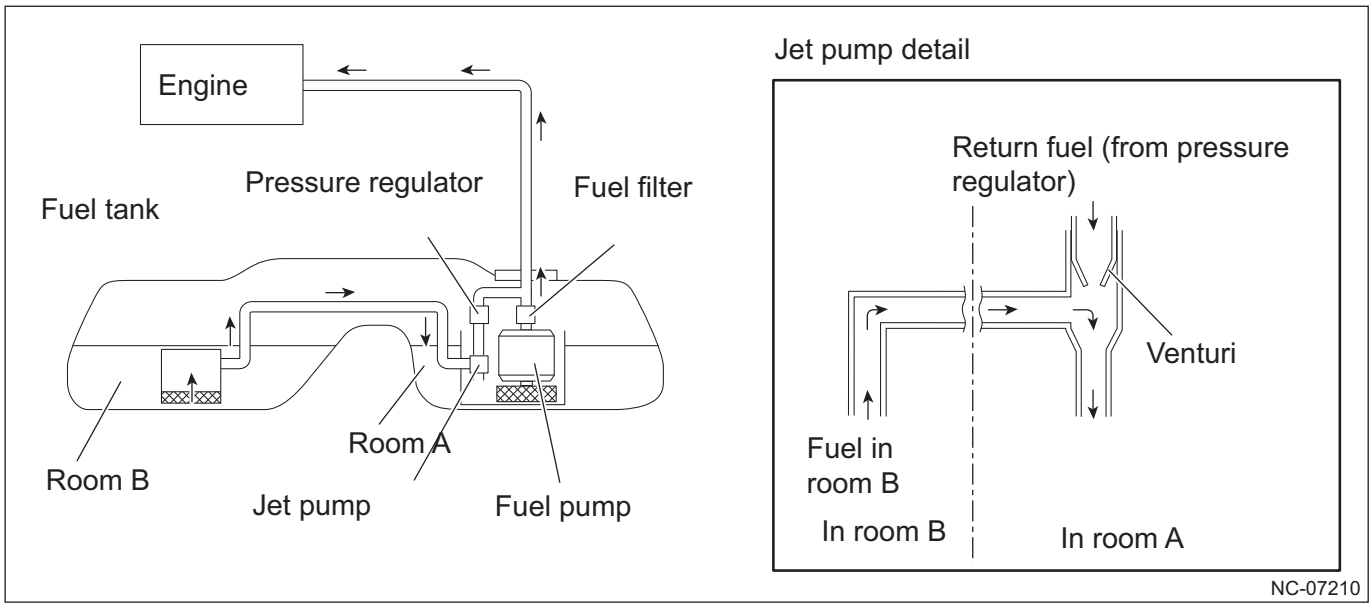
The structure includes stiffening of the high-pressure fuel pump case, cam carrier LH, and cylinder head LH, and a cast-iron fuel pipe protector is installed using high-strength bolts. This improves fuel system safety performance in the event of a collision.



(a) High-pressure fuel pump case
(b) Fuel pipe protector LH No. 2
(c) Fuel pipe protector LH No. 3
(d) High-strength bolt

Jet pump

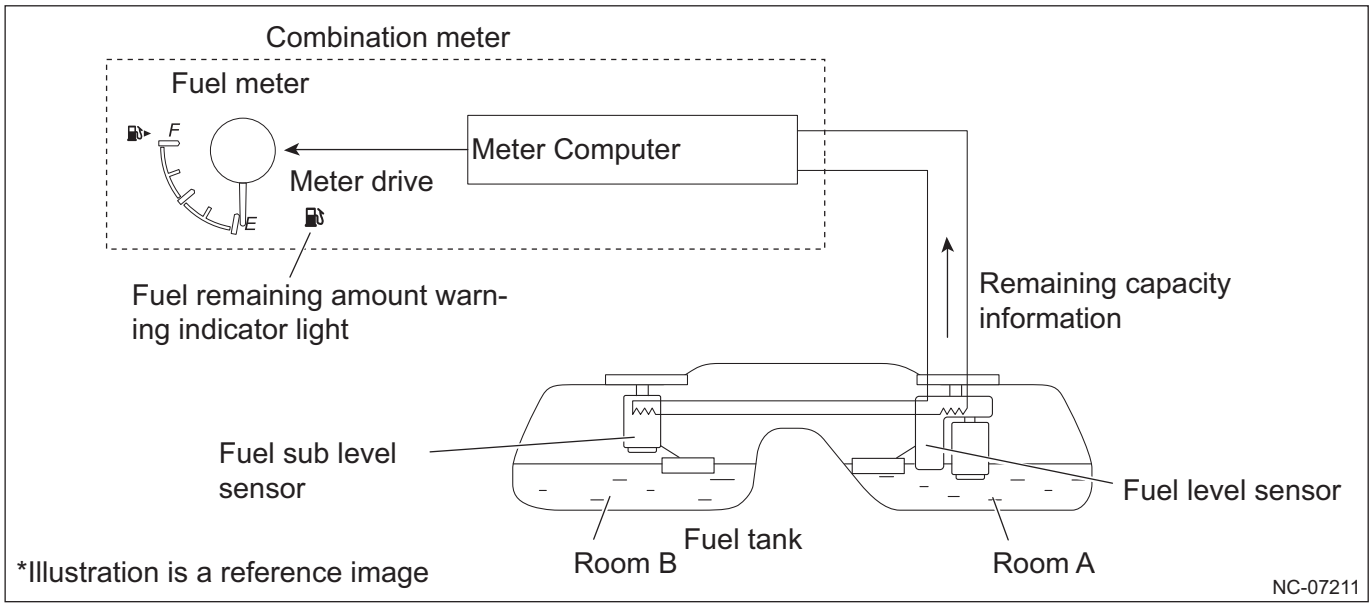
When the fuel level decreases in the straddle-type fuel tank, it is divided into two chambers (A and B) and fuel remains in chamber B. When the return fuel passes through the venturi of the jet pump, the remaining fuel is transported to chamber A by means of negative pressure.



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 [for cylinder direct injection]

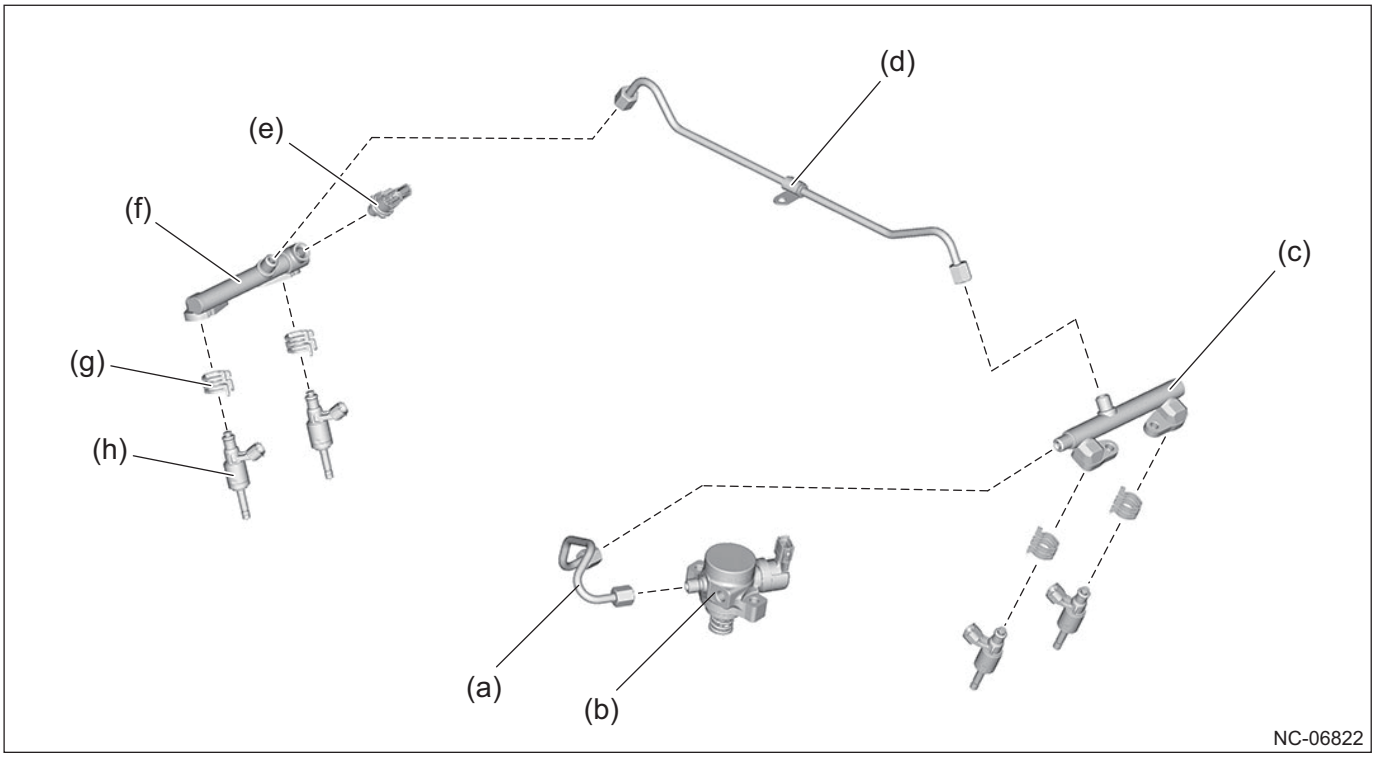
Chrome molybdenum steel fuel delivery pipes have been adopted.

A fuel pressure sensor (high-pressure side) 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 pipes has been changed.

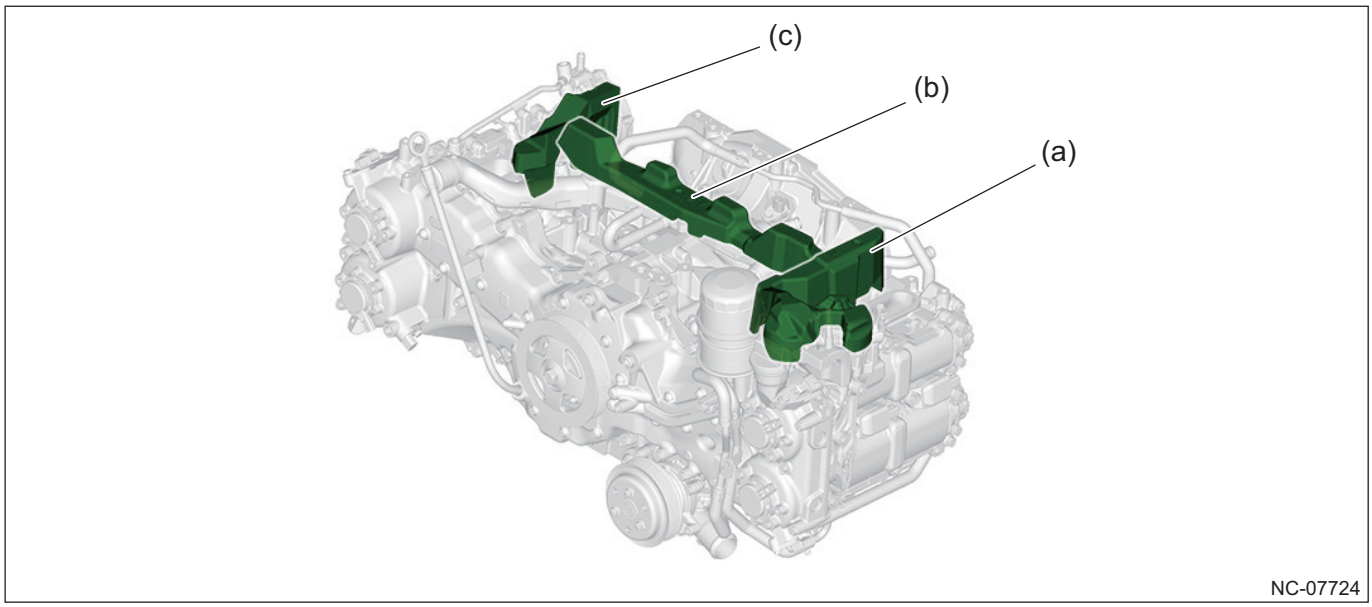
A fuel injector holder has been adopted on the mounting part of the fuel injector assembly (for cylinder direct injection). The structure continually presses the fuel injector with spring force to prevent the fuel injector from moving as combustion pressure is applied to the fuel injector when fuel pressure 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 (for cylinder direct injection). This reduces fuel injector operating noise transmission and improves quietness, while also ensuring sealing performance of the fastened part.



(a) High-pressure fuel delivery pipe
(b) High-pressure fuel pump
(c) Fuel injector pipe LH
(d) High-pressure fuel delivery pipe assembly
(e) Fuel pressure sensor (high-pressure side)
(f) Fuel injector pipe RH
(g) Fuel injector holder
(h) Fuel injector assembly (for cylinder direct injection)

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

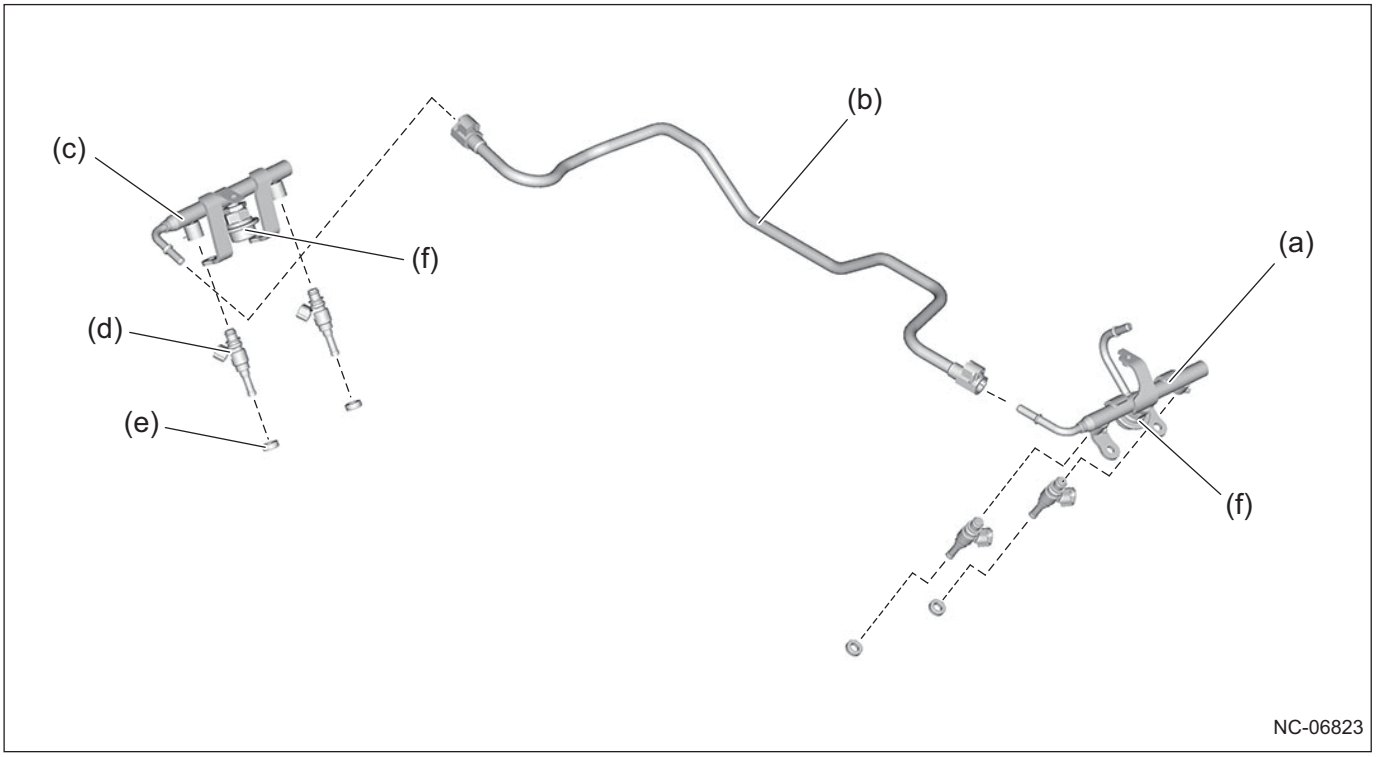


(a) Fuel pipe insulator No. 3
(b) Fuel pipe insulator No. 2
(c) Fuel pipe insulator No. 1

Fuel delivery pipe [for port injection]

Carbon steel fuel delivery pipes have been adopted.

A pulsation damper is installed on both the fuel pipe LH and RH, reducing fuel pulsation.



(a) Fuel pipe LH
(b) Fuel delivery pipe
(c) Fuel pipe RH
(d) Fuel injector assembly (for port injection)
(e) Seal ring
(f) Pulsation damper

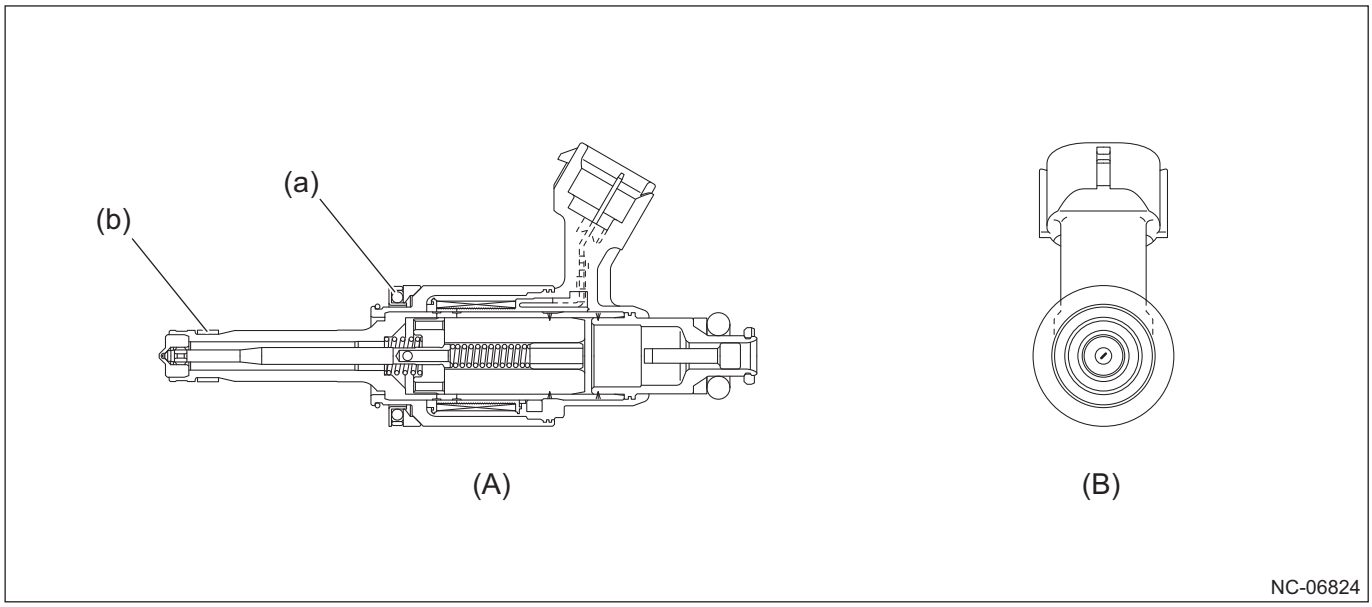
Fuel injector assembly [for cylinder direct injection]

A high-pressure slit nozzle injector with a slit-shape injection hole has been adopted for cylinder direct injection.

This fuel injector atomizes the fuel, which expands in a fan shape and incorporates large amounts of air as it is injected into the combustion chamber. This improves the spatial dispersion of the fuel injection, forming a homogeneous mixture and increasing performance and output. In order to promote catalyst warm-up immediately after start, fuel is injected onto the piston crown, forming a stratified mixture that allows the injection timing to be largely delayed. This greatly improves the early activation of the catalyst when the engine is cold.

Because the fuel injector is exposed inside the combustion chamber, a special coating is applied to the end, reducing the formation of deposits caused by fuel gas.

A fuel injector insulator is used at the part which contacts the cylinder head, and a fuel injector seal is used on the cylinder internal pressure seal. These reduce vibration and noise and improve seal performance.



(A) Cross section

(B) Injector orifice

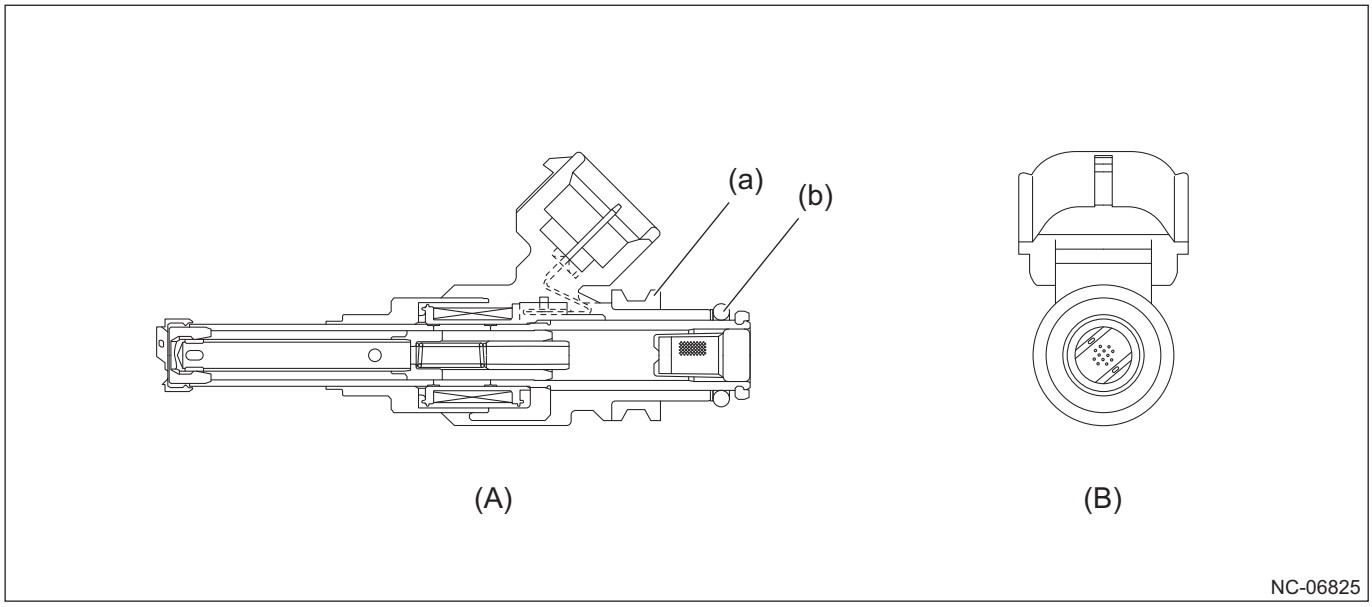
(a) Fuel injector insulator

(b) Fuel injector seal

Fuel injector assembly [for port injection]

Compact, lightweight 12-hole type fuel injectors have been adopted for port injection. These promote fuel atomization and reduce fuel adhesion to the intake port, improving fuel economy and emissions performance.

The nozzle has been extended to optimize the injected fuel mist shape.



(A) Cross section

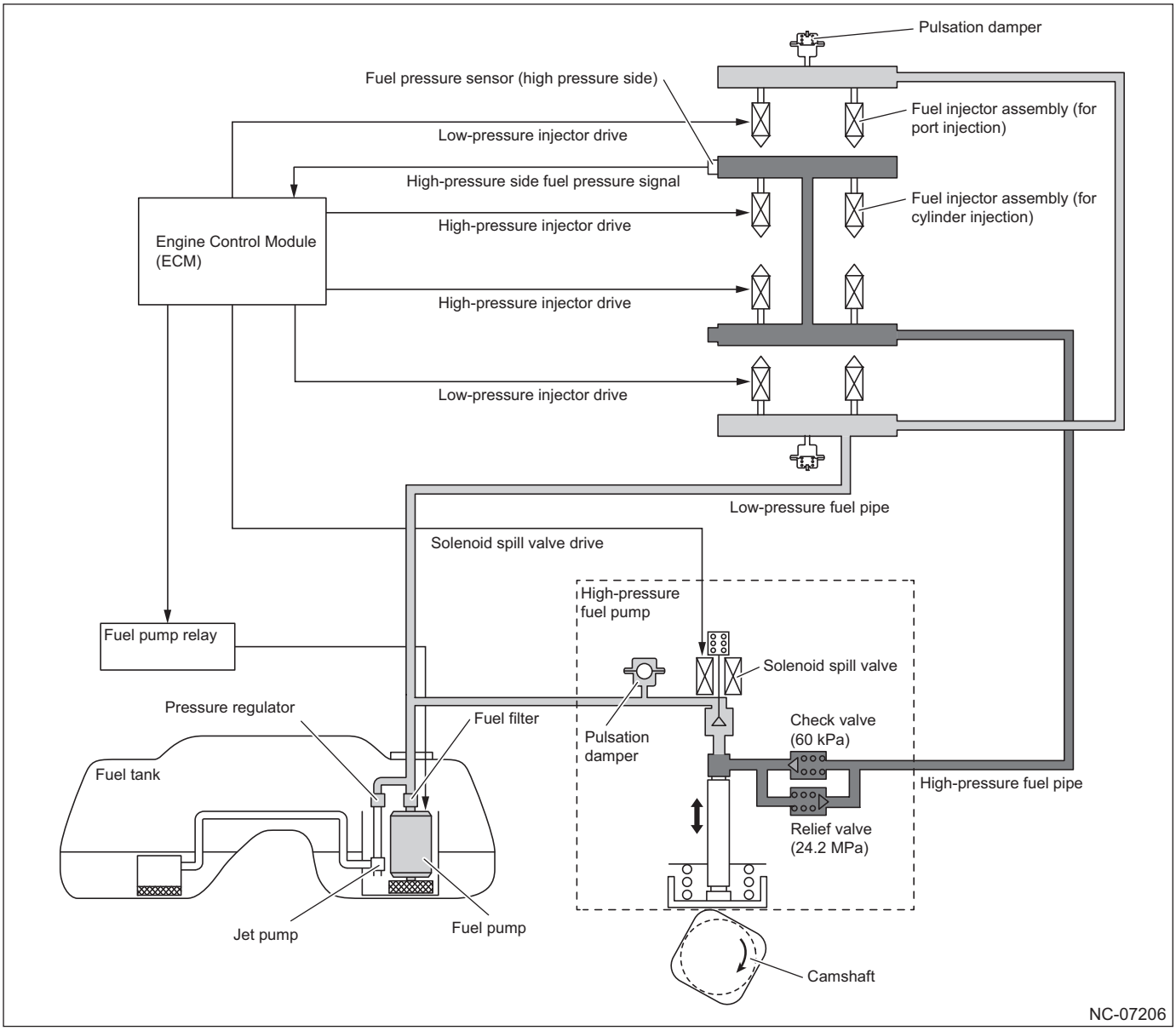
(B) Injector orifice

(a) Rubber

(b) O-ring

2.2.3 Construction and Operation

System diagram



System details

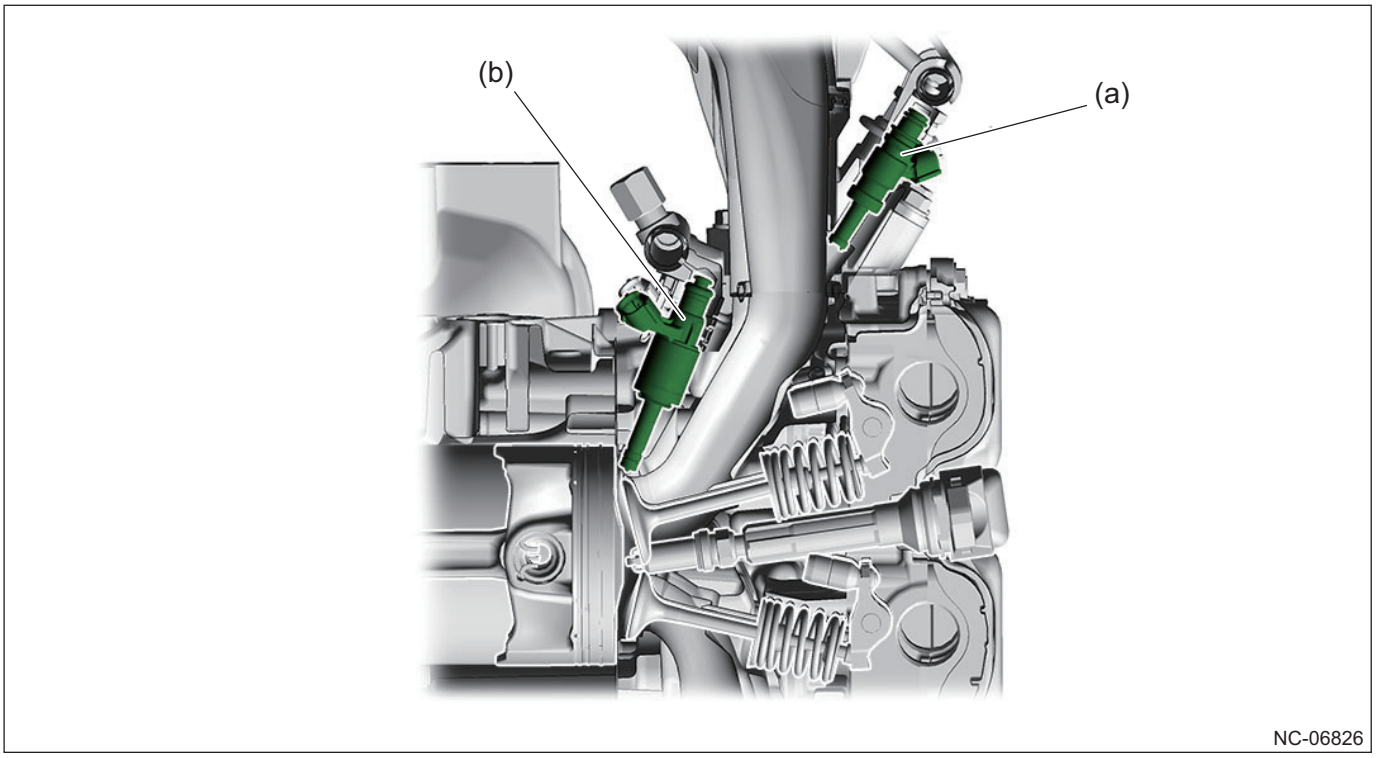
D-4S system

The D-4S system includes a cylinder direct fuel injection method that directly injects high-pressure fuel into the combustion chamber, and a port injection method which injects fuel into the intake port. Each of these methods is used according to the engine operating conditions.

The injection ratio of port injection and cylinder injection is optimized in order to create a homogeneous mixture at all ranges from low loads to high loads. This improves fuel economy, reduces emissions, and increases output.

Immediately after a cold engine start, injection from the port fuel injectors creates a homogeneous mixture inside the combustion chamber. The compression stroke injection from the fuel injectors for cylinder direct injection creates a stratified mixture around the spark plug, allowing the injection timing to be delayed and increasing the exhaust gas temperature in order to rapidly warm-up the catalyst.

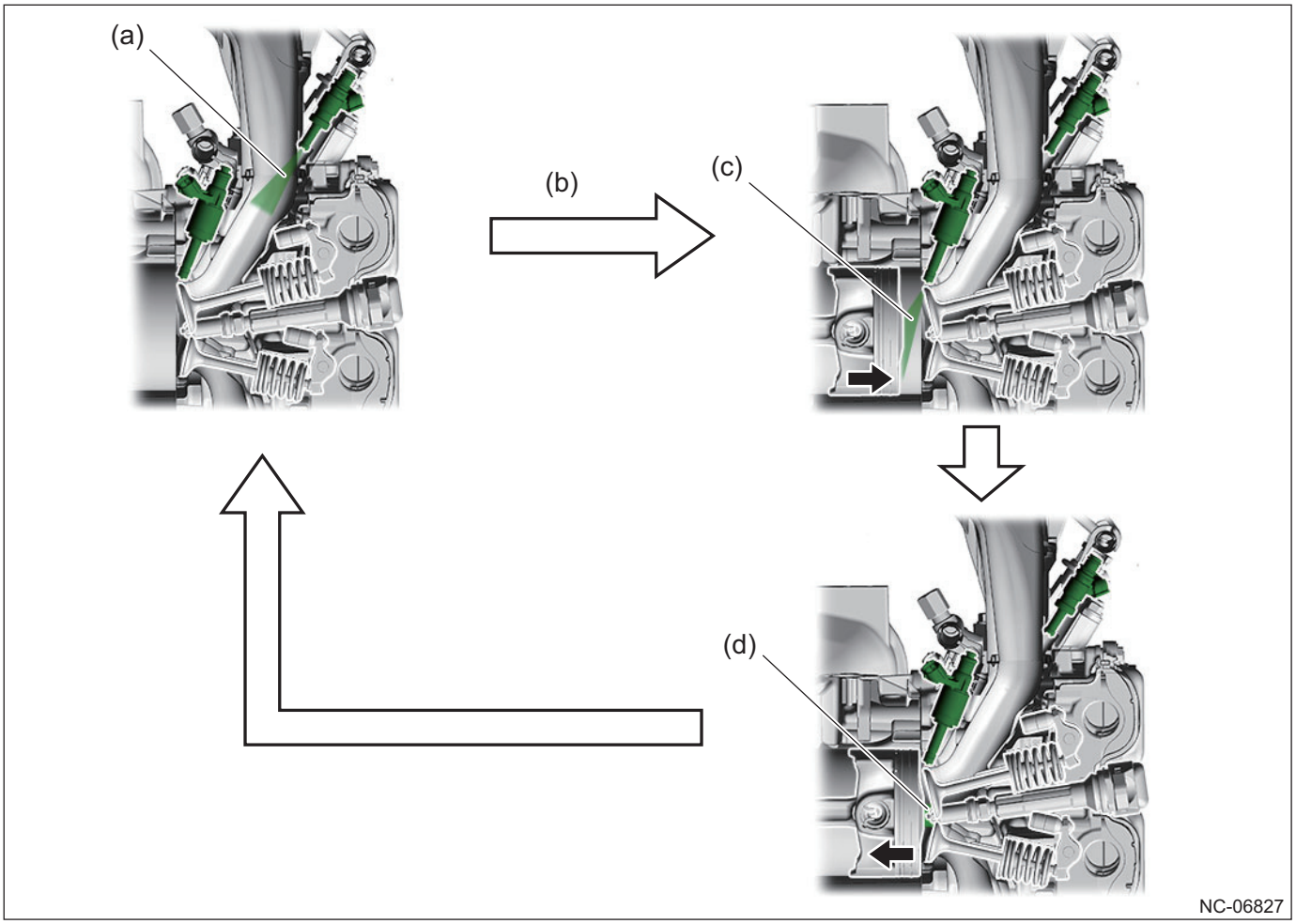
The high-pressure slit nozzle injectors that are used as the fuel injectors for cylinder direct injection atomize the fuel, which expands in a fan shape from the injector opening and incorporates large amounts of air as it is injected into the combustion chamber. The high-pressure atomized spray expands into the combustion chamber using its own energy, without depending on air currents. This creates an efficient and homogeneous mixture with the intake air, delivering ideal combustion in all driving ranges.



(a) Fuel injector assembly (for port injection)

(b) Fuel injector assembly (for cylinder direct injection)

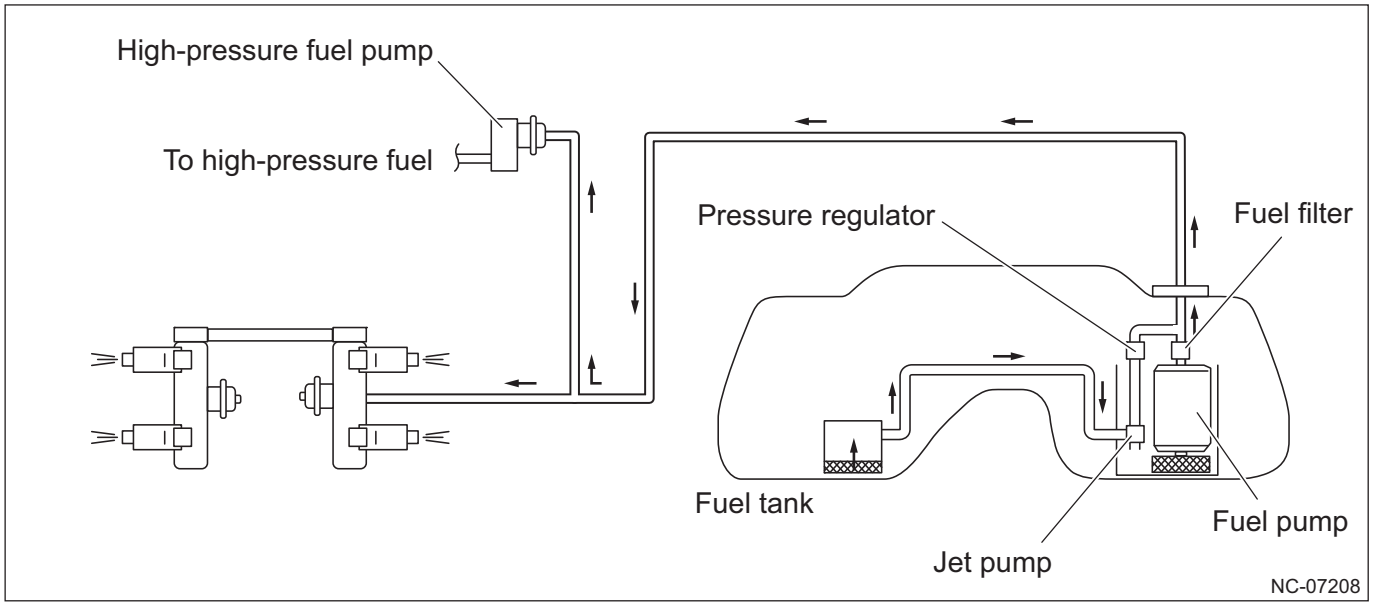
Image of fuel injection at a cold start



(a)	Expansion to intake stroke	Before the intake valve opens, fuel is injected into the intake port from the fuel injector assembly (for port injection).
(b)	Intake stroke	The intake valve opens and a homogeneous mixture is drawn into the combustion chamber.
(c)	Compression stroke	During the second half of the compression stroke, fuel is injected into the combustion chamber from the fuel injector assembly (for cylinder direct injection).
(d)	Expansion stroke	The stratified mixture around the spark plug is ignited.

Fuel return less system

Fuel pressure control in the low-pressure fuel system is performed by a pressure regulator installed in the low-pressure 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 improving emissions performance.



2.3 Emission Control System

2.3.1 Overview

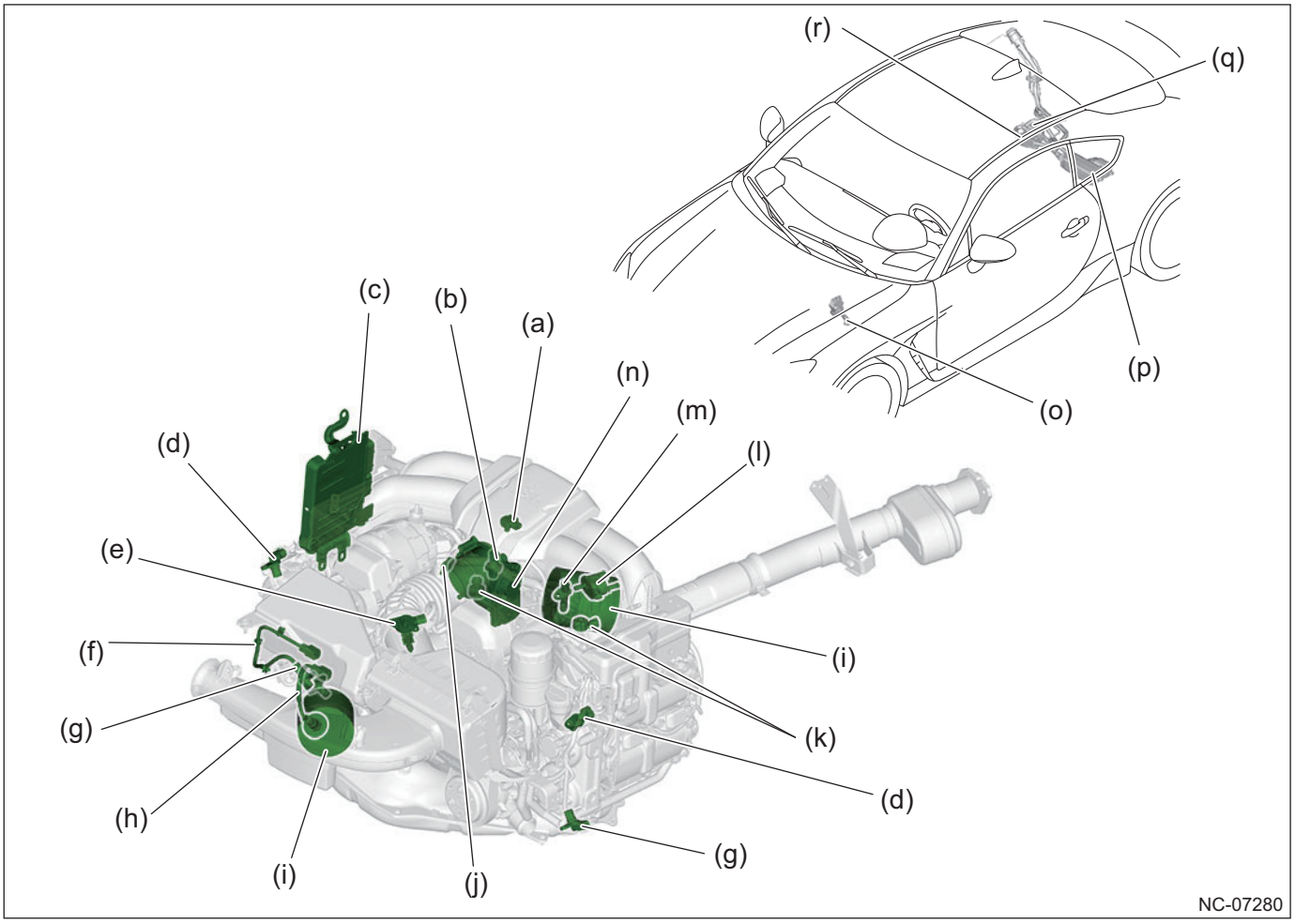
Overview

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

2.3.2 Component

Component layout drawing



(a) Manifold pressure sensor
(b) PCV valve
(c) Engine Control Module (ECM)
(d) Intake camshaft position sensor
(e) Air flow and intake air temperature sensor
(f) Rear oxygen sensor
(g) Exhaust camshaft position sensor
(h) Front oxygen (A/F) sensor
(i) Ternary catalyst
(j) Engine coolant temperature sensor
(k) Knock sensor
(l) Purge control solenoid valve
(m) Crankshaft position sensor
(n) Throttle body
- Throttle position sensor
- Throttle motor

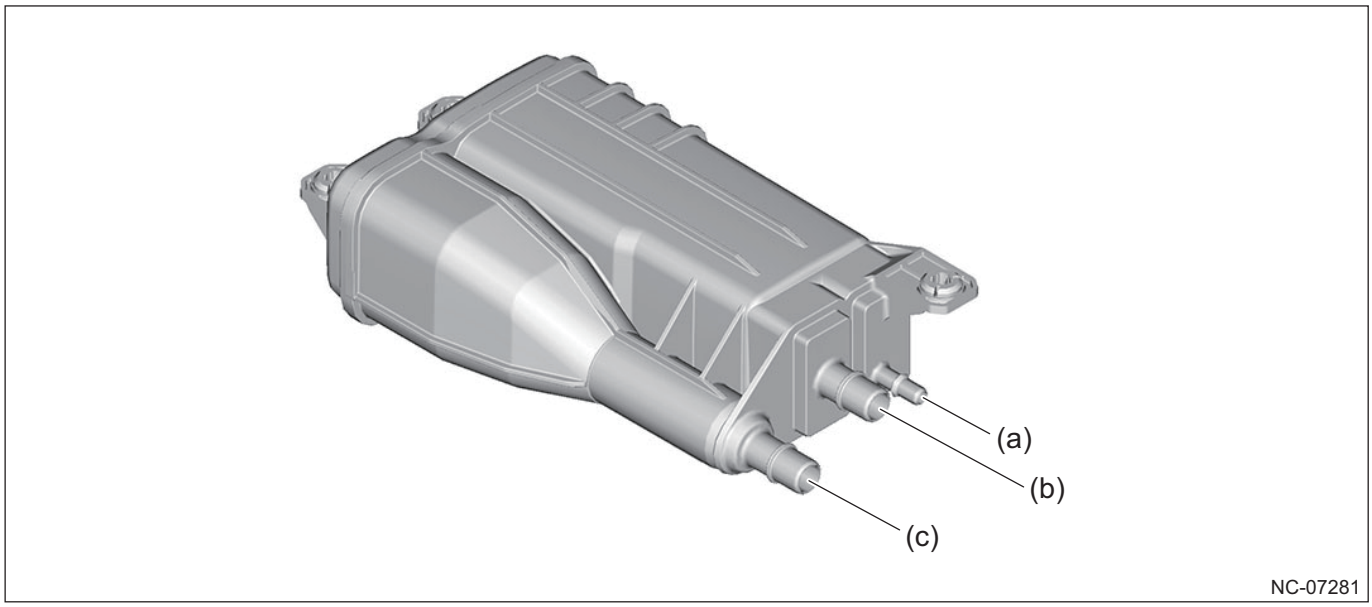
(o) Accelerator pedal position sensor
(p) Canister
(q) ELCM
(r) Drain filter

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.

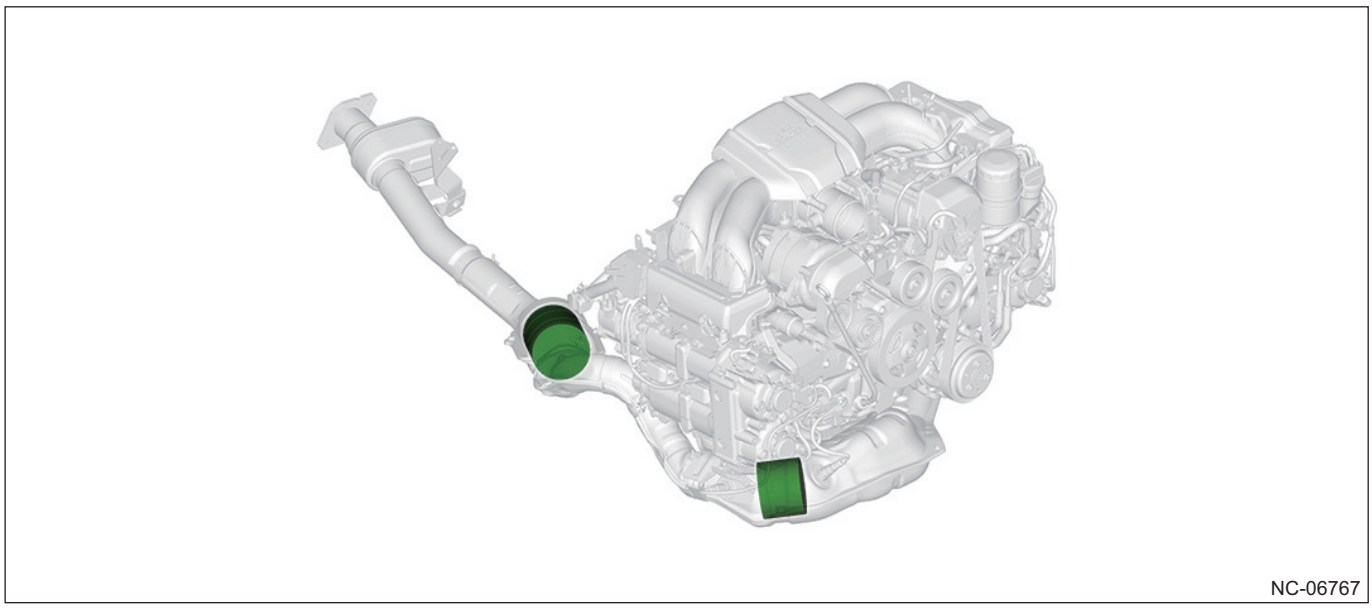
The canister is mounted at the rear of the fuel tank.



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

Ternary catalyst

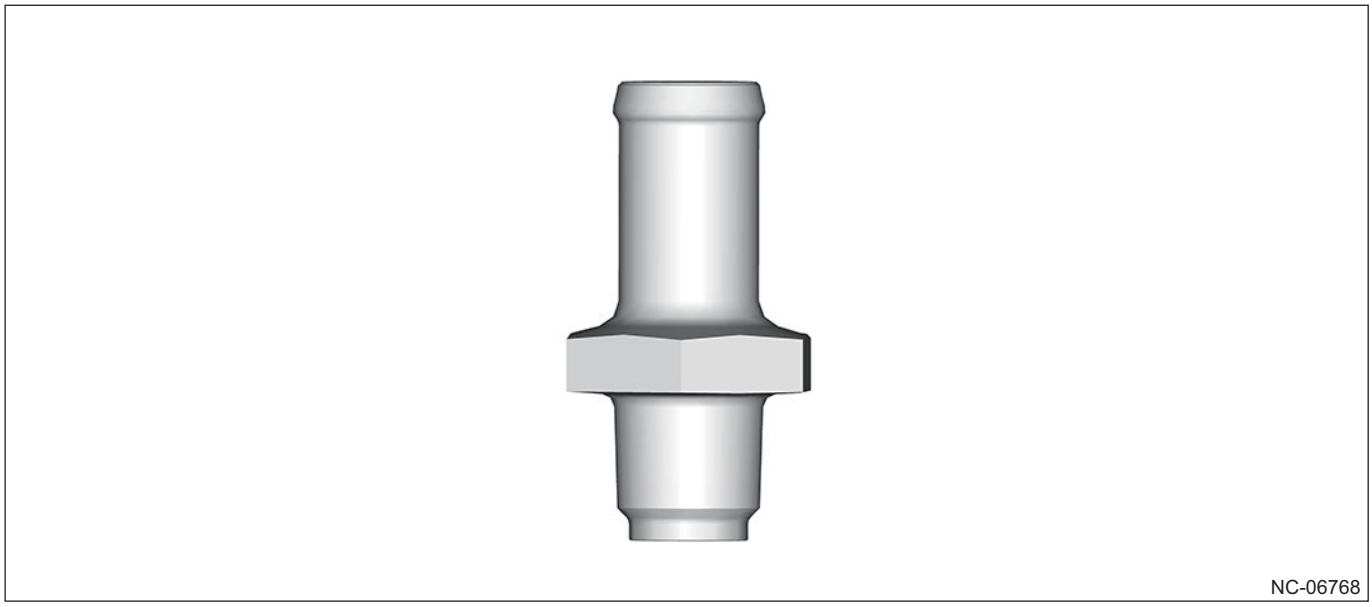
The ternary catalysts are positioned at the front exhaust pipe and center exhaust pipe, ensuring sufficient emissions performance.



PCV valve

Optimizing the PCV valve nipple and exhaust-side hose diameter ensures compliance with North America OBD regulations.

A steel PCV valve is adopted to ensure durability.



2.3.3 Construction and Operation

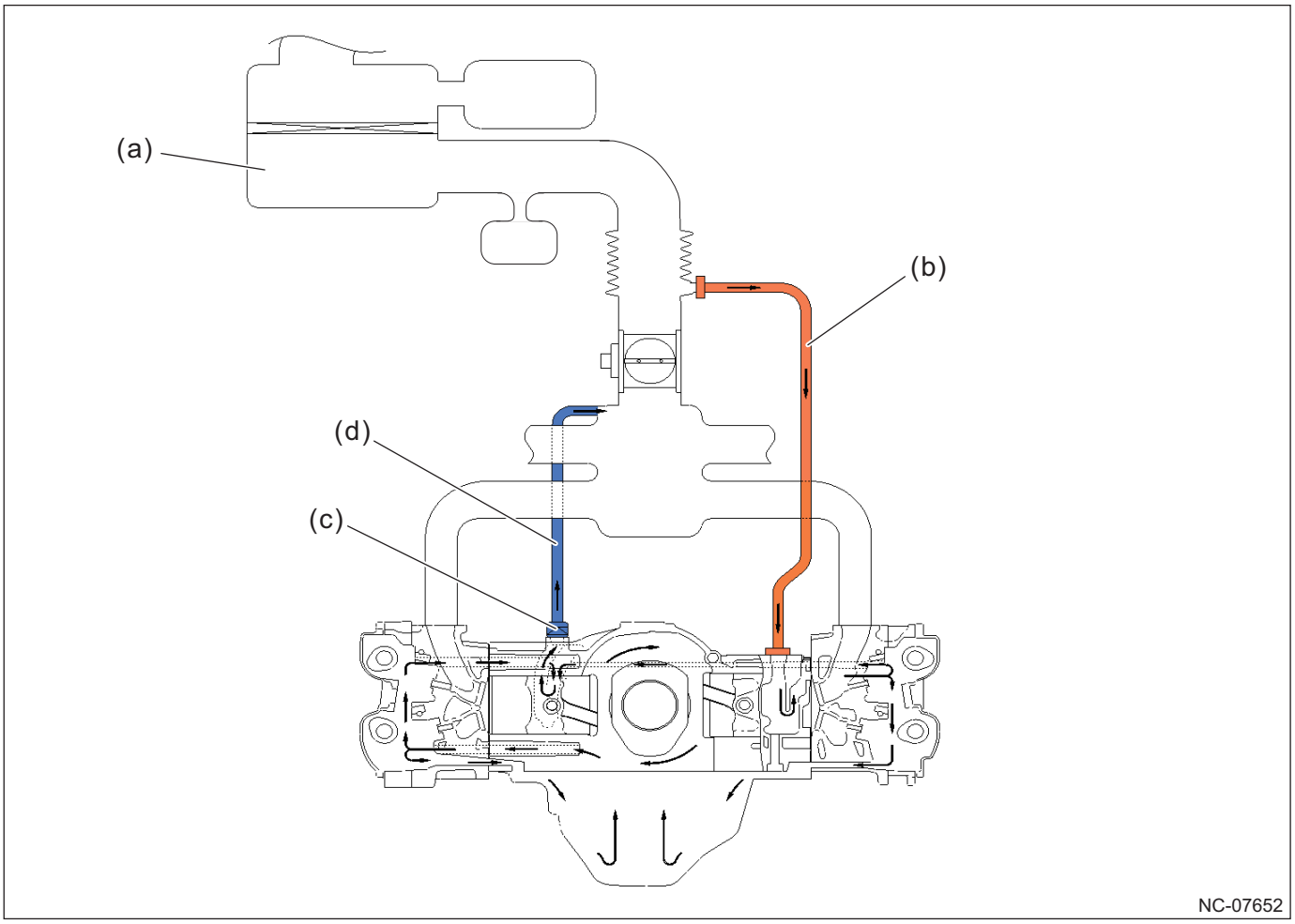
Main component functions

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 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.
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 the air pollution caused by the blowby gas discharged from the crankcase.



(a) Air cleaner
(b) Fresh air introduction hose
(c) PCV valve
(d) PCV hose

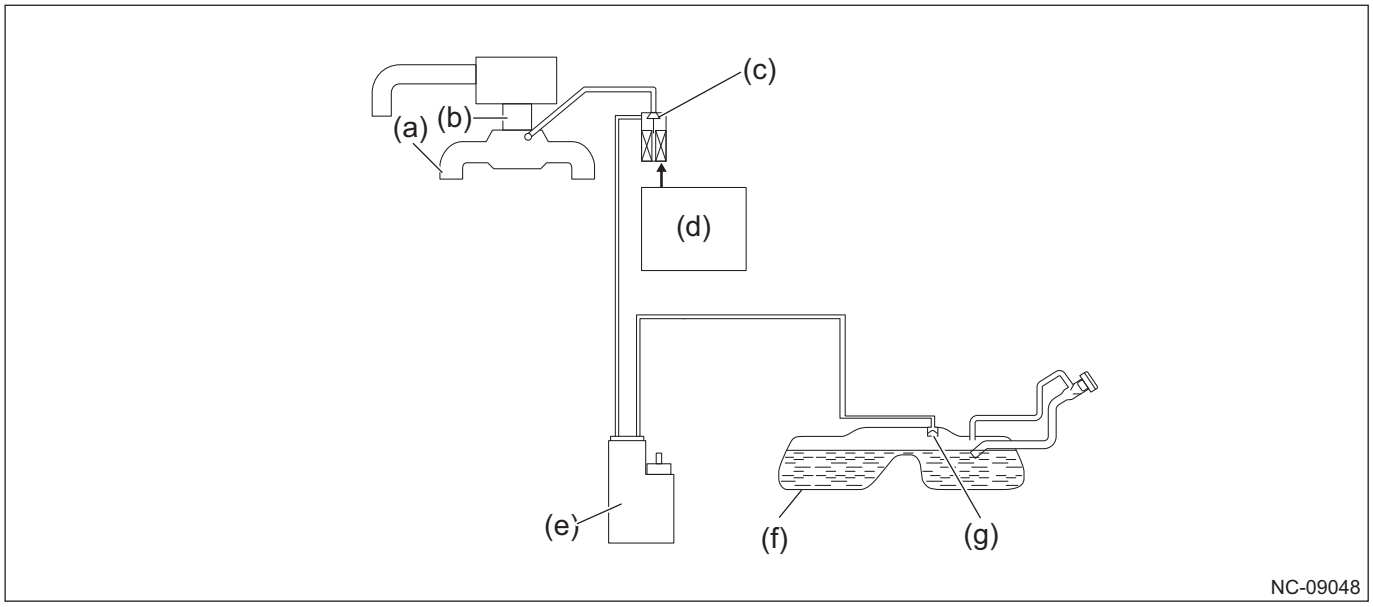
Fuel evaporation gas emission prevention system

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, and pipes connecting those 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) Intake manifold

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

(c) Purge control solenoid valve

(d) Engine Control Module (ECM)

(e) Canister

(f) Fuel tank

(g) Fuel cut valve

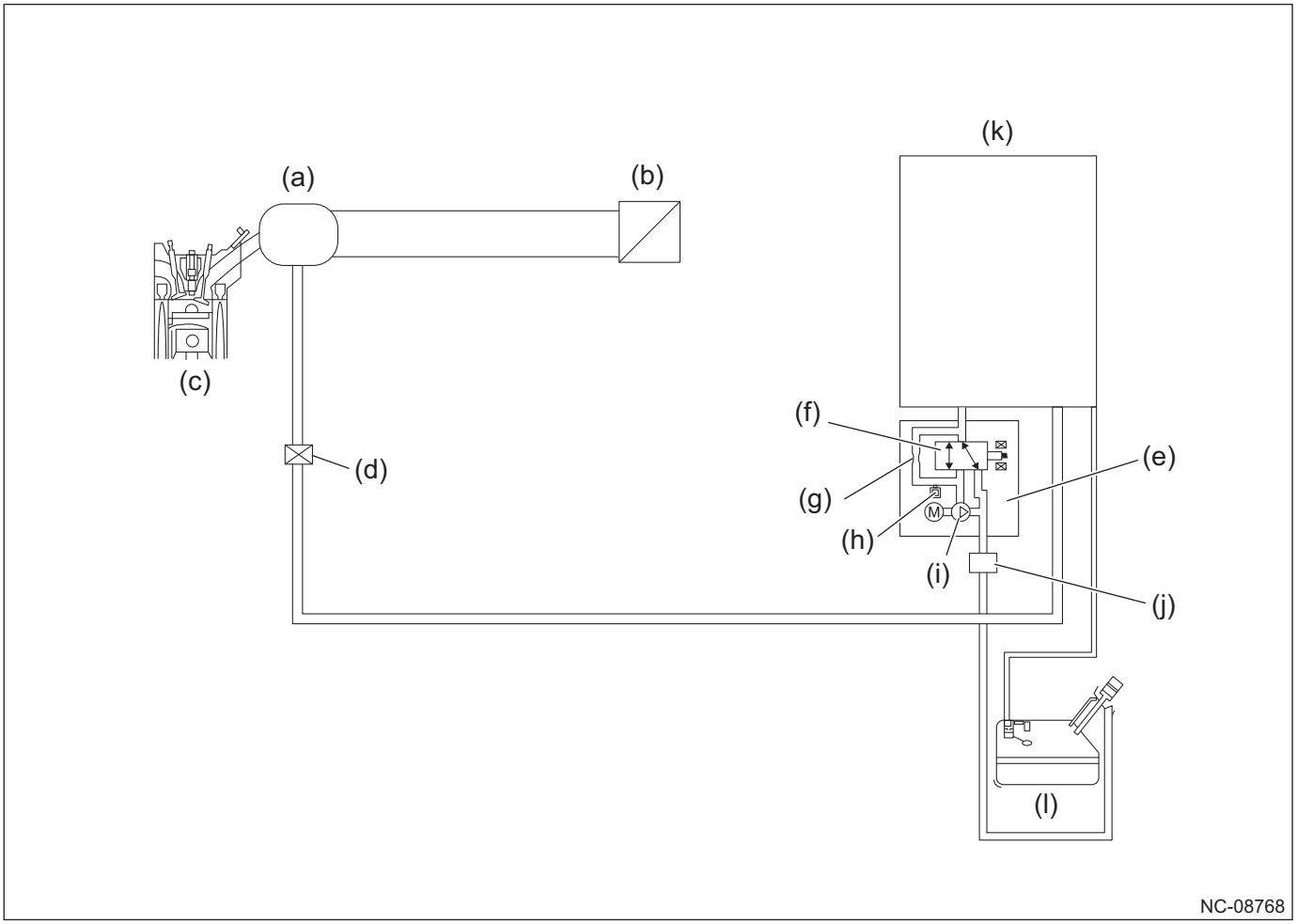
Evaporative leak check module system

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.

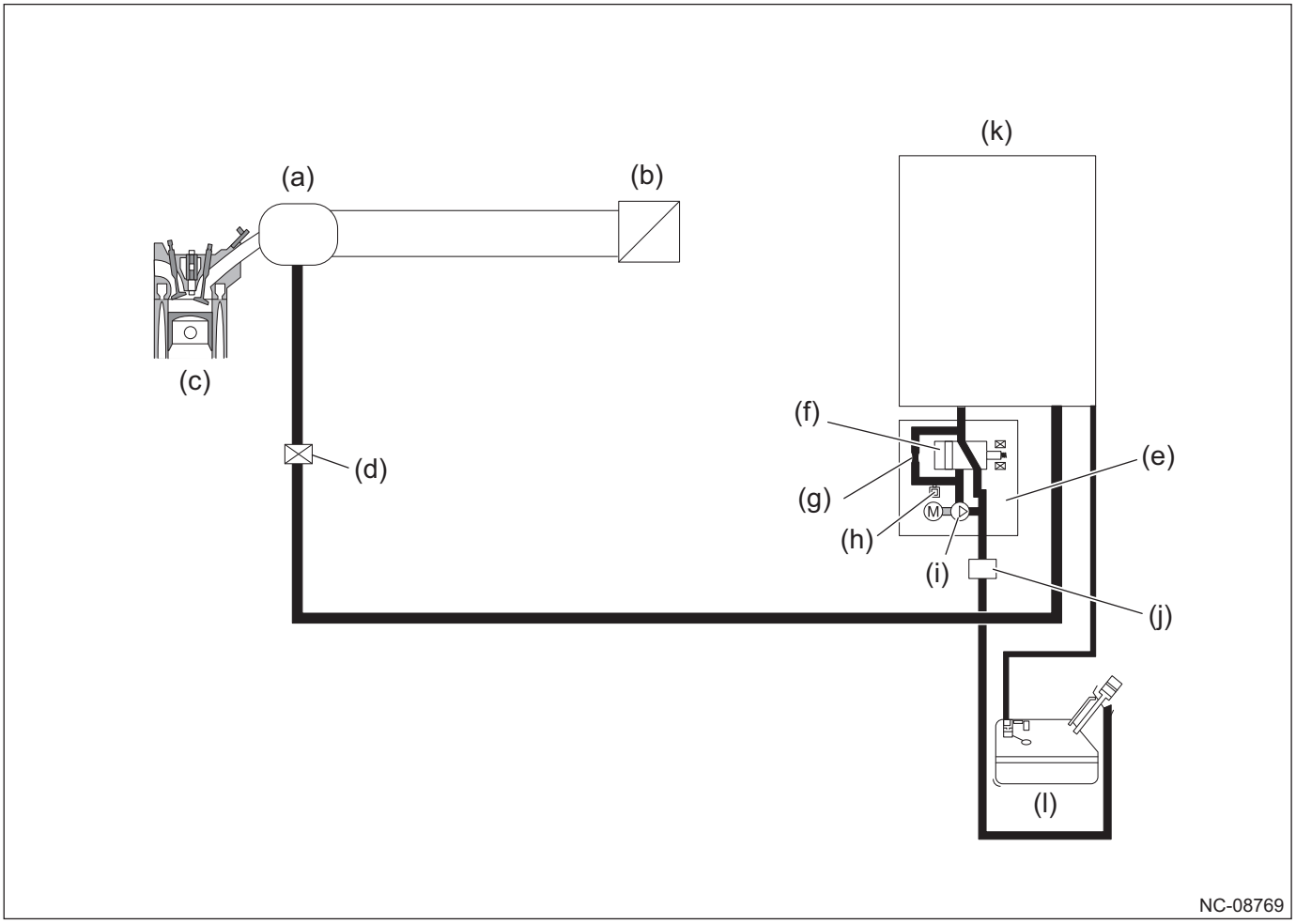


(a) Intake manifold
(b) Air cleaner
(c) Engine
(d) Purge control solenoid valve
(e) ELCM
(f) Switching valve
(g) Reference orifice
(h) Pressure sensor
(i) Vacuum pump
(j) Drain filter
(k) Canister
(l) Fuel tank

■ Operation during normal driving

Vacuum pump: not operating

Switching valve: not operating (atmosphere release)

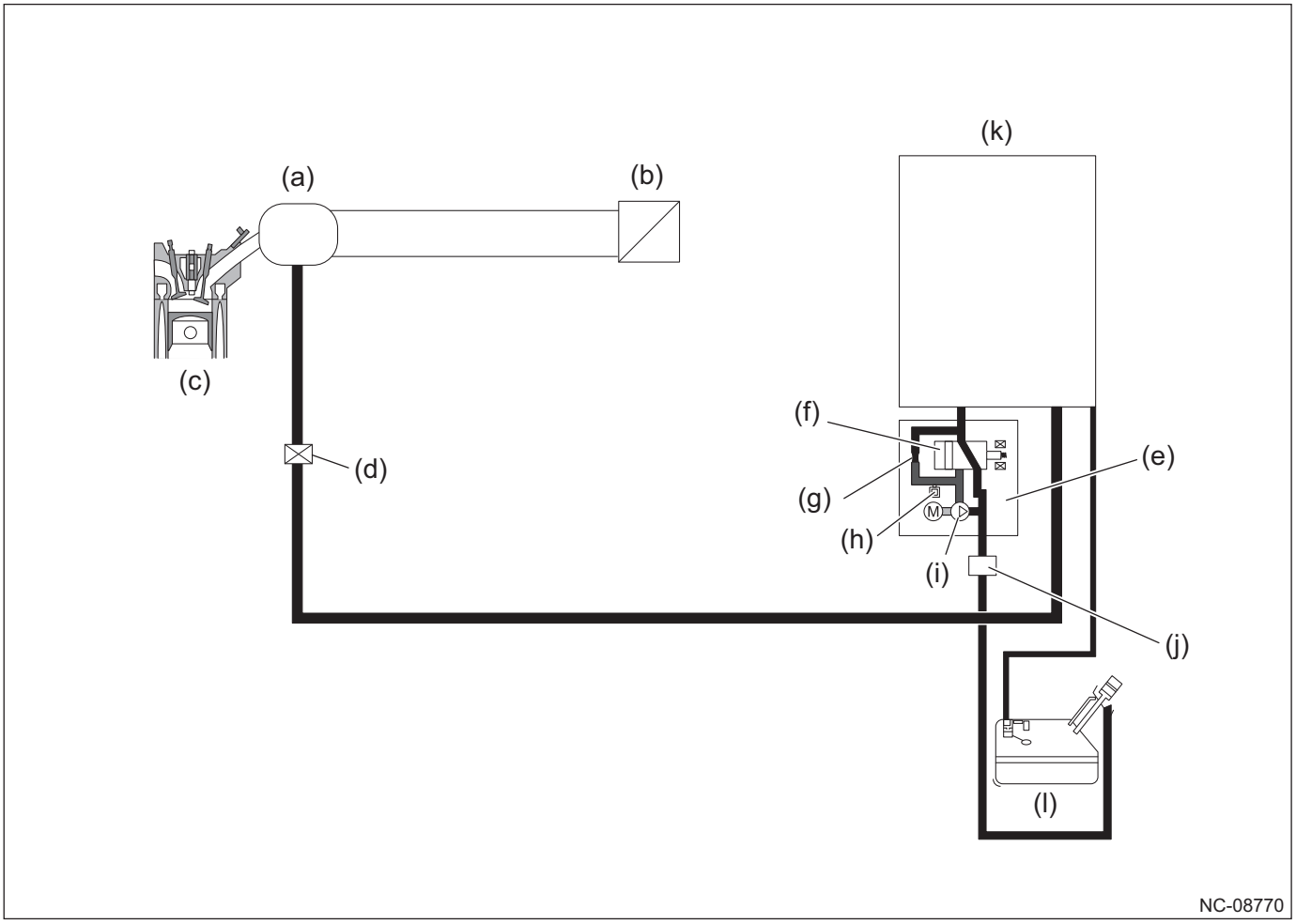


(a) Intake manifold
(b) Air cleaner
(c) Engine
(d) Purge control solenoid valve
(e) ELCM
(f) Switching valve
(g) Reference orifice
(h) Pressure sensor
(i) Vacuum pump
(j) Drain filter
(k) Canister
(l) Fuel tank

■ Operation during diagnosis (during reference orifice pressure detection)

Vacuum pump: operating

Switching valve: not operating (atmosphere release)

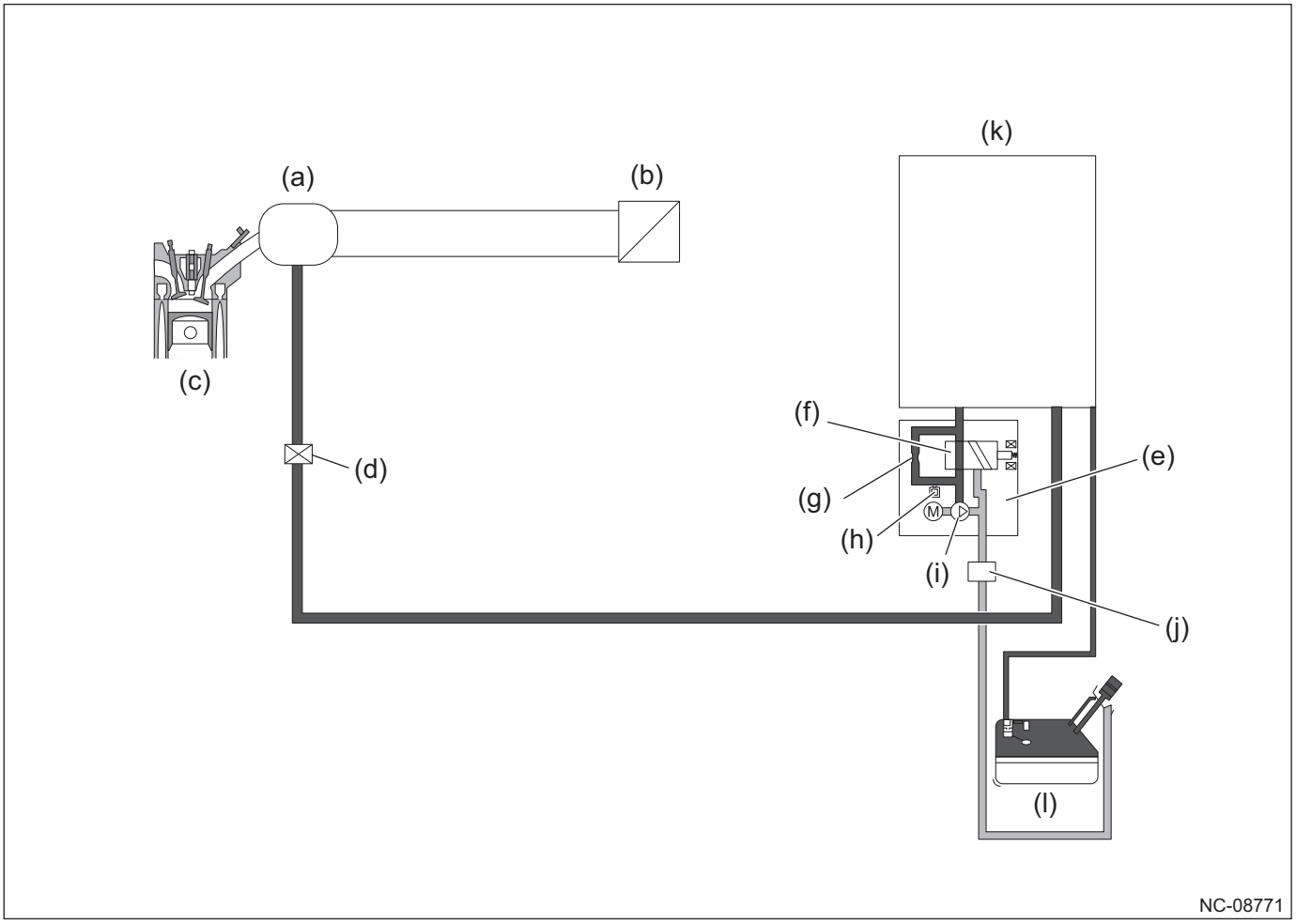


(a) Intake manifold
(b) Air cleaner
(c) Engine
(d) Purge control solenoid valve
(e) ELCM
(f) Switching valve
(g) Reference orifice
(h) Pressure sensor
(i) Vacuum pump
(j) Drain filter
(k) Canister
(l) Fuel tank

■ Operation during diagnosis (during negative pressure introduction)

Vacuum pump: operating

Switching valve: operating (closed)



(a) Intake manifold
(b) Air cleaner
(c) Engine
(d) Purge control solenoid valve
(e) ELCM
(f) Switching valve
(g) Reference orifice
(h) Pressure sensor
(i) Vacuum pump
(j) Drain filter
(k) Canister
(l) Fuel tank

2.4 Intake and Exhaust System

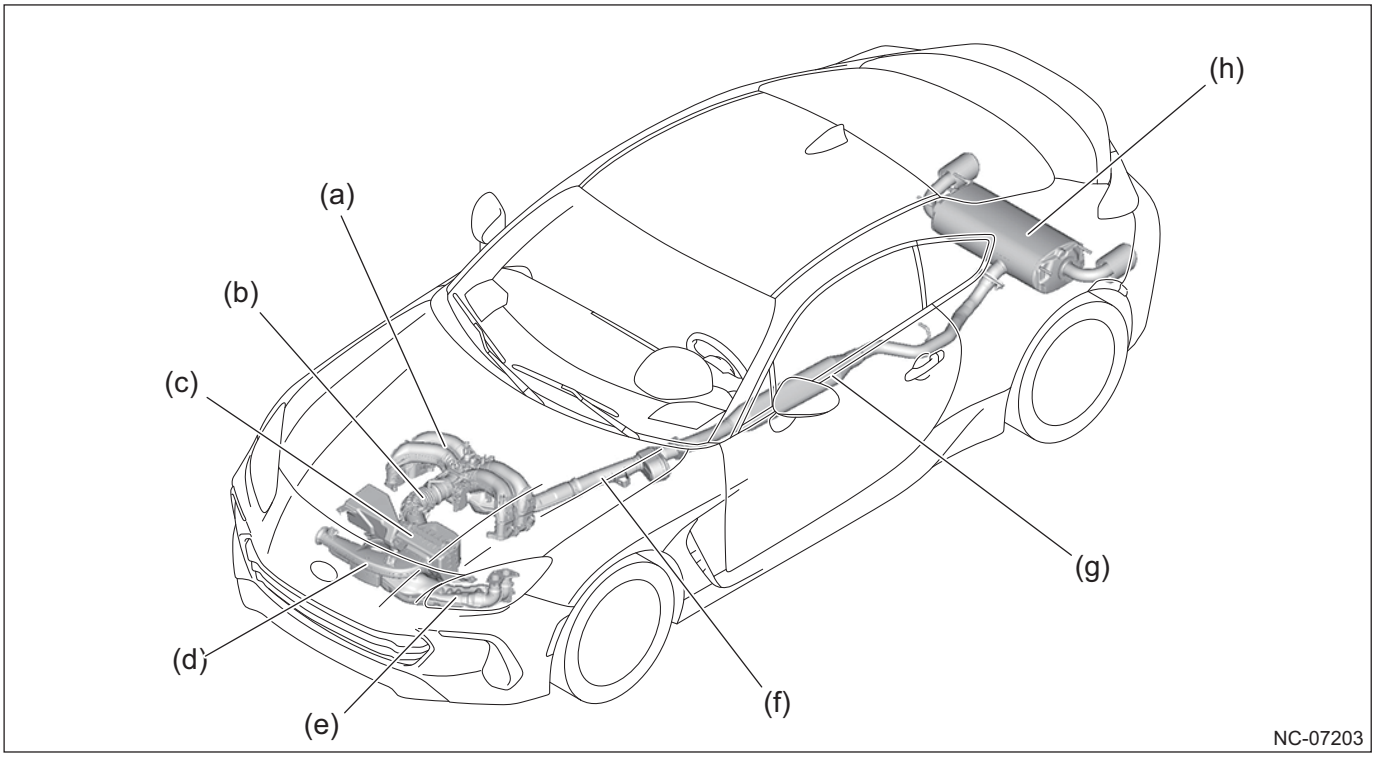
2.4.1 Overview

Overview

- The layout places the air intake system towards the front of the vehicle in order to support the FR power unit layout of the horizontally opposed engine.
- A single-valve type electronic control throttle body has been adopted.
- An air intake plate has been adopted on the bottom of the air intake duct in order to ensure good intake performance even in rain or snow.
- An exhaust pipe that supports the high-output engine has been adopted for a FR sports car exhaust system that achieves both sports driving performance and fuel economy performance.
- A stainless steel exhaust pipe has been adopted to reduce weight and ensure corrosion resistance.
- The ternary catalysts are positioned at the front exhaust pipe and center exhaust pipe, ensuring sufficient emissions performance. A ternary catalyst is installed at the front exhaust pipe collector in order to reduce emissions immediately after engine start (when the engine is cold).

2.4.2 Component

Component layout drawing



(a) Intake manifold assembly
(b) Air intake boot
(c) Air cleaner case
(d) Air intake duct
(e) Front exhaust pipe
(f) Center exhaust pipe
(g) Rear exhaust pipe
(h) Muffler

Component details

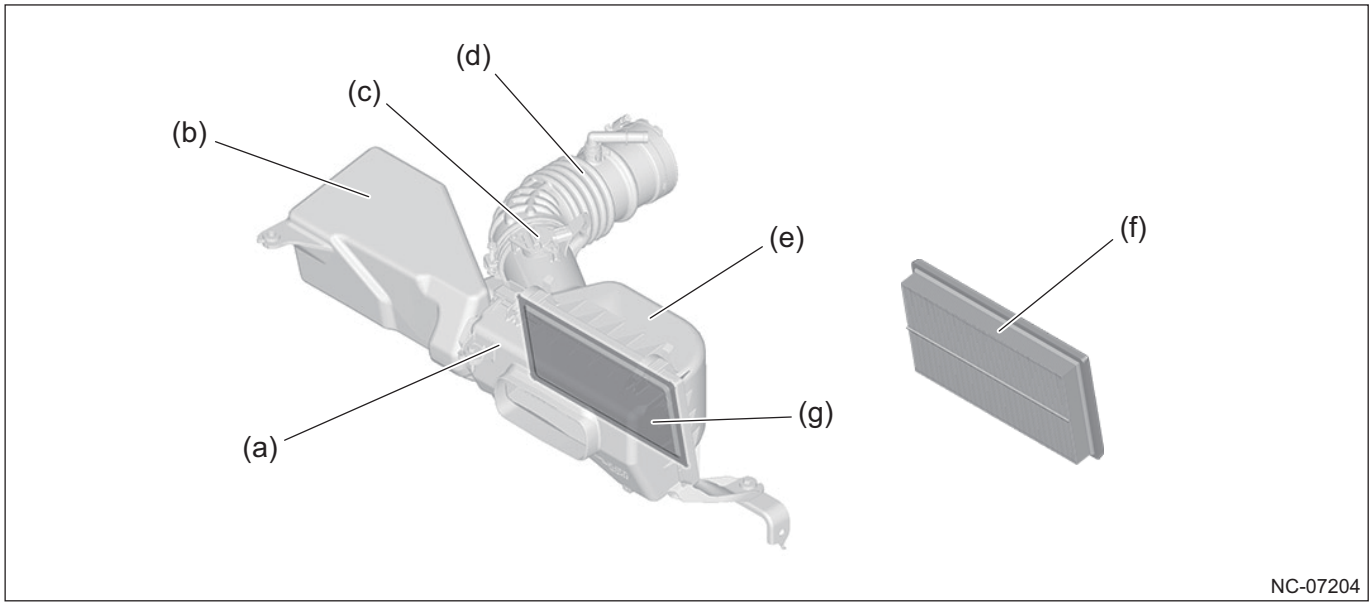
Air cleaner

A removable type of air cleaner case has been adopted to improve serviceability. An airflow and intake air temperature sensor is also installed on the air cleaner case (rear).

A resonator chamber is provided on the air cleaner case (front) and air intake boot, reducing intake noise.

The air cleaner element adds a fine fabric layer to the surface of the dry paper filter for improved cleaning performance.

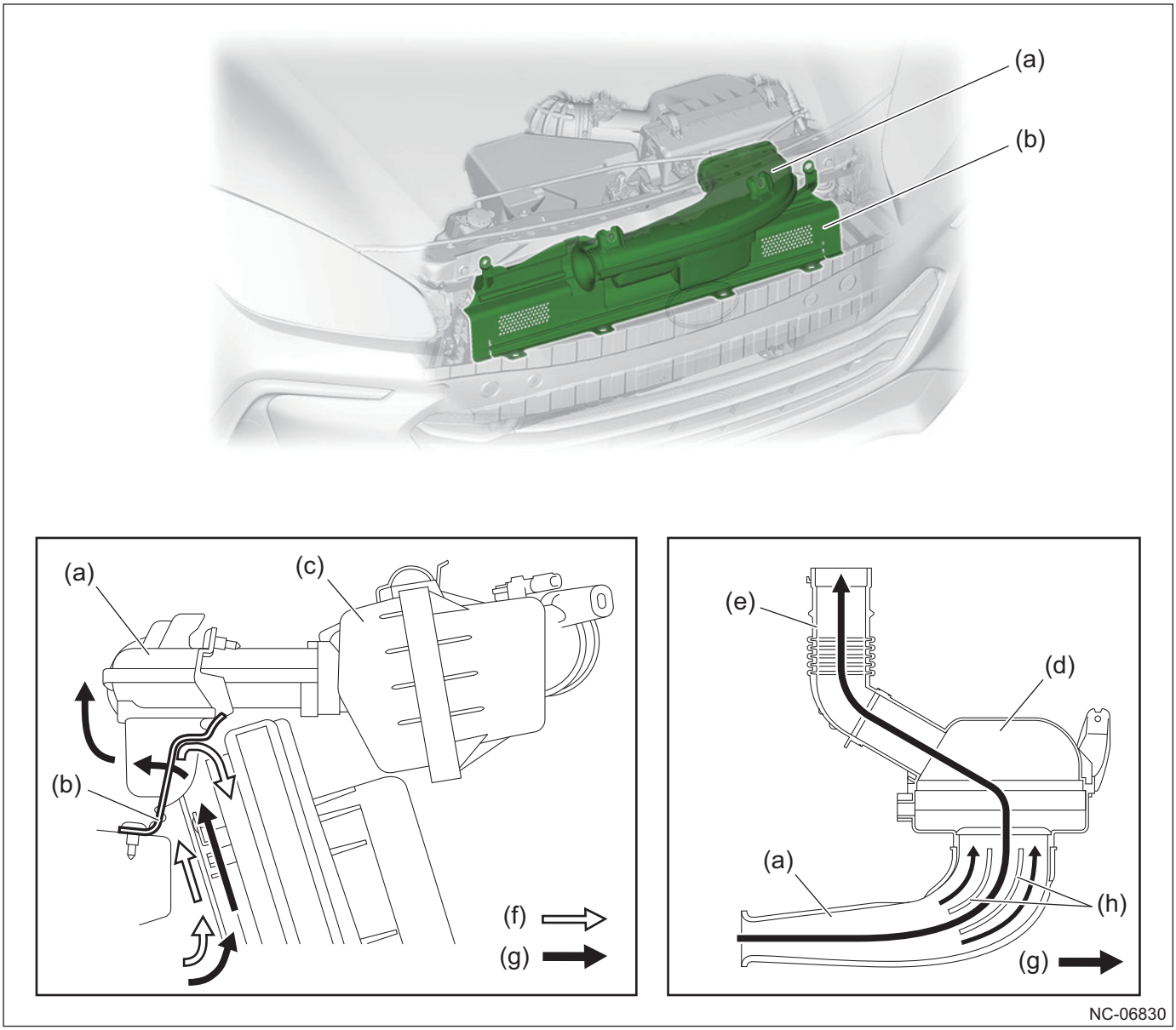
An HC adsorption filter has been adopted on the air cleaner case (rear). It adsorbs the fuel evaporation gas that accumulated in the intake system while the engine was stopped, and prevents it from being discharged into the atmosphere.



(a) Air cleaner case (front)
(b) Resonator chamber
(c) Air flow and intake air temperature sensor
(d) Air intake boot
(e) Air cleaner case (rear)
(f) Air cleaner element
(g) HC adsorption filter

An air-water separation structure using an air intake plate has been adopted. This prevents the intrusion of water or snow in the intake air, making it difficult for water or snow to enter the engine.

A flow control plate was added inside the air intake duct to control turbulence and reduce airflow resistance. The shape of the air cleaner case (rear) and the inner diameter of the air intake boot were expanded to improve output by reducing airflow resistance.



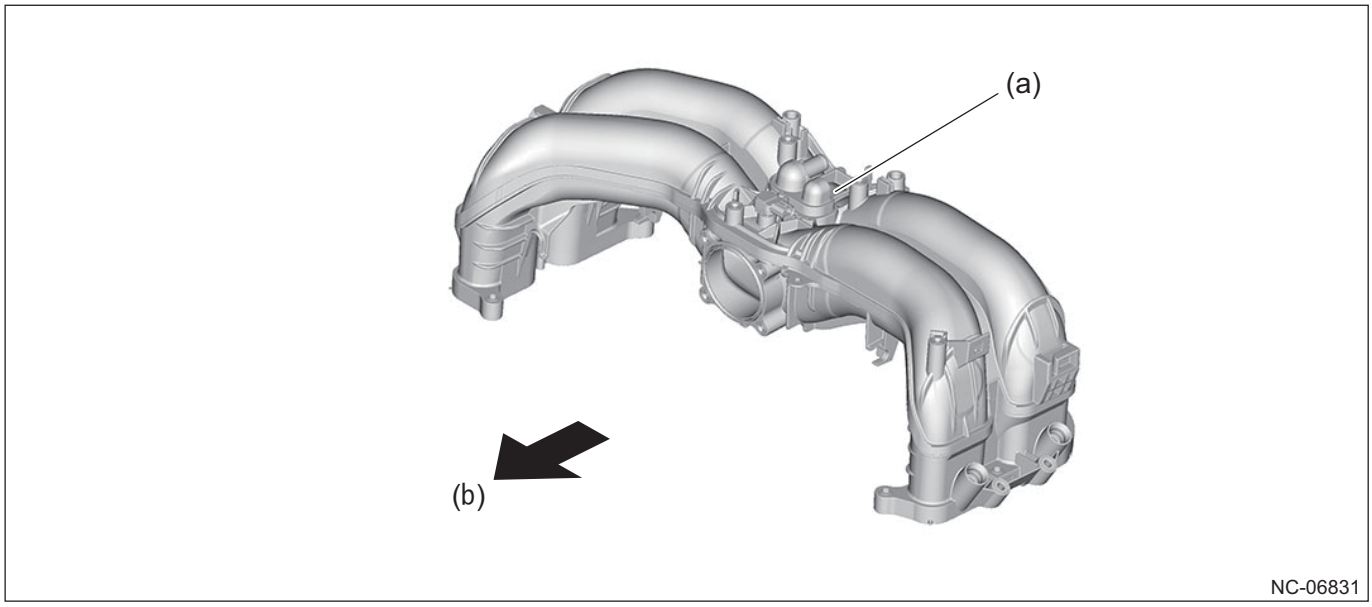
(a) Air intake duct
(b) Air intake plate
(c) Air cleaner case (front)
(d) Air cleaner case (rear)
(e) Air intake boot
(f) Water or snow
(g) Air
(h) Flow control plate

Intake manifold assembly

A resin intake manifold assembly is used to reduce weight.

The adopted port specifications (diameter, length) eliminate the dip in medium-speed torque and produce a smooth torque curve all the way to the torque peak. This provides smooth acceleration up to high engine speeds.

In order to produce the exciting sports car sound of a natural air intake engine, a curved surface shape is used at positions around the intake manifold periphery and the plate thickness was optimized, controlling the radiated noise that causes rough engine sound.



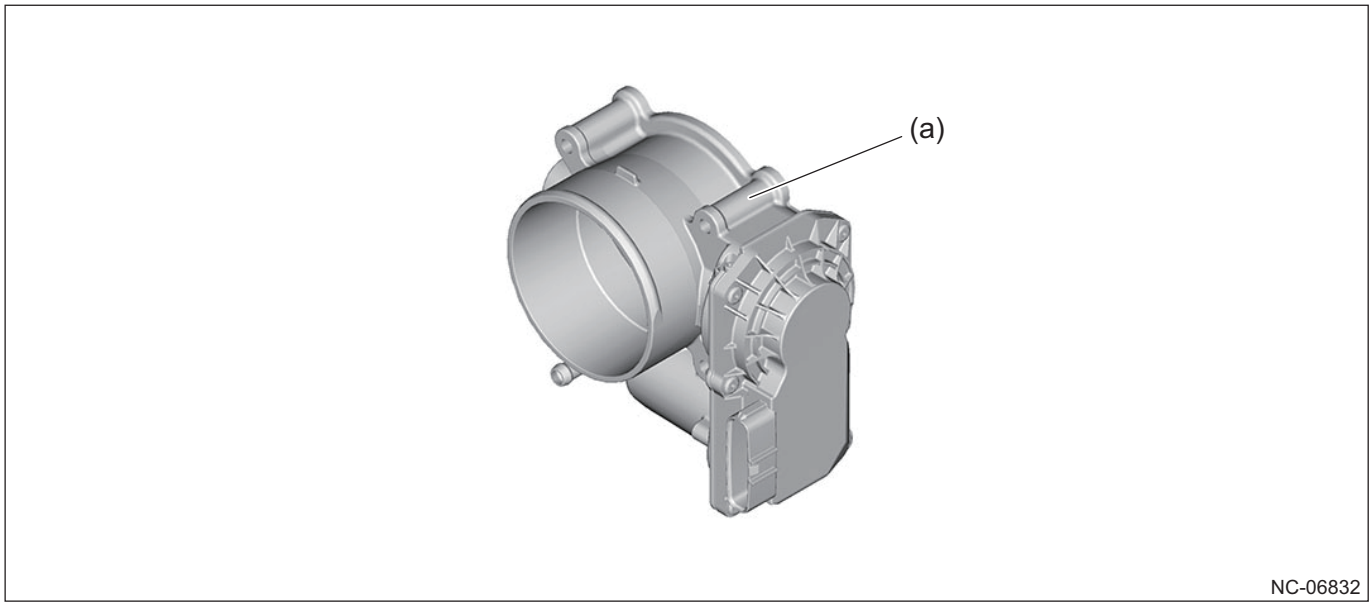
(a) Intake manifold assembly

(b) Engine front

Throttle body

A large-diameter throttle has been adopted to support high output.

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

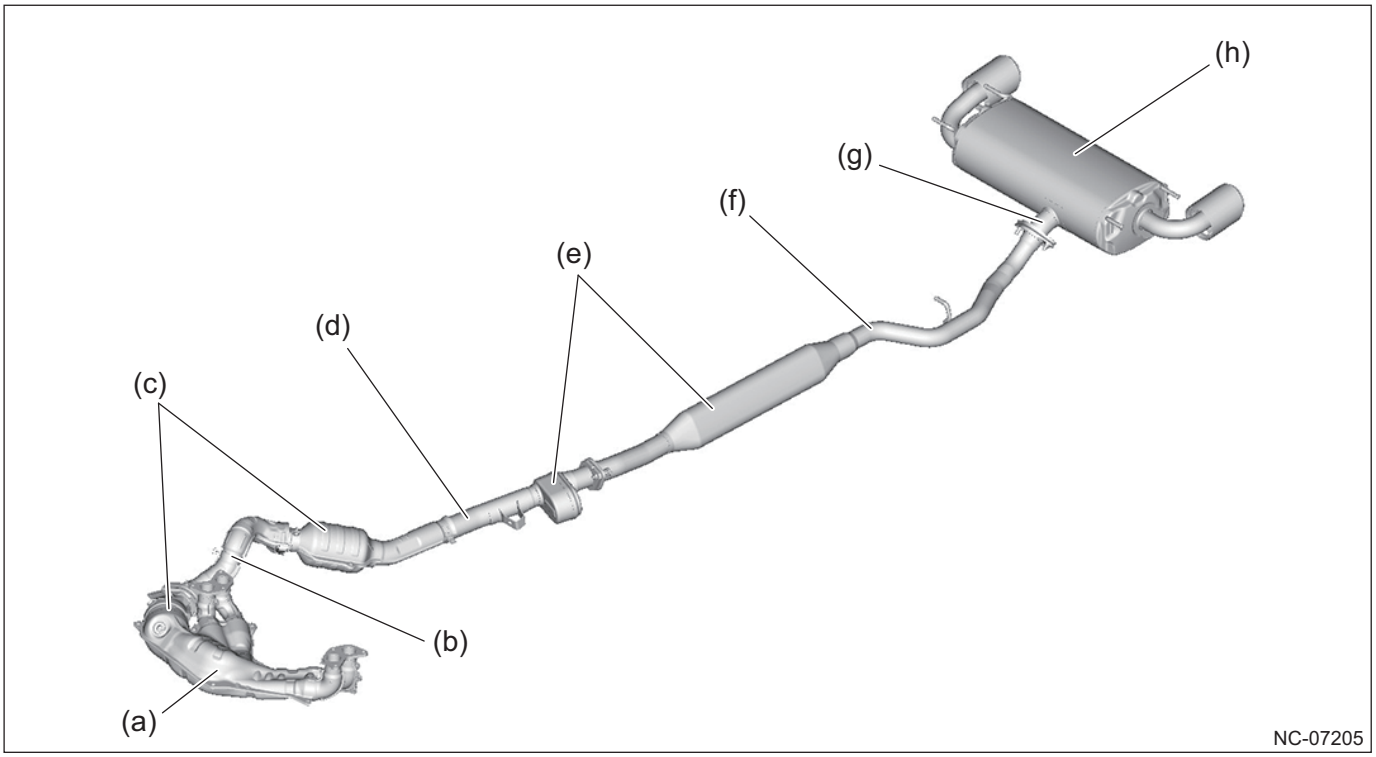


(a) Throttle body

Exhaust pipe

A stainless steel exhaust pipe has been adopted to reduce weight and ensure corrosion resistance.

A ball joint mechanism has been adopted at the fastening parts of the center exhaust pipe and rear exhaust pipe, reducing booming noise and vibration inside the vehicle.

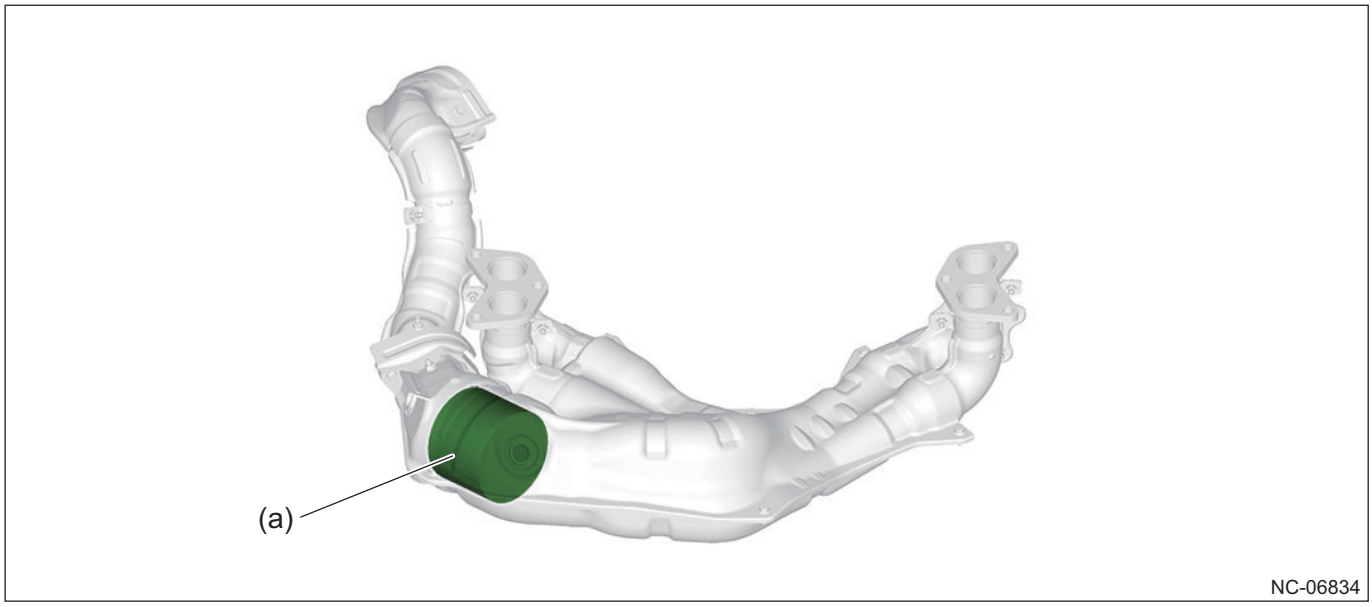


(a) Front exhaust pipe
(b) Joint pipe
(c) Ternary catalyst
(d) Center exhaust pipe
(e) Sub muffler
(f) Rear exhaust pipe
(g) Muffler
(h) Main muffler

A ternary catalyst integrated with the exhaust pipe has been adopted.

The use of a heat insulator on the stainless steel exhaust pipe reduces noise. This ensures heat resistance, accelerating catalyst warm-up immediately after engine start and reducing emissions.

A 4-2-1 layout has been adopted. Optimizing the pipe diameter reduces exhaust pressure loss and increases output.



(a) Ternary catalyst

2.4.3 Construction and Operation

System details

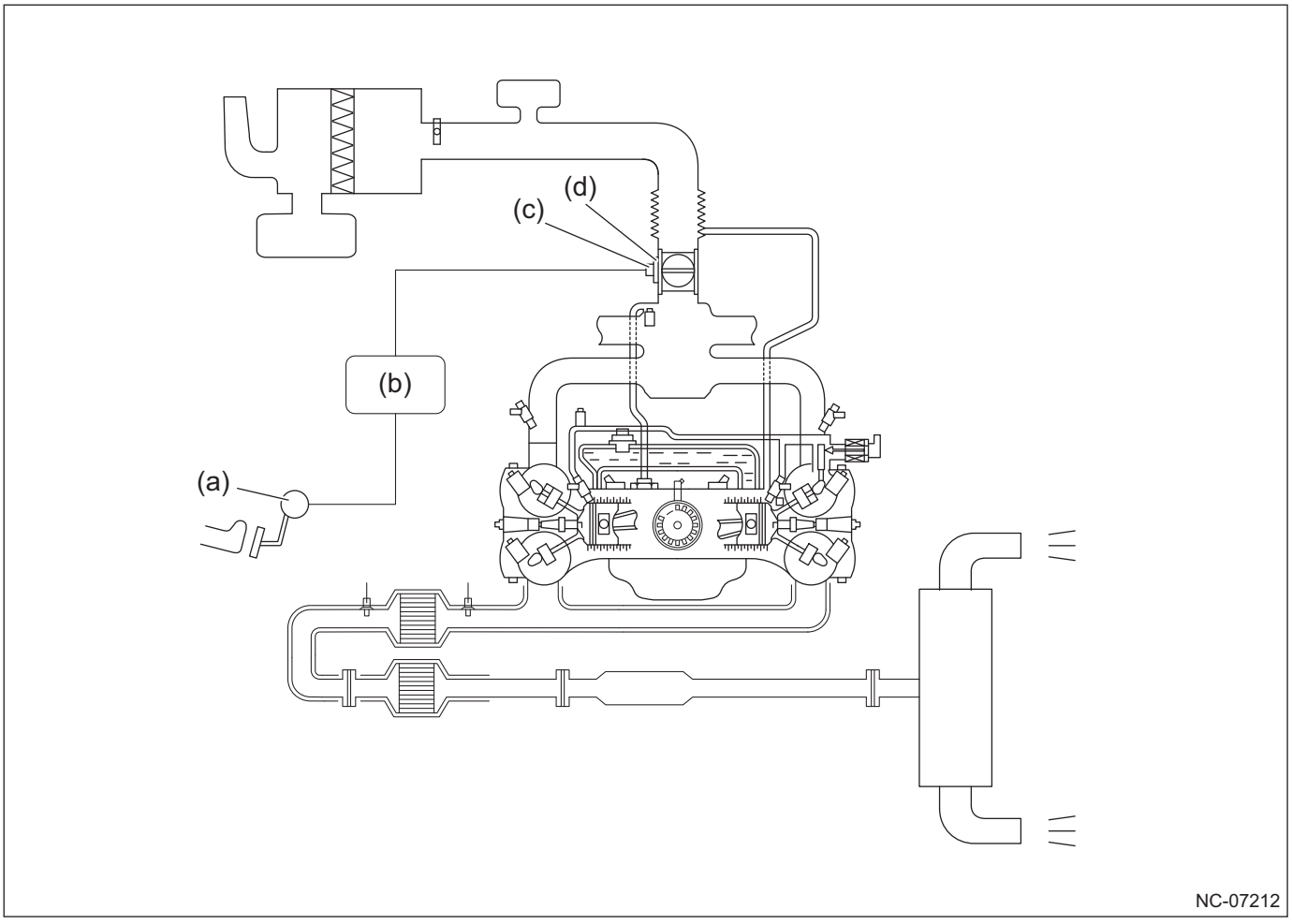
Electronic throttle system

The electronic throttle system detects how much the accelerator pedal is depressed by means of the accelerator pedal position sensor, and the Engine Control Module (ECM) uses the throttle motor to precisely operate the throttle valve.

The operation of the driver (amount of the accelerator pedal depressing) is transmitted to the Engine Control Module (ECM) through the accelerator pedal position sensor on the accelerator pedal. The Engine Control Module (ECM) determines the throttle opening angle according to the driving conditions and drives the throttle motor. Feedback of the throttle valve opening angle is sent to the Engine Control Module (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) Accelerator pedal position sensor
(b) Engine Control Module (ECM)
(c) Throttle position sensor
(d) Throttle motor

2.5 Cooling System

2.5.1 Overview

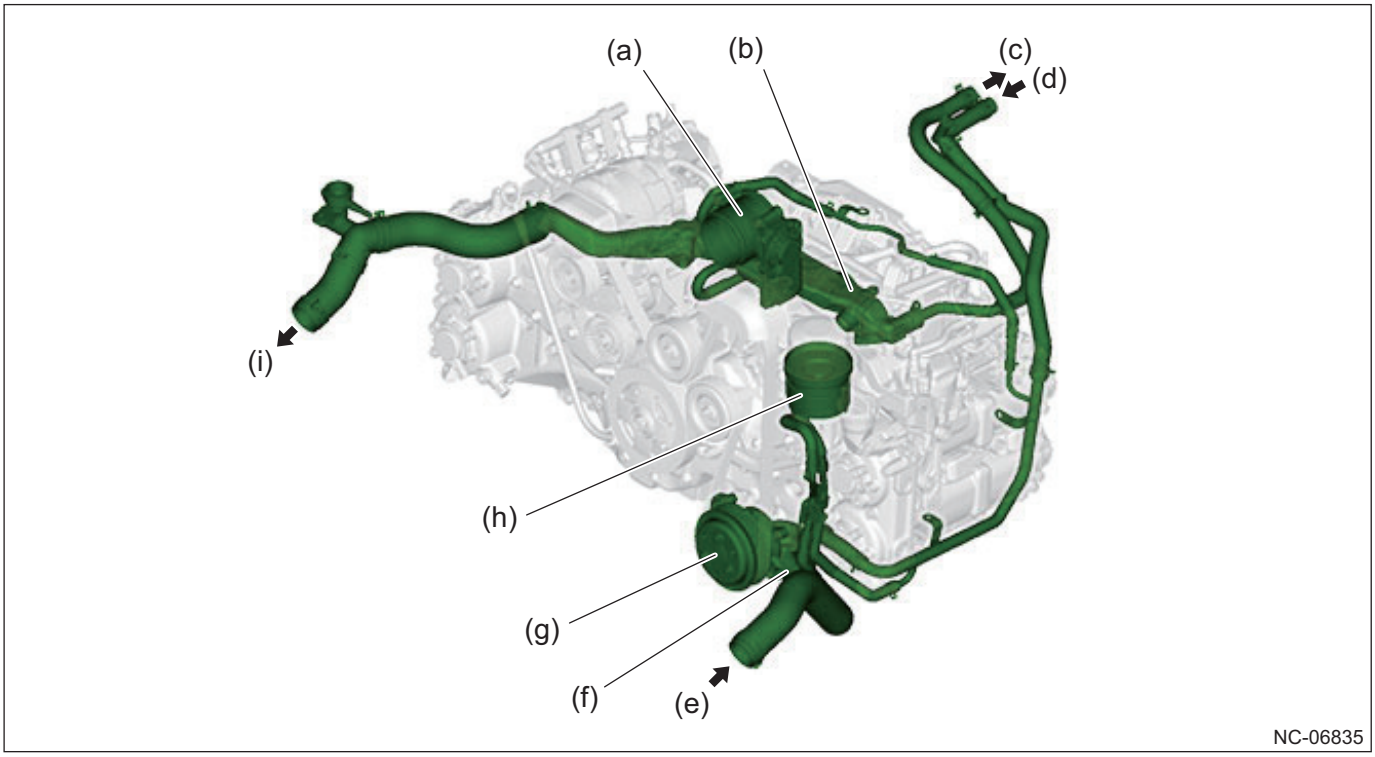
Overview

- 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.
- In order to reduce air accumulation, an air bleed valve was installed on the OUT side of the heater hose.
- The water-cooled engine oil cooler is installed to improve engine reliability.
- An ATF warmer is installed on the TX6A automatic transmission, increasing the ATF warm-up speed and reducing AT friction. This improves fuel economy when the power unit is cold.
- The position where the engine coolant temperature sensor is installed on the water tank pipe assembly is close to the coolant outlet on the cylinder block RH. This improves sensor measurement accuracy and improves engine control.

2.5.2 Component

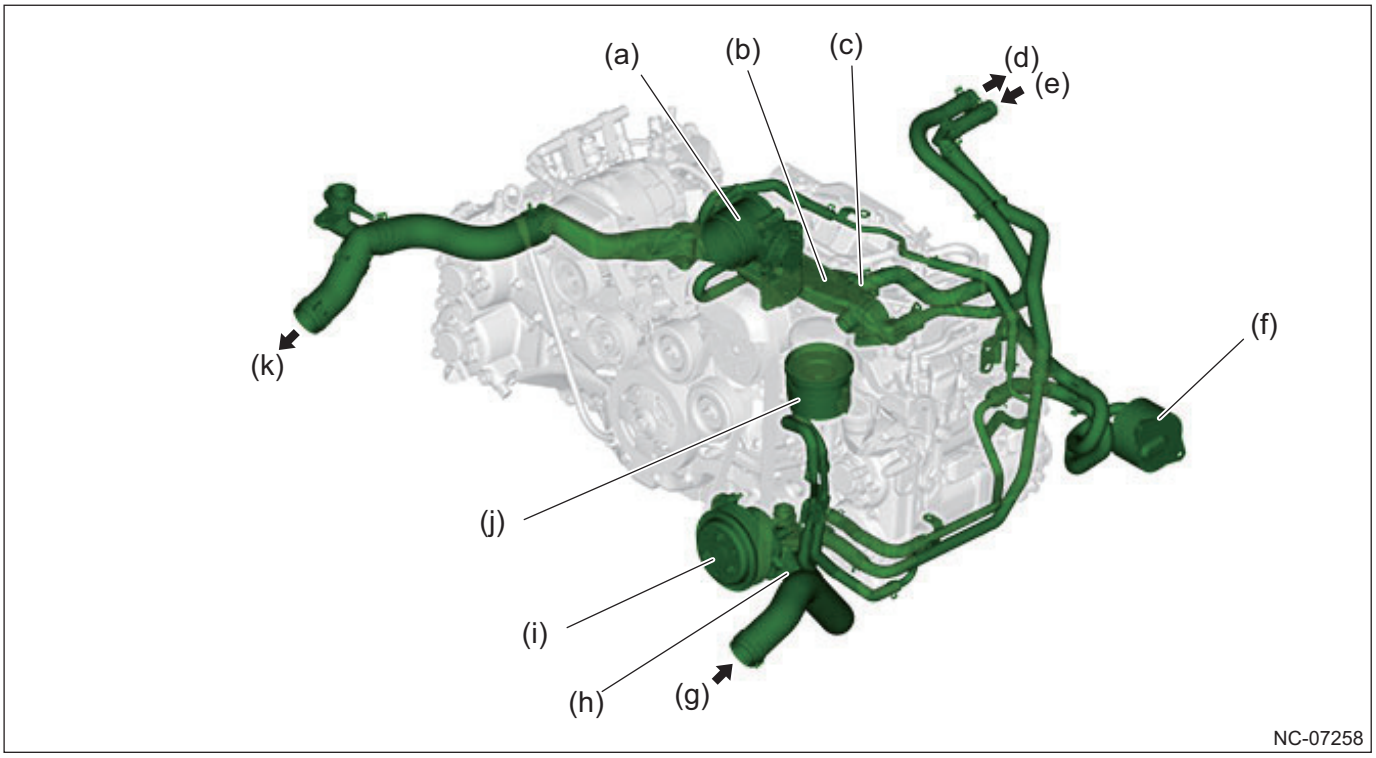
Component layout drawing

Flow of coolant (MT)



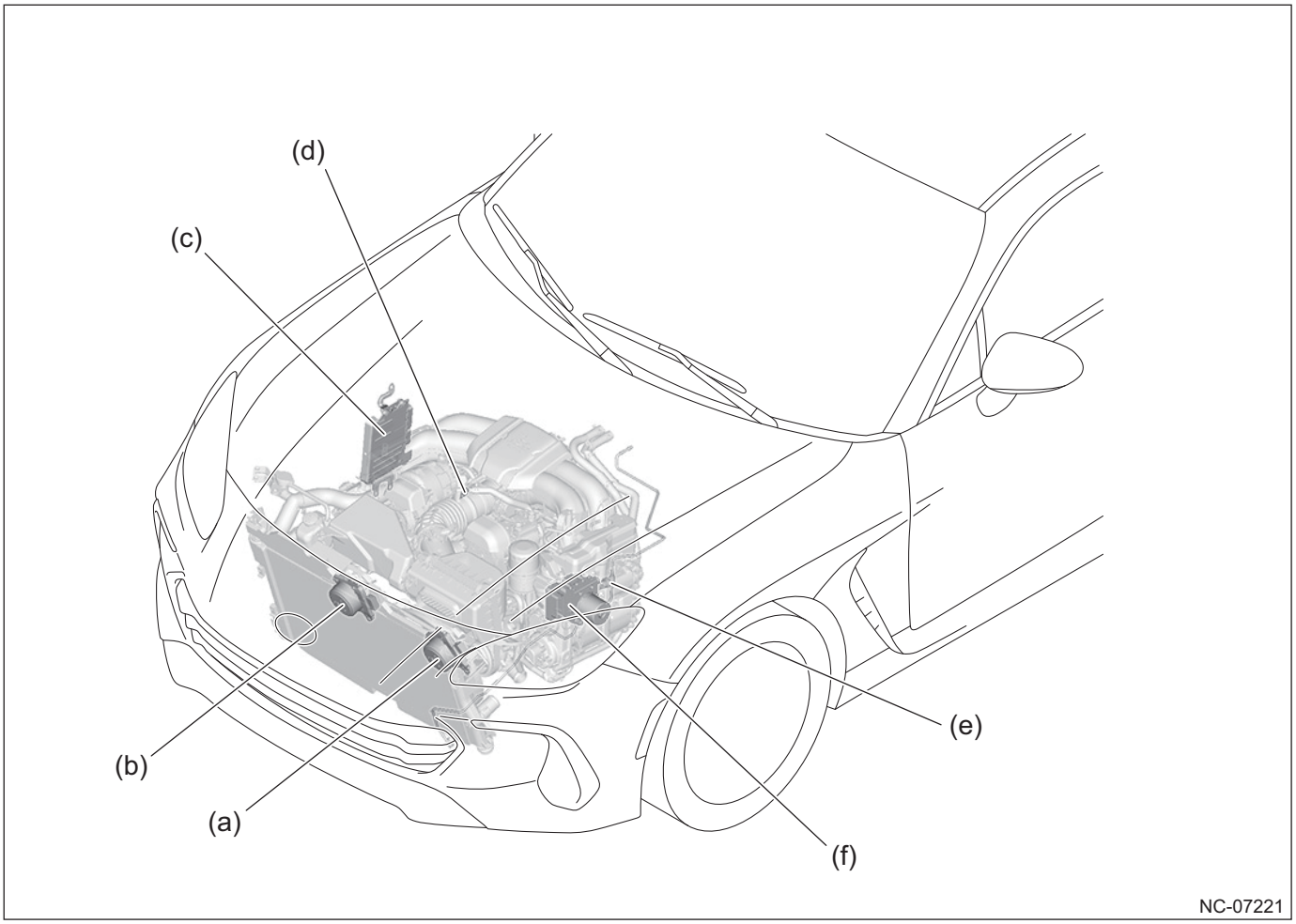
(a) Throttle body
(b) Water tank pipe assembly
(c) To heater core
(d) From heater core
(e) From radiator
(f) Thermostat
(g) Water pump
(h) Engine oil cooler
(i) To radiator

Flow of coolant (AT)



(a) Throttle body
(b) Water tank pipe assembly
(c) Thermostat (SUB)
(d) To heater core
(e) From heater core
(f) ATF warmer
(g) From radiator
(h) Thermostat (MAIN)
(i) Water pump
(j) Engine oil cooler
(k) To radiator

Cooling fan system



(a) Fan motor LH

(b) Fan motor RH

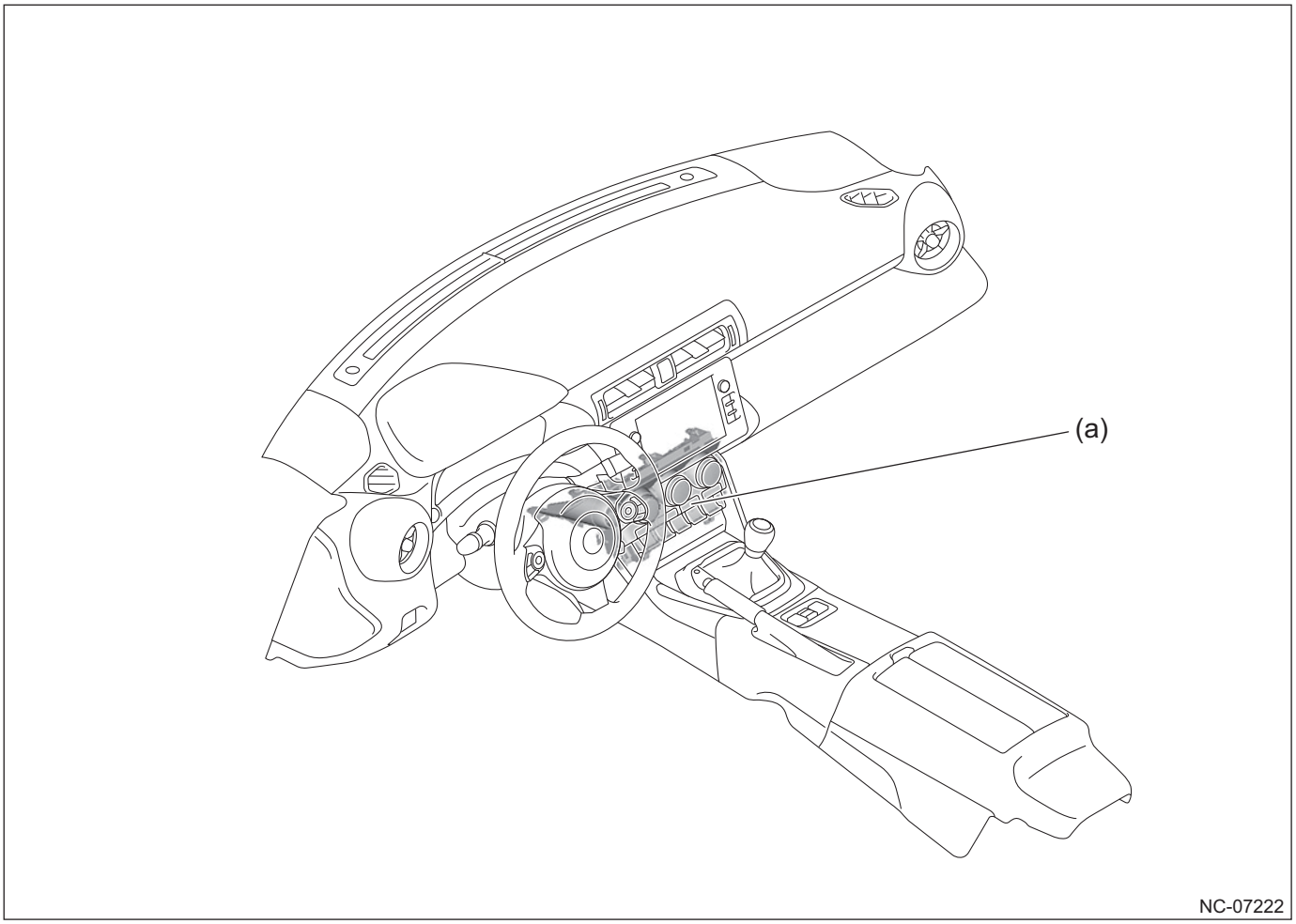
(c) Engine Control Module (ECM)

(d) Engine coolant temperature sensor

(e) Pressure switch

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

Cooling fan system



(a) A/C CM

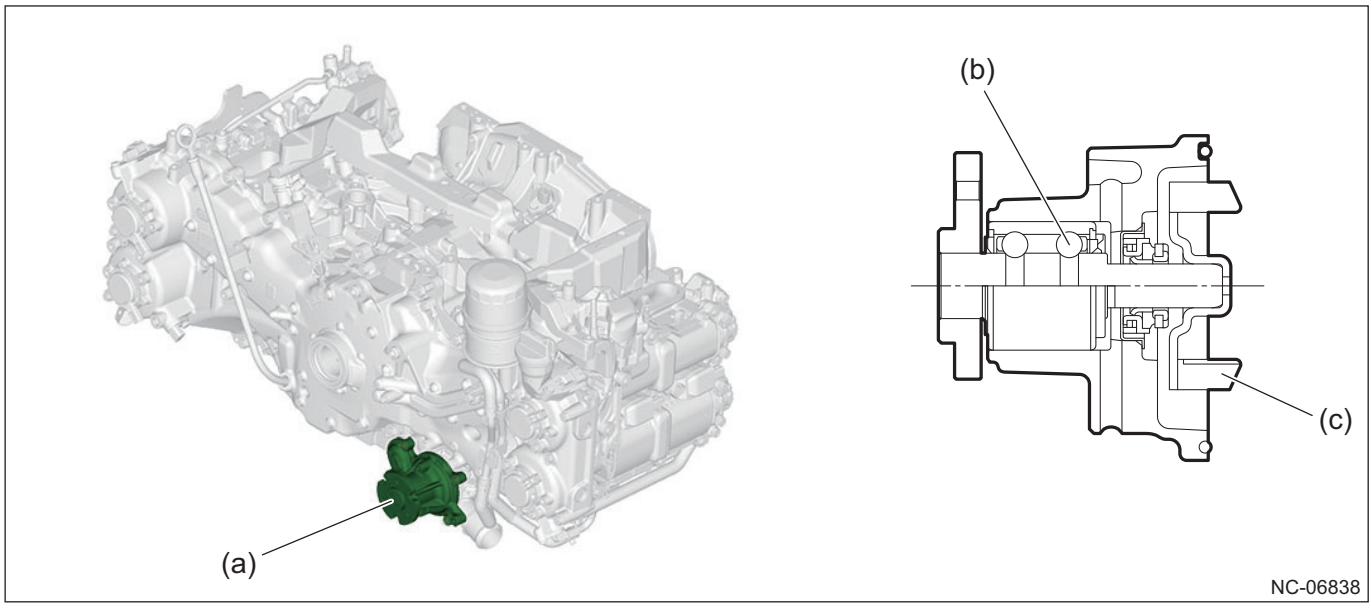
Component details

Water pump

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

A small-diameter pump impeller has been adopted for a more compact size. Also, the appropriate flow rate has been ensured by optimizing the blade shape of the pump impeller, and increasing the speed of the water pump by reducing the outer diameter of the water pump pulley.

The shape of the coolant circuit (cylinder block, cylinder head, oil pan upper, and water tank pipe assembly) has been optimized to reduce overall pressure loss in the coolant circuit.

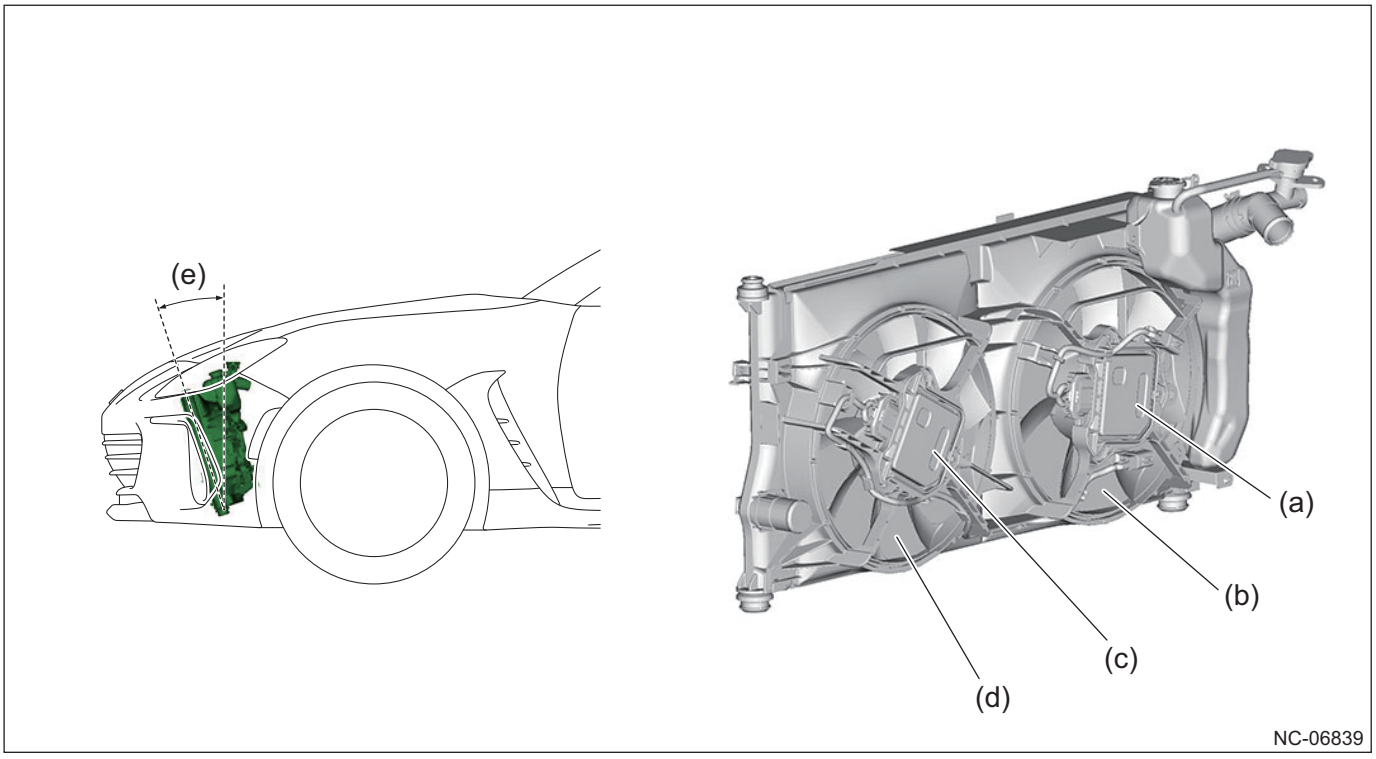


(a) Water pump
(b) Bearing
(c) Pump impeller

Radiator

A cross-flow type aluminum core radiator has been adopted and the radiator capacity was increased, improving cooling performance.

The radiator is inclined 17 degrees forward to achieve a low vehicle height.



(a) Fan motor RH
(b) Fan RH
(c) Fan motor LH
(d) Fan LH
(e) Radiator inclined 17 degrees forward

Radiator fan

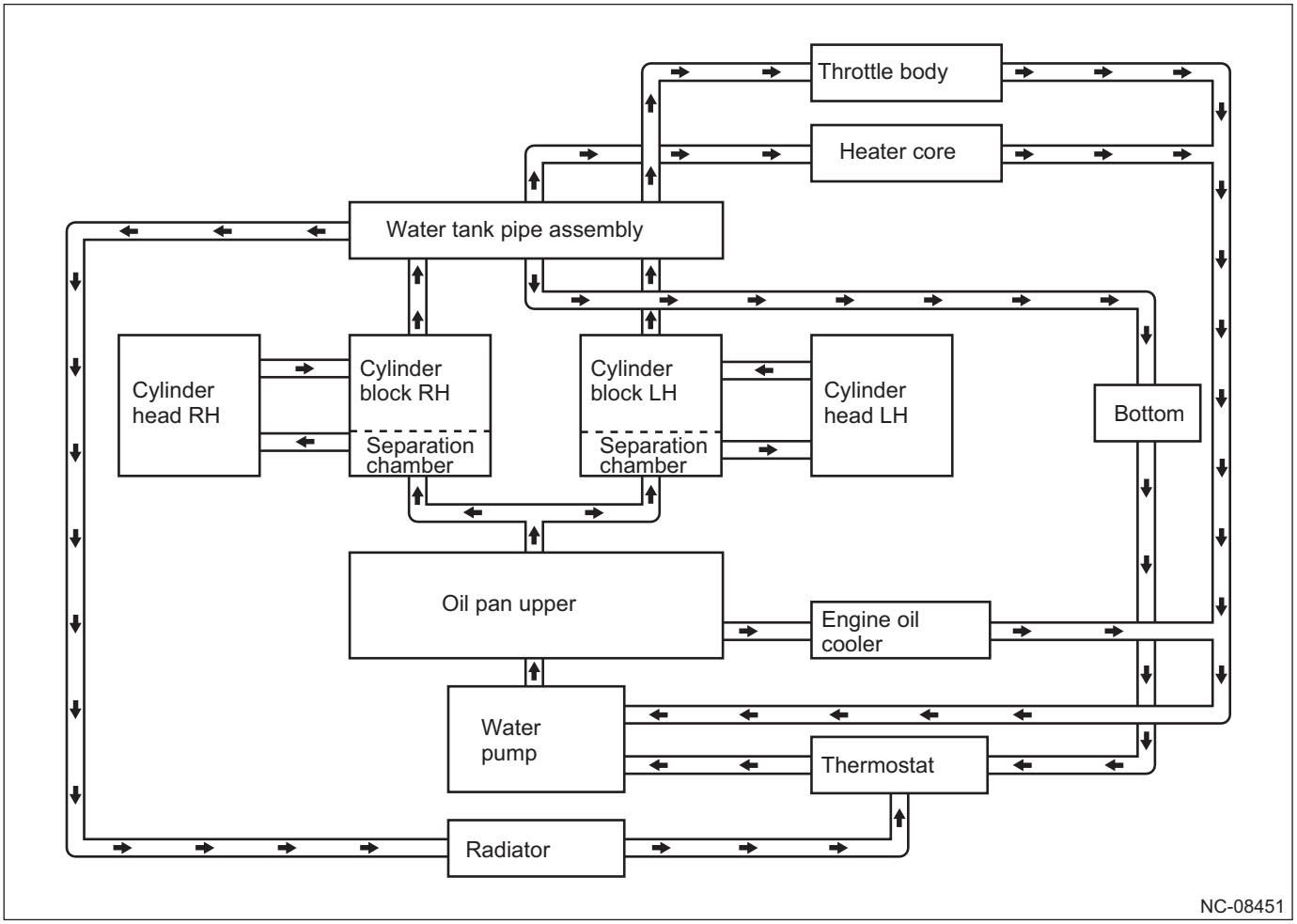
The cooling fan controller is integrated with the fan motor LH/RH for a more compact size.

Based on the signal from the Engine Control Module (ECM), the cooling fan controller controls the fan motor LH/RH speed to the optimal output according to the engine conditions, driving conditions, air conditioning operation, and other factors. This continuously controls the fan motor to the optimal speed to improve cooling performance and fuel economy.

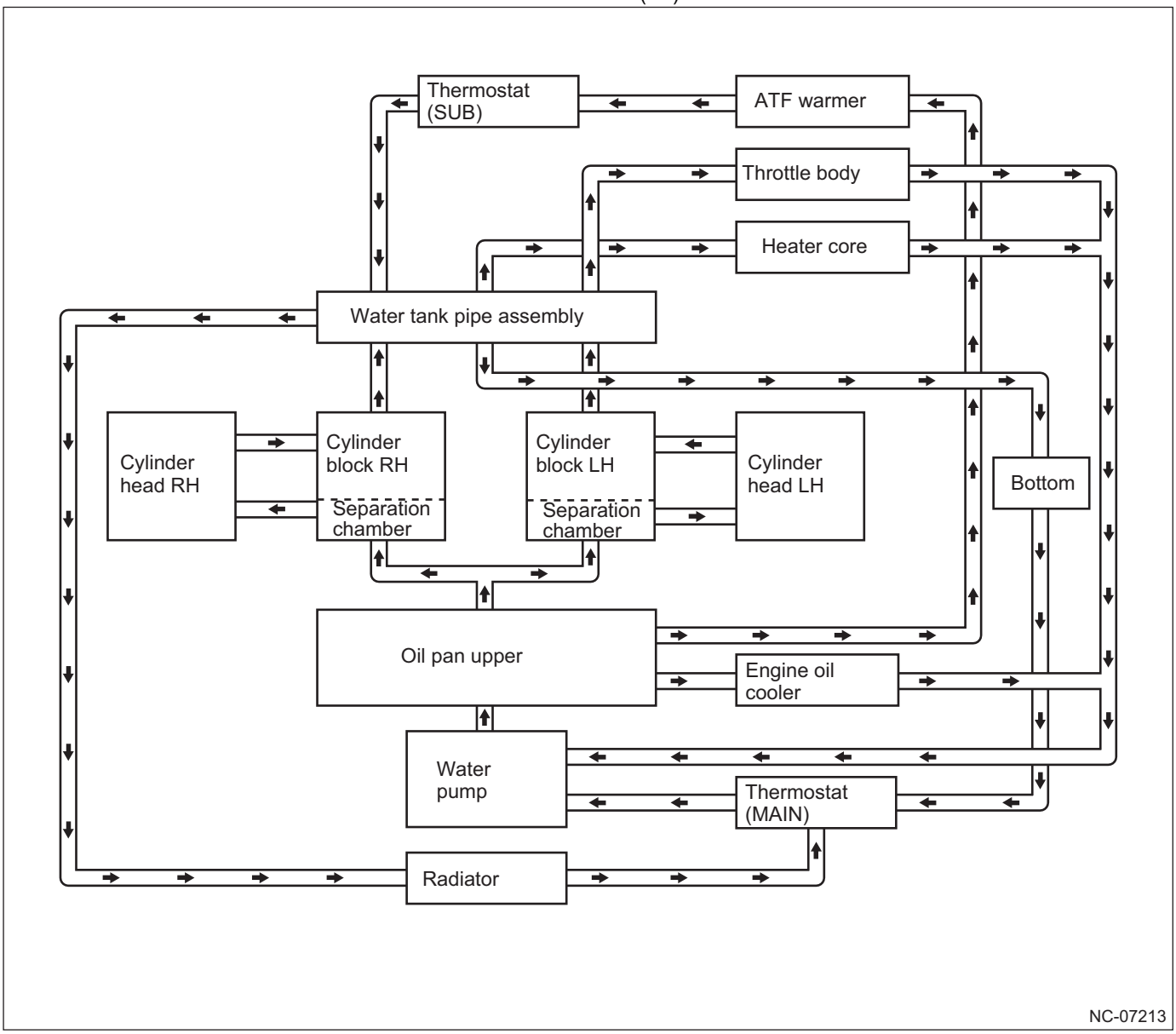
2.5.3 Construction and Operation

System diagram

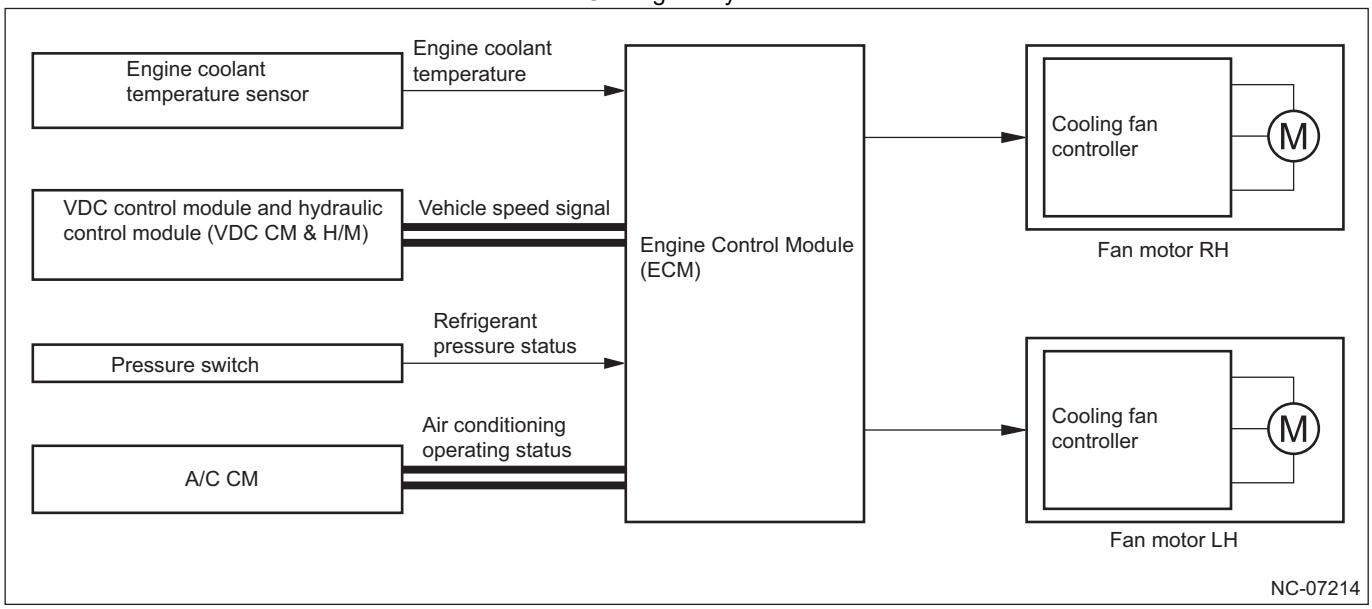
Flow of coolant (MT)



Flow of coolant (AT)



Cooling fan system



Main component functions

Name	Function and construction
Engine Control Module (ECM)	Sends the control signal to the cooling fan controller.
Fan motor RH • Cooling fan controller	Operates based on signals from the Engine Control Module (ECM).
Fan motor LH • Cooling fan controller	
Engine coolant temperature sensor	Detects the engine coolant temperature.
VDC control module and hydraulic control module (VDC CM & H/M)	Sends the vehicle speed signals to the Engine Control Module (ECM).
Pressure switch	Detects the refrigerant pressure status.
A/C CM	Sends the air conditioning operating status information to the Engine Control Module (ECM).

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, and vehicle speed, and sends a signal to the cooling fan controller in order to control the cooling fan speed.

2.6 Lubrication System

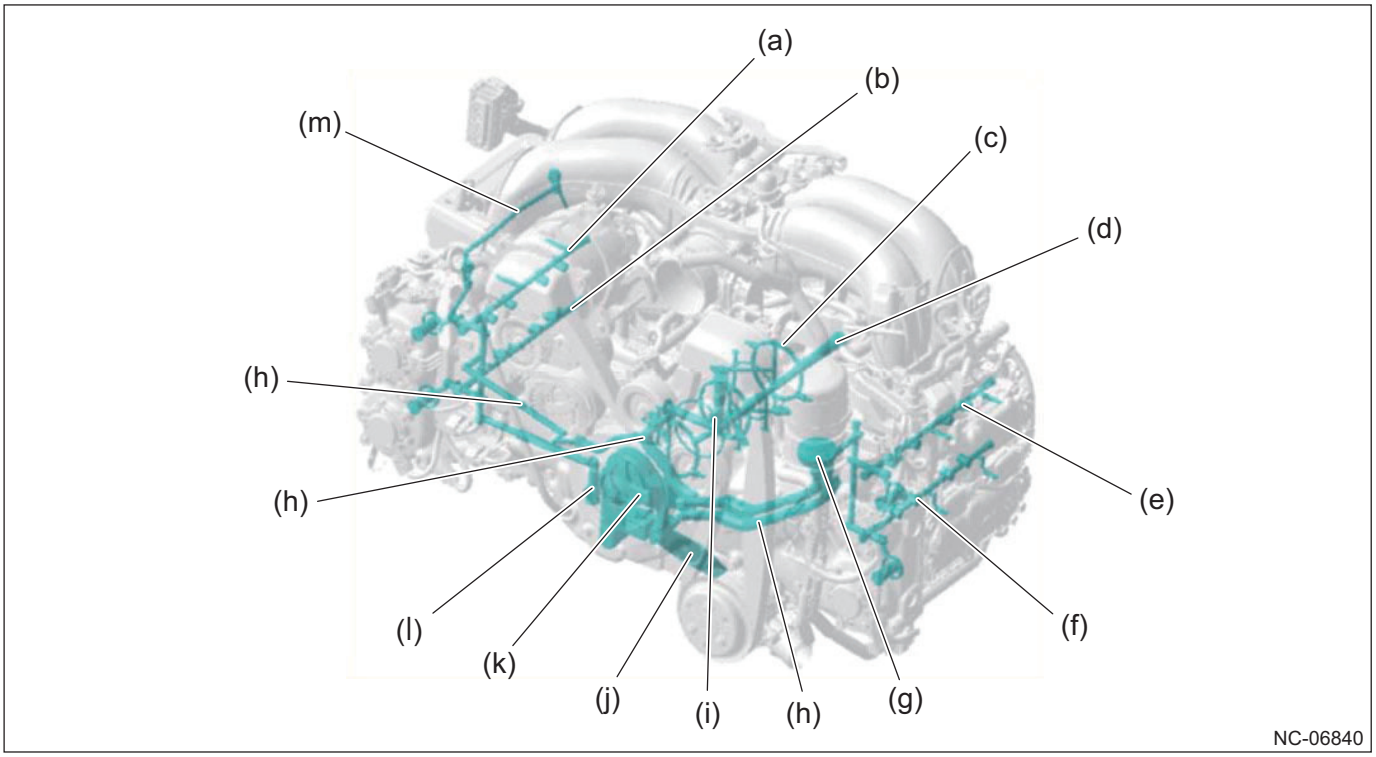
2.6.1 Overview

Overview

- Full pressure feed and full filter methods are adopted for lubrication.

2.6.2 Component

Component layout drawing

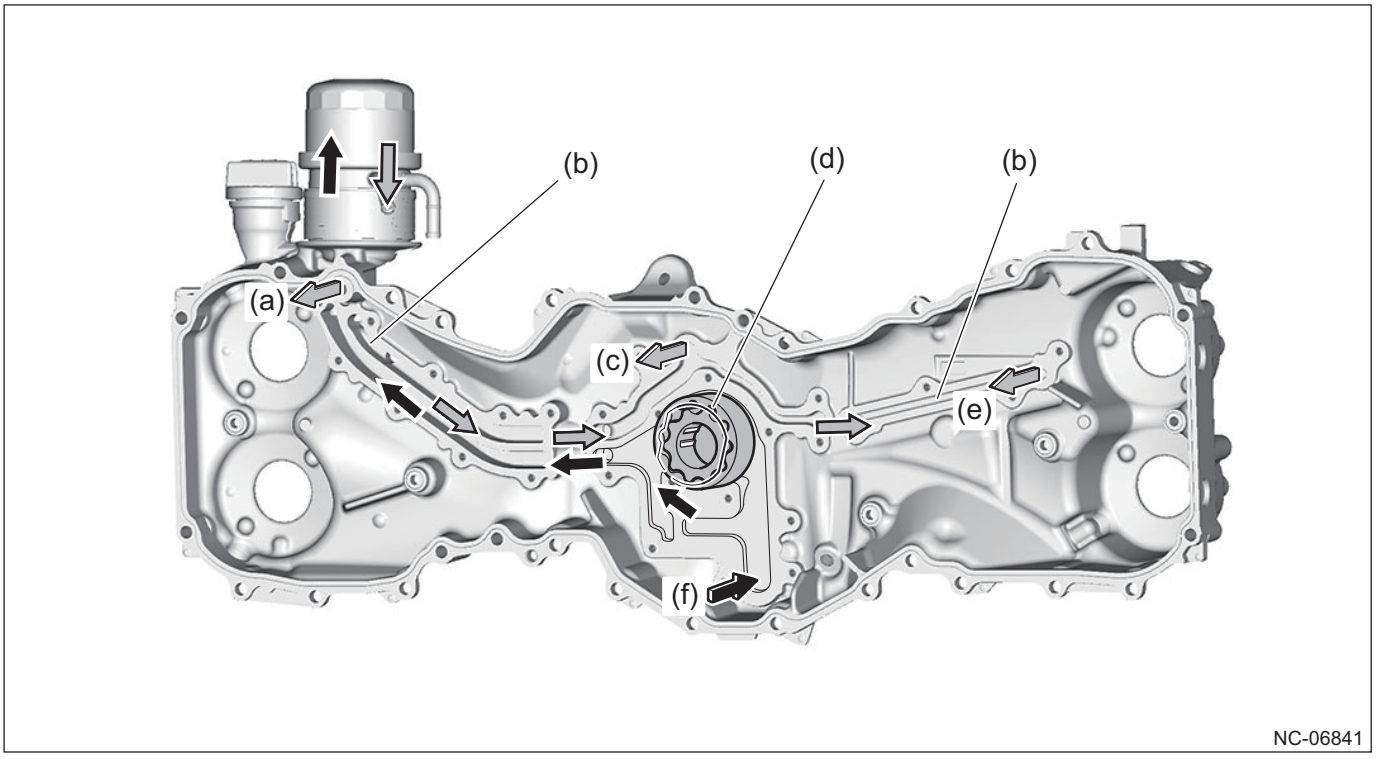


(a) Intake cam journal RH oil passage
(b) Exhaust cam journal RH oil passage
(c) Crankshaft journal oil passage
(d) Main oil passage
(e) Intake cam journal LH oil passage
(f) Exhaust cam journal LH oil passage
(g) Engine oil cooler
(h) Oil passage in chain cover
(i) Chain tensioner LH oil passage
(j) Oil strainer
(k) Oil pump
(l) Chain tensioner RH oil passage
(m) Oil pipe

Component details

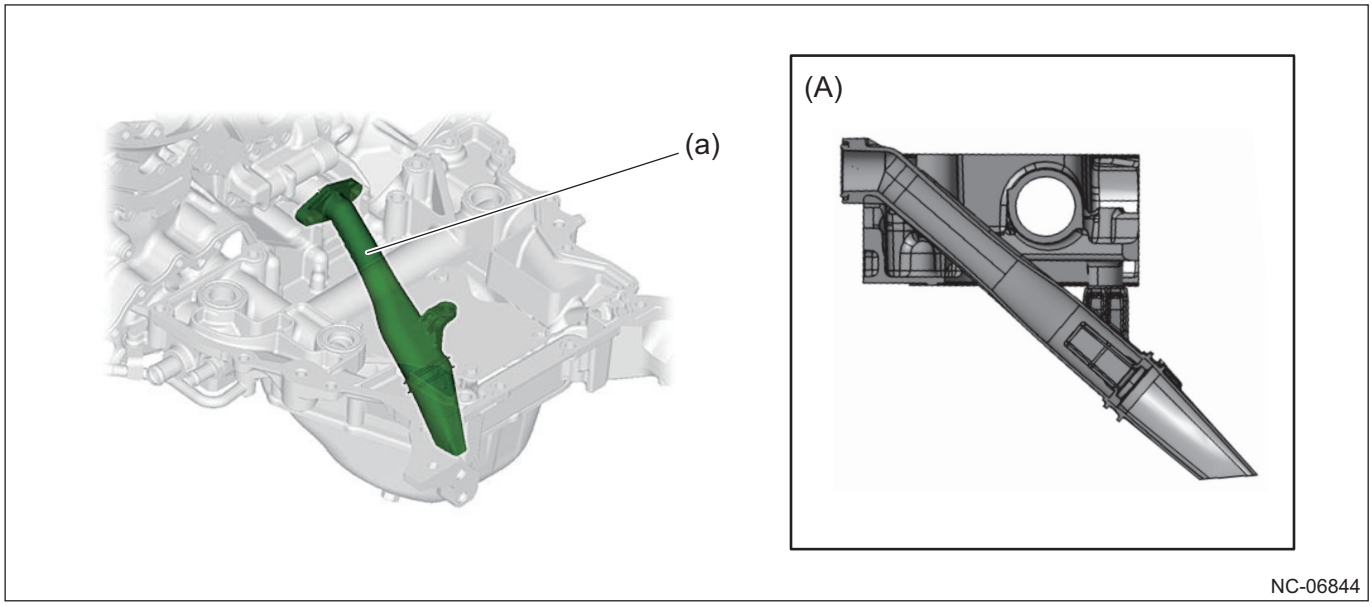
Oil pump

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

The larger strainer passage cross section and simplified passage shape reduce pressure loss and improve oil pump efficiency.

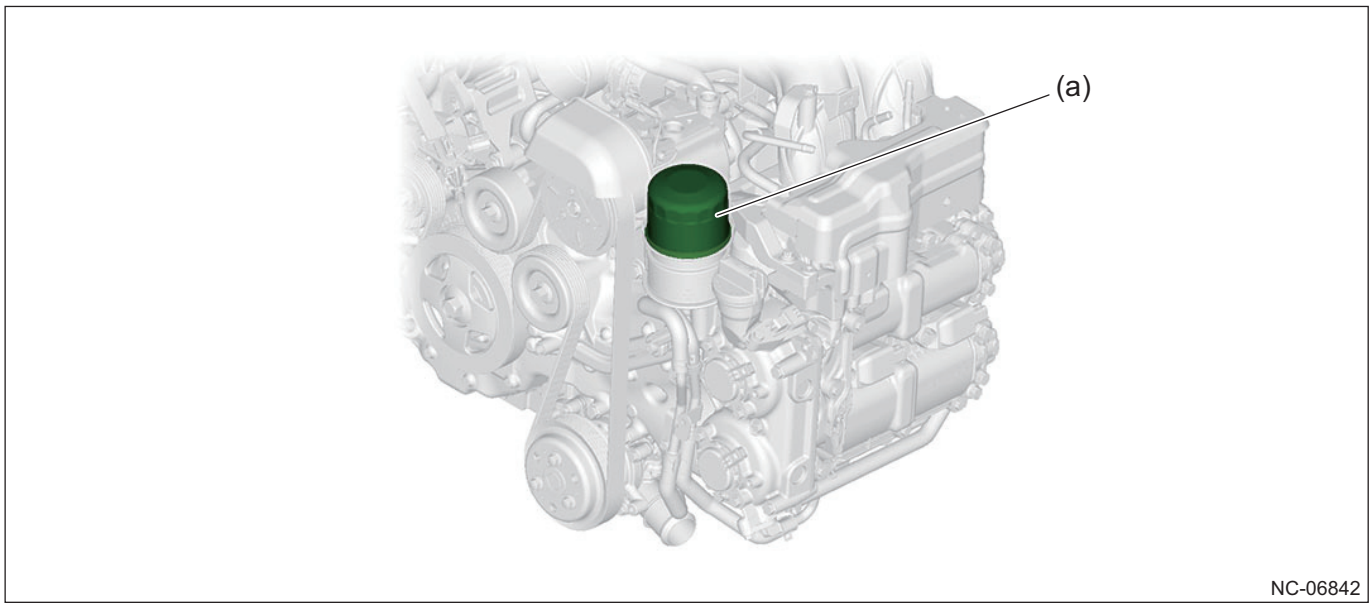


(A) Cross section

(a) Oil strainer

Oil filter

In order to protect pedestrians, an oil filter which is installed inside the relief valve with reduced overall height has been adopted.

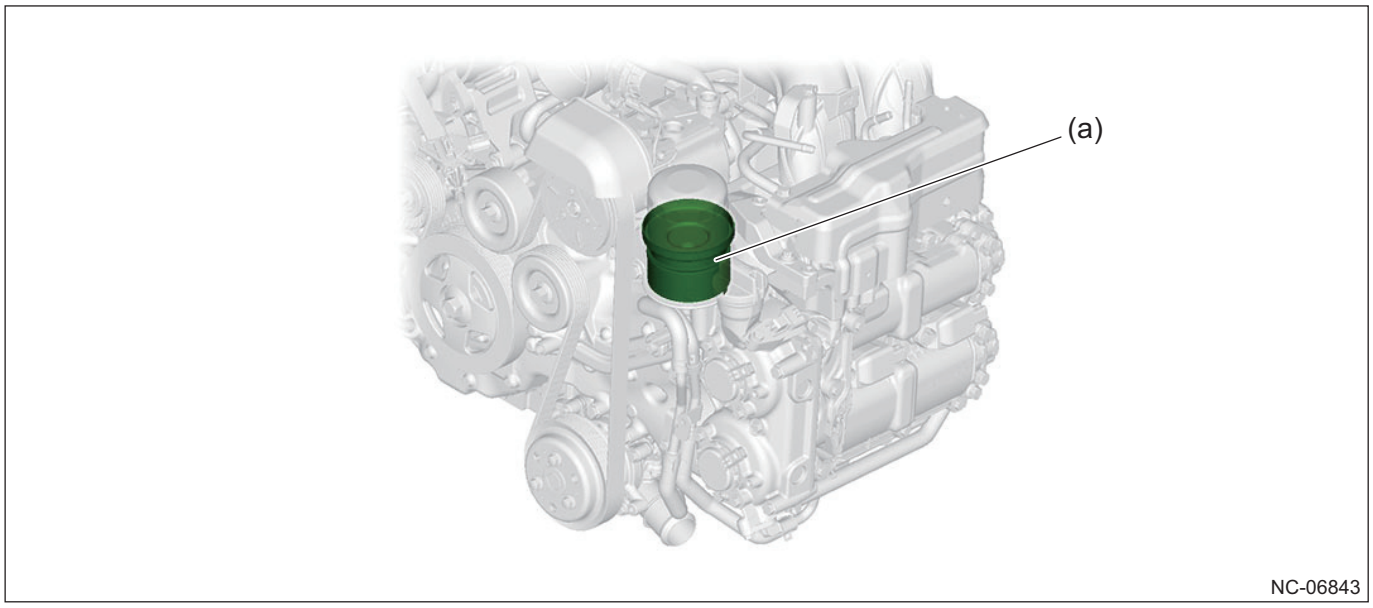


(a) Oil filter

Engine oil cooler

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

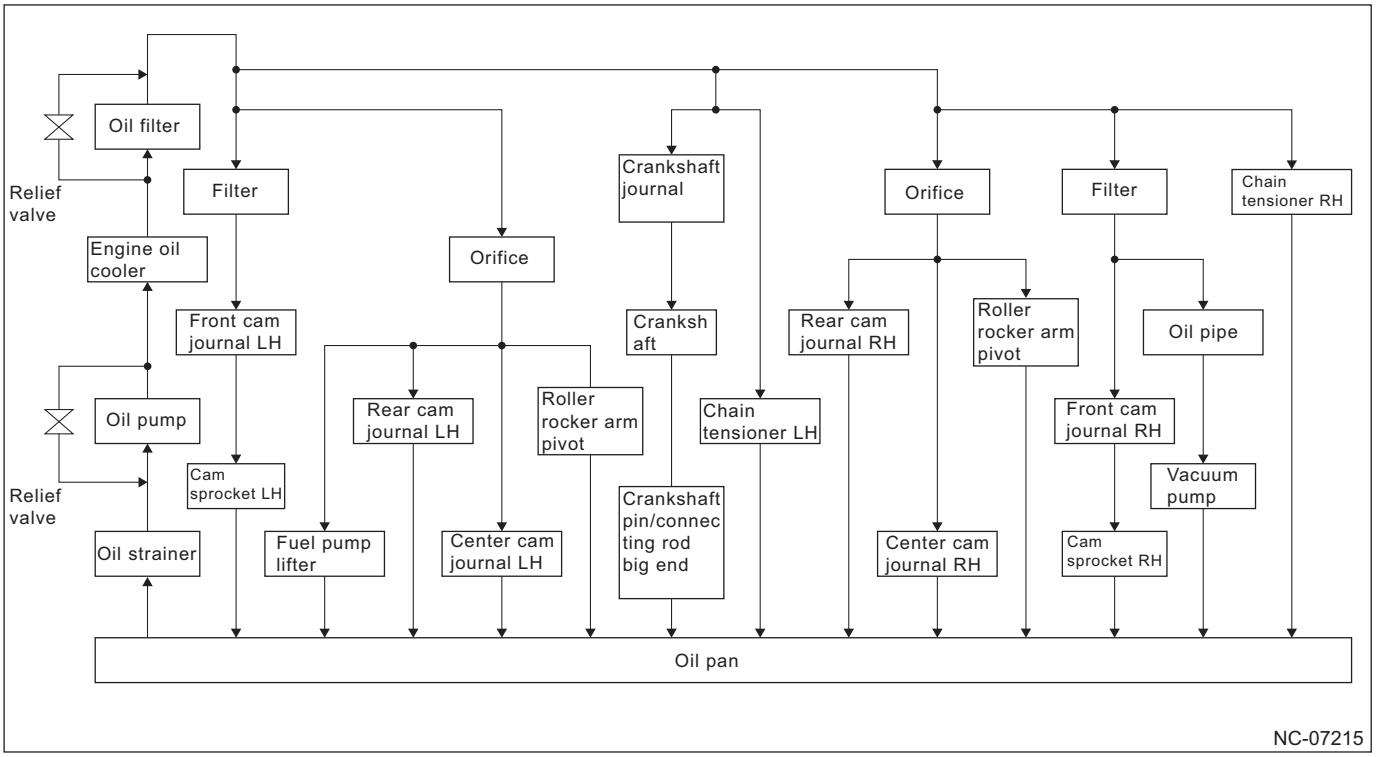
The smaller coolant pipe diameter reduces the height, helping to ensure pedestrian protection performance. Arranging the coolant pipes parallel at the engine front secures space for installation of a fuel protector, improving collision safety performance.



(a) Engine oil cooler

2.6.3 Construction and Operation

System diagram



2.7 Engine Control System

2.7.1 Overview

Overview

Performing high-precision overall control of fuel injection control (EFI), ignition timing control, electronic throttle control, AVCS, and other systems increases performance and output, reduces fuel consumption, and improves emission performance.

A D-4S (Direct injection 4-stroke gasoline engine Superior version) system equipped with both cylinder direct fuel injection method and port injection method has been adopted. This system performs central control of the fuel injectors for cylinder direct injection and port injection at the Engine Control Module (ECM), producing the optimal combustion conditions according to the driving conditions. This reduces fuel consumption, improves emissions performance, and delivers higher output in practical driving ranges.

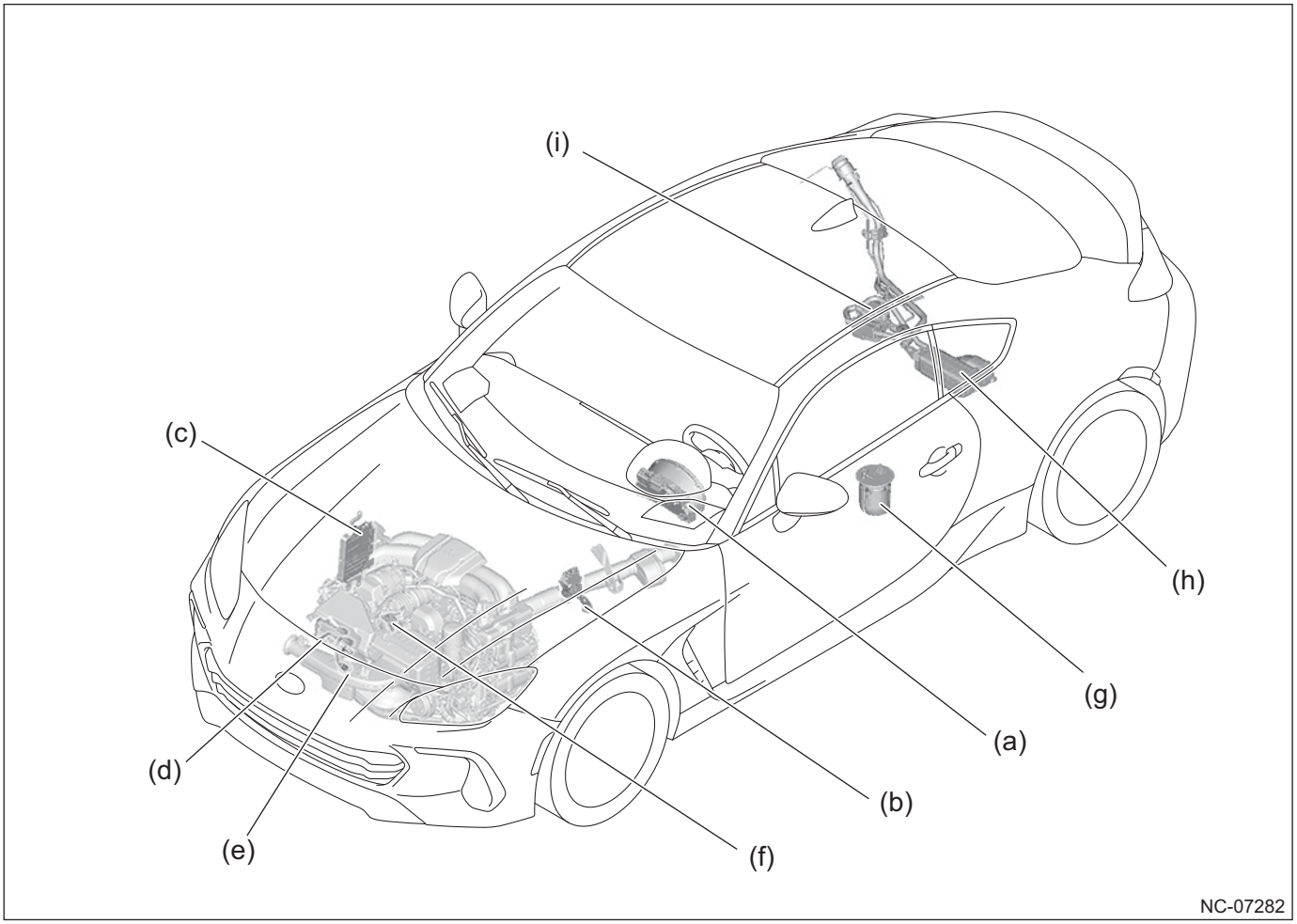
The diagnosis (self diagnosis) function and the fail-safe function are installed for when problems occur.

The adoption of a next generation Engine Control Module (ECM) integrates the injection driver and simplifies the control system.

2.7.2 Component

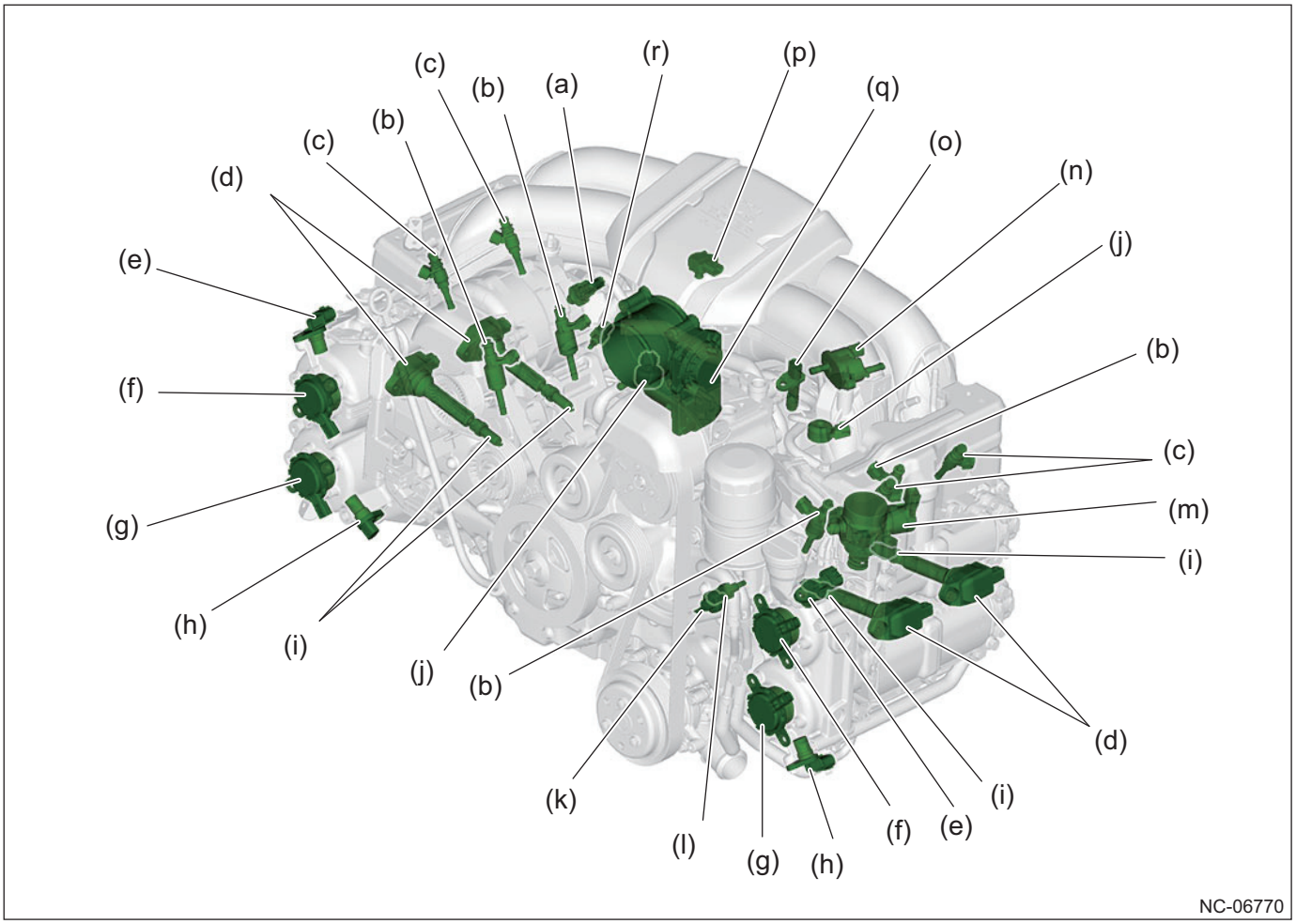
Component layout drawing

Main component 1



(a) Combination meter
(b) Accelerator pedal position sensor
(c) Engine Control Module (ECM)
(d) Rear oxygen sensor
(e) Front oxygen (A/F) sensor
(f) Air flow and intake air temperature sensor
(g) Fuel pump assembly
(h) Canister
(i) ELCM

Main component 2



(a) Fuel pressure sensor (high-pressure side)

(b) Fuel injector (for cylinder direct injection)

(c) Fuel injector (for port injection)

(d) Ignition coil

(e) Intake camshaft position sensor

(f) Intake oil control solenoid

(g) Exhaust oil control solenoid

(h) Exhaust camshaft position sensor

(i) Spark plug

(j) Knock sensor

(k) Oil pressure switch

(l) Engine oil temperature sensor

(m) High-pressure fuel pump

(n) Purge control solenoid valve

(o) Crankshaft position sensor

(p) Manifold pressure sensor

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

(r) Engine coolant temperature sensor

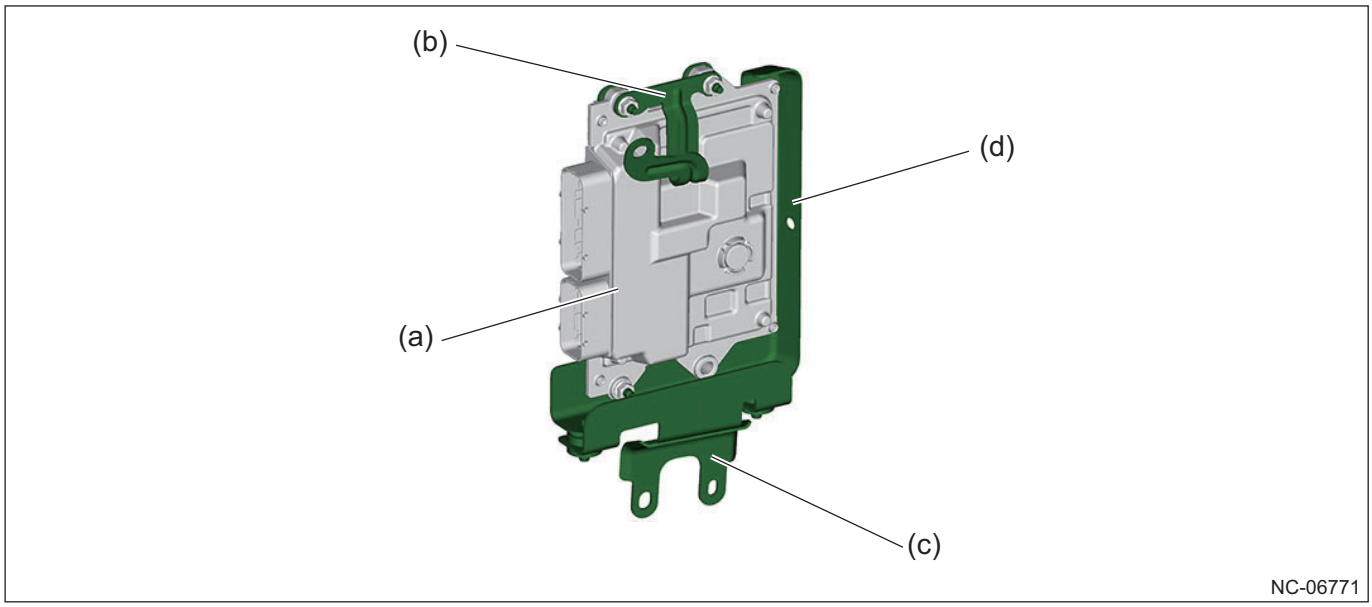
Component details

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, and canister purge control.

The adoption of a next generation Engine Control Module (ECM) integrates the injection driver and simplifies the control system.

The structure of the Engine Control Module (ECM) bracket is divided into 3 parts.

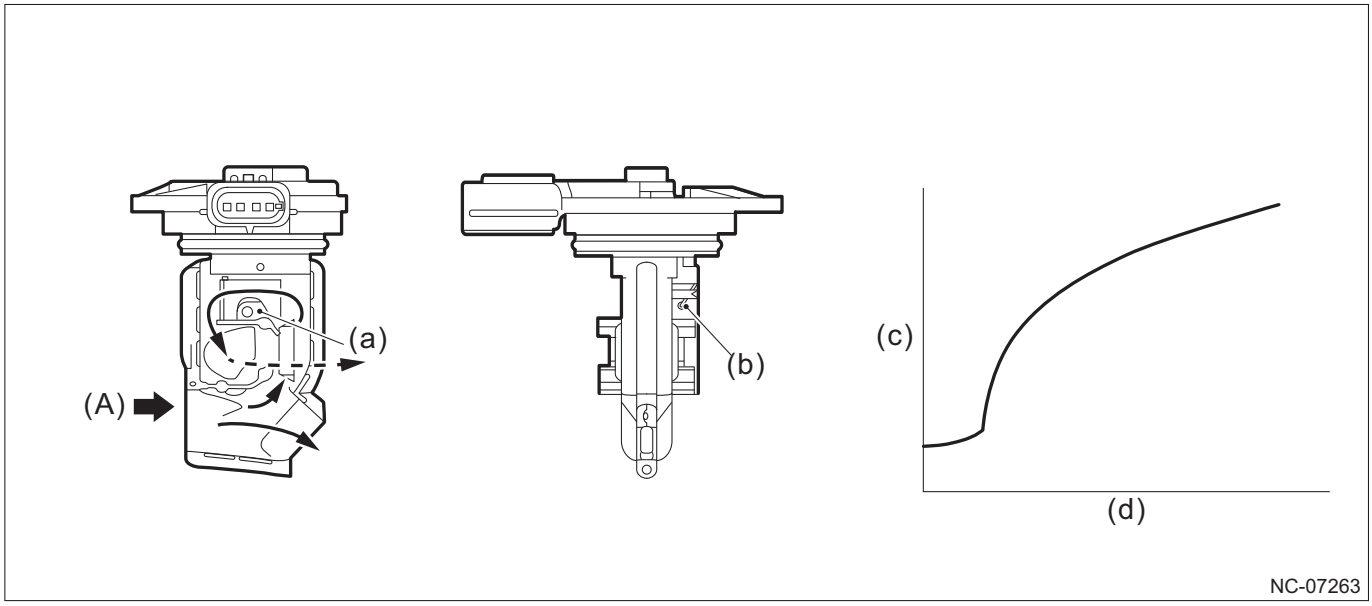


(a) Engine Control Module (ECM)
(b) Engine Control Module (ECM) bracket 1
(c) Engine Control Module (ECM) bracket 2
(d) Engine Control Module (ECM) bracket 3

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.



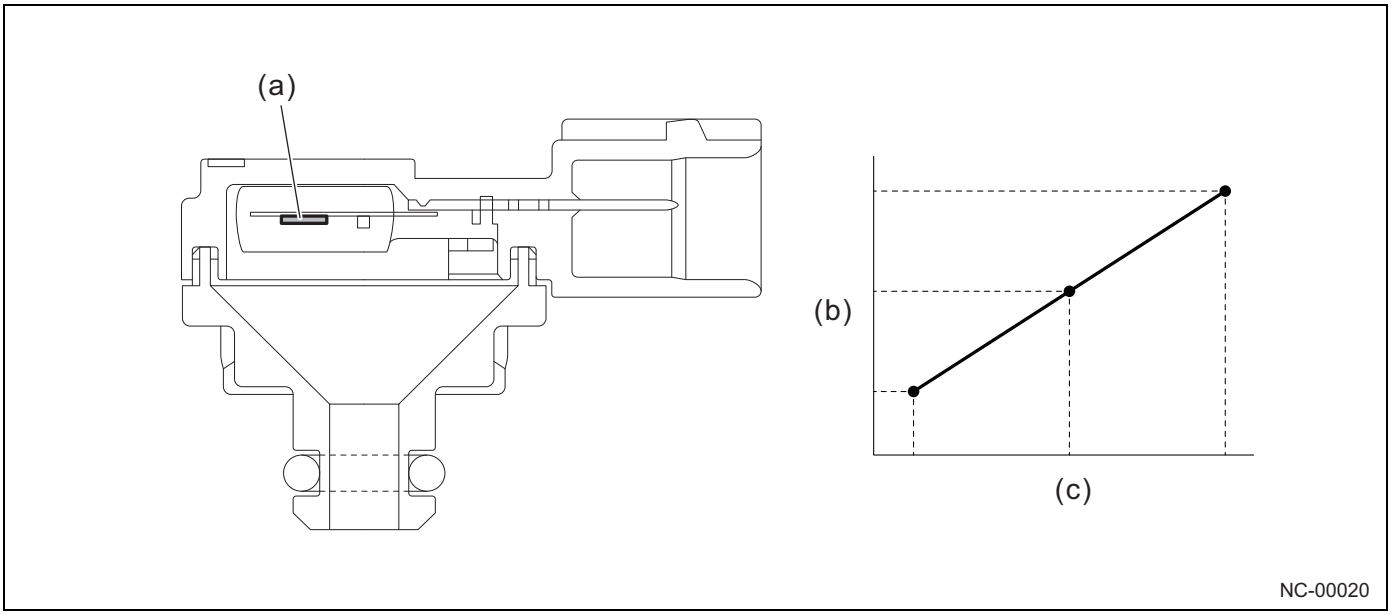
(A) Air flow sensor

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

Manifold pressure sensor

The manifold pressure sensor is installed in the intake manifold, and measures intake pressure.

The measured intake air pressure is converted into an electrical signal and 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.

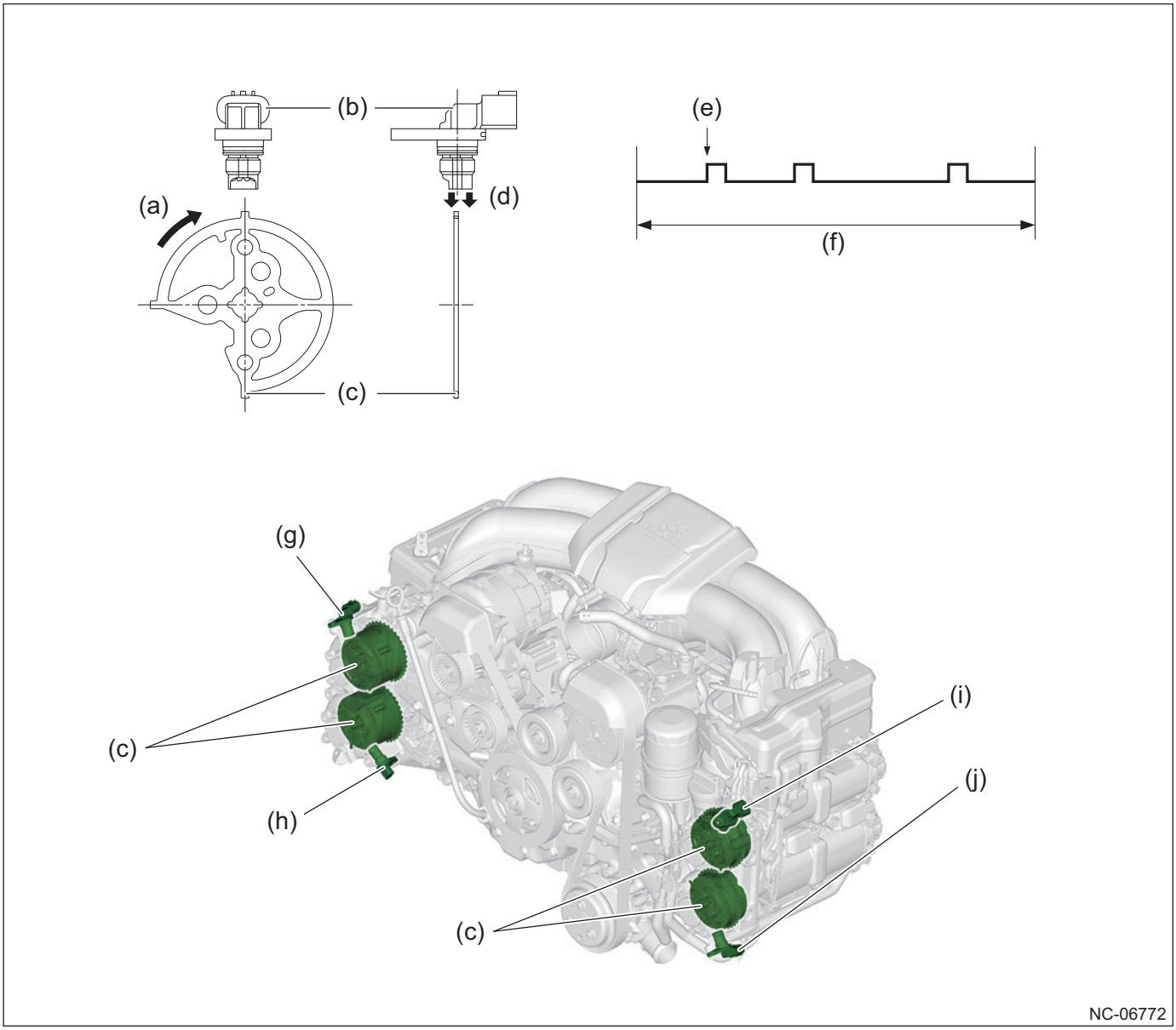


(a) IC chip
(b) Output voltage (V)
(c) Absolute pressure (kPa)

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.

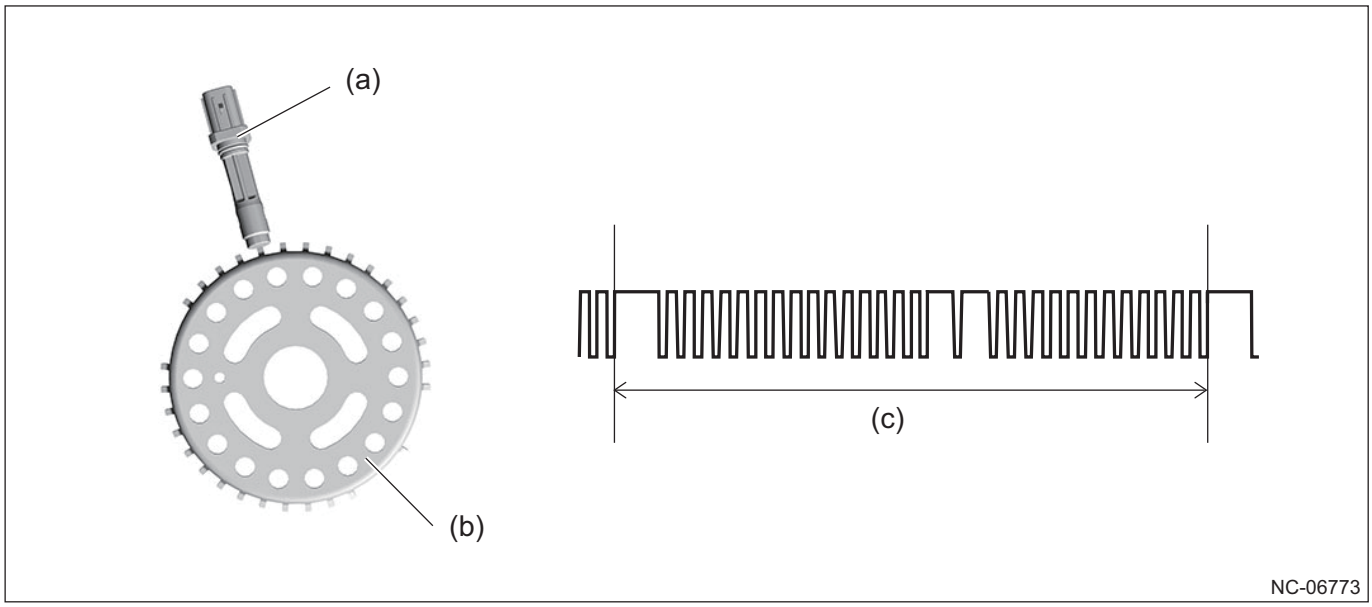
A semiconductor type crankshaft position sensor has been adopted.

The diameter of the crankshaft position sensor plate has been reduced to support higher engine speeds.

When the crankshaft rotates, the air gap between the crankshaft position sensor and crankshaft position sensor plate changes.

This change in the air gap also changes the magnetic field that is created by the magnet inside the sensor.

This change in the magnetic field changes the magnetic circuit output inside the sensor, inducing a voltage pulse at the instant when each tooth is aligned with the sensor position. This pulse is then sent to the Engine Control Module (ECM).

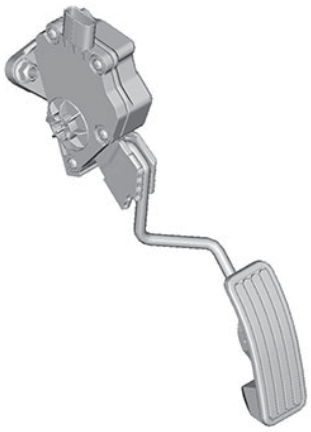


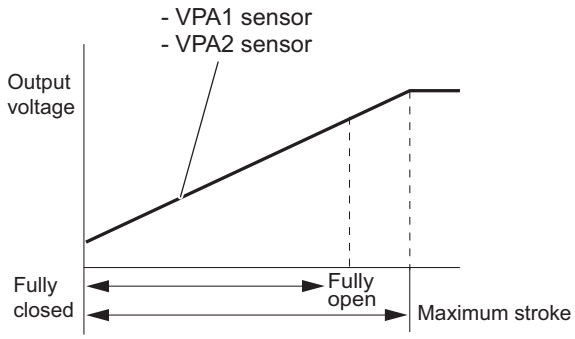
(a) Crankshaft position sensor
(b) Crankshaft position sensor plate
(c) One crankshaft rotation

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.





Accelerator position sensor
Output voltage characteristics

NC-07283

Throttle position sensor, throttle motor

The throttle position sensor and throttle motor are installed on the throttle body.

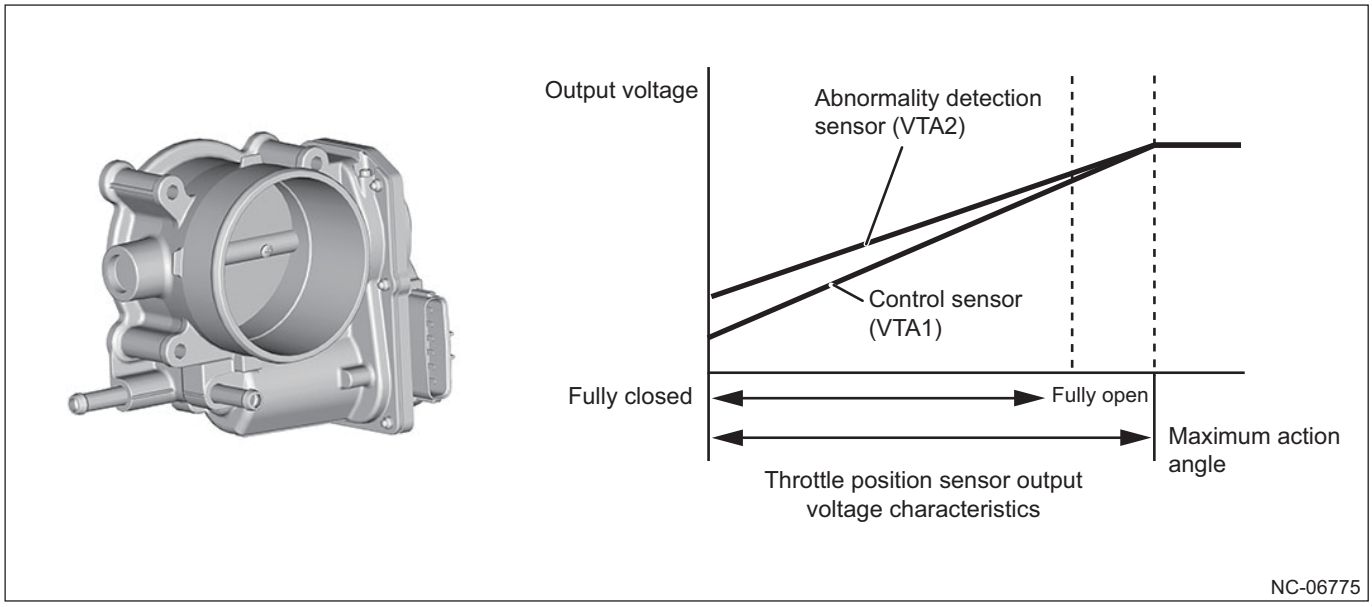
The throttle position sensor detects the throttle valve opening angle, and the throttle motor opens and closes the throttle valve.

A non-contact type throttle position sensor is adopted. It uses a Hall element*2 that can acquire an electrical signal representing the strength of the magnetic field by using the Hall effect*1. This produces output voltage which is linear with regards to the throttle valve opening angle.

When the throttle valve opening angle changes, the angle of the magnetic field generated by the flow of current applied inside the Hall element also changes, and the strength of the magnetic field in the direction perpendicular to the applied current changes. The change in voltage generated in the direction perpendicular to both this applied current and magnetic field is sent to the Engine Control Module (ECM) as the throttle valve opening angle signal. Dual sensors (main: VTA1, sub: VTA2) that have different output characteristics are adopted to ensure reliability.

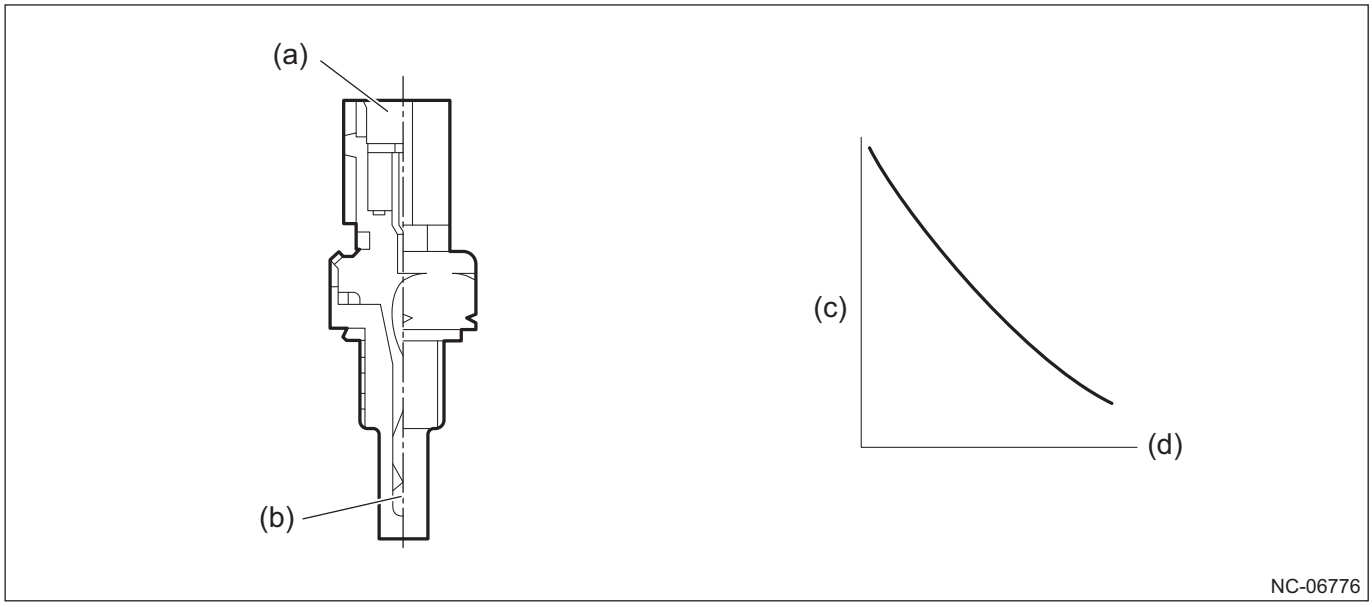
Reference

- *1: This phenomenon explains that when current is applied to a rod or plate-shaped conductor or semiconductor and a magnetic field is applied in a direction perpendicular to this current, an electric potential difference is generated in the direction perpendicular to the current and magnetic field.
- *2: This is an electronic component that utilizes the electromotive force resulting from an electric potential difference in a magnetic field.



Engine coolant temperature sensor

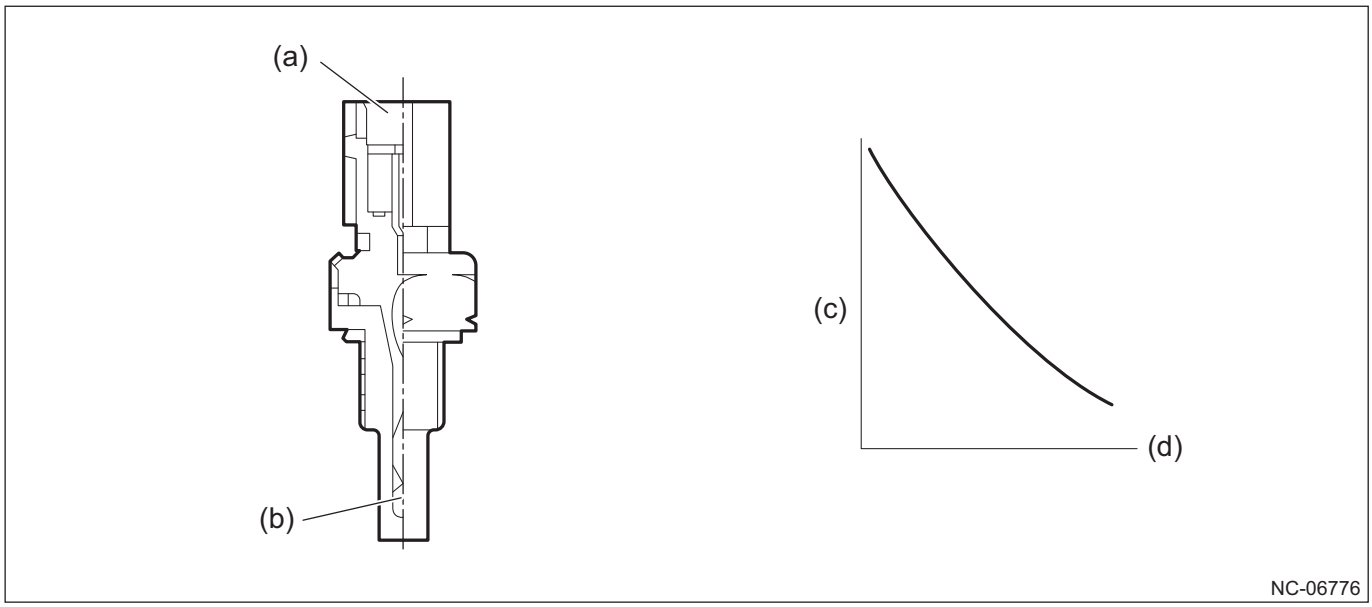
The installation position of the engine coolant temperature sensor was provided directly above the outlet of the engine coolant pipe from the engine main body, increasing sensing accuracy and improving engine control performance. This sensor uses a thermistor in which the resistance decreases as the 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).

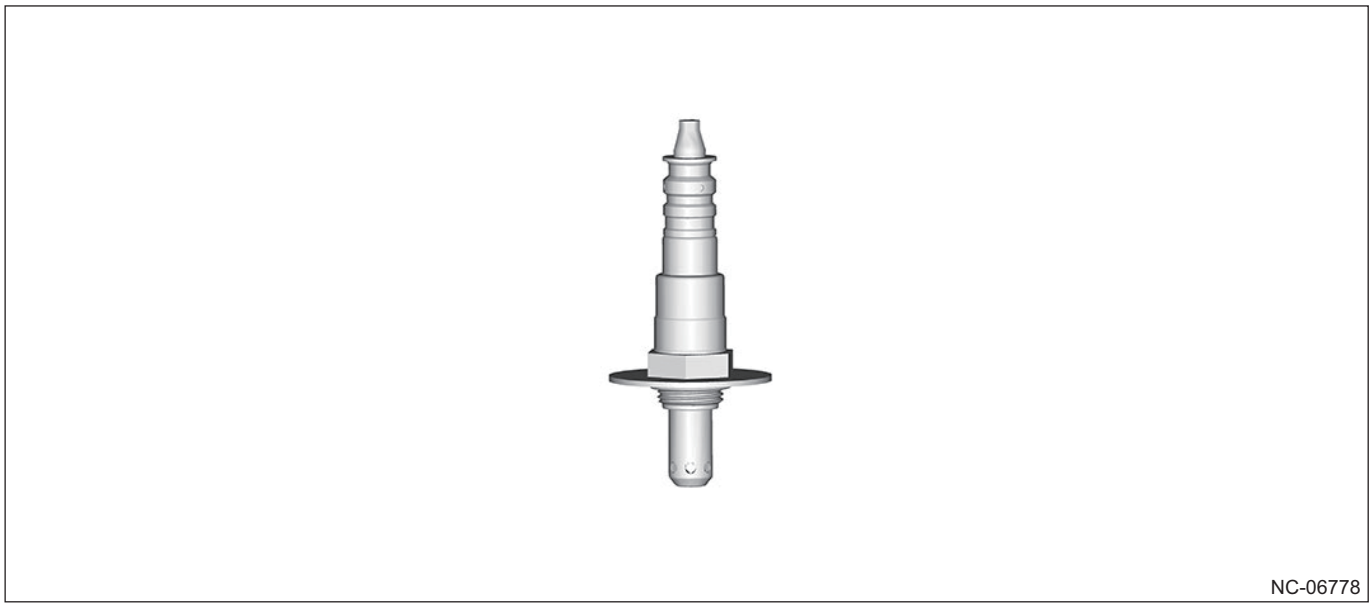


Front oxygen (A/F) sensor

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 (ZrO_2) is adopted for 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.

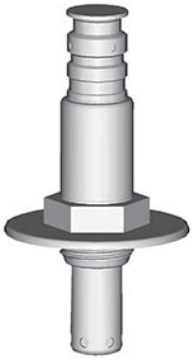

NC-06778

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).



NC-05153

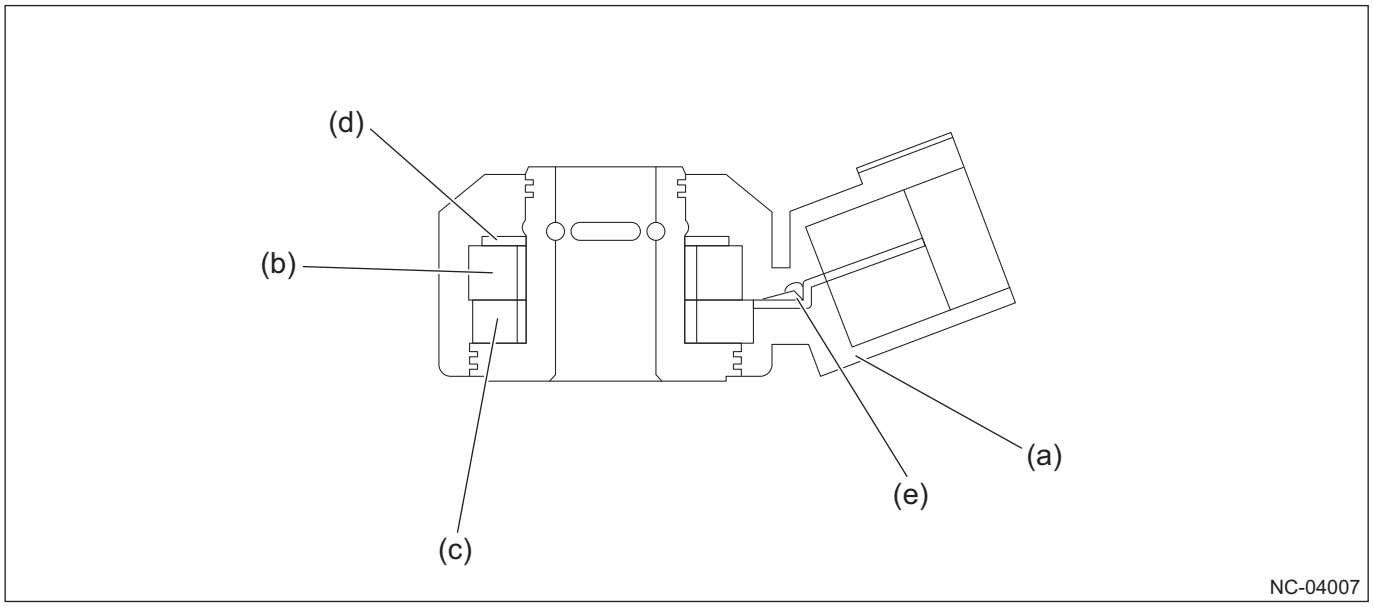
Knock sensor

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.

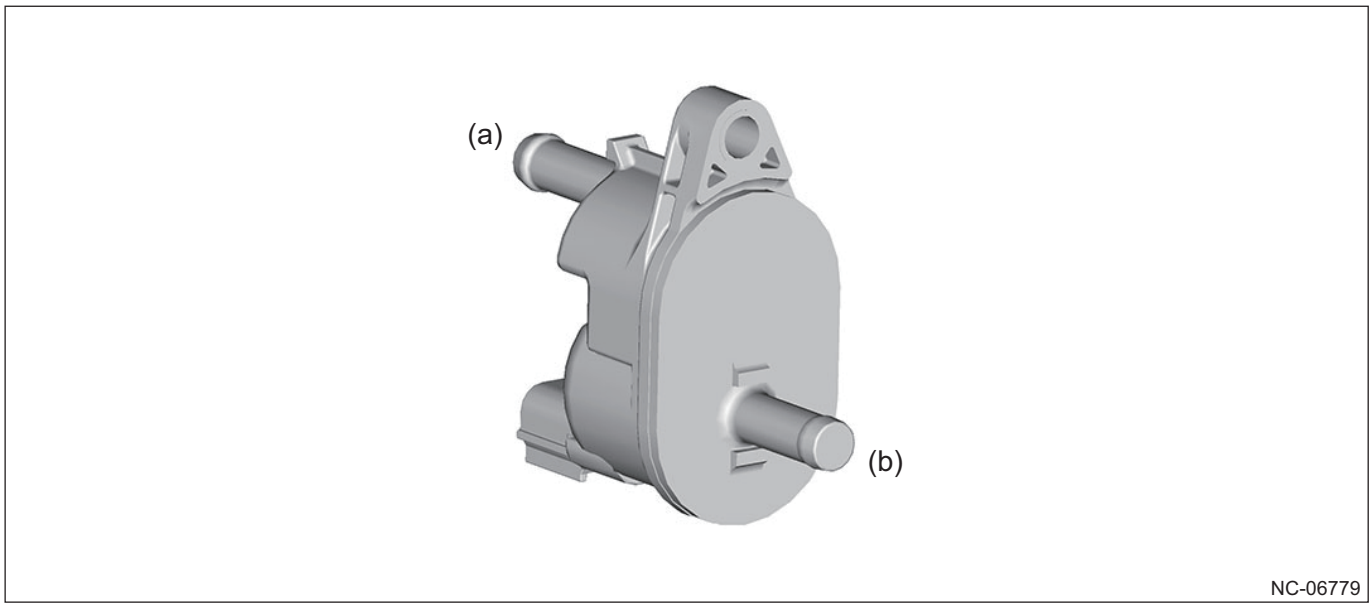
In addition to the piezoelectric element, the sensor is composed of weight and case. When knocking occurs in the engine, the weight moves in the case and then a voltage occurs in the piezoelectric element.



(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 intake manifold to suction the fuel evaporation gas stored in the canister into the intake manifold.



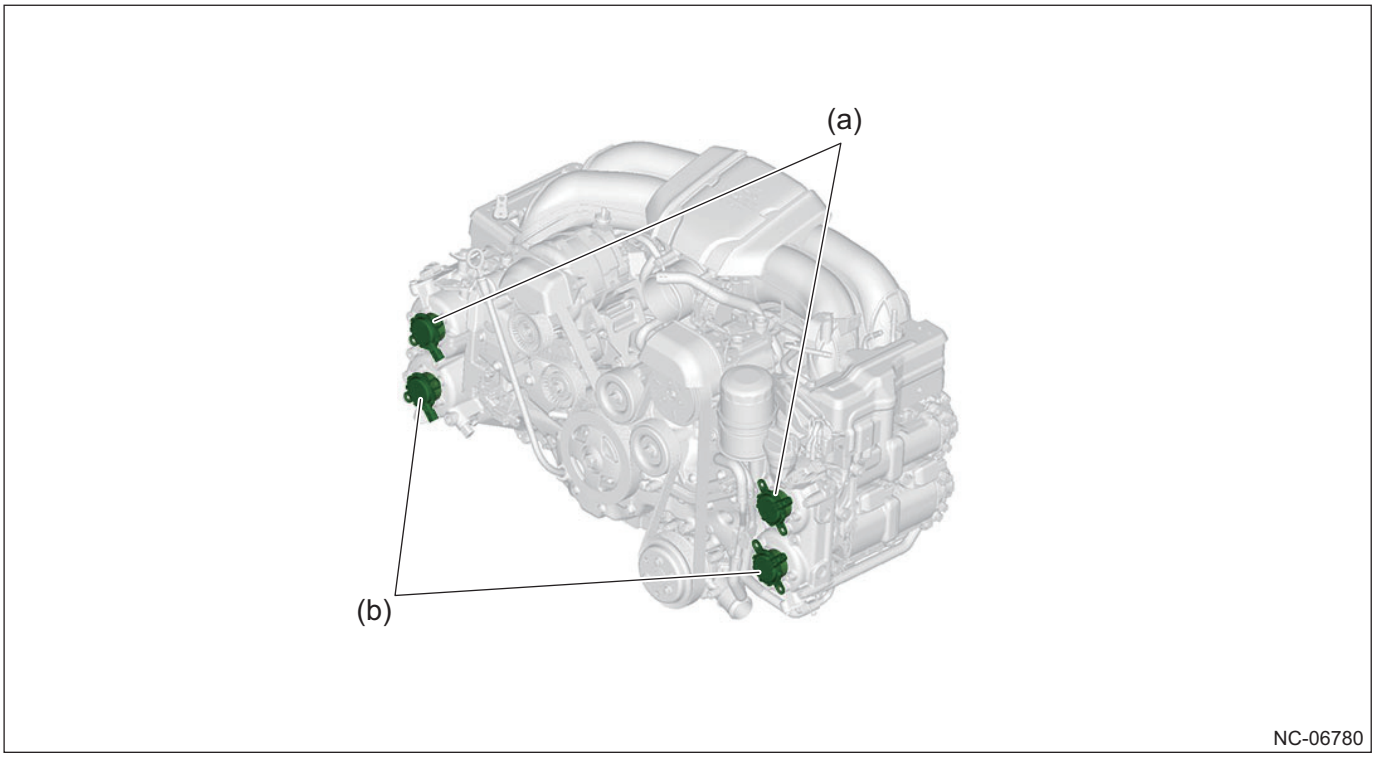
(a) From canister

(b) To intake manifold

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

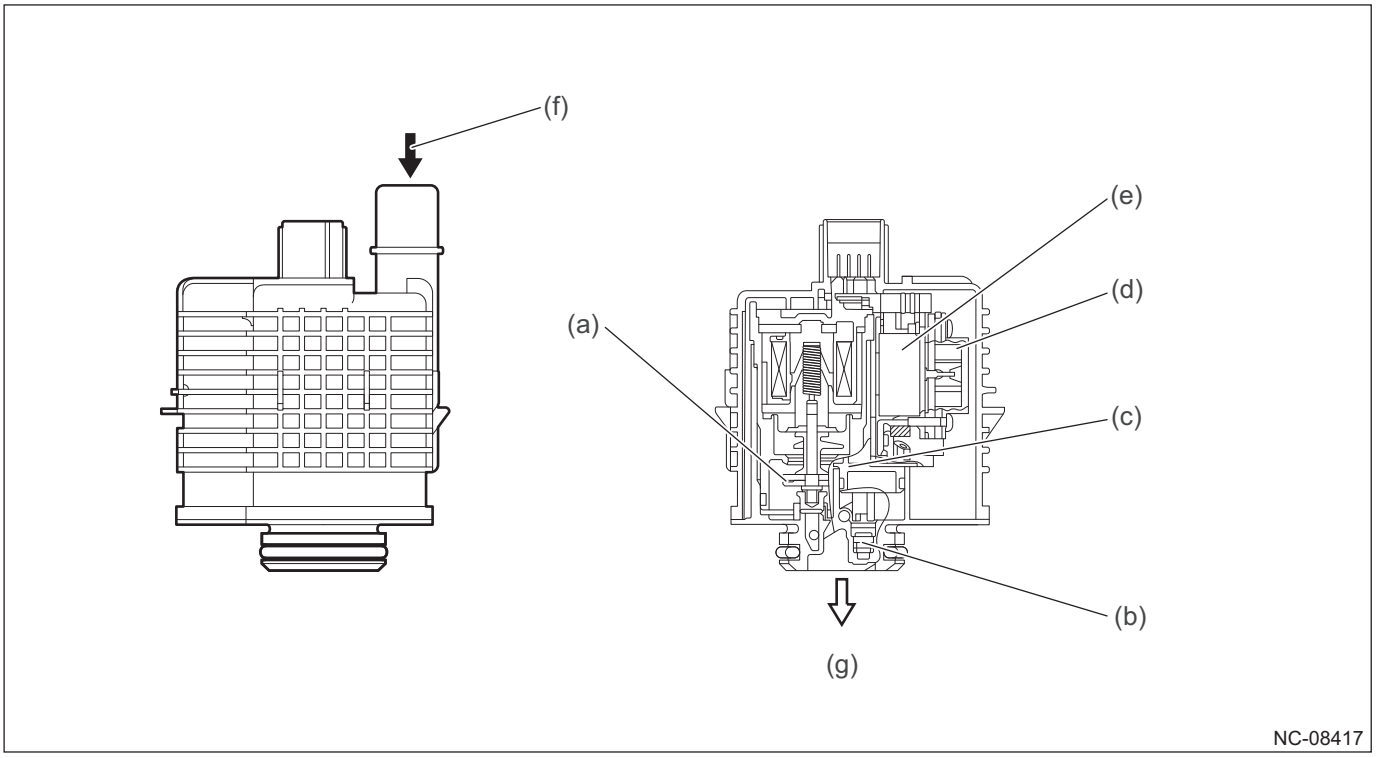
(b) Exhaust oil control solenoid

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).

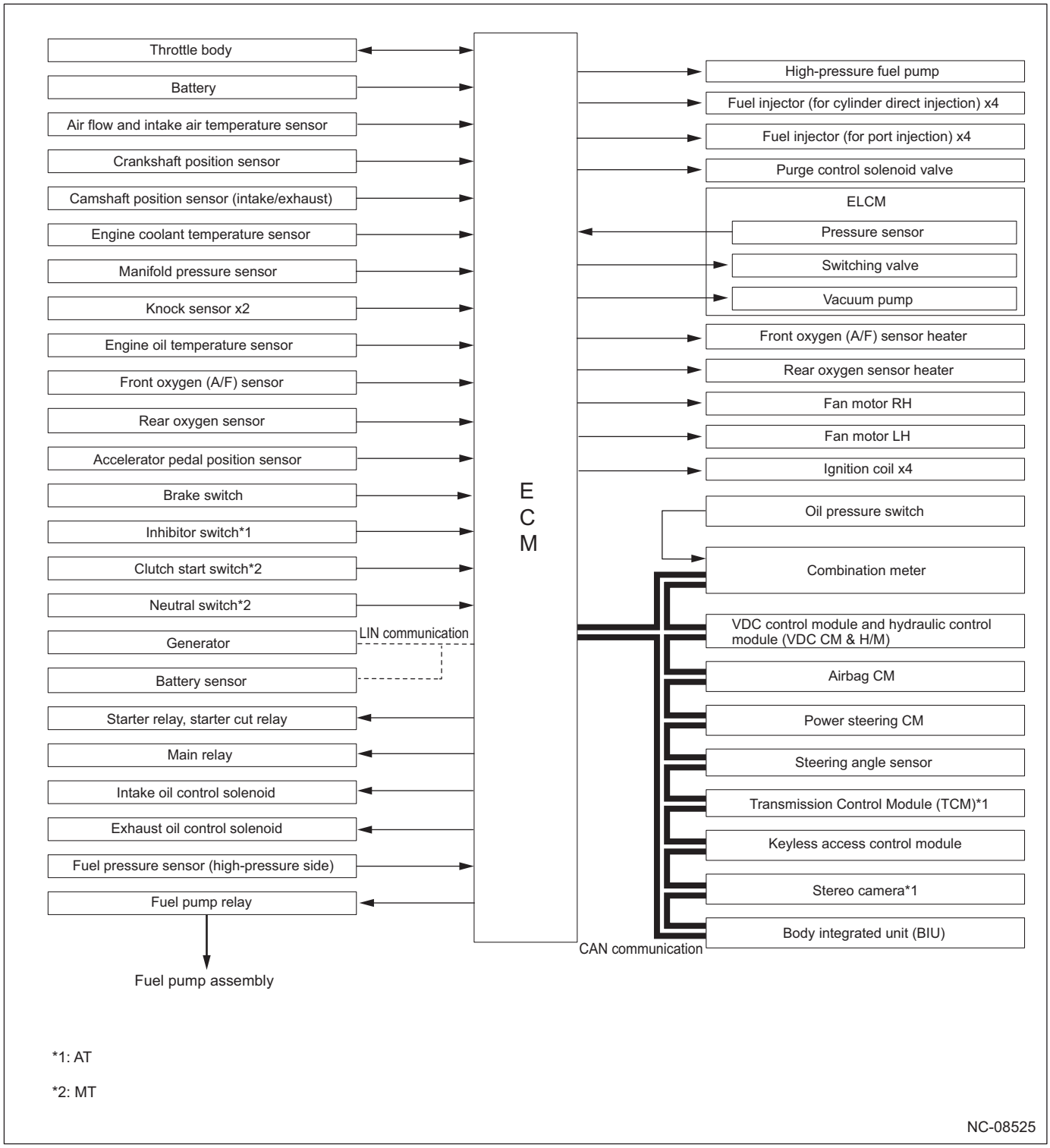
A DC brushless motor is used as the pump motor.



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

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 (high-pressure side)		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		This detects the ELCM pressure and sends the signal to the Engine Control Module (ECM).

List of actuators

Name		Function and construction
Ignition coil		This sends the ignition check signal.
Fuel pump assembly		This sends fuel under pressure from the fuel tank to the fuel injector (for port injection) 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 (for cylinder direct injection)		This injects fuel directly into the top of the combustion chamber based on the injector drive signals from the Engine Control Module (ECM).
Fuel injector (for port injection)		This injects fuel into the intake port 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.
Switching valve		This opens and closes the fresh air passage based on the signals received from the Engine Control Module (ECM).
Vacuum pump		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 (EFI, D-4S)	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.
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 (EFI, D-4S)

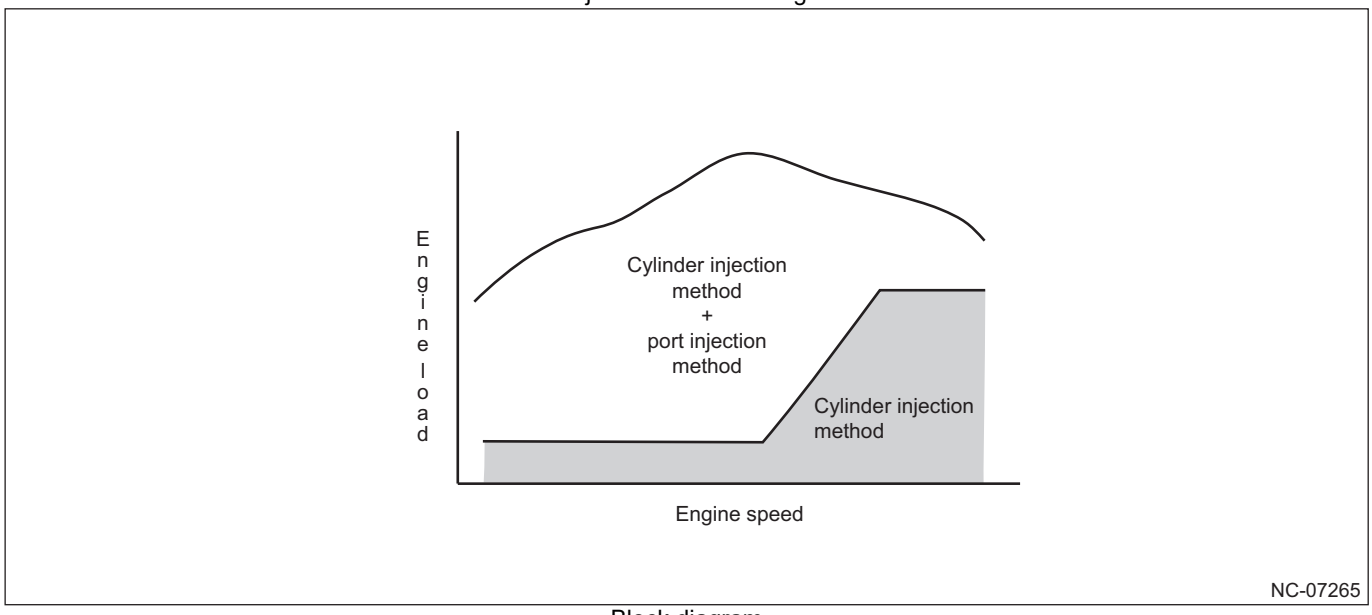
This detects the intake airflow by means of the air flow and intake air temperature sensor, and controls the fuel injection amount.

Based on the signals from various sensors, the Engine Control Module (ECM) controls the amount of fuel injected by each cylinder direct injection and port injection fuel injector, as well as the injection timing, according to the engine speed and engine load to produce optimal combustion conditions.

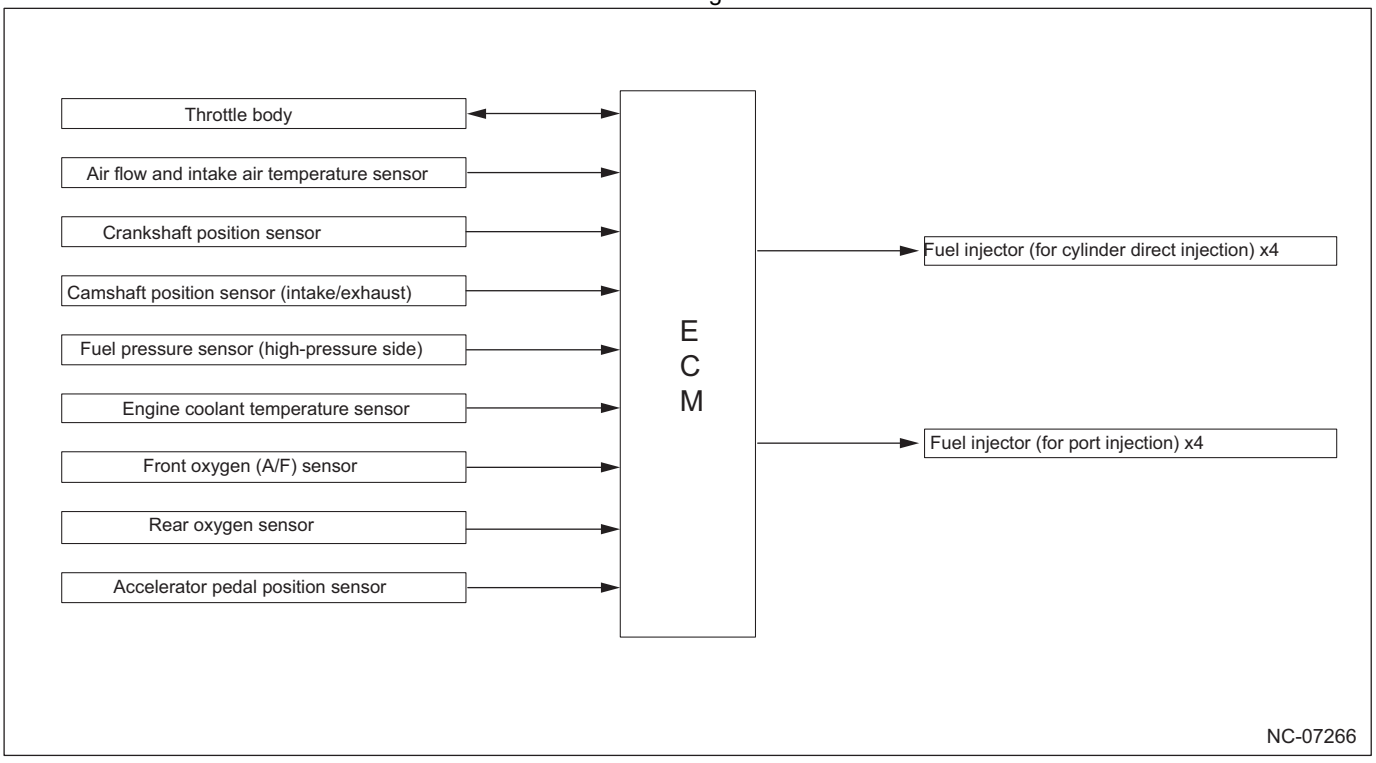
In order to accelerate catalyst warm-up at a cold start, stratified combustion is used to delay the injection timing by a large amount.

This expands the usage range for cylinder injection method + port injection method in high-speed ranges and improves output.

Fuel injection method categories



Block diagram



■ Stratified combustion

Immediately after a cold start, fuel is injected from the fuel injector (for port injection) from the expansion stroke to the intake stroke, and fuel is injected from the fuel injector (for cylinder direct injection) during the second half of the compression stroke in order to stratify the mixture (air-fuel ratio 15:1 to 16:1), allowing the ignition timing to be delayed by a large amount. This raises the temperature of the exhaust gas and accelerates catalyst warm-up, resulting in a large improvement to emissions performance when the engine is cold.

■ Homogeneous combustion

Fuel is injected from the fuel injector (for port injection) from the expansion stroke to the intake stroke, and fuel is injected from the fuel injector (for cylinder direct injection) during the second half of the intake stroke to produce optimal combustion conditions. Either or both of these injection methods is/are used to create a homogeneous mixture and cool the air compressed by the vaporization heat of the injected fuel. This results in improved charging efficiency and higher output.

■ Air-fuel ratio control

This decides the amount of fuel to inject according to the engine speed and intake airflow. It also performs feedback control of the air-fuel ratio after start using the signal from the front oxygen (A/F) sensor.

Control and combustion types

Control	Combustion state	Air-fuel ratio	Injection timing*	Control condition
Lean air-fuel ratio control	Stratified combustion	15 to 16	Compression stroke	Immediately after cold start
Theoretical air-fuel ratio control	Homogeneous combustion	14 to 15	Intake stroke	Driving at low to medium loads
Prohibiting air-fuel ratio feedback control	Homogeneous combustion	-	Intake stroke	Driving at high loads
				When engine is cold

**: The table shows the injection timing for the fuel injector (for cylinder direct injection). Control is also performed for each fuel injector (for port injection) so that fuel is injected from the expansion stroke to the intake stroke according to the engine operating conditions.*

■ Fuel cut

Fuel injection is temporarily stopped in order to protect the engine and improve fuel economy.

Fuel cut

Fuel cut during deceleration	During deceleration (when the Engine Control Module (ECM) judges that the throttle is OFF) when the engine speed is at or above the prescribed value, fuel injection is stopped in order to prevent catalyst overheating caused by misfire and to improve fuel economy. When the coolant temperature is low, the fuel cut engine speed and recovery speed are higher.
Fuel cut due to engine speed	• When the engine speed is at or above the prescribed value, fuel injection is stopped to prevent excessive engine speed. • When the engine is cold, fuel injection is stopped at a lower engine speed than normal to protect the engine.
Fuel cut when shifting from N to D position*	When the engine speed is at or above the prescribed value, fuel injection is stopped when the shift lever is operated to reduce shifting shock and protect the automatic transmission.

*: AT

Fuel cut engine speed during deceleration

When lock-up control is active [r/min]	1000 or higher
When lock-up control is not active [r/min]	1000 or higher

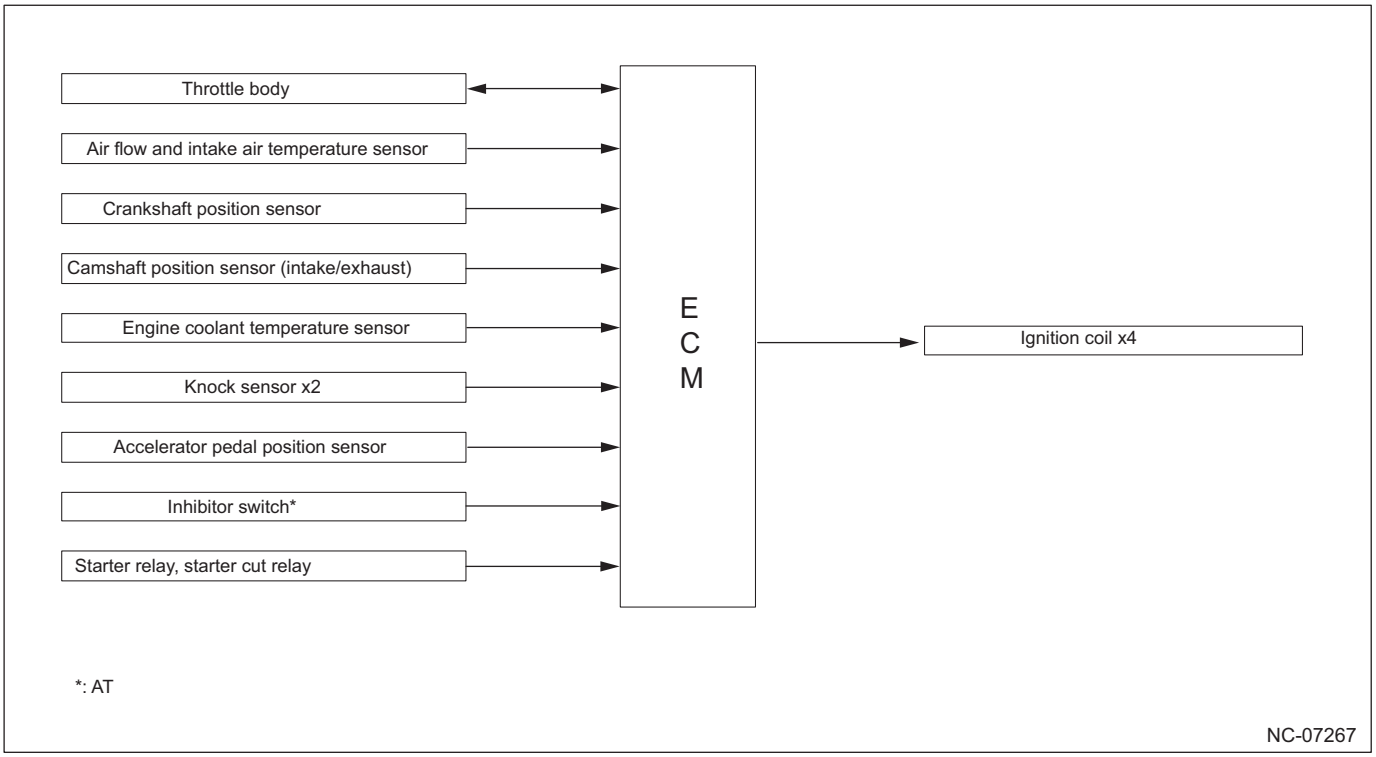
Fuel cut engine speed at high speeds

Engine speed [r/min]	7450 or higher

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.

Knock control using a knock sensor is adopted, and high-precision control is performed.



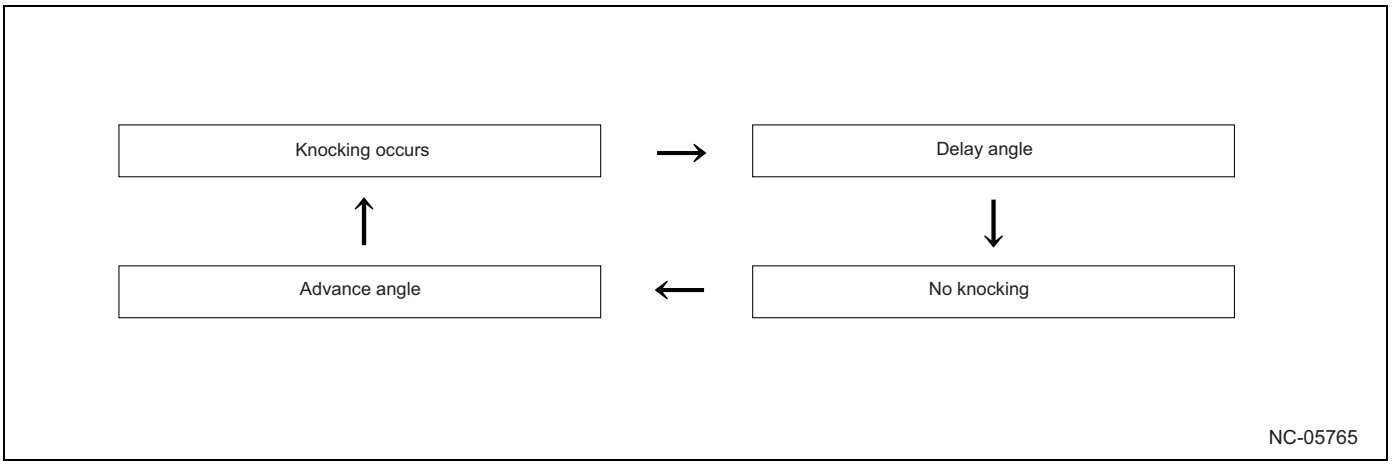
Calculating the ignition timing: Ignition timing = A. Initial set ignition timing or B. Basic advance angle + C. Correction advance angle

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.



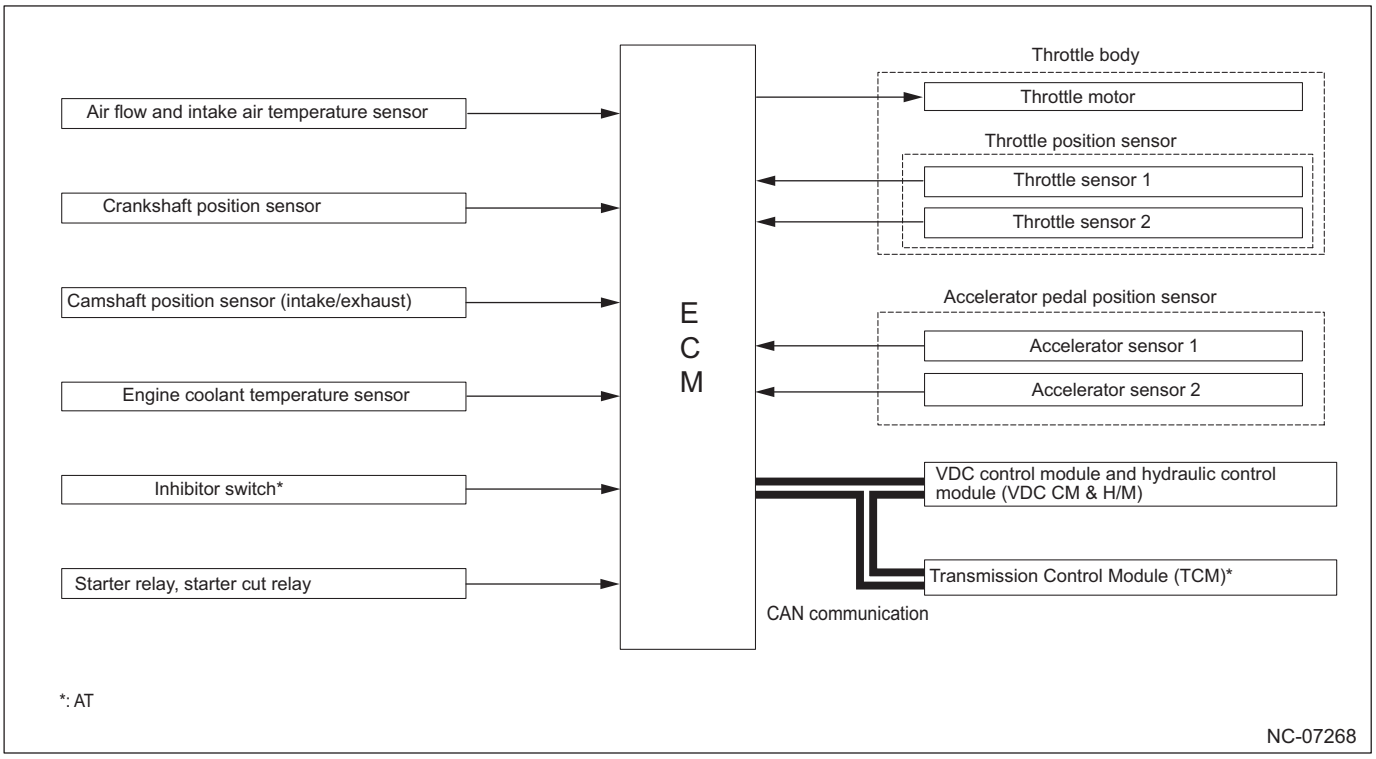
Electronic throttle control

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).

With an AT model, throttle control is different when in the D and M positions and when in the R position. When in the R position, control is performed that limits the change in throttle valve opening angle in response to the amount of accelerator pedal operation compared to the D and M positions. This prevents the feeling of the vehicle moving suddenly when reversing.

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

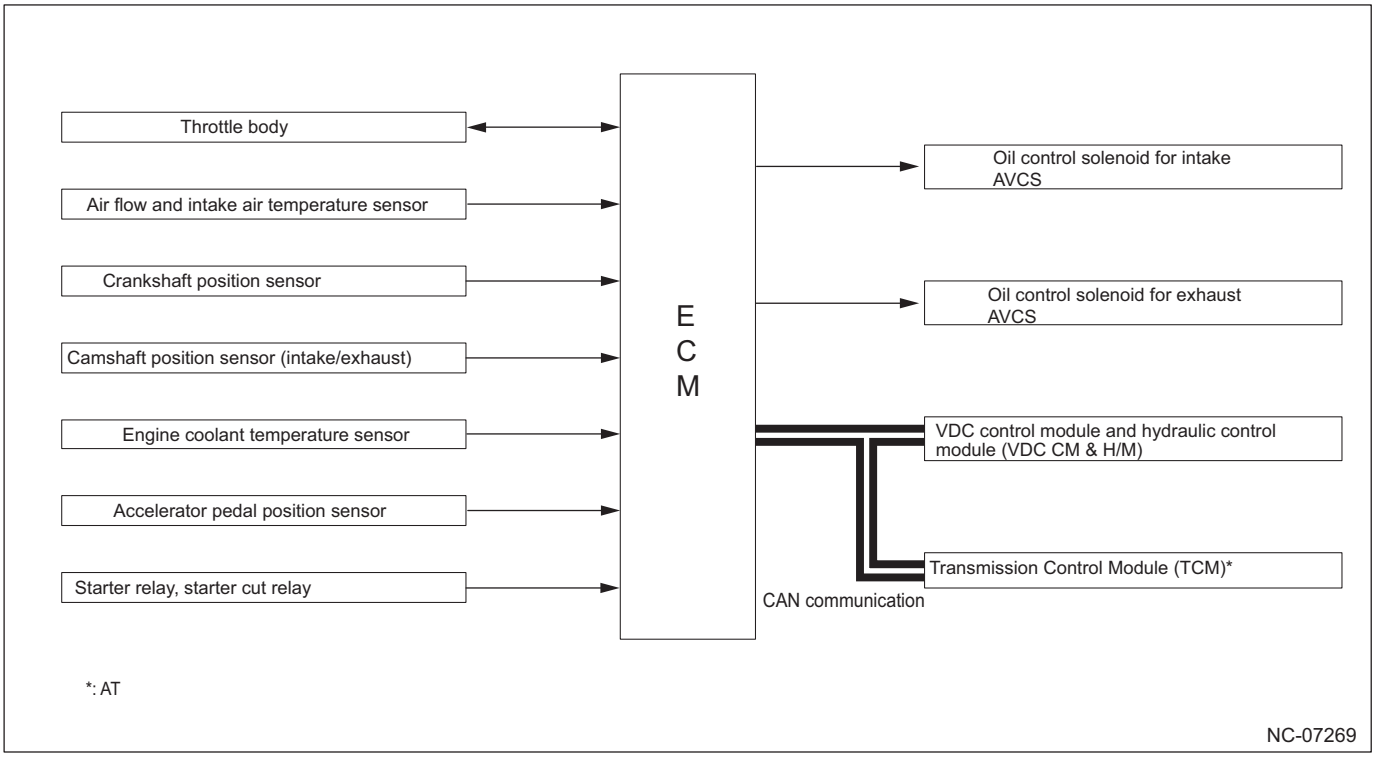
The sensor circuits of the throttle position sensor and accelerator position sensor utilize redundant circuits in order to reinforce the fail-safe function and ensure reliability.



AVCS

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

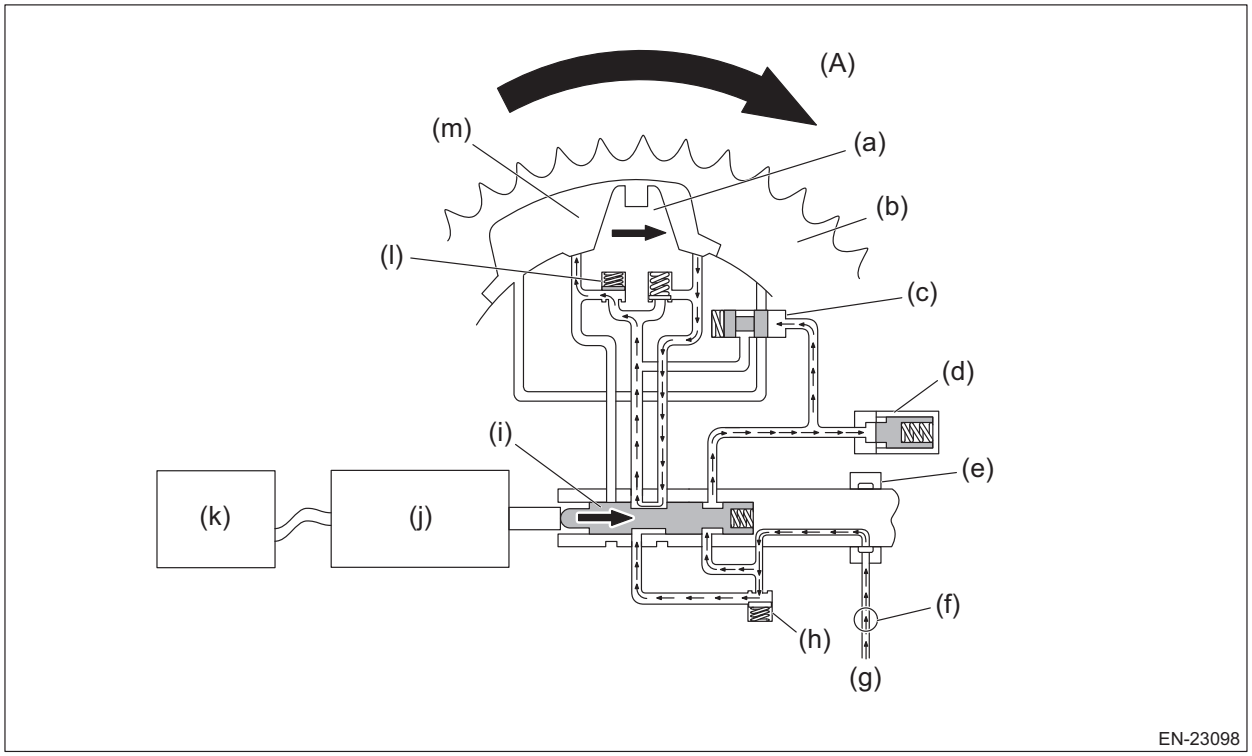
The Engine Control Module (ECM) determines the optimal camshaft angle according to the crank angle by referencing the engine speed, vehicle speed, throttle opening angle, and other relevant parameters. The oil control solenoid moves the spool and switches the oil passage between the advance angle and 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.



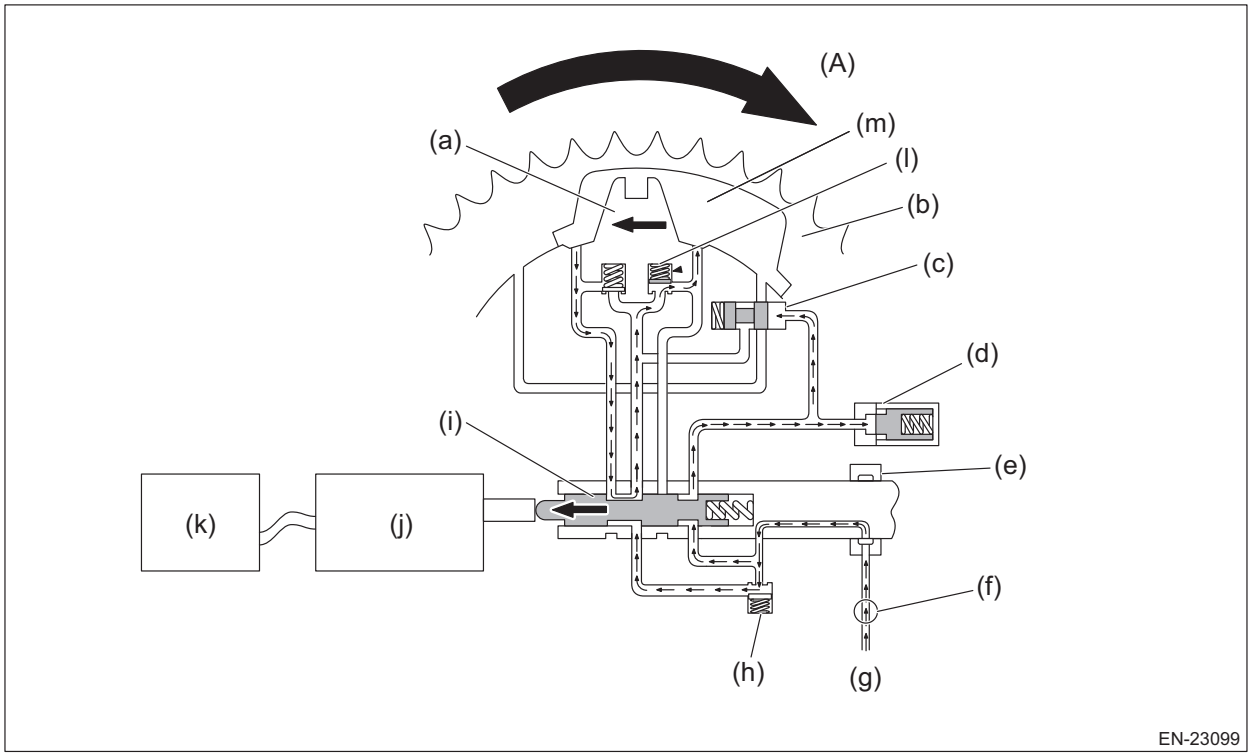
(A) Cam sprocket rotation direction

(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.



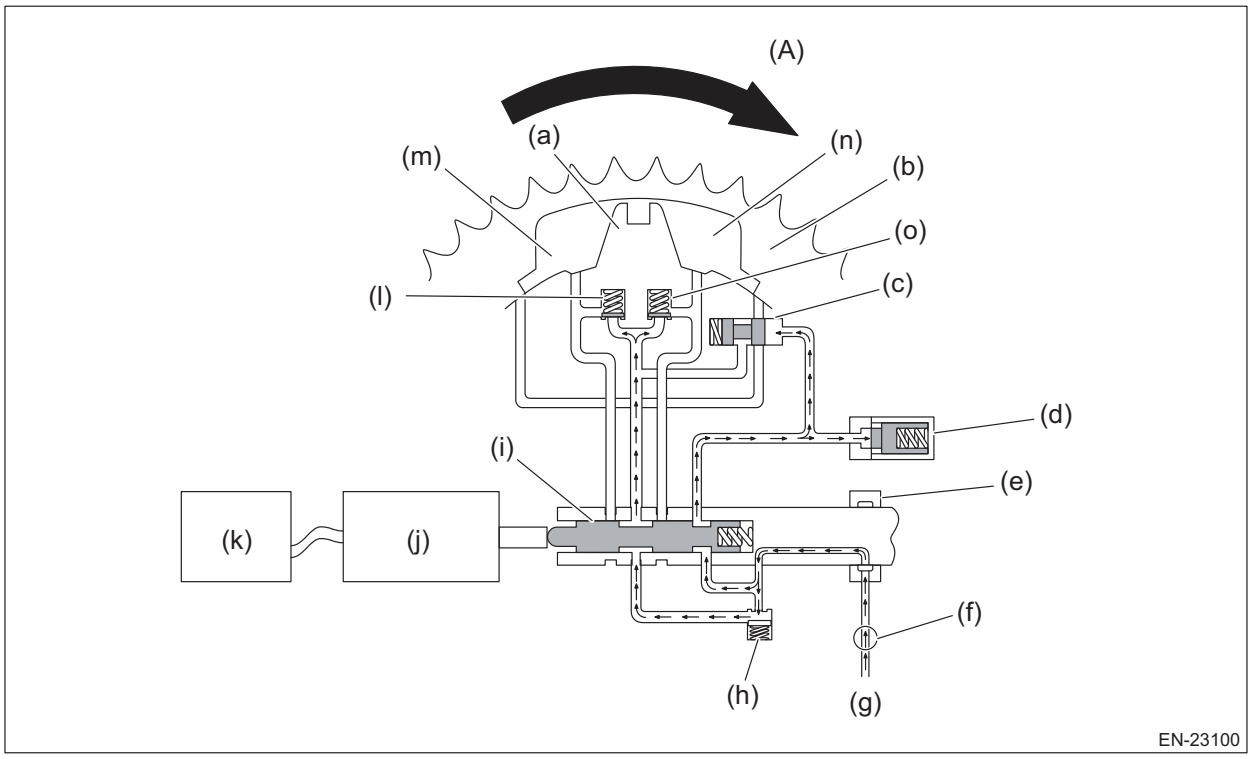
(A) Cam sprocket rotation direction

(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 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

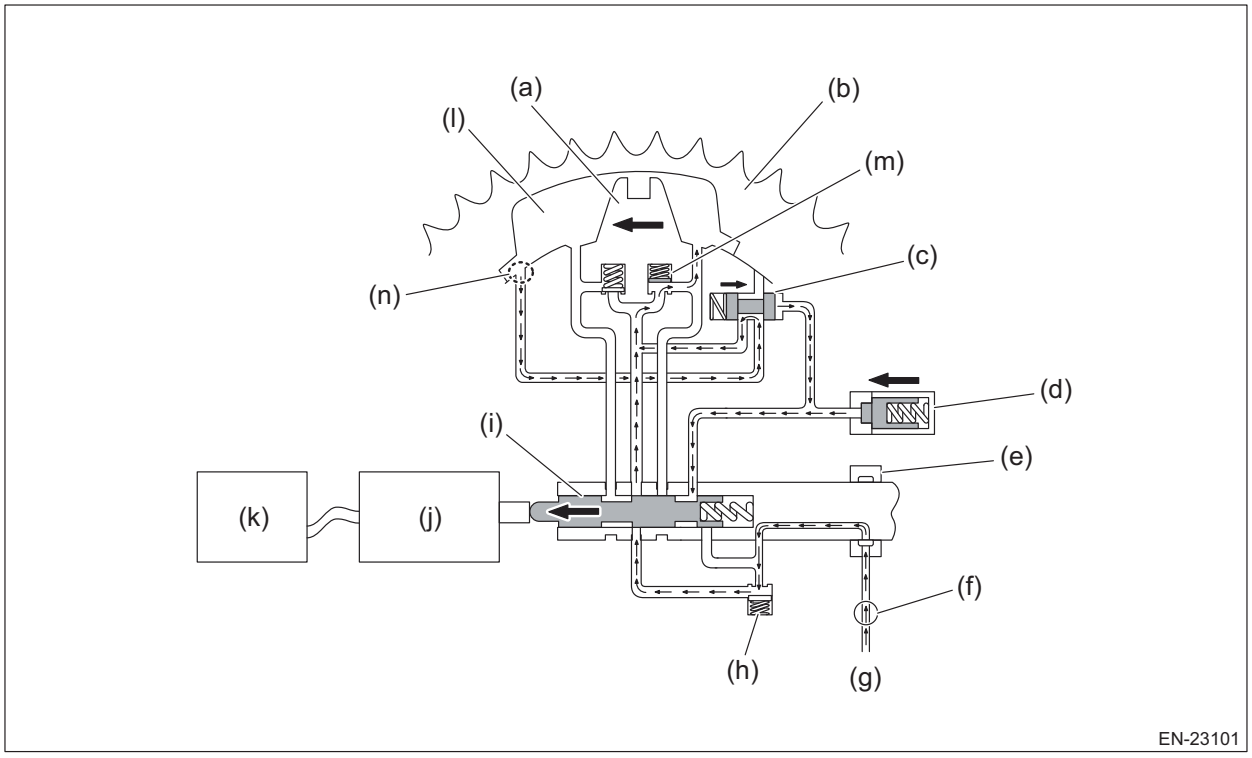
■ Intermediate lock

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.



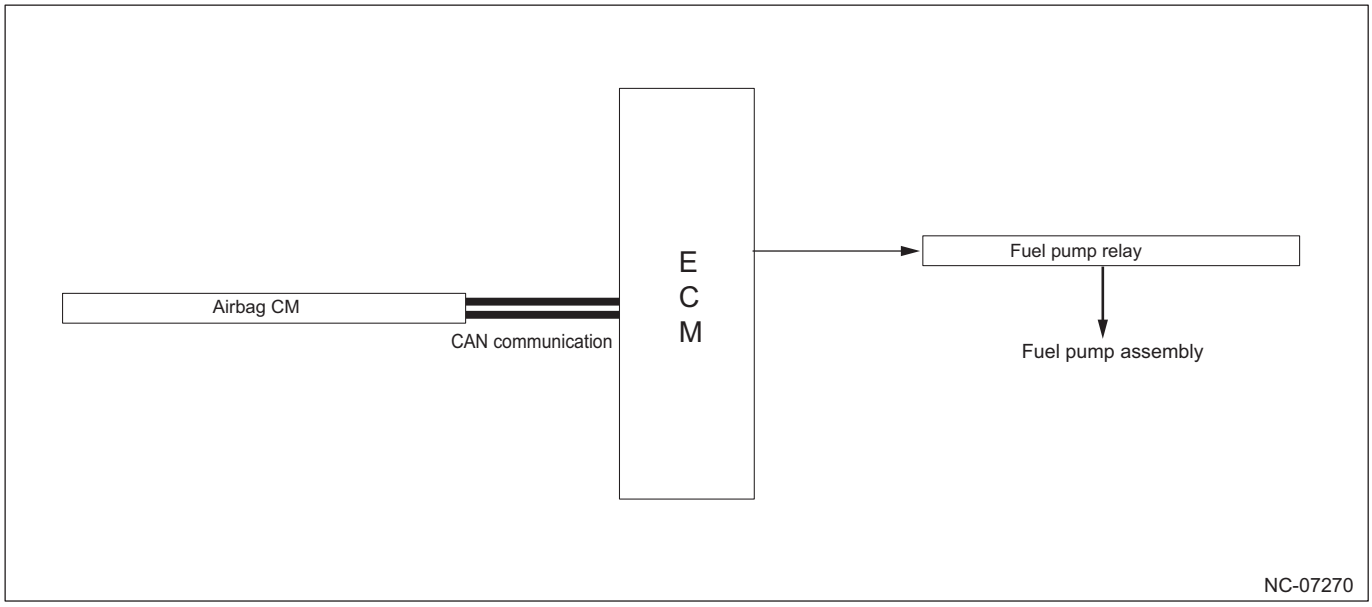
(a) Rotor vane
(b) Housing and sprocket
(c) Detent valve
(d) Lock pin
(e) Front camshaft cap
(f) Oil pump
(g) From oil strainer
(h) Inlet check valve
(i) Spool valve
(j) Oil control solenoid
(k) Engine Control Module (ECM)
(l) Advance angle oil pressure chamber
(m) Delay angle check valve
(n) Detent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

Low-pressure fuel pump control

When IG ON and the engine speed signal is continually input, the fuel pump relay turns ON and drives the fuel pump assembly.

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

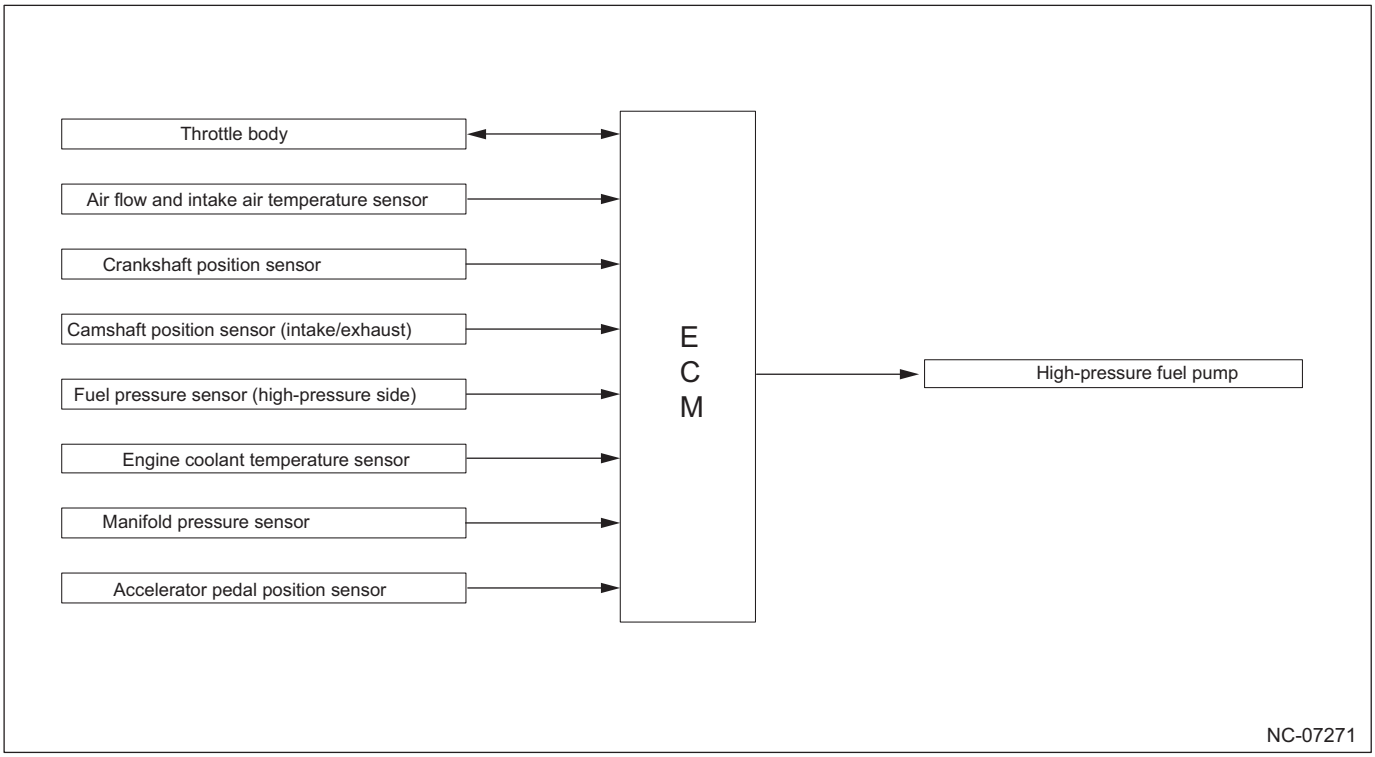
The Engine Control Module (ECM) detects the airbag activation signal, and turns OFF the fuel pump relay to stop the fuel pump assembly.



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 (high-pressure side) that is installed on the fuel pipe, and performs feedback control so the pressure is the target value.



Canister purge control

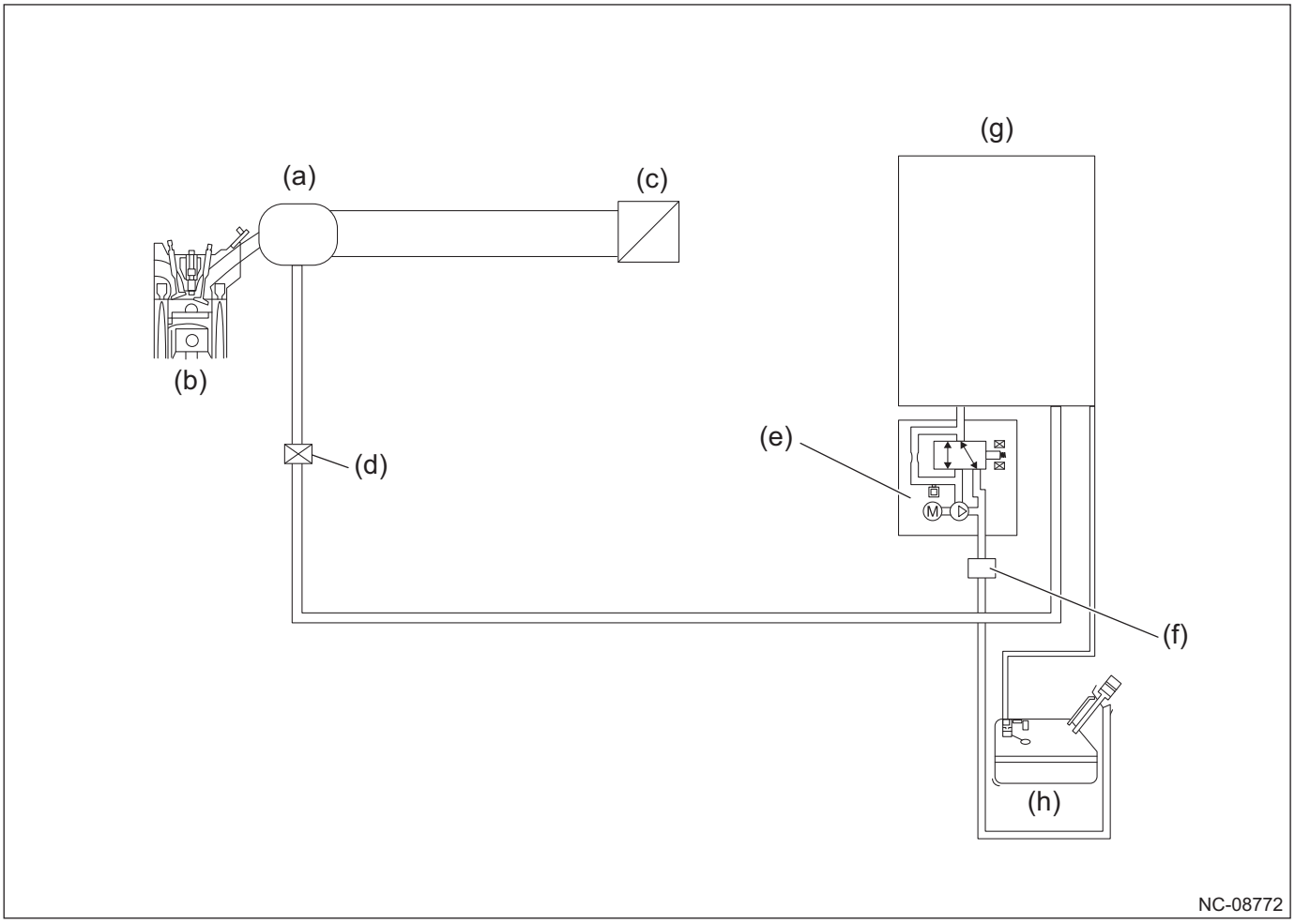
This sets a purge flow passage in one system and controls the fuel evaporation gas from the canister that flows to the purge port according to the engine conditions. The fuel evaporation gas that adhered to the canister is suctioned into the engine, preventing the release of fuel evaporation gas.

The purge port is installed downstream of the throttle valve, and suctions fuel evaporation gas into the intake manifold according to the driving conditions. The purge amount is controlled by the purge control solenoid valve that is installed mid-way on the purge pipe.

The Engine Control Module (ECM) controls the purge control solenoid valve according to the engine conditions and suctions fuel evaporation gas from the canister into the engine.

The purge control solenoid valve is installed on the bottom of the intake manifold.

A detection sensor is adopted in order to detect leakage of fuel evaporation gas.



(a) Intake manifold
(b) Engine
(c) Air cleaner
(d) Purge control solenoid valve
(e) ELCM
(f) Drain filter
(g) Canister
(h) Fuel tank

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

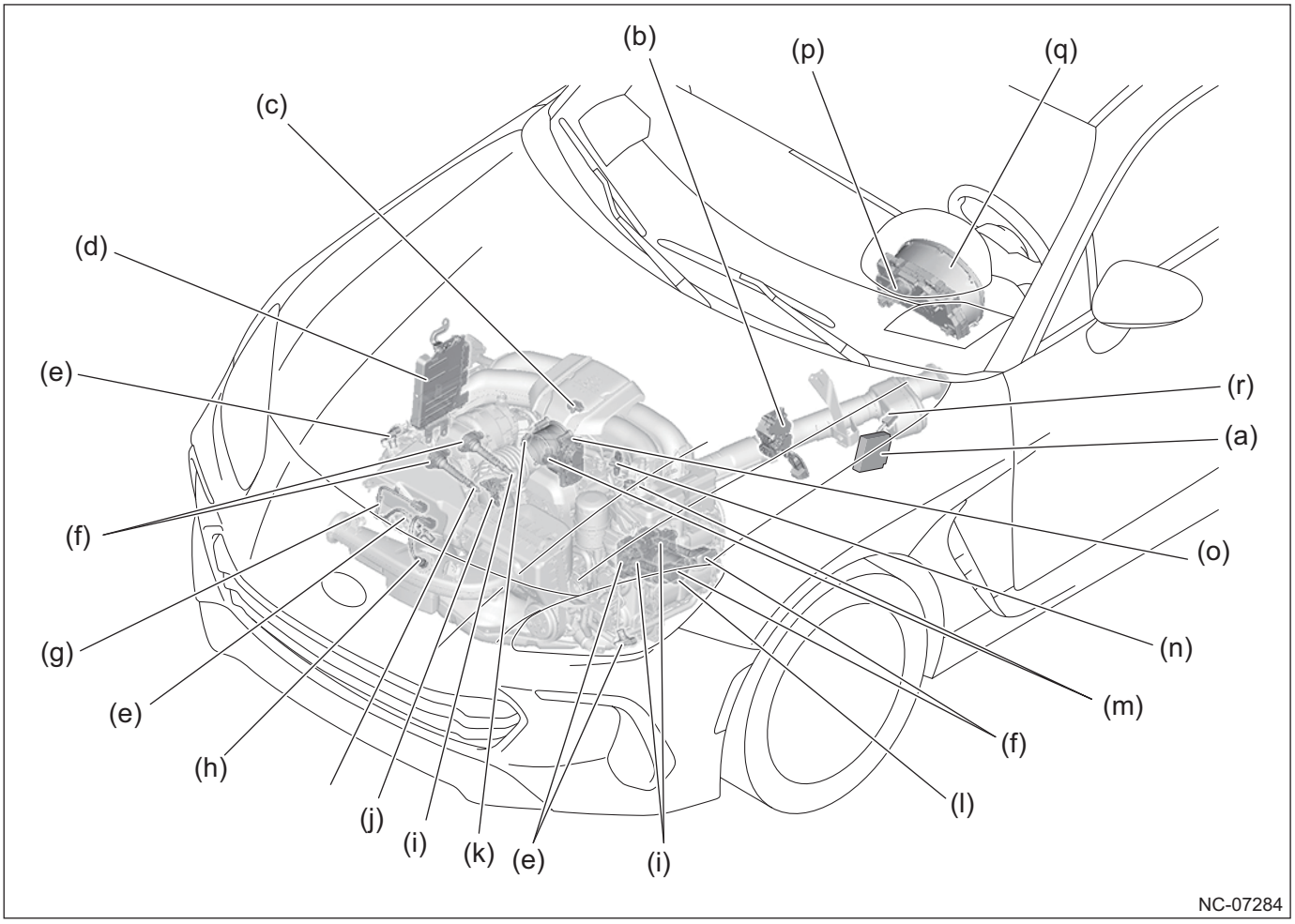
Overview

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) Transmission Control Module (TCM) (AT)

(b) Accelerator pedal position sensor

(c) Manifold pressure sensor

(d) Engine Control Module (ECM)

(e) Camshaft position sensor

(f) Ignition coil

(g) Rear oxygen sensor

(h) Front oxygen (A/F) sensor

(i) Spark plug

(j) Air flow and intake air temperature sensor

(k) Engine coolant temperature sensor

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

(m) Knock sensor

(n) Crankshaft position sensor

(o) Throttle body
- Throttle position sensor

(p) Engine switch

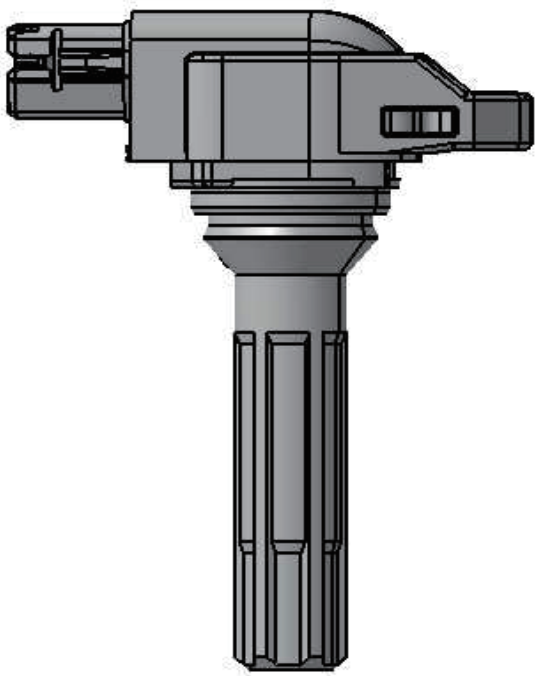
(q) Combination meter

(r) Clutch start switch (MT)

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).

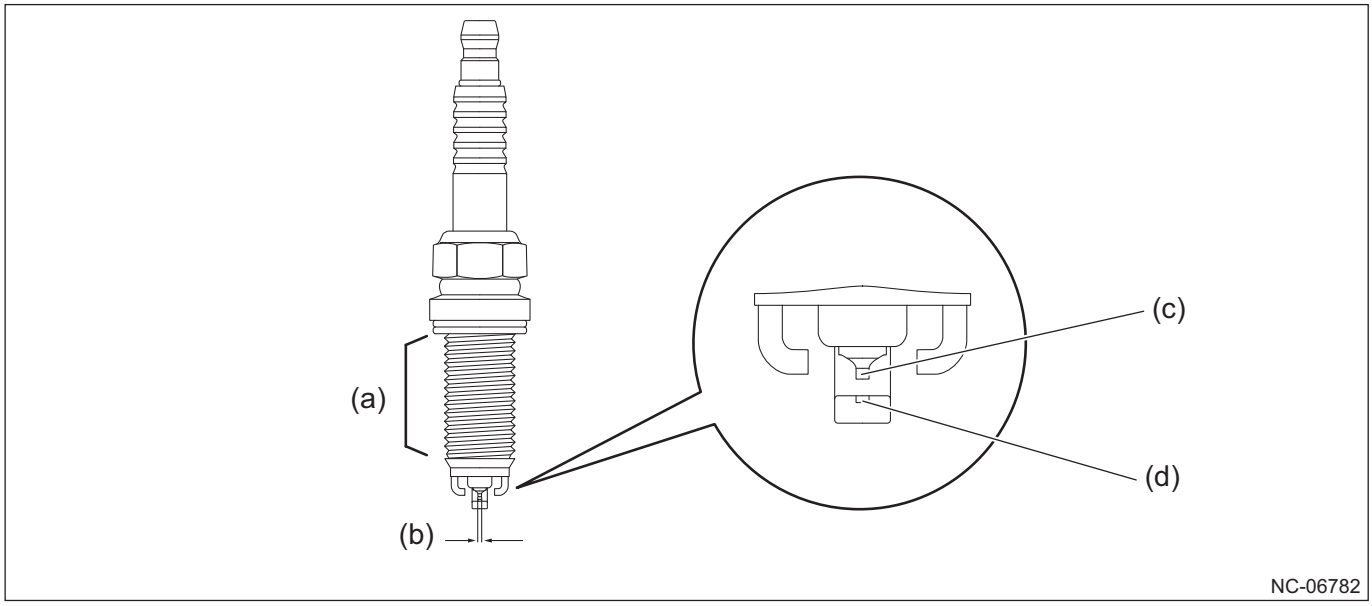


EN-23056

Spark plugs

Long-reach spark plugs are adopted to improve cylinder head cooling performance.

Grounded 3-pole spark plugs are adopted and use an iridium alloy 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 increases durability. The addition of 2 grounded electrodes further improves ignition performance, wear resistance, and fouling resistance.



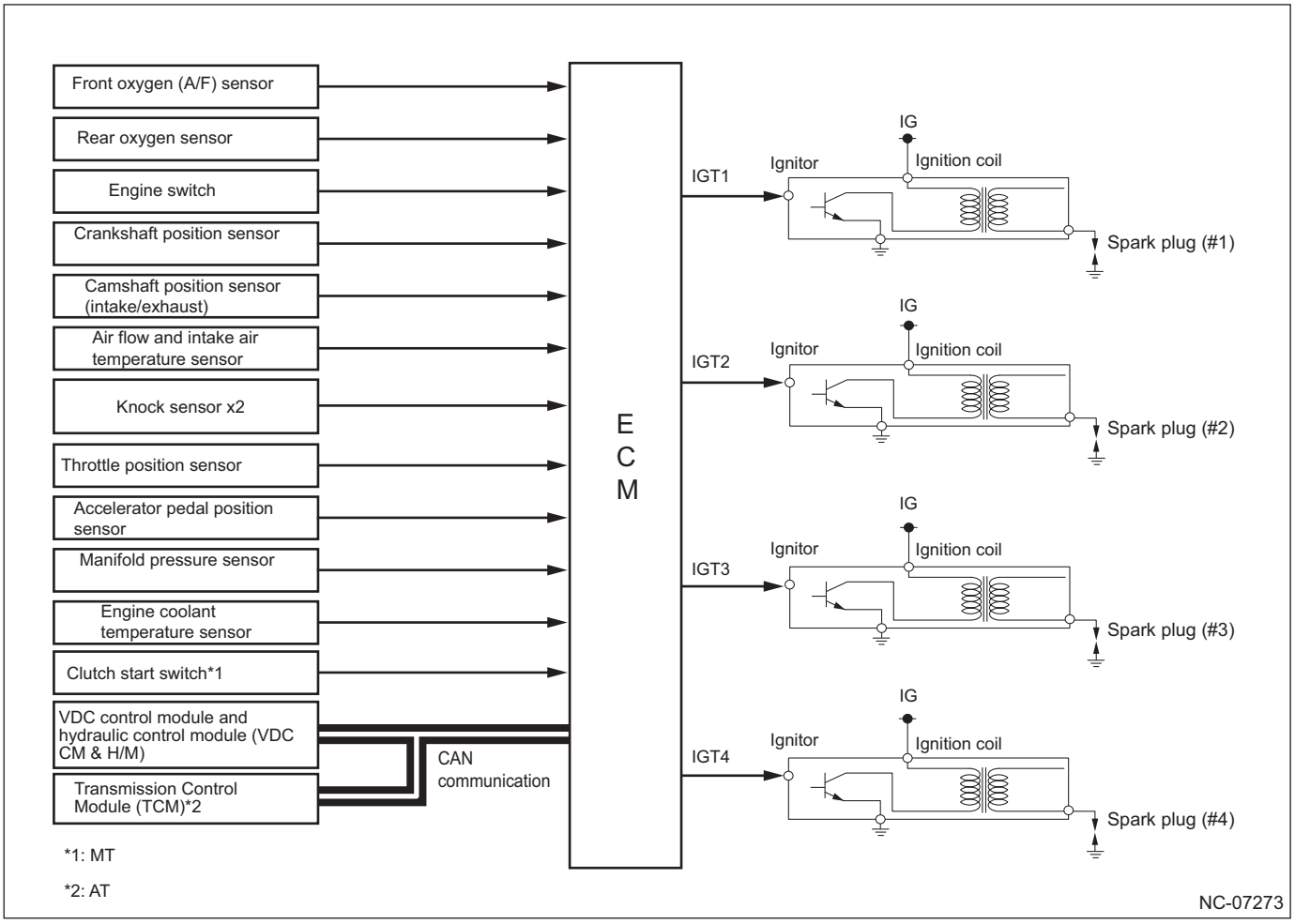
(a) Long reach
(b) Center electrode 0.217 in (0.55 mm)
(c) Iridium
(d) Platinum

Spark plug specifications

DENSO product	ZXE27HBR8
Plug gap [in (mm)]	0.028 to 0.031 (0.7 to 0.8)

2.8.3 Construction and Operation

System diagram



2.9 Starting/Charging System

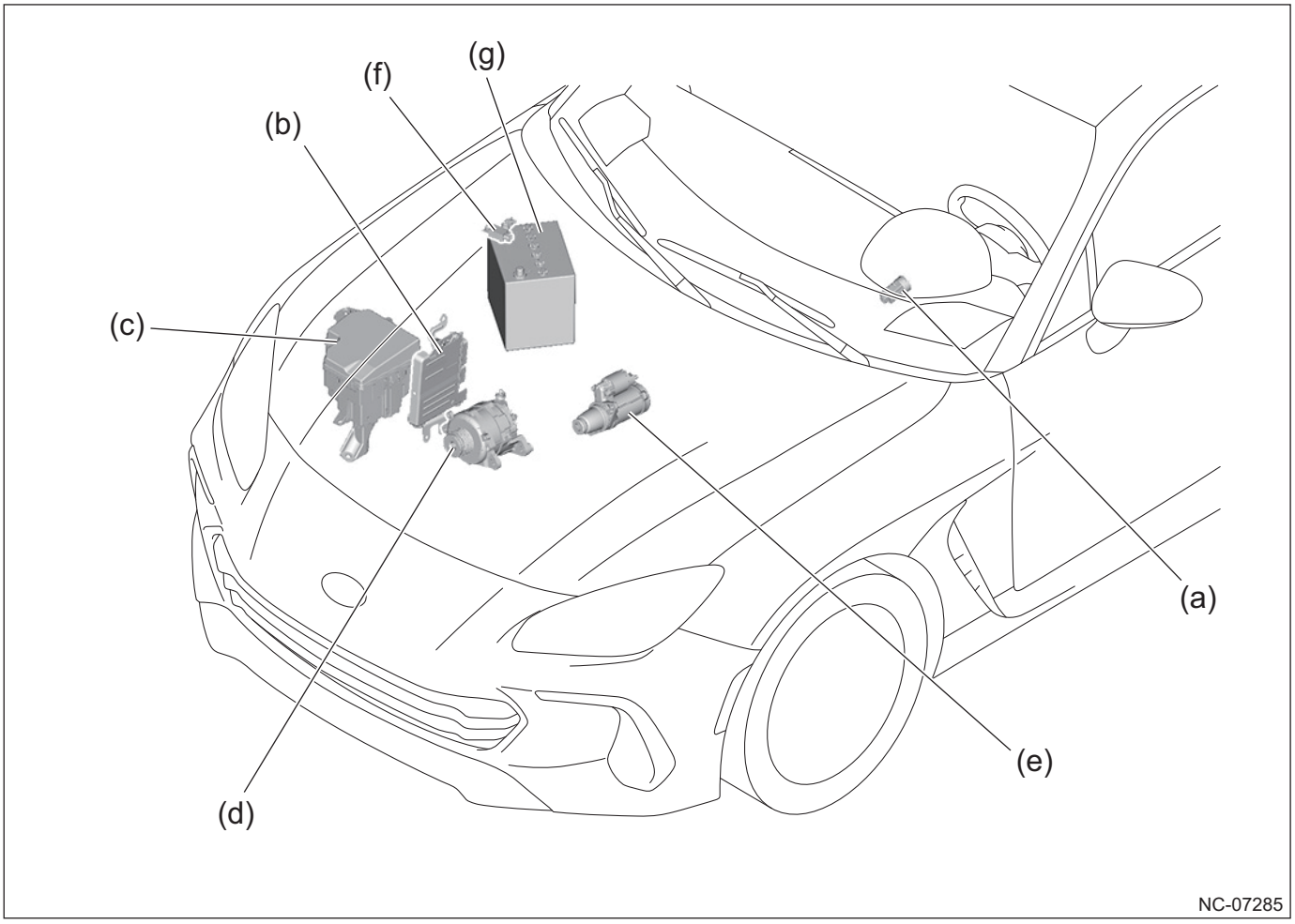
2.9.1 Overview

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



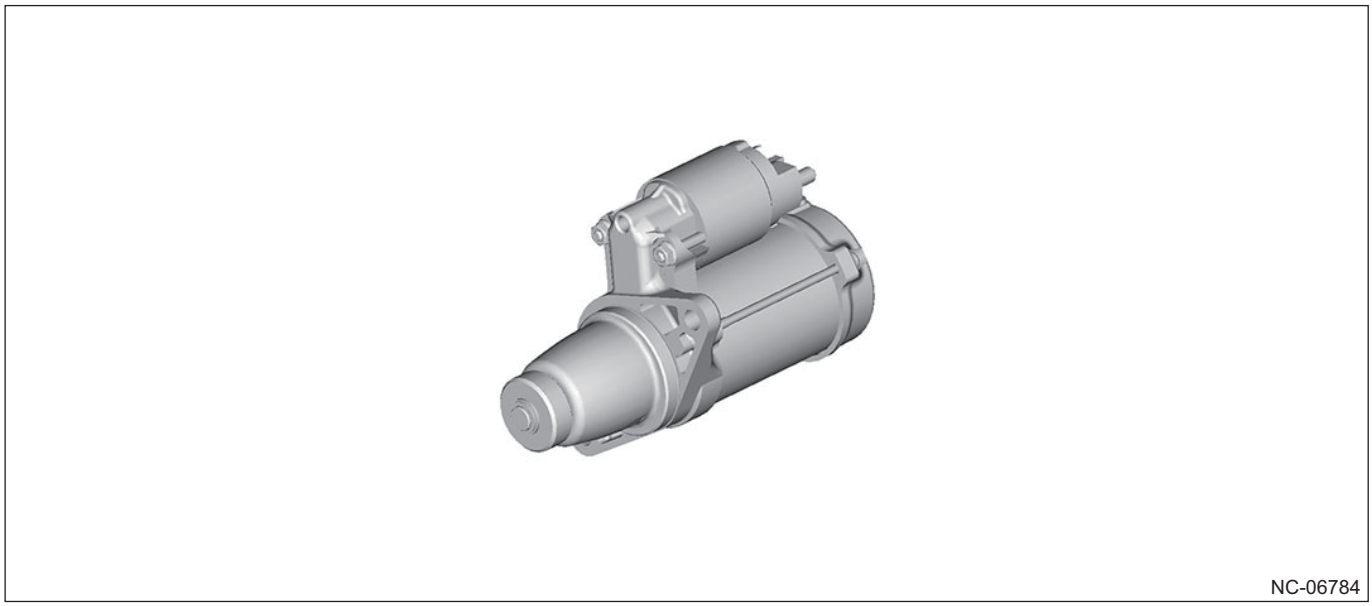
(a) Engine switch
(b) Engine Control Module (ECM)
(c) M/B (main fuse & relay box)
(d) Generator
(e) Starter
(f) Battery sensor
(g) Battery

Component details

Starter

A small and lightweight planetary starter is adopted.

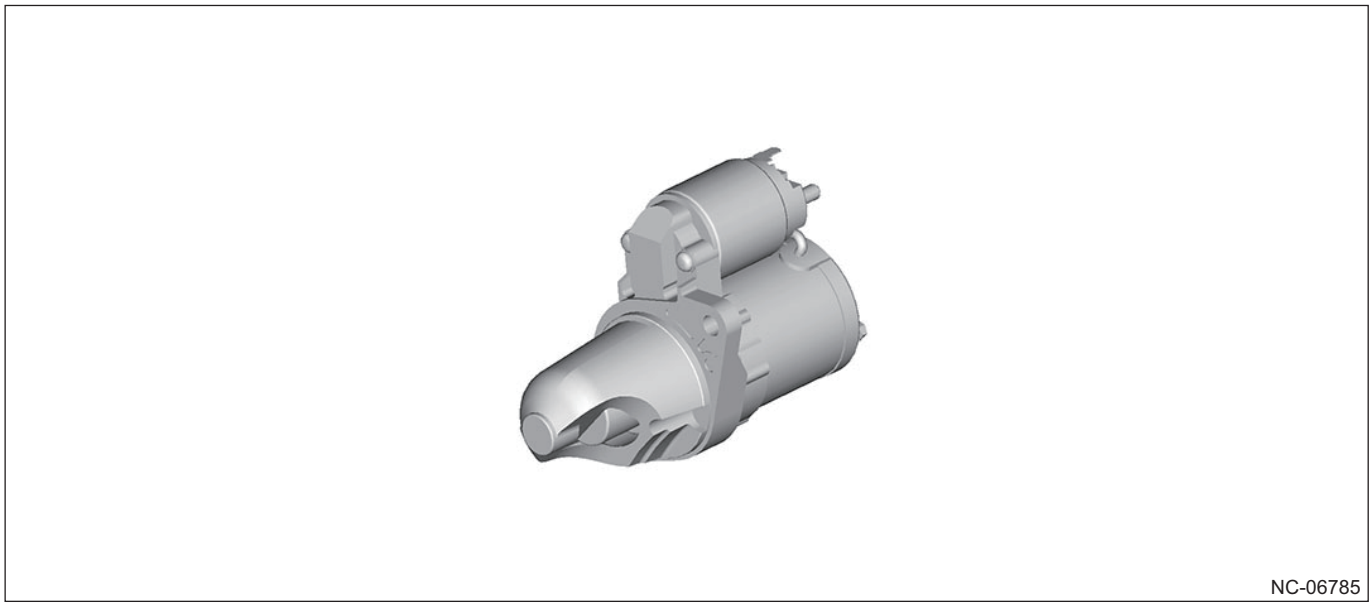
AT



Starter specifications (AT)

Type	Planetary
Rated voltage (V)	12
Rated output (kW)	1.6

MT

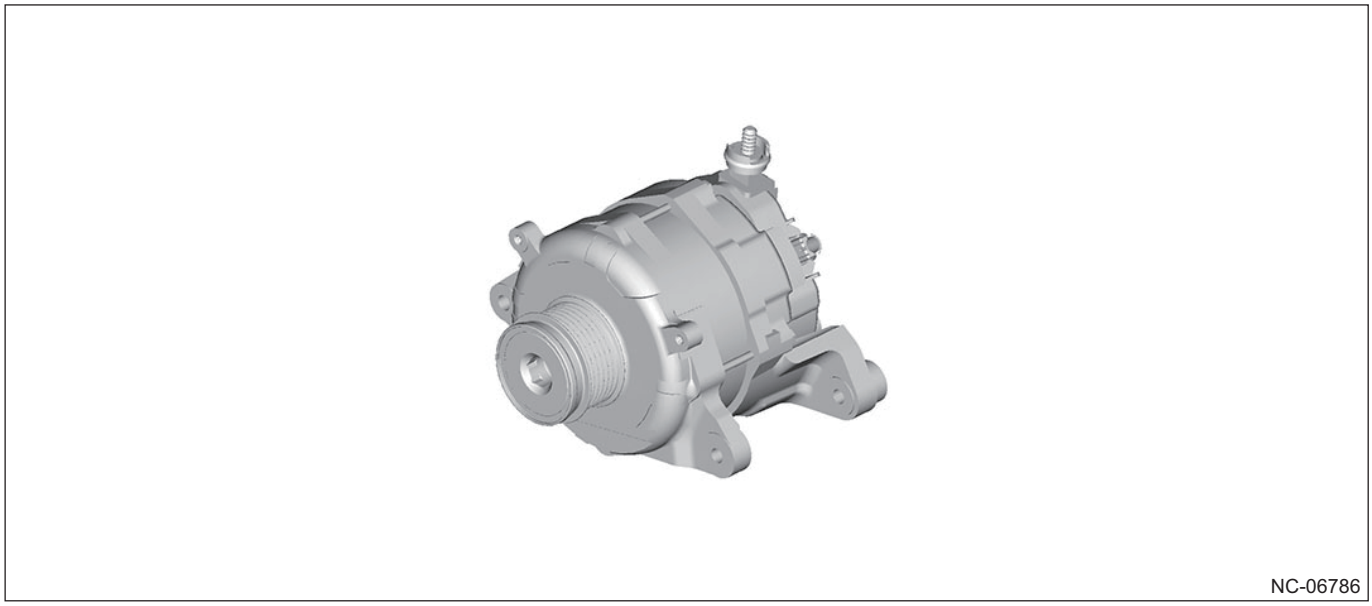


Starter specifications (MT)

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

Generator

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

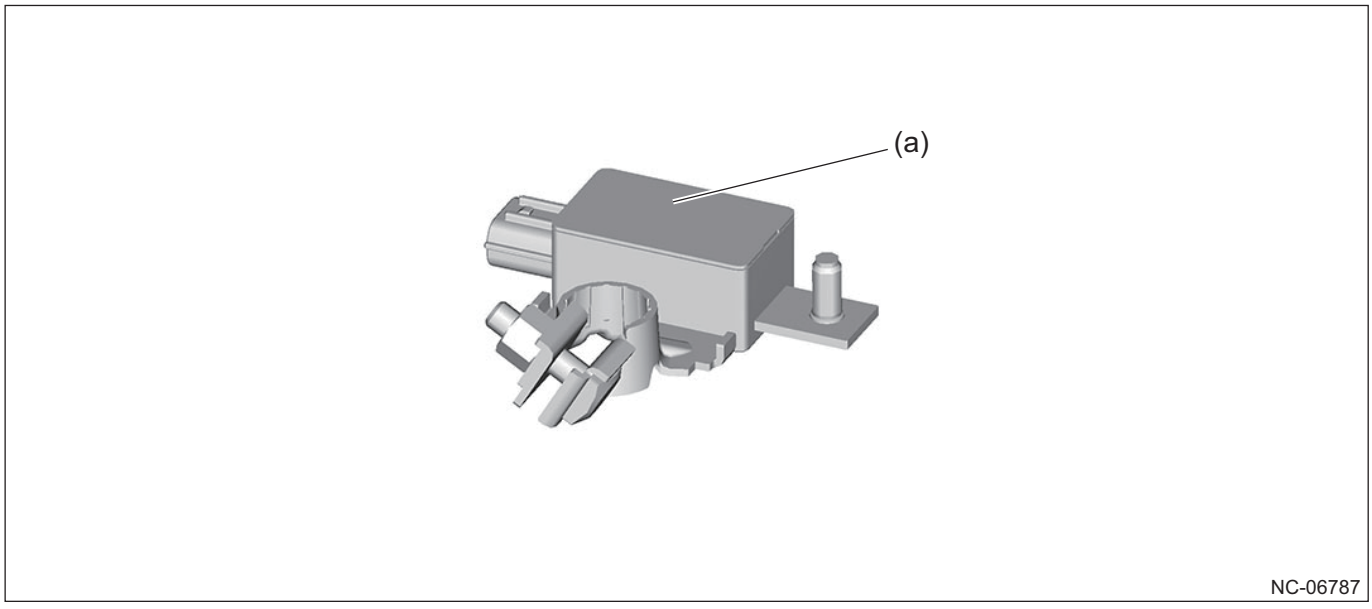


Generator specifications

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

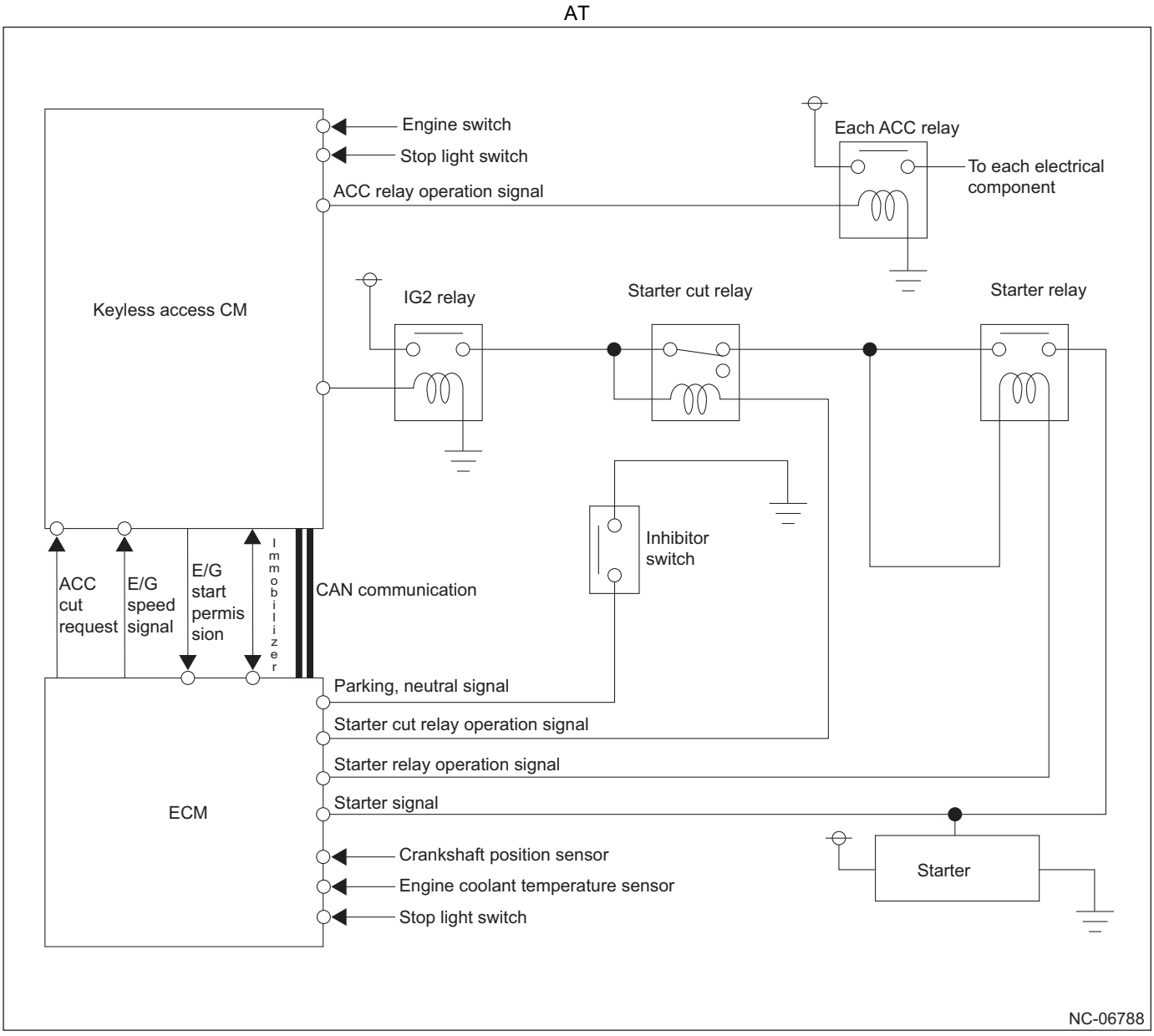
System details

Starting system

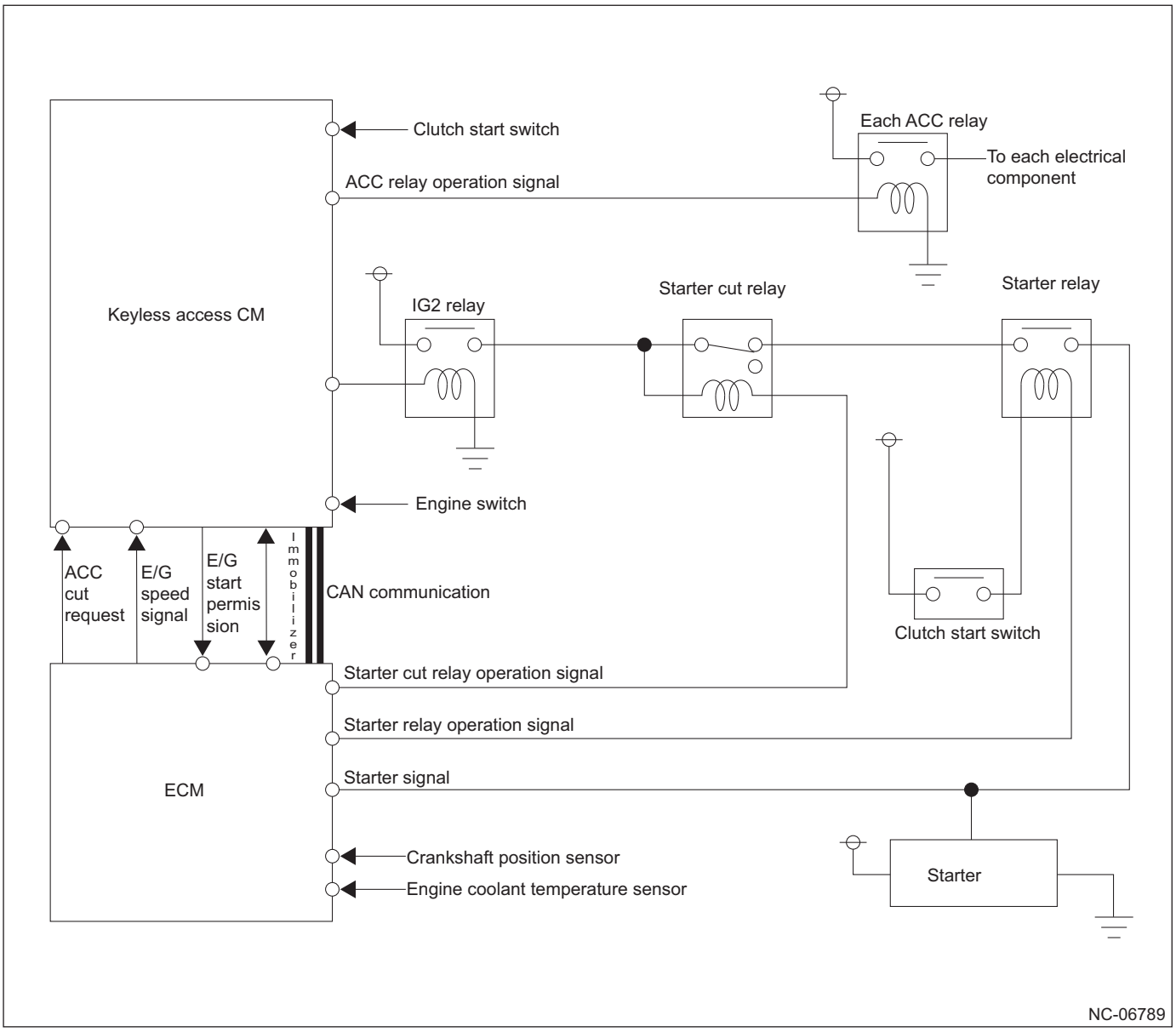
When the keyless access CM receives the start signal from the engine switch, the keyless access CM transmits the engine start permission signal to the Engine Control Module (ECM). When Engine Control Module (ECM) receives the engine start permission signal, it judges the conditions and operates the starter relay to drive the starter. At this time, the keyless access CM turns OFF the ACC relay operation signal following instructions from the Engine Control Module (ECM) in order to prevent flickering of the meter, clock, and other displays.

During cranking, the Engine Control Module (ECM) sends the activation signal to the starter relay until full engine start is detected. Full engine start is judged by the Engine Control Module (ECM), and when full engine start is judged, the Engine Control Module (ECM) stops activation of the starter relay.

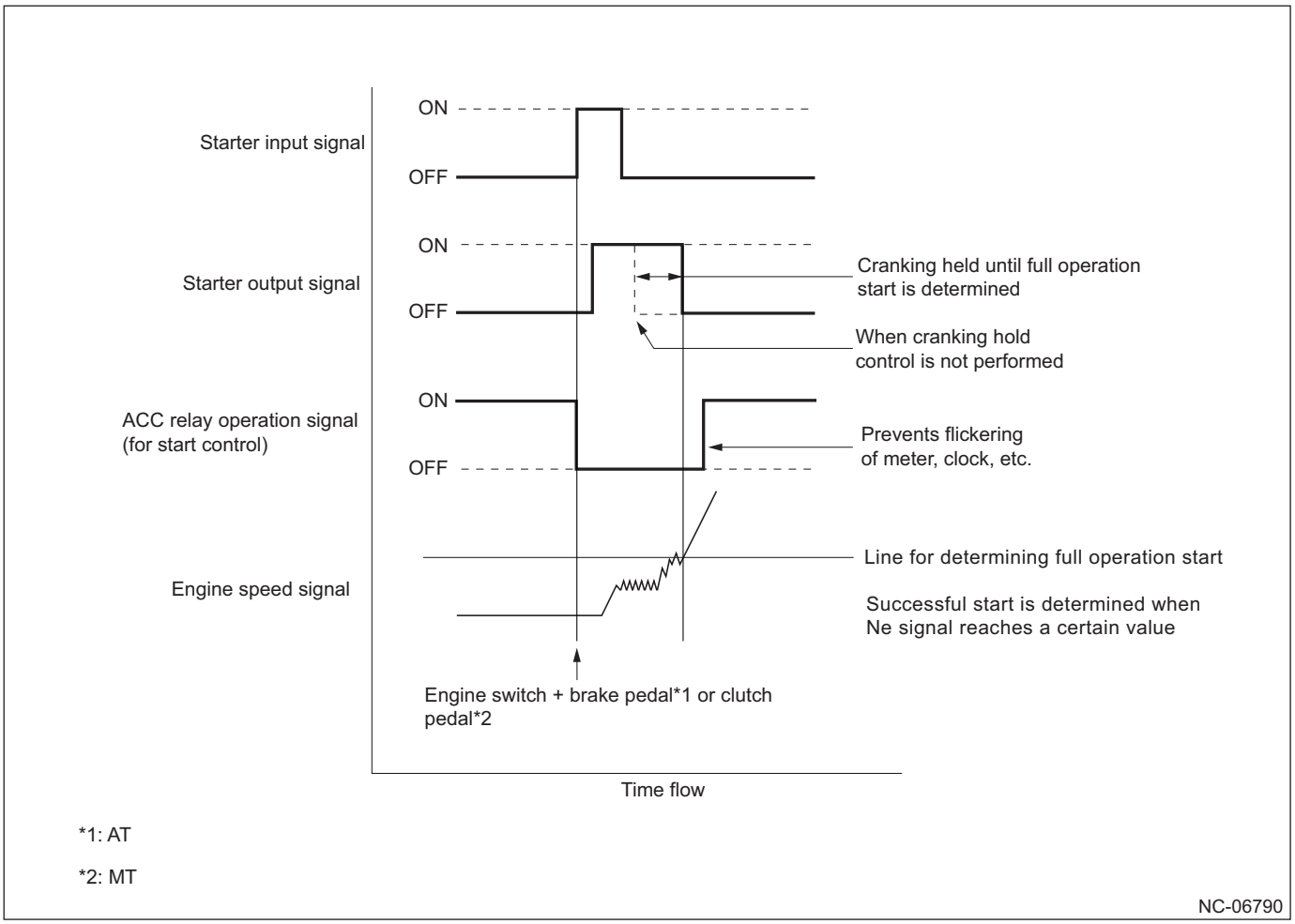
The cranking hold time and full engine start judgment count by the Engine Control Module (ECM) are decided according to the engine coolant temperature.



MT

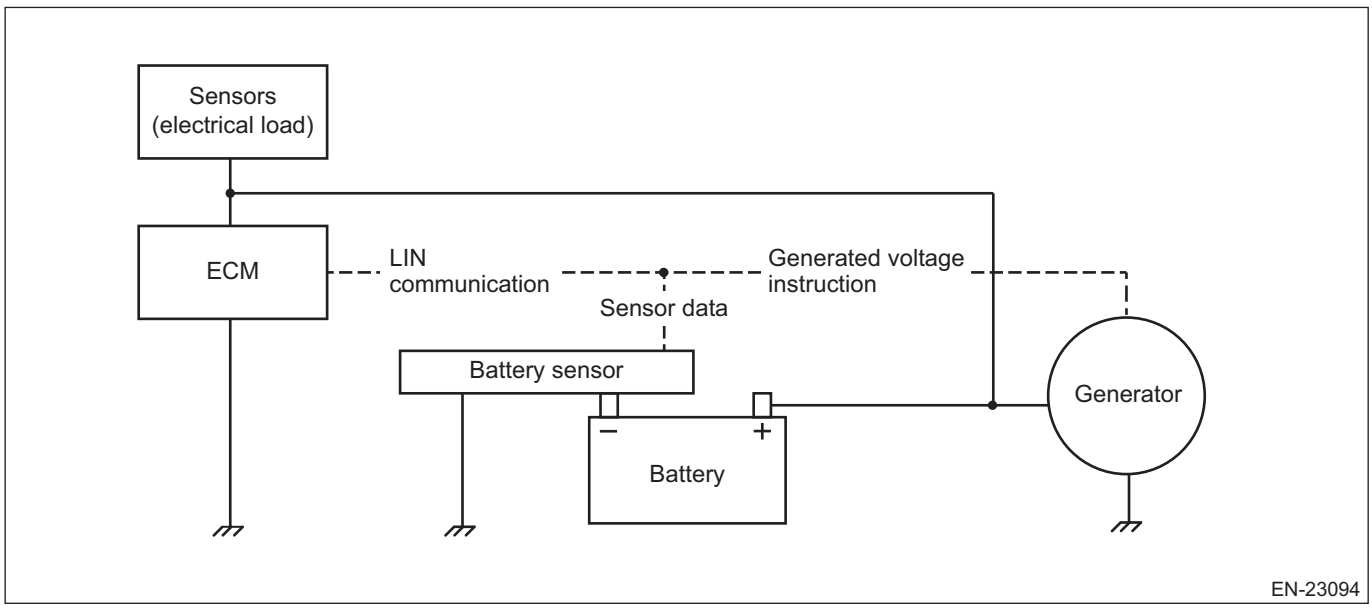

Clutch start switch
ACC relay operation signal
Each ACC relay
To each electrical component
Keyless access CM
IG2 relay
Starter cut relay
Starter relay
Engine switch
ACC cut request
E/G speed signal
E/G start permis sion
Immobilizer
CAN communication
Clutch start switch
Starter cut relay operation signal
Starter relay operation signal
ECM
Starter signal
Crankshaft position sensor
Engine coolant temperature sensor
Starter
NC-06789

Timing chart



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

CONTENTS

3.1 General Overview 3-2
3.1.1 Overview 3-2
3.1.2 Component 3-3
3.2 Control system 3-5
3.2.1 Overview 3-5
3.2.2 Component 3-6
3.2.3 Construction and Operation 3-14
3.3 Clutch 3-18
3.3.1 Overview 3-18
3.3.2 Component 3-20
3.3.3 Construction and Operation 3-25
3.4 TL70 Manual Transmission 3-27
3.4.1 Overview 3-27
3.4.2 Component 3-29
3.4.3 Construction and Operation 3-37
3.5 TX6A Automatic Transmission 3-42
3.5.1 Overview 3-42
3.5.2 Component 3-46
3.5.3 Construction and Operation 3-63
3.6 Rear Differential 3-94
3.6.1 Overview 3-94
3.6.2 Component 3-96
3.6.3 Construction and Operation 3-99
3.7 Drive Shaft/Propeller Shaft/Axle 3-101
3.7.1 Overview 3-101
3.7.2 Component 3-103

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.

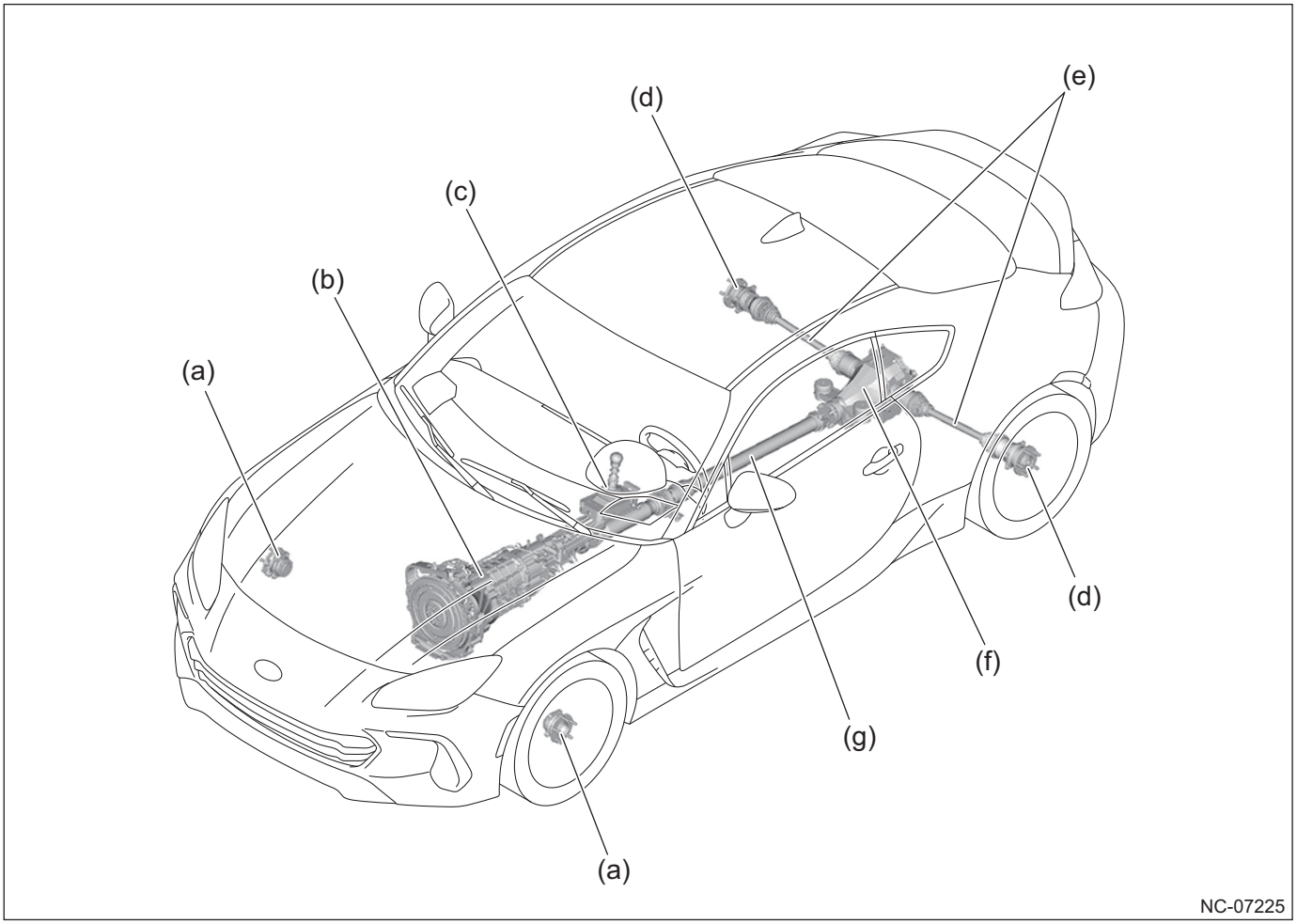
- Transmission: Device that reduces and increases the engine speed and transmits force to the drive wheels.
- Differential: Device that absorbs the rotation differences between right and left and front and rear drive wheels that occur when turning, etc.
- Drive shaft: Shaft that transmits drive force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

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

3.1.2 Component

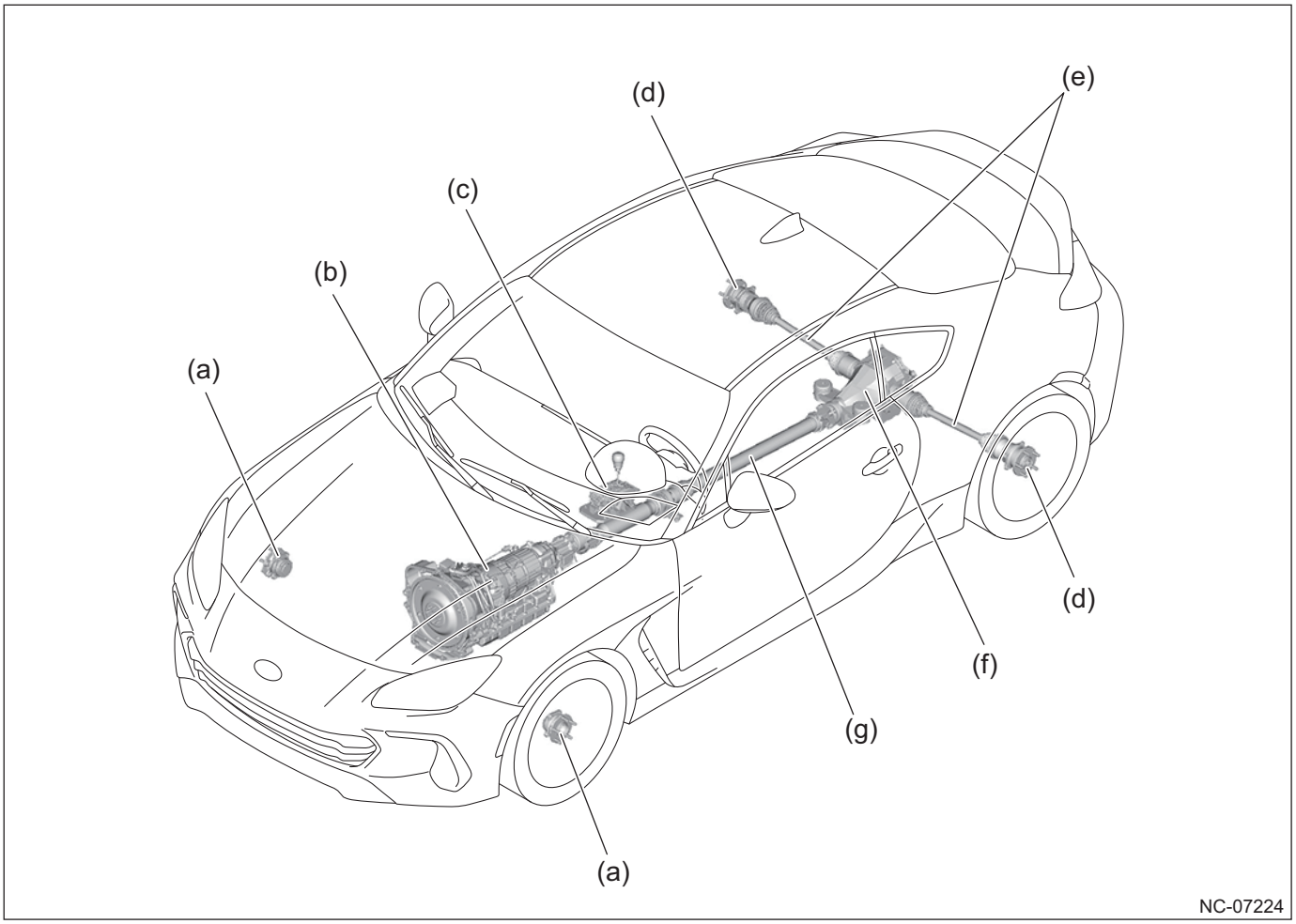
Component layout drawing

Manual Transmission



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

Automatic transmission



(a) Front axle
(b) Automatic transmission
(c) Control System
(d) Rear axle
(e) Rear drive shaft
(f) Rear differential
(g) Propeller shaft

3.2 Control system

3.2.1 Overview

Overview

A shift knob wrapped with real leather is provided for the manual transmission.

A semi direct type of shift control mechanism is adopted for the manual transmission.

A slider type of gear shift lever is adopted where the gear shift lever is operated while pulling up the slider when shifting into reverse to prevent mistaken operation when starting off or reversing with a manual transmission.

A select lever grip wrapped with real leather is provided for the automatic transmission.

A gate type select lever is adopted for the automatic transmission.

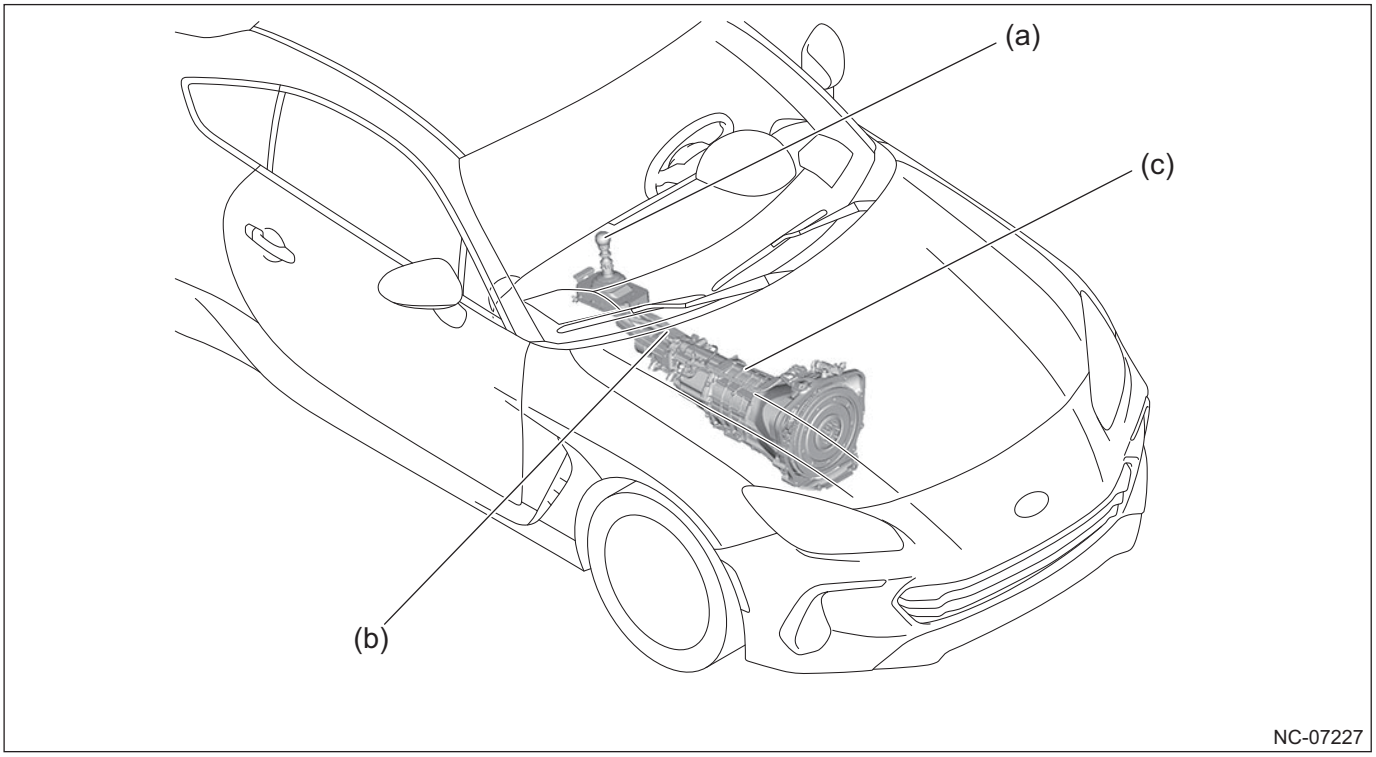
A shift lock system and N-R lock control are adopted to prevent mistaken operation of the select lever in an automatic transmission.

Paddle shift switches are adopted that enable selection of the gear position in an automatic transmission without releasing the steering wheel.

3.2.2 Component

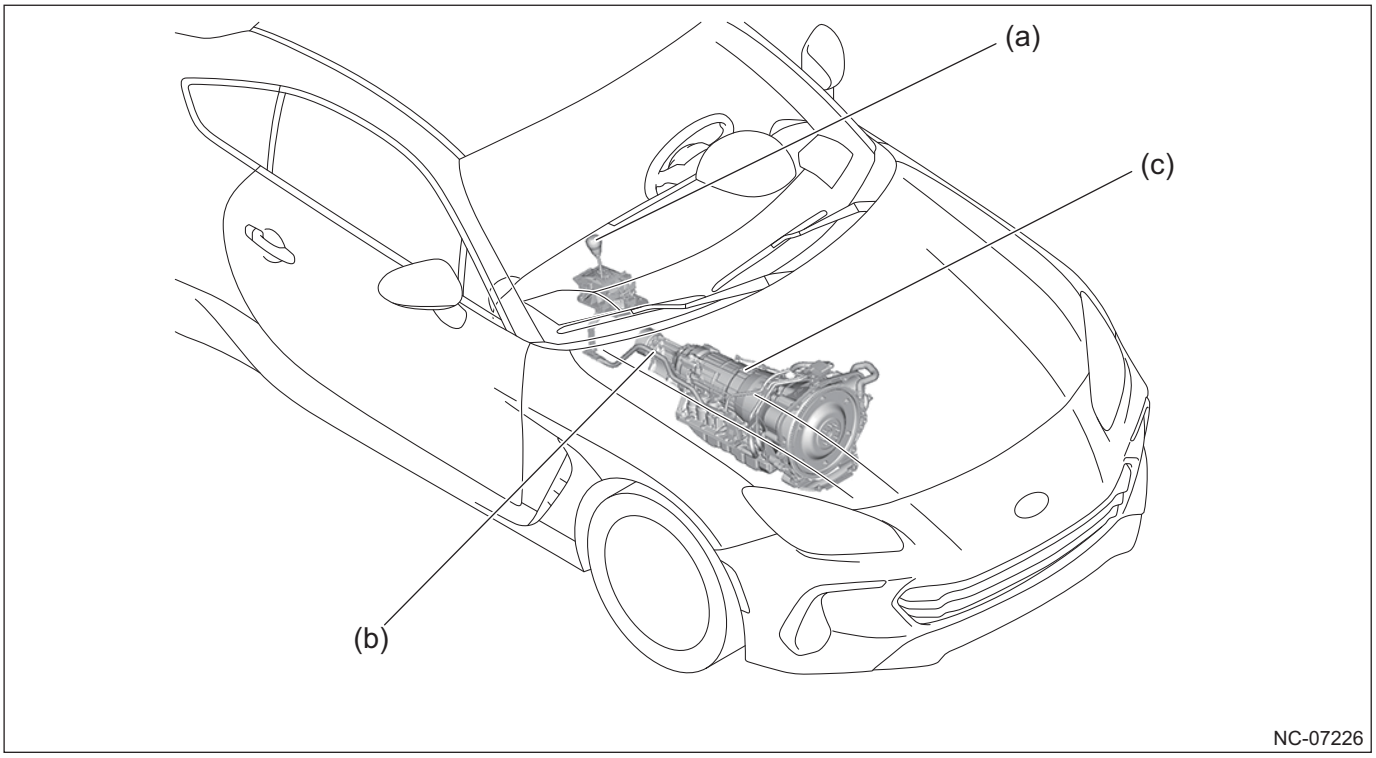
Component layout drawing

Shift control (manual transmission)



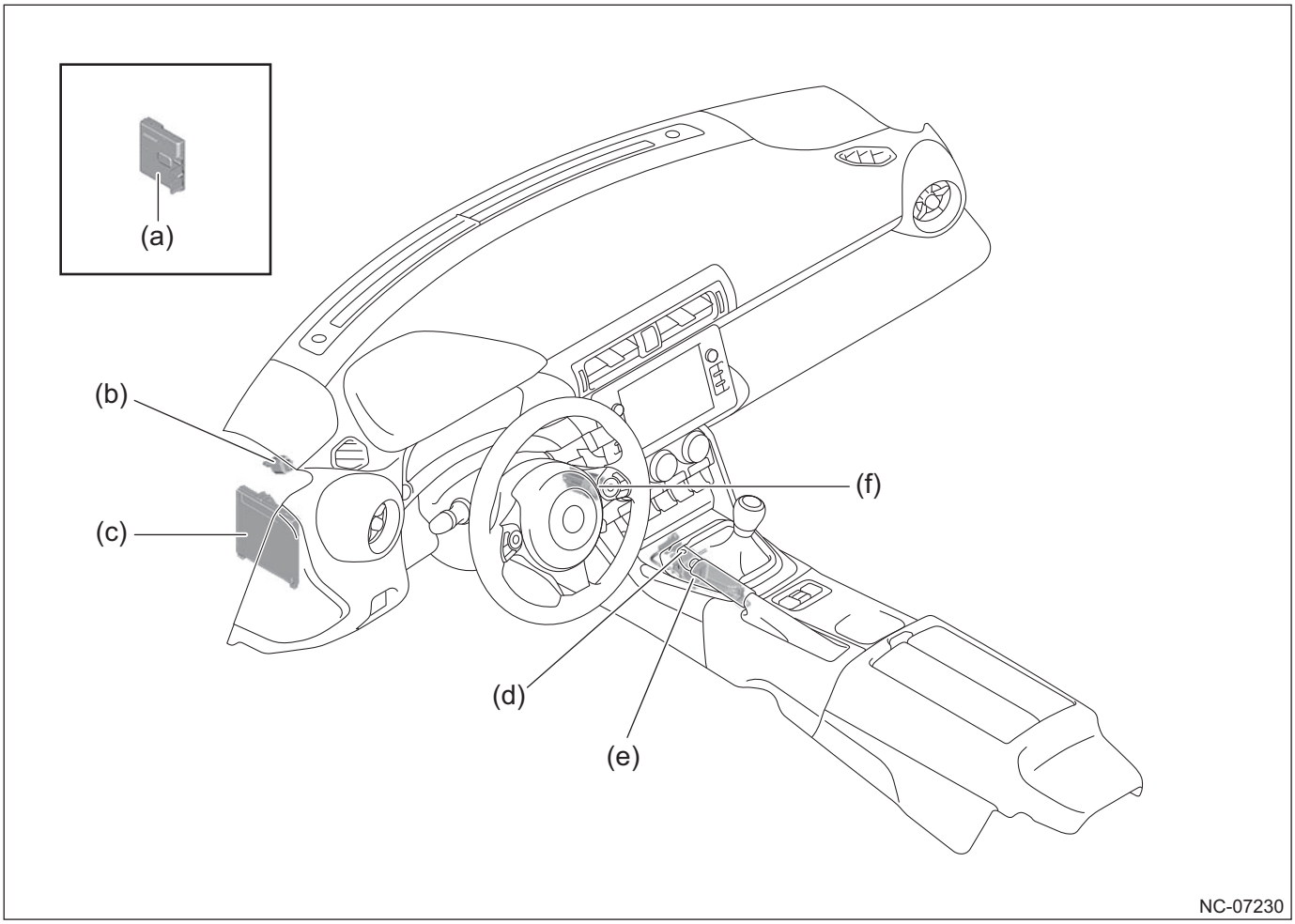
(a) Gear shift lever
(b) Semi direct mechanism
(c) Manual transmission assembly

Shift control (automatic transmission)



(a) Select lever
(b) Select lever rod
(c) Automatic transmission assembly

Shift lock control system



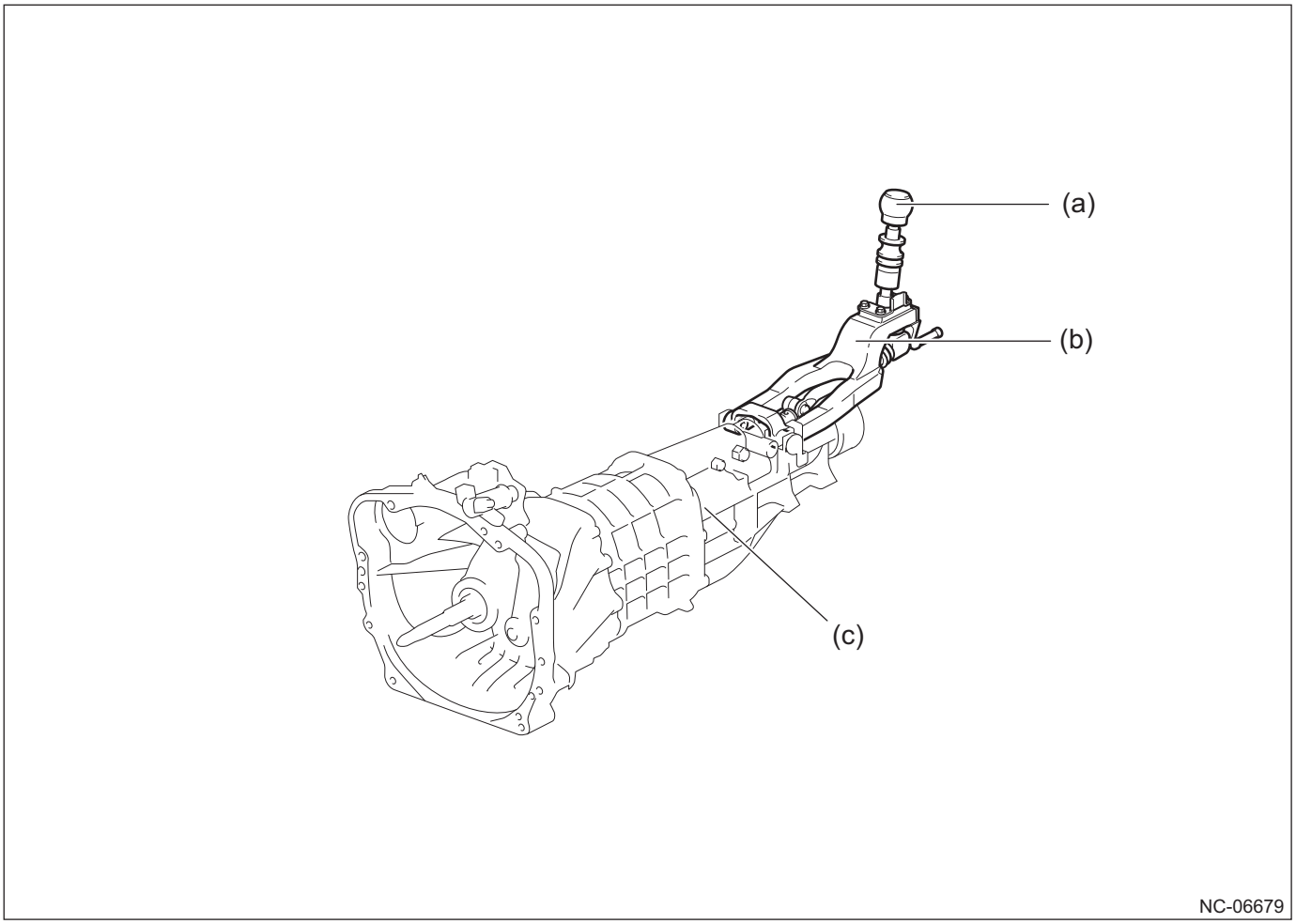
(a) Keyless access CM
(b) Stop light switch assembly
(c) Body Integrated Unit (BIU)
(d) Button cover (indicator)
(e) Shift lock solenoid
(f) Engine switch

Component details

Shift control (manual transmission)

A semi direct type of shift control mechanism is adopted for a short stroke and highly rigid feel.

Real leather wrapping is provided for the shift knob.



(a) Shift knob

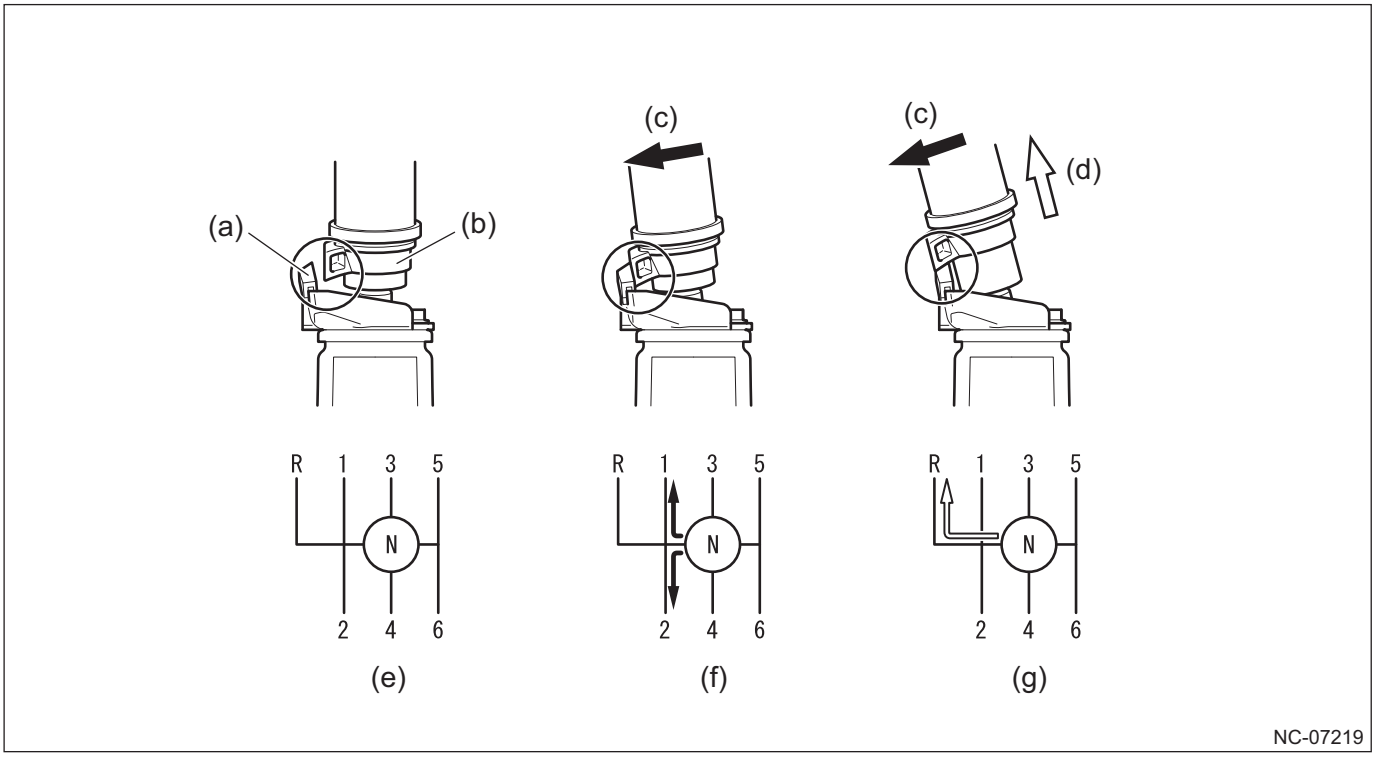
(b) Semi direct mechanism

(c) Manual transmission assembly

■ 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 1st speed or 2nd speed
(g) Selecting reverse

■ Shift gate

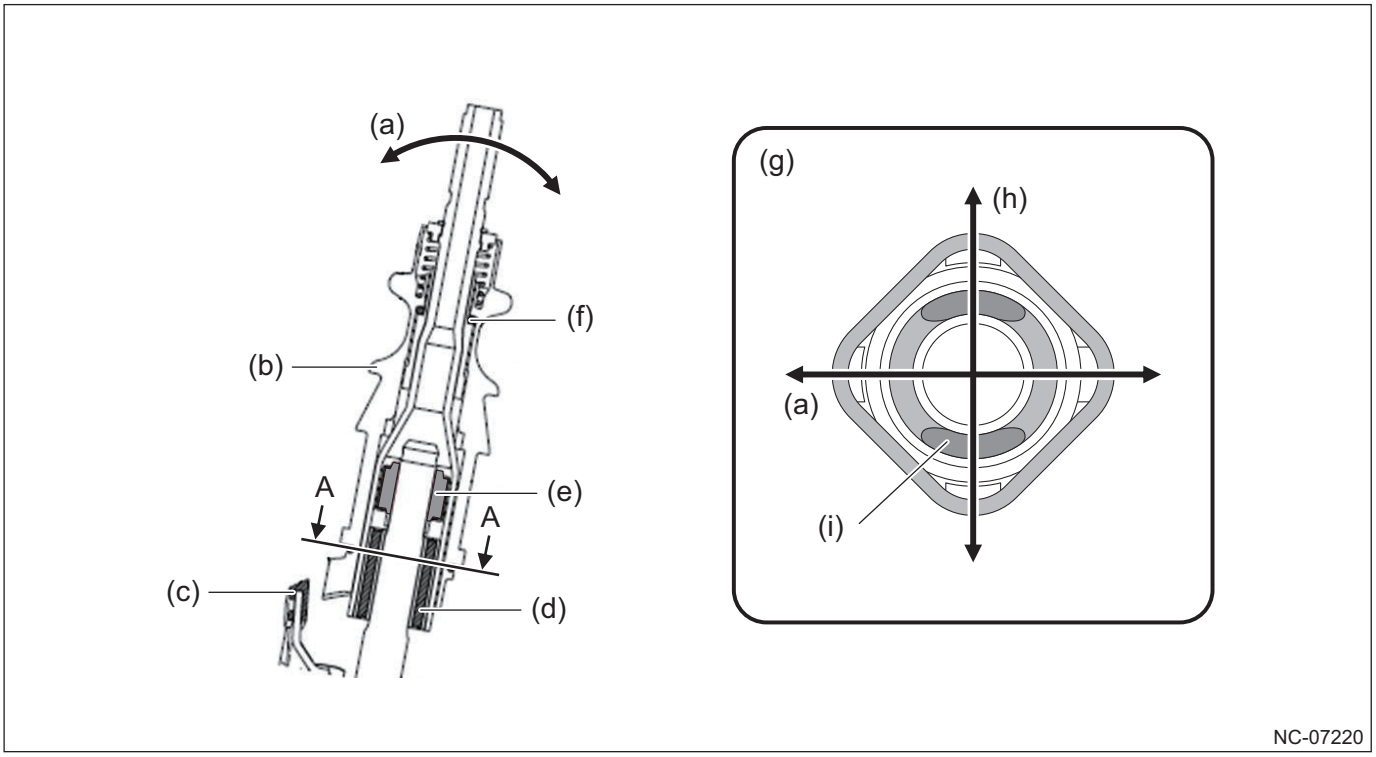
The shift gate shape is optimized to achieve both continuity of operation and clarification of the shift position, resulting in a smooth and crisp shift feel.

■ Gear shift lever

This has a dual structure due to the adoption of an upper damper inside the lever shaft. The dual characteristics change from low rigidity to high rigidity as the lever is pushed in strongly. When operated with light force, the low rigidity of the lever softens the feel, but during hard operation such as sporty driving, the high rigidity of the lever results in a sporty shift feel.

Cavities are set in some areas in the shifting (forward/reverse) direction of the lower damper. This softens the feel when operating the shift with a light load, while maintaining high operational rigidity in the select (horizontal) direction that results in accurate gear selection.

The slider retention mechanism is renewed to suppress vibration, improving vibration and noise performance.



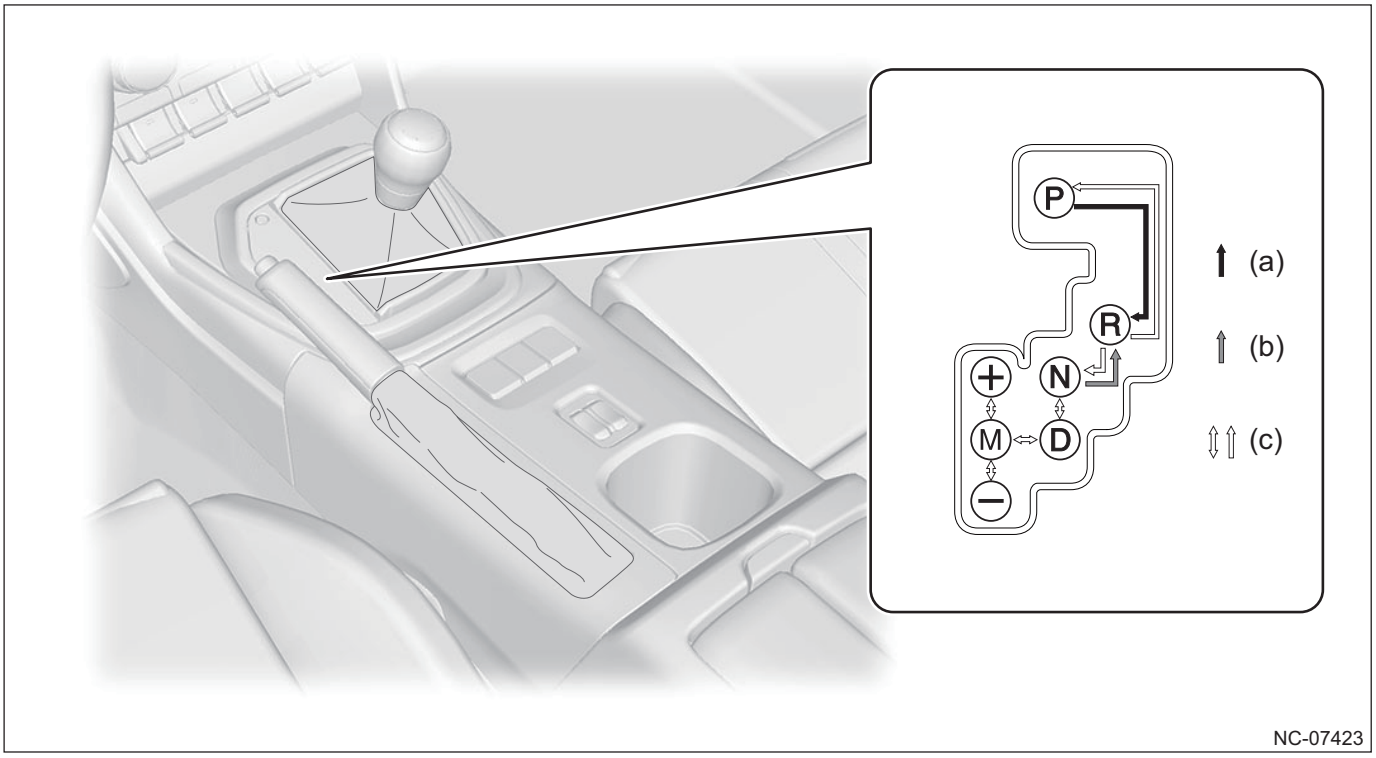
(a) Select (horizontal) direction
(b) Slider for reversing
(c) Stopper for reversing
(d) Lower damper
(e) Upper damper
(f) O-ring
(g) A-A cross section
(h) Shift (forward/reverse) direction
(i) Cavity

Shift control (automatic transmission)

Real leather wrapping is provided for the select lever grip.

(PRND) + manual mode (M) is adopted as the shift pattern.

A shift lock system and N-R lock control are adopted to prevent mistaken operation of the select lever in an automatic transmission.



(a) The shift position can be changed from P to another position only while the brake pedal is depressed with the engine switch ON.

(b) Operation from the N position to the R position is not possible when driving.

(c) The lever can be moved as-is along the gate. (For safety, depress the brake pedal and stop the vehicle completely before operating between the P position and D position.)

■ 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.

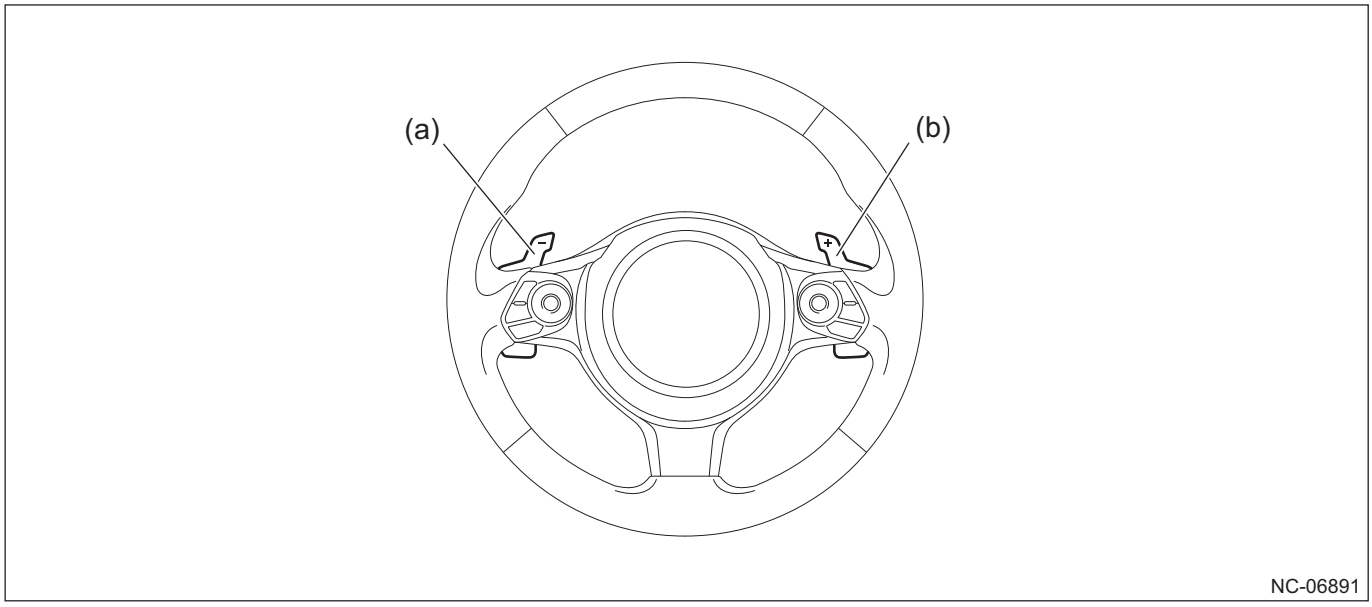
■ M mode switch

The M mode switch is installed in the select lever. The switch detects that the select lever is located at the M position, and it detects the + (UP)/- (DOWN) operations of the select lever.

Paddle shift switch (automatic transmission)

When the select lever is shifted to the M position, the transmission enters manual mode. Also, when a paddle shift switch is operated while the shift is in the D position, the transmission enters manual mode temporarily. By operating a paddle switch located on the steering wheel, the driver can quickly select the appropriate gear for fast braking or acceleration without releasing the steering wheel.

When the driver wants to shift gears while driving in manual mode, the driver can shift up or down by operating a paddle shift switch (+/-) or select lever (+/-). At this time, the M mode indicator and shifted gear positions are displayed on the shift position/shift range indicator in the combination meter.

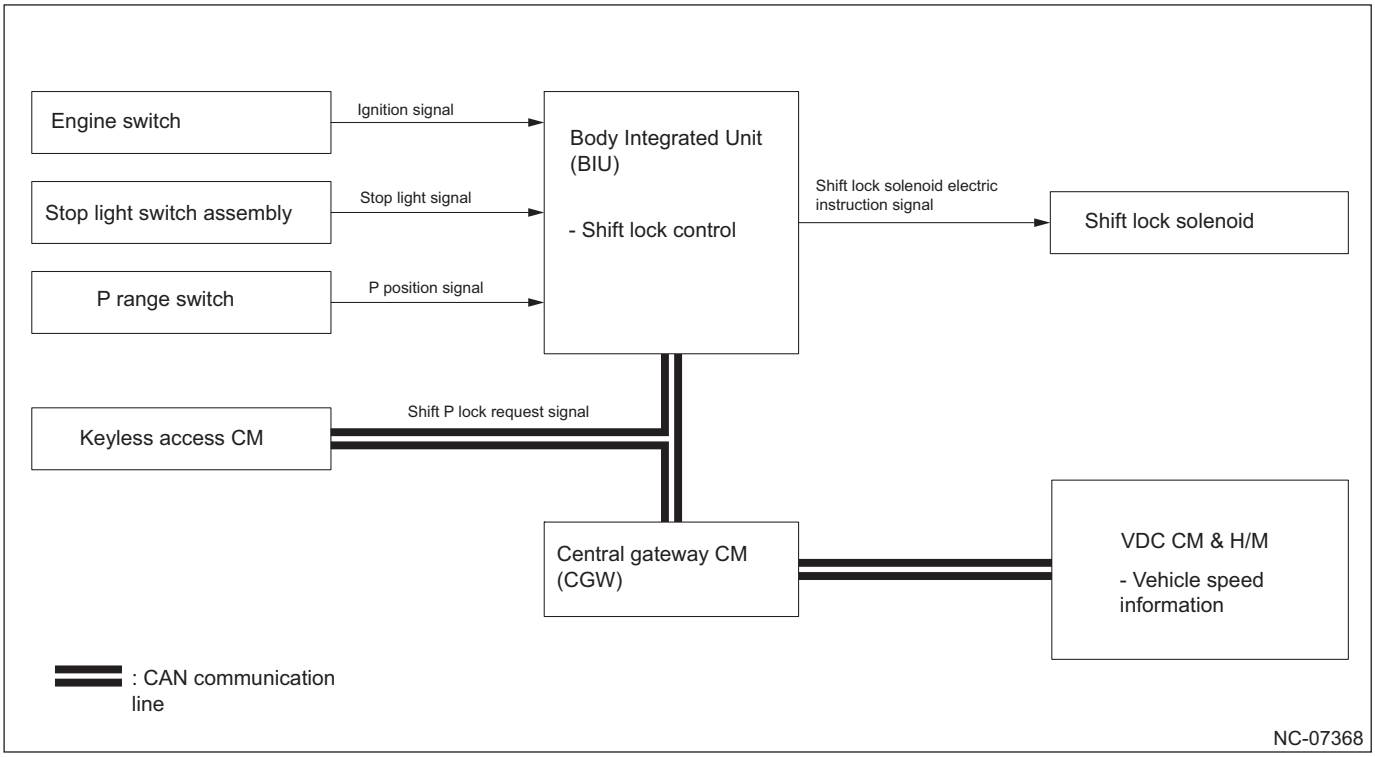


(a) Paddle shift switch (-)

(b) Paddle shift switch (+)

3.2.3 Construction and Operation

System diagram



Main component functions

Component	Function
Body Integrated Unit (BIU)	Controls the operation of the shift lock solenoid according to various signals.
Shift lock solenoid	Locks the select lever to the P position.
Shift lock manual release plate	Used to release the locked condition of the shift lock solenoid manually.
Stop light switch assembly	Outputs the brake signal to the Body Integrated Unit (BIU).
P range switch	Detects that the select lever is located at the P position.

System details

Shift lock system

A shift lock system is adopted to prevent mistaken operation of the select lever in an automatic transmission.

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 is electric for all vehicles and the structure is simplified.

A shift lock manual release plate is provided under the indicator as an emergency measure when moving the vehicle with a method such as towing. This enables the shift lock mechanism to be released manually.

■ Construction and operation of shift lock mechanism

The shift position can be changed from P to another position only while the brake pedal is depressed with the engine switch ON due to the control of the Body Integrated Unit (BIU).

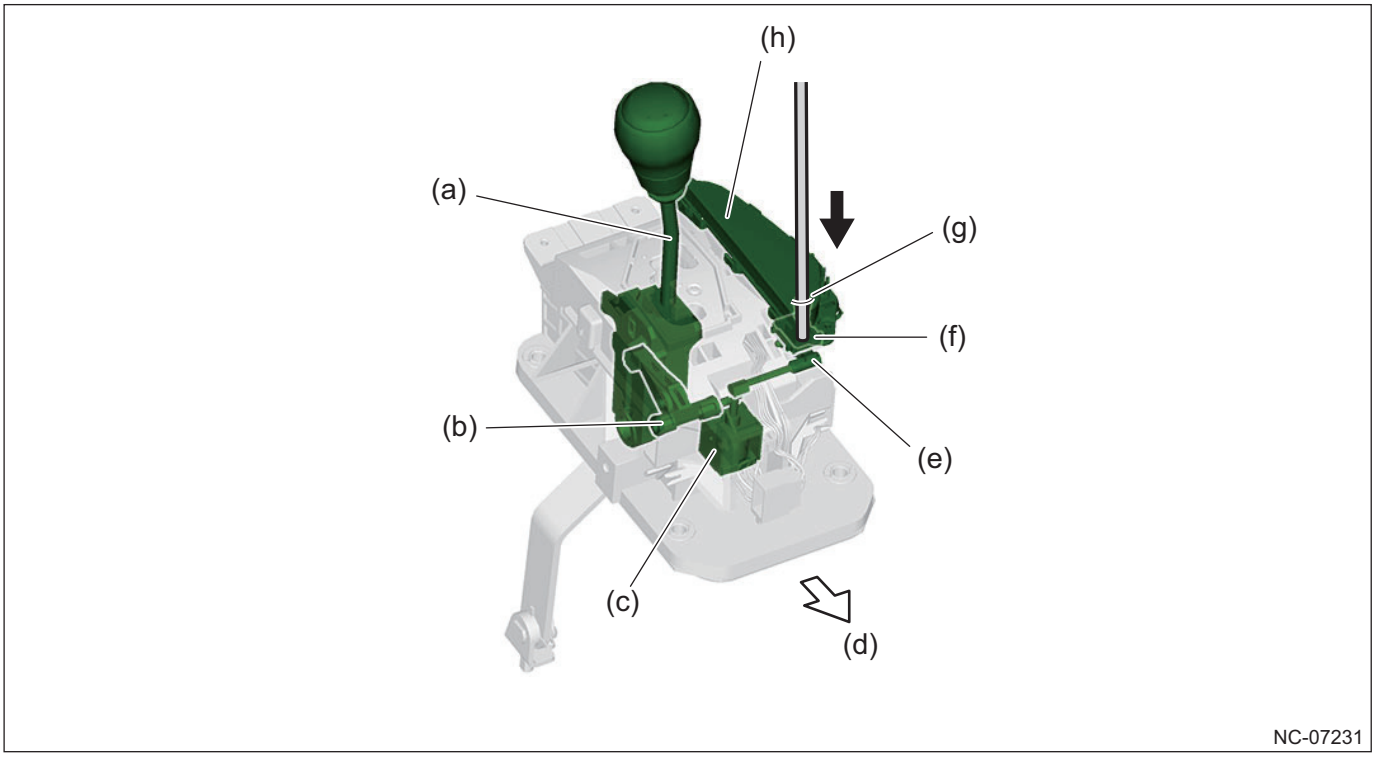
The shift lock mechanism is composed of the lever, shift lock plate, shift lock manual release plate, shift lock release rod, and shift lock solenoid.

▮ During electric operation

When the brake pedal is depressed, the shift lock solenoid pulls the shift lock plate, releasing the shift lock plate.

▮ During manual operation

Remove the button cover on the indicator, insert a tool such as a thin flat-head screwdriver, and press the shift lock manual release plate. The shift lock solenoid is pressed via the shift lock release rod, releasing the shift lock plate.



(a) Lever
(b) Shift lock plate
(c) Shift lock solenoid
(d) Front of vehicle
(e) Shift lock release rod
(f) Shift lock manual release plate
(g) Shift lock release hole
(h) Indicator

N-R lock control

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 of the select lever. This activates the N-R lock mechanism, preventing the select lever from being operated from the N position to the R position and preventing the transmission from entering reverse.

3.3 Clutch

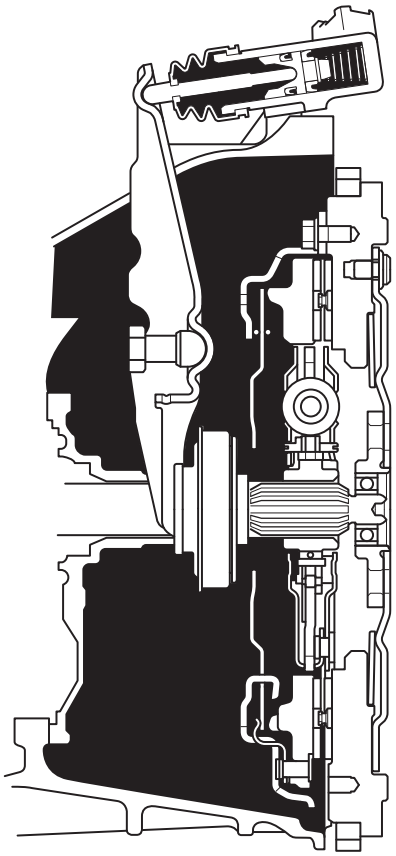
3.3.1 Overview

Overview

A dry, single disc, diaphragm type of clutch mechanism is provided in vehicles equipped with the TL70 manual transmission.

A push type of clutch assembly is adopted to achieve both appropriate depression response to clutch operations and controllability.

The clutch capacity is also increased to support the higher engine output.



NC-07245

Specifications

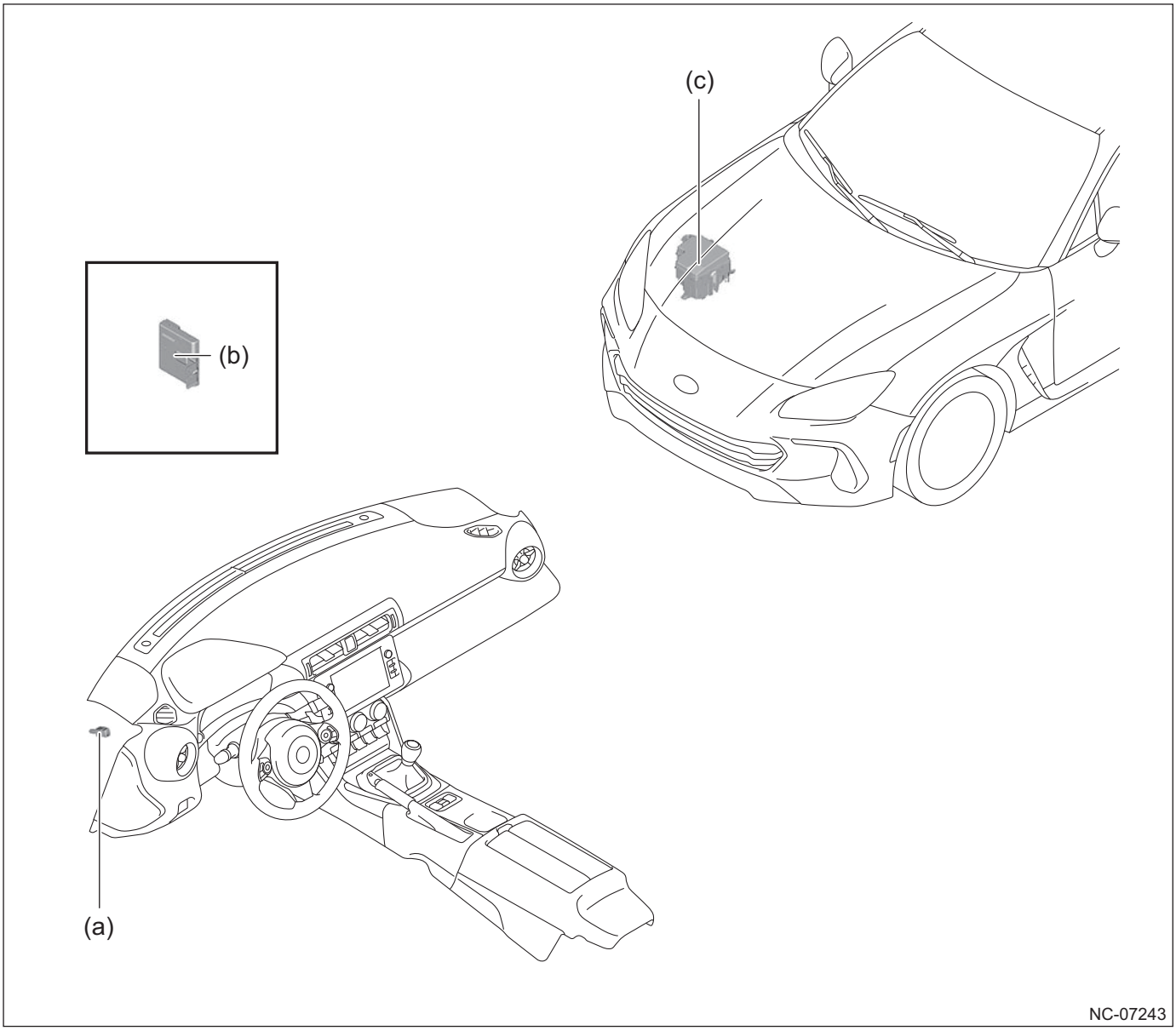
Clutch specifications

Transmission type		TL70
Engine type		FA24
Clutch assembly	Type	Dry, single disc, diaphragm type
	Operation method	Oil pressure type
Clutch cover	Size (in (mm))	9.055 (230)
	Installation load (lbf (N, kgf))	1325.4 (5895, 601.1)
Clutch disc	Outer diameter × inner diameter × thickness (in (mm))	9.06 × 6.10 × 0.13 (230 × 155 × 3.2)*1 9.06 × 6.10 × 0.14 (230 × 155 × 3.5)*2
	Material	Semi mold
Clutch master cylinder assembly	Type	Plunger type
	Bore (in (mm))	0.687 (17.46)
Clutch release cylinder assembly	Type	Non-adjustable type
	Bore (in (mm))	0.813 (20.64)
Clutch pedal	Stroke (in (mm))	4.331 (110)
	Pedal lever ratio	5.44

**1: Flywheel side*
**2: Clutch cover side*

3.3.2 Component

Component layout drawing



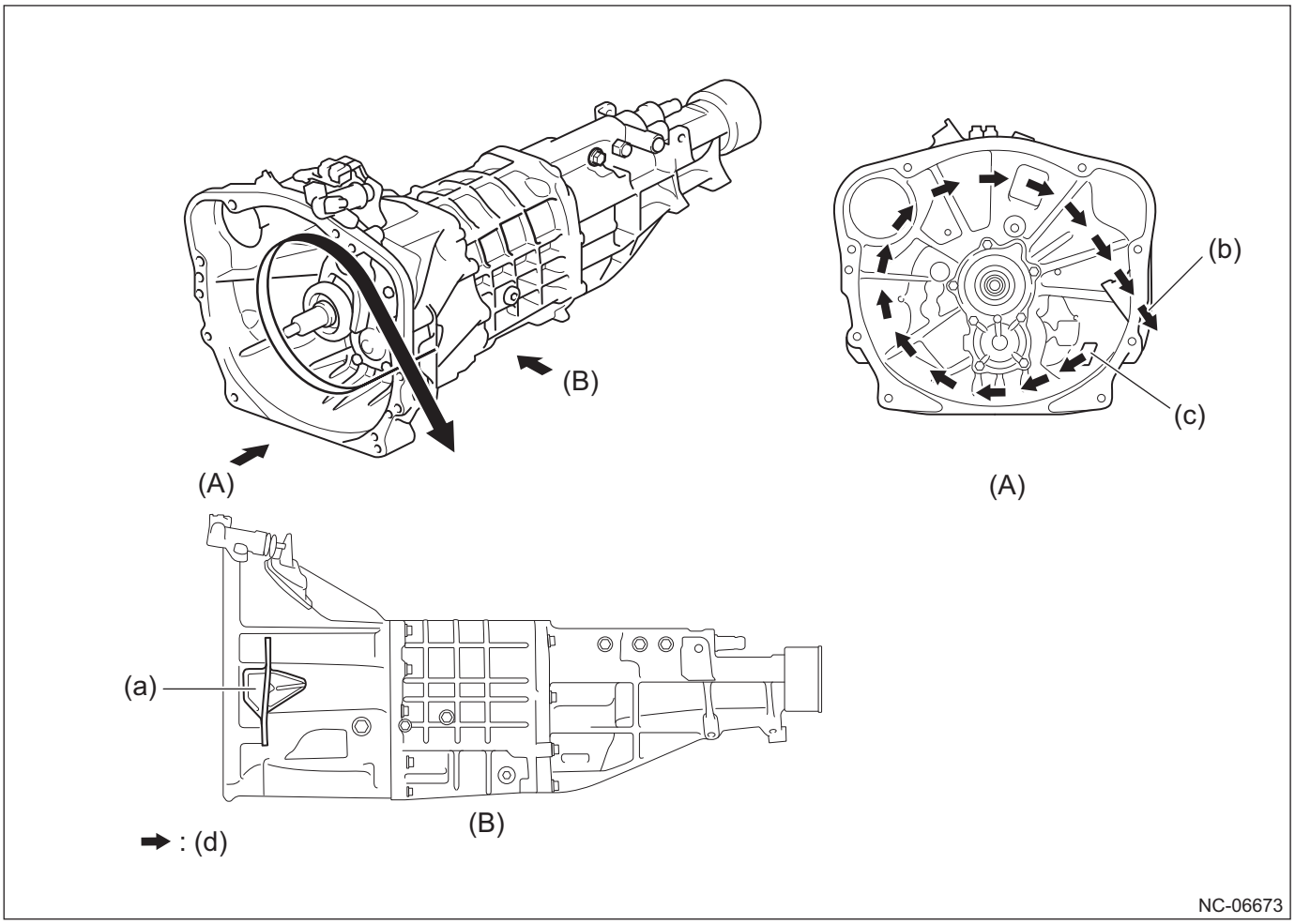
(a) Clutch start switch
(b) Keyless access control module
(c) Starter relay (in main fuse & relay box)

Component details

Clutch housing

Intake and exhaust ports for clutch cooling are provided on the clutch housing of the TL70 6-speed manual transmission to ensure good clutch cooling performance and wear resistance.

An exhaust port waterproof cover is provided to prevent water from entering the clutch housing.



(A) VIEW A

(B) VIEW B

(a) Exhaust port waterproof cover

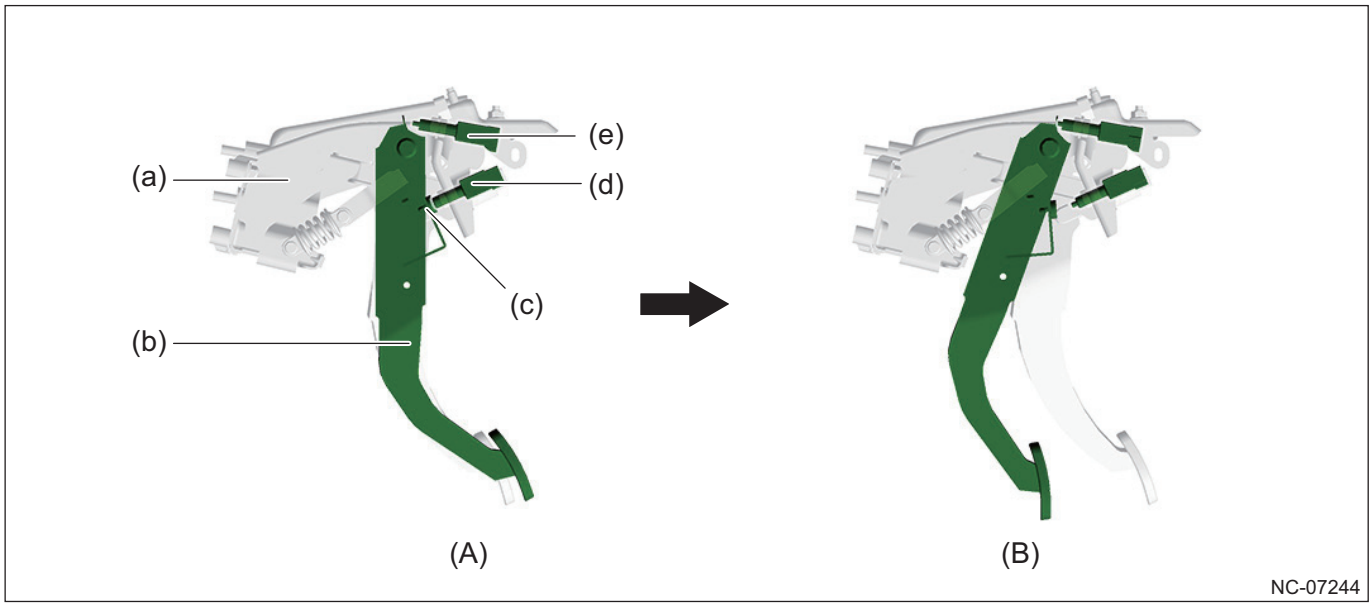
(b) Exhaust port

(c) Intake port

(d) Air flow

Clutch start 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) When clutch pedal released

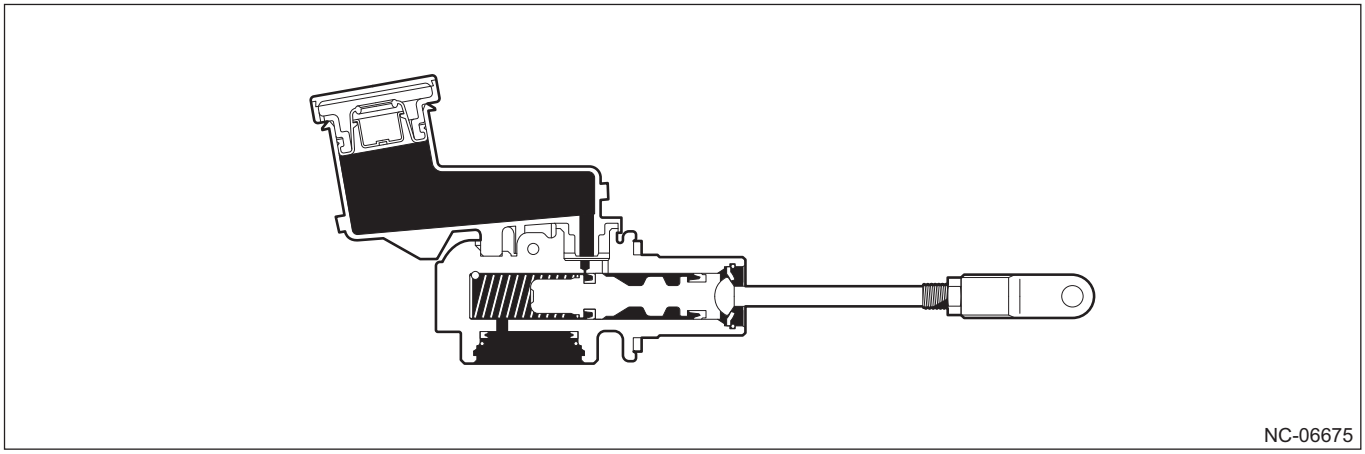
(B) When clutch pedal depressed

(a) Clutch pedal bracket
(b) Clutch pedal
(c) Clutch pedal stopper B
(d) Clutch switch assembly
(e) Clutch start switch

Clutch master cylinder assembly

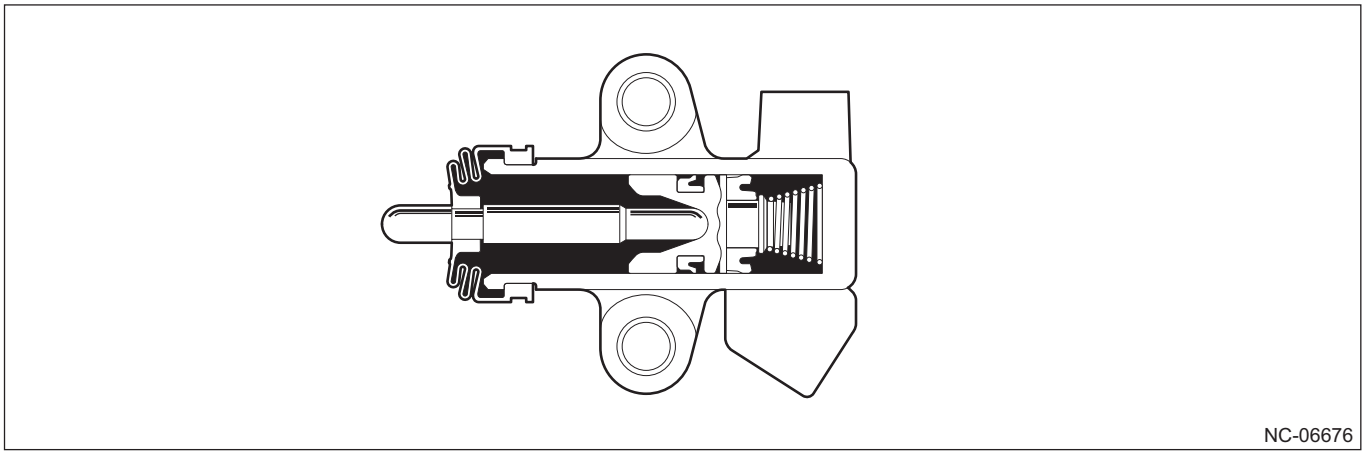
A plunger type of clutch master cylinder assembly with a cylinder diameter of 0.687 in (17.46 mm) is adopted.

A reservoir tank that is integrated with the master cylinder is adopted.



Clutch release cylinder

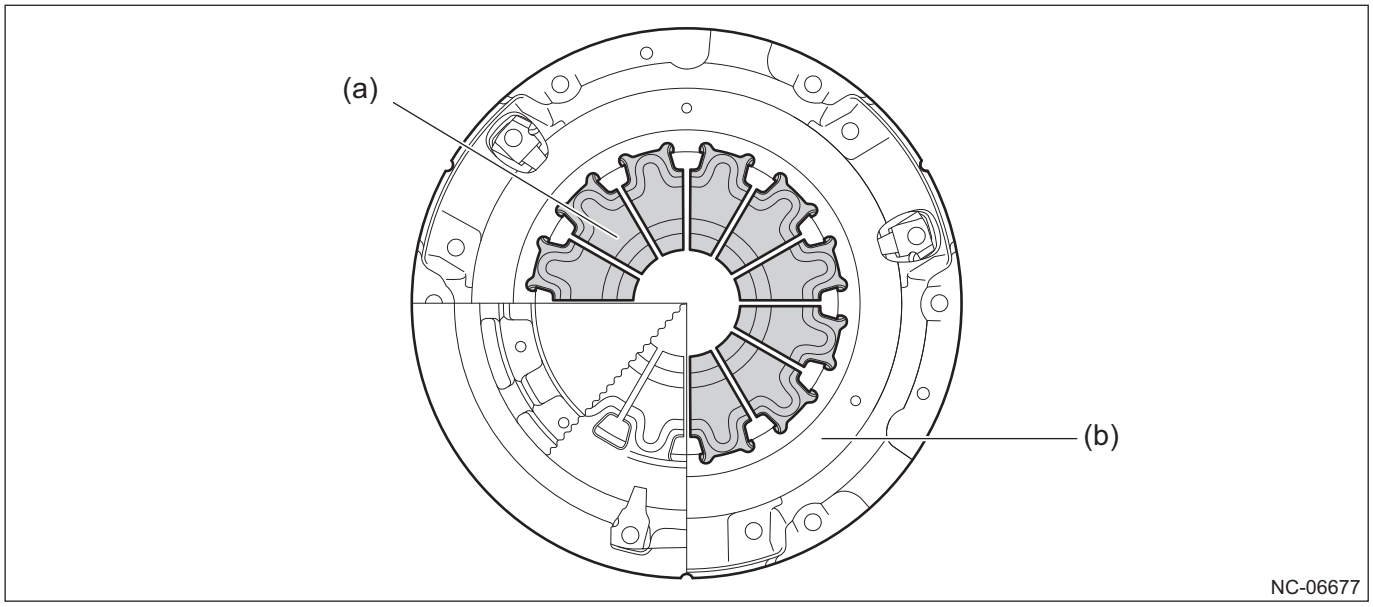
A non-adjustable type of operating cylinder with a cylinder diameter of 0.813 in (20.64 mm) is adopted.



Clutch cover

A diaphragm type spring is adopted for the clutch cover.

Also, the load characteristics are optimized to support the higher engine output.



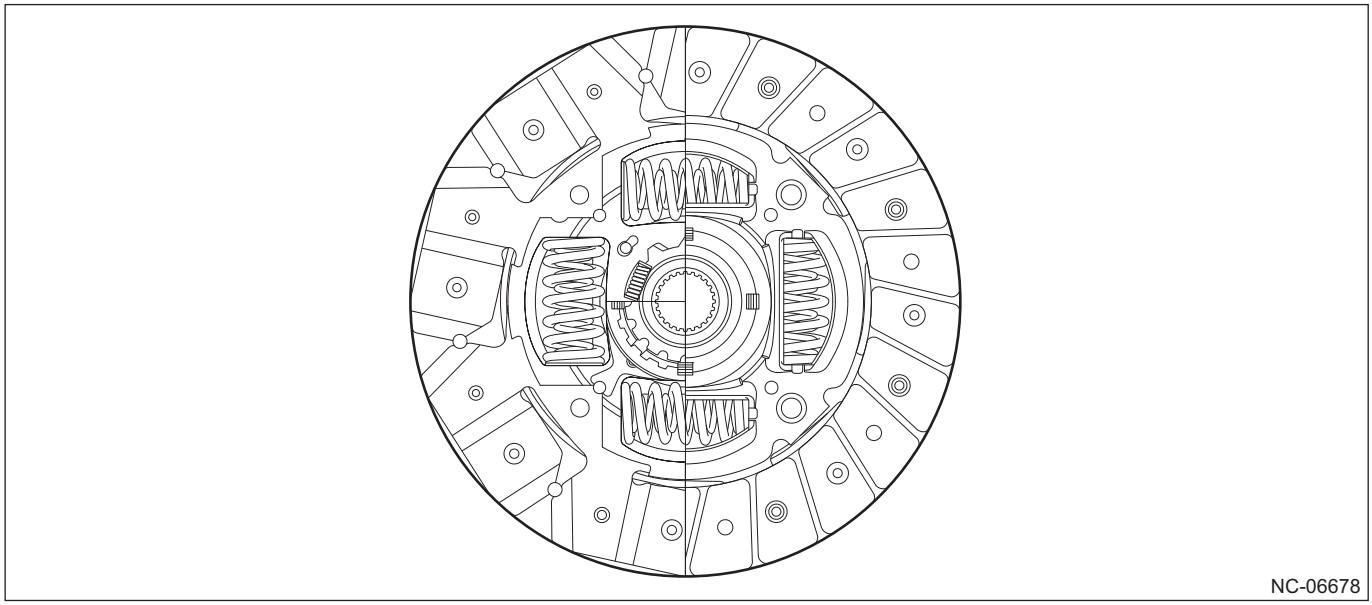
(a) Diaphragm type spring

(b) Clutch cover assembly

Clutch disc

A semi mold type of clutch disc is adopted.

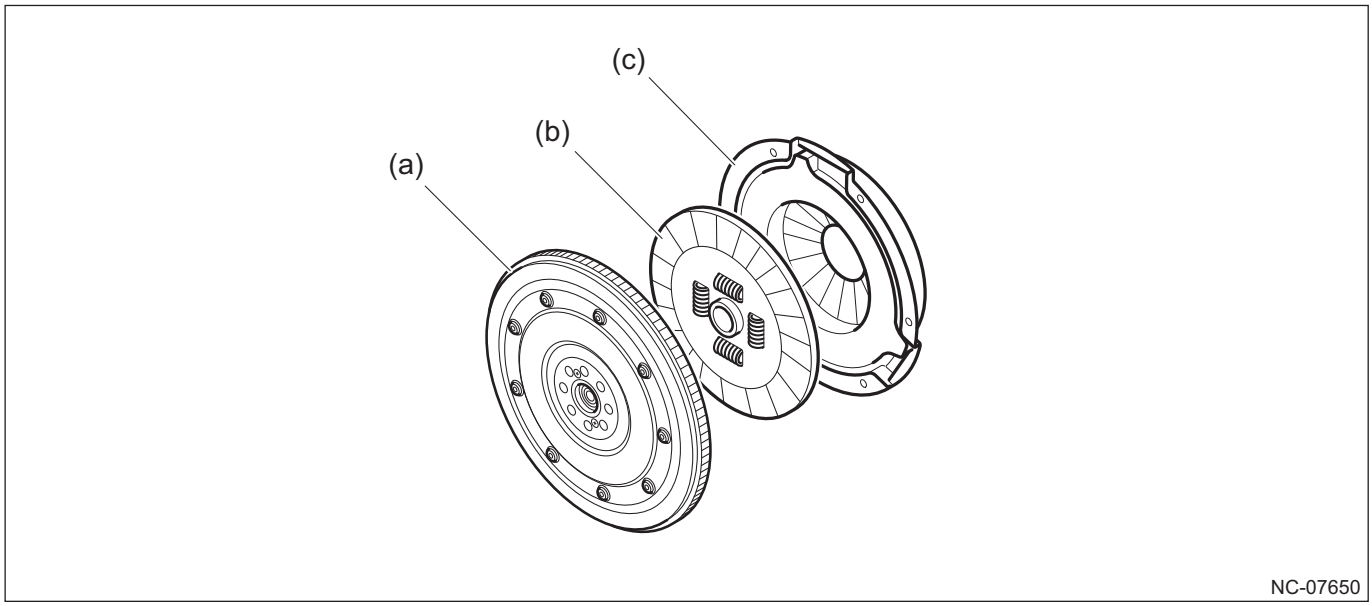
Also, the damper characteristics are optimized to support the higher engine output.



Flywheel

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

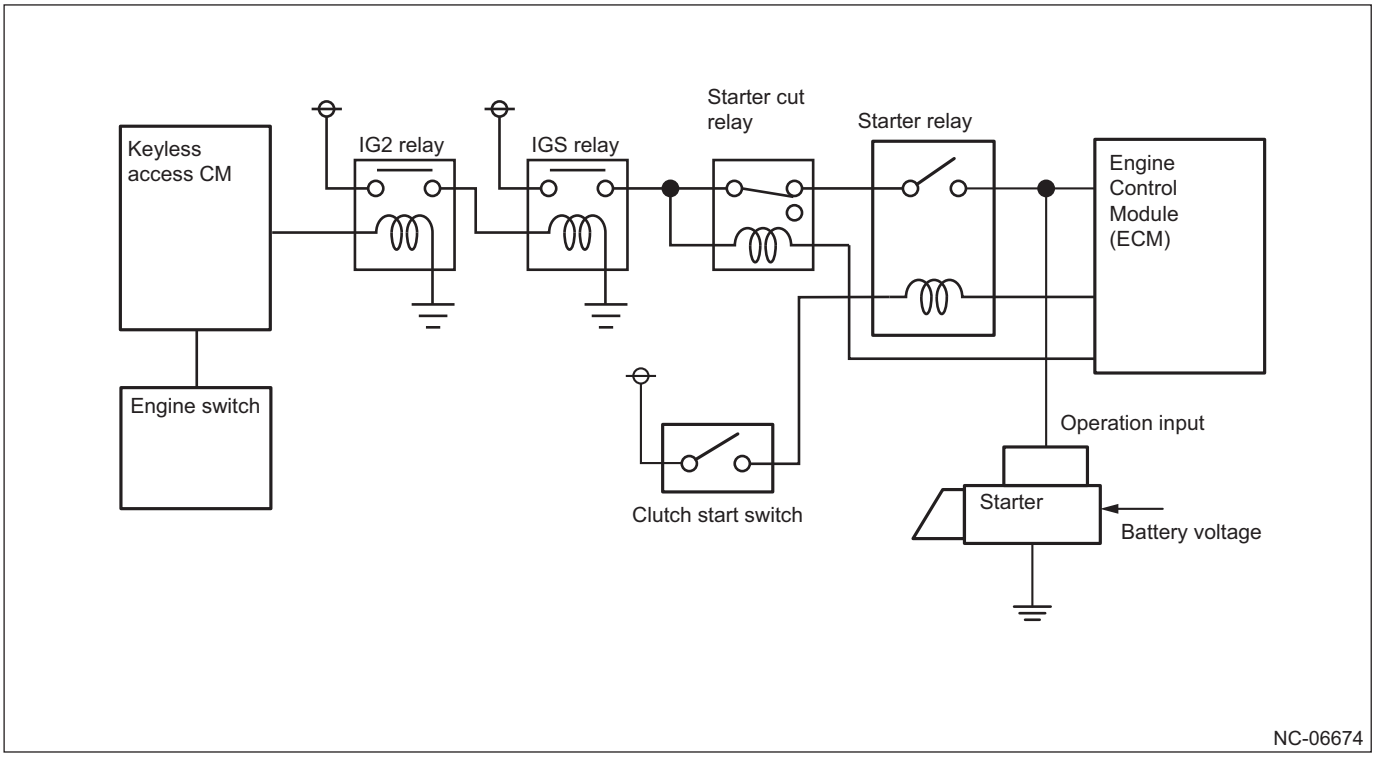
The characteristic of this type of flywheel is low vibration and noise because the engine output is transmitted from the crankshaft to the clutch disc via the drive plate and mass flywheel.



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

3.3.3 Construction and Operation

System diagram



System details

Clutch start system

A clutch start system is adopted for vehicles equipped with the TL70 manual transmission.

In this system, a clutch start switch is provided between the keyless access CM and starter relay circuit to prohibit starter operation while 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.

The clutch start switch is installed on the clutch pedal bracket.

3.4 TL70 Manual Transmission

3.4.1 Overview

Overview

A TL70 6-speed manual transmission assembly is adopted.

The gear strength is increased to support the higher engine output.

A carbon synchronizer is adopted for the frequently used 4th speed synchronizer mechanism, achieving both a light shift feel and durability.

Sliding ball bearings are adopted for the shift fork rod support to reduce friction during operation and ensure a good shift feel when driving or stationary.

Low viscosity gear oil and thrust needle bearings are adopted to reduce the shift operation effort during low temperatures.

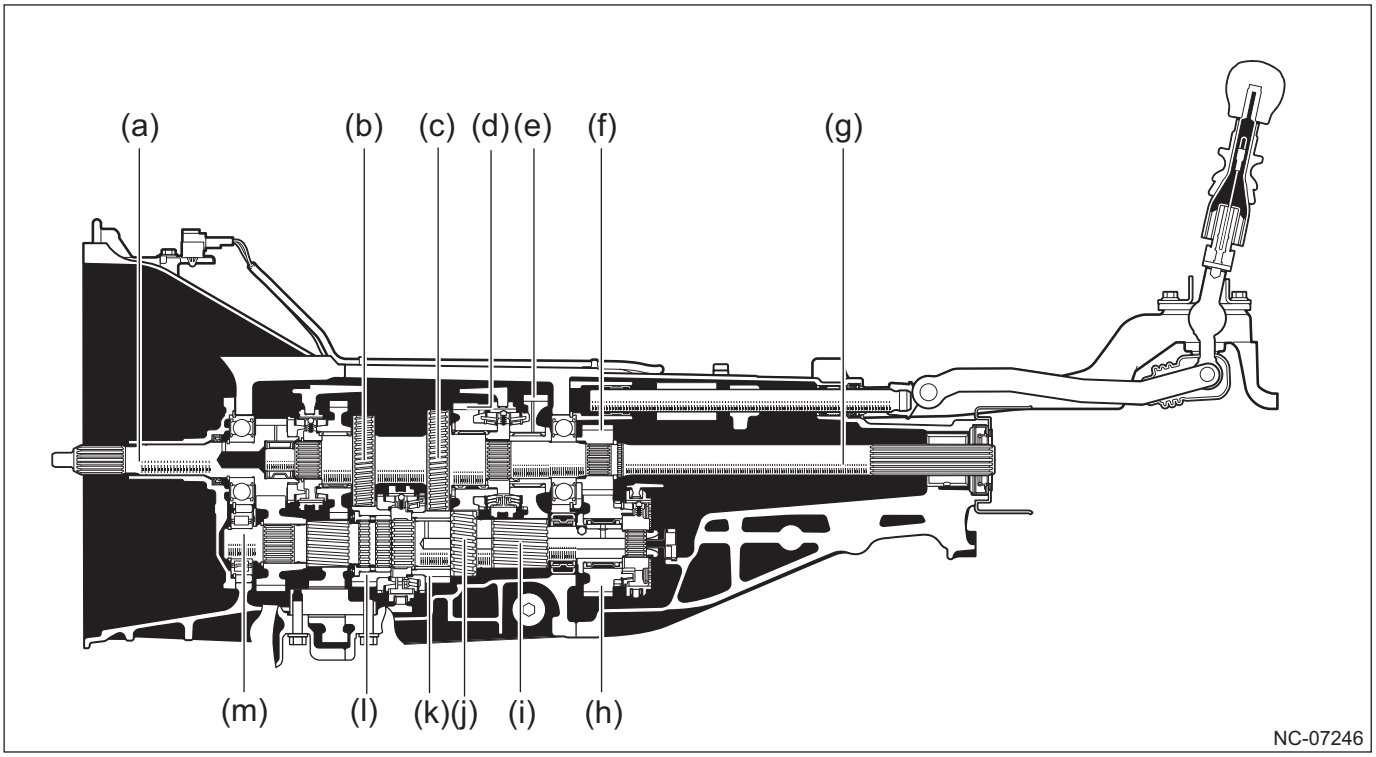
Specifications

Transmission specifications

Engine type	FA24
Transmission type	TL70
Driving method	FR (rear wheel drive)
Type	Forward: Always engaged type Reverse: Always engaged type
1st speed gear ratio	3.626
2nd speed gear ratio	2.189
3rd speed gear ratio	1.541
4th speed gear ratio	1.213
5th speed gear ratio	1.000
6th speed gear ratio	0.767
Reverse	3.438
Name of oil used	MT Gear Oil LV75W (SAE75W, API GL-4)
Weight (including gear oil) (Ib (kg))	94.59 (42.9)
Oil capacity (US qt (liters, Imp qt))	2.3 (2.2, 1.9)

3.4.2 Component

Component layout drawing



(a) Input shaft
(b) 4th driven gear
(c) 3rd driven gear
(d) 2nd driven gear
(e) 1st driven gear
(f) 6th driven gear
(g) Output shaft
(h) 6th drive gear
(i) 1st drive gear
(j) 2nd drive gear
(k) 3rd drive gear
(l) 4th drive gear
(m) Driven shaft (counter shaft)

Component details

Cases

High rigidity is ensured due to the rib layout and case shape based on FEM analysis.

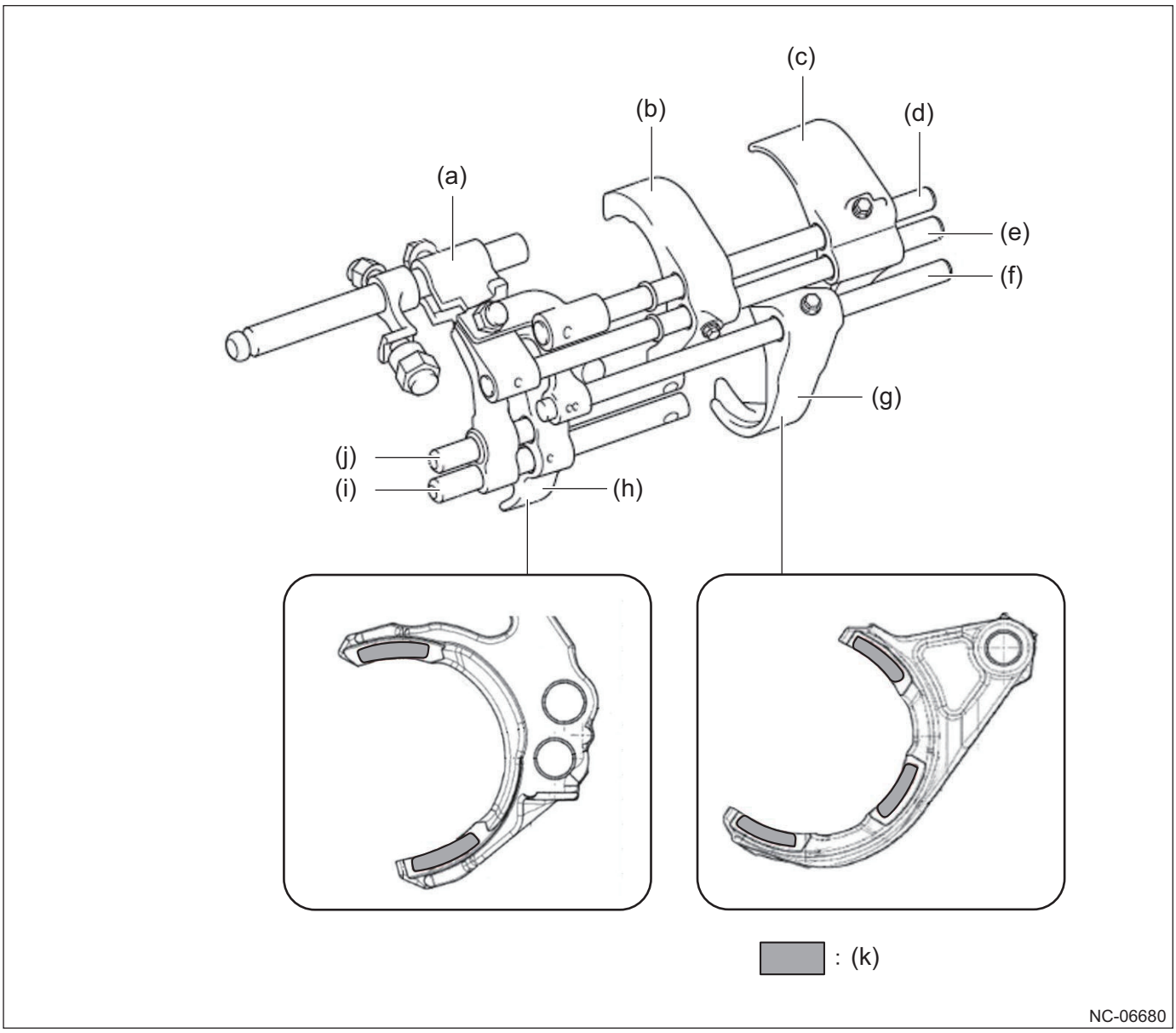
A housing, case, and cover made of cast aluminum are adopted.

Shift and select mechanism

A triple cone synchronizer mechanism is adopted for the 1st speed to 3rd speed for excellent operability and durability.

The shift fork shaft slide mechanism and shift detent mechanism reduce friction, clarify the neutral position, and improve the quick shift feeling.

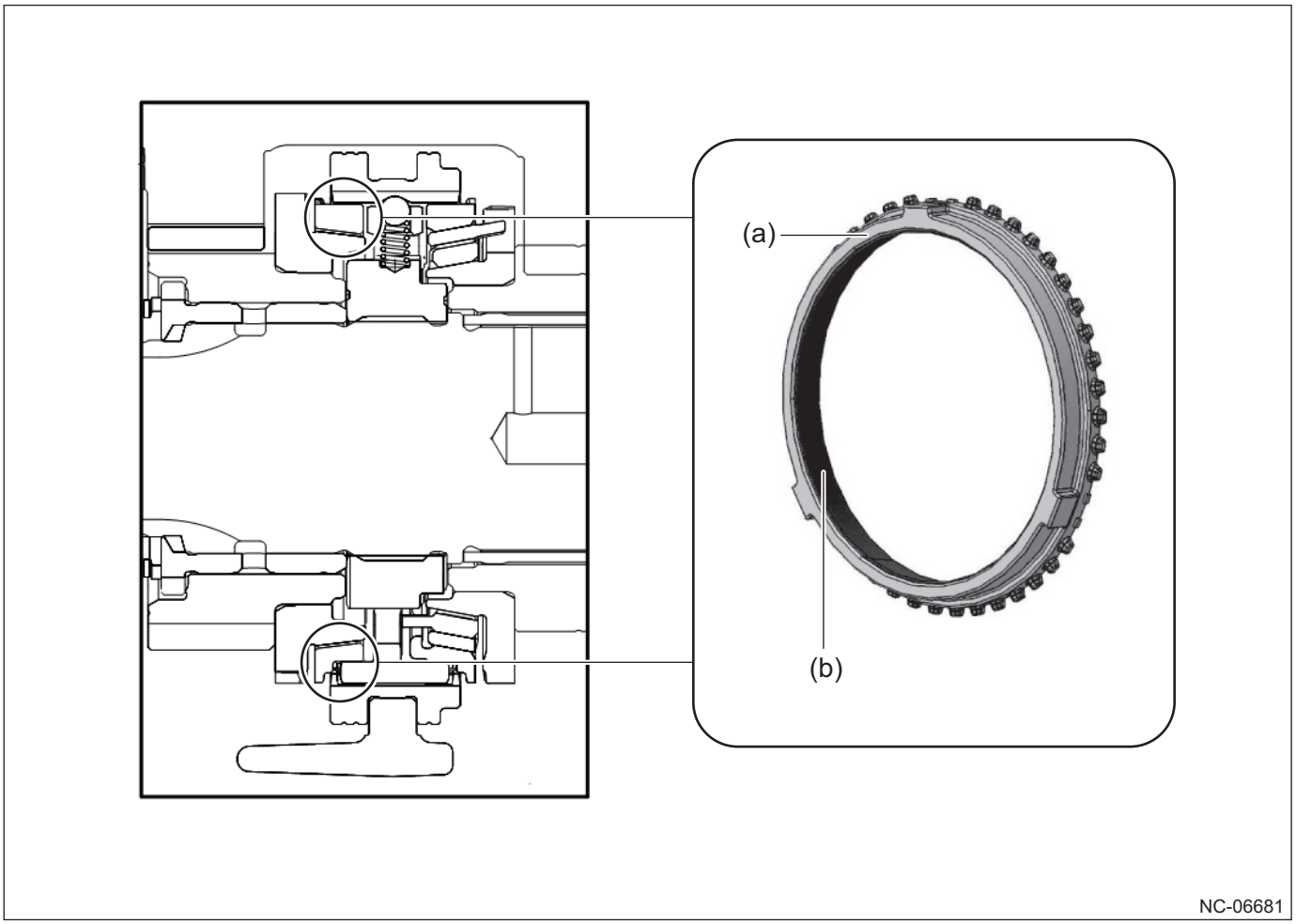
A peak pad made of resin is adopted for the 3rd speed/4th speed shift fork and 6th speed shift fork to support the higher engine output.



(a) Interlock block
(b) 1st speed/2nd speed shift fork
(c) 5th speed/reverse shift fork
(d) Main shift fork shaft
(e) Shift fork shaft No. 2
(f) Shift fork shaft No. 3
(g) 3rd speed/4th speed shift fork
(h) 6th speed shift fork
(i) Shift fork shaft No. 5
(j) Shift fork shaft No. 4
(k) Resin peak pad

■ Carbon synchronizer

Carbon friction material is adopted on the inner side of the synchronizer ring for the frequently used 4th speed, achieving both a light shift feel and durability even while maintaining a single cone structure.

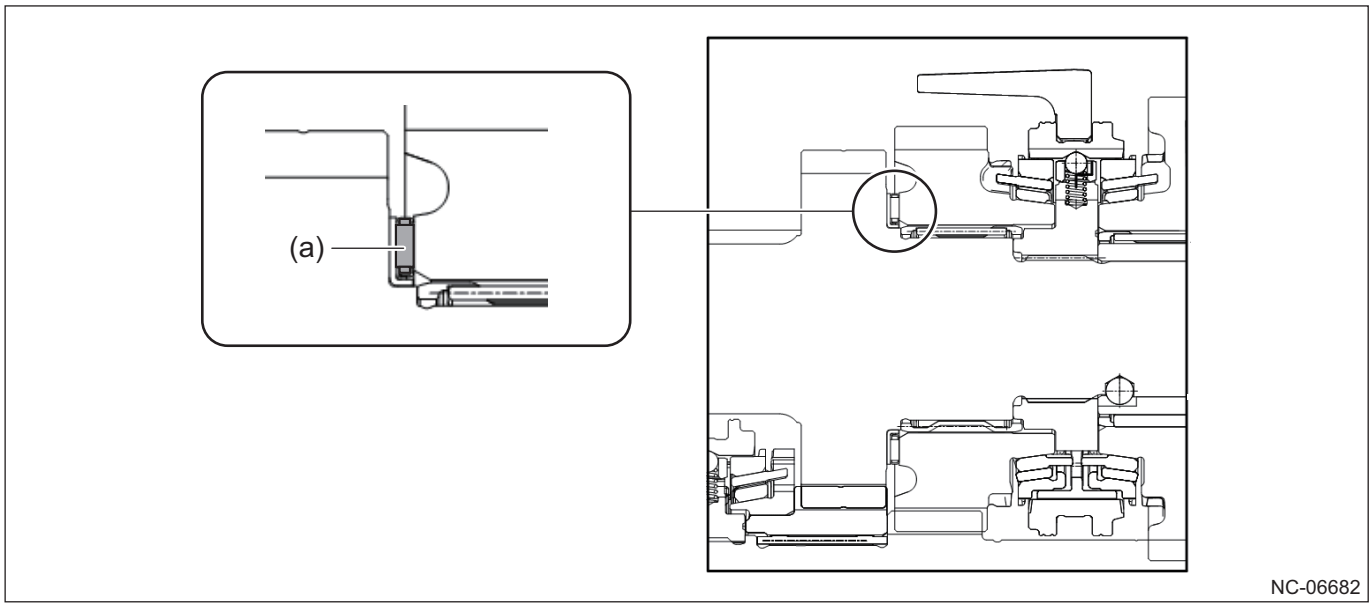


(a) 4th speed synchronizer ring

(b) Carbon friction material

■ Thrust needle bearing

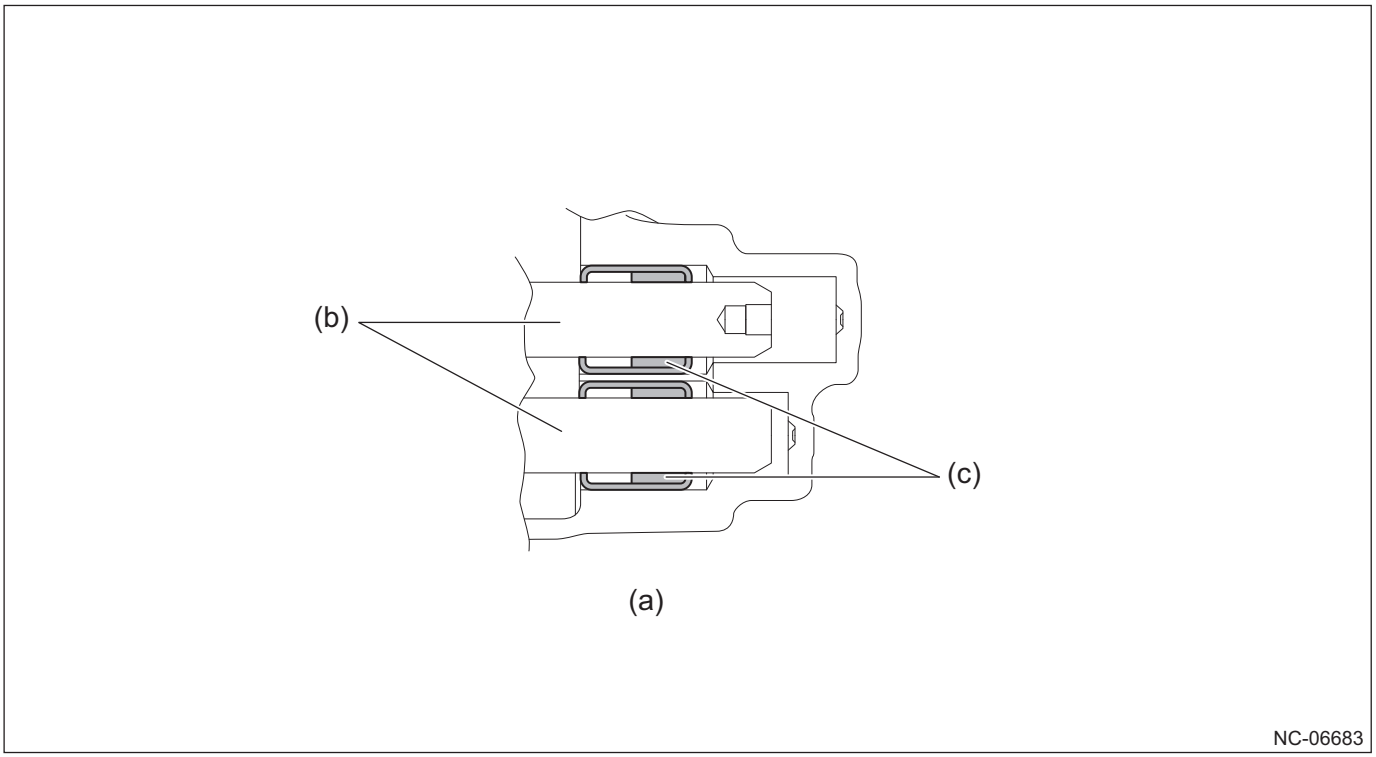
Thrust needle bearings are adopted on the end face of the 2nd speed gear to reduce the operation effort for shifting to 2nd speed and improve shift operability during low temperatures.



(a) Thrust needle bearing

■ Sliding ball bearings

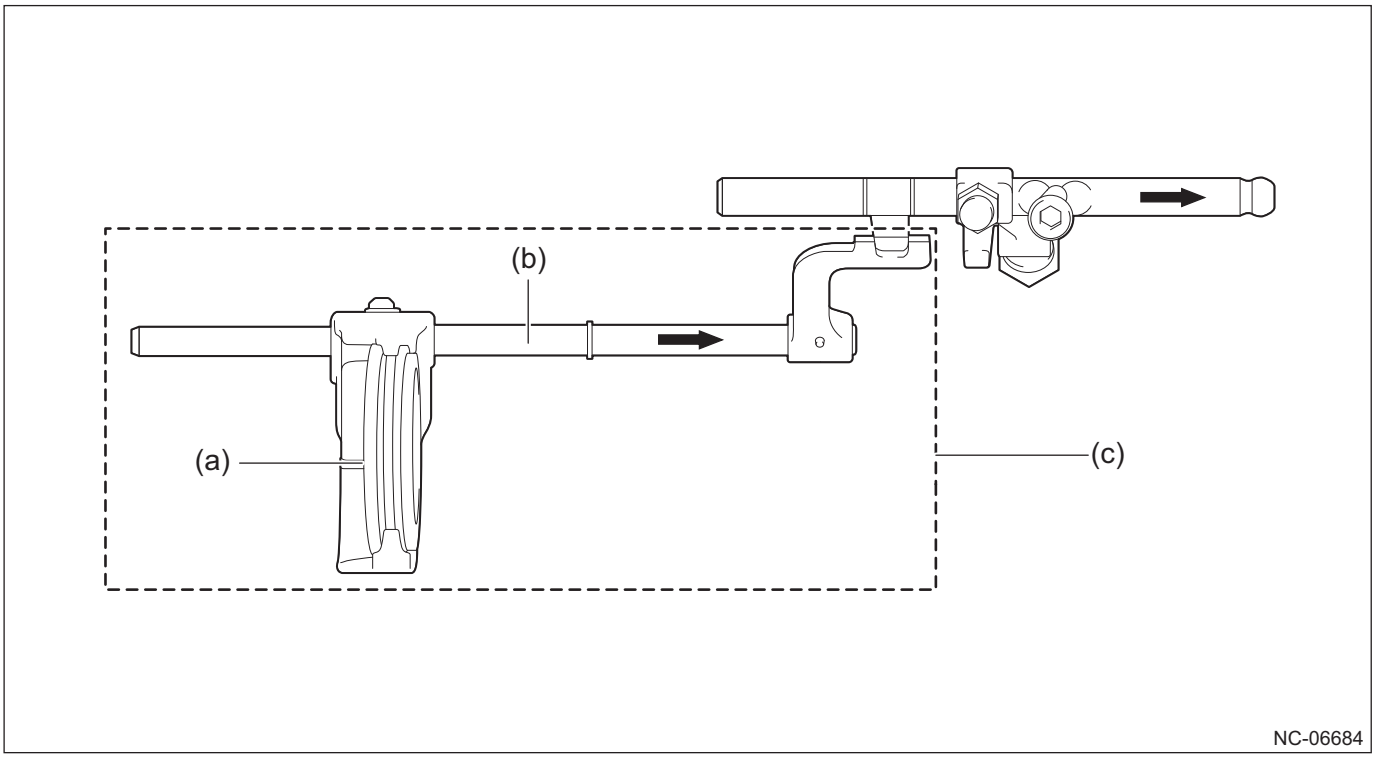
Sliding ball bearings are adopted for the shift fork shaft support to reduce friction during operation.



(a) Shift fork shaft support
(b) Shift fork shaft
(c) Sliding ball bearings

■ Shift fork shaft slide mechanism

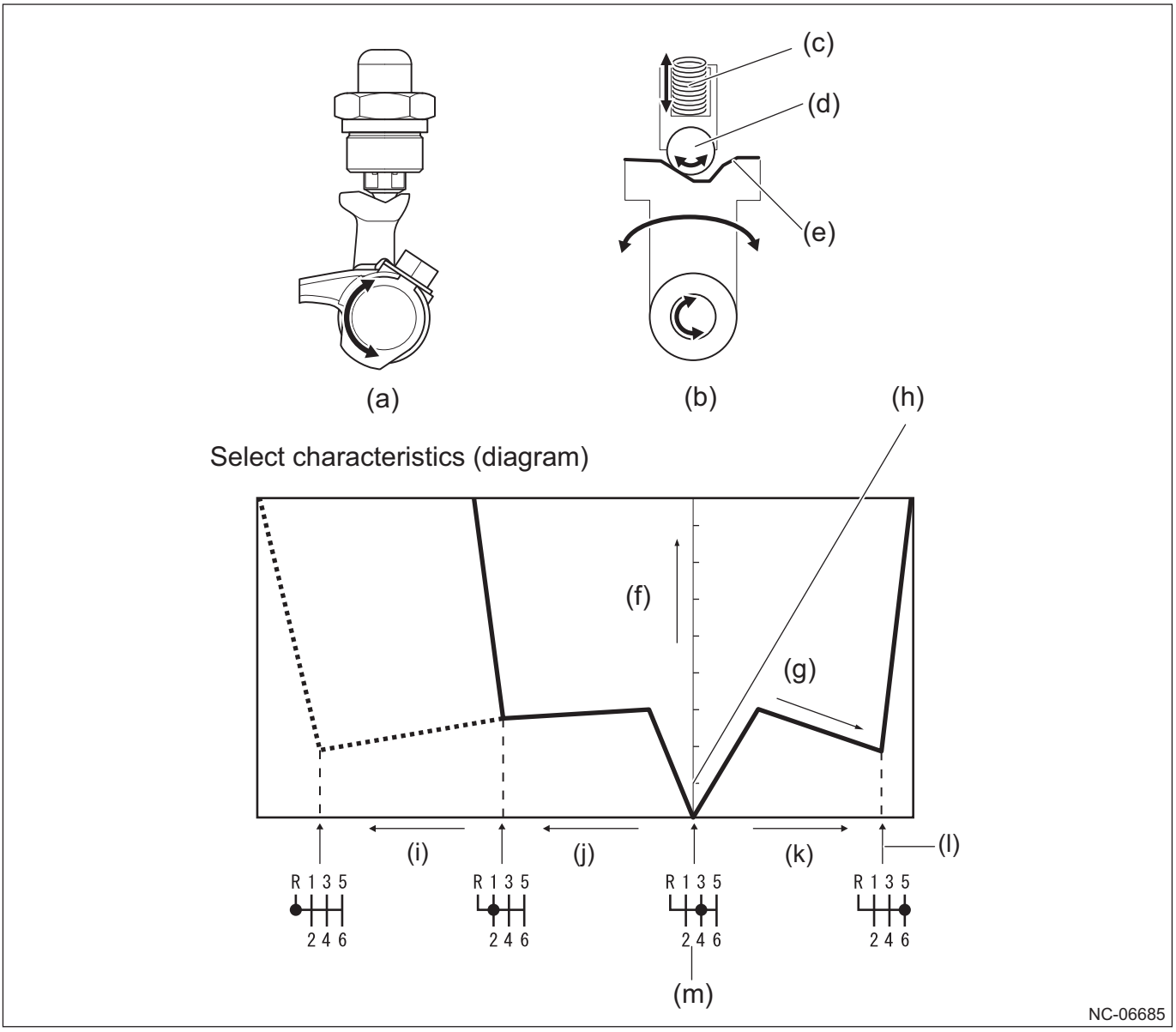
All of the shift forks are fixed to the shift fork shaft and a method that slides the entire fork shaft is adopted to reduce the friction during operation.



(a) Shift fork
(b) Shift fork shaft
(c) Entire fork shaft slides

■ Shift detent mechanism

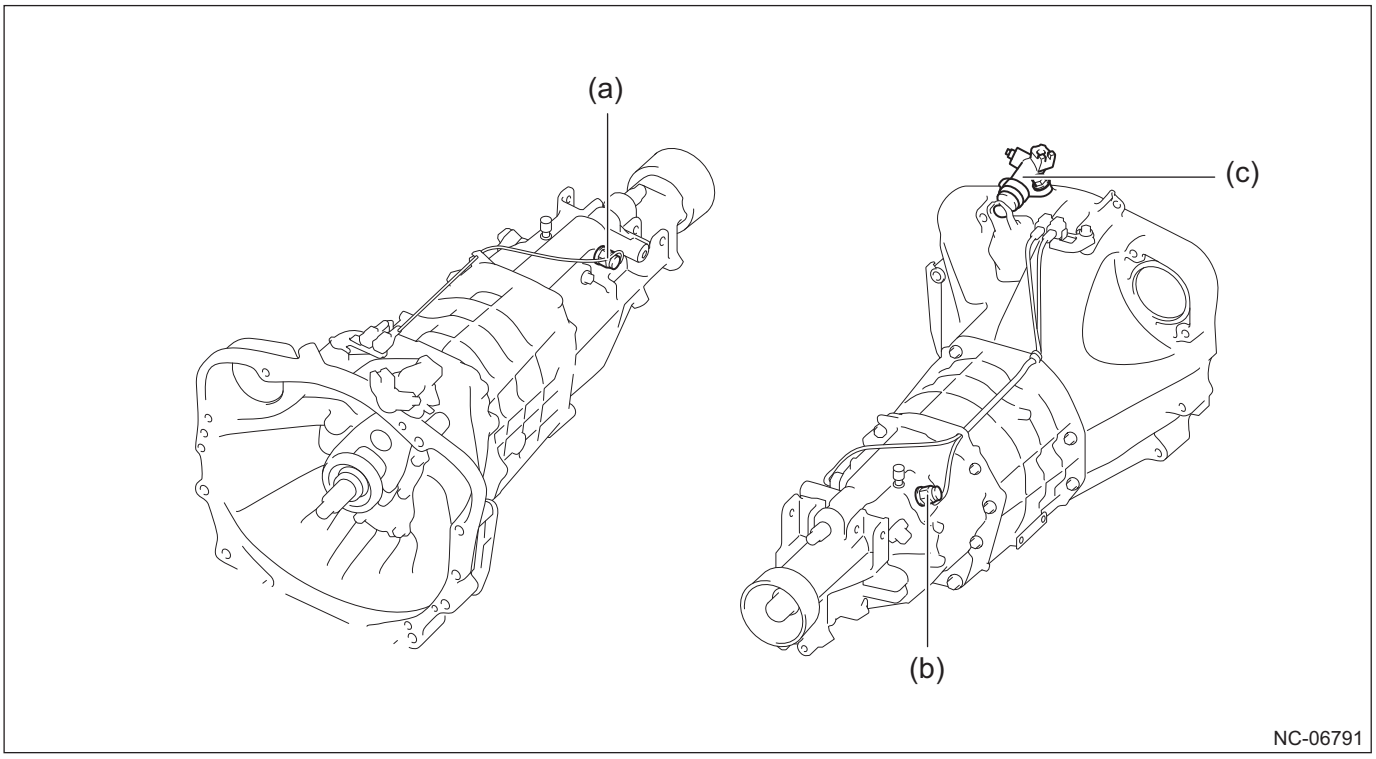
A ball plunger type of shift detent is adopted, and a nonlinear cam is adopted to clarify the neutral position and enable a quick select operation with negative gradient characteristics.



(a) Cam type
(b) Structure of cam type
(c) Spring
(d) Ball
(e) Cam profile (controls load)
(f) Operation effort
(g) Negative gradient
(h) Easy-to-understand neutral position (click feel)
(i) R side
(j) 1st-2nd speed side
(k) 5th-6th speed side
(l) Select stroke
(m) Neutral position

Switch layout

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



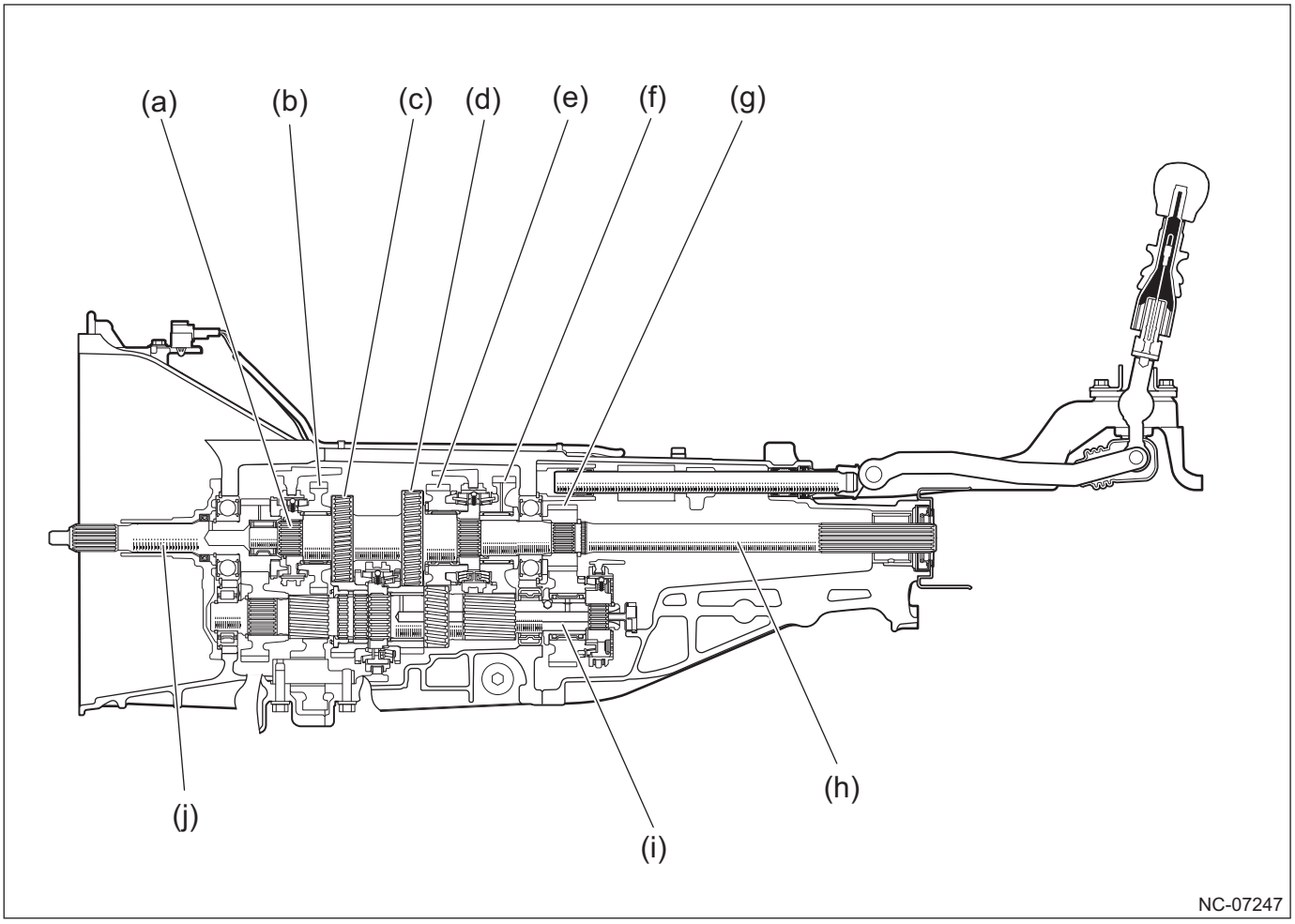
(a) Neutral position switch
(b) Back-up light switch assembly
(c) Operating cylinder

3.4.3 Construction and Operation

Power transmission mechanism

Gear train

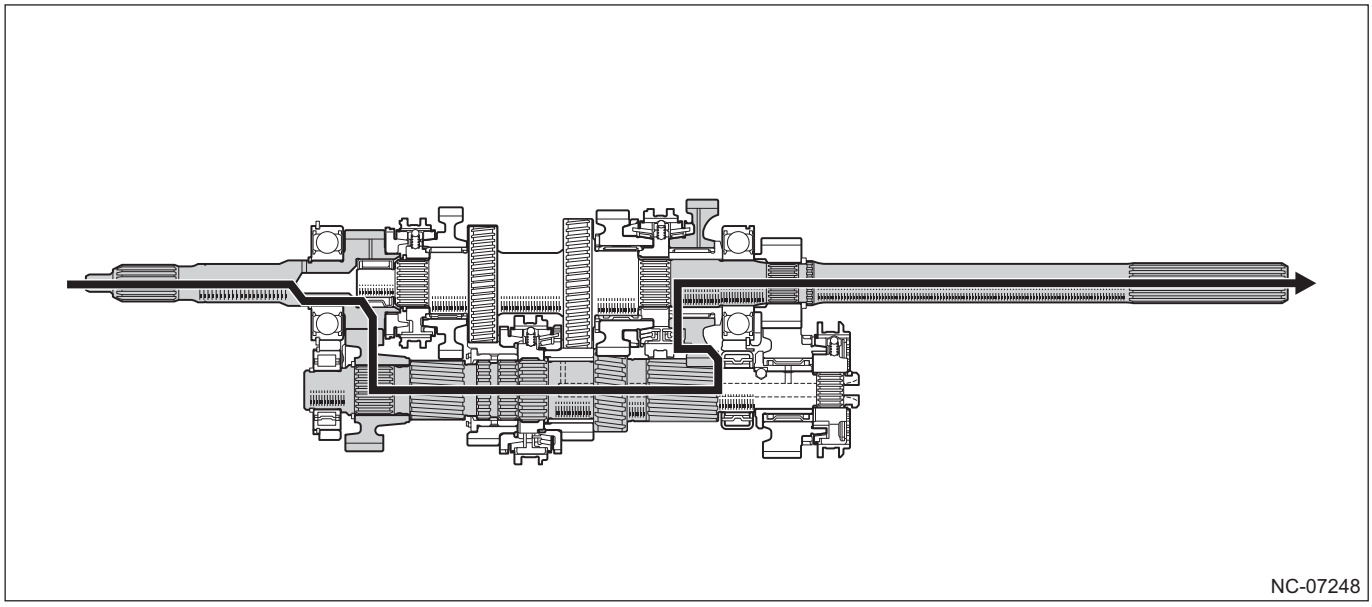
In the gear train, direct connection is used for 5th speed and O/D is used for 6th speed. Also, the order of the gear arrangement from the front is 5th, reverse, 4th, 3rd, 2nd, 1st, and 6th.



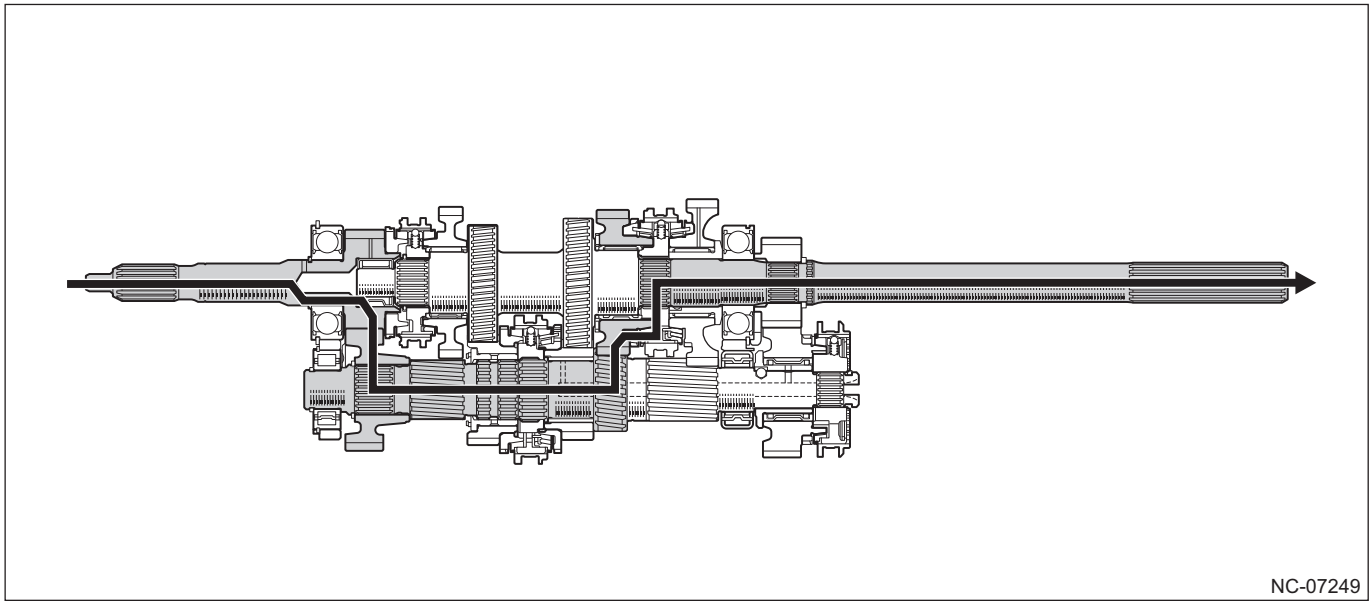
(a) 5th speed
(b) Reverse gear
(c) 4th speed
(d) 3rd speed
(e) 2nd speed
(f) 1st speed
(g) 6th speed
(h) Output shaft
(i) Driven shaft (counter shaft)
(j) Input shaft

■ Operation

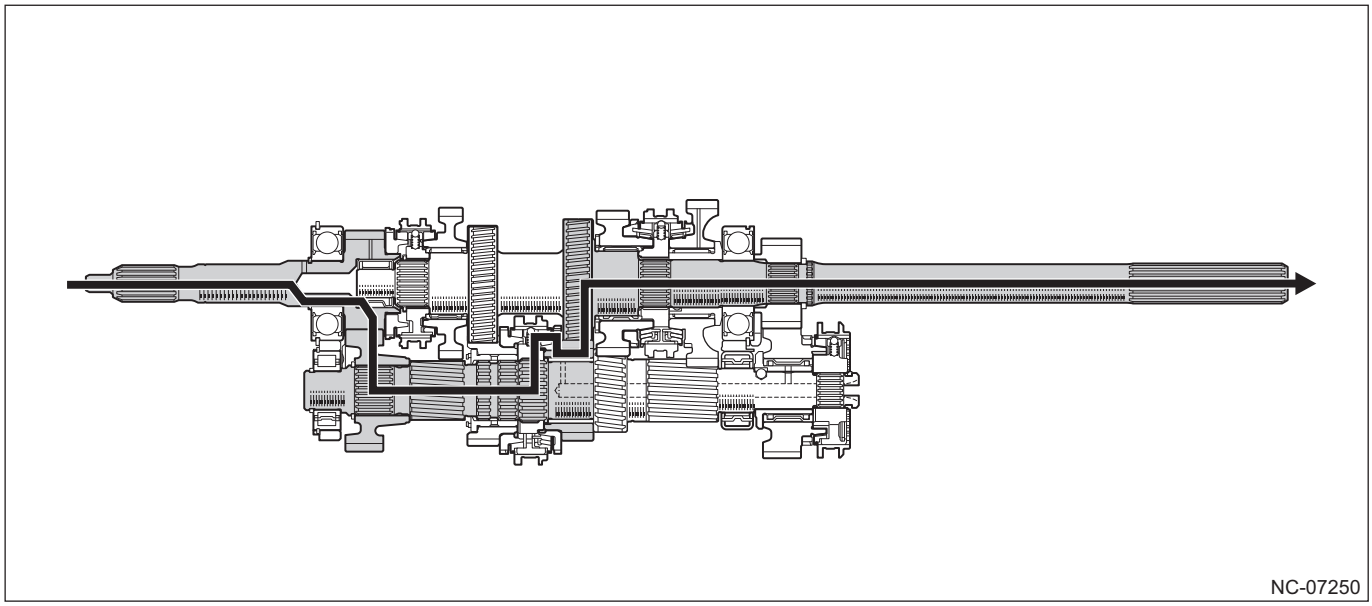
Gear train operation (1st speed)



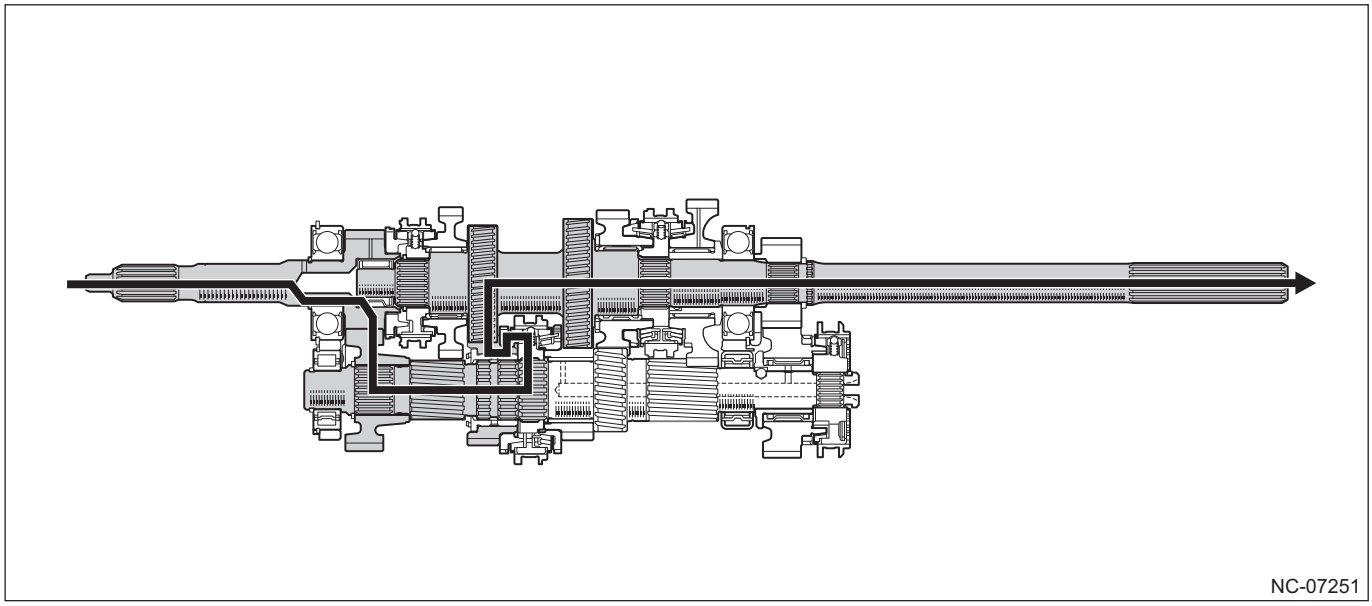
Gear train operation (2nd speed)



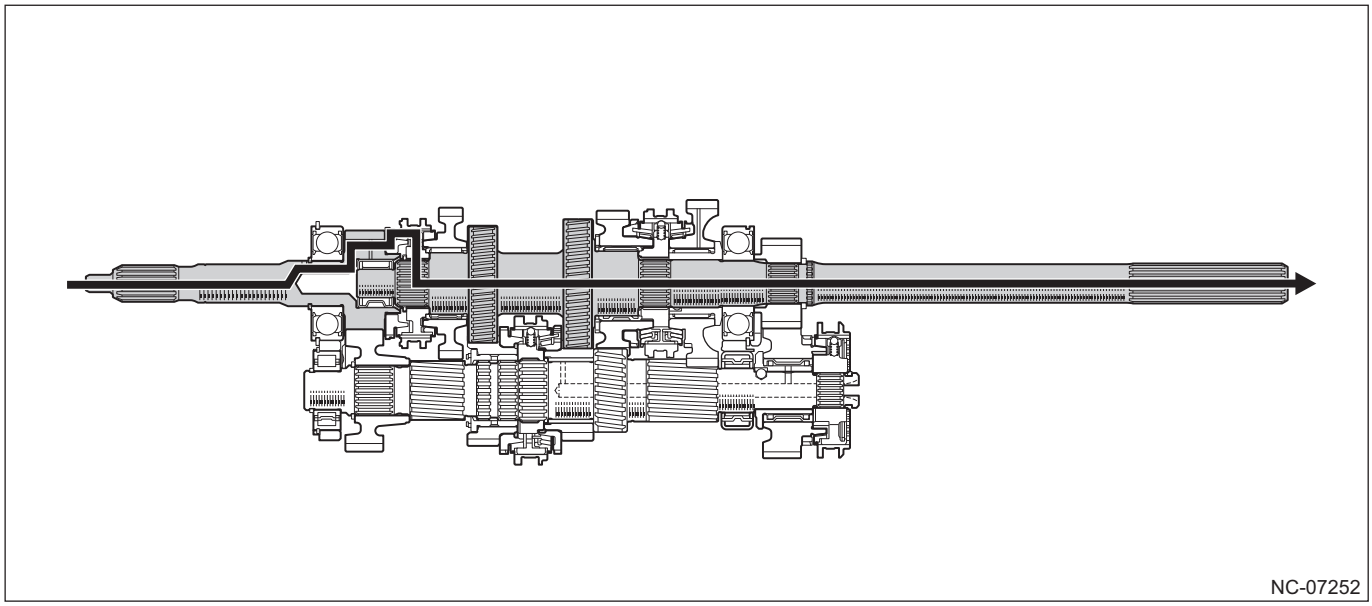
Gear train operation (3rd speed)



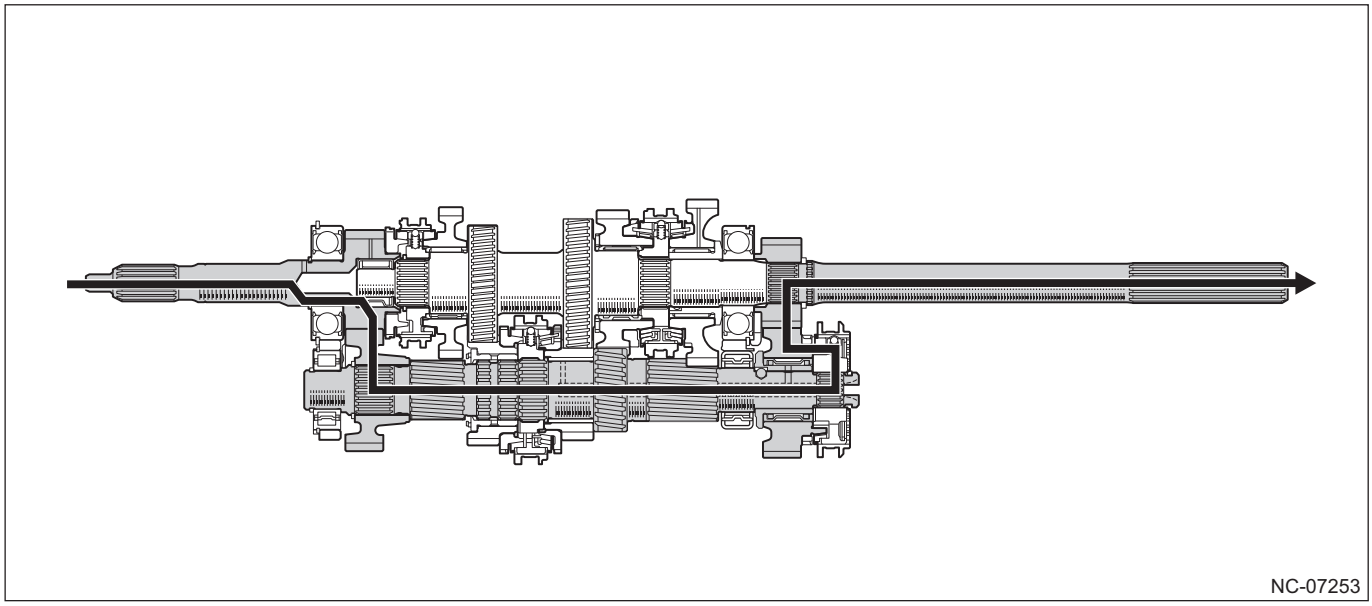
Gear train operation (4th speed)



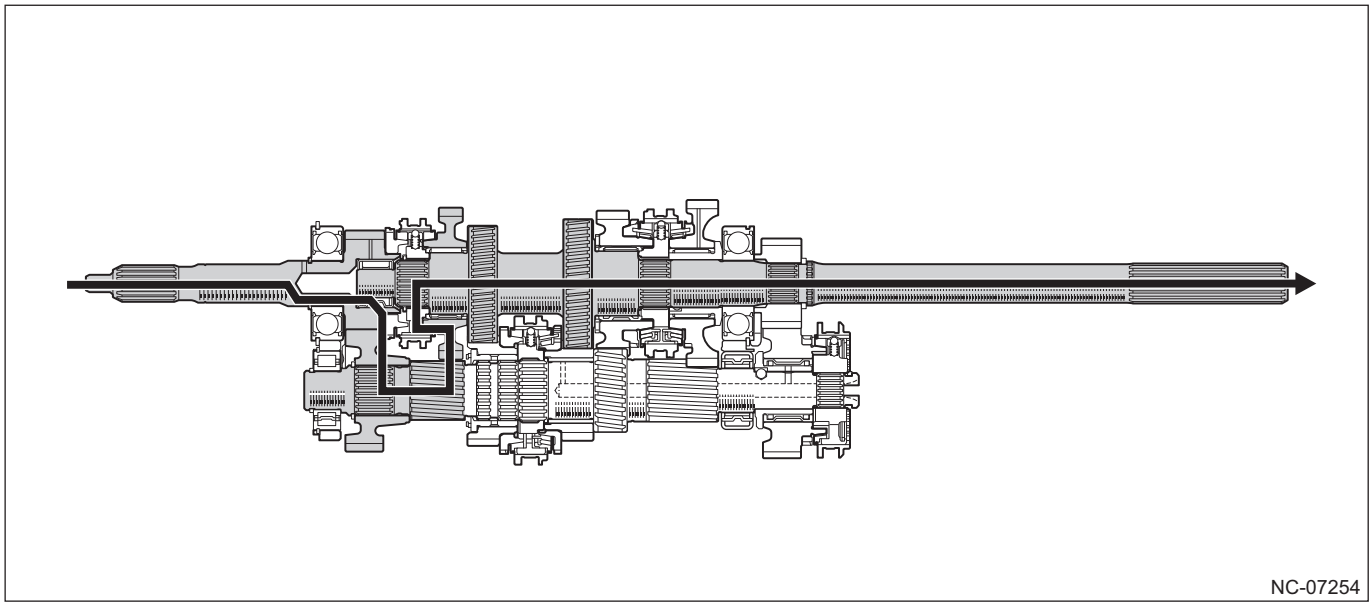
Gear train operation (5th speed)



Gear train operation (6th speed)



Gear train operation (reverse)



3.5 TX6A Automatic Transmission

3.5.1 Overview

Overview

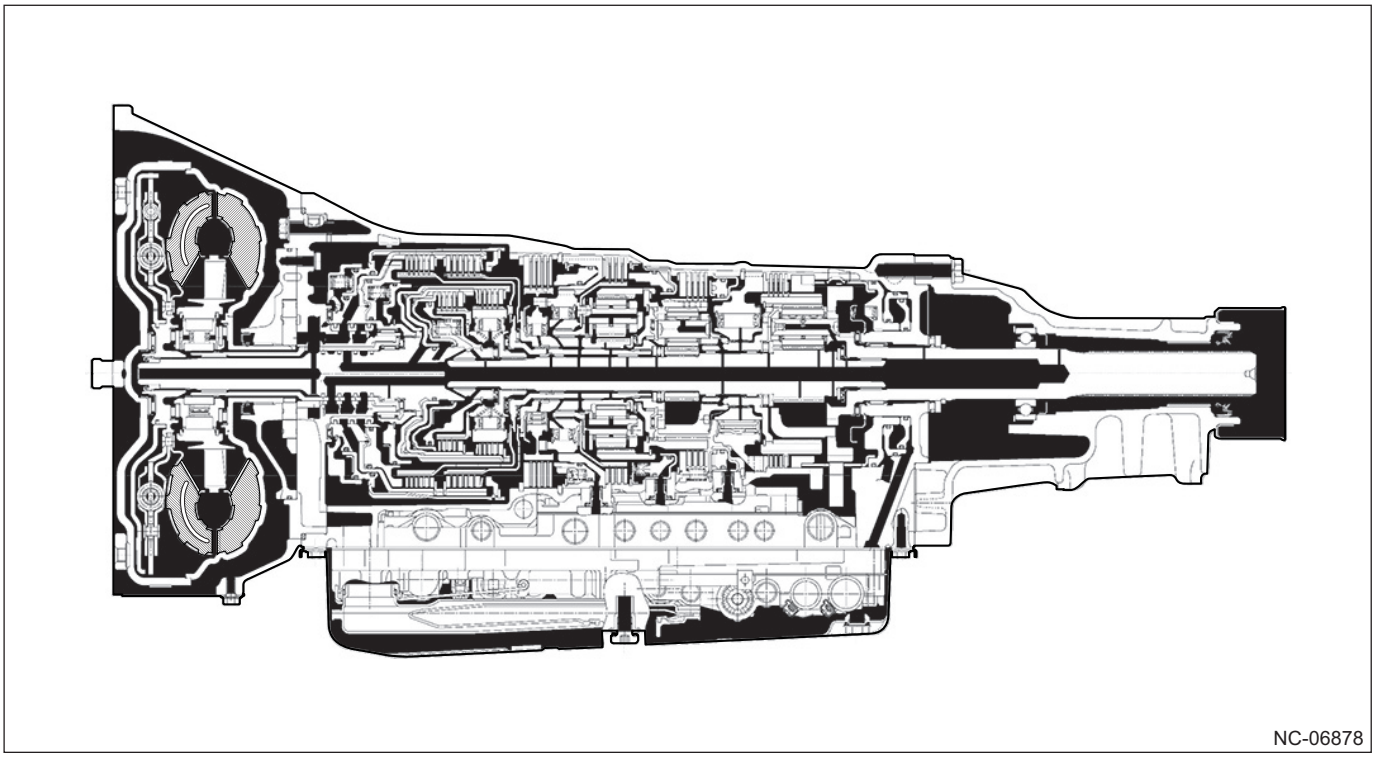
A TX6A 6-speed automatic transmission (E-6AT) is adopted.

The capacity of the gear train and the oil pressure control mechanism is increased and the latest electronic control is performed for smooth shifting characteristics and excellent fuel efficiency.

The torque converter capacity is increased and the number of clutch and brake discs is increased to support the higher engine output.

Auto fluid WS is adopted as the automatic transmission fluid. Viscosity on the high temperature side is equivalent to conventional ATF, and the viscosity is decreased in the actual operating temperature range while maintaining the durability of AT to reduce dragging loss and ensure fuel efficiency.

The AT oil filler tube and level gauge are discontinued, and an oil level detection mechanism using the overflow method is adopted. For the detailed oil refilling and adjustment procedures, refer to the repair manual.


NC-06878

TX6A automatic transmission

Development objectives

- Achieve a lighter and more compact design befitting of a class-leading model
- Achieve highly responsive and appropriate acceleration and deceleration that follows the intentions/operations of the driver
- Achieve excellent fuel efficiency under various driving conditions
- Achieve a gradual and smooth shift feeling
- Achieve excellent drivability
- Achieve excellent quietness when driving at high speed

Development item list (○ : Applicable, -: Not applicable)

Item		Sports performance	Power performance	Fuel efficiency	Lightweight/ compact	Shift feeling	Drivability	Operability	Quietness	Quality
6-speed gear train		-	○	○	○	○	○	-	○	○
Torque converter		-	○	○	○	-	-	-	○	-
Adoption of aluminum alloy carrier (front planetary)		-	-	-	○	-	-	-	-	-
Adoption of new friction material		-	-	○	-	-	-	-	-	-
Adoption of non-crescent oil pump		-	-	○	○	-	-	-	-	-
Adoption of aluminum oil pump cover		-	-	-	○	-	-	-	-	-
Adoption of small transmission solenoid		-	-	-	○	-	-	-	-	-
Adoption of resin accumulator		-	-	-	○	-	-	-	-	-
Adoption of felt strainer		-	-	-	○	-	-	-	-	○
Control valve		○	-	-	-	○	-	-	-	-
AT control	Adoption of highly precise oil pressure control system	-	-	-	○	○	-	-	-	-
	Down shift control for deceleration	-	-	○	-	-	-	-	-	-
	Lock-up control	-	-	○	-	-	-	-	-	-
	Slip lock-up control	-	-	○	-	-	-	-	-	-
	Adaptive control	-	-	-	-	○	○	○	-	-
	Blipping down shift control	○	-	-	-	○	-	-	-	-
	Over-revving prevention up shift control	-	-	-	-	-	-	-	-	○
	Lubrication orifice switching control	-	-	-	-	-	-	-	-	○
Manual shift		-	-	-	-	-	-	○	-	-
Adoption of auto fluid WS		-	-	○	-	-	-	-	-	-
Adoption of oil level detection mechanism		-	-	-	-	-	-	-	-	○
ATF cooler (with warmer feature)		-	-	○	-	-	-	-	-	-

Specifications

Torque converter specifications

Transmission type	TX6A (E-6AT)
Installed engine	FA24
Type	3-element, single stage, 2-phase type (with lock-up mechanism)
Stall torque ratio	1.95

Transmission specifications

Transmission type		TX6A (E-6AT)
Installed engine		FA24
Type		Electronic control planetary gear type
Gear ratio	Gear position 1	3.538
	Gear position 2	2.060
	Gear position 3	1.405
	Gear position 4	1.000
	Gear position 5	0.713
	Gear position 6	0.582
	Reverse	3.168
Oil used		Auto fluid WS
Weight (including automatic transmission fluid)	lb (kg)	170.4 (77.3)
Oil capacity (including ATF cooler)	US qt (liters, Imp qt)	7.9 (7.5, 6.6)

Planetary gear specifications (number of gear teeth)

Transmission type		TX6A (E-6AT)
Installed engine		FA24
Front planetary	Sun gear	33
	Pinion gear (inner)	19
	Pinion gear (outer)	18
	Ring gear	75
Mid planetary	Sun gear	26
	Pinion gear	20
	Ring gear	66
Rear planetary	Sun gear	26
	Pinion gear	20
	Ring gear	66

Clutch specifications (number of sprags)

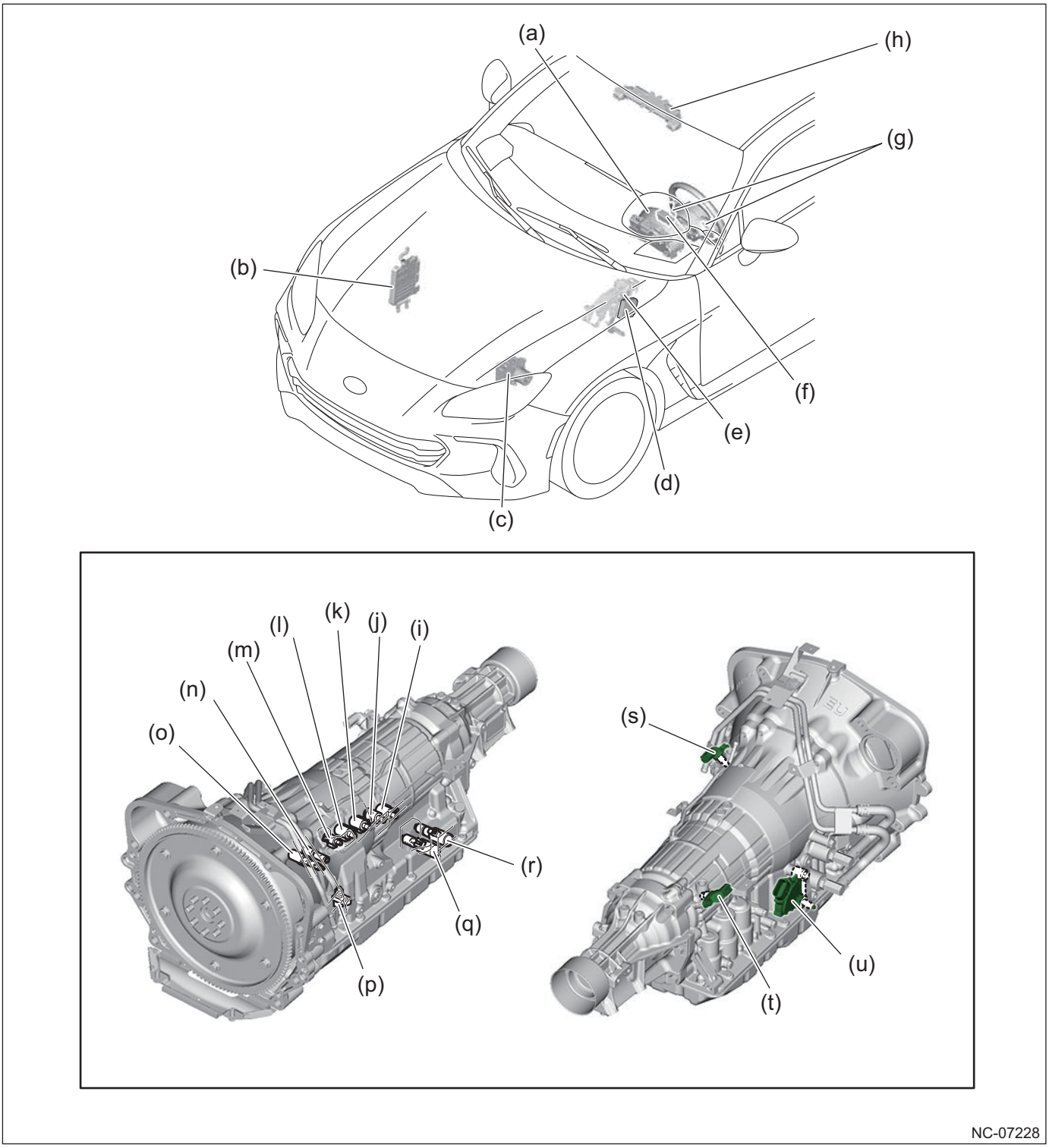
Transmission type		TX6A (E-6AT)
Installed engine		FA24
One-way clutch No. 1	F1	21
One-way clutch No. 2	F2	22
One-way clutch No. 3	F3	22
One-way clutch No. 4	F4	25

Friction element specifications (number of discs)

Transmission type		TX6A (E-6AT)
Installed engine		FA24
Clutch No. 1	C1	4
Clutch No. 2	C2	5
Clutch No. 3	C3	5
Clutch No. 4	C4	4
Brake No. 1	B1	3
Brake No. 2	B2	4
Brake No. 3	B3	4
Brake No. 4	B4	5

3.5.2 Component

Component layout drawing



(a) Combination meter
(b) Engine Control Module (ECM)
(c) VDC CM & H/M
(d) Transmission Control Module (TCM)
(e) Stop light switch assembly
(f) Console switch
(g) Paddle shift switch
(h) Stereo camera*
(i) Shift solenoid C (S3)
(j) Shift solenoid B (S2)
(k) Shift solenoid D (S4)
(l) Shift solenoid A (S1)
(m) Shift solenoid E (SR)
(n) Pressure solenoid A (SL1)
(o) Pressure solenoid D (SLT)
(p) ATF temperature sensor
(q) Pressure solenoid B (SL2)
(r) Torque converter clutch pressure solenoid (SLU)
(s) Turbine speed sensor
(t) Output speed sensor
(u) Inhibitor switch

*: *Models equipped with EyeSight*

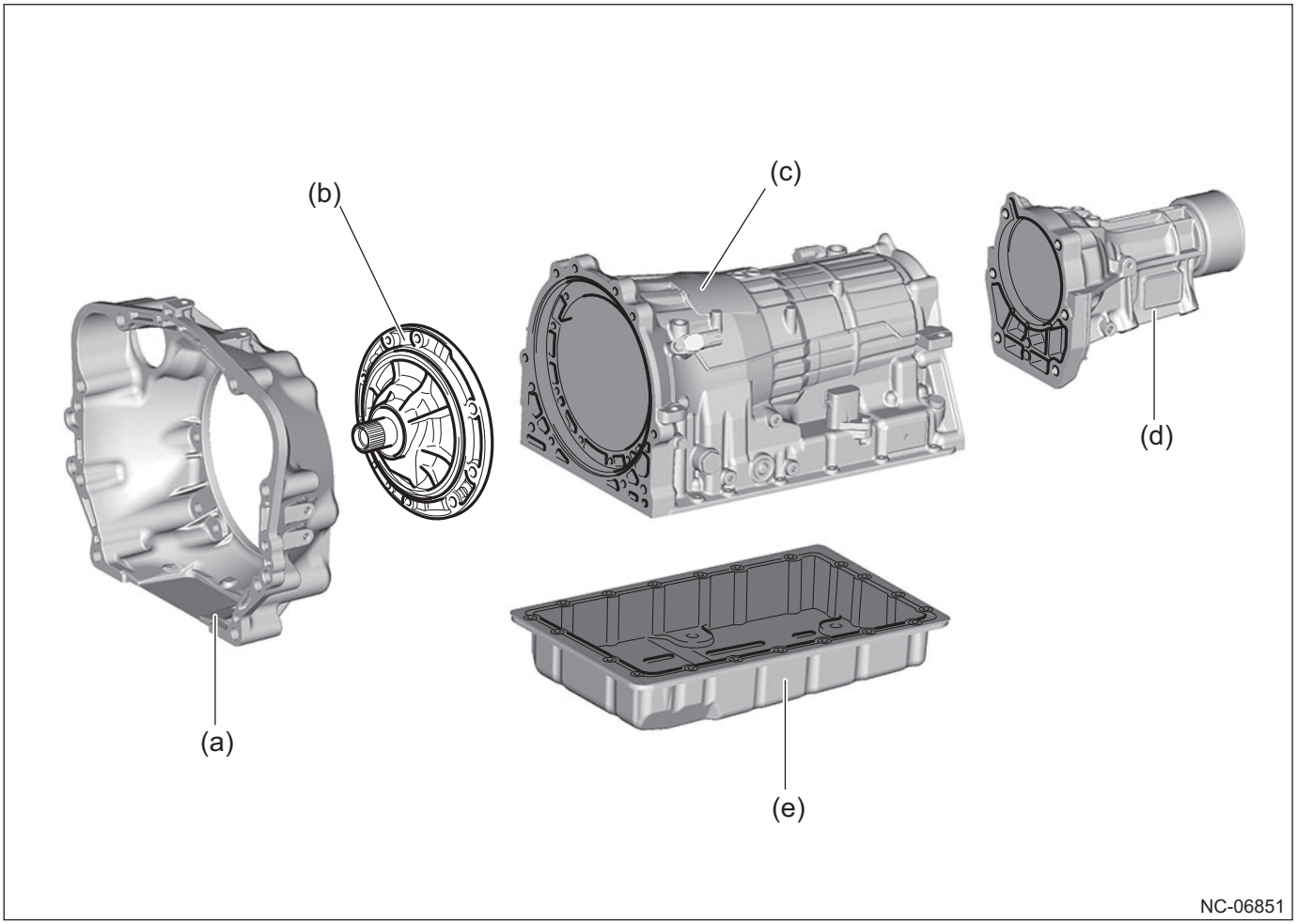
Component details

Cases

A converter case, ATF main case, and extension case made of an aluminum alloy are adopted to reduce weight, and the optimization of an efficient rib layout and case shape based on FEM analysis* reduces weight and ensures rigidity.

Reference

*: FEM (Finite Element Method) analysis is a structural analysis method used for the performance design of elements such as strength and reliability, vibration and noise, and collision safety.

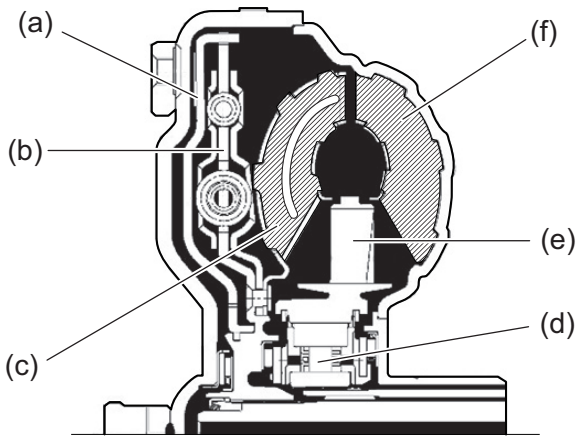


(a) Converter case
(b) Oil pump housing
(c) ATF main case
(d) Extension case
(e) Oil pan

Torque converter

A small and lightweight torque converter is adopted.

The vane shape inside the torque converter is optimized to ensure high transmission efficiency, excellent start-off and acceleration performance, and low fuel consumption characteristics.

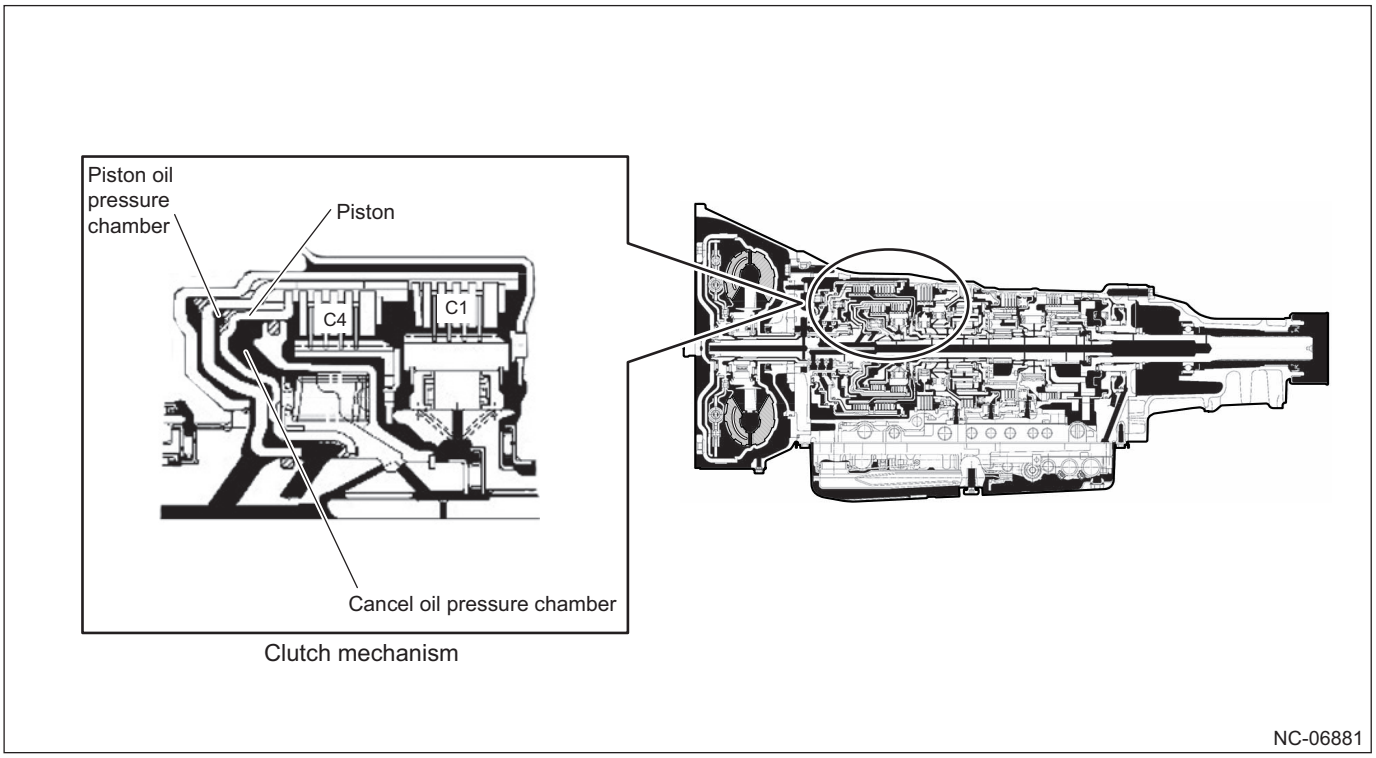


(a) Lock-up clutch
(b) Long traveling damper
(c) Turbine runner
(d) One-way clutch
(e) Stator
(f) Pump impeller

Clutch with centrifugal oil pressure cancel mechanism

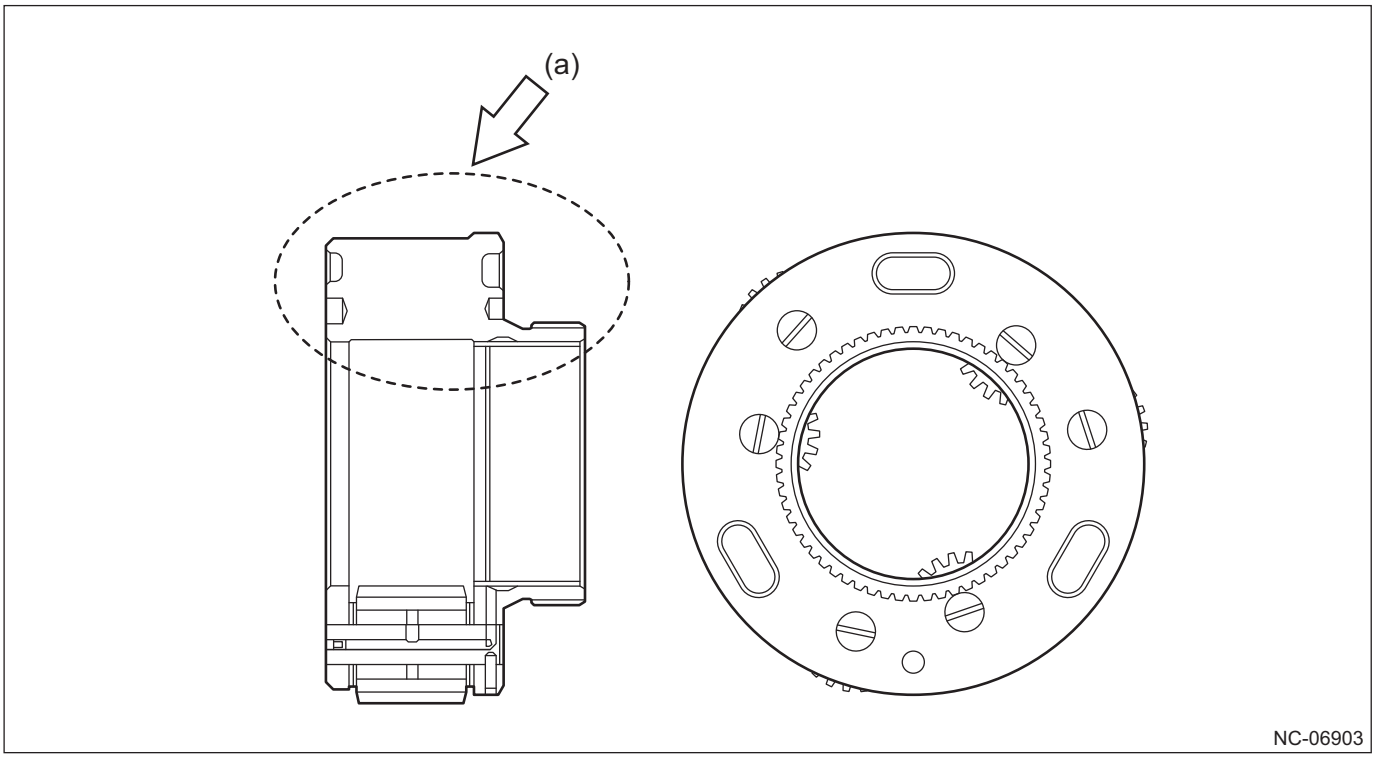
A centrifugal oil pressure cancel mechanism is adopted for the C1, C2, C3, and C4 clutch mechanisms that perform engagement and disengagement when shifting between the 2-3, 3-4, 4-5, and 5-6 speeds that require high responsiveness, achieving highly responsive and smooth shifting characteristics.

As the clutch rotation speed increases, centrifugal force acts on the oil inside the clutch, raising the oil pressure and resulting in early engagement. In addition, shifting shock may occur due to the difference in rotation speed between the input side and output side. In response, a cancel oil pressure chamber is provided that faces the piston oil pressure chamber in the clutch mechanism. This makes centrifugal oil pressure force of the same size act on the piston in the opposite direction, eliminating the effects of centrifugal force and achieving highly responsive shifting.



Aluminum carrier

Aluminum is adopted for the carrier of the front planetary gear, greatly reducing the weight. Integral molding is also adopted for the carrier and carrier cover, resulting in the discontinuance of welded parts, etc.

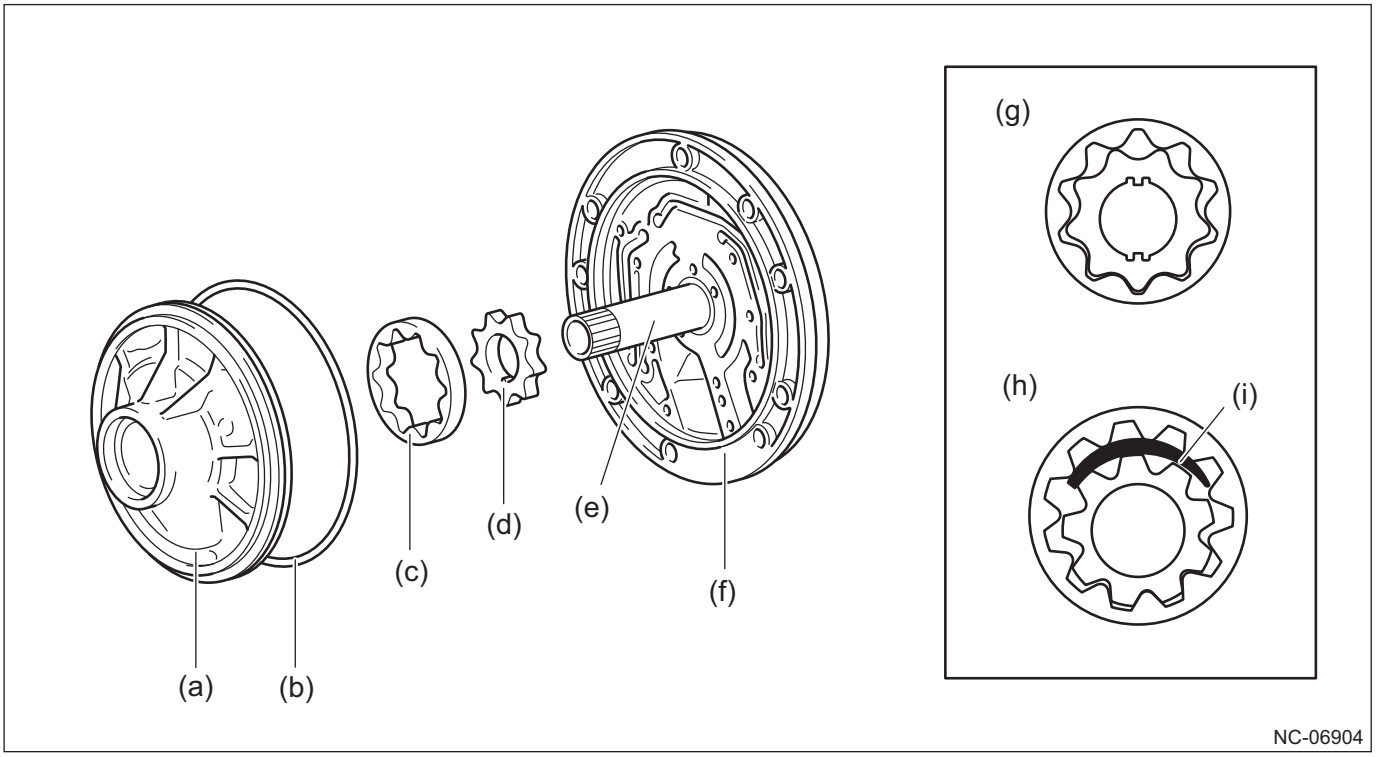


(a) Integral molding of carrier and carrier cover

Oil pump

A non-crescent oil pump is adopted. The non-crescent oil pump enables a lighter and smaller design due to the discontinuance of the crescent. This also increases the pump capacity efficiency during low speed rotation and reduces drive torque.

A pump cover made of an aluminum alloy is adopted. This reduces weight by approximately 40% compared to traditional oil pumps made of cast iron.



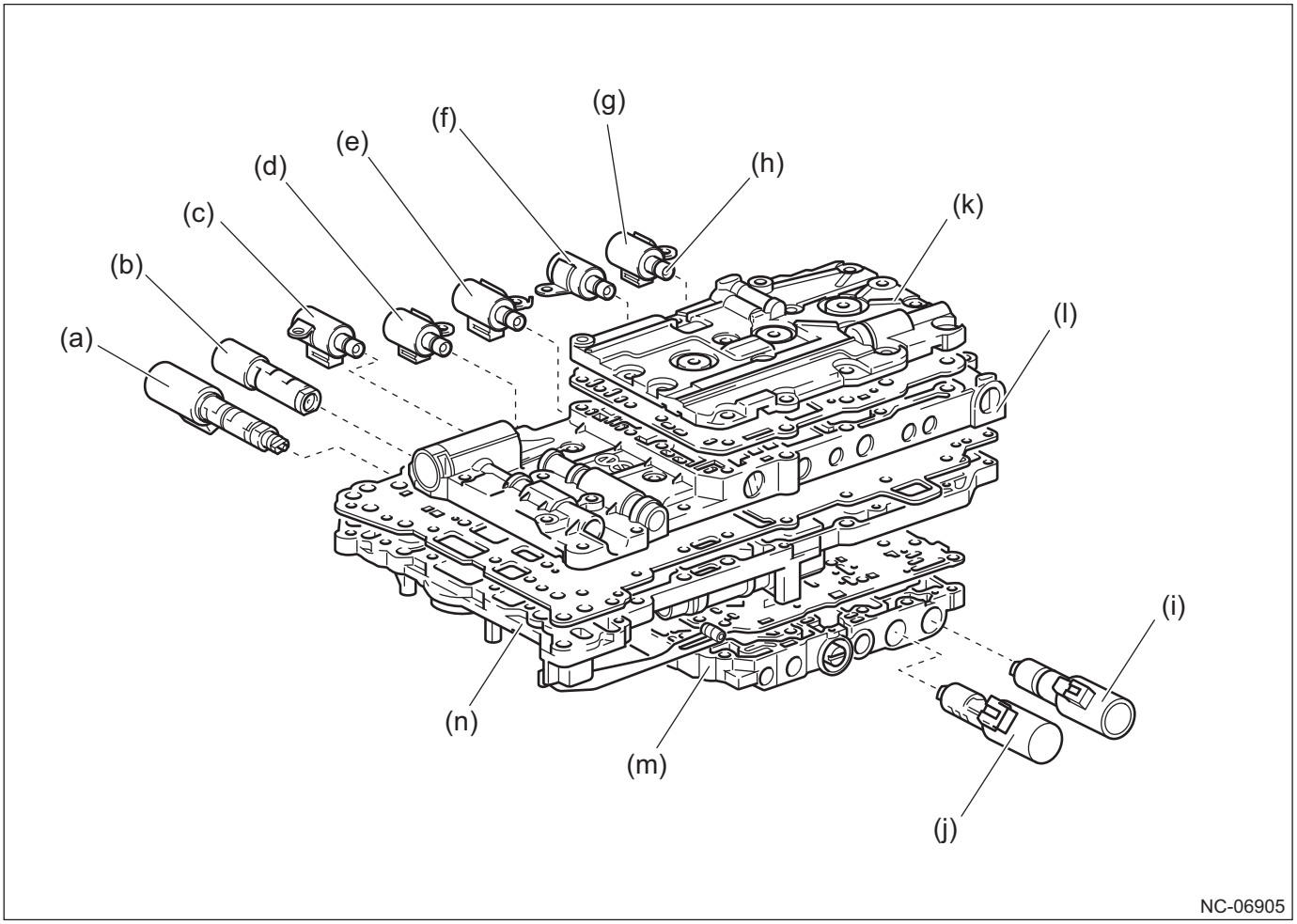
(a) Oil pump body
(b) O-ring
(c) Driven gear
(d) Drive gear
(e) Stator shaft
(f) Oil pump cover
(g) Non-crescent oil pump
(h) Reference: Crescent oil pump
(i) Crescent

Hydraulic control section

A valve body made of a light aluminum alloy and a structure divided into 4 upper and lower parts are adopted. Transmission solenoids and linear solenoids are installed to the valve body on the lower side.

A strainer is provided on the end of each transmission solenoid to prevent the entry of any foreign matter.

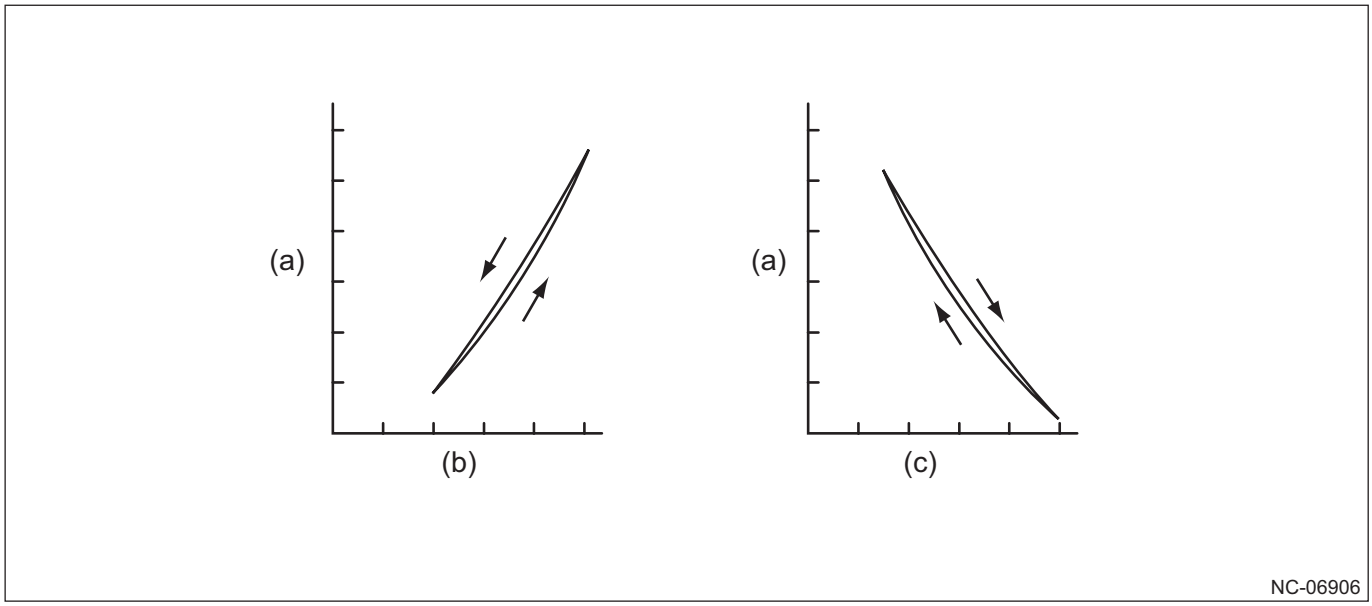
Specifications with excellent oil pressure responsiveness are adopted with the objective of achieving highly responsive shifting.



(a) Pressure solenoid D (SLT)
(b) Pressure solenoid A (SL1)
(c) Shift solenoid E (SR)
(d) Shift solenoid A (S1)
(e) Shift solenoid D (S4)
(f) Shift solenoid B (S2)
(g) Shift solenoid C (S3)
(h) Strainer
(i) Torque converter clutch pressure solenoid (SLU)
(j) Pressure solenoid B (SL2)
(k) Upper valve body No. 2
(l) Upper valve body
(m) Lower valve body No. 2
(n) Lower valve body

■ Linear solenoid

Weight is reduced by making the solenoid part of each of the pressure solenoid D (SLT), torque converter clutch pressure solenoid (SLU), and pressure solenoid A (SL1)/pressure solenoid B (SL2) smaller without reducing their attractive force.



(a) Solenoid output oil pressure

(b) Solenoid current (torque converter clutch pressure solenoid (SLU))

(c) Solenoid current (pressure solenoid D (SLT), pressure solenoid A (SL1)/pressure solenoid B (SL2))

Linear solenoid functions

Linear solenoid	Function
Pressure solenoid D (SLT)	Accumulator back pressure control
Torque converter clutch pressure solenoid (SLU)	Lock-up control
Pressure solenoid A (SL1)	Accumulator back pressure control/clutch oil pressure control
Pressure solenoid B (SL2)	Brake oil pressure control

■ Transmission solenoid

A shift solenoid A (S1), shift solenoid B (S2), shift solenoid C (S3), and shift solenoid D (S4) are provided for shift position switching, and a shift solenoid E (SR) is provided for orifice switching.

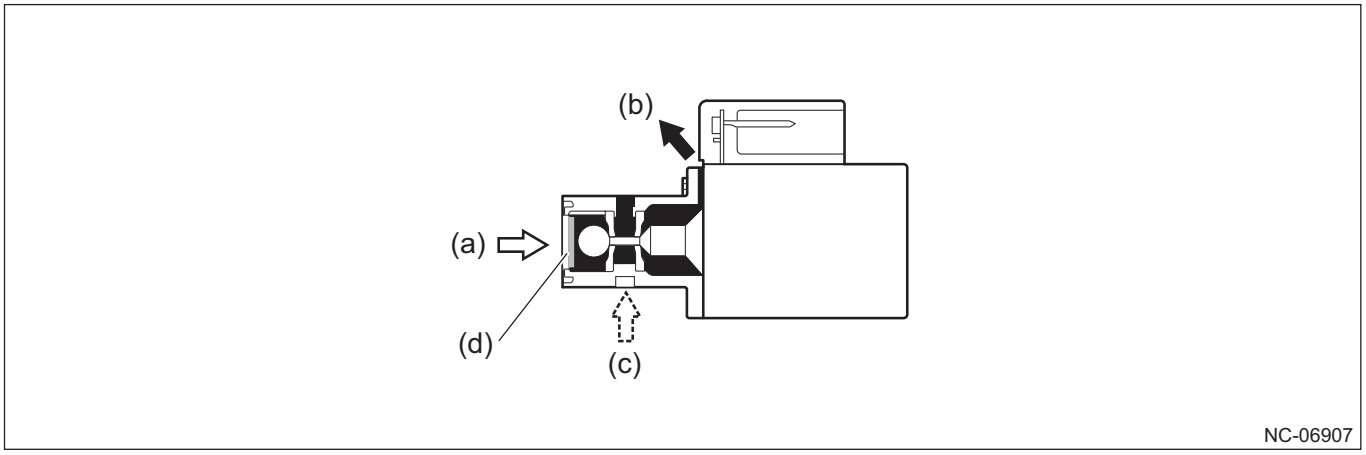
A small and lightweight 3-way solenoid is adopted for each transmission solenoid. Excellent responsiveness that supports even at low oil temperatures is also achieved.

The end is equipped with a strainer for excellent reliability even in the case of foreign matter entry.

Transmission solenoid functions

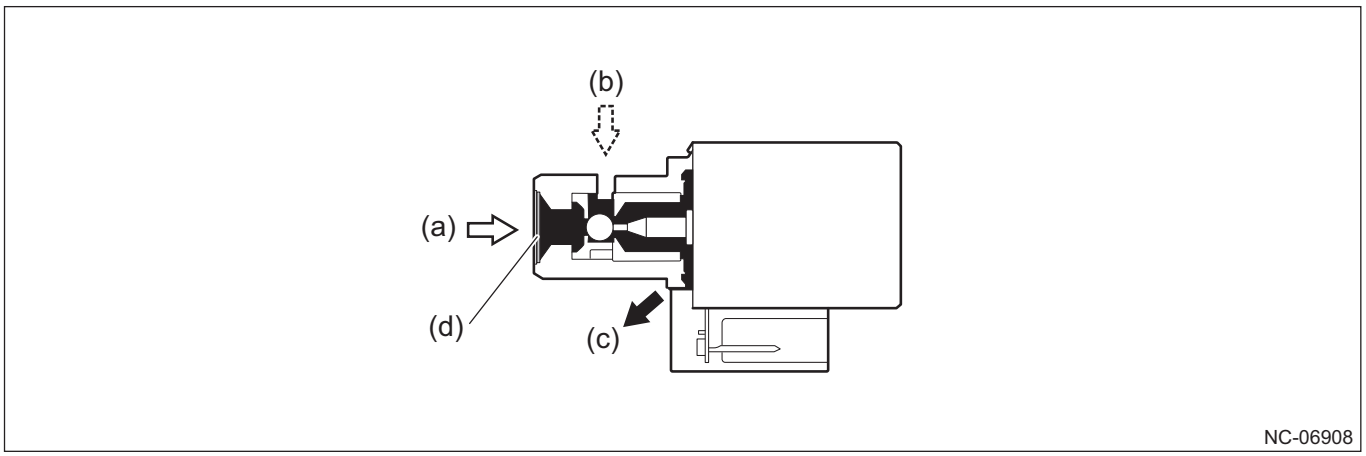
Transmission solenoid	Type	Function
Shift solenoid A (S1)	3-way type	1-2 shift valve switching, SL1 relay valve switching
Shift solenoid B (S2)	3-way type	2-3 shift valve, 5-6 shift valve switching
Shift solenoid C (S3)	3-way type	3-4 shift valve switching
Shift solenoid D (S4)	3-way type	4-5 shift valve switching
Shift solenoid E (SR)	3-way type	C4 relay valve switching, B1 relay valve switching

Shift solenoid A (S1), shift solenoid B (S2), shift solenoid C (S3)/shift solenoid E (SR)



(a) Line oil pressure
(b) Drain
(c) Control pressure
(d) Strainer

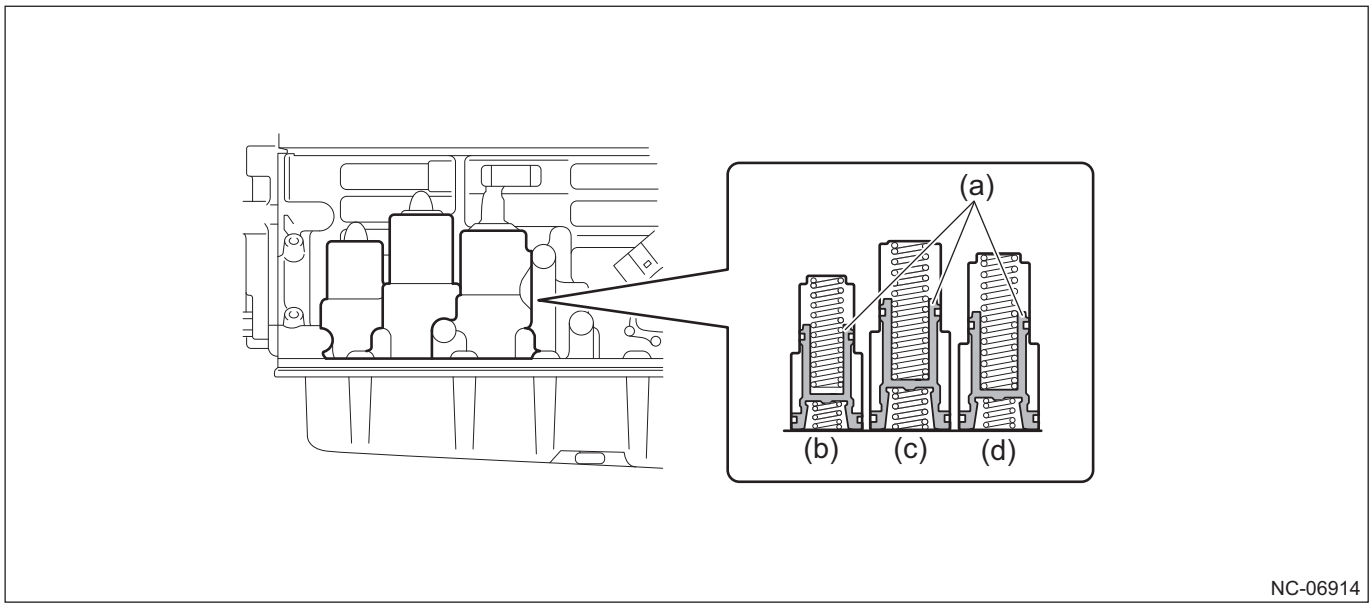
Shift solenoid D (S4)



(a) Line oil pressure
(b) Control pressure
(c) Drain
(d) Strainer

Resin accumulator

The adoption of resin (PPS) as the material for the C2, C3, and B3 accumulators greatly reduces weight.

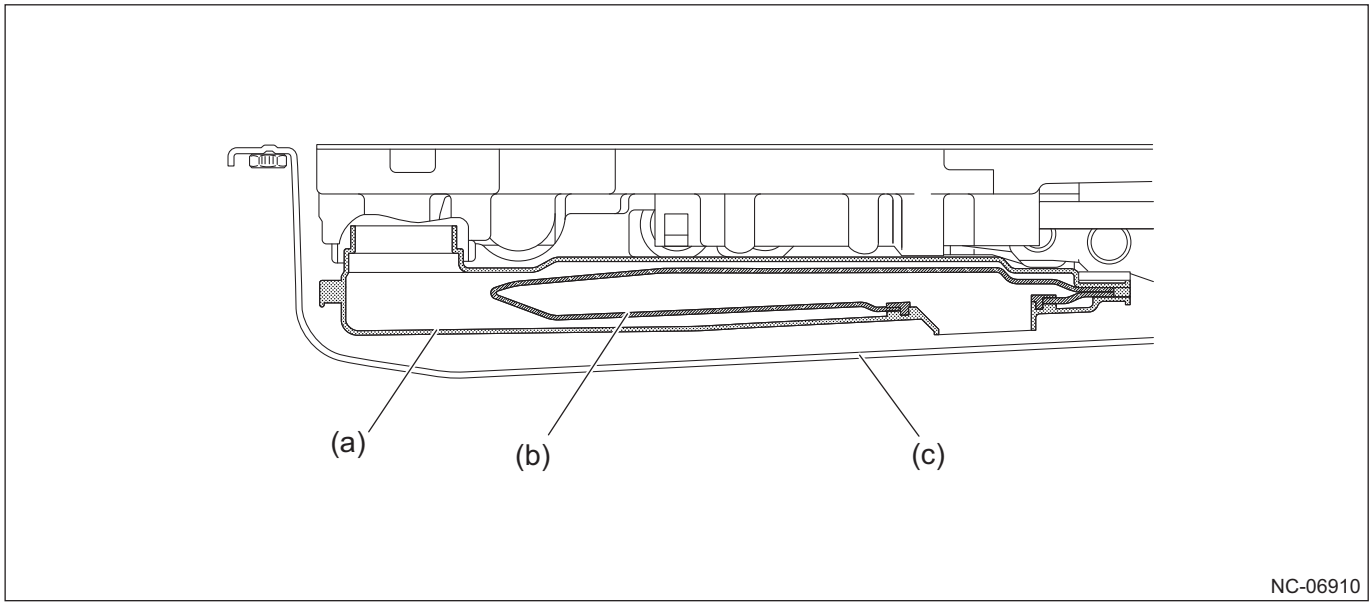


(a) Resin accumulator
(b) C-2
(c) B-3
(d) C-3

Felt strainer

A felt strainer (resin case) is adopted. This reduces weight by approximately 40% compared to traditional metallic mesh strainers.

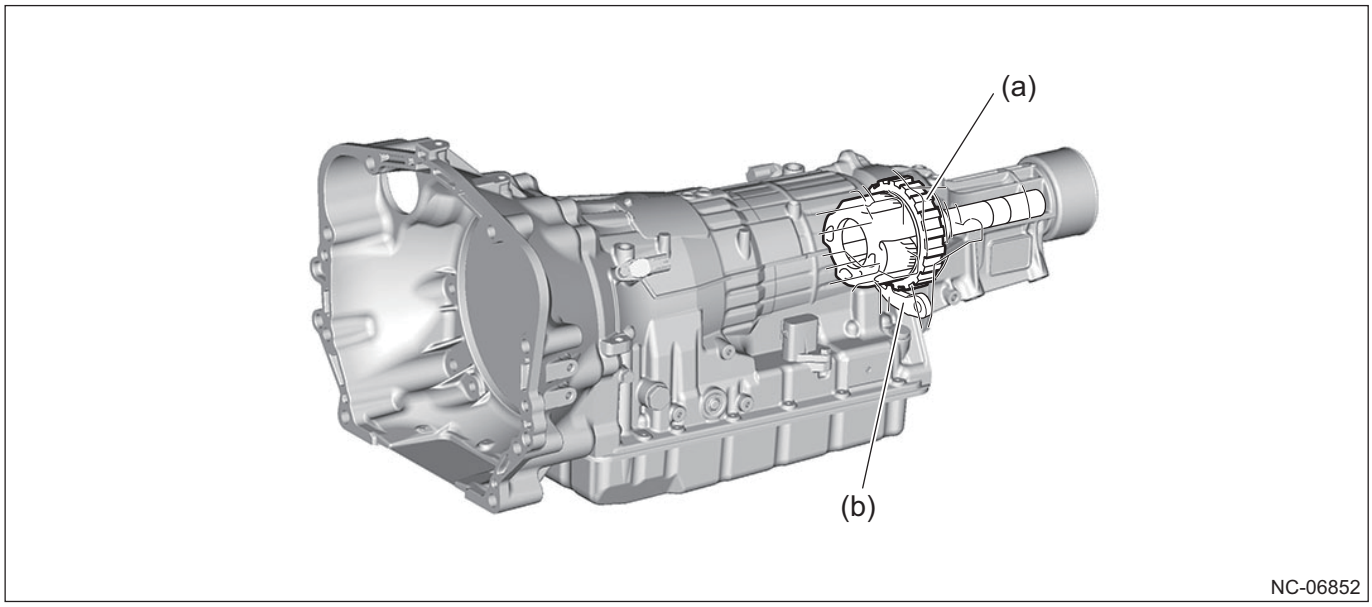
The felt strainer is excellent at catching minute foreign matter, ensuring reliability. Durability against gear and shaft flaking is also ensured.



(a) Resin case
(b) Felt strainer
(c) Oil pan

Parking lock mechanism

A parking gear is positioned in the rear planetary gear carrier. The parking lock pawl engages with the parking gear to lock the rotation of the output shaft.



(a) Parking gear

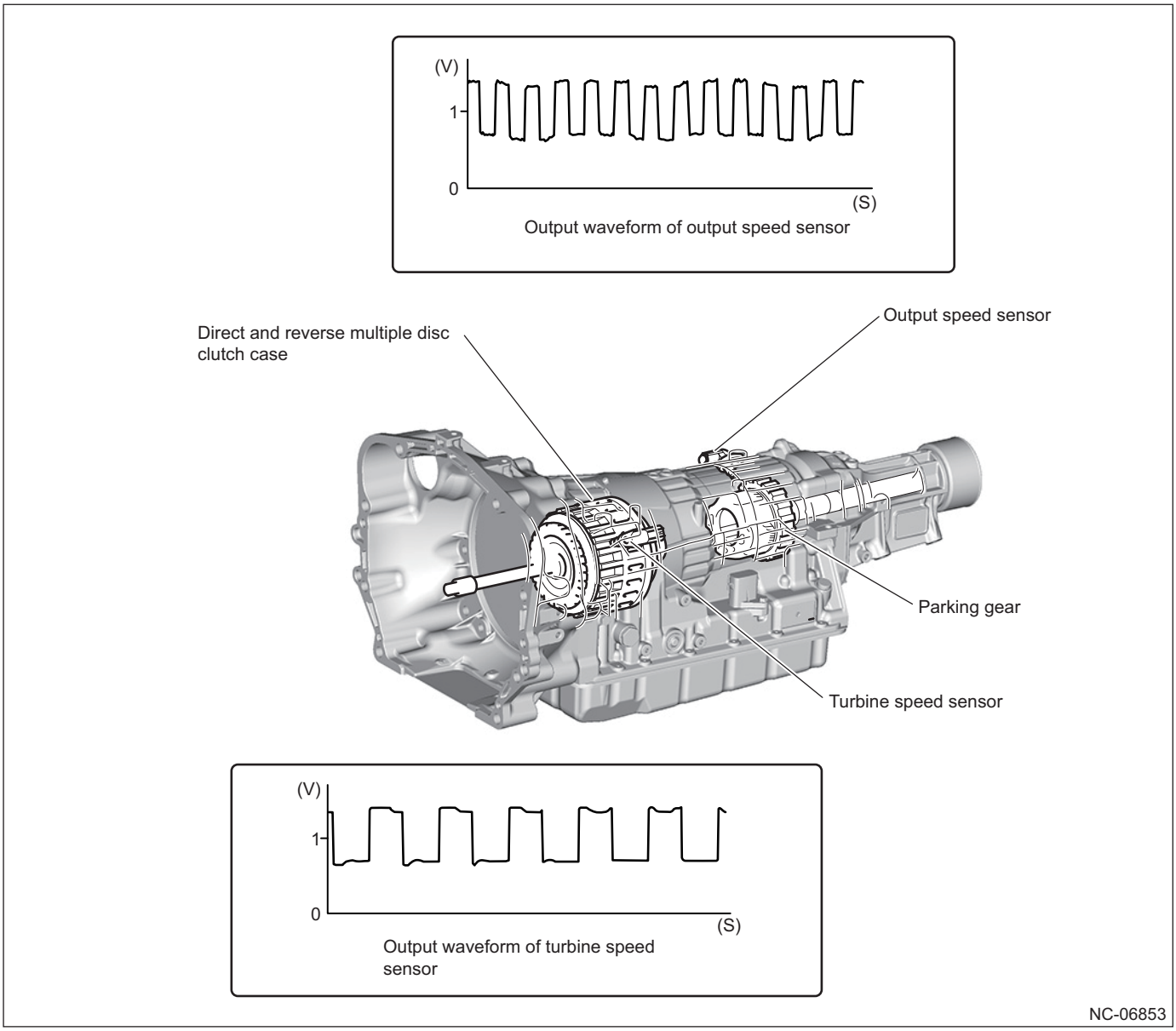
(b) Parking lock pawl

Speed sensor

A turbine speed sensor rotor is provided on the direct and reverse multiple disc clutch case to detect the input rotation speed of the transmission. The rotation speed signal for the input shaft is output to the transmission control computer by the turbine speed sensor installed on the left side of the ATF main case.

An output speed sensor rotor is provided for the parking gear. The rotation speed signal for the output shaft is output to the Transmission Control Module (TCM) by the output speed sensor installed on the right side of the ATF main case.

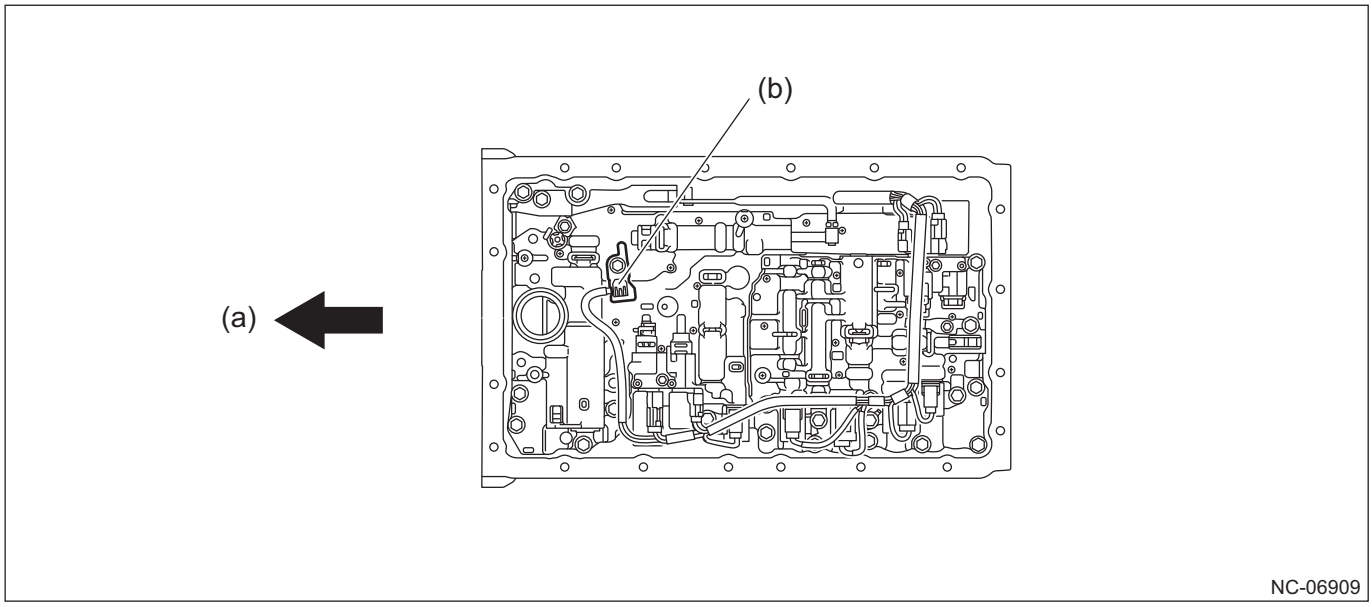
A Hall IC sensor is adopted for each sensor.



ATF temperature sensor

An ATF temperature sensor for oil pressure control during shifting is installed inside the valve body.

The ATF temperature sensor directly measures the oil temperature inside the oil passage at the oil pump discharge section where the temperature increase has stabilized, enabling more accurate oil temperature detection.

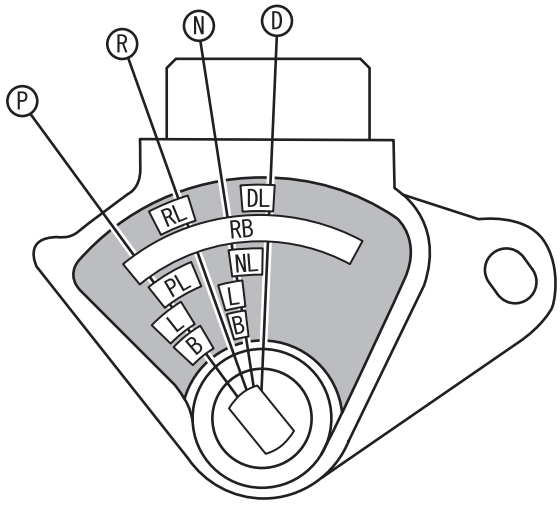


(a) Front of vehicle

(b) ATF temperature sensor

Inhibitor switch

This detects the position of the select lever and sends the signal to the Transmission Control Module (TCM).



Internal contact diagram

Rotation connection table

	Starter		Indicator				
Terminal / Shift position	B (+)	L	RB (+)	PL	RL	NL	DL
P	○—○		○—○				
R			○—○				
N	○—○		○			○	
D			○				○

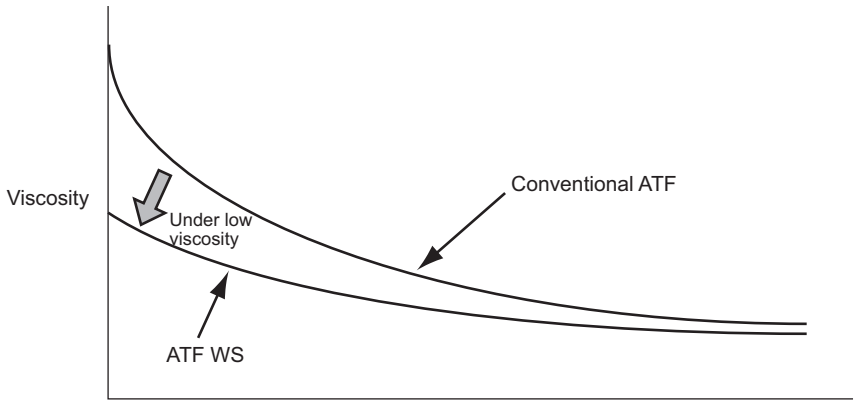
NC-06911

Automatic transmission fluid (ATF)

Auto fluid WS is adopted.

The viscosity is decreased in the actual operating temperature range to reduce dragging loss and achieve excellent fuel efficiency characteristics.

Viscosity on the high temperature side is equivalent to conventional ATF, maintaining the formation of an oil film on part surfaces to prevent wear and seizure.



Characteristics of automatic transmission fluid (auto fluid WS)

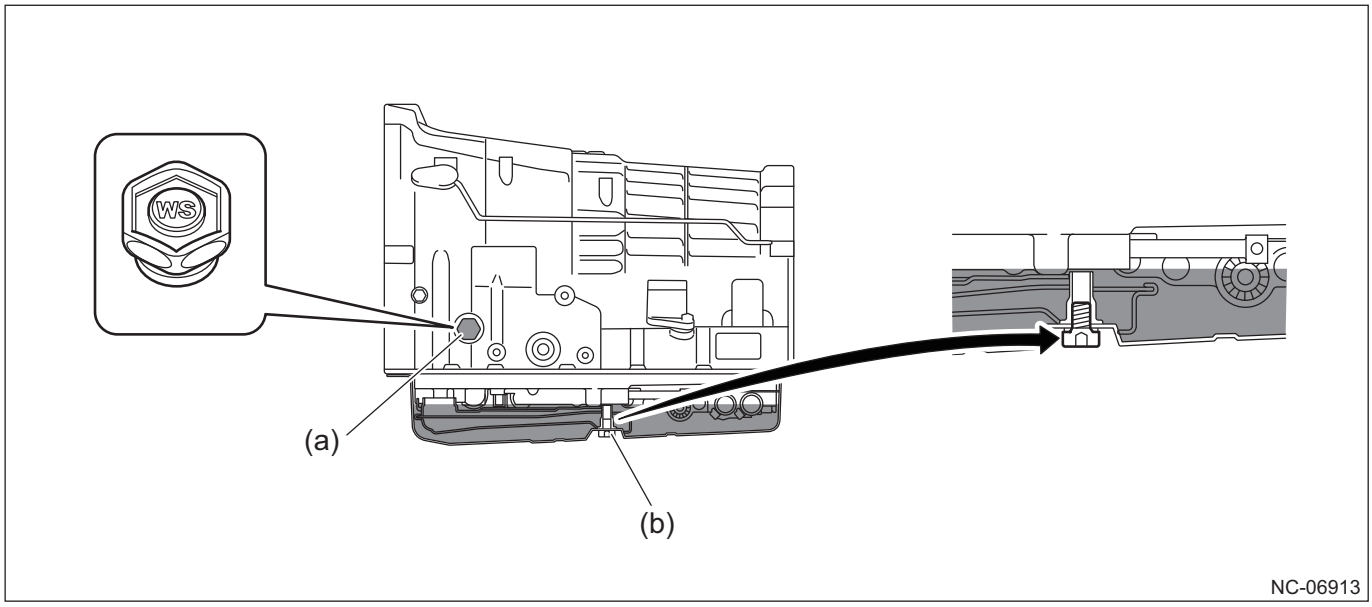
NC-06915

Oil level detection mechanism

An oil level detection mechanism using the overflow method is adopted.

Overfilling, underfilling, or filling of the incorrect oil type in the market is prevented because the oil level is guaranteed by the AT manufacturer, resulting in a maintenance-free design.

Oil level adjustment during repair or replacement is performed mechanically with the overflow method, enabling the highly precise management of the oil level. For the detailed oil refilling and adjustment procedures, refer to the repair manual.



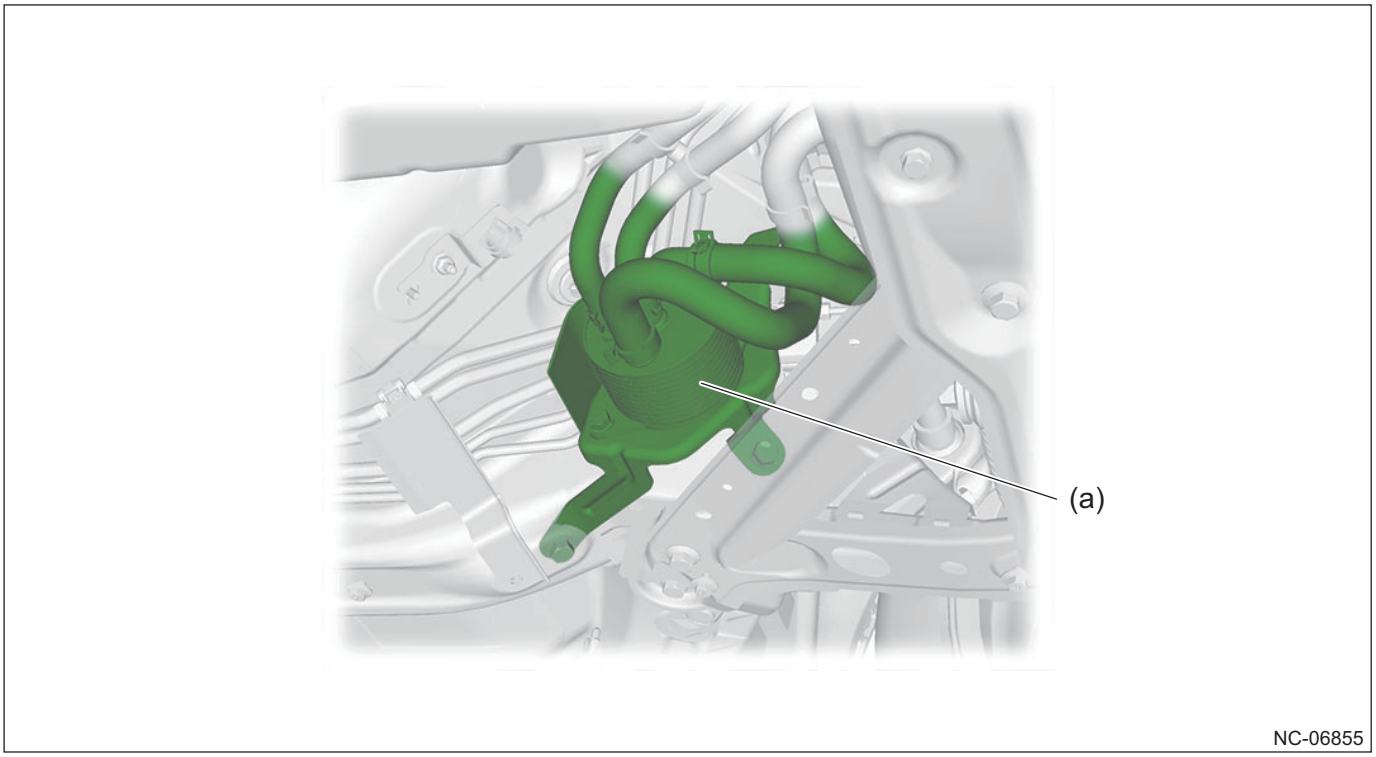
(a) ATF filling port

(b) Overflow plug

ATF cooler (with warmer feature)

An ATF cooler (with warmer feature) is adopted.

A structure is adopted that does not use a traditional radiator built-in type oil cooler. This promotes early warming up of the ATF when cold to shorten the time until slip lock-up control starts and reduce friction loss, resulting in excellent fuel efficiency characteristics. This also functions as an oil cooler when the temperature is high.



(a) ATF cooler (with warmer feature)

Effect

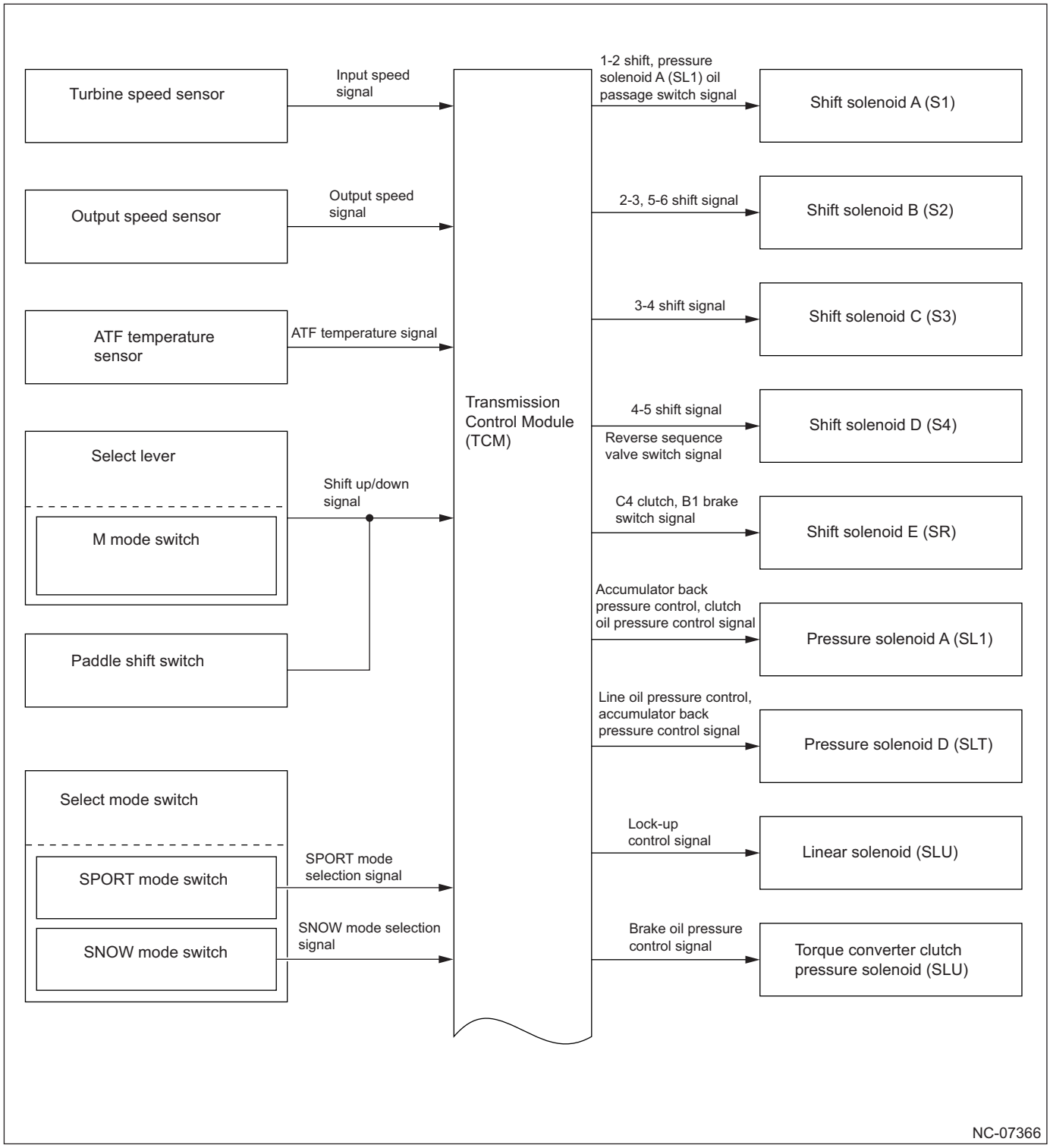
ATF status		Heat exchange method	Effect
During warm-up		Coolant → ATF	Warms up the ATF early to shorten the time until slip lock-up starts. Reduces AT friction loss at an early stage.
After warm-up	During low/ medium loads	Coolant ←→ ATF	Maintains the ATF at a higher temperature than the radiator built-in type oil cooler, reducing friction loss.
	During high loads	Coolant ← ATF	When ATF cooling is necessary, cools the ATF with the same heat exchange to reduce ATF deterioration.

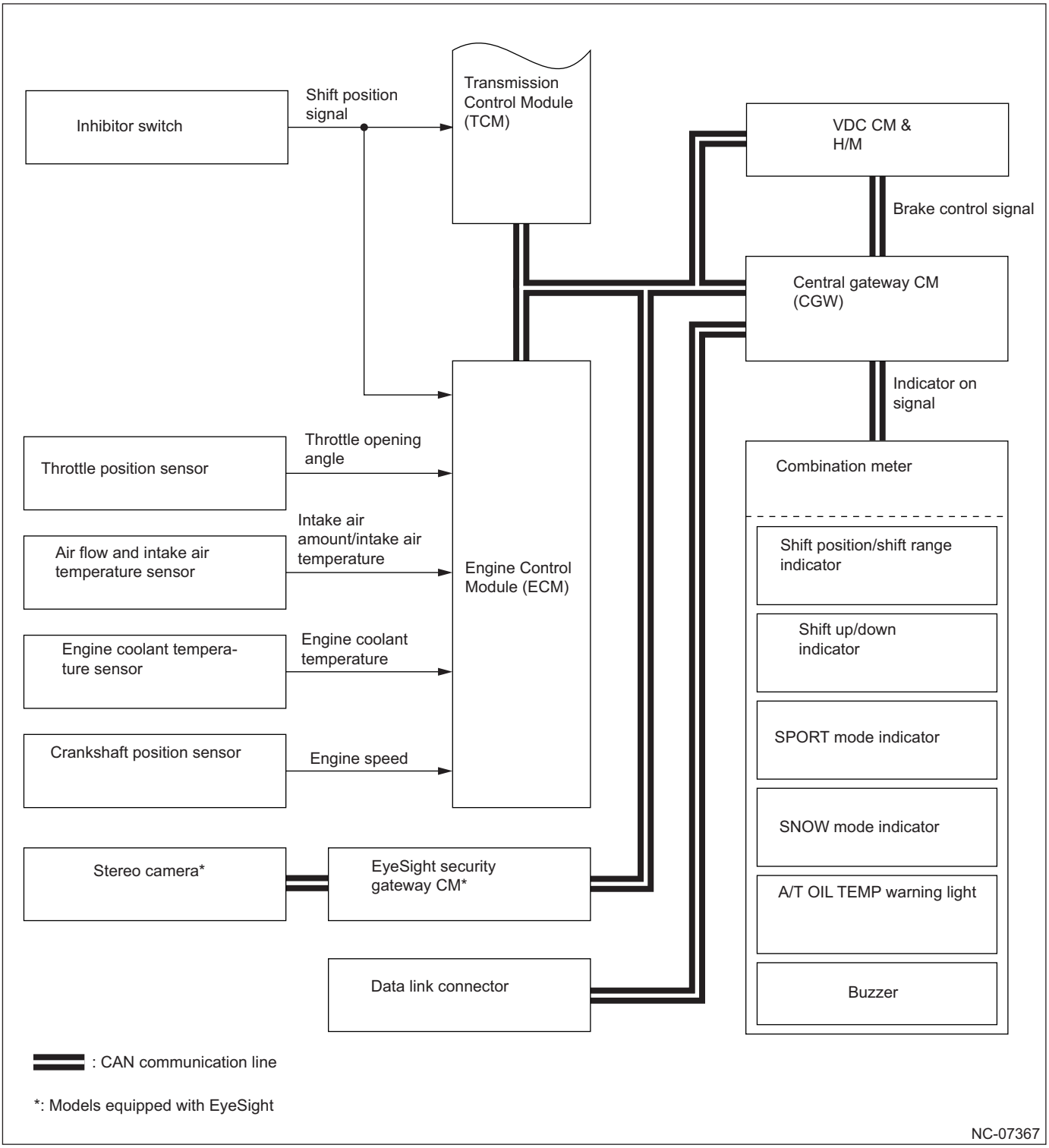
Core specifications

Core type	Aluminum water-cooled, multi-plate type
Core specifications (in (mm))	φ3.35 (85) ×10 levels
Oil capacity (US qt (liters, Imp qt))	0.11 (0.1, 0.09)
Dry weight (lb (kg))	0.84 (0.38)

3.5.3 Construction and Operation

System diagram




Inhibitor switch
Shift position signal
Transmission Control Module (TCM)
VDC CM & H/M
Brake control signal
Central gateway CM (CGW)
Indicator on signal
Throttle position sensor
Throttle opening angle
Combination meter
Intake air amount/intake air temperature
Air flow and intake air temperature sensor
Engine Control Module (ECM)
Shift position/shift range indicator
Shift up/down indicator
Engine coolant temperature sensor
Engine coolant temperature
SPORT mode indicator
Crankshaft position sensor
Engine speed
SNOW mode indicator
Stereo camera*
EyeSight security gateway CM*
A/T OIL TEMP warning light
Data link connector
Buzzer
: CAN communication line
*: Models equipped with EyeSight
NC-07367

Main component functions

Component		Function
Shift solenoid A (S1)		Operates during 1-2 shifting. Switches the oil passage for pressure solenoid A (SL1) pressure.
Shift solenoid B (S2)		Operates during 2-3 and 5-6 shifting.
Shift solenoid C (S3)		Operates during 3-4 shifting.
Shift solenoid D (S4)		Operates during 4-5 shifting. Switches the oil passage for pressure solenoid A (SL1) pressure. Switches the reverse sequence valve.
Shift solenoid E (SR)		Switches the C4 clutch and B1 brake.
Pressure solenoid D (SLT)		Performs line oil pressure control and accumulator back pressure control.
Torque converter clutch pressure solenoid (SLU)		Performs lock-up control.
Pressure solenoid A (SL1)		Performs clutch oil pressure control and accumulator back pressure control.
Pressure solenoid B (SL2)		Performs brake oil pressure control.
Output speed sensor		Detects the output shaft speed of the transmission.
Turbine speed sensor		Detects the input shaft speed of the transmission.
ATF temperature sensor		Detects the oil temperature inside the transmission oil pressure control circuit.
Engine coolant temperature sensor		Detects the engine coolant temperature.
Throttle position sensor		This detects the throttle opening angle.
Air flow and intake air temperature sensor		Detects the intake air amount and intake temperature.
Crankshaft position sensor		Detects the engine speed.
Inhibitor switch		Detects the shift position of the transmission.
Console switch	Select mode switch	Selects SNOW mode or SPORT mode.
Select lever (M mode switch)		Detects the ON or OFF status of the M mode (M position). Also, detects a shift up or down operation by the select lever in M mode.
Paddle shift switch		Detects shift up or down operation in M mode (M position) or while in the D position.
Combination meter	Shift position/shift range indicator	Notifies the driver of the current shift position and gear position.
	SPORT mode indicator	Notifies the driver that the select mode switch is in SPORT mode by turning on the light.
	SNOW mode indicator	Notifies the driver that the select mode switch is in SNOW mode by turning on the light.
Engine Control Module (ECM)		Performs engine - transmission cooperation control and engine control based on the signals from the sensors. Includes the diagnosis mode and the fail-safe function in consideration of serviceability at system failure.
Transmission Control Module (TCM)		Performs engine - transmission cooperation control and transmission control based on the signals from the sensors. Includes the diagnosis mode and the fail-safe function in consideration of serviceability at system failure. Performs cooperation control with the stereo camera to control the transmission. *
VDC CM & H/M		Sends the ABS/VDC/TSC control status.

Component	Function
Stereo camera*	Performs control calculations based on camera image processing and the signals from the sensors and computers, and sends control signals to the computers and actuators.
Data link connector	When a diagnosis tool is connected to this and operated, diagnosis codes and computer data can be read.

**: Models equipped with EyeSight*

System details

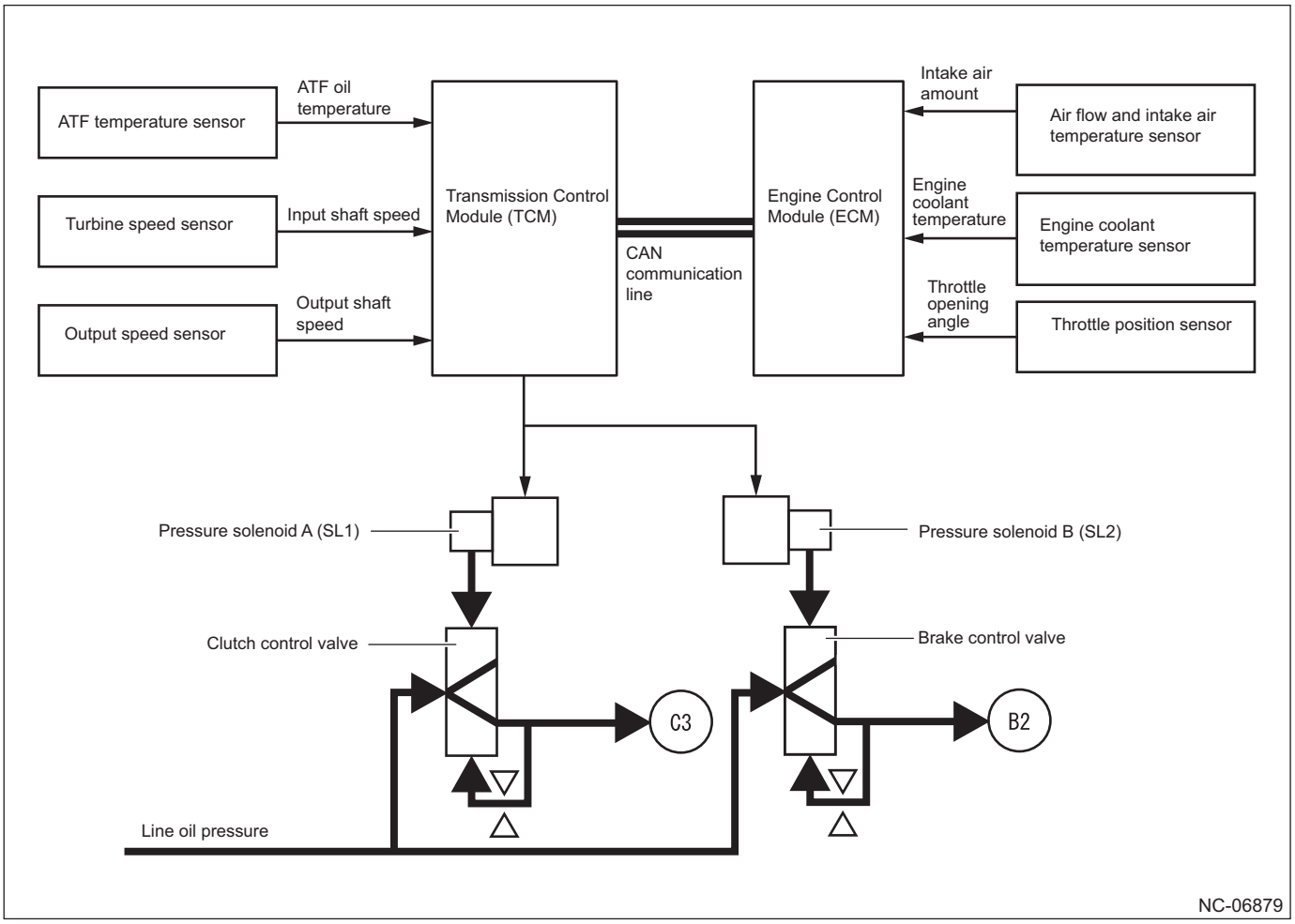
The Transmission Control Module (TCM) performs control such as slip lock-up control, adaptive control, and blipping down shift control based on the signals from the sensors. This also achieves smooth shifting characteristics and excellent shifting responsiveness.

The diagnosis function and the fail-safe function are provided in consideration of serviceability and safety.

Clutch-to-clutch shift control

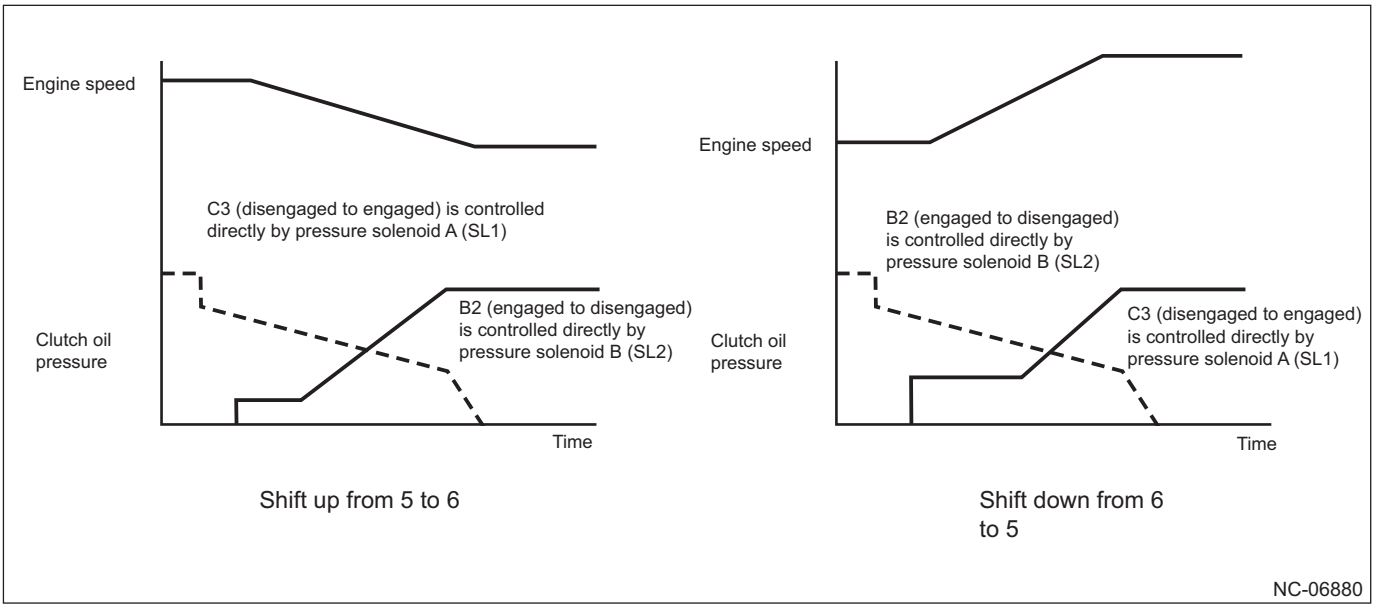
Clutch-to-clutch shift control is adopted for 5-6 shift control. This enables the one-way clutch to be discontinued for 5-6 shifting, reducing size and weight.

The output oil pressure of the pressure solenoid A (SL1) and pressure solenoid B (SL2) that are controlled by the signals from the Transmission Control Module (TCM) operates the control valve to directly control the oil pressure of the C3 clutch and B2 brake, respectively.



■ Up/down shift

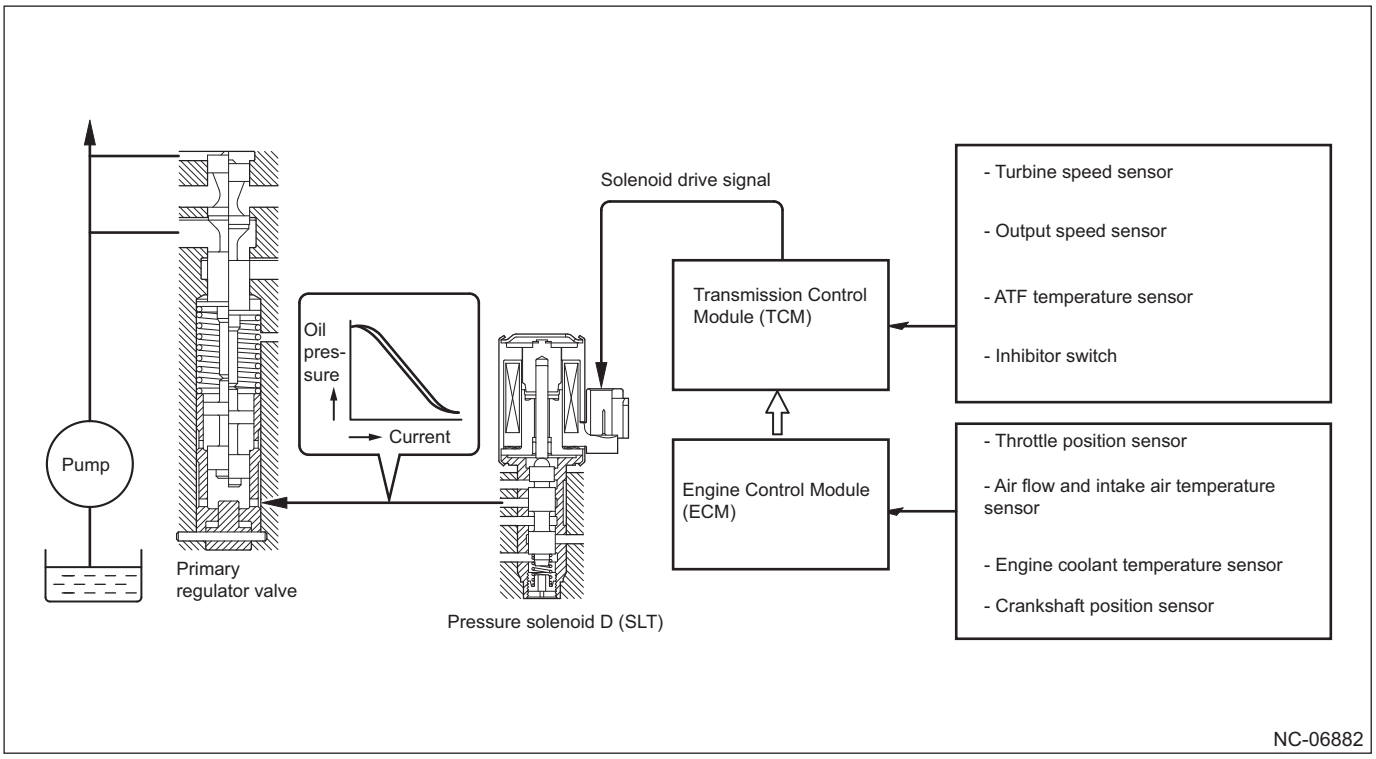
Based on information such as the engine torque and the input and output shaft speeds, the clutches to disengage and engage are each controlled with the optimal oil pressure and timing, resulting in excellent shifting characteristics under all driving conditions.



Line oil pressure control

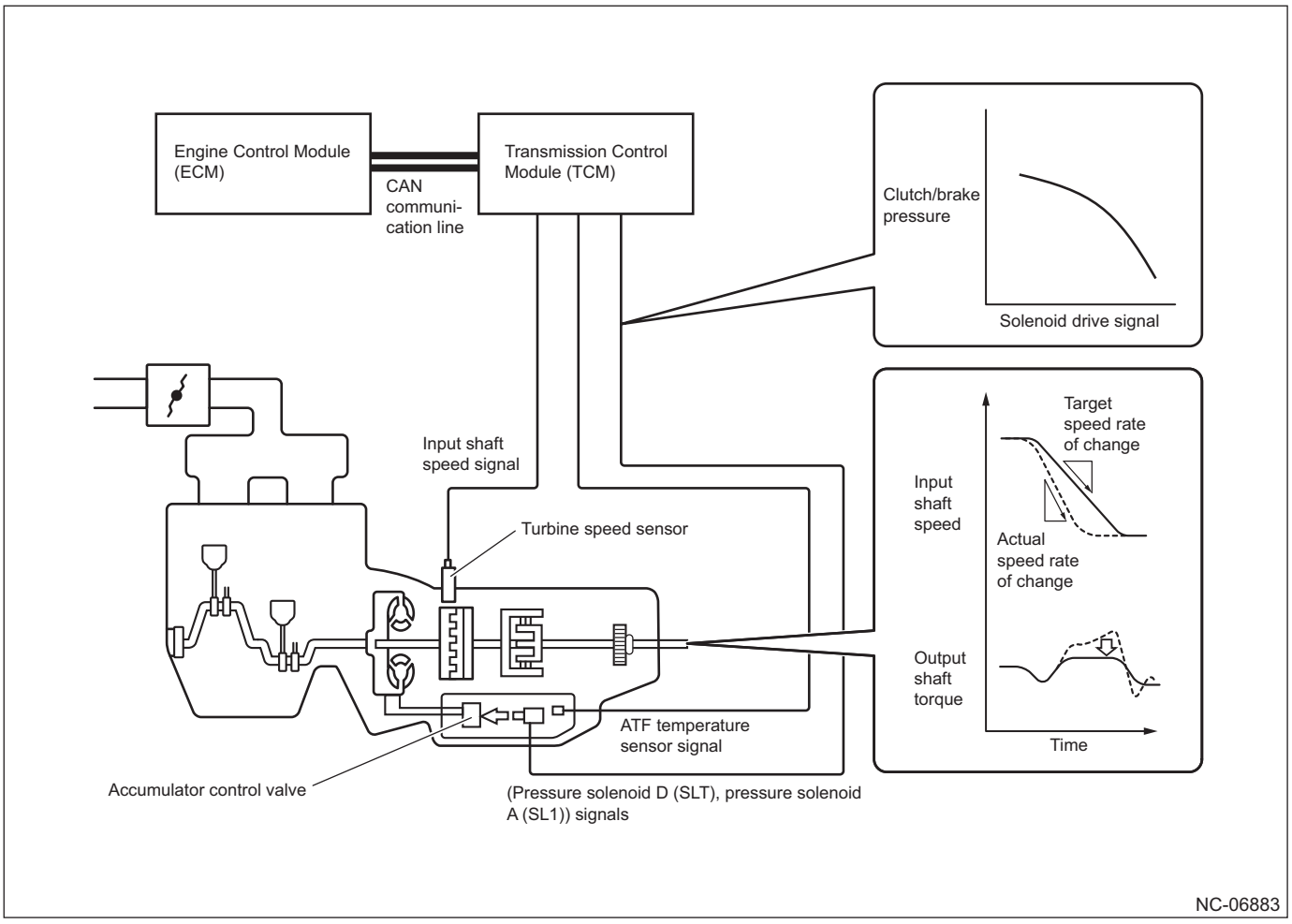
The pressure solenoid D (SLT) is used to control the line oil pressure to the optimal level based on the engine torque information from the engine side.

This enables highly precise and fine control of the line oil pressure according to the engine output and conditions, resulting in excellent shifting characteristics.



Direct oil pressure control of clutch oil pressure

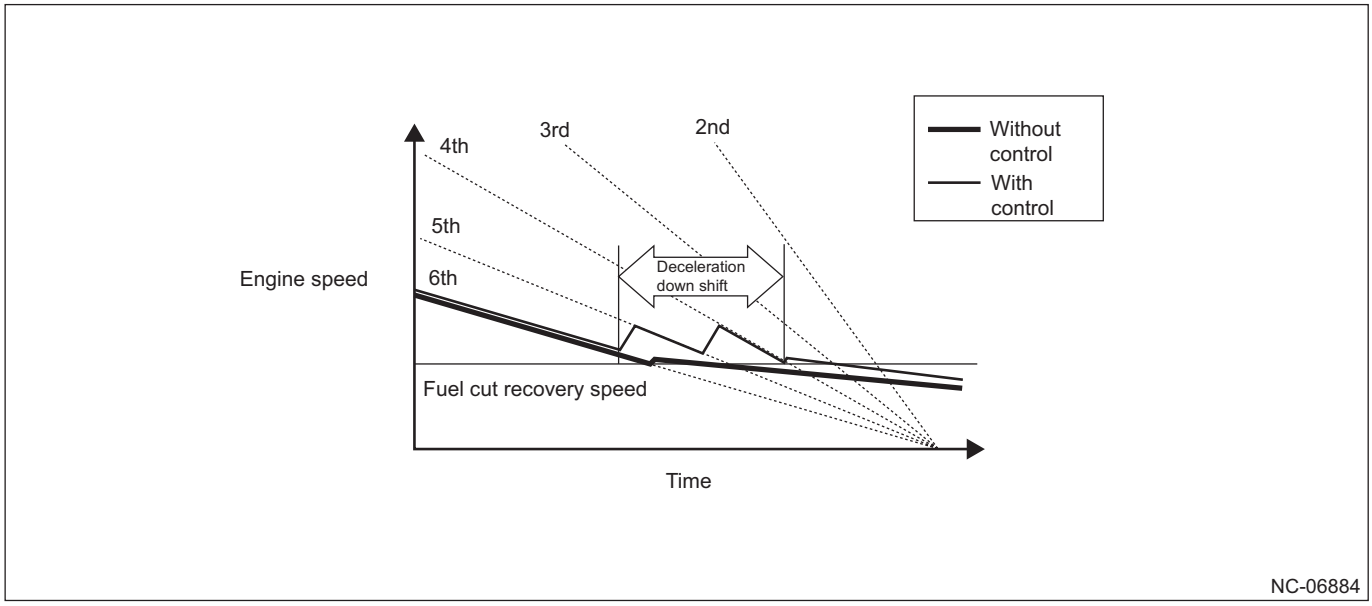
Based on the signals from sensors such as the turbine speed sensor, fine control of the clutch oil pressure is performed with the pressure solenoid D (SLT) and pressure solenoid A (SL1) according to the engine output and driving conditions to achieve smoother shifting.



Down shift control for deceleration

Down shift control for deceleration is adopted that achieves low fuel consumption by continuing fuel cut control for as long as possible.

In down shift control for deceleration, 6-5 shift down and 5-4 shift down are performed from the 6th speed status before fuel cut recovers. Down shift control for deceleration is performed aggressively to expand the fuel cut range and achieve low fuel consumption.



Shift and lock-up control

Shift point control and lock-up control (including slip lock-up control) are performed according to the shift position, vehicle speed, acceleration opening angle, and driving conditions.

Shift positions and gear positions, lock-up patterns (○ : Full lock-up, △ : Slip, ×: Converter)

Position	1st	2nd	3rd	4th	5th	6th
D	×	×	△ , ○	△ , ○	△ , ○	△ , ○
D (SPORT)	×	○	○	○	○	○
M	×	○	○	○	○	○

Shift position/lock-up control operation conditions

ATF temperature	Gear position operating status	Lock-up operating status
Below 68°F (20°C)	6th prohibited	L/U prohibited Slip prohibited
68°F (20°C) or higher	-	L/U permitted Slip prohibited
104°F (40 °C) or higher	-	L/U permitted Slip permitted

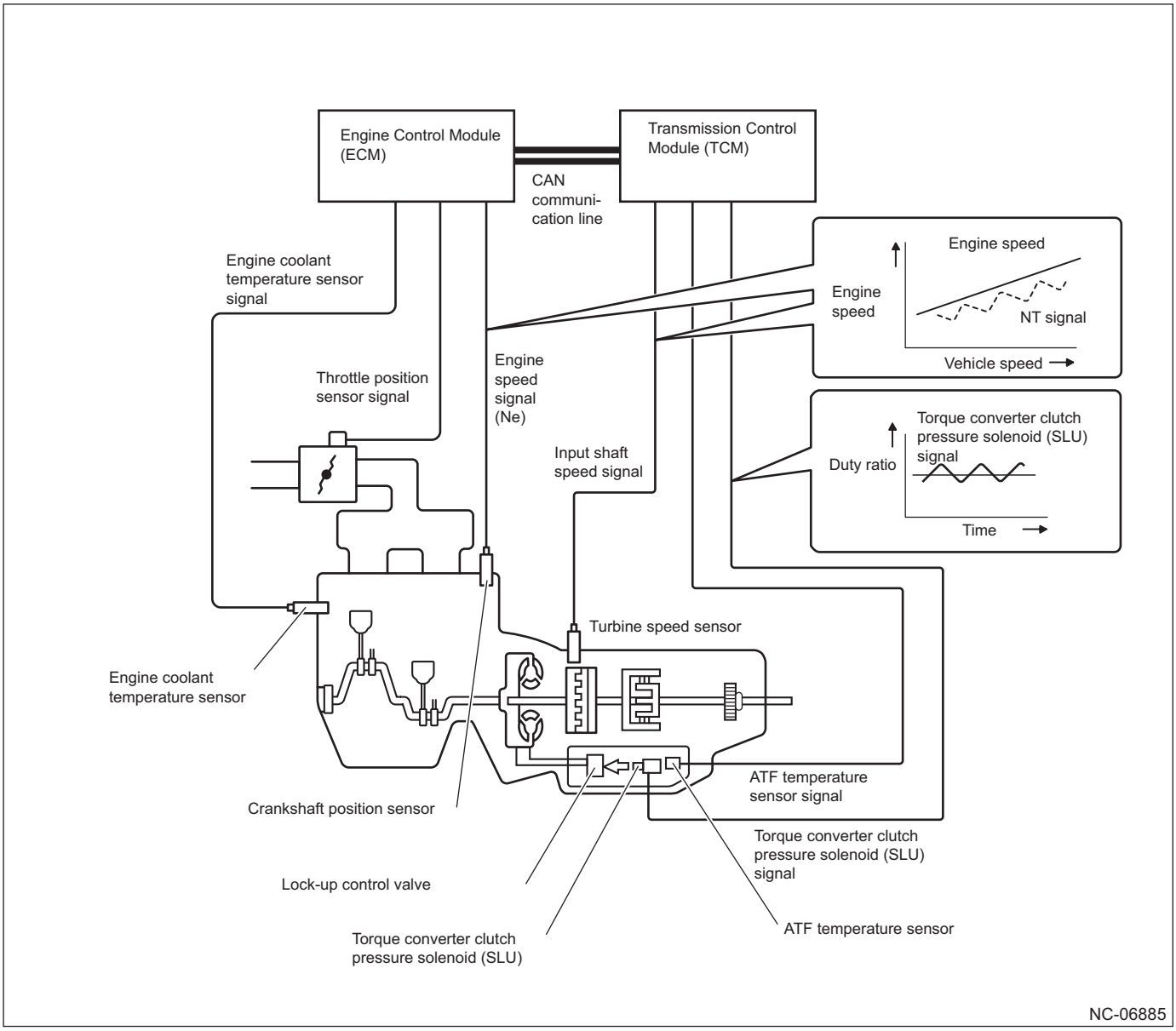
Slip lock-up control

The use of the H ∞ (H-infinity) control theory enables a minute slip to be applied stably and continuously to the lock-up clutch. As a result, lock-up can be operated in a wider range for excellent fuel efficiency characteristics.

The slip lock-up operation range is set from the 3rd to 6th speeds.

In low to medium speed ranges, minute slip rotation of the specified amount is applied to the lock-up clutch to ensure the transmission efficiency of the torque converter and achieve excellent fuel efficiency characteristics.

Even when the accelerator is OFF, the lock-up clutch slips minutely the same as when the accelerator is ON, expanding the fuel cut range of the engine.



Adaptive control

The accelerator operations, brake operations, and vehicle behavior are sensed to ascertain the driving environment and driving conditions, enabling automatic shifting to the optimal gear position according to the driver's intentions. Also, in SPORT mode, adaptive control is operated aggressively for an enjoyable linear response to the driver's intentions and operations.

■ Hill climb/down control

When an uphill or downhill slope is detected according to the gradient (load) estimate calculated from the various sensor values, frequent shift control according to the accelerator operations of the driver are suppressed to stabilize the vehicle behavior, improving controllability and drivability.

■ Braking control

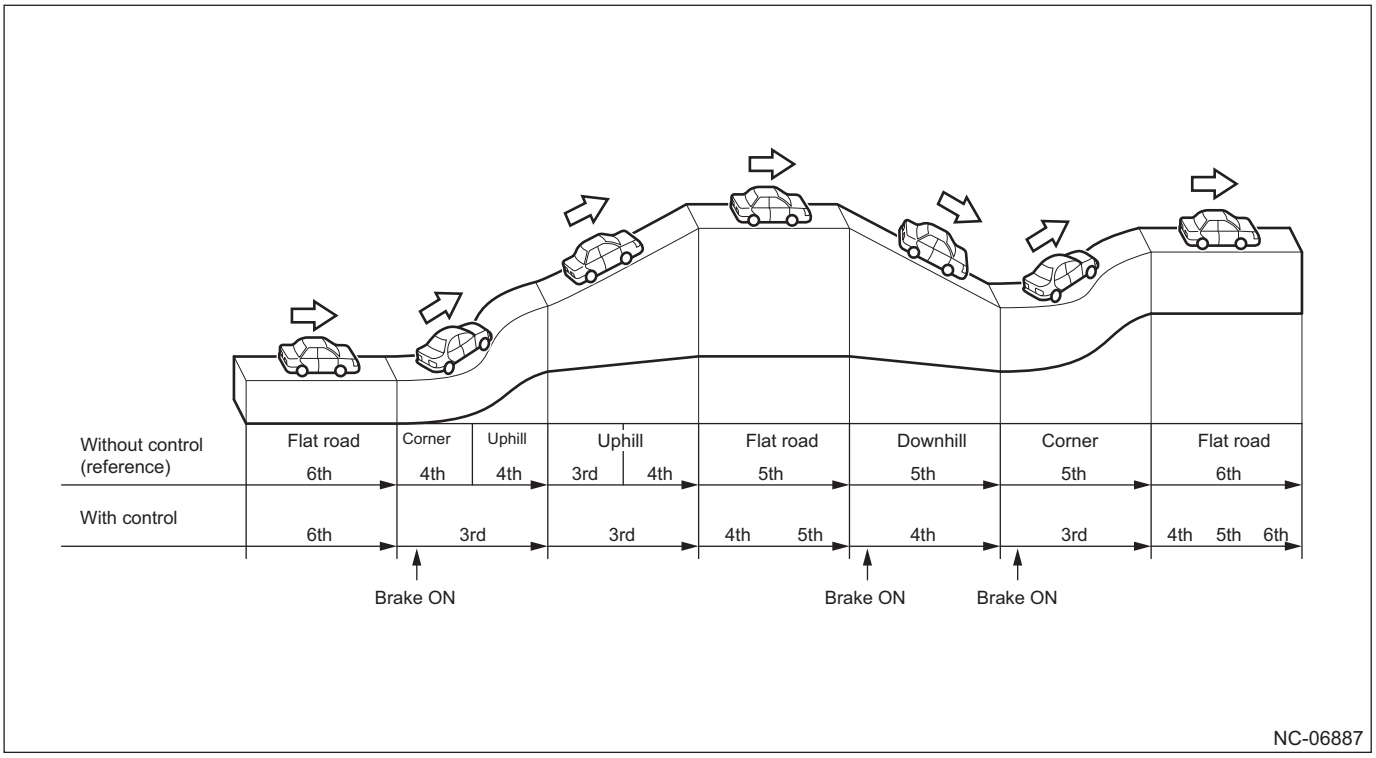
Down shifting is performed earlier than in normal driving to supplement the feeling of deceleration by the engine brake when braking, such as when entering a corner, and also to prepare for re-acceleration when exiting a corner. This improves drivability and operability during sporty driving.

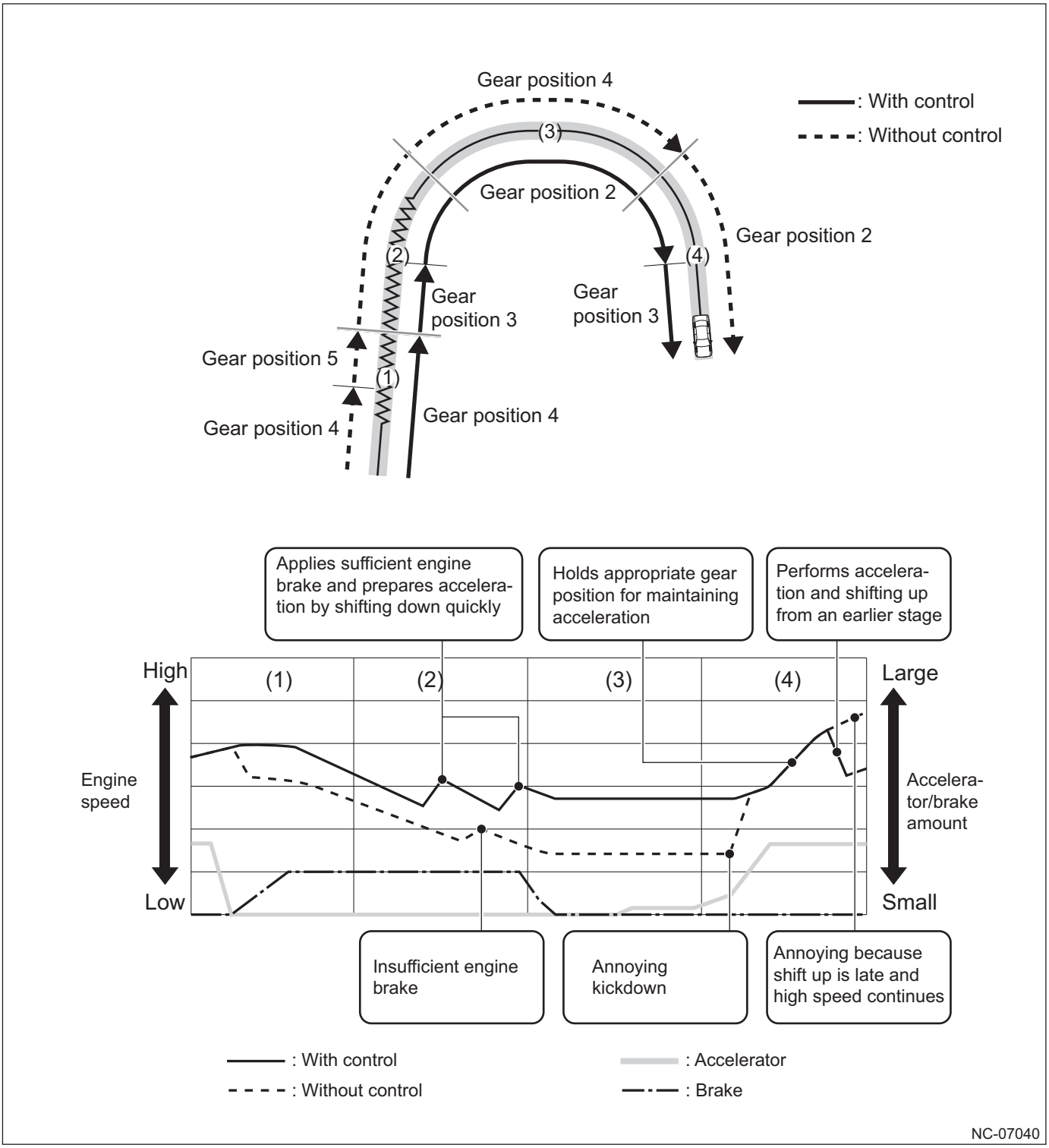
■ Cornering control

When the vehicle body G sensors detects that the vehicle is cornering, up shift during cornering is suppressed and the optimal gear position for re-acceleration is maintained, improving drivability and operability.

■ Accelerator pedal quick return control

When the accelerator pedal is returned from the depressed condition at a certain speed or higher, the selected gear position is maintained without up shifting to improve drivability and operability.





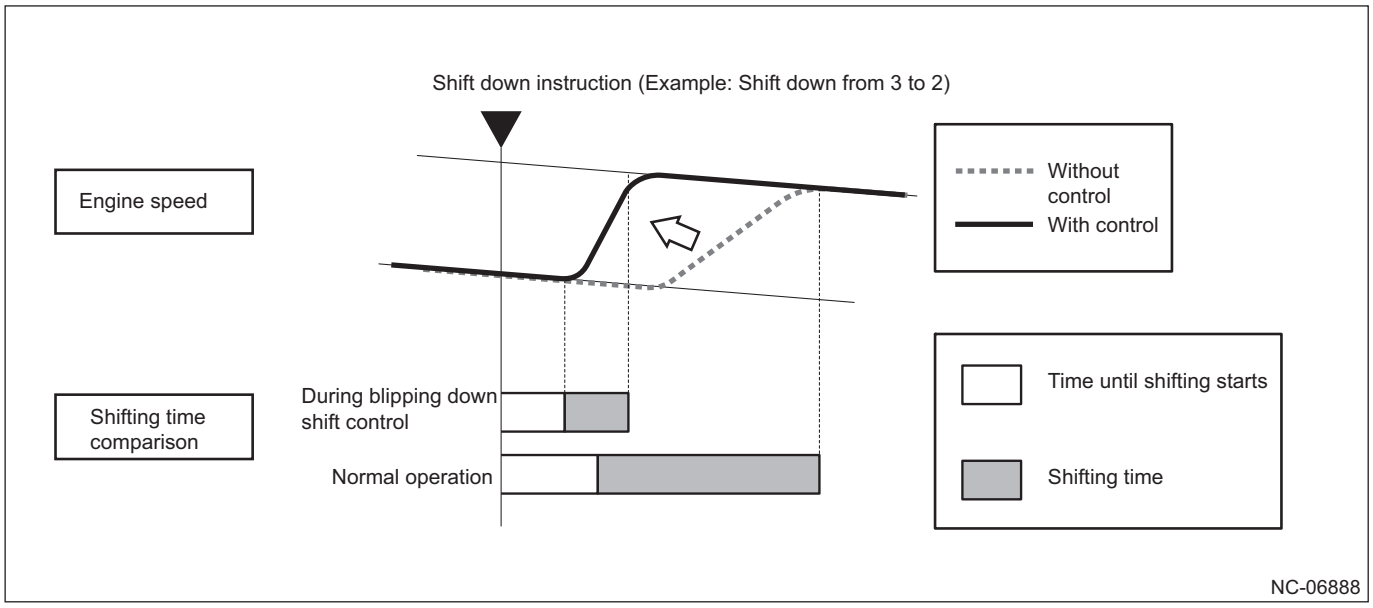
■ Driver intention responsive control

This control estimates the driver's intentions from the accelerator operations and vehicle conditions, and switches to a shift pattern that is comfortable for each individual driver without needing a switch operation.

Blipping down shift control

The TX6A has a system for the integrated control of the engine and transmission powertrain.

The oil pressure control system quickly disengages the engine brake clutch to form the neutral status. The powertrain integrated control opens the throttle valve and raises the engine speed at once to the gear position synchronization speed after shifting. Then, the engine brake clutch is quickly engaged to achieve highly responsive shifting.



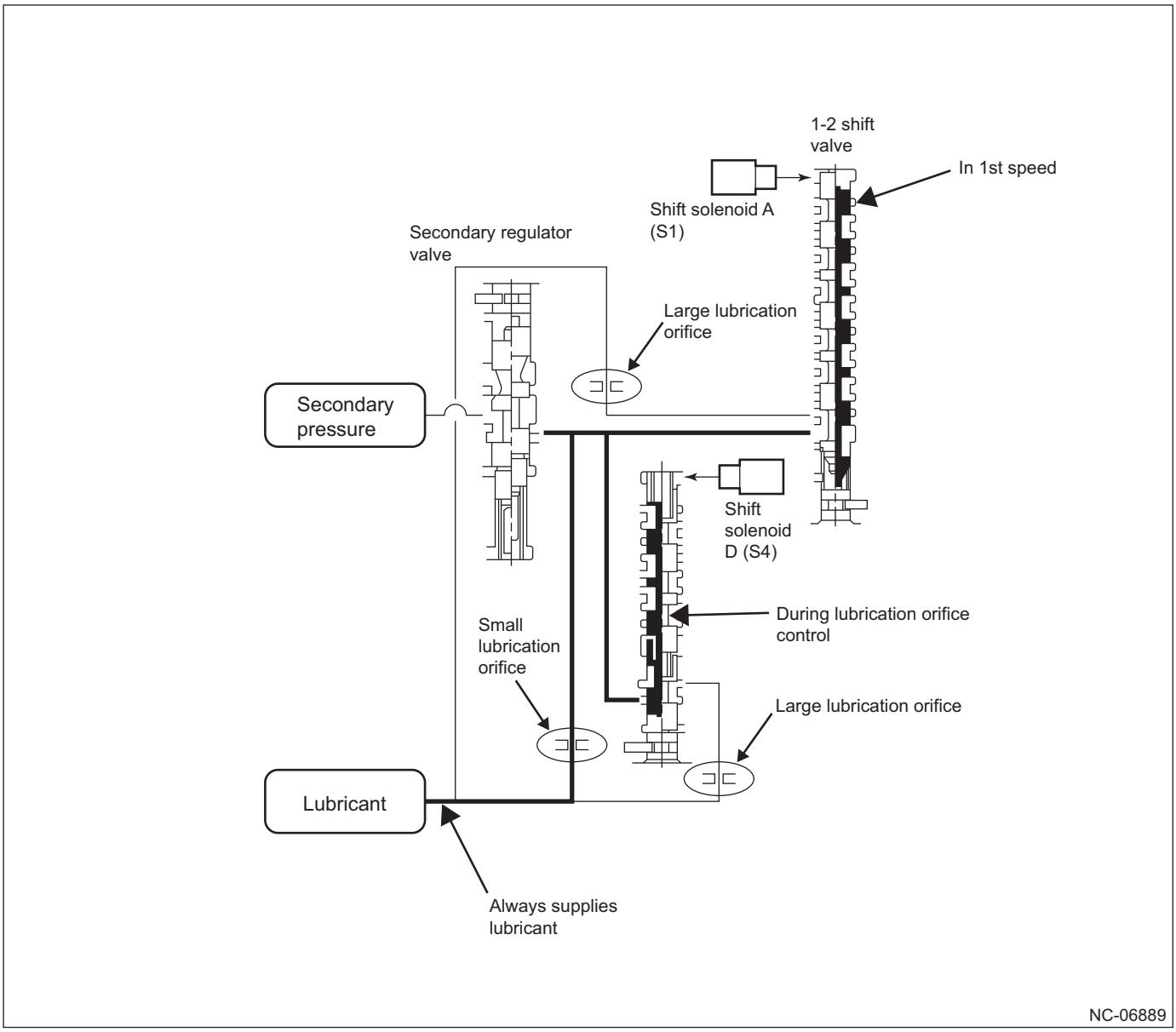
Over-revving prevention up shift control

To prevent excessive engine speed, shift up is performed automatically if the engine speed exceeds a certain speed.

Lubrication orifice switching control

Lubrication orifice switching control is adopted to ensure resistance to air suction at extremely low temperatures. This reduces the lubricant amount for when stopping in 1st gear only, except for reverse.

When stopping in 1st gear, only the small lubrication orifice is used, and at other times, the lubricant is supplied from either or both of the 2 large lubrication orifices.



Select mode switch

The select mode switch is provided at the rear of the select lever. SPORT mode or SNOW mode can be selected according to the switch operation of the driver. Also, normal mode is entered when no switch is selected.

When driving in SPORT or SNOW mode, the driver is notified of the corresponding mode by turning on the SPORT mode indicator or SNOW mode indicator in the combination meter.

Mode characteristics

Normal mode	This mode is set optimally for easy driving.
SPORT mode	The transmission shift points are changed from normal mode by the Transmission Control Module (TCM) and adaptive control is operated aggressively to increase the direct feel and responsiveness, and support sporty driving. Cooperation control with the Engine Control Module (ECM) is also performed to switch engine responsiveness to achieve sporty output.
SNOW mode	The Transmission Control Module (TCM) limits use of 1st speed to achieve good drive force control even on slippery surfaces such as snowy roads.

Reference

The mode may not switch to SPORT mode in the following cases.

- When using Adaptive Cruise Control or Conventional Cruise Control
- When the engine is cold
- When an abnormality occurs in the engine electronic control system or automatic transmission electronic control system

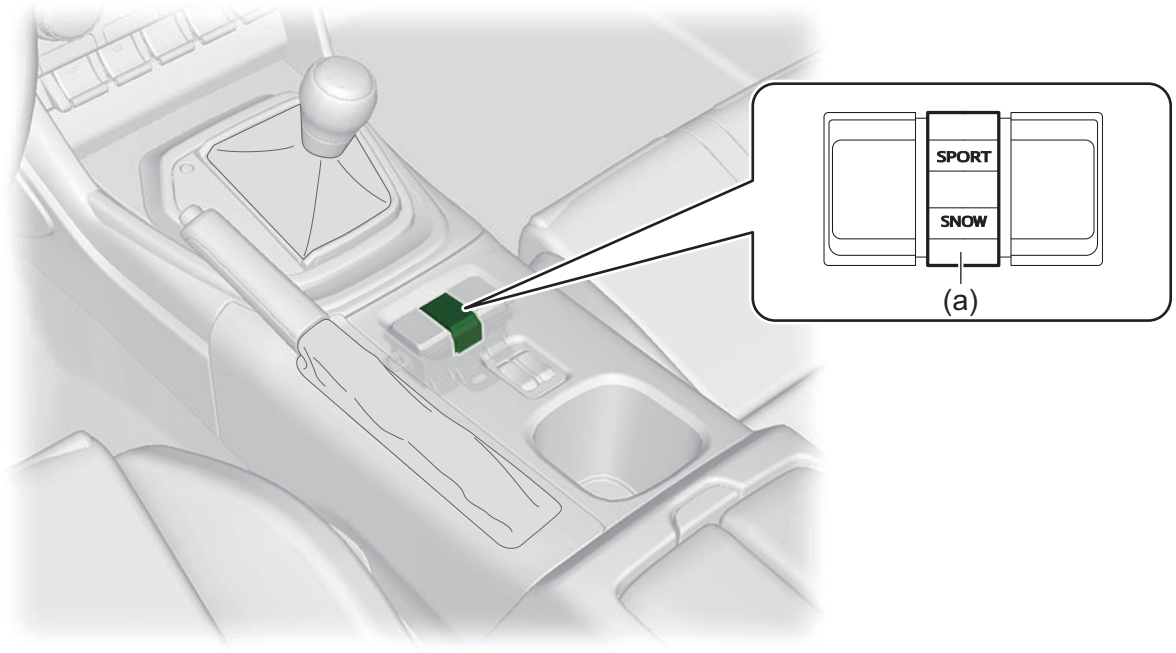
The mode may not switch to SNOW mode in the following cases.

- When an abnormality occurs in the engine electronic control system or automatic transmission electronic control system

The mode may switch to normal mode automatically in the following cases.

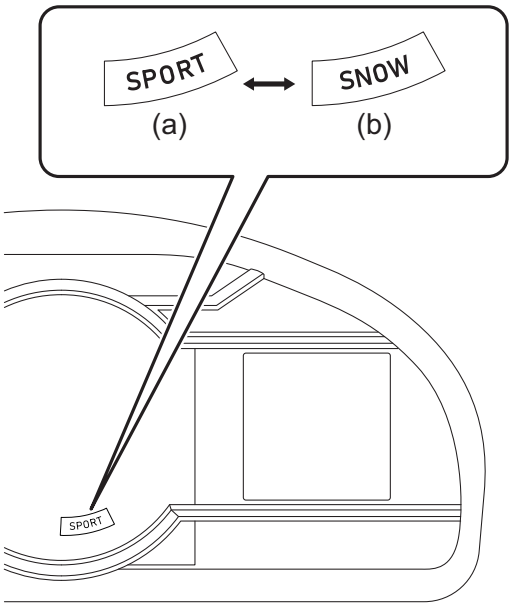
- When the engine is stopped while SPORT mode or SNOW mode is selected
- When Adaptive Cruise Control or Conventional Cruise Control was used while driving in SPORT mode
- When an abnormality occurs in the engine electronic control system or automatic transmission electronic control system while SPORT mode or SNOW mode is selected
- When automatically starting off from 2nd speed or stopping in 2nd speed while driving in SPORT mode, the idling speed is high during warm-up, and the road surface is slippery

Each mode switch



(a) Select mode switch

Each mode indicator



(a) SPORT mode indicator

(b) SNOW mode indicator

Manual shift control

Manual shift is adopted that enables the easy manual selection of the gear position by operating + (UP)/- (DOWN) of the select lever. Furthermore, paddle shift switches (transmission shift switches) are provided on the rear of the steering wheel to enable + (UP)/- (DOWN) operations while continuing to hold the steering wheel.

The manual shift is a mechanism that enables driving in the selected gear according to the operation of the select lever or paddle shift switches (transmission shift switches) after the select lever is moved to the M position to change from automatic shift mode to M mode.

The paddle shift switch operations are enabled even when in the D position, and the mode can be switched temporarily to M mode by operating a paddle shift switch. This enables shifting up or down by operating the paddle shift switch without releasing the steering wheel even while in the D position.

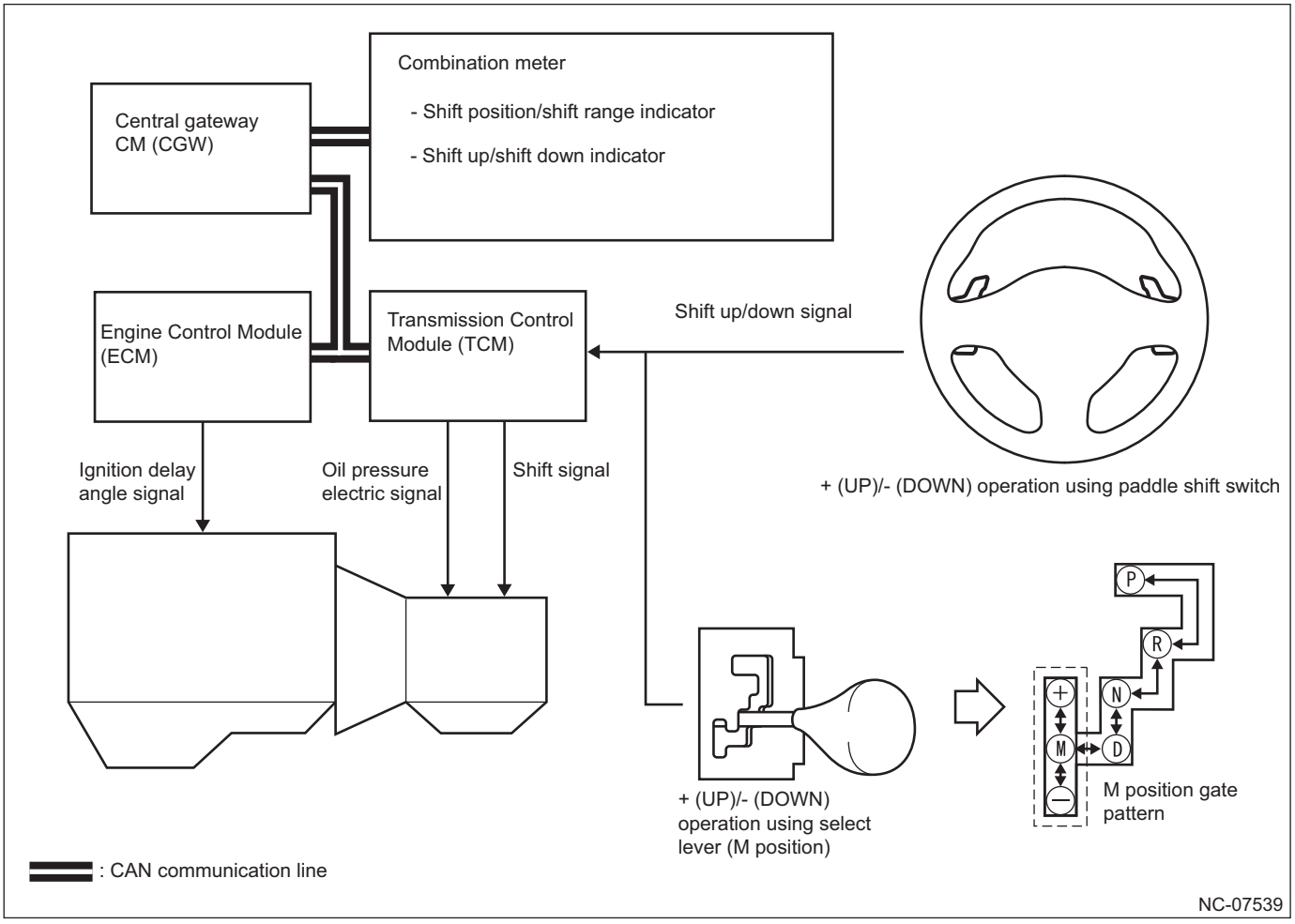
When the M position is selected by the select lever, it is possible to fully use the range up to the maximum engine speed by holding the shift range.

Reference

- Even while in M mode, shift down is performed when the vehicle speed decreases.
- Shift up is performed automatically when the engine oil temperature is high.
- When a paddle shift switch is operated while in the D position, if the vehicle speed is low or the system determines that the driver intends to accelerate based on various parameters, the mode returns to normal driving automatically.

M mode control

Shift mode	M mode automatic cancellation	Automatic shift up at high engine speed	Automatic shift down when vehicle speed decreases
D position M mode	○	○	○
M position M mode	×	○ (Only when engine oil temperature is high)	○


Combination meter
- Shift position/shift range indicator
- Shift up/shift down indicator
Central gateway CM (CGW)
Engine Control Module (ECM)
Transmission Control Module (TCM)
Shift up/down signal
Ignition delay angle signal
Oil pressure electric signal
Shift signal
+ (UP)/- (DOWN) operation using paddle shift switch
+ (UP)/- (DOWN) operation using select lever (M position)
P
R
N
D
M
+
—
M position gate pattern
: CAN communication line
NC-07539

■ Manual shift indicator display

Shift position/shift range indicators are located in the combination meter. These support sporty driving in manual shift.

The M mode indicator turns on when the select lever is in the M position, or when M mode is entered temporarily by operating a paddle shift switch while in the D position.

The shift range indicator displays the number of the selected gear position while in the M position, or when a paddle shift switch is operated while in the D position. When in SPORT mode, this displays the number of the gear position even while in the D position.

The D position indicator turns on while in the D position in SPORT mode.

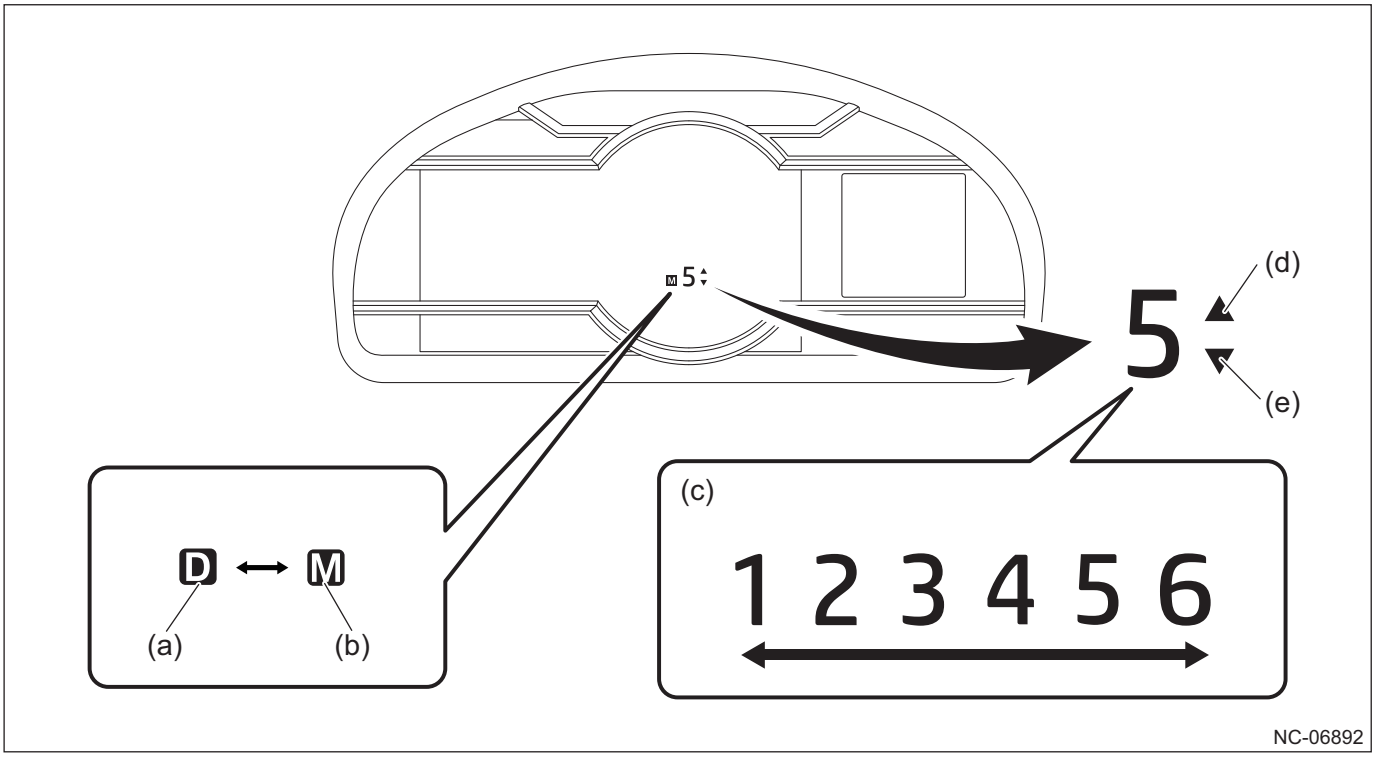
The shift up/down indicators are displayed in the M position, or when M mode is entered temporarily while in the D position.

The shift up indicator turns on or flashes when shift up is possible.

The shift down indicator turns on or flashes when shift down is possible. Also, when shift down is operated while the shift down indicator is off, the reject warning buzzer sounds (beeps) from the combination meter.

Reference

- Shift up/down indicator on: Shift up/down is possible
- Shift up/down indicator flashes: Shift change request due to high fuel consumption



(a) D position indicator
(b) M mode indicator
(c) Shift range indicator
(d) Shift up indicator
(e) Shift down indicator

■ Available gear positions during range selection control in M mode and D position

Shifting is performed automatically by the selected shift range according to the speed and driving conditions as shown in the table below.

Shift position operation

Select lever position	Shift position operation (+/-)	Shift position/shift range indicator display	Available gear position of AT
D	Not operated (operation by paddle shift switch available)	D	6, 5, 4, 3, 2, 1 (automatic shift)
M	Operation available	6	6
		5	5
		4	4
		3	3
		2	2
		1	1

Fail-safe

This function prevents major impairment to driveability even if an abnormality occurs in one of the sensors or solenoids. For the detailed controls, refer to the repair manual.

Diagnosis

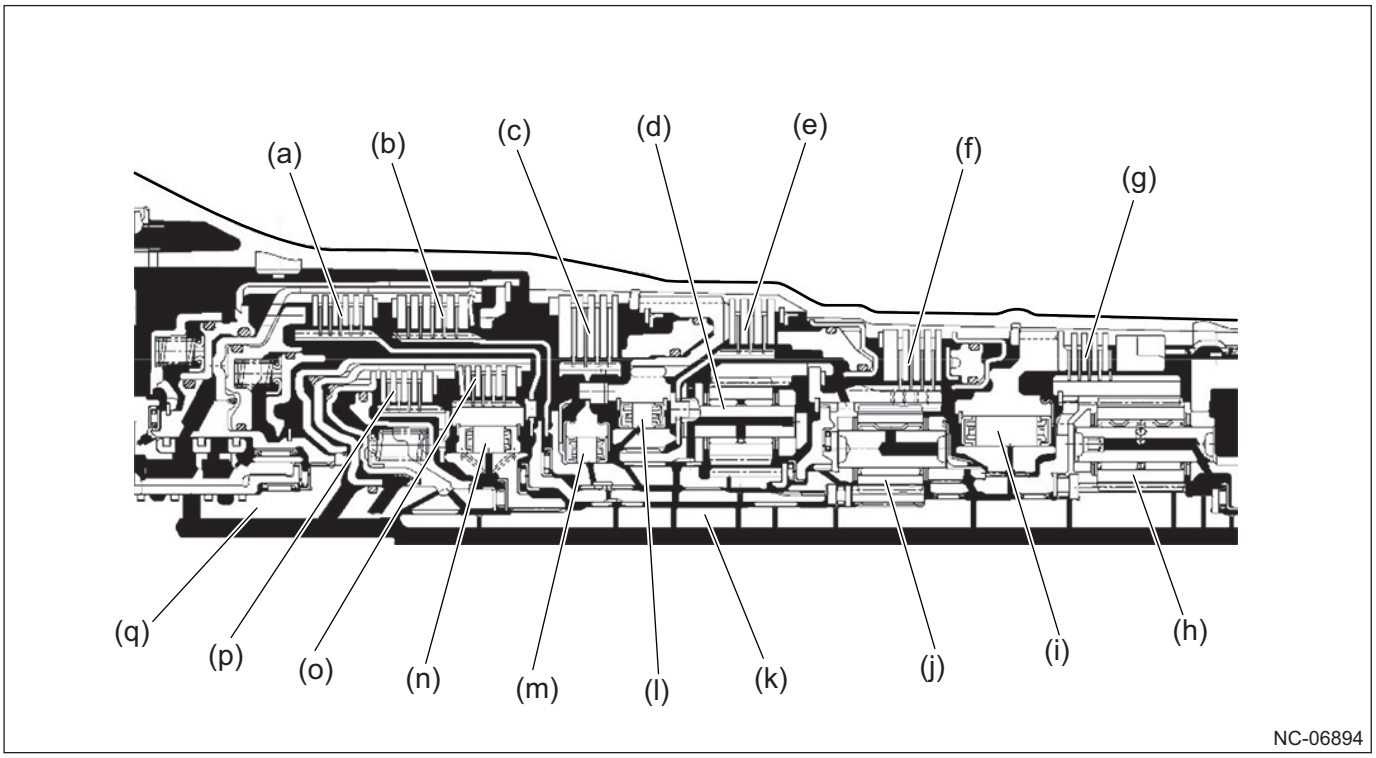
Each CM can be accessed via the CAN communication line by connecting the Subaru Select Monitor to the connector on the vehicle (data link connector). This enables diagnosis codes to be output, as well as operations such as data monitoring (checking CM data, etc.), active tests (driving various actuators as desired), and customization (setting of control programs). For details, refer to the service manual.

Power transmission mechanism

Gear train

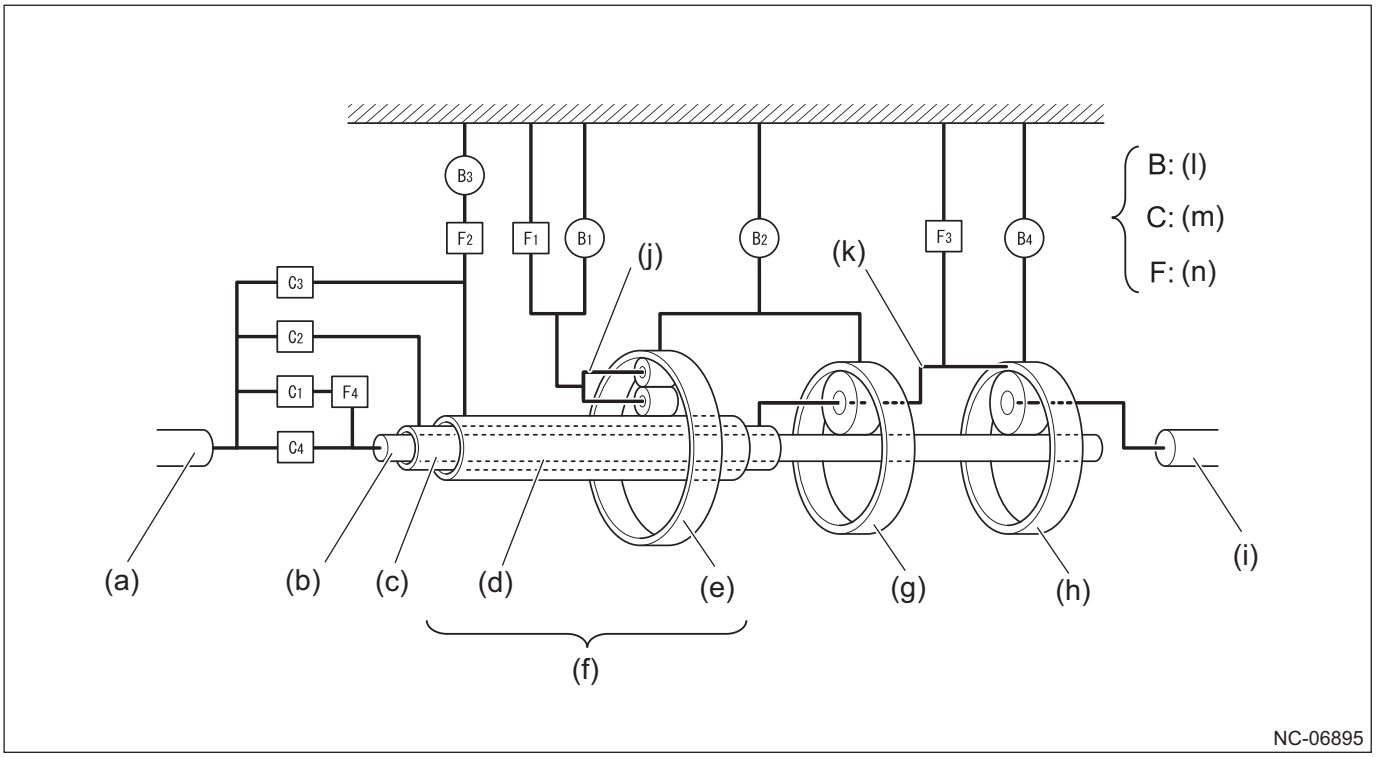
The gear train is composed of 4 multi-plate brakes, 4 multi-plate clutches, 4 one-way clutches, and 3 planetary gears comprised of a sun gear, pinion gear, and ring gear.

The material of the front planetary gear carrier is changed from tradition iron to an aluminum alloy integral molding, reducing weight by approximately 50% compared to traditional gear carriers.



(a) Clutch No. 2 (C2)
(b) Clutch No. 3 (C3)
(c) Brake No. 3 (B3)
(d) Front planetary
(e) Brake No. 1 (B1)
(f) Brake No. 2 (B2)
(g) Brake No. 4 (B4)
(h) Rear planetary
(i) One-way clutch No. 3 (F3)
(j) Mid planetary
(k) Intermediate shaft
(l) One-way clutch No. 1 (F1)
(m) One-way clutch No. 2 (F2)
(n) One-way clutch No. 4 (F4)
(o) Clutch No. 1 (C1)
(p) Clutch No. 4 (C4)
(q) Input shaft

■ Structure of TX6A gear train



(a) Input shaft
(b) Intermediate shaft
(c) Mid planetary gear carrier
(d) Front planetary sun gear
(e) Front planetary ring gear
(f) Front planetary gear
(g) Mid planetary ring gear
(h) Rear planetary ring gear
(i) Output shaft
(j) Front planetary carrier
(k) Mid planetary carrier
(l) Brake
(m) Clutch
(n) One-way clutch

Components and their operation

Component		Action
Clutch No. 1	C1	Connects the input shaft and the intermediate shaft via one-way clutch No. 4 (F4).
Clutch No. 2	C2	Connects the input shaft and mid planetary carrier.
Clutch No. 3	C3	Connects the input shaft and front planetary sun gear.
Clutch No. 4	C4	Connects the input shaft and the intermediate shaft.
Brake No. 1	B1	Locks the rotation of the front planetary carrier.
Brake No. 2	B2	Locks the rotation of the front and mid planetary ring gears.
Brake No. 3	B3	Locks the outer race of one-way clutch No. 2 (F2).
Brake No. 4	B4	Locks the rotation of the rear planetary ring gear.
One-way clutch No. 1	F1	Locks the counterclockwise rotation* of the front planetary carrier relative to the case.
One-way clutch No. 2	F2	Locks the counterclockwise rotation* of the front planetary sun gear when brake No. 3 (B3) operates.
One-way clutch No. 3	F3	Locks the counterclockwise rotation* of the rear planetary ring gear. Locks the counterclockwise rotation* of the mid planetary carrier.
One-way clutch No. 4	F4	Locks the counterclockwise rotation* of the intermediate shaft when clutch No. 1 (C1) operates.

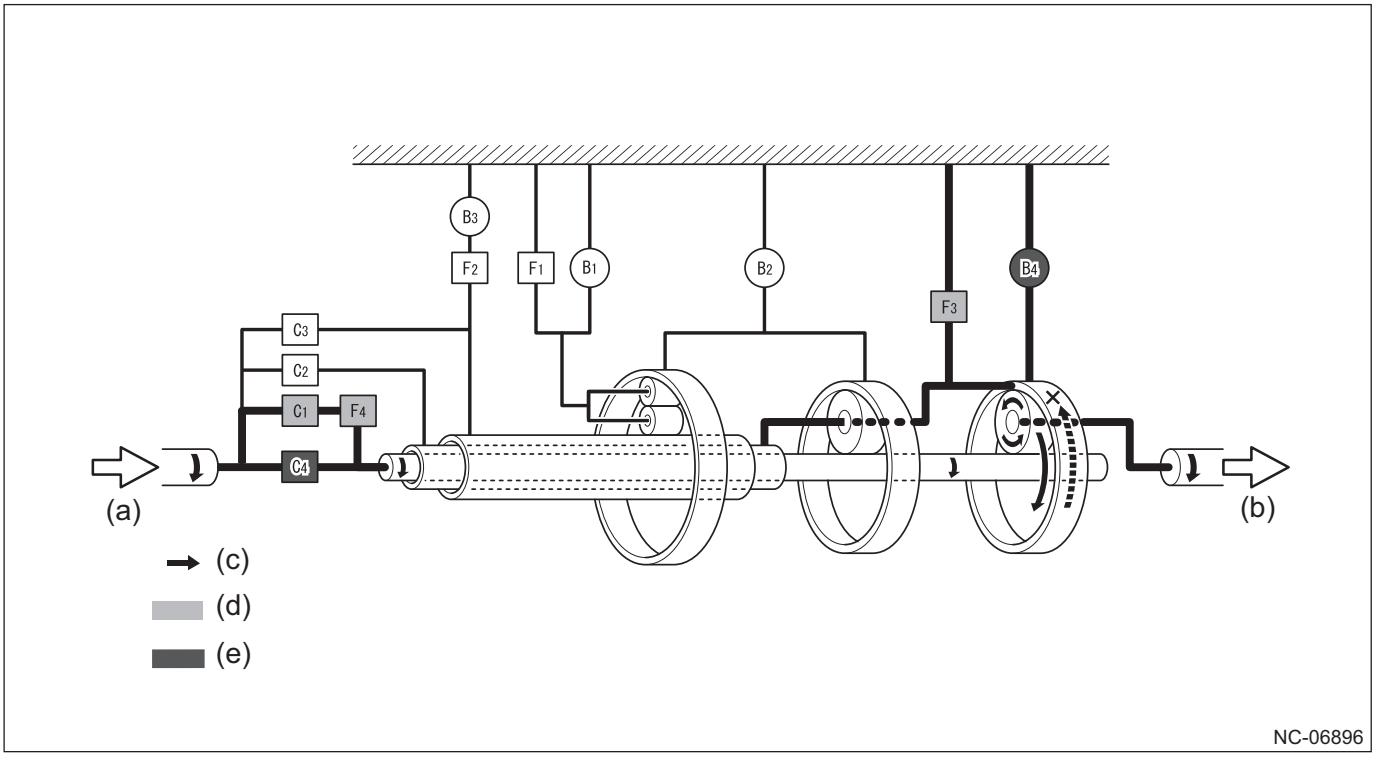
**: When viewed from input shaft side*

Components and their operating conditions (○ : Engaged, △ : Engaged but power not transmitted, -: Not applicable)

		C1	C2	C3	C4	B1	B2	B3	B4	F1	F2	F3	F4	Gear ratio
P		-	-	-	-	-	-	-	-	-	-	-	-	-
R		-	-	○	-	○	-	-	○	○	-	-	-	3.168
N		-	-	-	-	-	-	-	-	-	-	-	-	-
D	1st	○	-	-	-	-	-	-	-	-	-	○	○	3.538
	2nd	○	-	-	○	-	○	○	-	○	○	-	○	2.060
	3rd	○	-	○	○	○	-	△	-	○	-	-	○	1.405
	4th	○	○	△	○	-	-	△	-	-	-	-	○	1.000
	5th	△	○	○	-	○	-	△	-	-	-	-	-	0.713
	6th	△	○	-	-	△	○	△	-	-	-	-	-	0.582
M	1st	○	-	-	○	-	-	-	○	-	-	○	○	3.538
	2nd	○	-	-	○	-	○	○	-	○	○	-	○	2.060
	3rd	○	-	○	○	○	-	△	-	○	-	-	○	1.405
	4th	○	○	△	○	-	-	△	-	-	-	-	○	1.000
	5th	△	○	○	-	○	-	△	-	-	-	-	-	0.713
	6th	△	○	-	-	△	○	△	-	-	-	-	-	0.582

■ Operation of TX6A gear train

1st

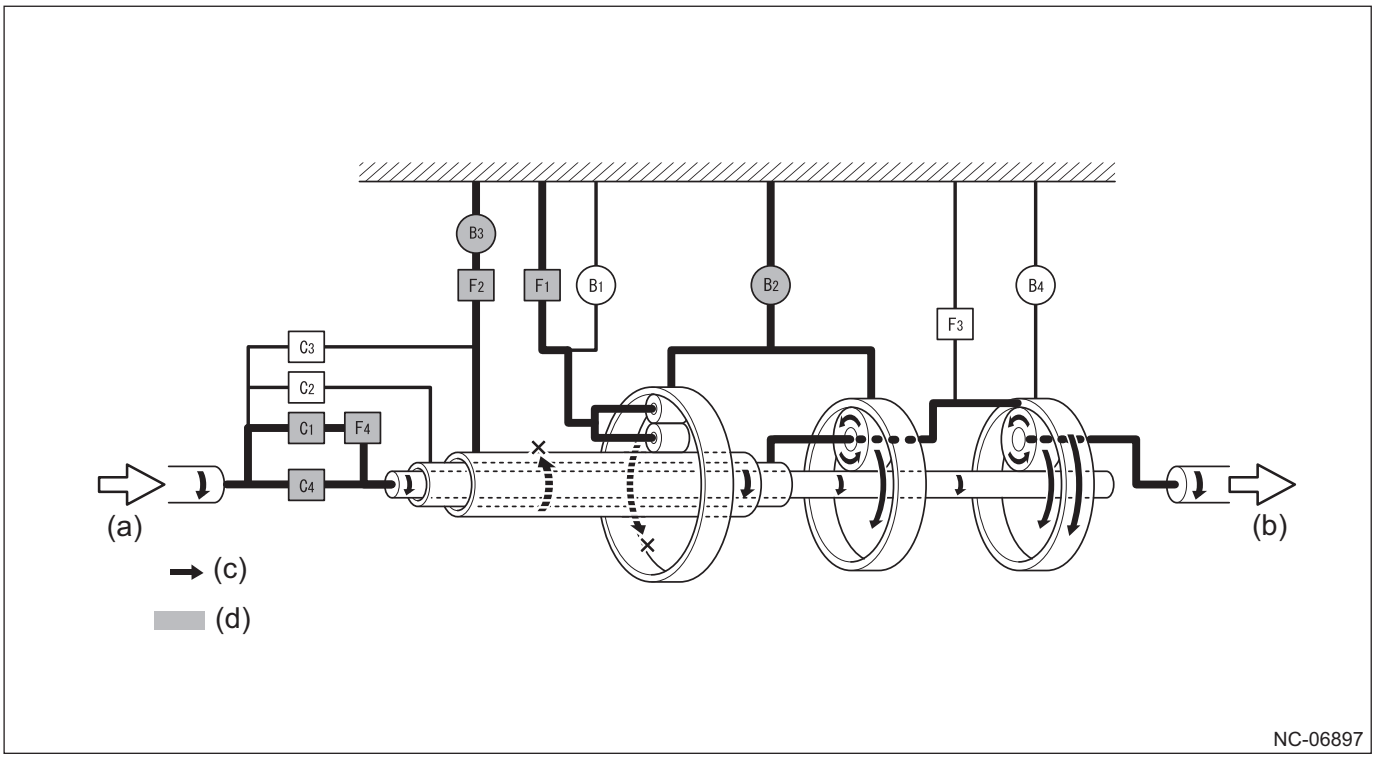


(a) Input
(b) Output
(c) Gear/shaft rotation
(d) Operation
(e) Operation in M mode

Clutch/brake operating status (○ : Engaged, (○): Power transmission in M mode, -: Not applicable)

	C1	C2	C3	C4	B1	B2	B3	B4	F1	F2	F3	F4	Gear ratio
1st	○	-	-	(○)	-	-	-	(○)	-	-	○	○	3.538

2nd

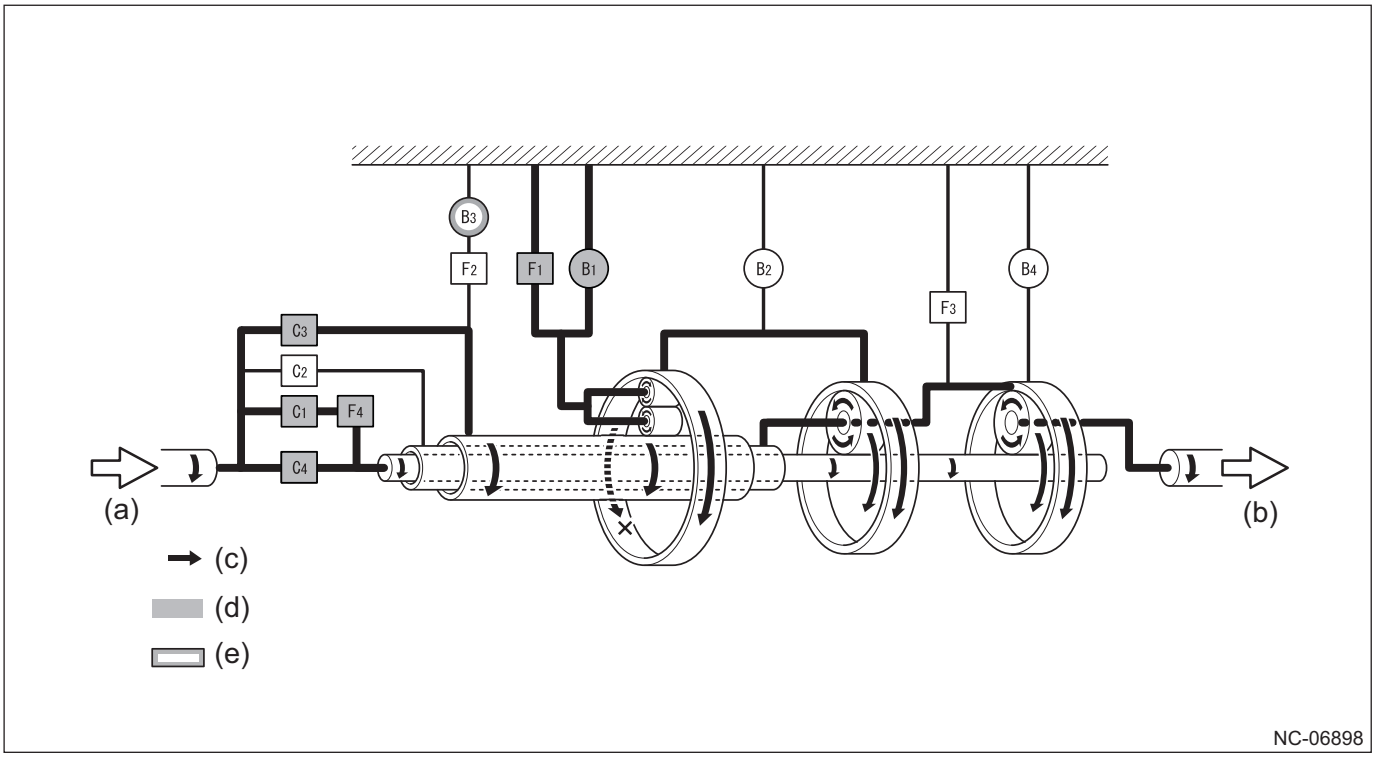


(a) Input
(b) Output
(c) Gear/shaft rotation
(d) Operation

Clutch/brake operating status (○ : Engaged, -: Not applicable)

	C1	C2	C3	C4	B1	B2	B3	B4	F1	F2	F3	F4	Gear ratio
2nd	○	-	-	○	-	○	○	-	○	○	-	○	2.060

3rd

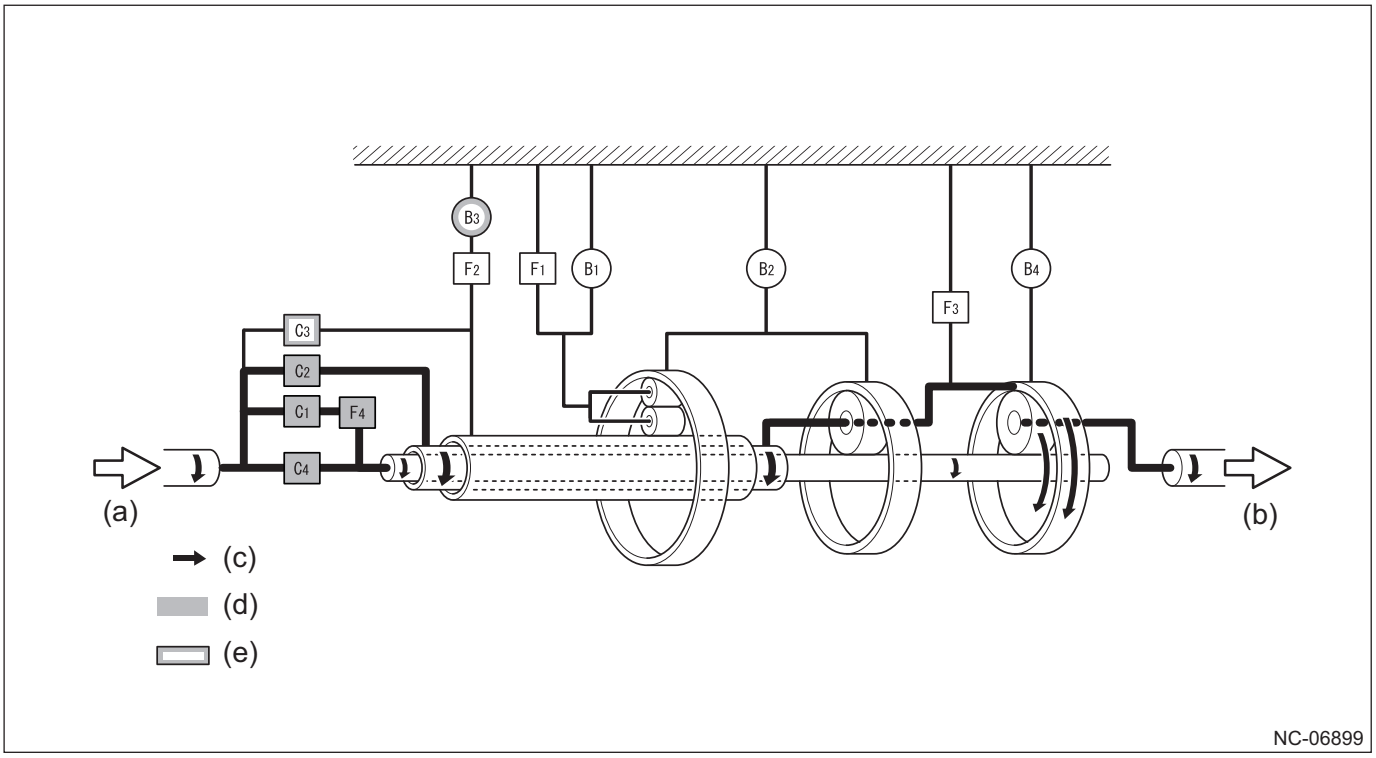


(a) Input
(b) Output
(c) Gear/shaft rotation
(d) Operation
(e) Engaged but power not transmitted

Clutch/brake operating status (○ : Engaged, △ : Engaged but power not transmitted, -: Not applicable)

	C1	C2	C3	C4	B1	B2	B3	B4	F1	F2	F3	F4	Gear ratio
3rd	○	-	○	○	○	-	△	-	○	-	-	○	1.405

4th

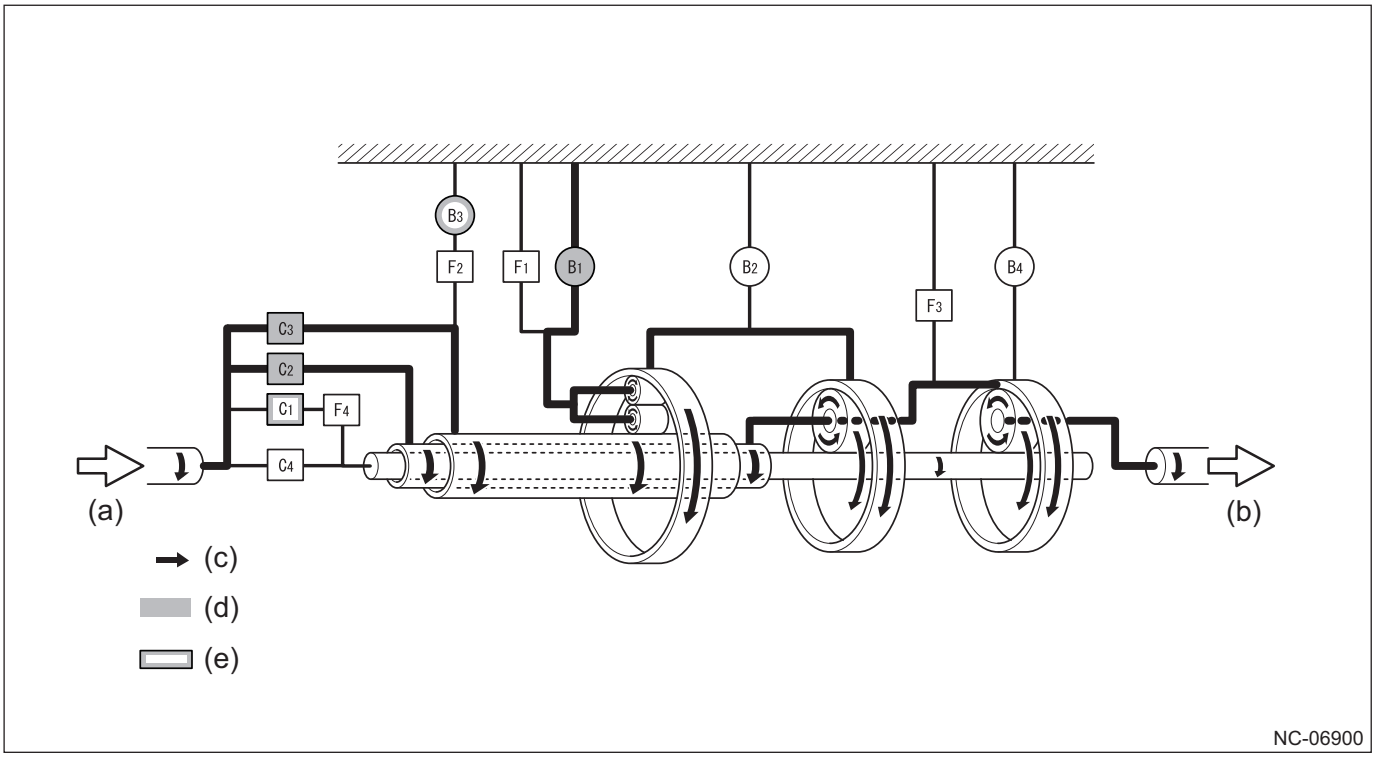


(a) Input
(b) Output
(c) Gear/shaft rotation
(d) Operation
(e) Engaged but power not transmitted

Clutch/brake operating status (○ : Engaged, △ : Engaged but power not transmitted, -: Not applicable)

	C1	C2	C3	C4	B1	B2	B3	B4	F1	F2	F3	F4	Gear ratio
4th	○	○	△	○	-	-	△	-	-	-	-	○	1.000

5th

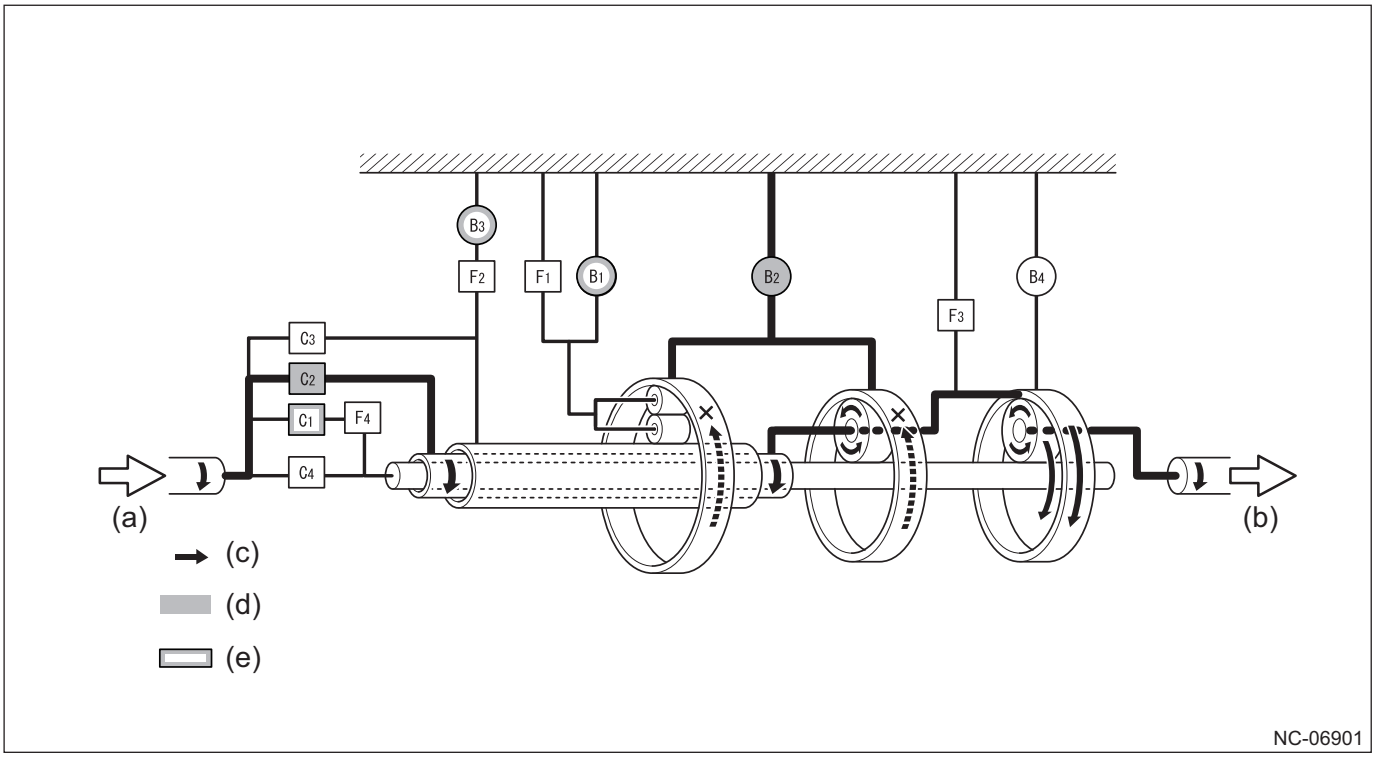


(a) Input
(b) Output
(c) Gear/shaft rotation
(d) Operation
(e) Engaged but power not transmitted

Clutch/brake operating status (○ : Engaged, △ : Engaged but power not transmitted, -: Not applicable)

	C1	C2	C3	C4	B1	B2	B3	B4	F1	F2	F3	F4	Gear ratio
5th	△	○	○	-	○	-	△	-	-	-	-	-	0.713

6th

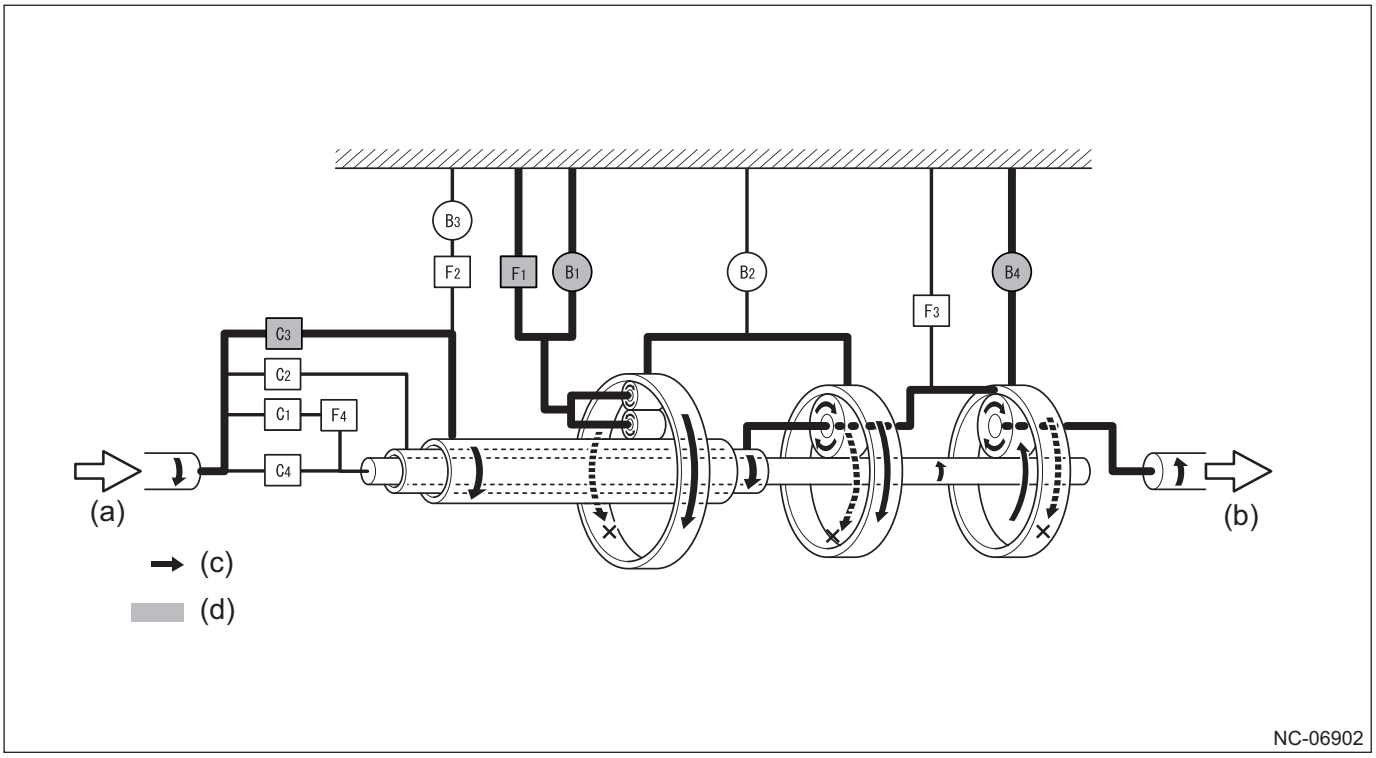


(a) Input
(b) Output
(c) Gear/shaft rotation
(d) Operation
(e) Engaged but power not transmitted

Clutch/brake operating status (○ : Engaged, △ : Engaged but power not transmitted, -: Not applicable)

	C1	C2	C3	C4	B1	B2	B3	B4	F1	F2	F3	F4	Gear ratio
6th	△	○	-	-	△	○	△	-	-	-	-	-	0.582

R (R position)



(a) Input
(b) Output
(c) Gear/shaft rotation
(d) Operation

Clutch/brake operating status (○ : Engaged, -: Not applicable)

	C1	C2	C3	C4	B1	B2	B3	B4	F1	F2	F3	F4	Gear ratio
R	-	-	○	-	○	-	-	○	○	-	-	-	3.168

3.6 Rear differential

3.6.1 Overview

Overview

A torque-sensing limited slip differential (Torsen LSD)* is adopted for the differential carrier assembly RR.

Reference
*"Torsen" is a registered trademark of JTEKT Corporation.

The torque-sensing limited slip differential (Torsen LSD) optimizes the differential limiting force to reduce traction loss and ensure vehicle controllability.

Low viscosity multi-grade oil that reduces oil agitation resistance and bearing rolling resistance during low oil temperatures is adopted for the torque-sensing limited slip differential (Torsen LSD) to achieve low fuel consumption.

Specifications

Rear differential specifications

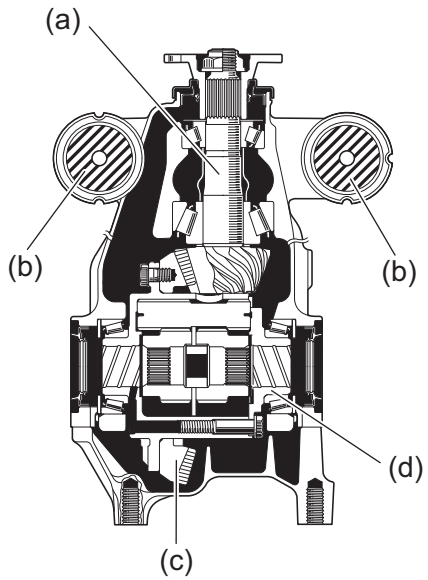
Transmission	6MT	6AT
Reduction speed ratio	4.100	3.909
Ring gear size (in (mm))	8.07 (205)	8.07 (205)
Number of drive pinion teeth	10	11
Number of ring gear teeth	41	43
Number of pinions	8	8
Name of oil used	Differential Gear Oil LX (API GL-5 and SAE 75W-85)	Differential Gear Oil LX (API GL-5 and SAE 75W-85)
Oil amount (US qt (liters, Imp qt)) (reference)	1.22 (1.15, 1.01)	1.22 (1.15, 1.01)

Caution

- Never perform work that allows only one wheel to spin, such as applying drive force while only the rear wheel on one side is contacting the ground, or using an on-car wheel balancer. The structure of the Torsen LSD means that drive force will be transmitted even to the stopped wheels, which may cause the vehicle to start off suddenly. This will also subject the differential mechanism to a load, which may cause a malfunction.
- Use left and right rear wheels and tires of the same type and size, and mount tires with minimal wearing difference on their outer diameter between the left and right.

3.6.2 Component

Component layout drawing



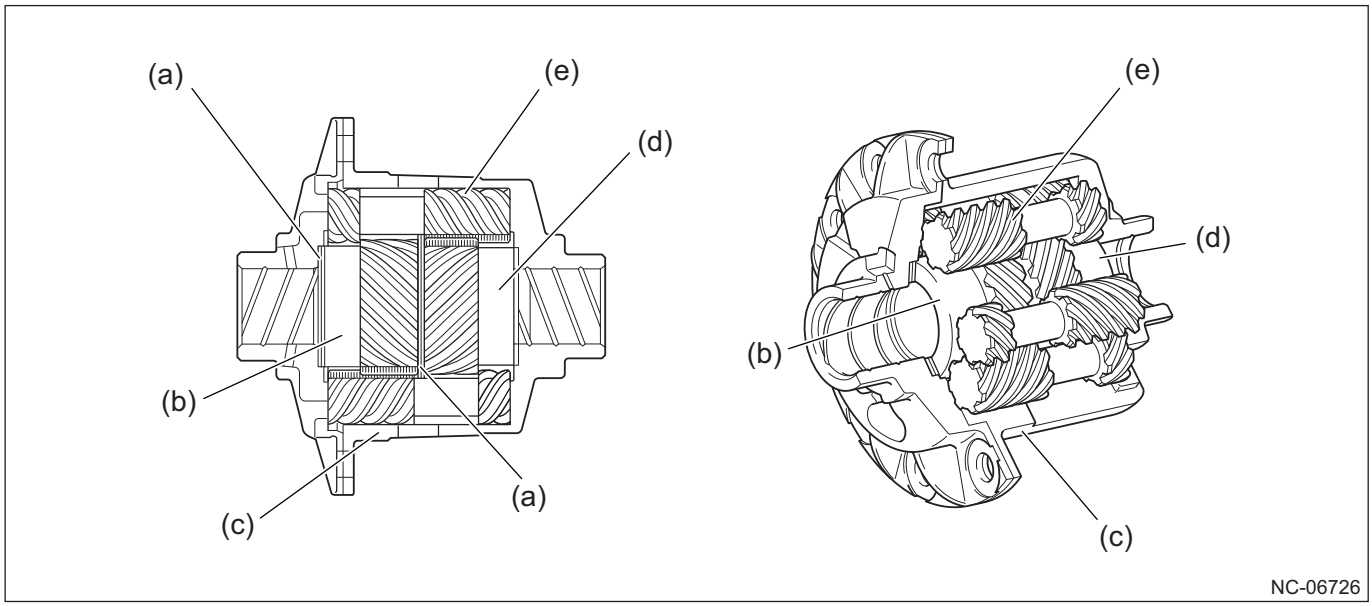
NC-06725

(a) Drive pinion
(b) Differential mount
(c) Ring gear
(d) Differential case

Component details

Helical gear type Torsen LSD

The rear differential case sub-assembly is composed of a differential case, 8 pinion gears, 2 side gears, and 4 thrust washers. The pinion gears engage as 1 set of 2 gears, and each also engages with one side gear. The pinion gear is supported by the hole provided on the differential case, and is designed so that it revolves on the side gear while rotating around itself.



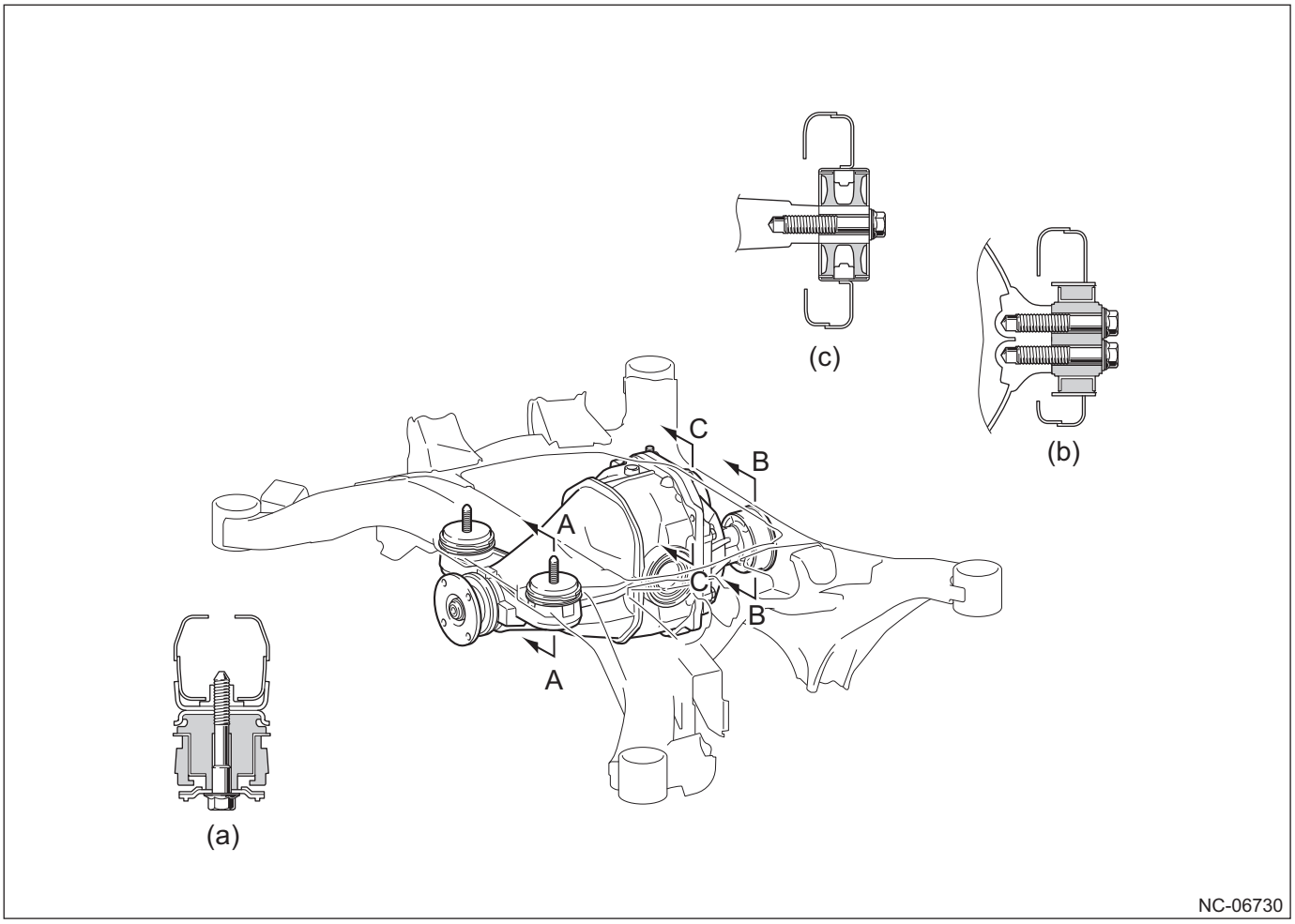
(a) Thrust washer
(b) Left side gear
(c) Differential case
(d) Right side gear
(e) Pinion gear

Rear differential mount

The rear differential carrier assembly RR has a double anti-vibration structure in which it is installed to the rear suspension member sub-assembly via a rubber mount.

A 4-point support structure is used for installation onto the rear suspension member sub-assembly, with a liquid filled type of differential mount adopted on the front (2 points) and on the rear right side (a conventional type is adopted for the other point) to reduce vibration and noise.

The rubber shape on the rear right side mount is optimized for improved durability to support the higher engine output.



(a) A-A cross section
(b) B-B cross section
(c) C-C cross section

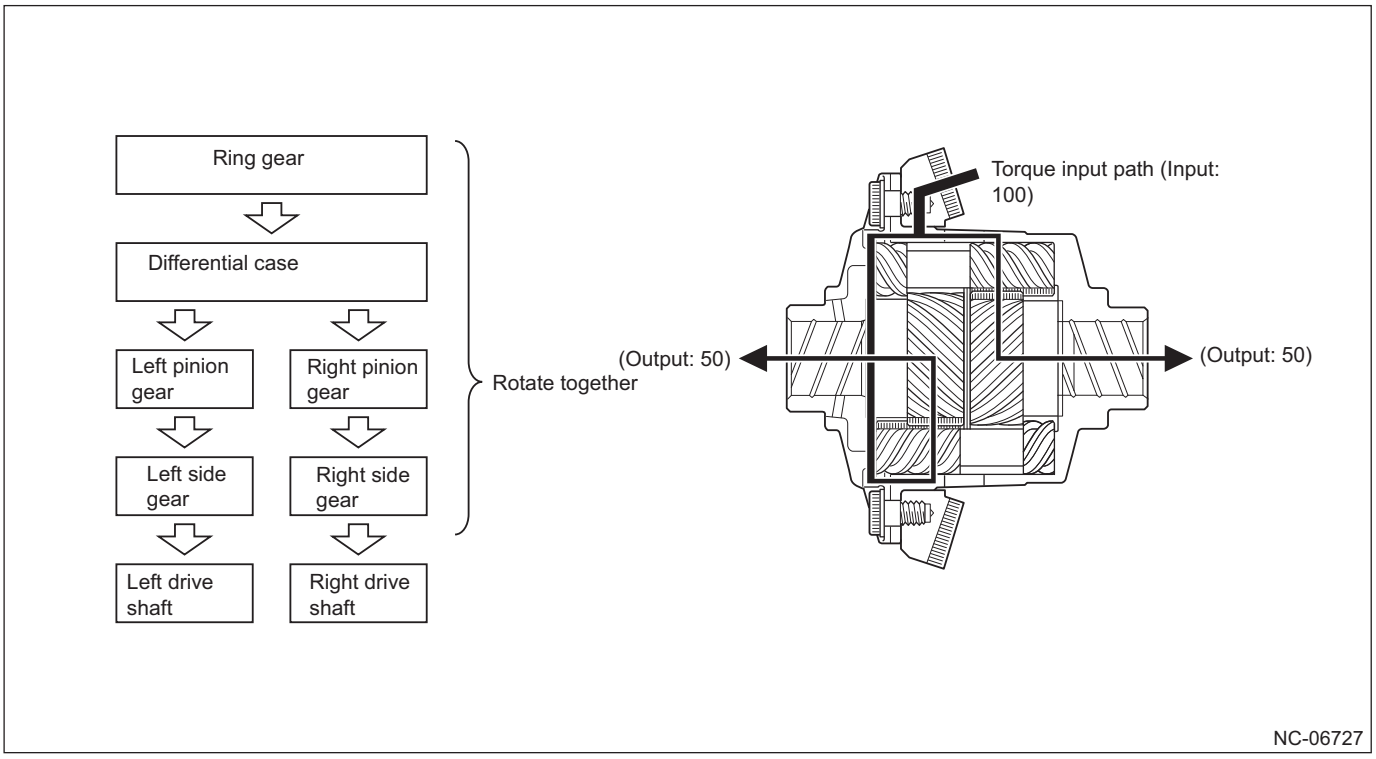
3.6.3 Construction and Operation

Power transmission mechanism

Operation of helical gear type Torsen LSD

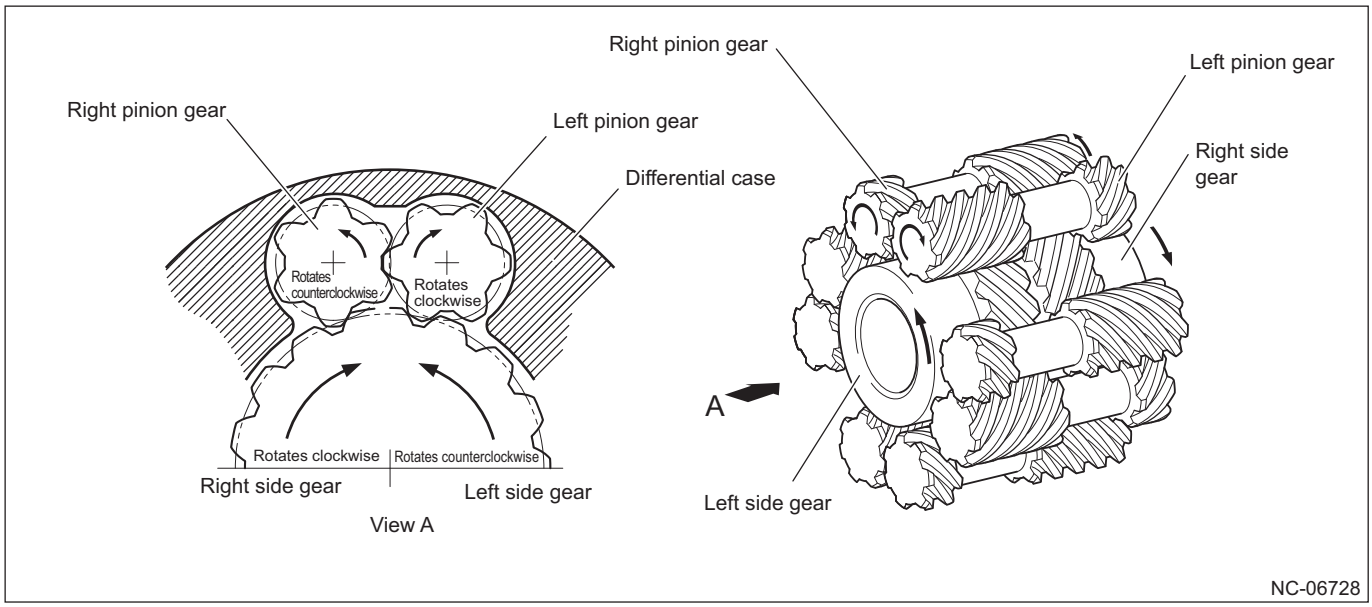
■ When traveling straight forward

Since the left and right drive shafts rotate in the same direction and cycle, the differential case, pinion gear, and side gear rotate together and the drive force is transmitted in the following order.



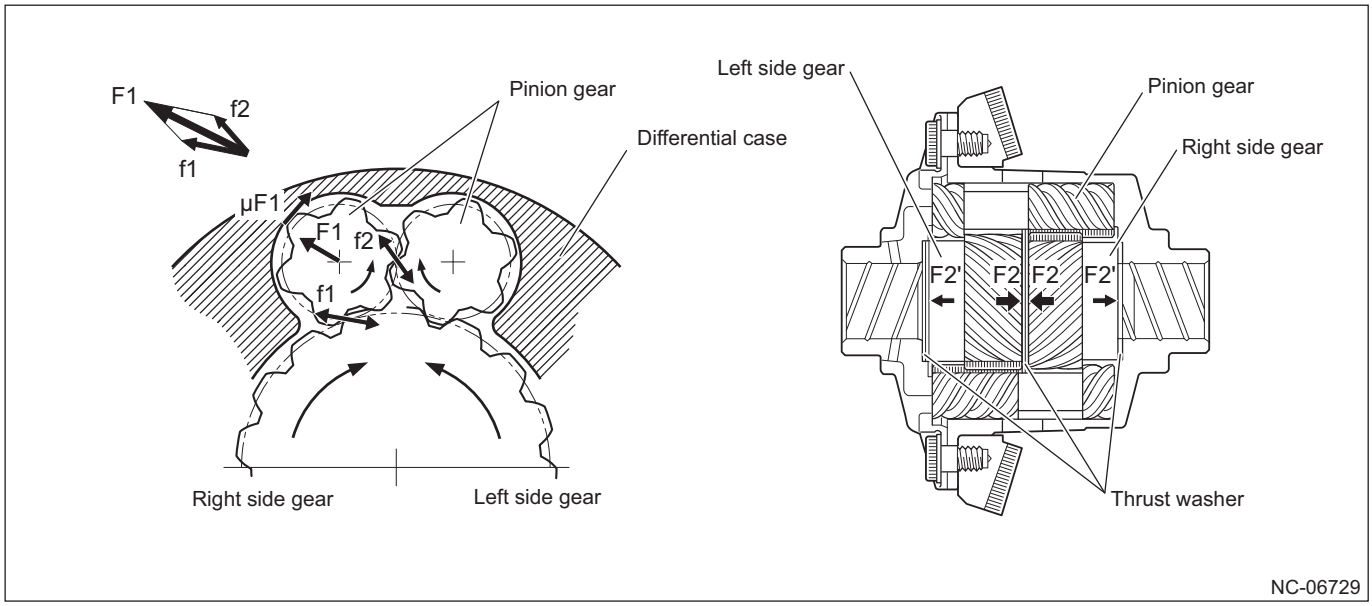
■ When turning

To simplify the explanation, assume that the differential case is fixed. When the left side gear is rotated counterclockwise, the left pinion gear that engages with the left side gear rotates clockwise, and the paired right pinion gear rotates counterclockwise. Then, since the right side gear rotates clockwise in the opposite rotation direction to the left side gear, a differential action is performed.



■ When differential limit operates

The differential limit is mainly performed at 2 locations; the friction between the tips of the pinion gear teeth and the inner side wall surface of the differential case, and between the side gear end faces and the thrust washers. Resultant force F1, which is the total of reaction force f1 for the engagement of the pinion gear and side gear that is proportional to the input torque and reaction force f2 for the engagement between the pinion gears, operates in the direction that the pinion gears press against the differential case. Frictional force μF1 that is generated at the tips of the pinion gear teeth and the inner wall of the differential case acts in the direction that stops the rotation of the pinion gears. Between the left and right side gears, thrust force F2 is generated in the axle shaft direction due to the twisting angle of the differential gear. Frictional force μF2 operates between the side gear end faces and thrust washers, acting in the direction that stops the rotation of the side gears. (Thrust force F2' is generated during deceleration.)



3.7 Drive Shaft/Propeller Shaft/Axle

3.7.1 Overview

Overview

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 is adopted that uses a double offset constant velocity joint as the center joint.

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

Specifications

Rear drive shaft

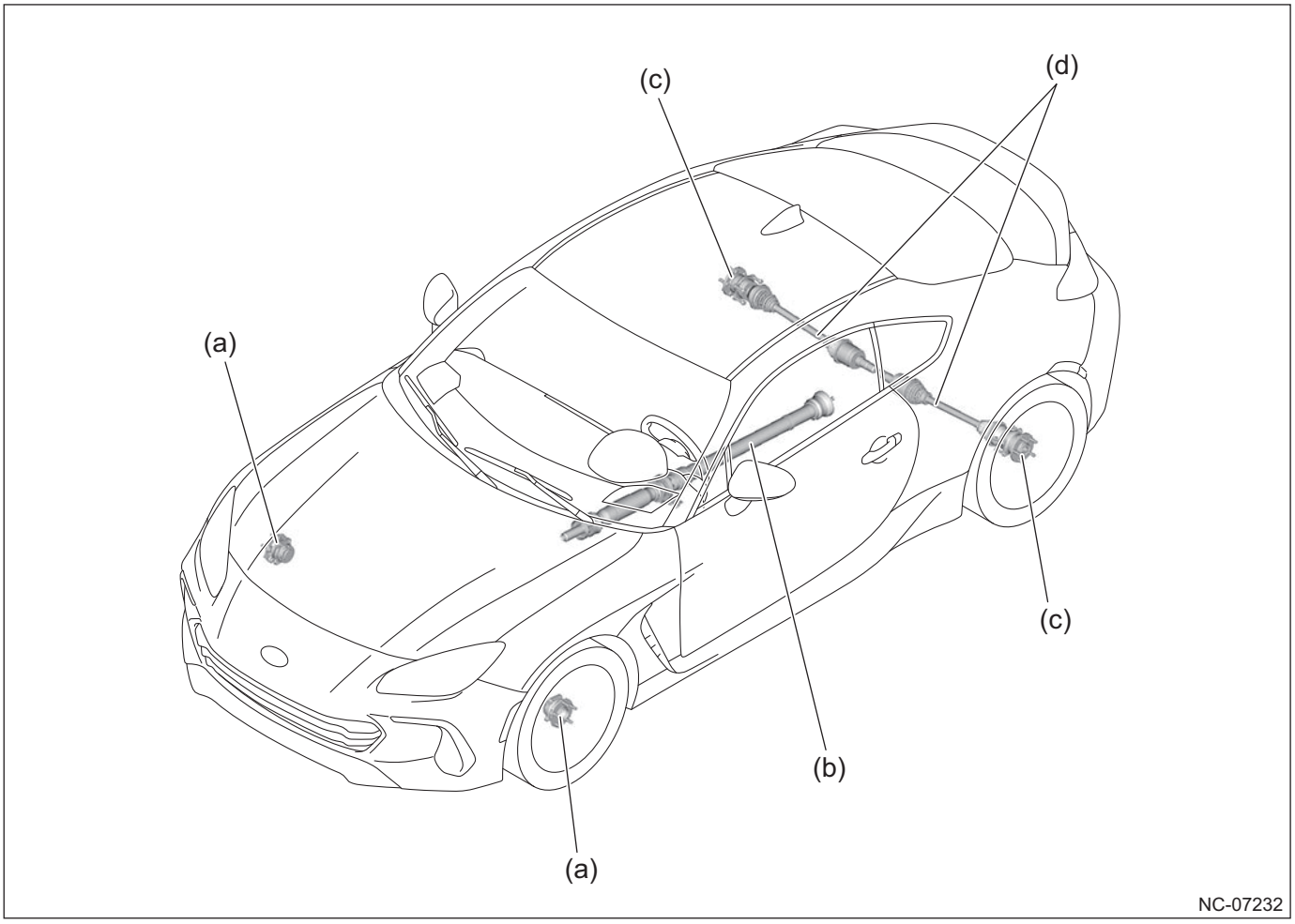
Drive shaft type	Rzeppa constant velocity joint + double offset constant velocity joint	
Joint-to-joint shaft length	in (mm)	11.81 (300)
Shaft diameter	in (mm)	1.11 (28.1)

Propeller shaft

Propeller shaft type		Cardan joint + double offset constant velocity joint	
Propeller shaft joint-to-joint length	Front side	in (mm)	20.14 (511.5)
	Rear side	in (mm)	31.32 (795.5)
Outer diameter of tube	Front side	in (mm)	2.76 (70)
	Rear side	in (mm)	2.24 (57)

3.7.2 Component

Component layout drawing



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

Component details

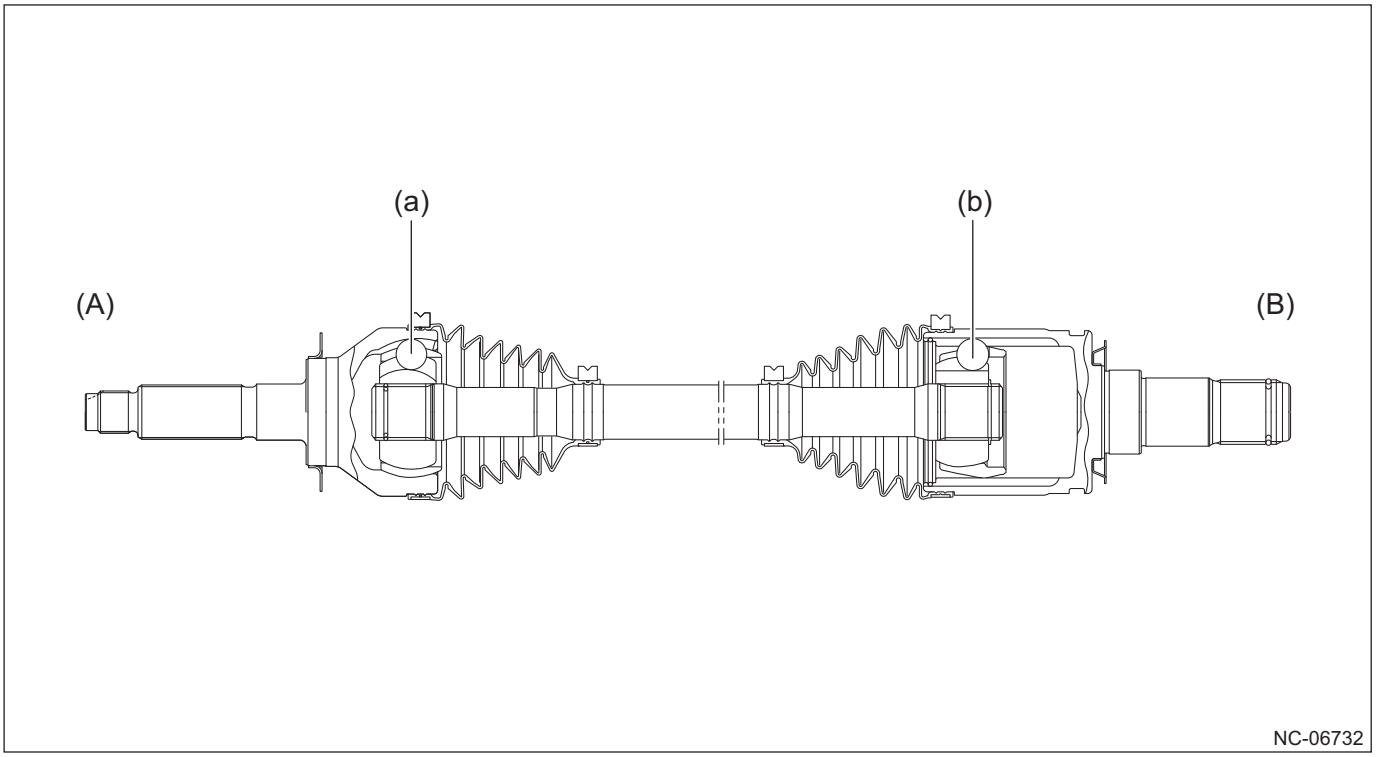
Drive shaft

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

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.

The joint capacity and shaft diameter are increased to support the higher engine output.

A resin boot is adopted for the rear drive shaft to reduce weight.



(A) Wheel side

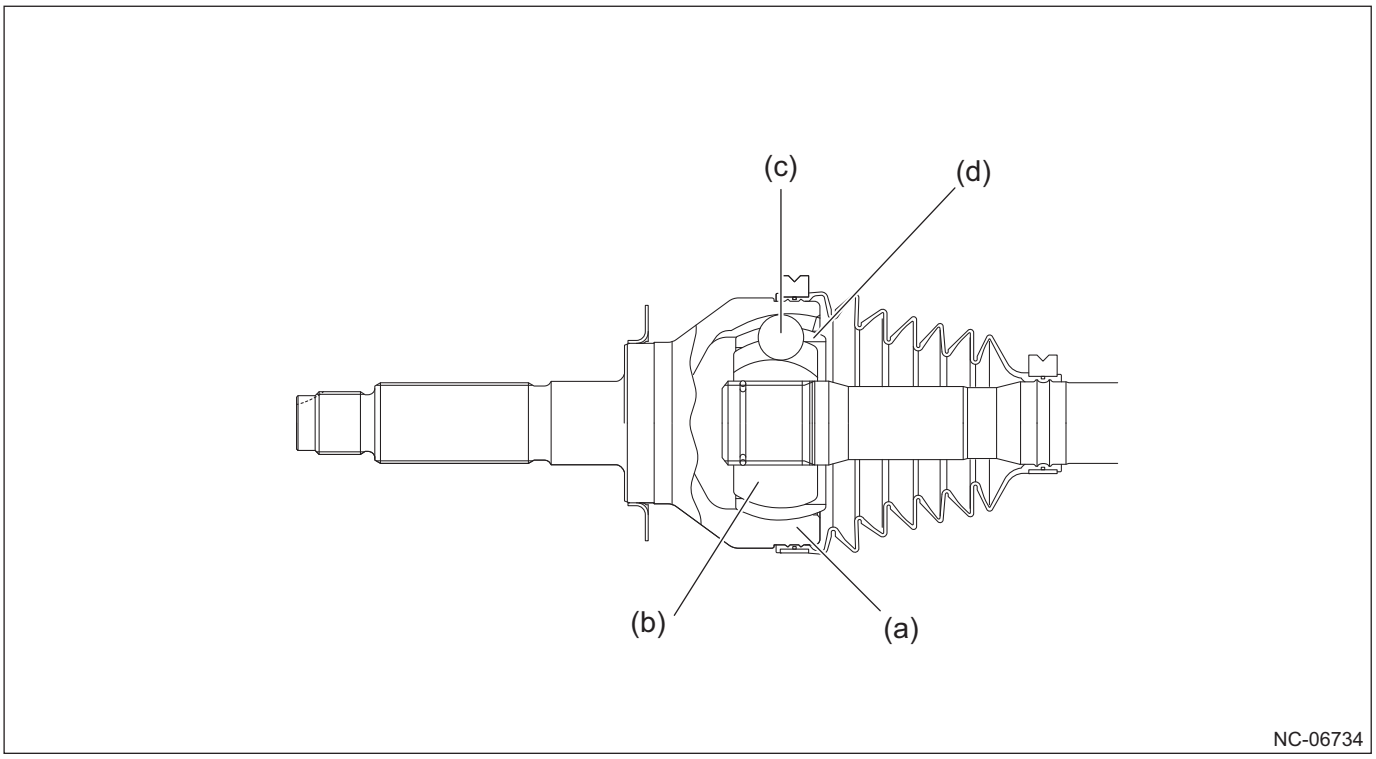
(B) Rear differential side

(a) Rzeppa constant velocity joint

(b) Double offset constant velocity joint

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 inside the outer race and outside the inner race have a spherical surface to form a large operating angle.

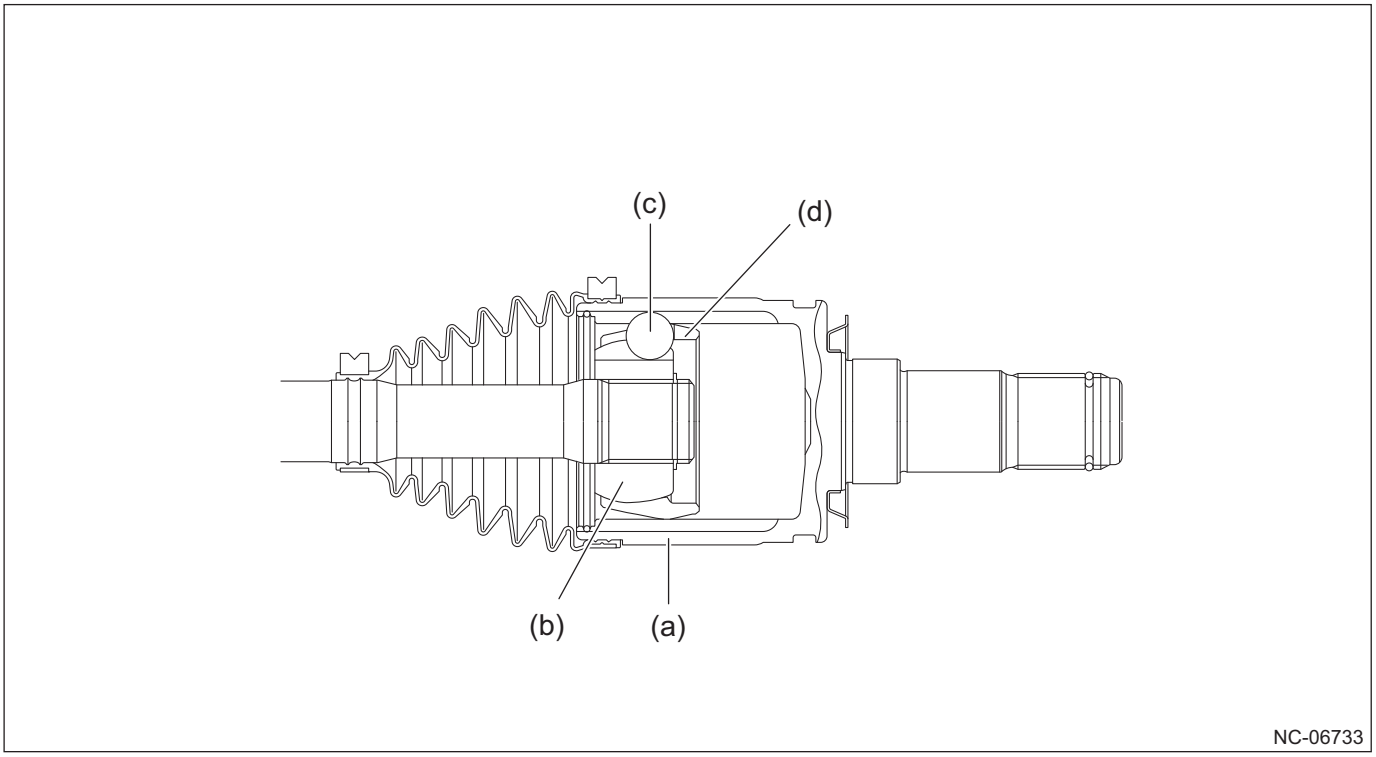


(a) Outer race
(b) Inner race
(c) Ball
(d) Ball cage

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

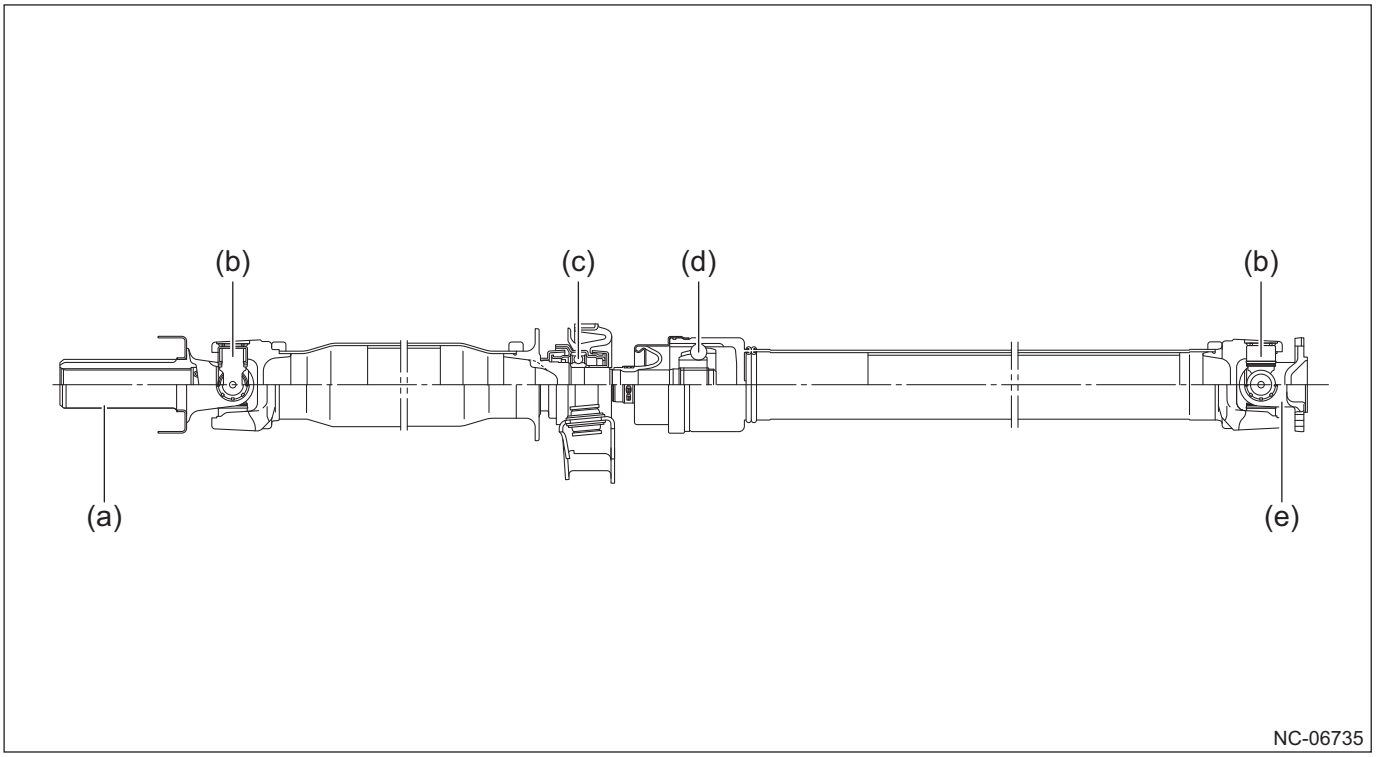
Propeller shaft

The three-joint type propeller shaft with center bearing is adopted.

This achieves a lightweight propeller shaft that improves strength and durability performance while maintaining quietness to support the higher engine output.

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 suppresses rotational vibration.



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

Axle

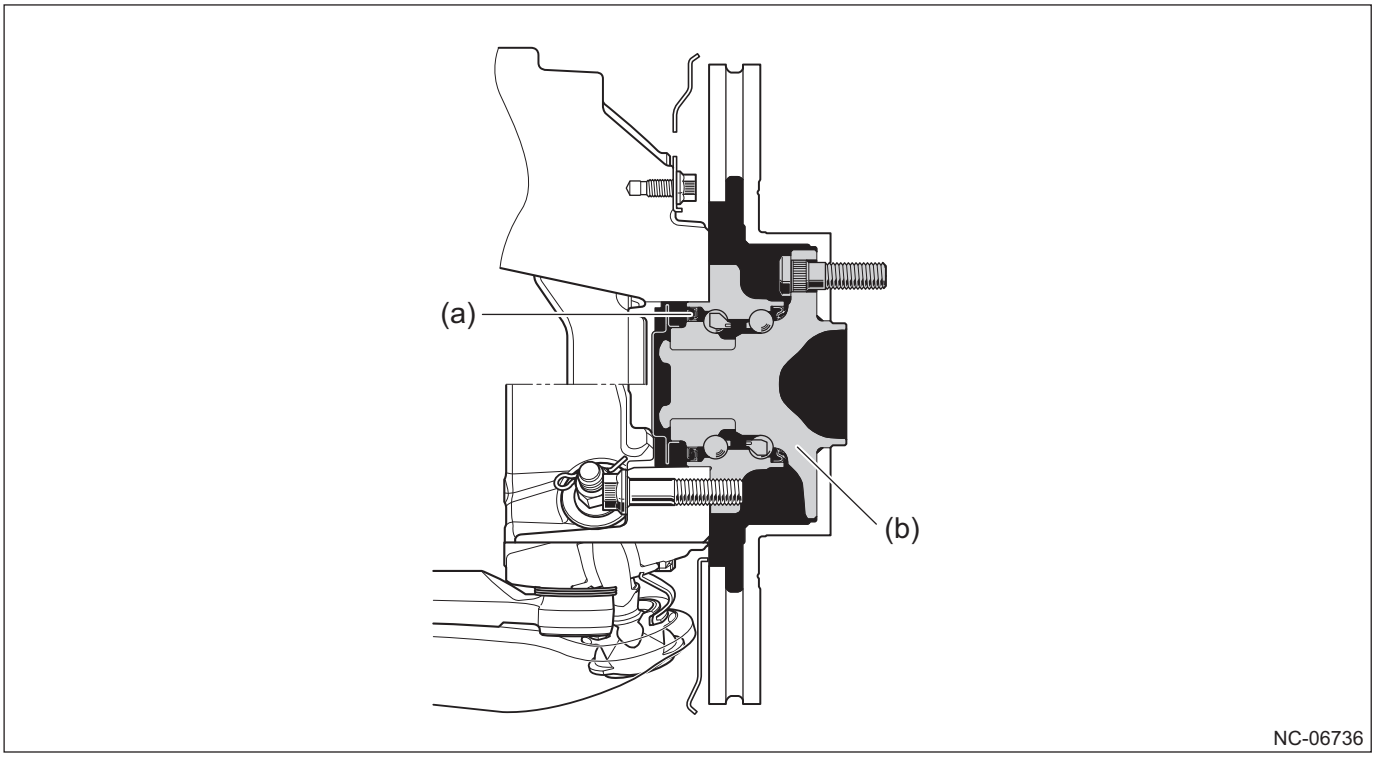
■ Front axle

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

On the unit type front hub unit bearing, one side of the bearing inner race is integrated with the axle hub. This is integrated with the oil seal to reduce the weight, improve durability, and consider serviceability.

The magnetic encoder for speed sensor FR is provided on the outer circumference of the bearing inner race.

As a result of adopting aluminum for the front axle housing, the parts that contact the axle hub housing are plated to suppress any corrosion that occurs due to contact with different types of metal.



(a) Magnetic encoder

(b) Front hub unit bearing

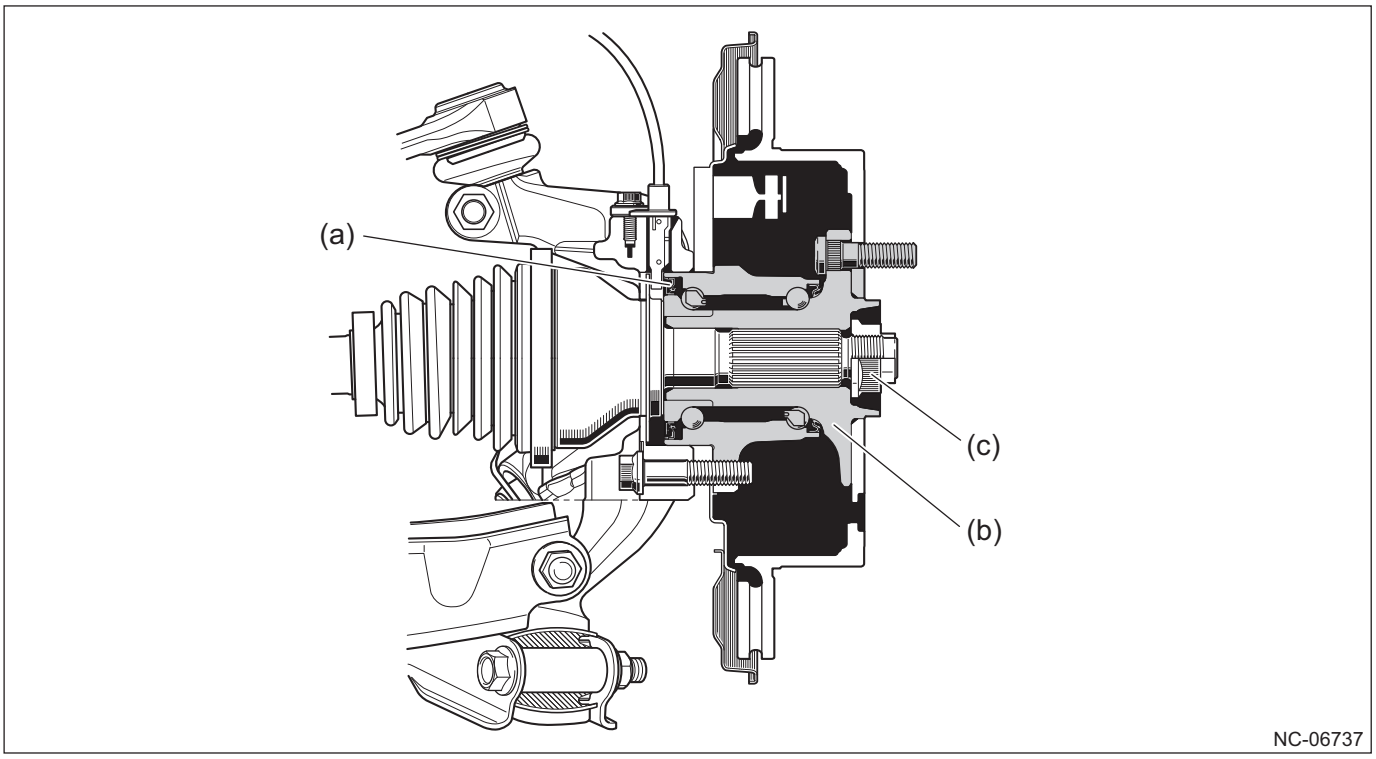
Caution
Since a magnet is used on the front hub unit bearing, do not place magnetic objects near the front hub unit bearing. Also, be careful not to allow any foreign matter to become attached.

■ Rear axle

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

On the unit type rear hub unit bearing, one side of the bearing inner race is integrated with the axle hub. This is integrated with the oil seal to reduce the weight, improve durability, and consider serviceability.

The magnetic encoder for speed sensor RR is provided on the outer circumference of the bearing inner race.



(a) Magnetic encoder
(b) Rear hub unit bearing
(c) Axle hub tightening nut (axle nut)

Caution
Since a magnet is used on the rear hub unit bearing, do not place magnetic objects near the rear hub unit bearing. Also, be careful not to allow any foreign matter to become attached.

4 SUSPENSION SYSTEM

CONTENTS

4.1 General Overview 4-2
4.1.1 Overview 4-2
4.1.2 Component 4-3
4.2 Front Suspension 4-5
4.2.1 Overview 4-5
4.2.2 Component 4-7
4.3 Rear Suspension 4-12
4.3.1 Overview 4-12
4.3.2 Component 4-14

4.1 General Overview

4.1.1 Overview

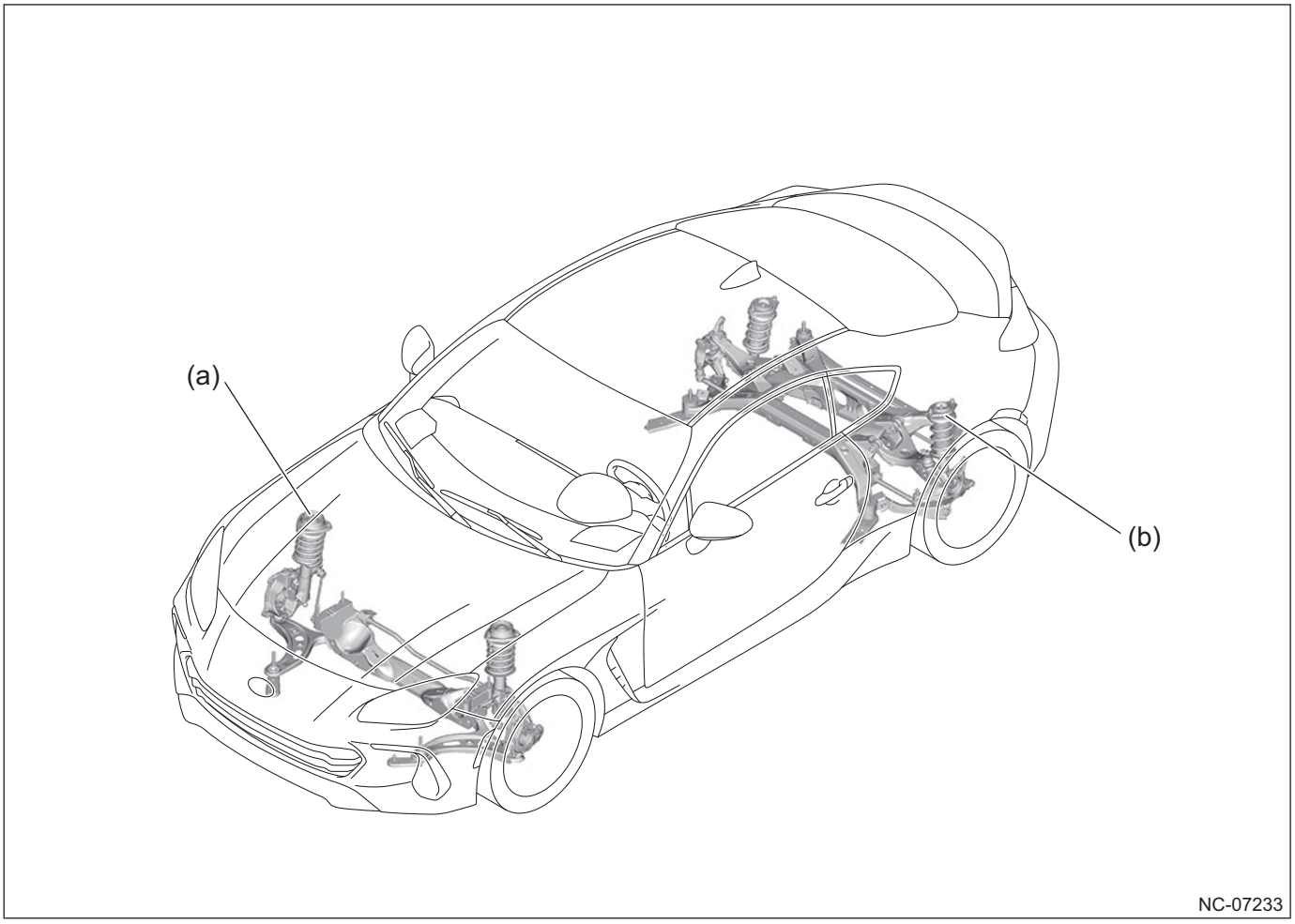
Overview

This chapter describes the following systems configuring the suspension system.

- Front Suspension
- Rear Suspension

4.1.2 Component

Component layout drawing



(a) Front suspension

(b) Rear suspension

Component details

The following items are changed or adopted to achieve comfortable movement in response to the steering.

Weight reduction

Adoption of a front axle housing made of cast aluminum and a hollow stabilizer front

Improvement in steering stability

■ Front

- Optimization of spring constant for coil spring front
- Optimization of strut COMPL front damping force and adoption of rebound spring

■ Rear

- Optimization of shock absorber COMPL rear damping force and movement of lower side installation points to outside
- Reduction of torsion spring constant for mount shock absorber rear and shock absorber lower bushing
- Optimization of stabilizer rear diameter and rubber bushing stabilizer rear
- Increased rigidity due to adoption of bushing with inter-ring for the rubber bushing trailing link on the rear axle housing side
- Increased stabilizer efficiency due to direct mounting of stabilizer rear on vehicle body

4.2 Front Suspension

4.2.1 Overview

Overview

A lightweight and high-rigidity MacPherson strut suspension is adopted for the front suspension system of the new SUBARU BRZ.

A layout is adopted that achieves the "low center of gravity" and "low inertia" that brings out the advantages of a horizontally opposed FR to deliver good handling performance that responds as the driver intended. This results in higher rigidity across the entire front suspension system.

A strut layout is adopted that lowers the mount strut front position as much as possible to create a low hood that makes a visual appeal focused on the lightweight and low center of gravity design, and the excellent aerodynamic characteristics.

A front axle housing made of cast aluminum and a hollow stabilizer front are adopted to reduce weight while maintaining rigidity.

The spring constant of the coil spring front and the damping force of the strut COMPL front are optimized, and a rebound spring is adopted to improve steering stability.

Specifications

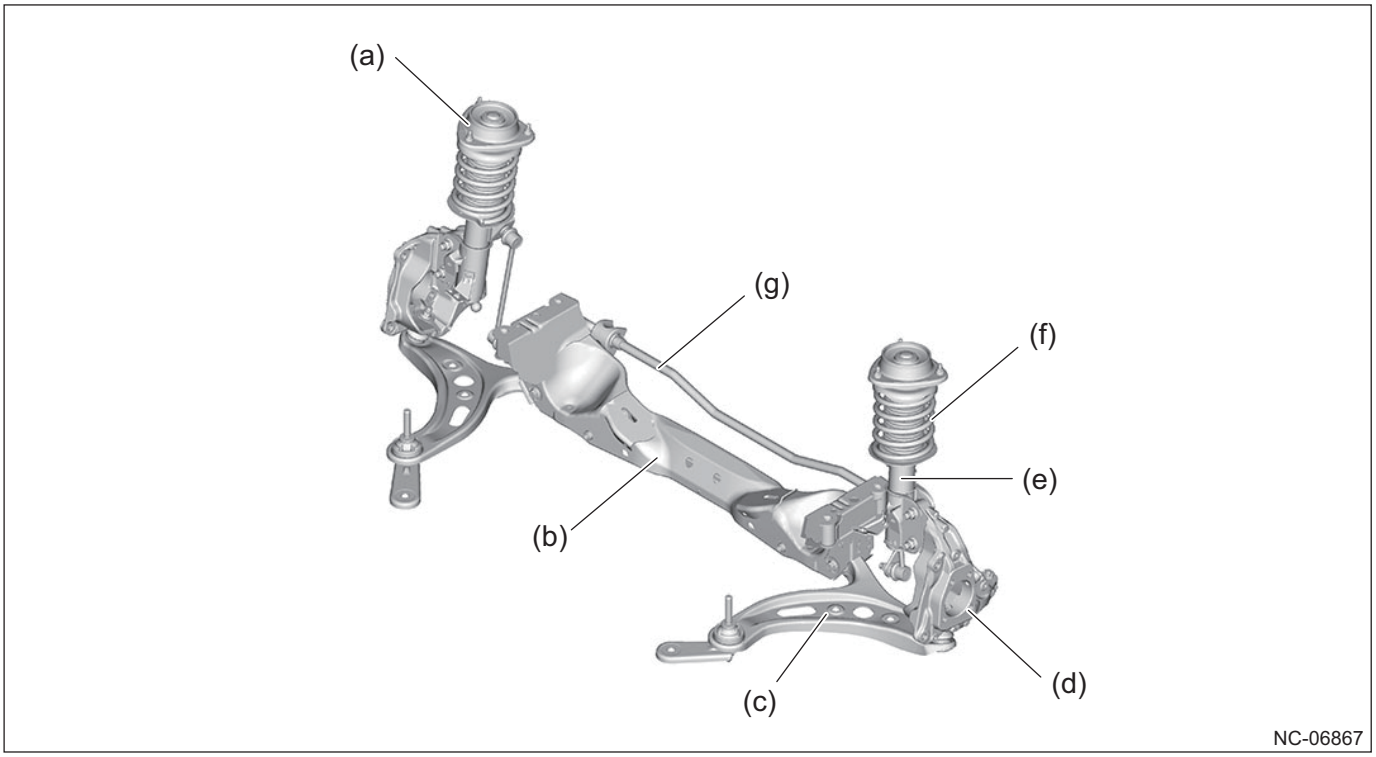
Front wheel alignment

Toe-in (in (mm))	0 (0)
Camber (deg)	0°00′
Caster (deg) (referential value)	5°55′
Kingpin angle (deg) (referential value)	15°30′

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

4.2.2 Component

Component layout drawing



(a) Mount strut front
(b) Crossmember COMPL front
(c) Arm assembly front
(d) Front axle housing
(e) Strut COMPL front
(f) Coil spring front
(g) Stabilizer front

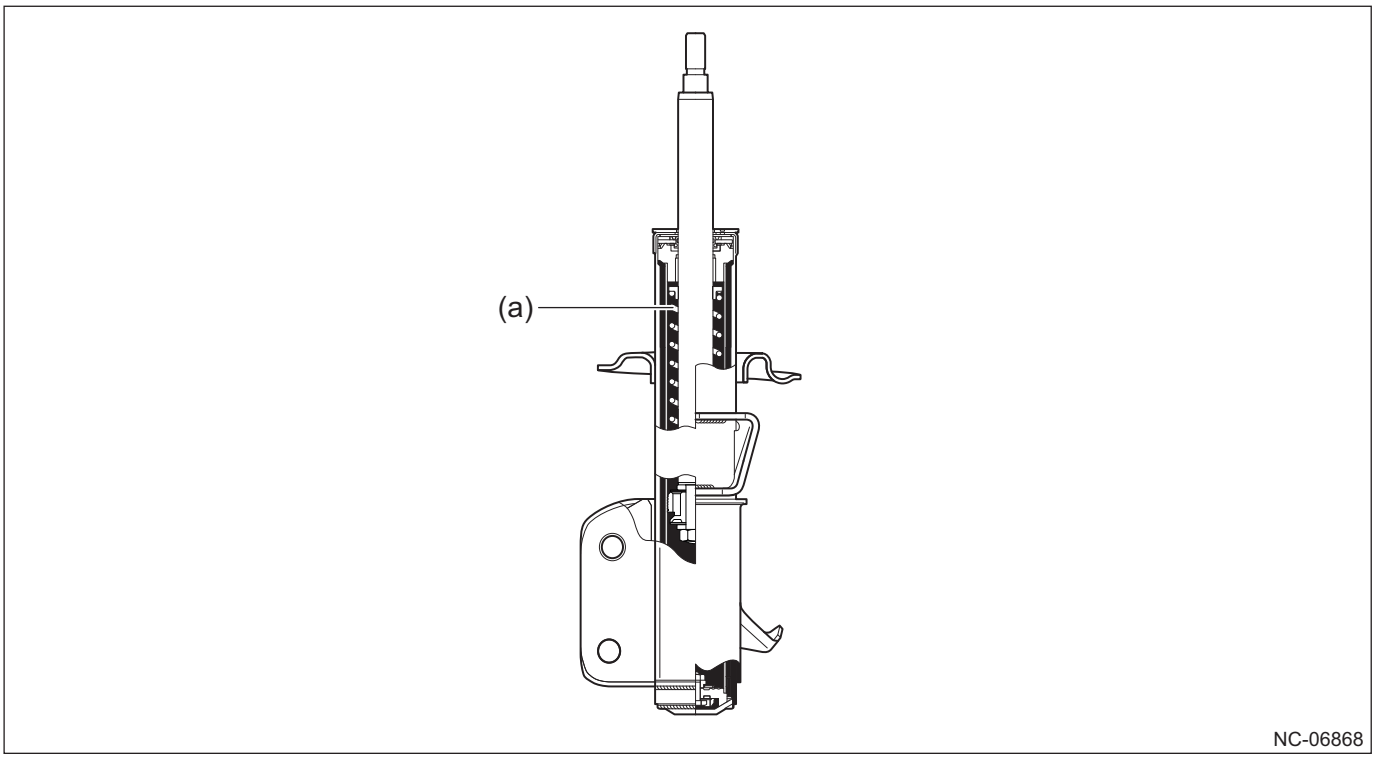
Component details

Front axle housing

A front axle housing made of cast aluminum is adopted to reduce weight while maintaining rigidity.

Shock absorber

The optimization of the damping force and adoption of a rebound spring for the strut COMPL front achieves high steering stability and responsiveness.

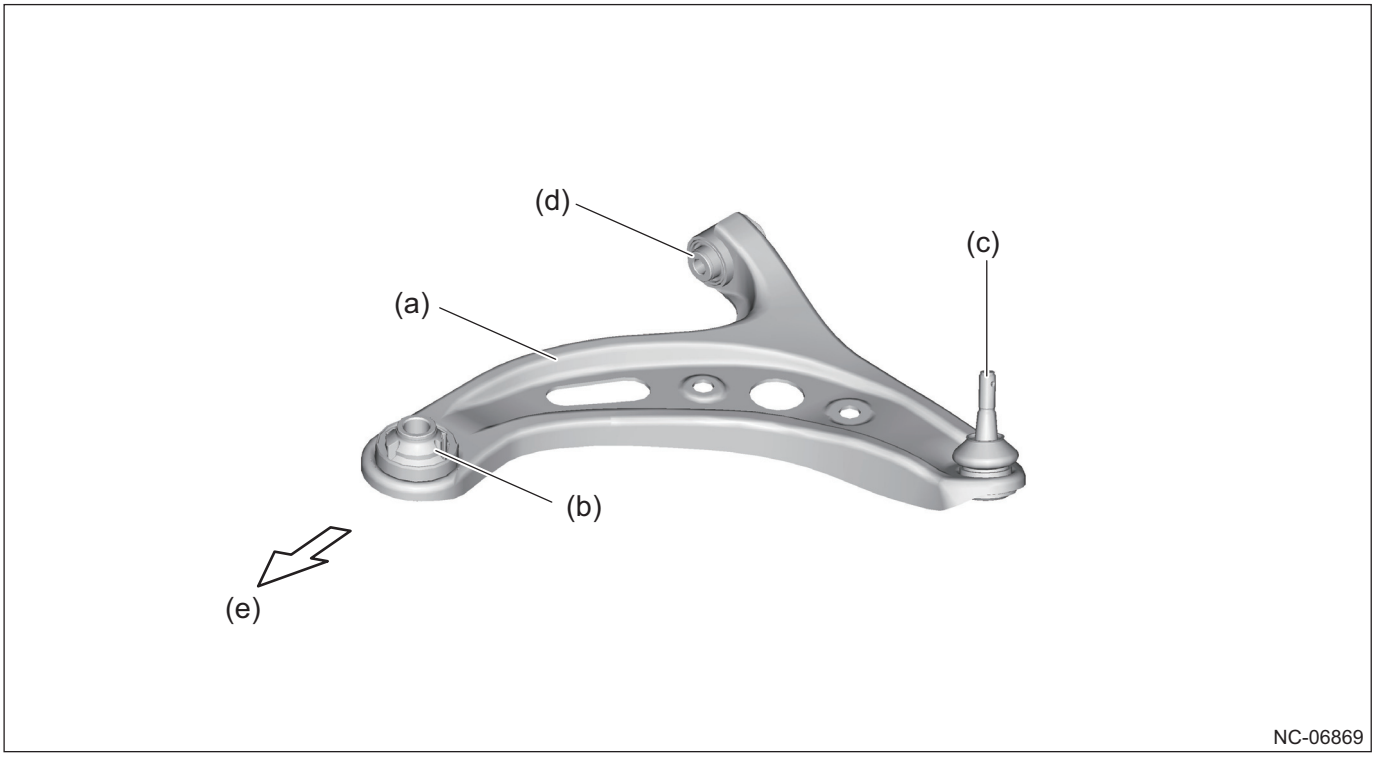


(a) Rebound spring

Lower arm and bushing

A lightweight, single sheet metal structure is adopted for the arm assembly front.

Heat-resistant rubber is adopted for the rubber bushing arm rear.



(a) Arm assembly front
(b) Rubber bushing arm front
(c) Front lower ball joint assembly
(d) Rubber bushing arm rear
(e) Front of vehicle

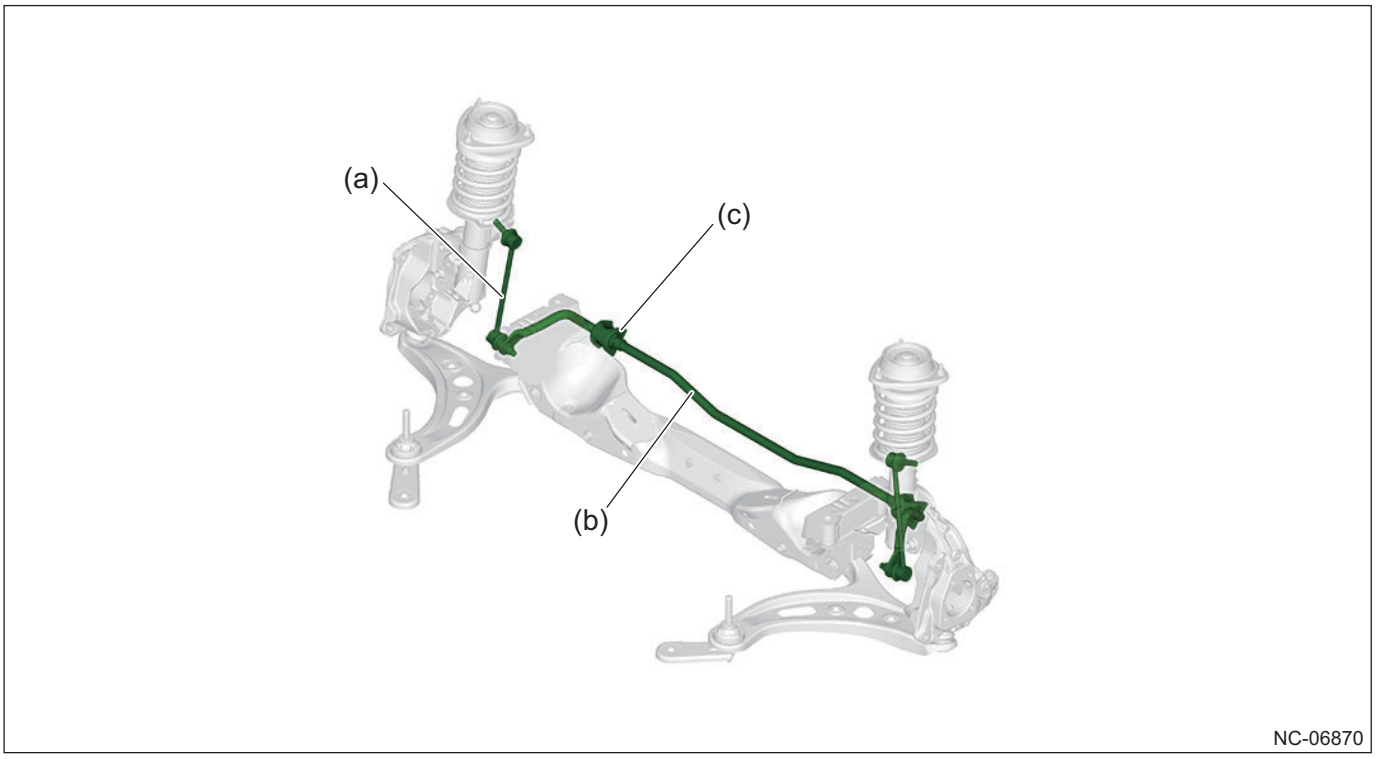
Stabilizer front

A Φ0.72 in (18.3 mm) hollow type of stabilizer front is adopted to reduce weight while maintaining rigidity.

The more highly efficient layout ensures high roll rigidity, next-level steering stability, and excellent stability and emergency avoidance performance when braking.

A ball joint type of front stabilizer link assembly is adopted.

Self-lubricating rubber is adopted for the rubber bushing stabilizer front.

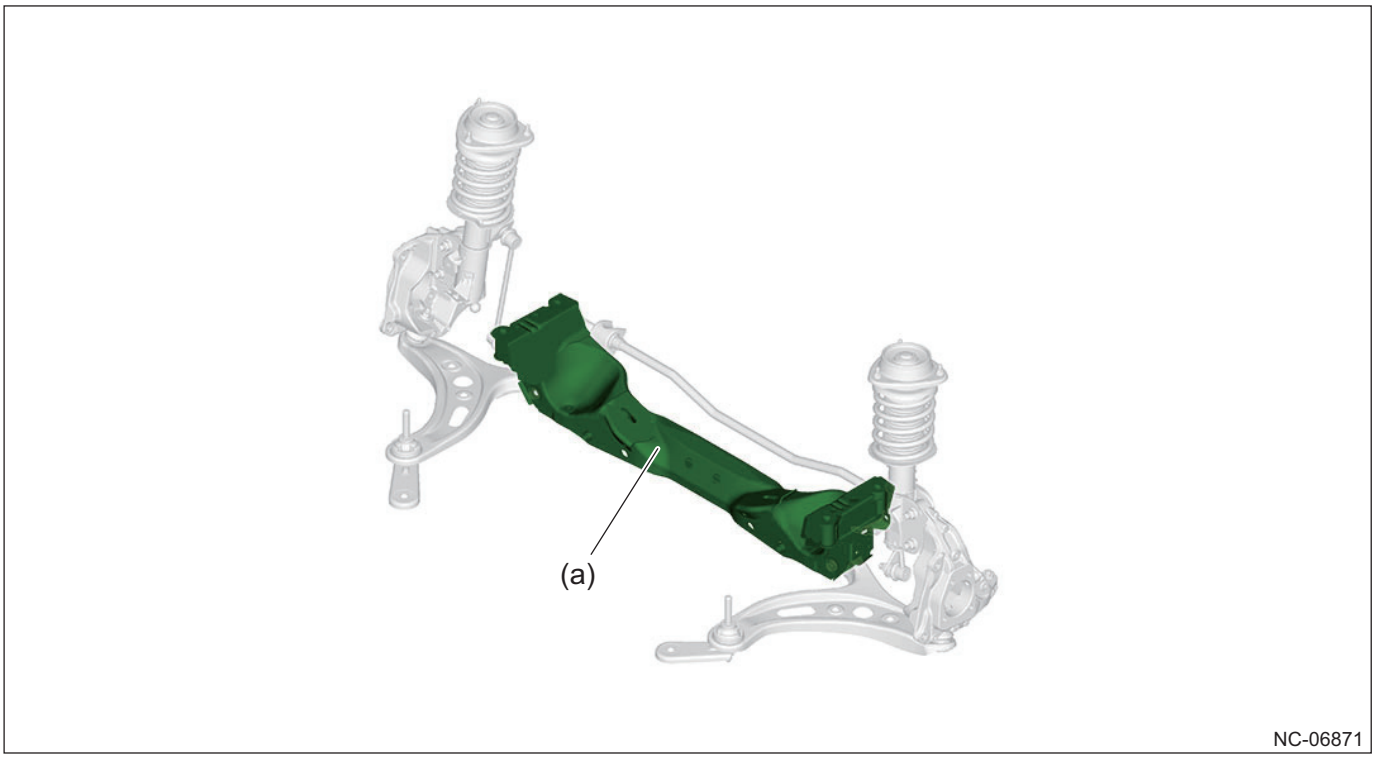


(a) Stabilizer link front
(b) Stabilizer front
(c) Rubber bushing stabilizer front

Suspension member

A closed cross section for UPR/LWR mating is used for the crossmember COMPL front, and a 2-level structure incorporating a pipe is adopted for the vehicle body installation section.

A layout where a pipe-shaped nut penetrates the member is adopted for the steering gearbox assembly support to make a structure that holds with a long span.



(a) Crossmember COMPL front

4.3 Rear Suspension

4.3.1 Overview

Overview

A double-wishbone type of rear suspension system is adopted for the new SUBARU BRZ, which is highly rated for its high rear grip.

Handling performance that responds as the driver intended is achieved due to the "easy-to-understand rear grip = integrated feel with vehicle" and "delivery of both comfort and stability," which are at the heart of pleasurable driving as a FR sports car.

The optimization of the shock absorber COMPL rear damping force and the movement of the lower side installation points to the outside ensure high steering stability performance.

The torsion spring constant for the mount shock absorber rear and shock absorber lower bushing is reduced to achieve comfortable movement in response to the 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.

Stable roll posture is ensured by optimizing the stabilizer rear diameter and directly mounting the stabilizer rear on the vehicle body.

Each member of the sub frame assembly rear is strengthened to support the higher engine output and mounting of the large-capacity differential carrier.

Specifications

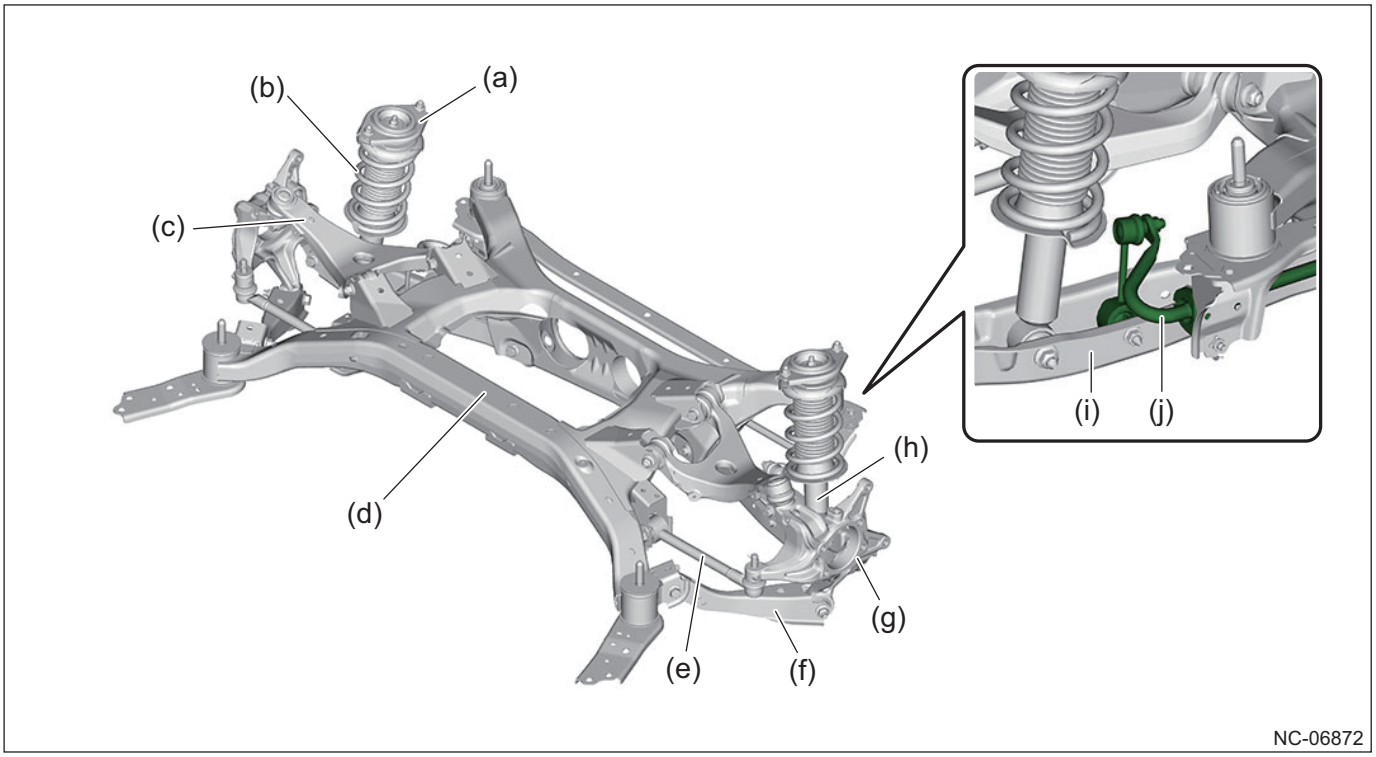
Rear wheel alignment

Toe-in in (mm)	0.08 (2)
Camber (deg)	-1°10′
Thrust angle (deg)	0°

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

4.3.2 Component

Component layout drawing



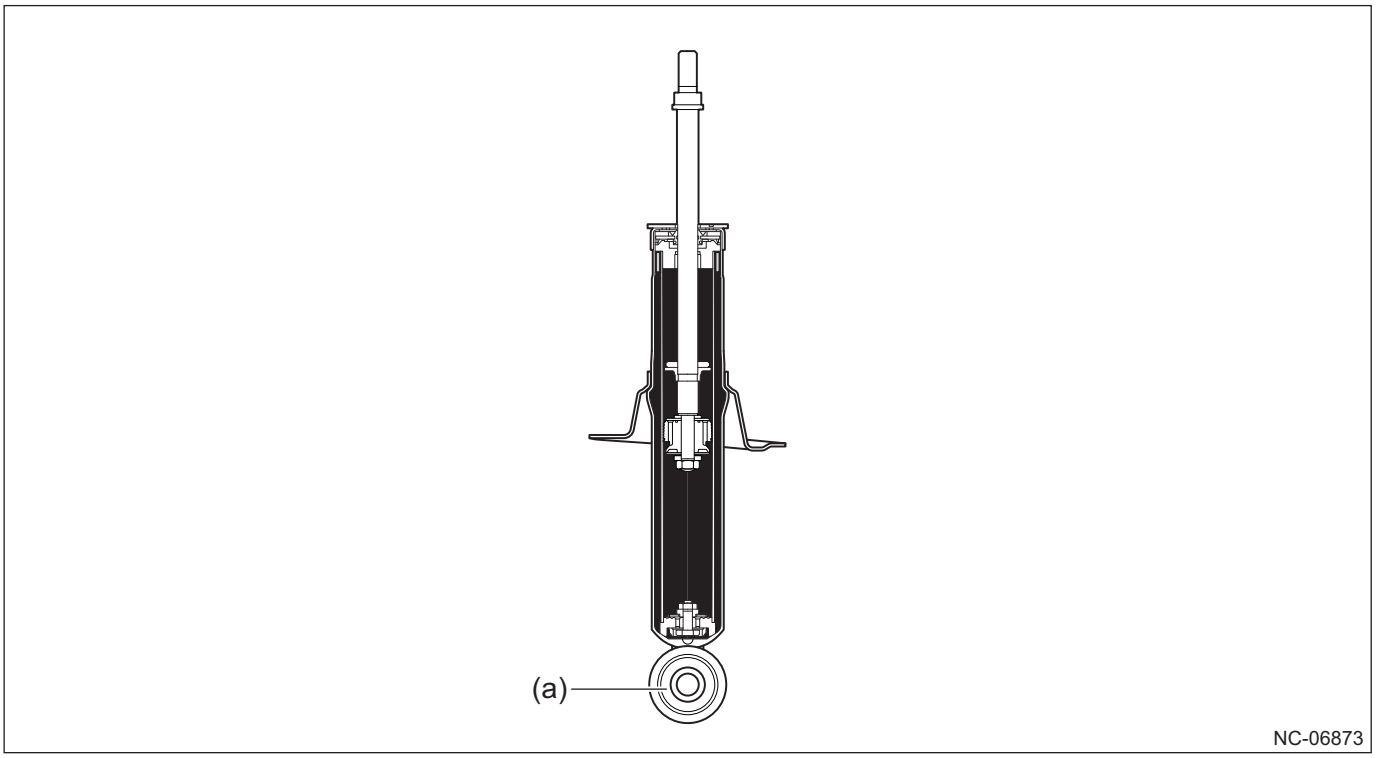
(a) Mount shock absorber rear
(b) Coil spring rear
(c) Arm assembly rear upper
(d) Sub frame assembly rear
(e) Rear lateral link assembly front
(f) Trailing link assembly rear
(g) Rear axle housing
(h) Shock absorber assembly rear
(i) Rear lateral link assembly rear
(j) Stabilizer rear

Component details

Shock absorber COMPL rear/mount

The optimization of the damping force for the shock absorber COMPL rear achieves high steering stability and responsiveness.

The torsion spring constant for the mount shock absorber rear and shock absorber lower bushing is reduced to achieve comfortable movement in response to the steering.

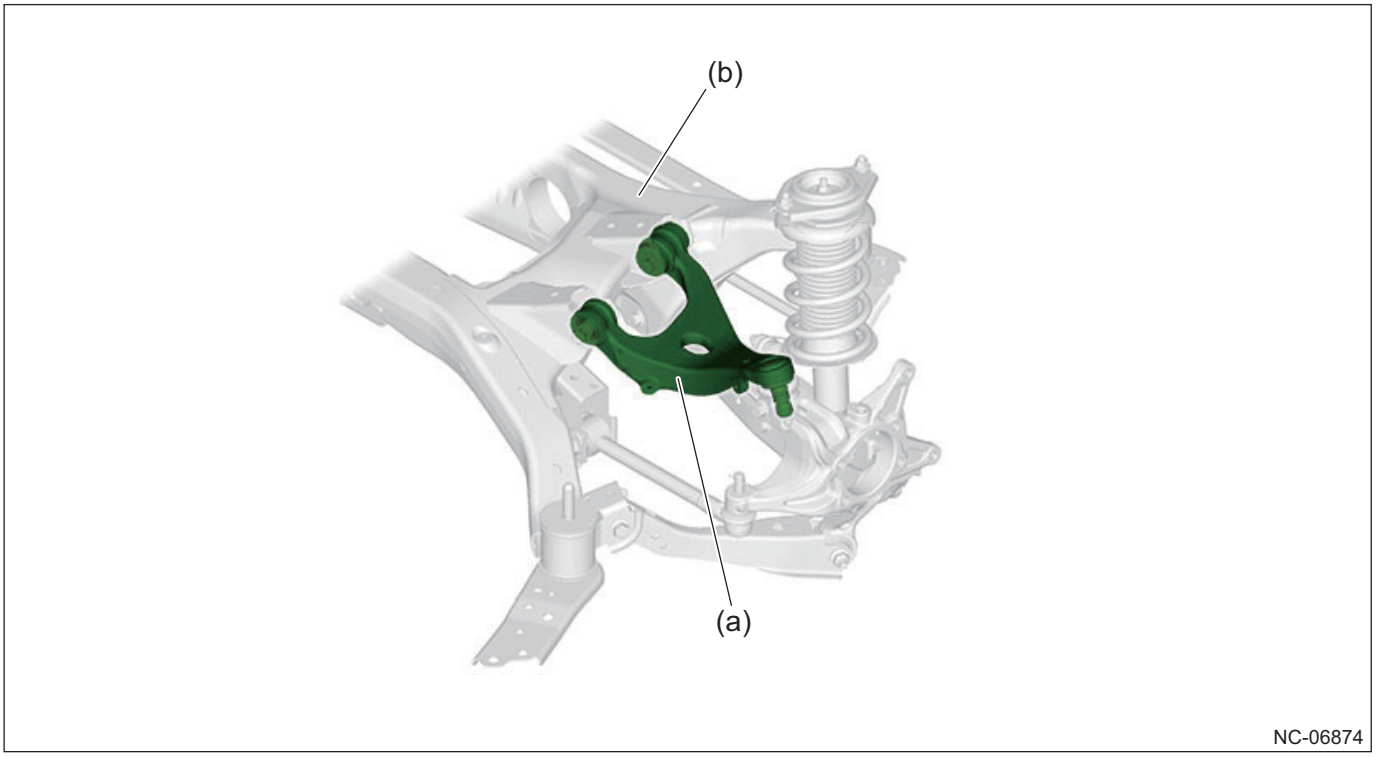


(a) Shock absorber lower bushing

Upper arm and bushing

An arm assembly rear upper made of cast iron is adopted.

Ball joints are adopted for installation on the rear axle housing.



(a) Arm assembly rear upper

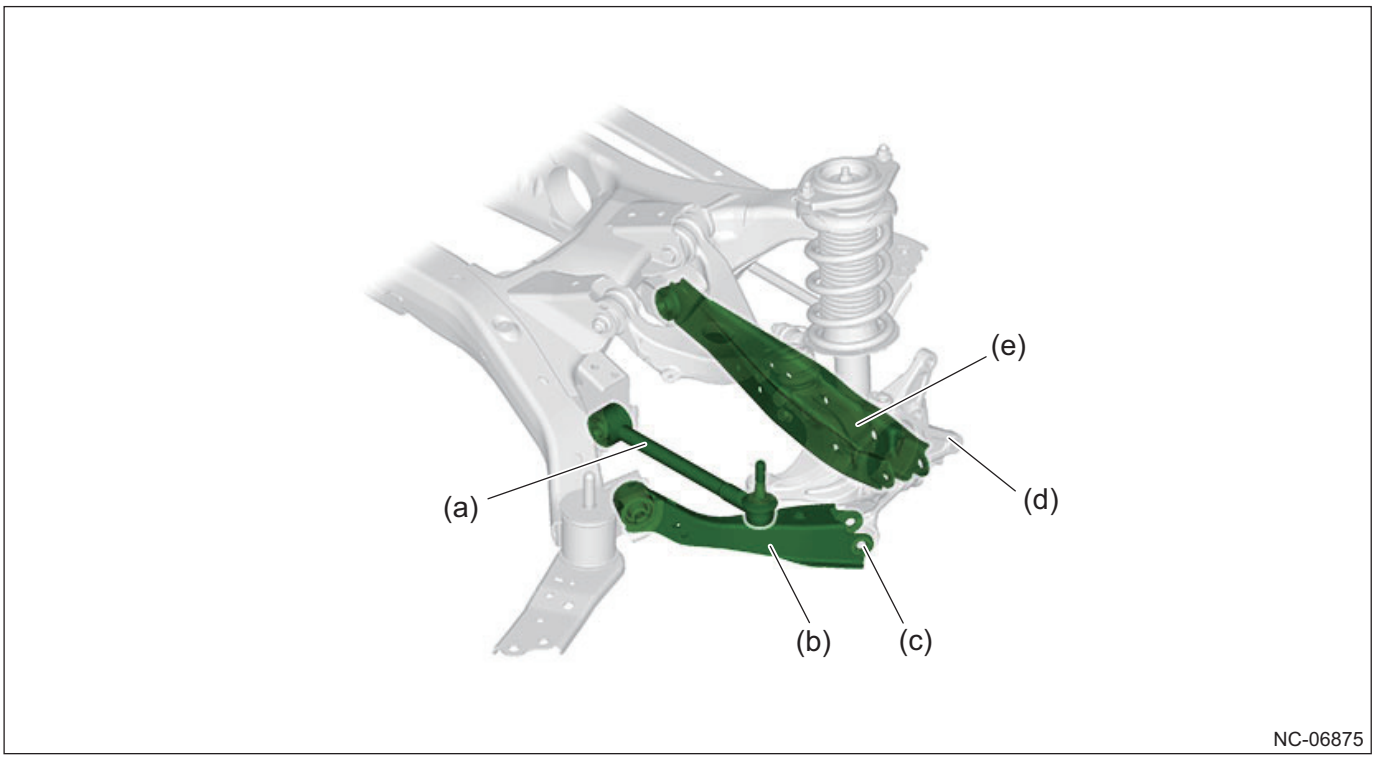
(b) Sub frame assembly rear

Lower arm and bushing

Pipe material is used for the lateral link assembly front. Also, ball joints are adopted for installation on the axle side.

A rear lateral link assembly rear made of pressed steel plates is adopted. Also, a pillow ball is adopted for installation on the axle side.

Rigidity is increased by adopting a bushing with inter-ring for the rubber bushing trailing link on the rear axle housing side. This ensures excellent steering stability.



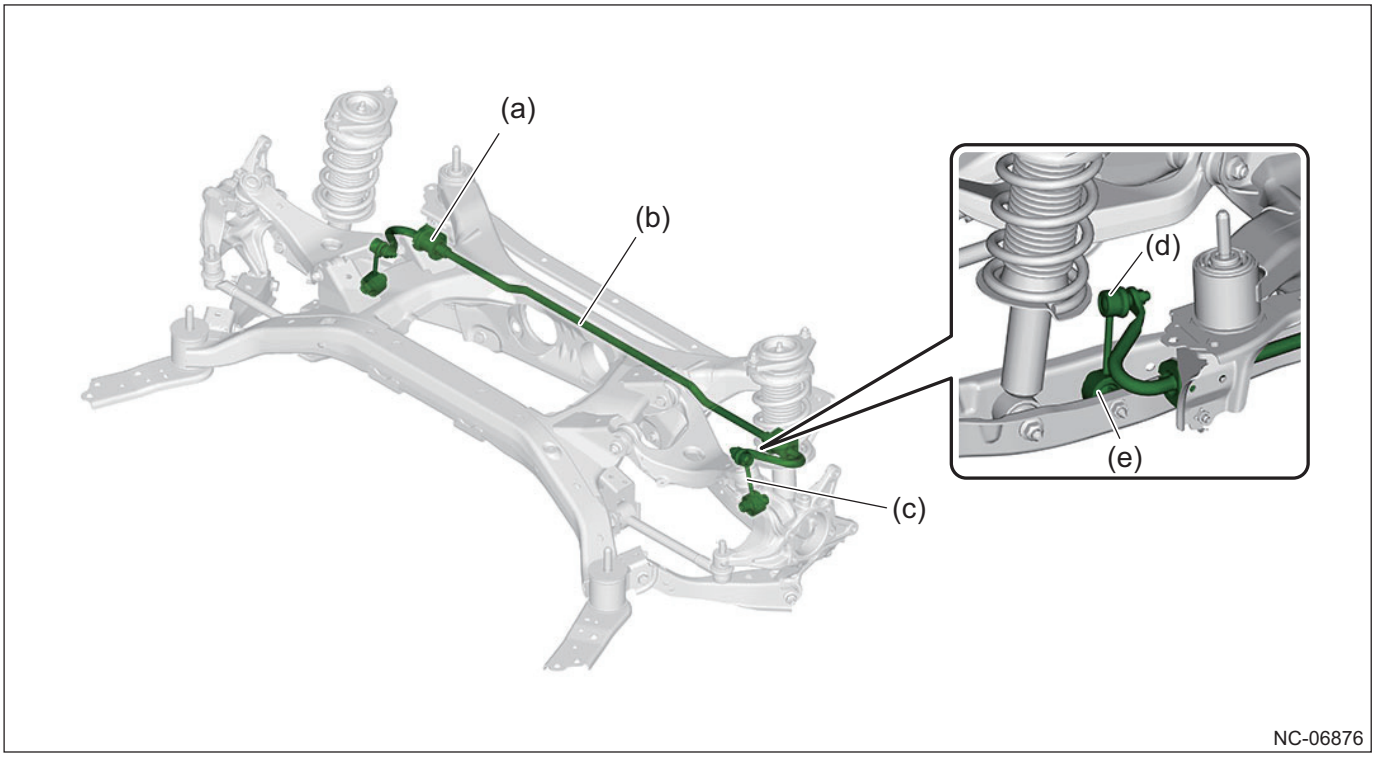
(a) Rear lateral link assembly front
(b) Trailing link assembly rear
(c) Rubber bushing trailing link
(d) Rear axle housing
(e) Rear lateral link assembly rear

Stabilizer

A Φ0.55 in (14.0 mm) solid type of stabilizer rear is adopted to optimize roll rigidity. The stabilizer rear is installed directly on the vehicle body to reduce the body sway.

A ball joint type of stabilizer link rear is adopted for the upper side and a bushing type is adopted for the lower side.

Self-lubricating rubber is adopted for the rubber bushing stabilizer rear.



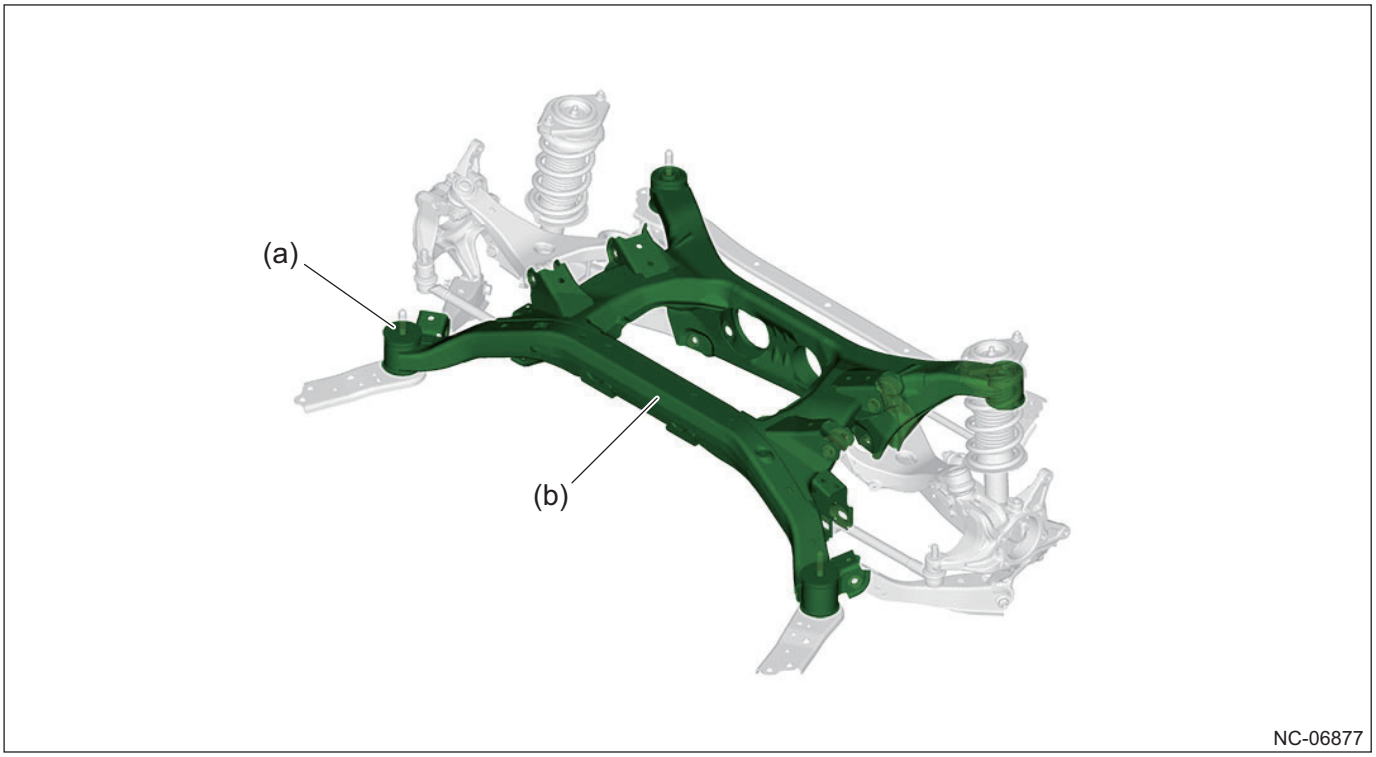
(a) Rubber bushing stabilizer rear
(b) Stabilizer rear
(c) Stabilizer link rear
(d) Ball joint type
(e) Bushing type

Suspension member

A box-shaped sub frame assembly rear with a closed cross section structure is adopted.

A stopper upper made of cold forged iron is adopted.

The adoption of a highly rigid sub frame assembly to support the higher engine output ensures excellent steering stability.



(a) Stopper upper

(b) Sub frame assembly rear

5 WHEEL & TIRE

CONTENTS

5.1 WHEEL & TIRE 5-2
5.1.1 Overview 5-2
5.1.2 Component 5-3
5.1.3 Construction and Operation 5-8

5.1 WHEEL & TIRE

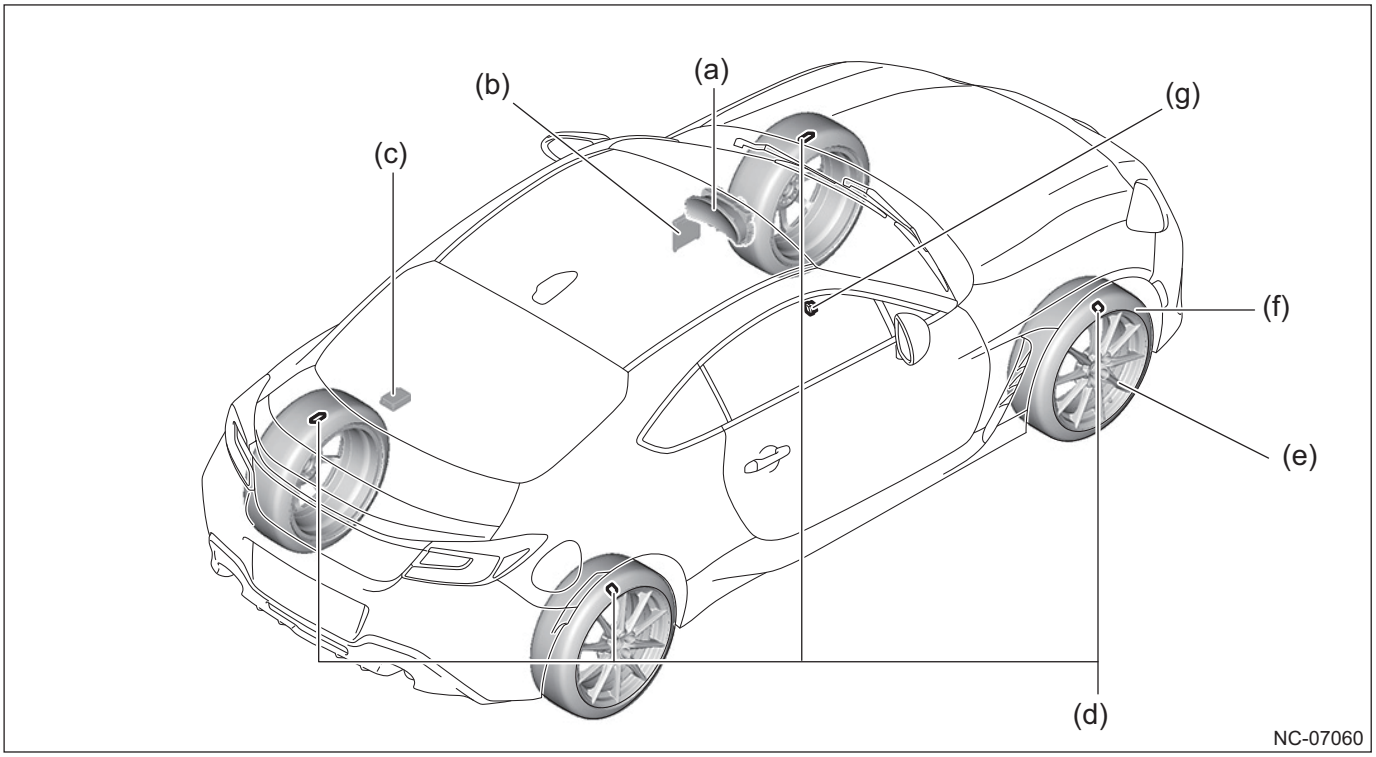
5.1.1 Overview

Overview

- A newly designed wheel that achieves both reduced weight and rigidity is adopted to improve the sports performance.
- 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) Combination meter
(b) Body integrated unit
(c) TPMS control module
(d) Transmitter (tire inflation pressure sensor)
(e) Wheel
(f) Tire
(g) TPMS set switch

Component details

Tire

Tire specifications		PREMIUM/PREMIUM EyeSight	LIMITED/LIMITED EyeSight
17 inches	215/45R17 87W	○	-
18 inches	215/40R18 85Y	-	○
18-inch (spare tire)	215/40R18 85Y	-	○ *

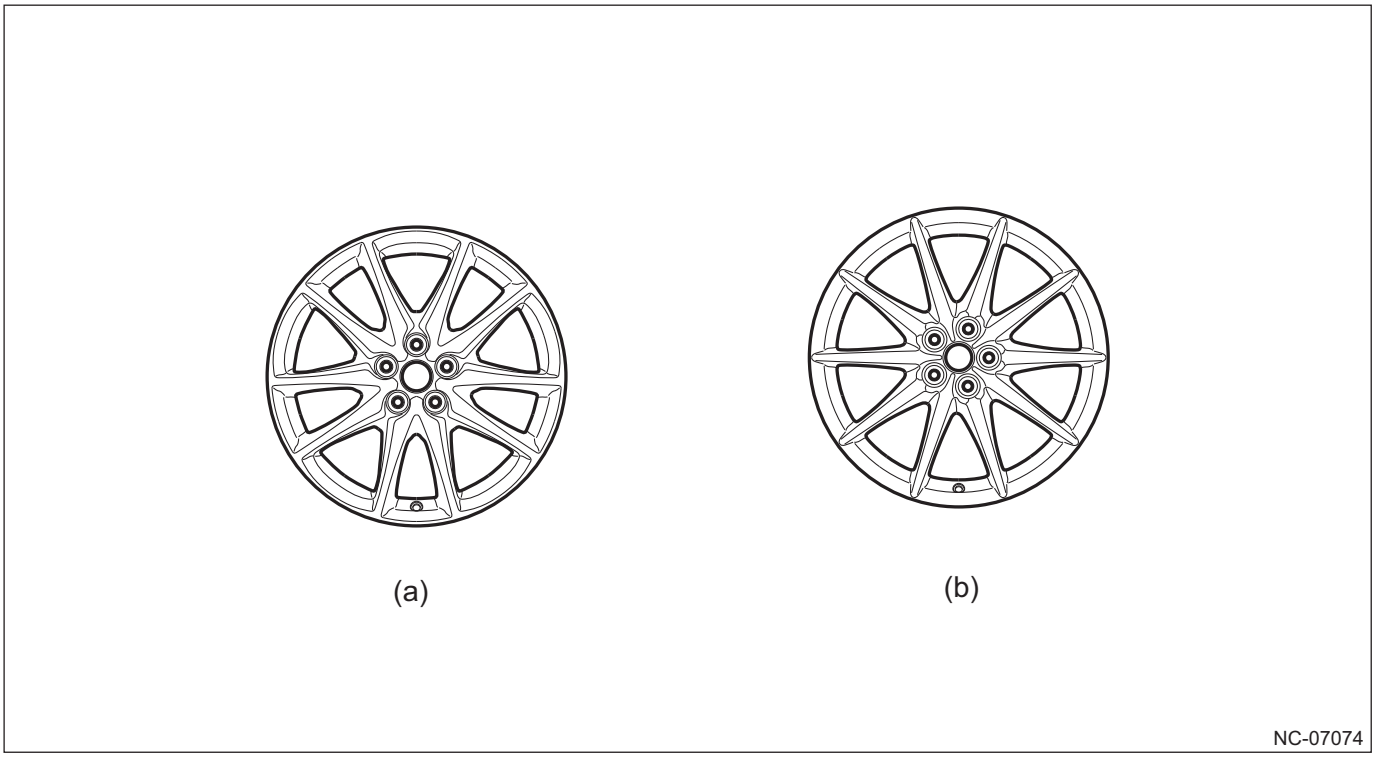
*: For Mexico

Wheel

Wheel specifications		
Wheel	17 inches	18 inches
	17x7 1/2J	18x7 1/2J
Material	Aluminum	Aluminum
Color	Super black high luster	Matte gray metallic

■ Wheel

- Wheels of 2 specifications are adopted that express a design with a sense of power and movement to heighten expectations for driving.
- Super black high luster and matte gray metallic are provided as the colors for the aluminum wheels.

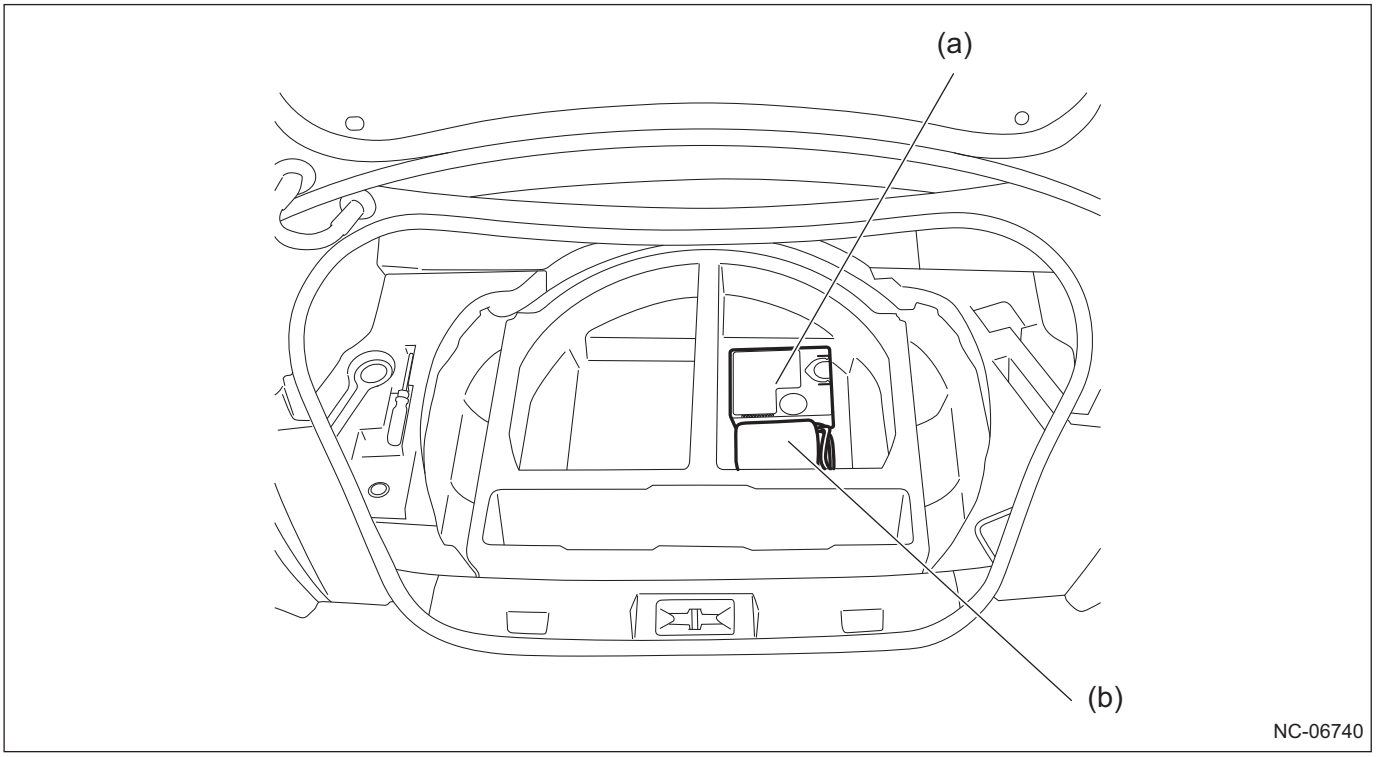


(a) 17x7 1/2J, super black high luster, aluminum

(b) 18x7 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.

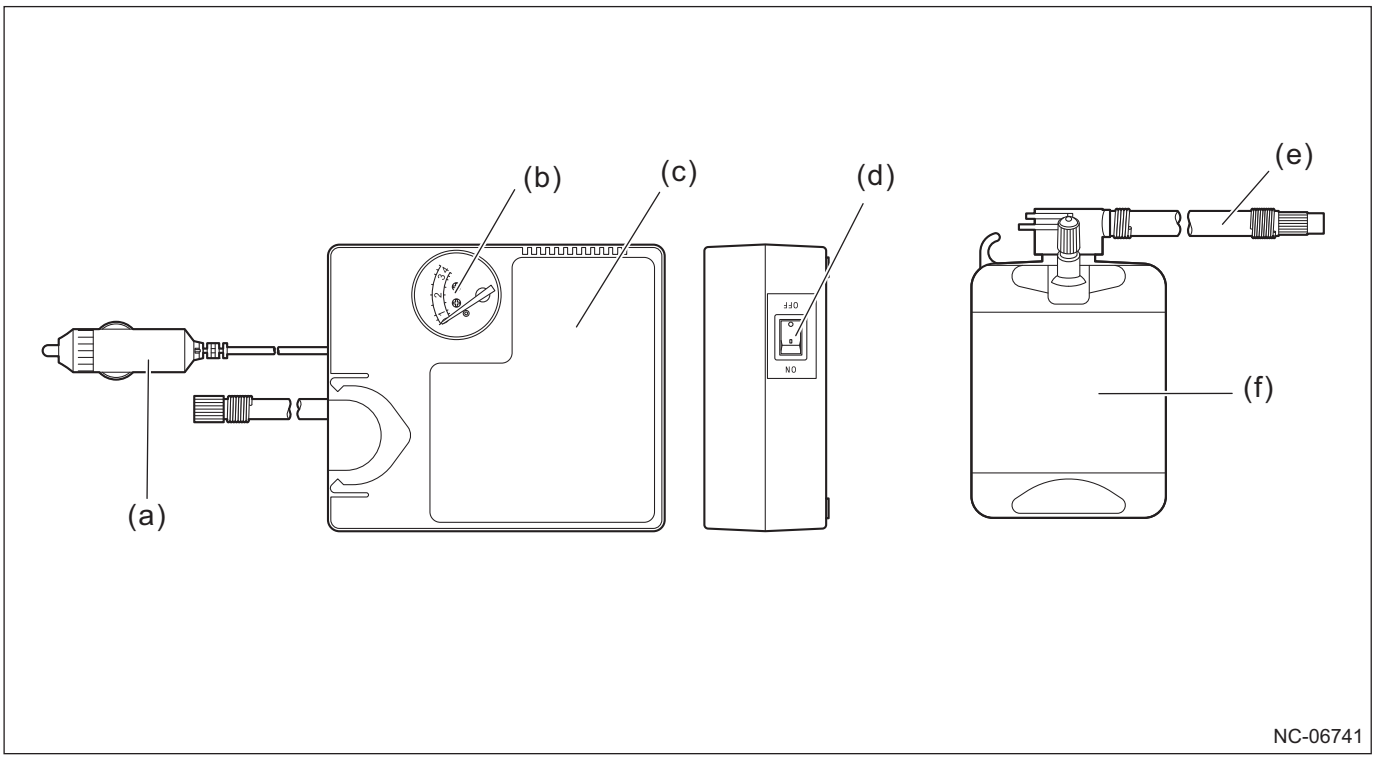


(a) Air compressor

(b) Repair agent bottle

Tubeless tire repair kit

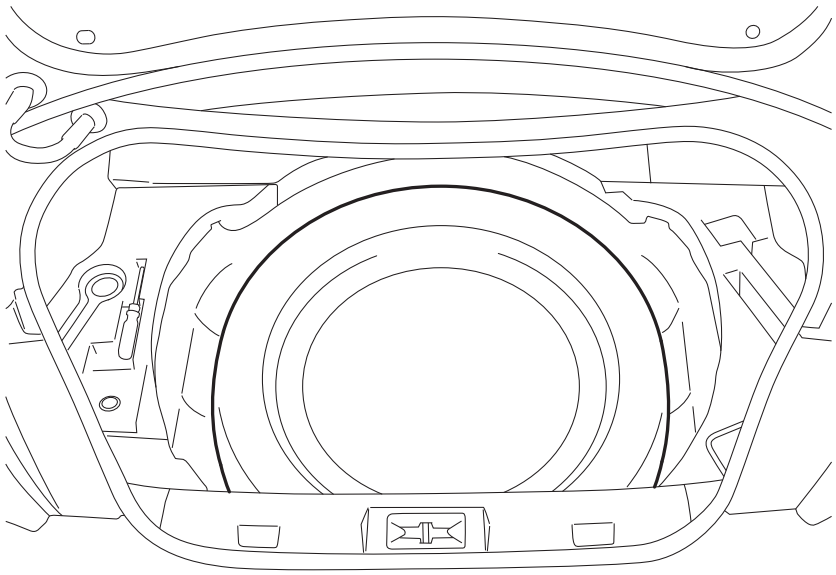
Item	Specifications	
Operating environment temperature	-22°F (-30°C) to 140°F (60°C)	
Maximum consumption current	10 A	
Locations where puncture emergency repair is possible	One hole from a nail, screw, etc., with a diameter less than 3/16 in (4 mm) located on the tread (excluding the side wall)	
Puncture 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.

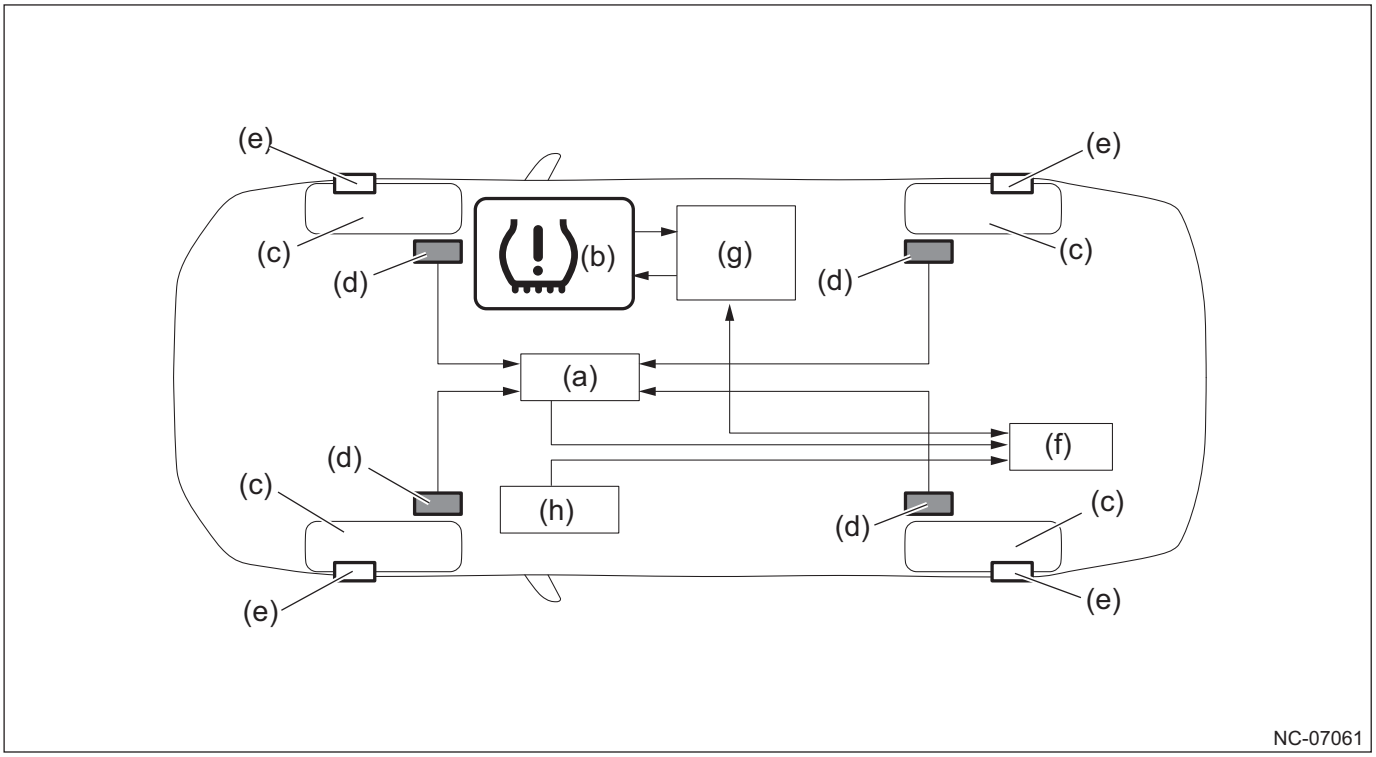


NC-07255

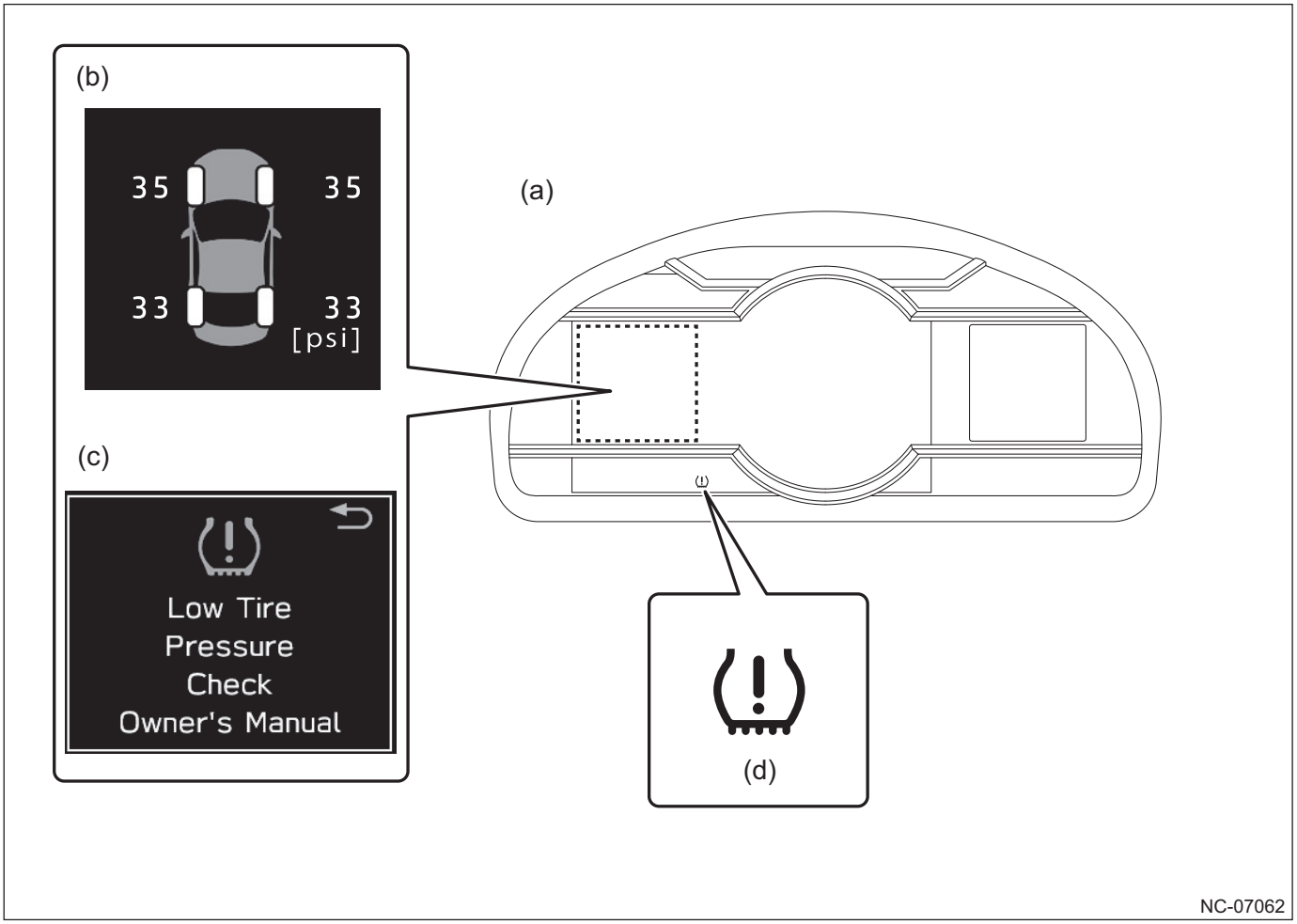
5.1.3 Construction and Operation

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 to 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 a driver.

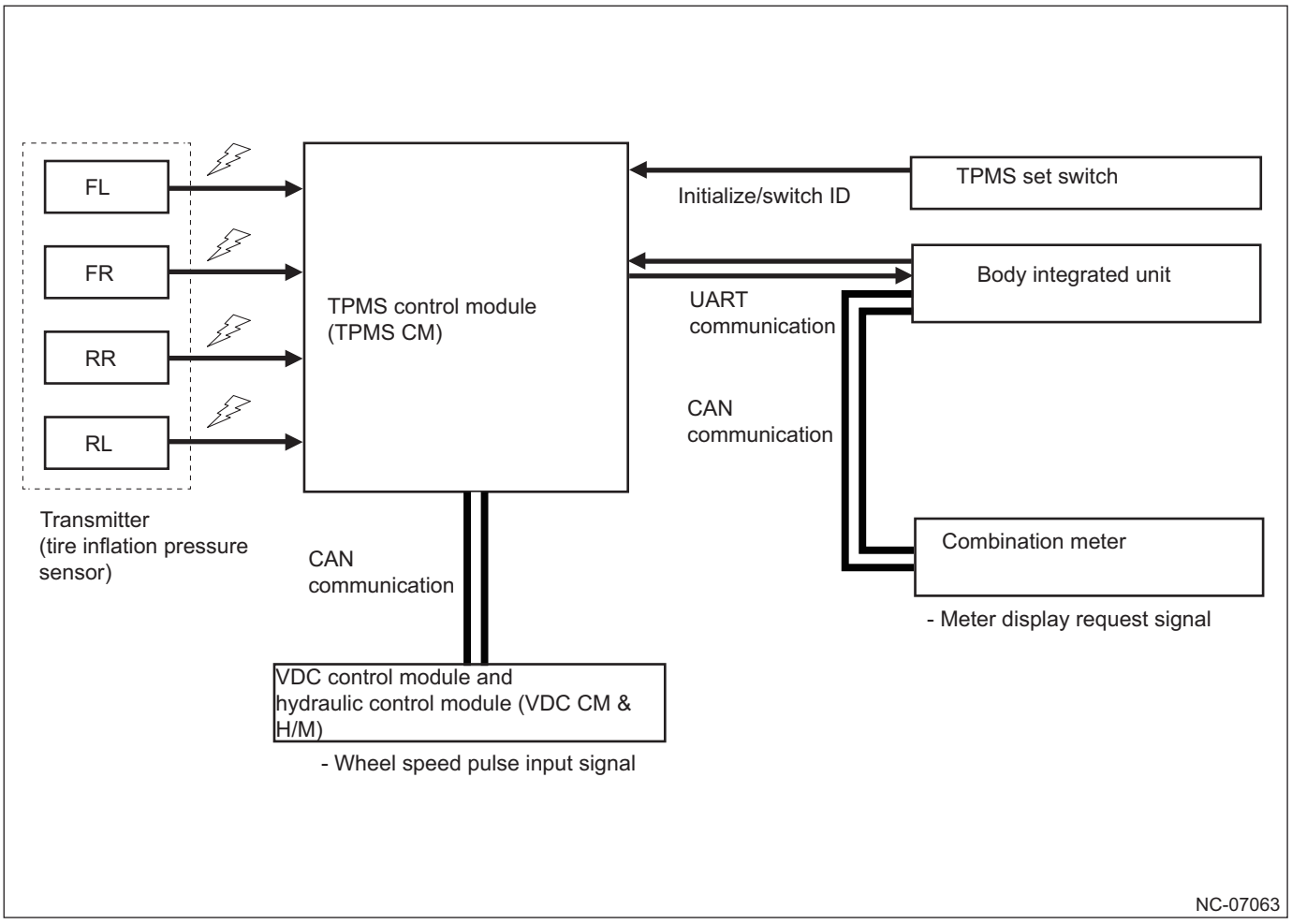


(a) VDC control module
(b) TPMS warning light
(c) Tire
(d) Wheel speed sensor
(e) Transmitter (tire inflation pressure sensor)
(f) TPMS control module
(g) Body integrated unit
(h) TPMS set switch



(a) Combination meter
(b) Multi information display screen
(c) Interruption screen
(d) TPMS warning light

System diagram



6 BRAKE SYSTEM

CONTENTS

6.1 General Overview 6-2
6.1.1 Overview 6-2
6.1.2 Component 6-3
6.2 Service Brake 6-4
6.2.1 Overview 6-4
6.2.2 Component 6-6
6.3 Vehicle Stability Control (Vehicle Dynamics Control) (VSC/VDC) 6-11
6.3.1 Overview 6-11
6.3.2 Component 6-12
6.3.3 Construction and Operation 6-21
6.4 Parking Brake 6-36
6.4.1 Overview 6-36
6.4.2 Component 6-37

6.1 General Overview

6.1.1 Overview

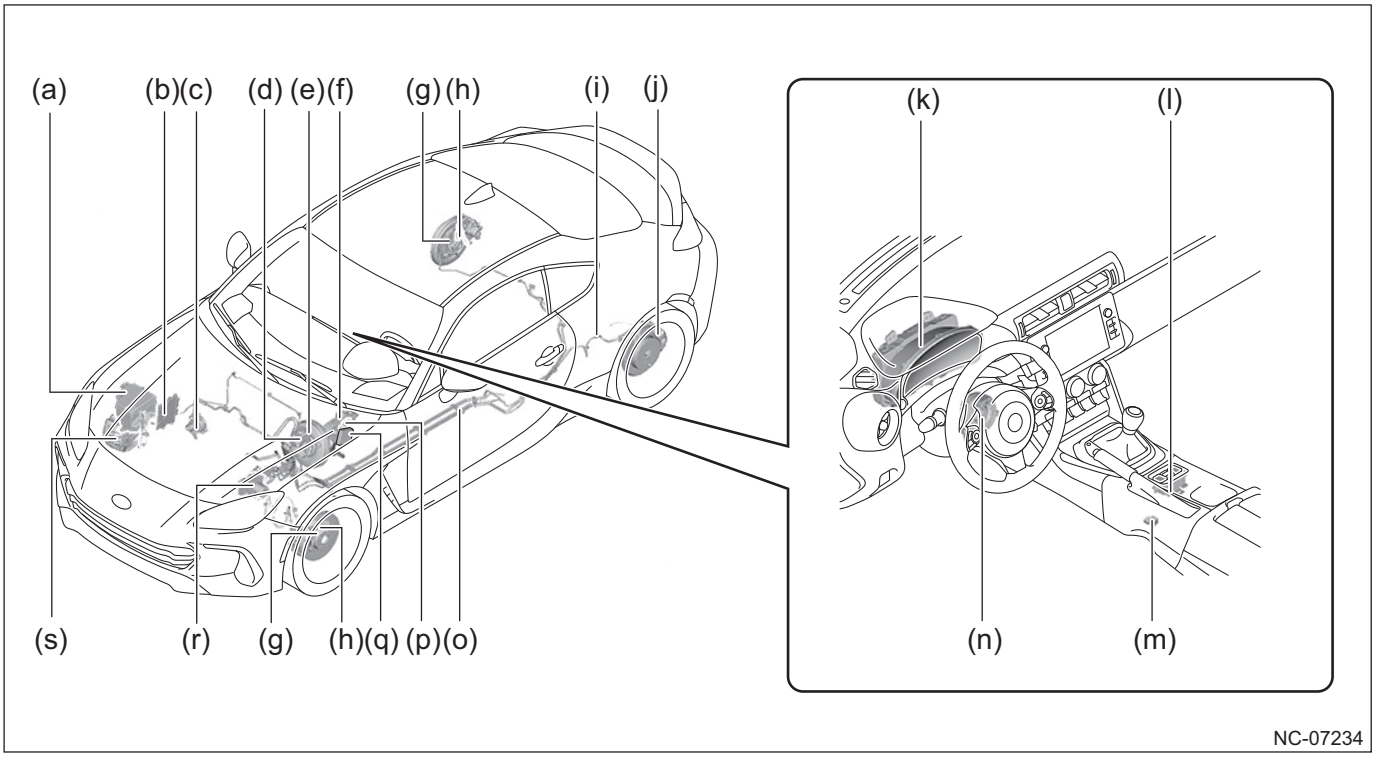
Overview

This chapter describes the following systems configuring the brake system.

- Service Brake
- Vehicle Stability Control (Vehicle Dynamics Control) (VSC/VDC)
- Parking Brake

6.1.2 Component

Component layout drawing



(a) Stop light relay (in main fuse & relay box)

(b) Engine Control Module (ECM)

(c) Vacuum pump

(d) Master cylinder assembly

(e) Vacuum booster assembly

(f) Brake pedal

(g) Magnetic encoder

(h) ABS wheel speed sensor

(i) Brake hose

(j) Rear brake caliper

(k) Combination meter assembly

(l) Console switch
- VSC (VDC) OFF switch
- TRACK switch

(m) Hand brake switch assembly

(n) Steering angle sensor

(o) Center brake pipe

(p) Stop light switch assembly

(q) Transmission Control Module (TCM)*

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

(s) Front brake caliper

*: AT

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 assembly compatible with brake assist control
- Engine-driven vacuum pump
- Brake pads made of copper-free materials
- Rear brake caliper with built-in duo servo parking brake

Specifications

Front brake

Cylinder size (in (mm))	φ1.591 × 2 (φ40.4 × 2)
Rotor outer diameter (in (mm))	φ11.57 (φ294)
Rotor sliding surface thickness (in (mm))	t0.94 (t24)
Pad material	FA431

Rear brake

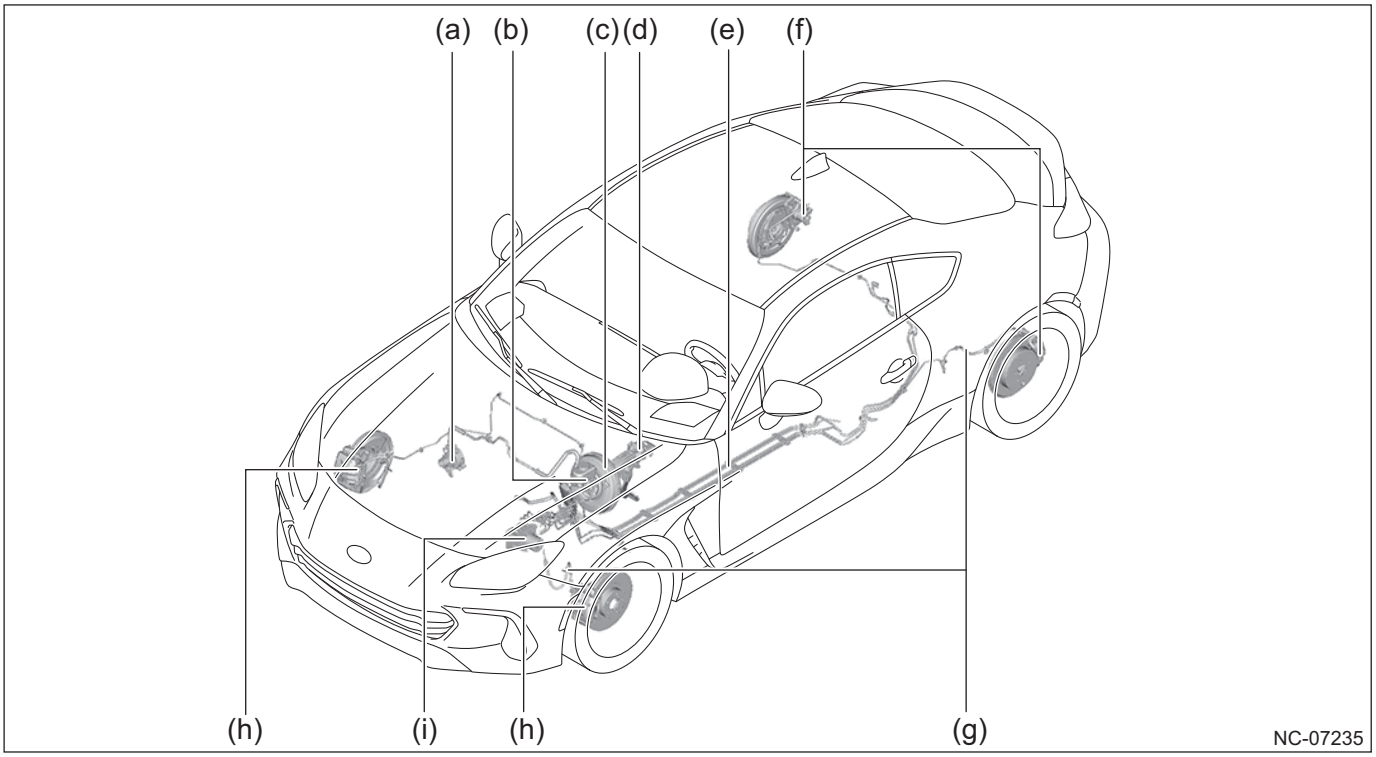
Cylinder size (in (mm))	φ1.591 (φ40.4)
Rotor outer diameter (in (mm))	φ11.42 (φ290)
Rotor sliding surface thickness (in (mm))	t0.71 (t18)
Pad material	FN410

Brake master cylinder

Cylinder size (in (mm))	φ1 (φ25.4)

6.2.2 Component

Component layout drawing



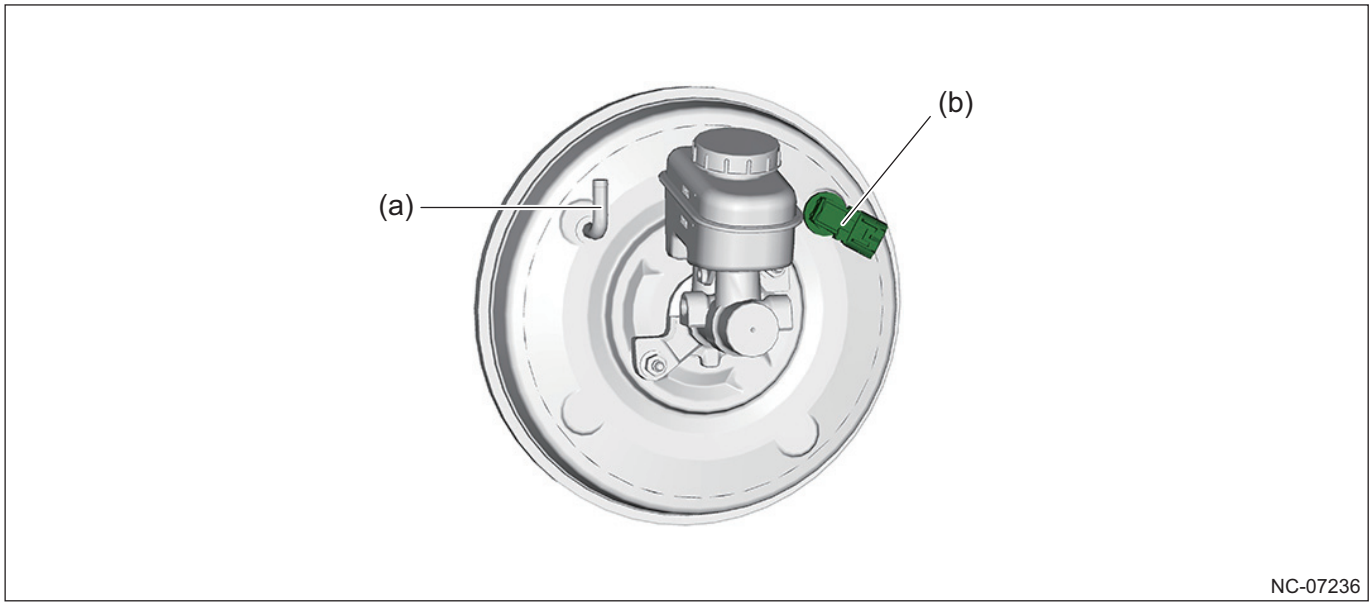
(a) Vacuum pump
(b) Master cylinder assembly
(c) Vacuum booster assembly
(d) Brake pedal
(e) Center brake pipe
(f) Rear brake caliper
(g) Brake hose
(h) Front brake caliper
(i) VDC control module and hydraulic control module (VDC CM & H/M)

Component details

Vacuum booster assembly

A vacuum booster assembly is adopted to improve brake effectiveness and ensure braking performance in emergencies.

- A relative pressure/negative pressure sensor is adopted for the vacuum sensor assembly to support brake assist control when the negative pressure has decreased.
- The vacuum nipple is positioned to improve operability when detaching and connecting the vacuum hose.
- A damping sheet is added to the vehicle body installation surface of the vacuum booster assembly in models with EyeSight to reduce the operating noise of Adaptive Cruise Control.



(a) Vacuum nipple

(b) Vacuum sensor assembly (relative pressure/negative pressure sensor)

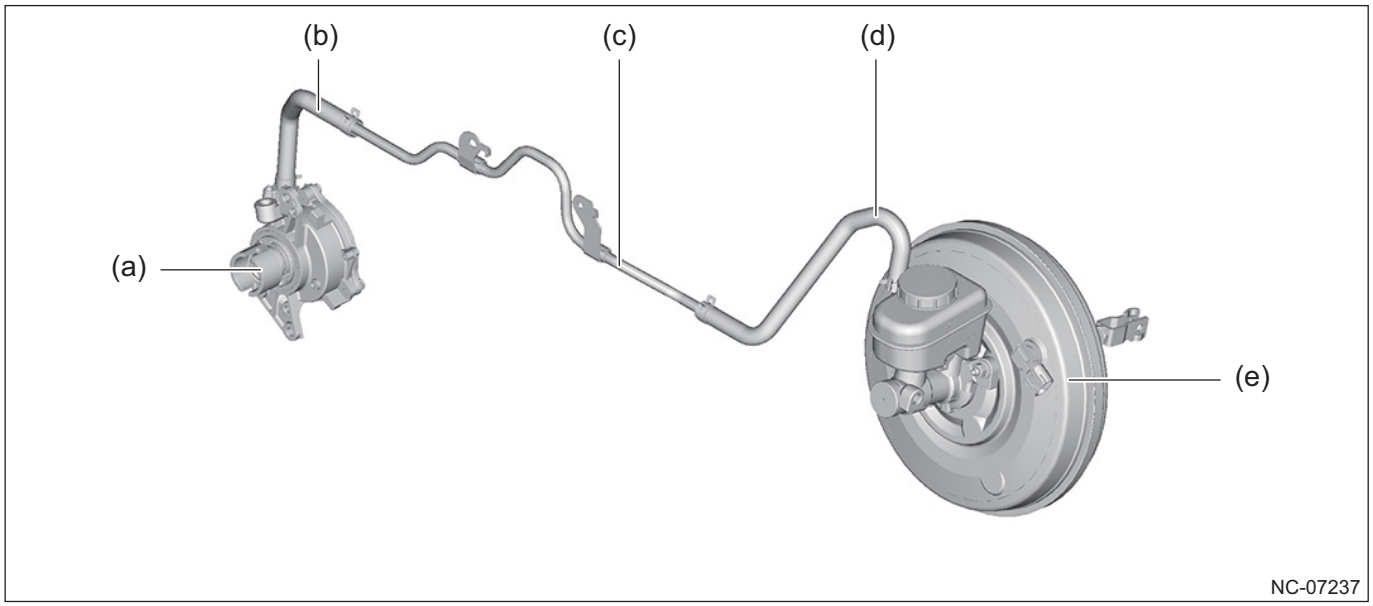
Vacuum pump

A vacuum pump that is driven by the engine is adopted to remove the lack of negative pressure supply speed in high altitude areas.

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 assembly negative pressure decreases by using the pressurizing function of the VDC control module and hydraulic control module (VDC CM & H/M) is adopted.

The arrangement of the negative pressure pipes is also optimized.



(a) Vacuum pump
(b) Vacuum hose COMPL
(c) Vacuum pipe assembly
(d) Vacuum hose COMPL
(e) Vacuum booster assembly

Front brake

■ Front brake caliper

The 16-inch brake caliper and brake pad are adopted for the front brake caliper to realize the braking performance with a sense of security and immediate effect when the brake pedal is depressed.

Brake caliper

- A part with a cylinder diameter of φ1.591 in × 2 (φ40.4 mm × 2) is adopted to ensure a good brake feeling.

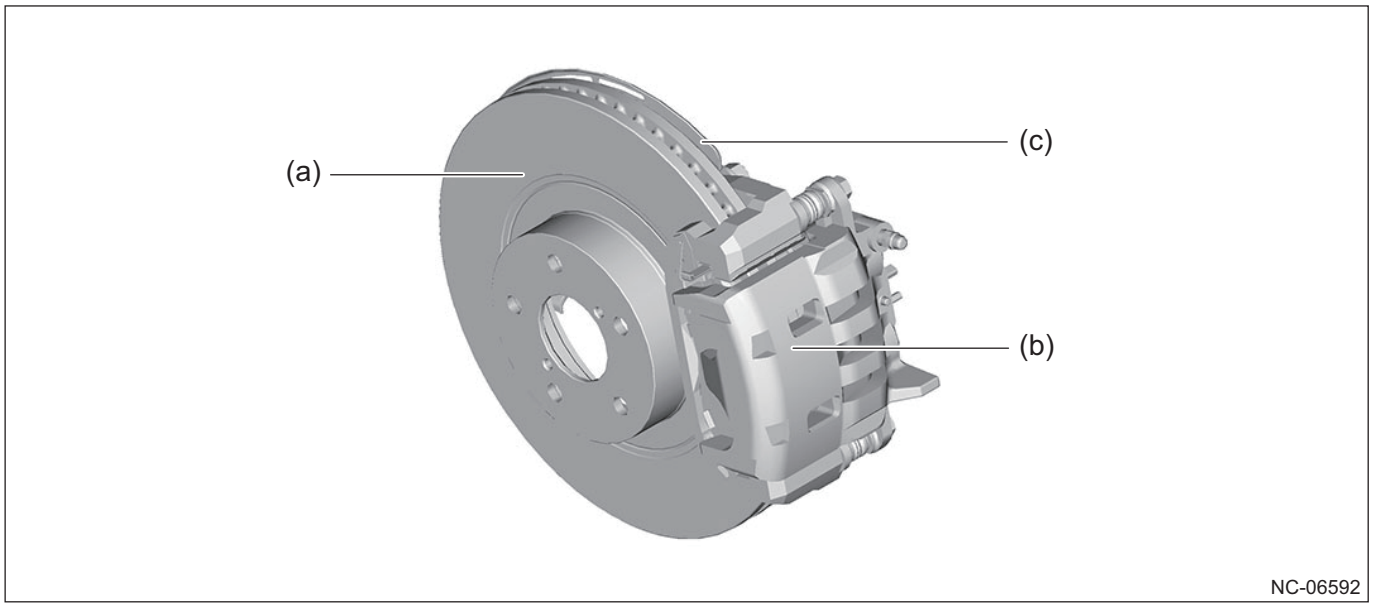
Brake pad

- Brake pads made of copper-free materials are adopted.

■ Front disc rotor

A 16-inch specification ventilated disc rotor is adopted.

Also, the disc cover shape is optimized to improve cooling performance.



(a) Front disc rotor
(b) Front brake caliper
(c) Front disc cover

Rear brake

■ Rear brake caliper

The 15-inch brake caliper and brake pad are adopted for the rear brake caliper to realize the braking performance with a sense of security and immediate effect when the brake pedal is depressed.

Brake caliper

- A part with a cylinder diameter of φ1.591 in (φ40.4 mm) is adopted to ensure a good brake feeling.

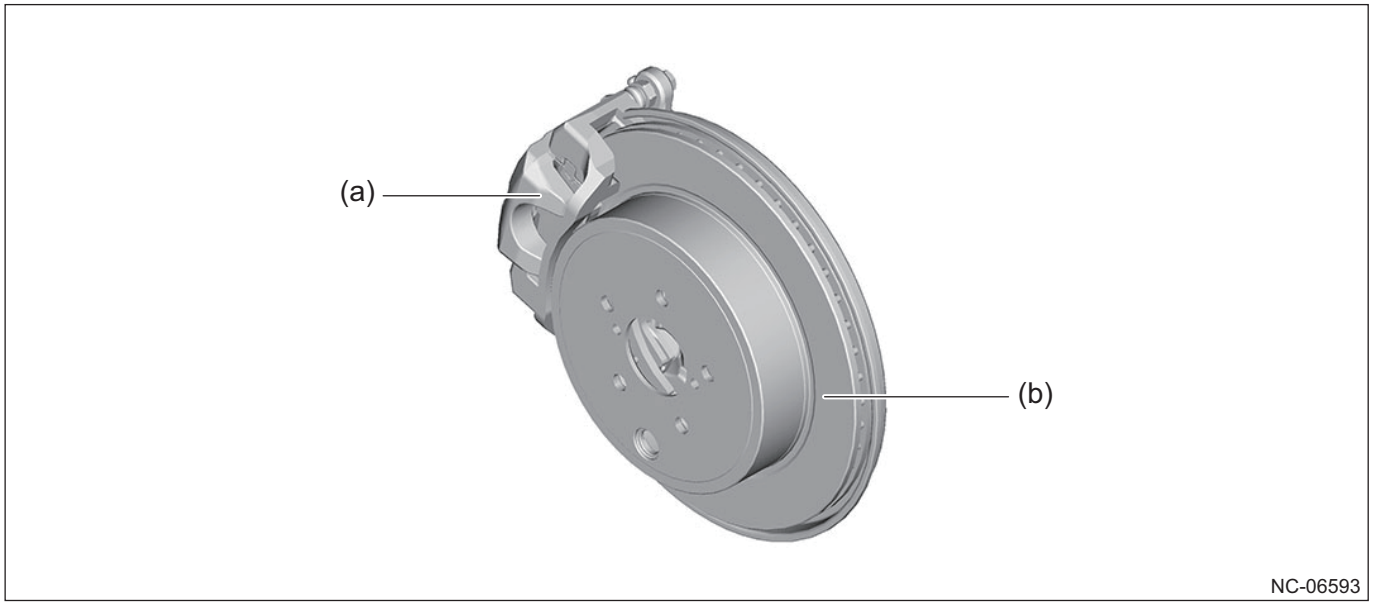
Brake pad

- Brake pads made of copper-free materials are adopted both to support North American copper regulations (less than 0.5% copper content) and to improve the braking μ.

■ Rear disc rotor

A 15-inch specification ventilated disc rotor is adopted.

Also, a part with a built-in duo servo parking brake is adopted.



(a) Rear brake caliper

(b) Rear disc rotor

6.3 Vehicle Stability Control (Vehicle Dynamics Control) (VSC/VDC)

6.3.1 Overview

Overview

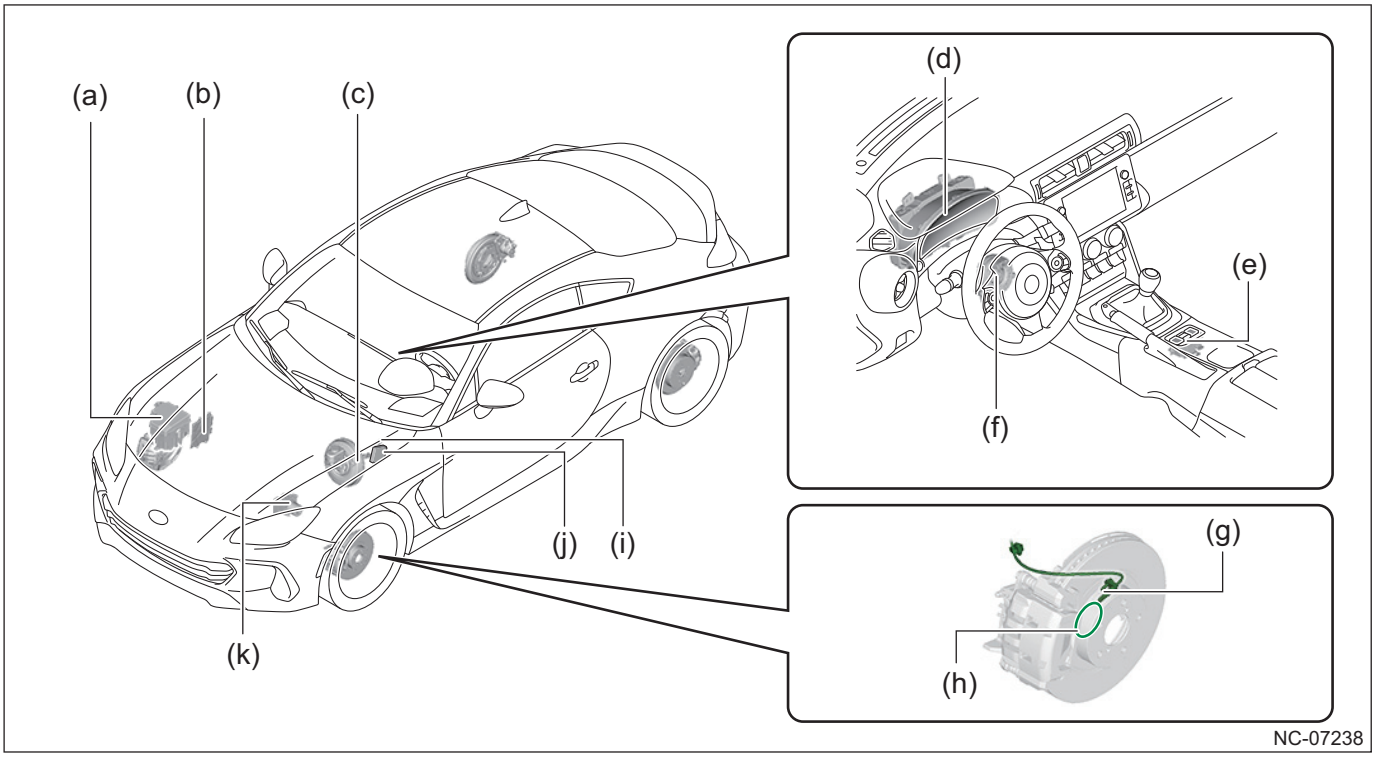
VDC always detects driving conditions of a vehicle with various types of sensors and assists the driver to achieve an ideal driving condition. Unstable behavior of the vehicle near the control limit such as side slipping is reduced through the braking control for each of the four wheels, engine output control, etc. Also, a VSC (VDC) system is adopted that supports EyeSight.

Vehicle Stability Control (Vehicle Dynamics Control) (VSC/VDC) performs the following controls.

- Anti-lock Brake System (ABS) with Electronic Brakeforce Distribution (EBD)
- Brake assist
- Traction control (TRAC)
- Vehicle Stability Control (Vehicle Dynamics Control) (VSC/VDC)
- Brake LSD
- Hill Start Assist (HSA)

6.3.2 Component

Component layout drawing



(a) Stop light relay (in main fuse & relay box)

(b) Engine Control Module (ECM)

(c) Vacuum booster assembly

(d) Combination meter assembly

(e) Console switch
- VSC (VDC) OFF switch
- TRACK switch

(f) Steering angle sensor

(g) ABS wheel speed sensor

(h) Magnetic encoder

(i) Stop light switch assembly

(j) Transmission Control Module (TCM)*

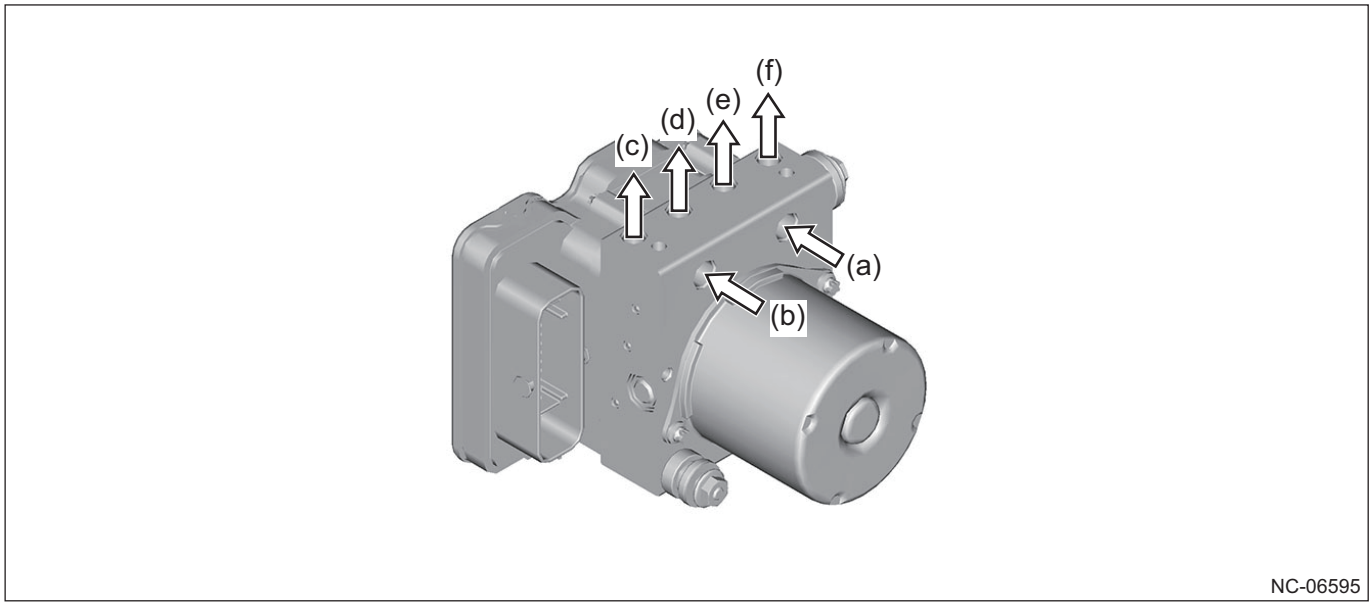
(k) VDC control module and hydraulic control module (VDC CM & H/M)

*: *AT*

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 lightweight and compact built-in yaw rate and longitudinal G, and lateral G sensors are adopted to support the brake assist function at time of negative pressure failure.

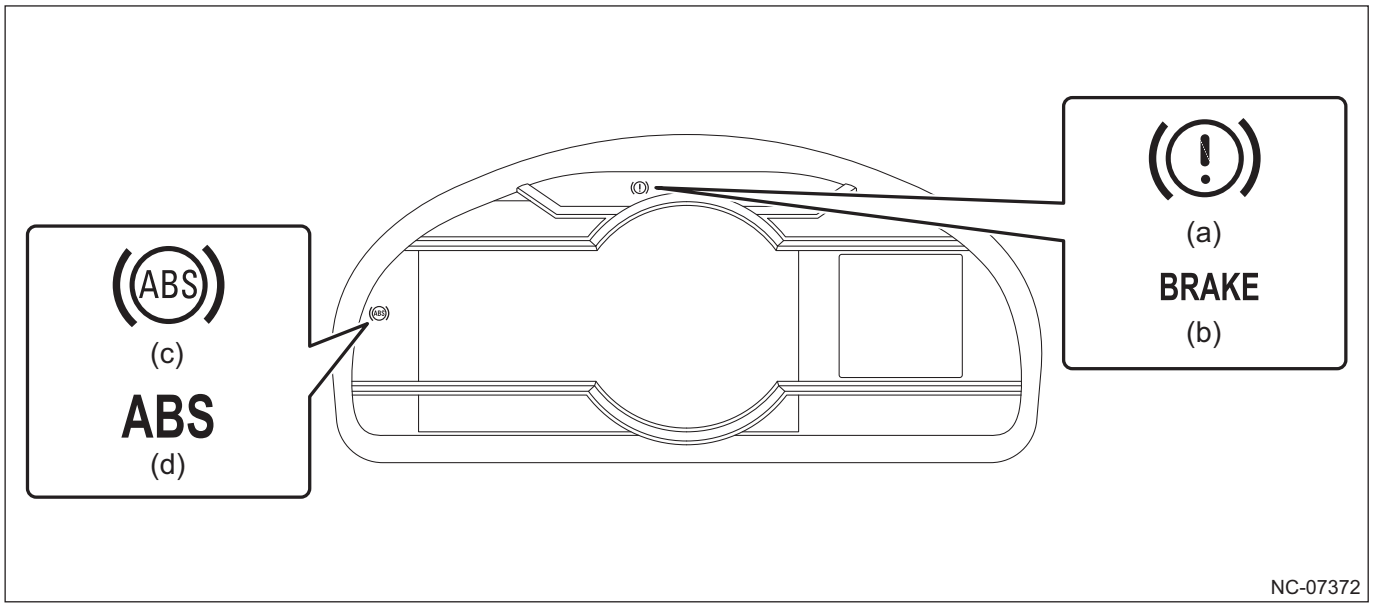


(a) From primary cylinder
(b) From secondary cylinder
(c) To rear right side caliper
(d) To front left side caliper
(e) To front right side caliper
(f) To rear left side caliper

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, the brake negative pressure system is malfunctioning, or the EBD electronic control system is malfunctioning.

The ABS warning light turns on when there is an abnormality in the ABS system.

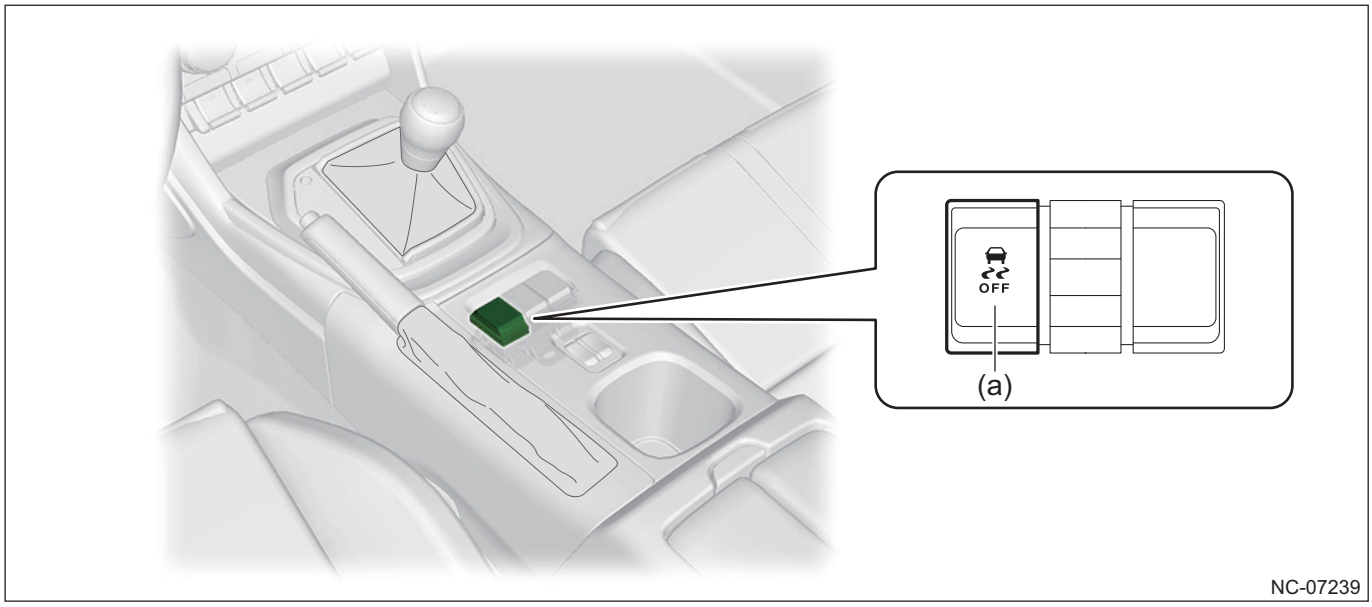


(a) Brake warning light (red) (other than U4, U7)
(b) Brake warning light (red) (U4, U7)
(c) ABS warning light (other than U4, U7)
(d) ABS warning light (U4, U7)

VSC (VDC) OFF switch

The VSC (VDC) OFF switch that disables functions such as the engine torque suppressing function and brake LSD control is installed in the center console.

Each time the switch is operated, the mode switches between NORMAL, TRAC OFF, and VSC (VDC) OFF.



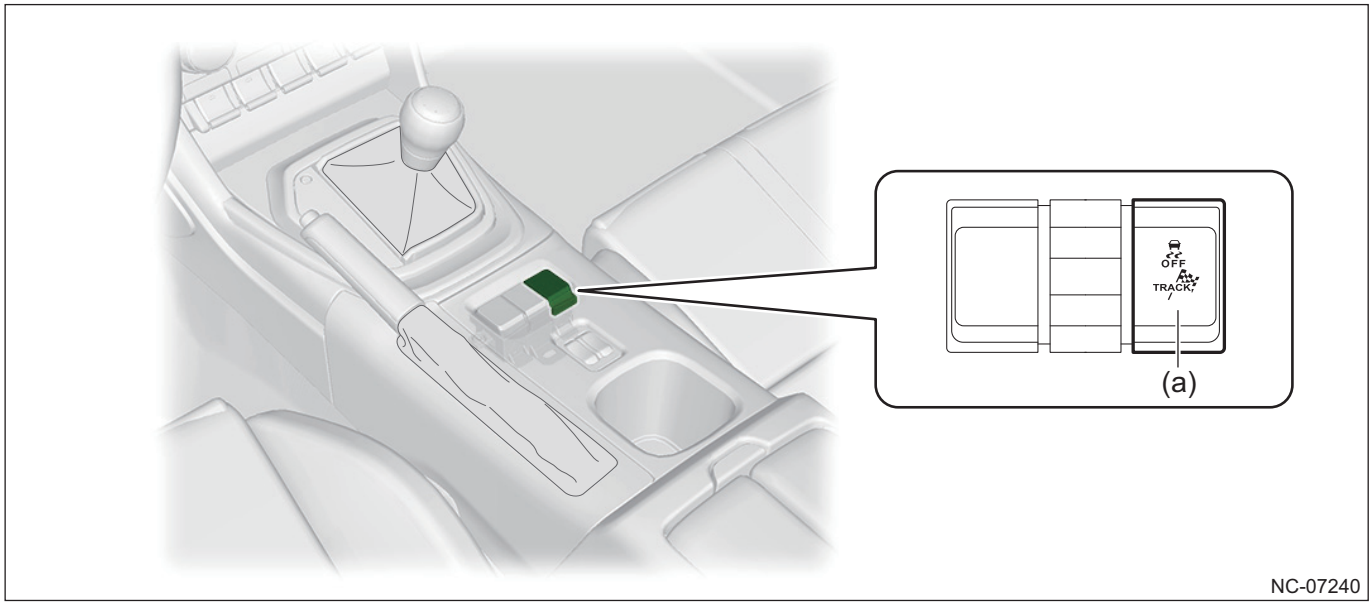
(a) VSC (VDC) OFF switch

Caution
The mode cannot be switched to VSC (VDC) OFF while driving.

TRACK switch

The TRACK switch that switches to a mode appropriate for sporty driving is installed in the center console.

Each time the switch is operated, the mode switches between NORMAL and TRACK.



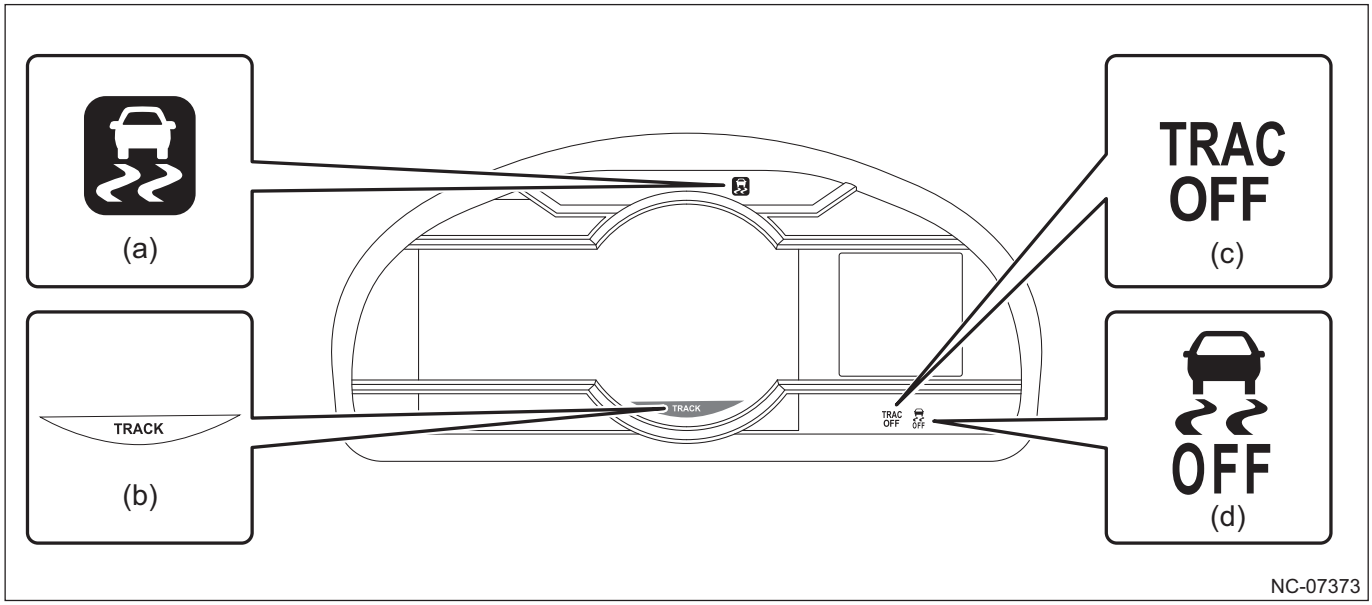
(a) TRACK switch

Vehicle Stability Control (Vehicle Dynamics Control) (VSC/VDC) warning light, VSC (VDC) OFF indicator light, TRAC OFF indicator light, TRACK indicator light

The Vehicle Stability Control (Vehicle Dynamics Control) (VSC/VDC) warning light turns on when there is an abnormality in the Vehicle Stability Control (Vehicle Dynamics Control) (VSC/VDC) system.

Operating the VSC (VDC) OFF switch disables functions such as the engine torque suppressing function and brake LSD control, which is effective for getting out of muddy or snowy roads, or for sporty driving, etc. When the torque suppressing function is turned OFF, the TRAC OFF indicator light and VSC (VDC) OFF indicator light turn on in the meter according to the selected mode so the driver can view the mode status at a glance.

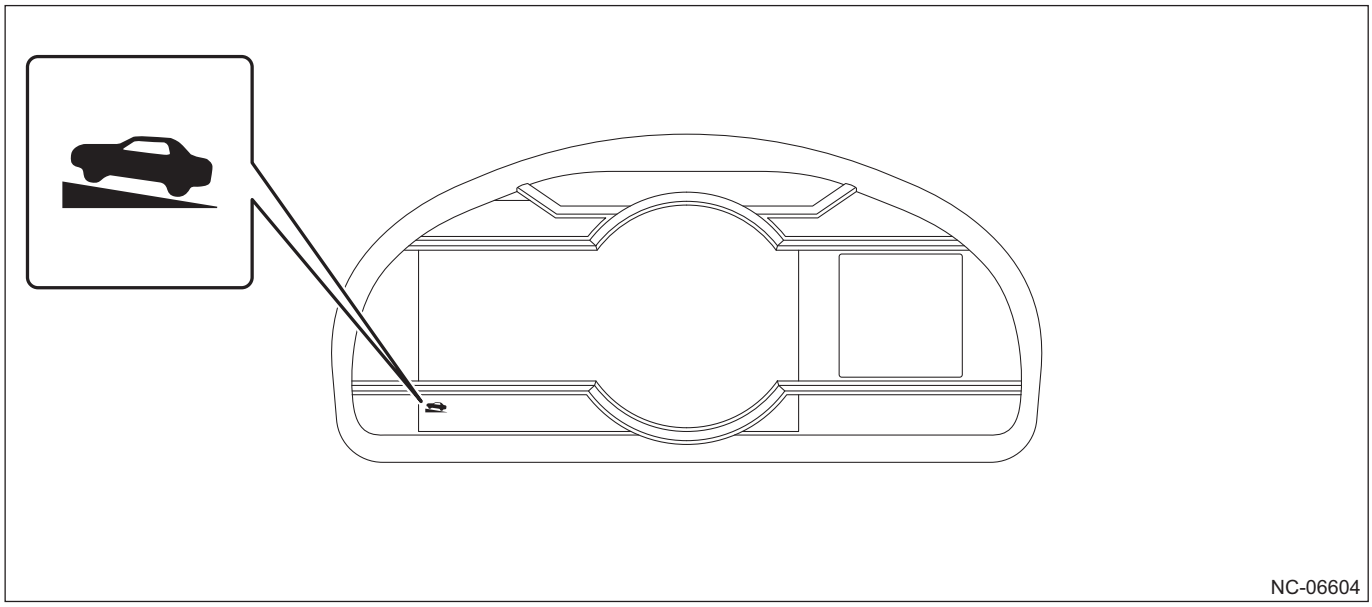
The TRACK indicator light also turns on when TRACK mode is selected.



(a) Vehicle Dynamics Control (VDC) warning light
(b) TRACK indicator light
(c) TRAC OFF indicator light
(d) VSC (VDC) OFF indicator light

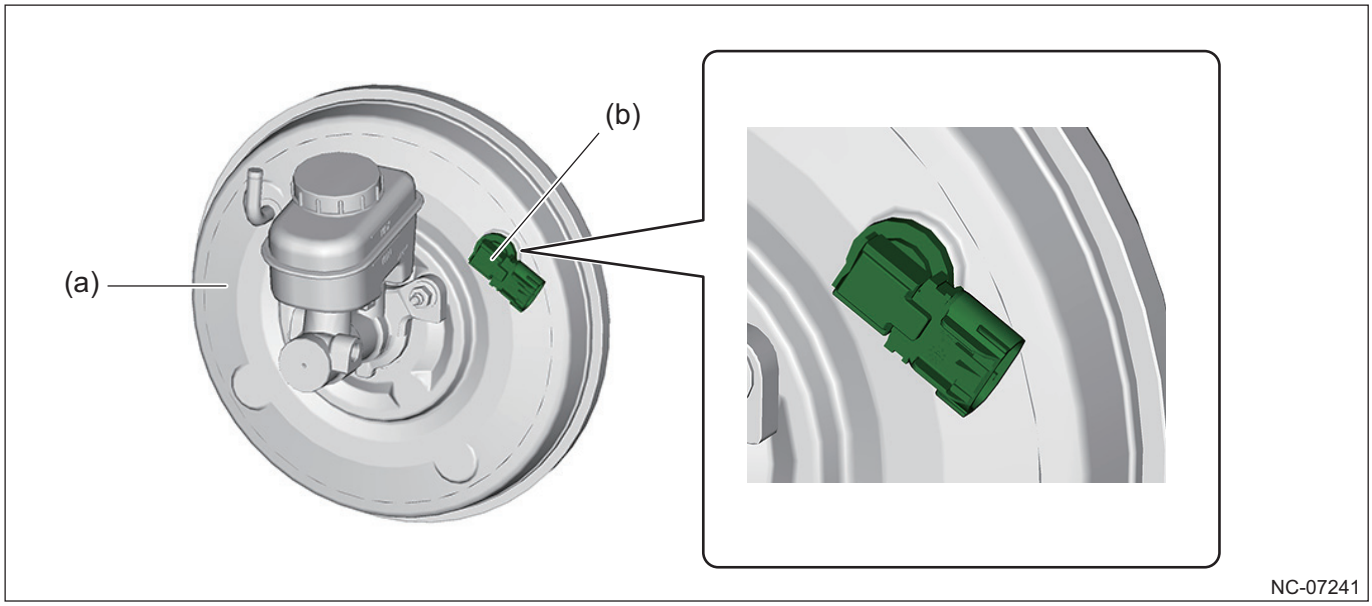
Hill Start Assist (HSA) indicator light

The Hill Start Assist (HSA) indicator light is located in the combination meter assembly. This notifies the driver of the status of the Hill Start Assist (HSA) system.



Vacuum sensor assembly (relative pressure/negative pressure sensor)

The relative pressure/negative pressure sensor is adopted to detect the negative pressure of the vacuum booster assembly.



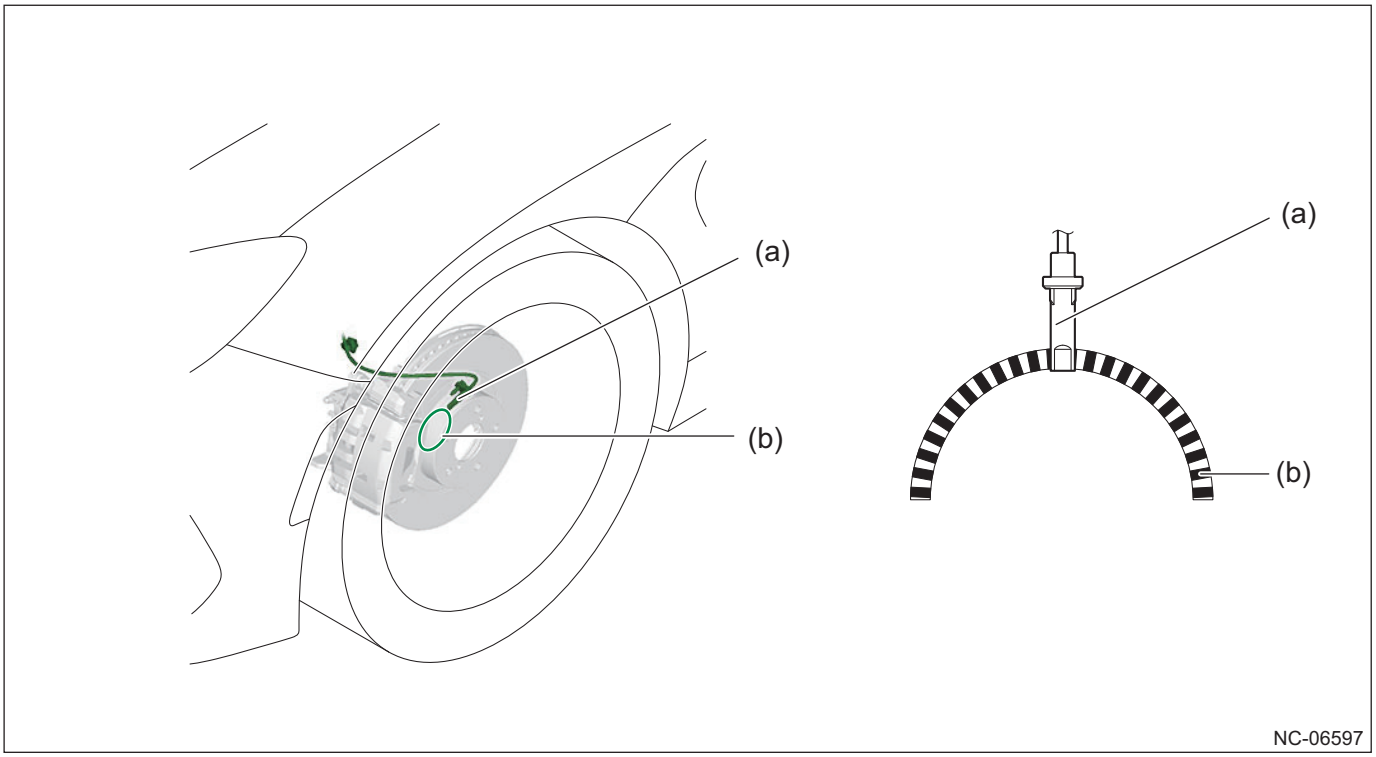
(a) Vacuum booster assembly

(b) Vacuum sensor assembly (relative pressure/negative pressure sensor)

ABS wheel speed sensor

A semiconductor type of active sensor is adopted for the ABS wheel speed sensor, which enables detection of the wheel speed from an extremely low speed for each of the 4 wheels.

A type that can determine forward or reverse travel is also adopted.



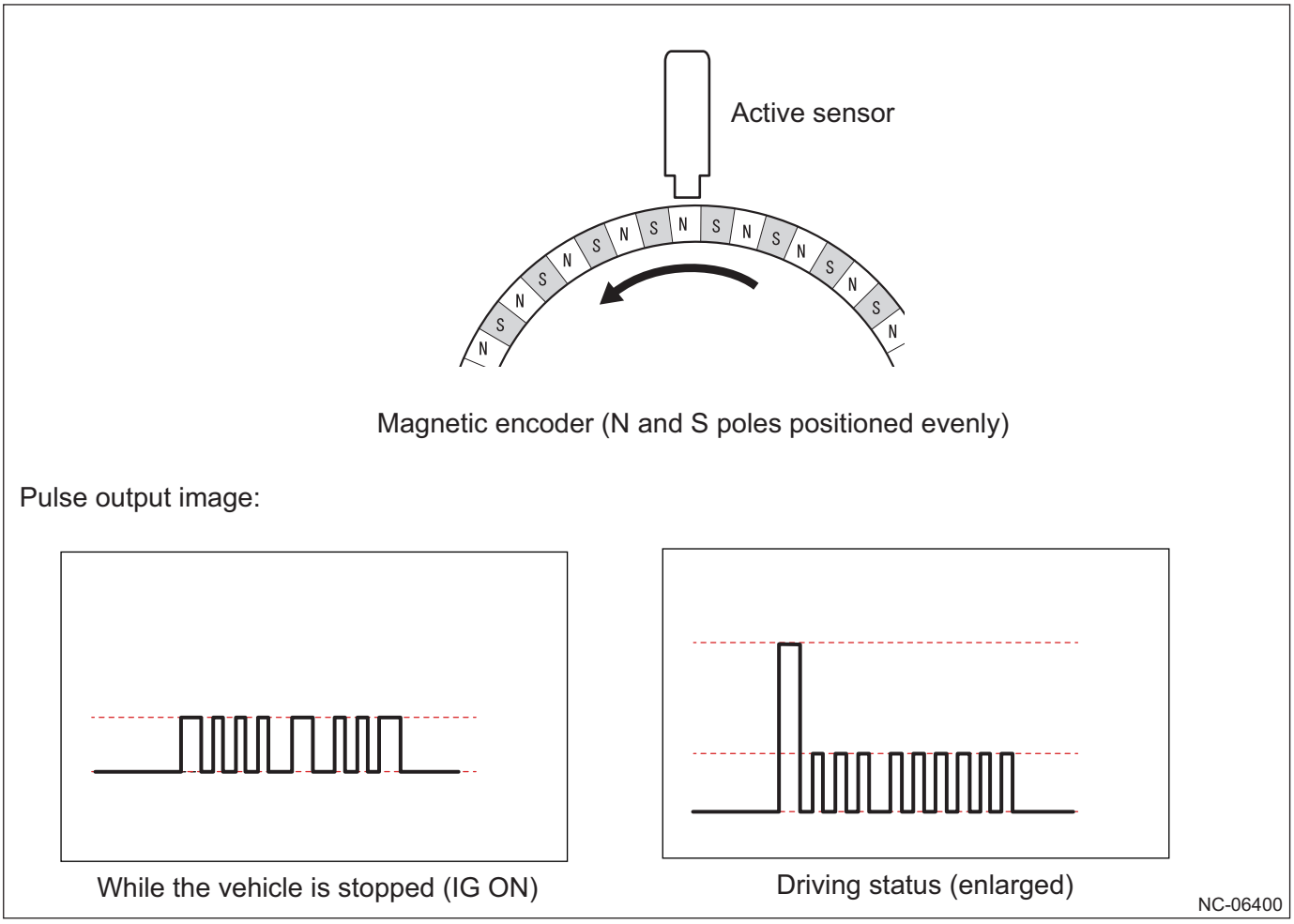
(a) ABS wheel speed sensor

(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 encoder 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.

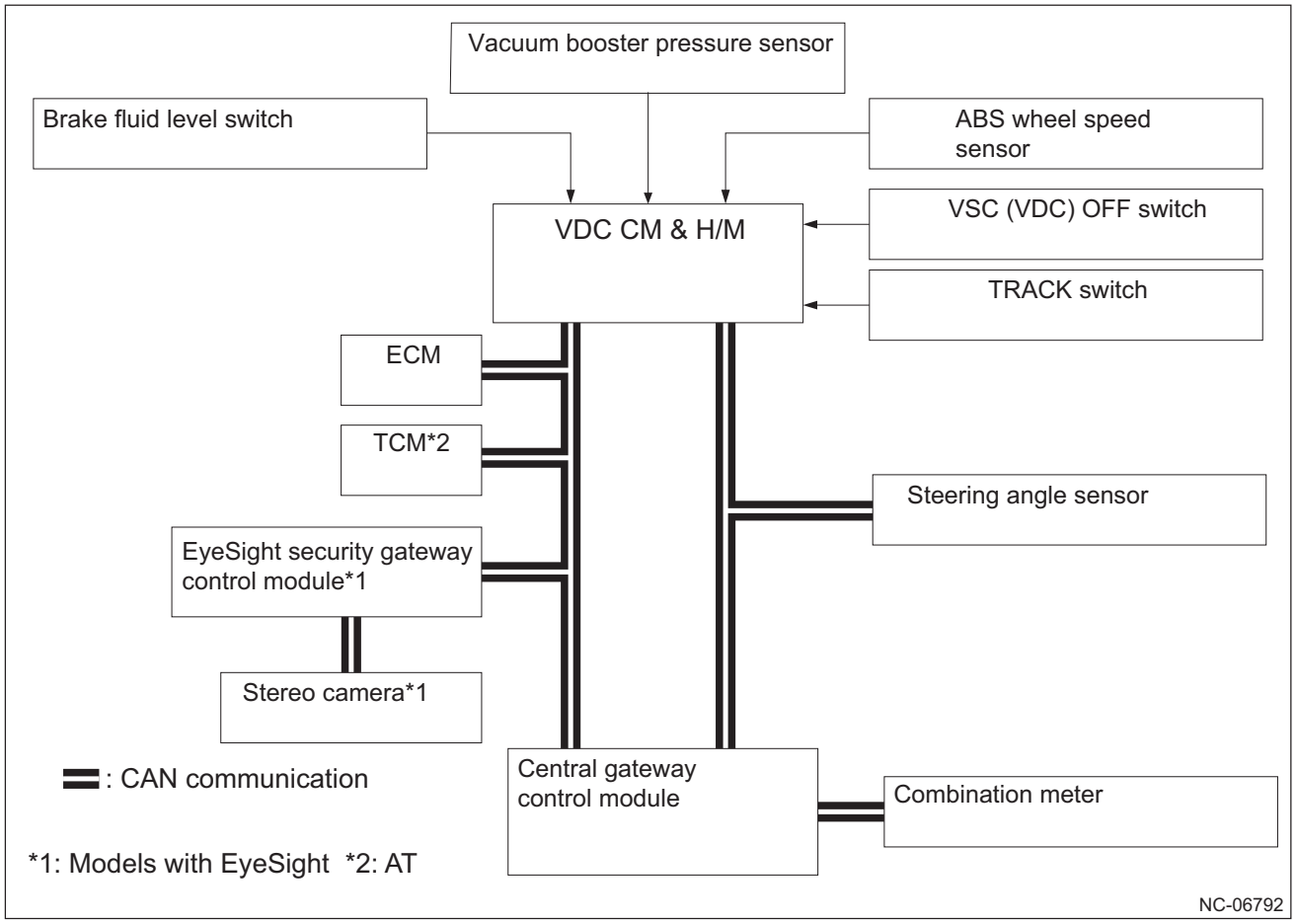


Reference

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



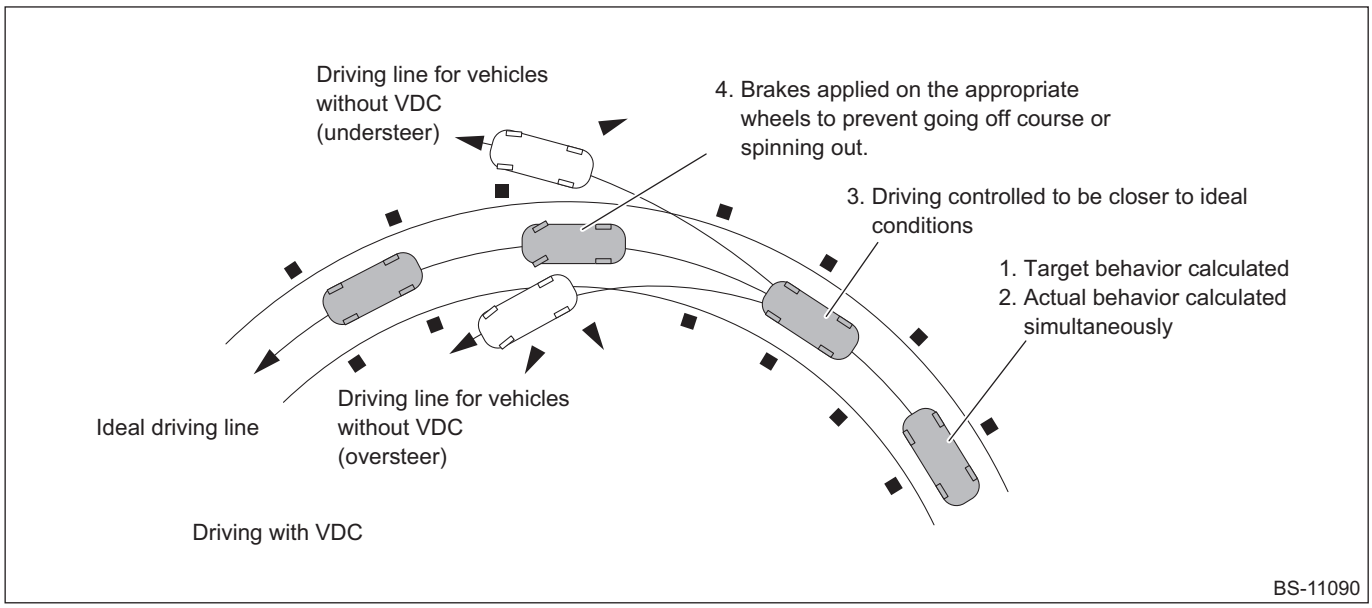
Main component functions

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.
Transmission Control Module (TCM)*		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 assembly		• Notifies the driver of the VSC (VDC) control status or system anomalies by turning on or flashing the various indicators in the combination meter assembly. • Notifies the driver of the vehicle status by displaying an interruption on the multi information display.
Vacuum booster pressure sensor		Detects the negative pressure inside the vacuum booster.
VSC (VDC) OFF switch		Switches between each mode of NORMAL, TRAC OFF, and VSC (VDC) OFF according to the switch operation.
TRACK switch		Switches between each mode of NORMAL and TRACK 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		
Stop light relay		Turns on the stop light.
Engine Control Module (ECM)		Controls the engine torque during VSC (VDC) control based on the signals from the VDC CM & H/M.

*: AT

System details

The yaw rate and longitudinal G sensors, and lateral G sensors are integrated into the VDC CM & H/M. They constantly monitor the vehicle status to optimize the timing at which the ABS (anti-lock control), TRAC (engine control and brake LSD control), and VSC (VDC) (engine and brake control to prevent side slipping) are activated. Thus, high driving safety is ensured with these controls.

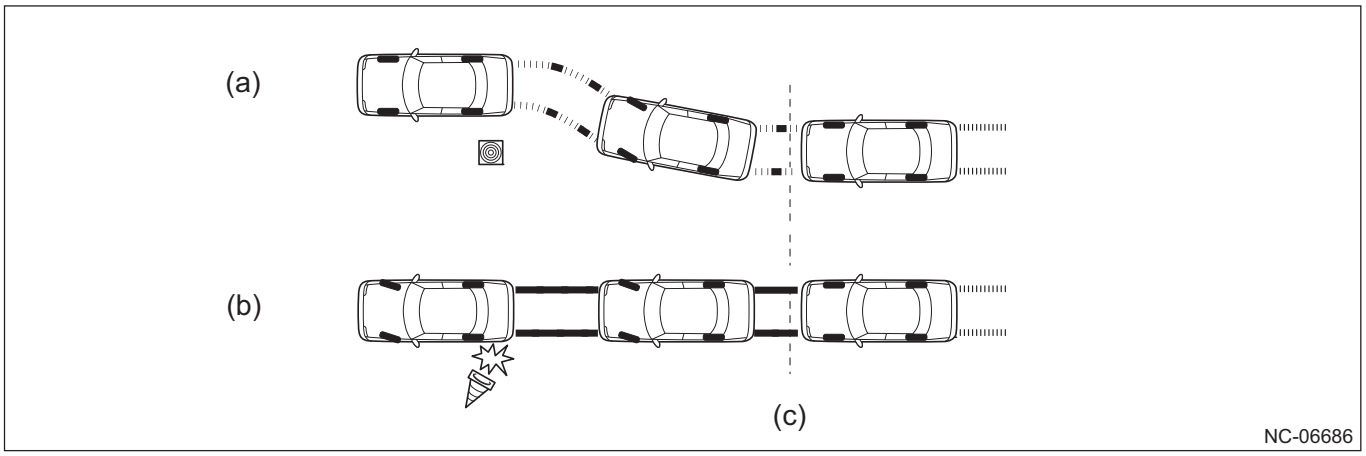


Anti-lock Brake System (ABS) with Electronic Brakeforce Distribution (EBD)

A basic requirement for a vehicle to move, turn, and stop is for the tires to grip the road surface and fulfill their role as tires. However, when braking suddenly or braking on slippery road surfaces such as snow or water puddles, the wheels may lock even though the vehicle is still moving, resulting in slip between the tires and road surface.

The Anti-lock Brake System (ABS) detects the wheel speeds in this kind of braking situation and uses computer control to control the brake oil pressure to all 4 wheels. This provides control that prevents the tires from locking to maintain steering operability and vehicle stability.

As well as providing the conventional ABS function, the Anti-lock Brake System (ABS) with Electronic Brakeforce Distribution (EBD) controls the braking force appropriately between the front and rear wheels and left and right wheels regardless of changes in load, such as when the vehicle is empty or carrying a load. This ensures excellent brake performance.

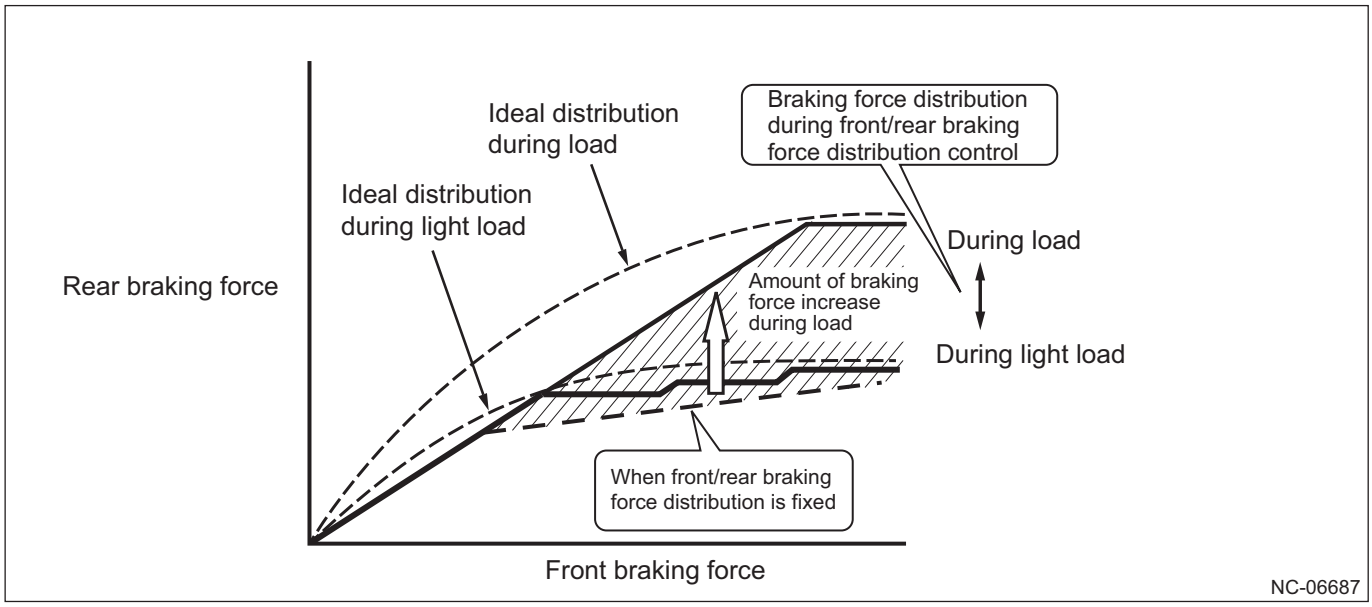


(a) Models equipped with ABS
(b) Models not equipped with ABS
(c) Braking start

■ Front/rear braking force distribution control

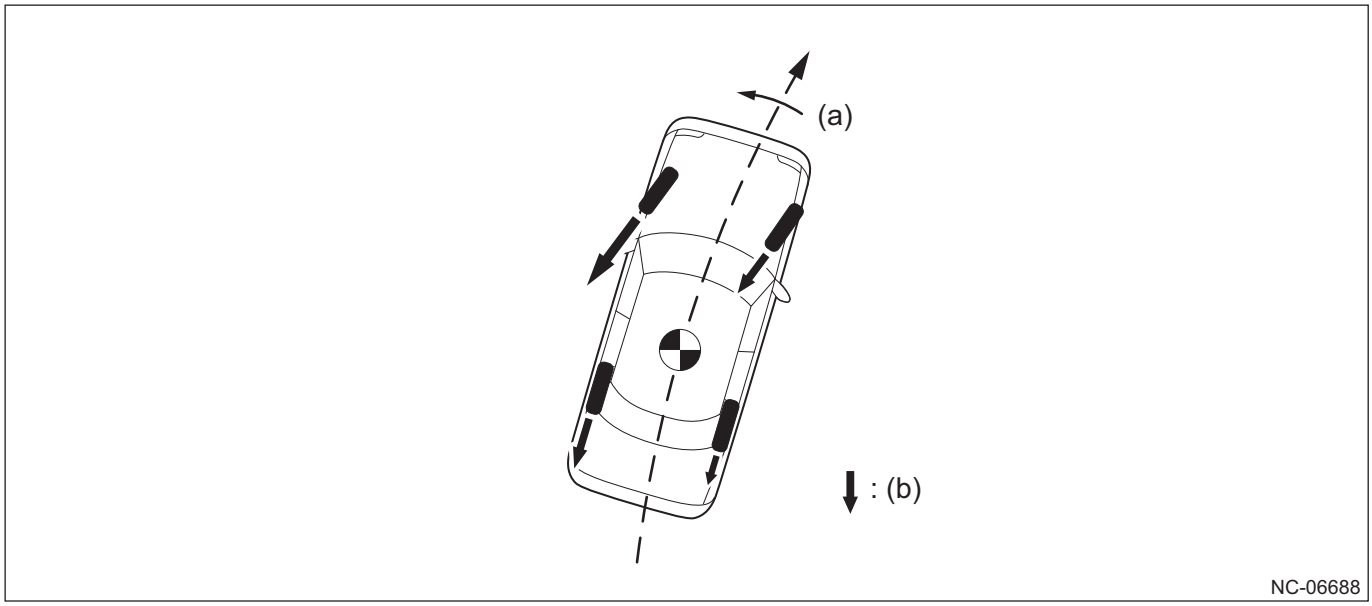
The purpose of front/rear braking force distribution control is to maximize the "stopping" performance, which is a basic element of braking performance. This control distributes the braking force between the front and rear wheels as appropriate for the vehicle driving conditions.

As a result, the braking force of the rear wheels is utilized effectively according to changes in the load due to cargo loading conditions or deceleration speed.



■ Left/right braking force distribution control

Left/right braking force distribution control is for controlling the braking force of the left and right wheels to ensure vehicle stability when braking during a turn. This control achieves excellent brake performance while ensuring vehicle stability while braking.



(a) Stabilization moment

(b) Braking force

Caution

The Anti-lock Brake System (ABS) does not raise the performance of the tires beyond their designed performance. Therefore, be sure to drive safely, maintaining the proper speed, vehicle distance, etc.

Using tires other than the specified parts, such as tires of a non-specified size, may negatively affect the Anti-lock Brake System (ABS) control.

When the engine is started, a motor noise may be heard due to the initial check immediately after first starting to drive, but this is not a malfunction.

The brake pedal may feel heavy if it is lightly depressed during the initial check, but this is not a malfunction.

Under the following conditions, the braking distance when the ABS operates may be longer than in vehicles not equipped with ABS.

- When driving on gravel roads or fresh snow
- When tire chains are attached
- When driving over level differences, such as road seams
- When driving on bad roads, such as bumpy roads or cobblestones

Brake assist

When an emergency braking operation is detected from brake pedal depression speed and amount, strong braking force is generated based on this.

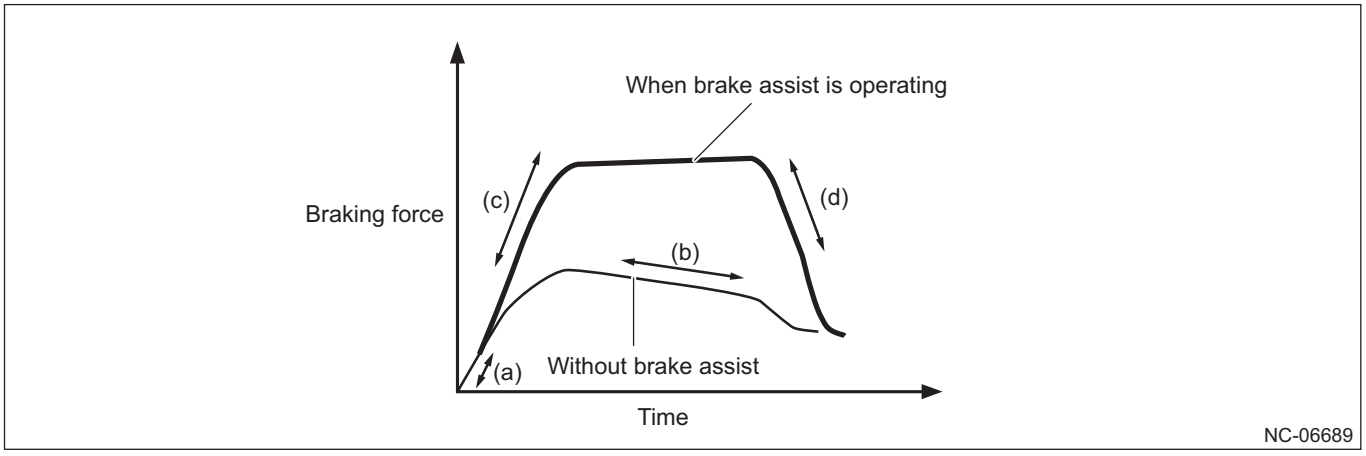
■ Brake assist concepts

In an emergency, a panicking driver may depress the brake pedal quickly but not very strongly, resulting in the application of only small braking force. ((a) in figure)

Furthermore, in the second half of the braking operation, this driver may fail to continue depressing the brake pedal for a long time, resulting in reduced braking force. ((b) in figure)

When the brake pedal is depressed quickly, brake assist increases the braking force even if the pedal was not depressed very strongly when it determines that the driver intended an emergency braking operation. ((c) in figure)

After operation, when the driver deliberately softens the brake pedal depression, brake assist reduces the amount of braking force assist to reduce discomfort. ((d) in figure)



Caution
Brake assist does not raise the performance of the brakes beyond their designed performance. Be sure to drive safely, maintaining the proper vehicle speed, vehicle distance, etc.

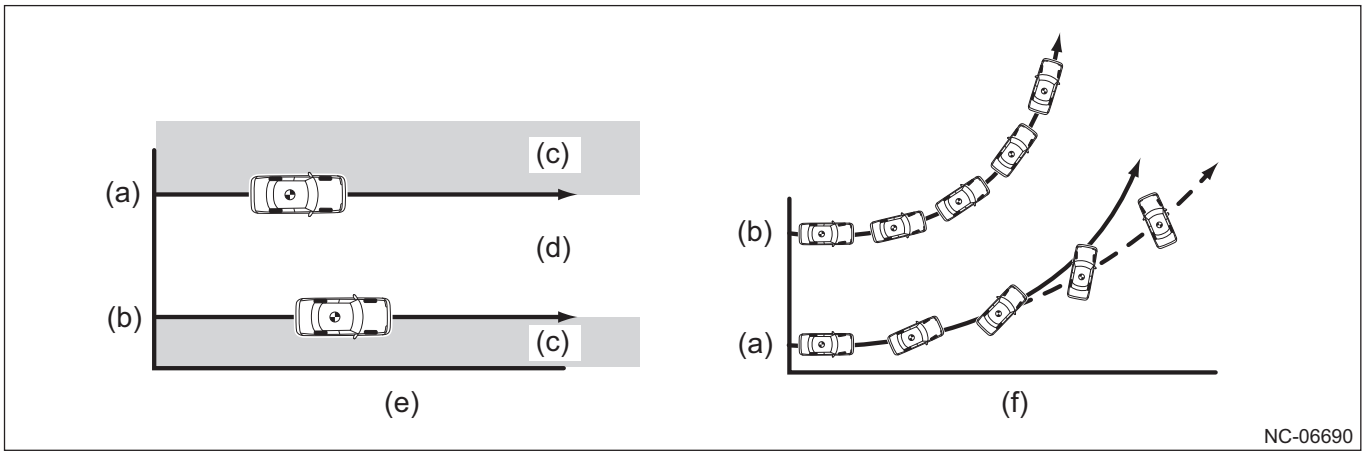
Traction control (TRAC)

When the throttle is opened too much when starting off or accelerating on a slippery road, etc., the excessive torque may cause the drive wheels to slip, impairing the starting off acceleration and maneuverability.

Traction control (TRAC) is composed of brake oil pressure control and drive force control for the drive wheels. This suppresses drive wheel slipping, provides drive force suitable for the road surface conditions, and ensures starting off acceleration, straight-line stability, and turning stability for the vehicle.

The characteristics of traction control (TRAC) are as follows.

- The delicate acceleration work required when starting off or accelerating on slippery roads is no longer required.
- Maneuverability and stability during acceleration is excellent.
- Turning is more stable even when accelerating during a turn.
- Stable acceleration can be obtained even when straddling road surfaces with different conditions between the left and right drive wheels.



(a) Without TRAC

(b) With TRAC

(c) High μ road

(d) Low μ road

(e) Acceleration performance (road straddling high μ road and low μ road)

(f) Turning stability (low μ road)

Vehicle Stability Control (Vehicle Dynamics Control) (VSC/VDC)

While the purpose of the Anti-lock Brake System (ABS) and traction control (TRAC) is mainly to ensure stability when braking or accelerating with a brake operation or accelerator operation, the purpose of the Vehicle Stability Control (Vehicle Dynamics Control) (VSC/VDC) is to ensure stability in the vehicle turning direction. Normally, a vehicle turns stably according to the steering operation. However, in situations such as unforeseen road surface conditions, vehicle speeds, or emergency turning, or when affected by external factors, there may be a tendency for strong side slipping to be applied to the rear wheels or front wheels.

To ensure stability even in these situations, the Vehicle Stability Control (Vehicle Dynamics Control) (VSC/VDC) performs brake oil pressure control and drive force control for each wheel to lessen the strong side slipping of the rear wheels or front wheels.

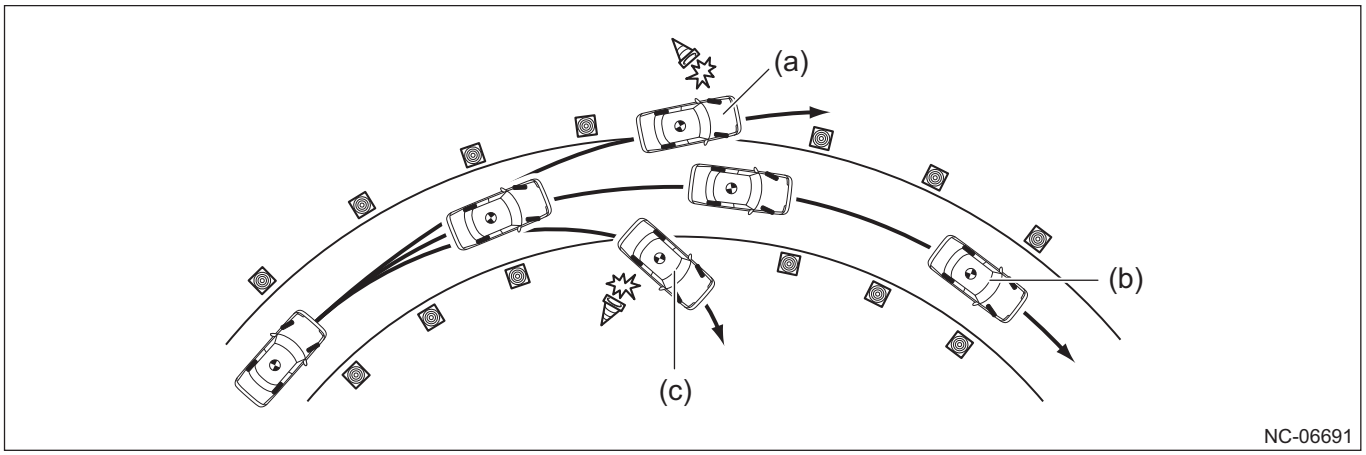
■ Overview of control performance

Vehicle Stability Control (Vehicle Dynamics Control) (VSC/VDC) detects the vehicle conditions based on the signals from the various sensors such as yaw rate sensor, and controls the brake oil pressure and drive force.

The following 2 examples are of situations where the tires exceed the lateral grip limits.

- When the rear wheels are losing their grip relative to the front wheels (strong rear wheel side slipping)
- When the front wheels are losing their grip relative to the rear wheels (strong front wheel side slipping)

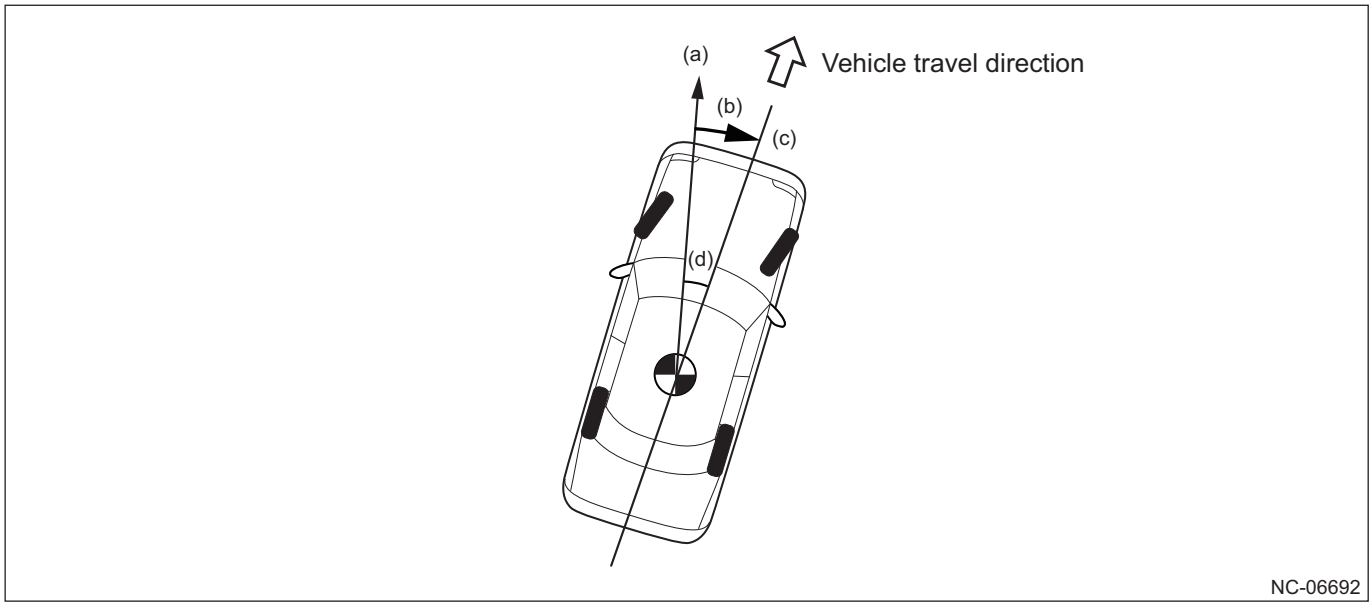
The Vehicle Stability Control (Vehicle Dynamics Control) (VSC/VDC) operates in the situation shown in the figure below to lessen the tendency for strong side slipping of the vehicle's rear wheels or front wheels.



(a) Strong front wheel side slipping
(b) VDC control
(c) Strong rear wheel side slipping

■ Determination of strong rear wheel side slipping tendency for vehicle

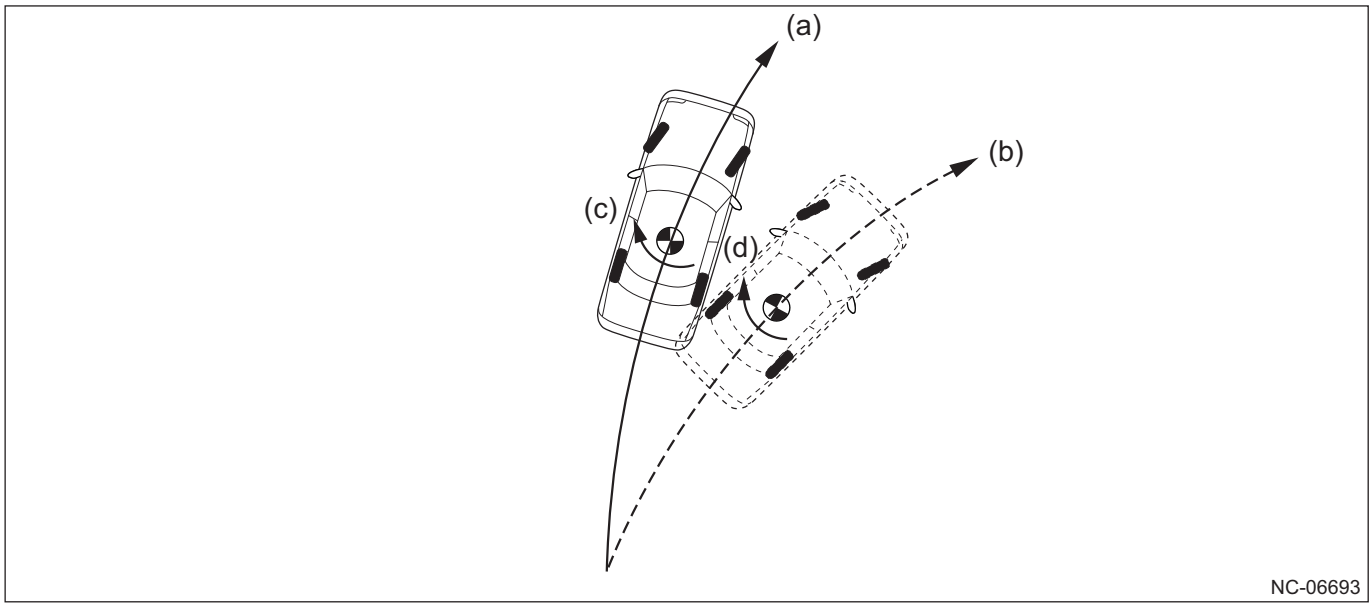
The tendency for rear wheel side slipping is determined by the VDC CM based on the values of the vehicle body slip angle and vehicle body slip angular velocity from the yaw rate sensor. The vehicle body is determined to have a rear wheel side slipping tendency when the vehicle body slip angle is large and the slip angular velocity is high.



(a) Travel direction of vehicle center of gravity
(b) Vehicle body slip angle
(c) Vehicle inclination
(d) Vehicle slip angular velocity

■ Determination of strong front wheel side slipping tendency for vehicle

The tendency for front wheel side slipping is determined by the VDC CM based on the target yaw rate and the actual vehicle yaw rate values. The front wheel side slipping tendency is determined to be large when the driver operates the steering and the actual vehicle yaw rate is lower than the target yaw rate that should be generated (determined from steering amount and vehicle speed), meaning that the vehicle body cannot turn.



(a) Actual travel trajectory
(b) Travel trajectory according to target yaw rate
(c) Actual yaw rate
(d) Target yaw rate

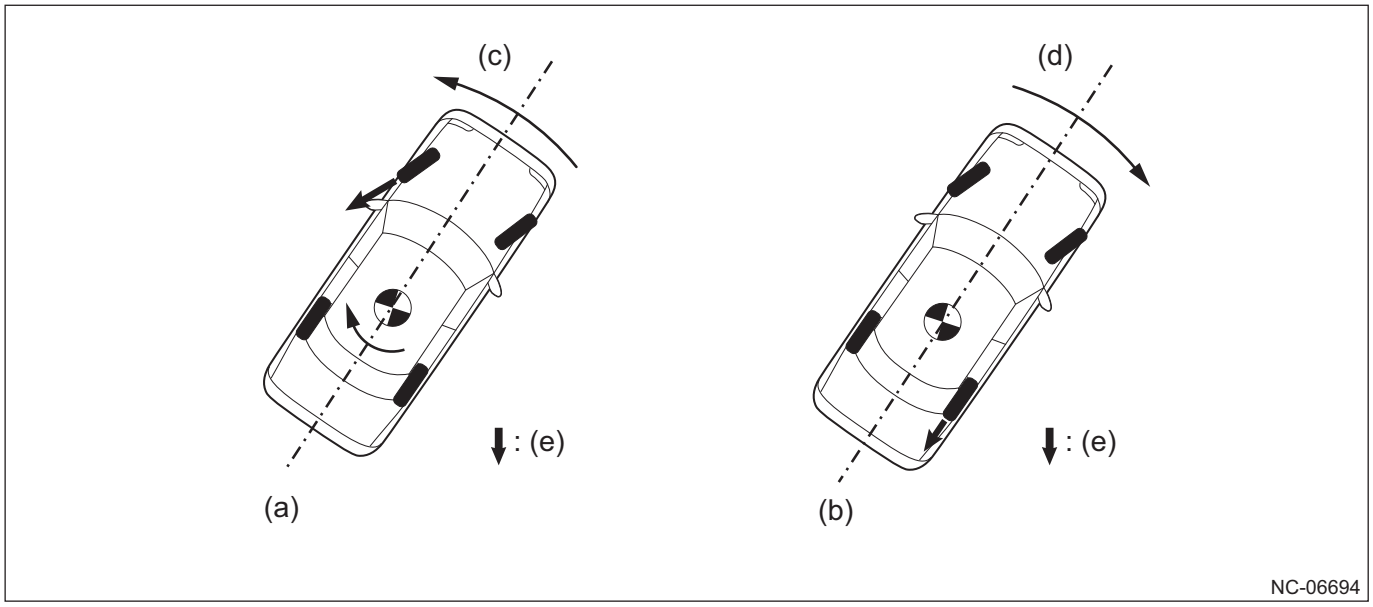
■ Operation of Vehicle Stability Control (Vehicle Dynamics Control) (VSC/VDC)

Lessening the strong rear wheel side slipping tendency for vehicle

When the VDC CM determines a rear wheel side slipping tendency, it applies the brake to the front wheel on the outer side of the turn according to the strength of the tendency. This generates stabilization moment facing the outer side of the turn to suppress the rear wheel side slipping tendency. This also contributes to ensuring vehicle stability when the vehicle speed is reduced by braking force.

Lessening the strong front wheel side slipping tendency for vehicle

When the VDC CM determines a front wheel side slipping tendency, it suppresses the drive force and applies the brake to the rear wheel on the inner side of the turn according to the strength of the tendency. This generates stabilization moment in the turning direction to suppress the front wheel side slipping tendency.

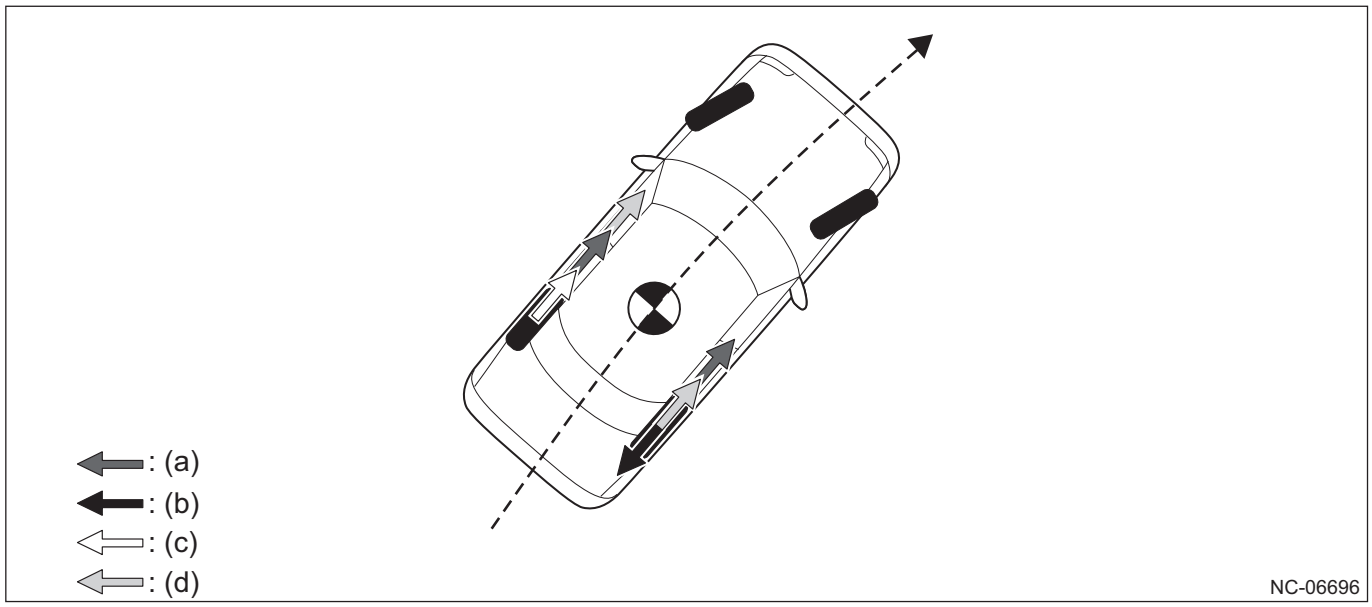


(a) Lessening the rear wheel side slipping tendency
(b) Lessening the front wheel side slipping tendency
(c) Rear wheel side slipping suppression moment
(d) Front wheel side slipping suppression moment
(e) Braking force

Brake LSD

When accelerating in a turn, the drive wheel on the inner side of the turn may spin due to the movement of the load to the outer side of the turn, making it difficult to transmit the drive force to the road surface. In this case, the operation of the differential stops the drive force from being transmitted to the drive wheel on the outer side of the turn as well.

The brake LSD detects the turning conditions and spinning of the wheels, and then suppresses the spinning by applying the brake to the drive wheel on the inner side of the turn. This transmits the drive force to the drive wheel on the outer side of the turn and enables acceleration as intended by the driver.



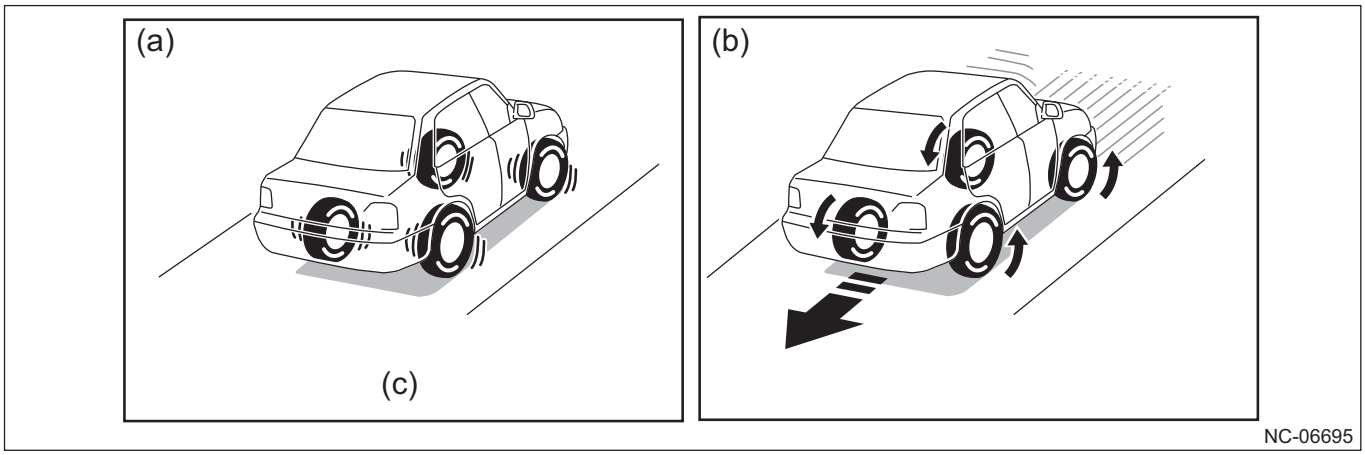
(a) Driving force
(b) Braking force
(c) Reaction force of braking force due to differential
(d) Drive force transmitted to tires

Hill Start Assist (HSA)

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.

Note that Hill Start Assist (HSA) is set to ON by default.



(a) With Hill Start Assist (HSA)

(b) Without Hill Start Assist (HSA)

(c) Brake control suppresses reverse movement of the vehicle when starting off on a hill

■ 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 (MT)
- When traveling uphill and the shift lever is set to a position other than D or M (AT)
- When traveling downhill and the shift lever is set to R
- When the accelerator pedal is not depressed

■ Switching the function ON/OFF

Hill Start Assist (HSA) is set to ON by default, but it can be switched between ON and OFF with the following procedure.

(1) Stop the vehicle in a safe and flat location, apply the parking brake, and stop the engine

(2) Start the engine, and check that the ABS warning light and Vehicle Stability Control (Vehicle Dynamics Control) (VSC/VDC) warning light are off

(3) Press and hold the VSC (VDC) OFF switch (for approximately 30 seconds)

(4) Check that the TRAC OFF indicator light and VSC (VDC) OFF indicator light turn on and then turn off

(5) After the indicator lights turn off in (4), release the VSC (VDC) OFF switch within 5 seconds and then press the VSC (VDC) OFF switch within 2 seconds

(6) Check that the hill start assist indicator light turns on and then turns off

(7) Stop the engine

(8) Hill start assist function is OFF

Reference

To switch from OFF to ON again, perform the procedure above from (1) to (8).

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.

6.4 Parking Brake

6.4.1 Overview

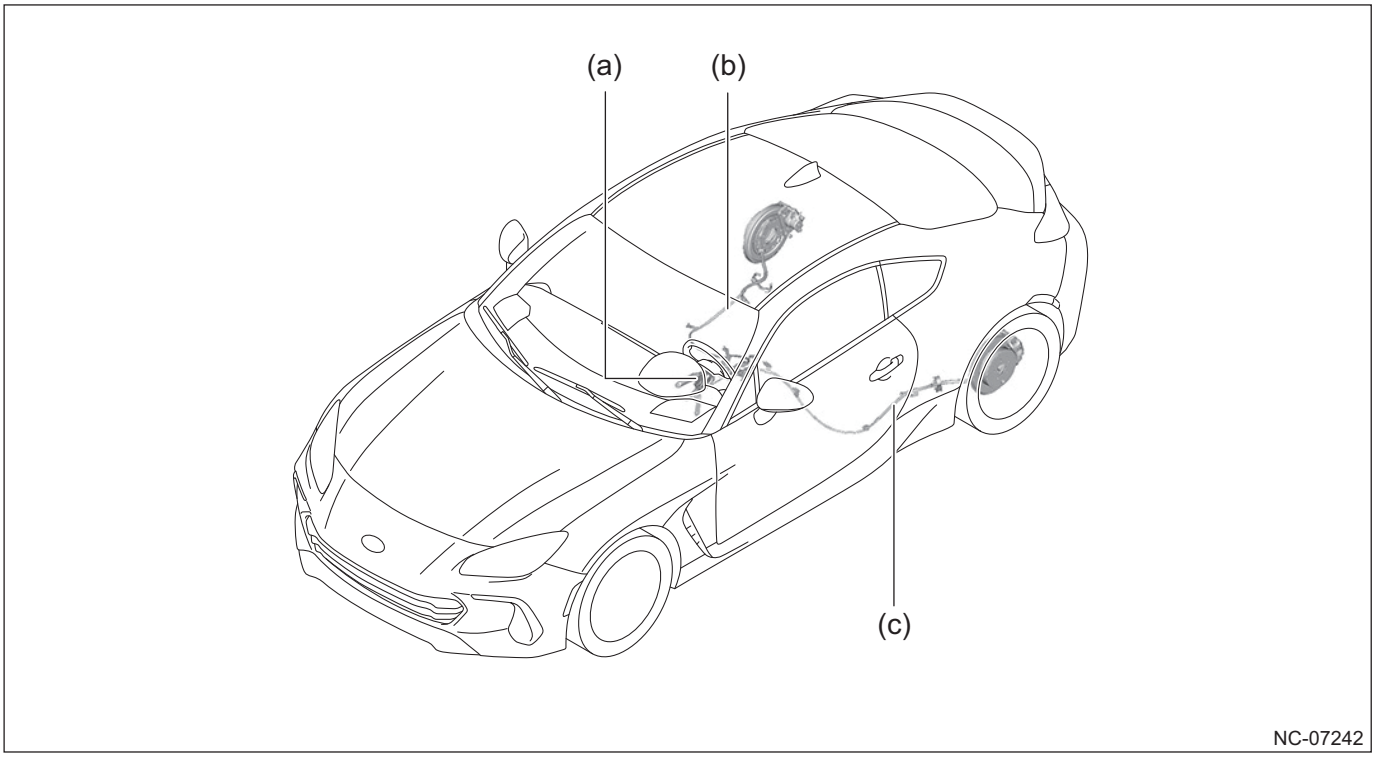
Overview

The following type of parking brake is adopted.

- Center lever type parking brake
- Light and high-performance forward pull type duo servo parking brake
- Parking brake lever with optimized lever ratio

6.4.2 Component

Component layout drawing

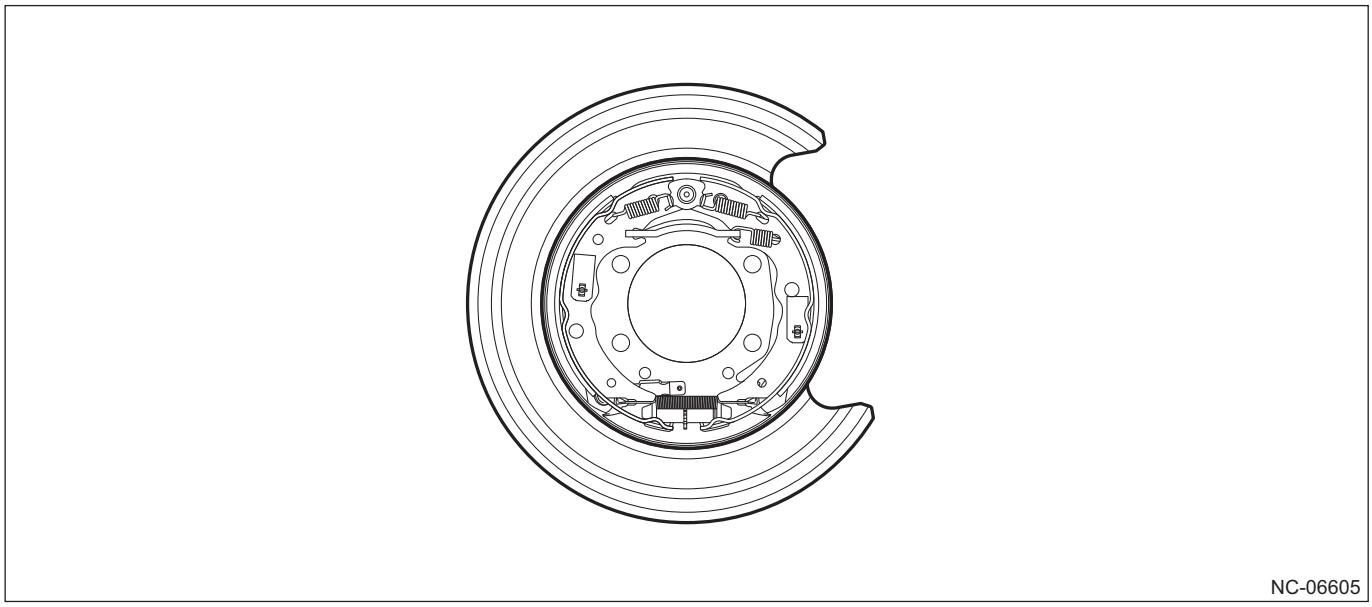


(a) Hand brake lever assembly
(b) Hand brake cable assembly RH
(c) Hand brake cable assembly LH

Component details

Parking Brake

A light and high-performance forward pull type of duo servo parking brake is adopted.



Parking brake lever

Real leather wrapping is provided for the parking brake lever.

The lever ratio is also optimized for an excellent operation feeling.

7 STEERING WHEEL

CONTENTS

7.1 General Overview 7-2
7.1.1 Overview 7-2
7.1.2 Component. 7-3
7.2 Steering Wheel 7-4
7.2.1 Overview 7-4
7.2.2 Component. 7-5
7.3 Power Assisted System 7-14
7.3.1 Overview 7-14
7.3.2 Component. 7-15
7.3.3 Construction and Operation. 7-18

7.1 General Overview

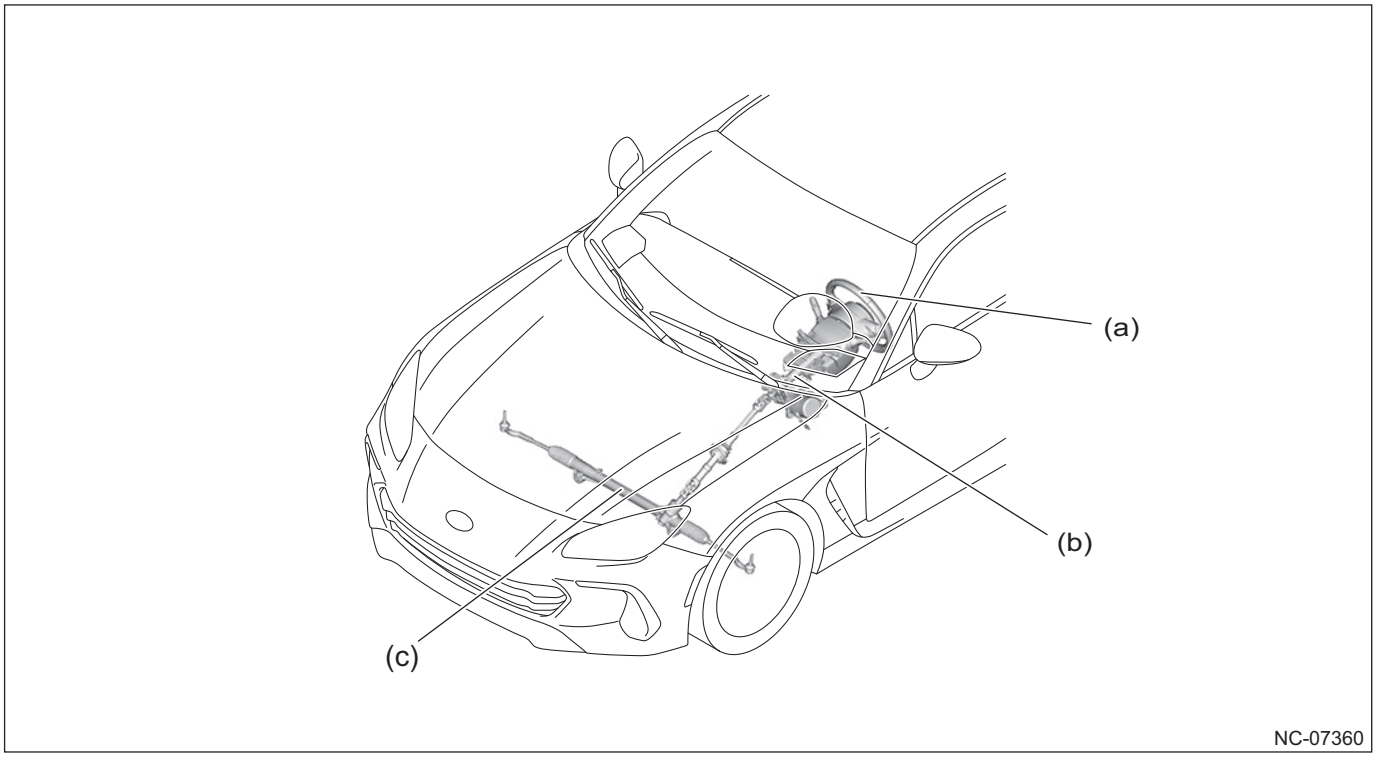
7.1.1 Overview

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 assembly
(b) Column assembly steering
(c) Steering gearbox assembly

7.2 Steering wheel

7.2.1 Overview

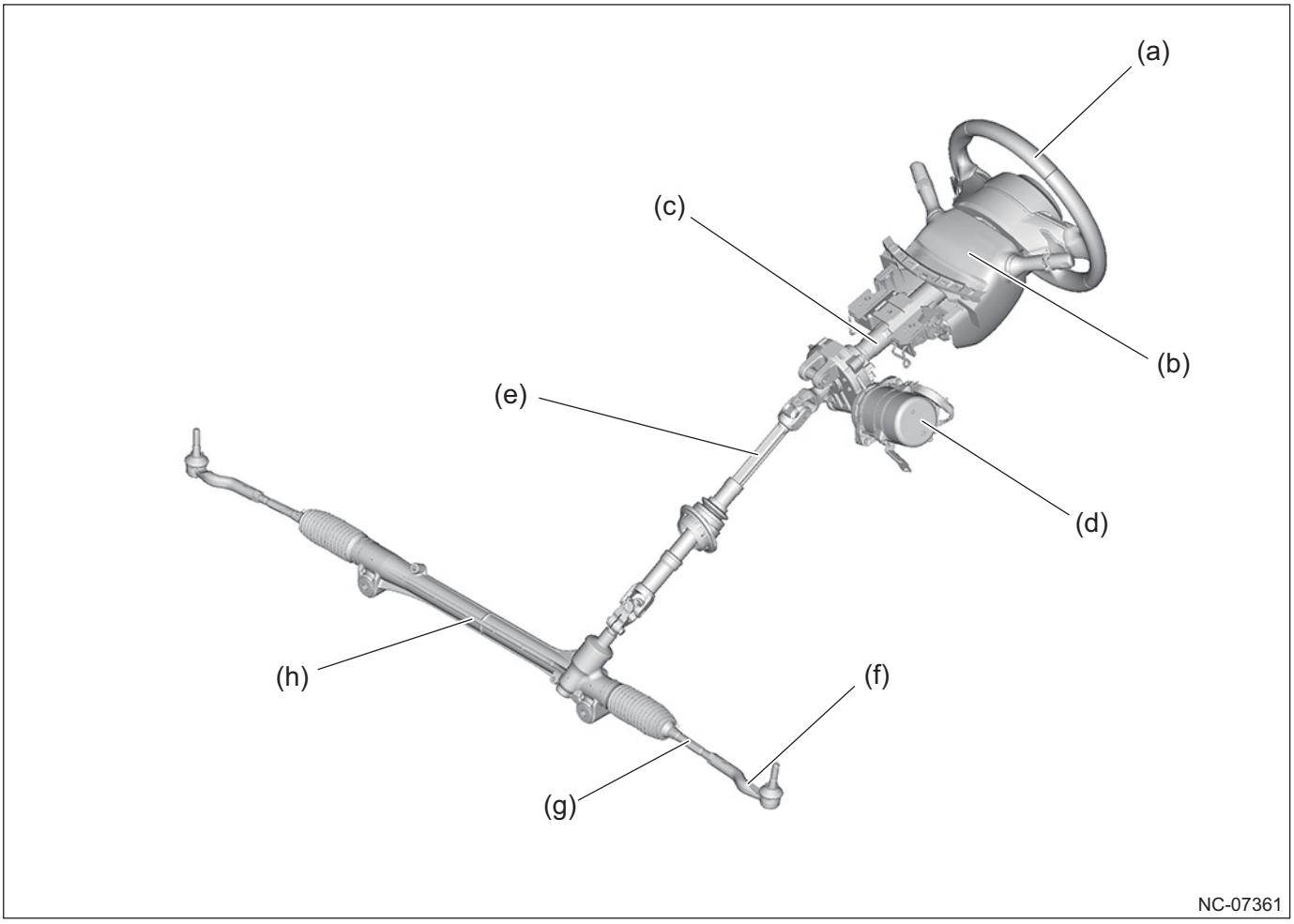
Overview

The following items are adopted for the steering wheel to improve safety and operability.

- Small diameter steering wheel assembly
- Column assembly steering with reduced weight due to integration with EPS power pack, and that ensures sufficient collapse stroke amount and tilt/telescopic adjustment amount

7.2.2 Component

Component layout drawing



(a) Steering wheel assembly
(b) Column cover
(c) Column assembly steering
(d) Motor control unit
(e) Universal joint assembly steering
(f) Tie-rod end
(g) Tie-rod
(h) Steering gearbox assembly

Component details

Steering wheel assembly

A 3-spoke steering wheel (highly tactile leather) is adopted.

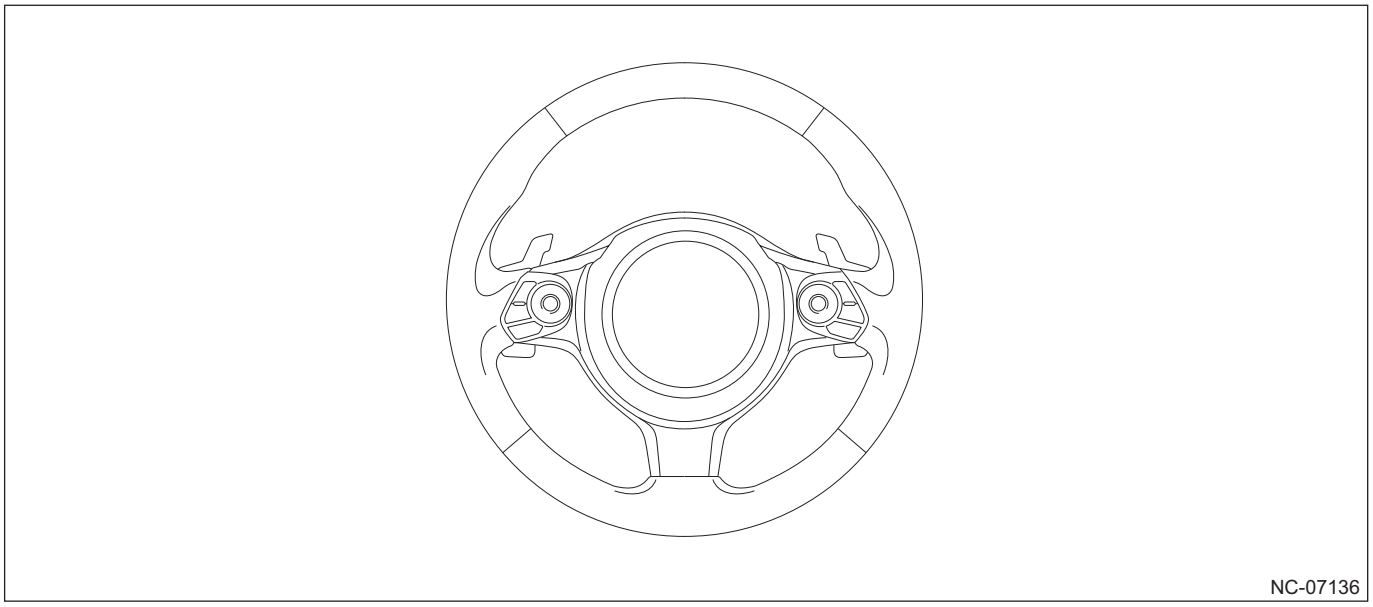
A special grip cross section designed for grip comfort is adopted for the steering wheel assembly, and together with a reduced diameter and grip hardness optimization, results in excellent operability.

A steering wheel assembly with SRS airbag is adopted in consideration of safety.

A dynamic damper (steering shake damper) is provided inside the steering wheel assembly to reduce vibration of the steering mechanism.

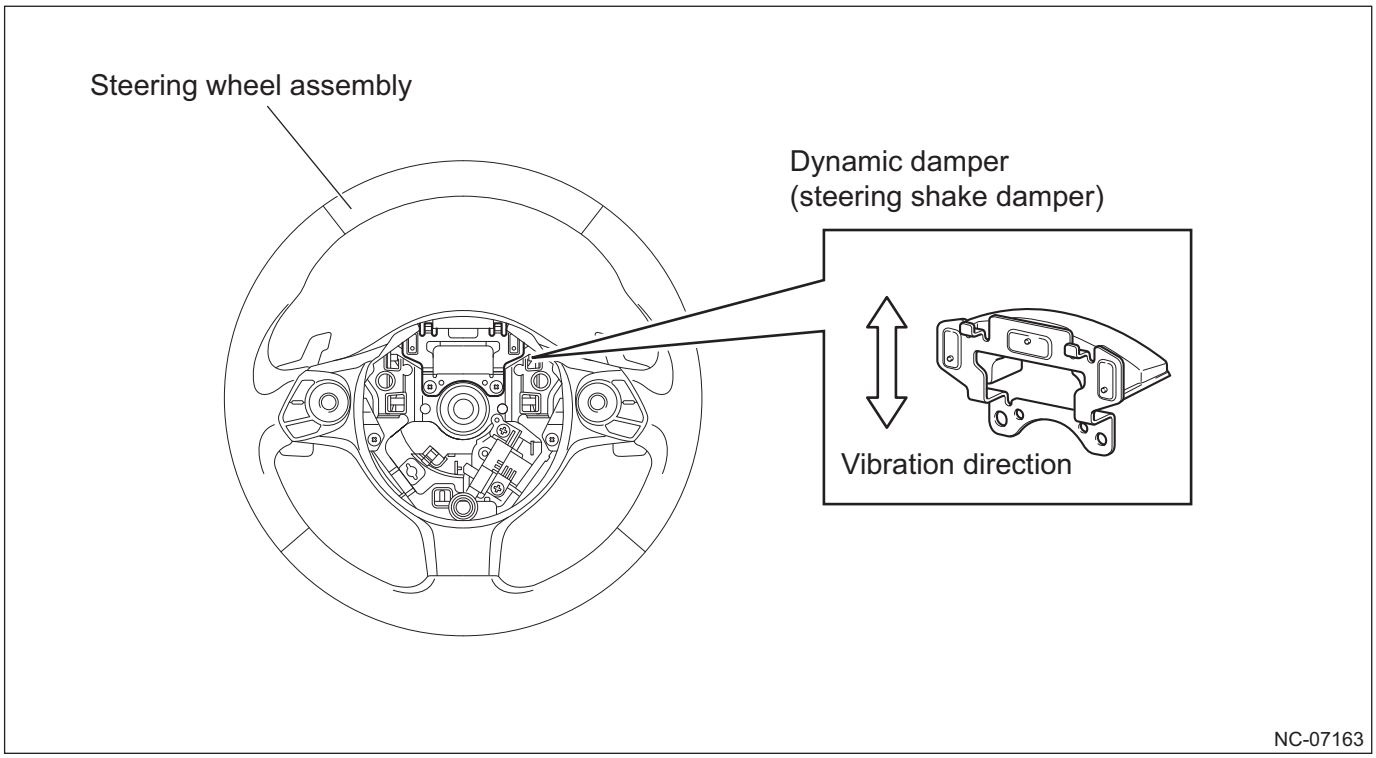
A paddle shift switch (transmission shift switch) is provided for some specifications.

A satellite switch is provided.



■ Structure of dynamic damper

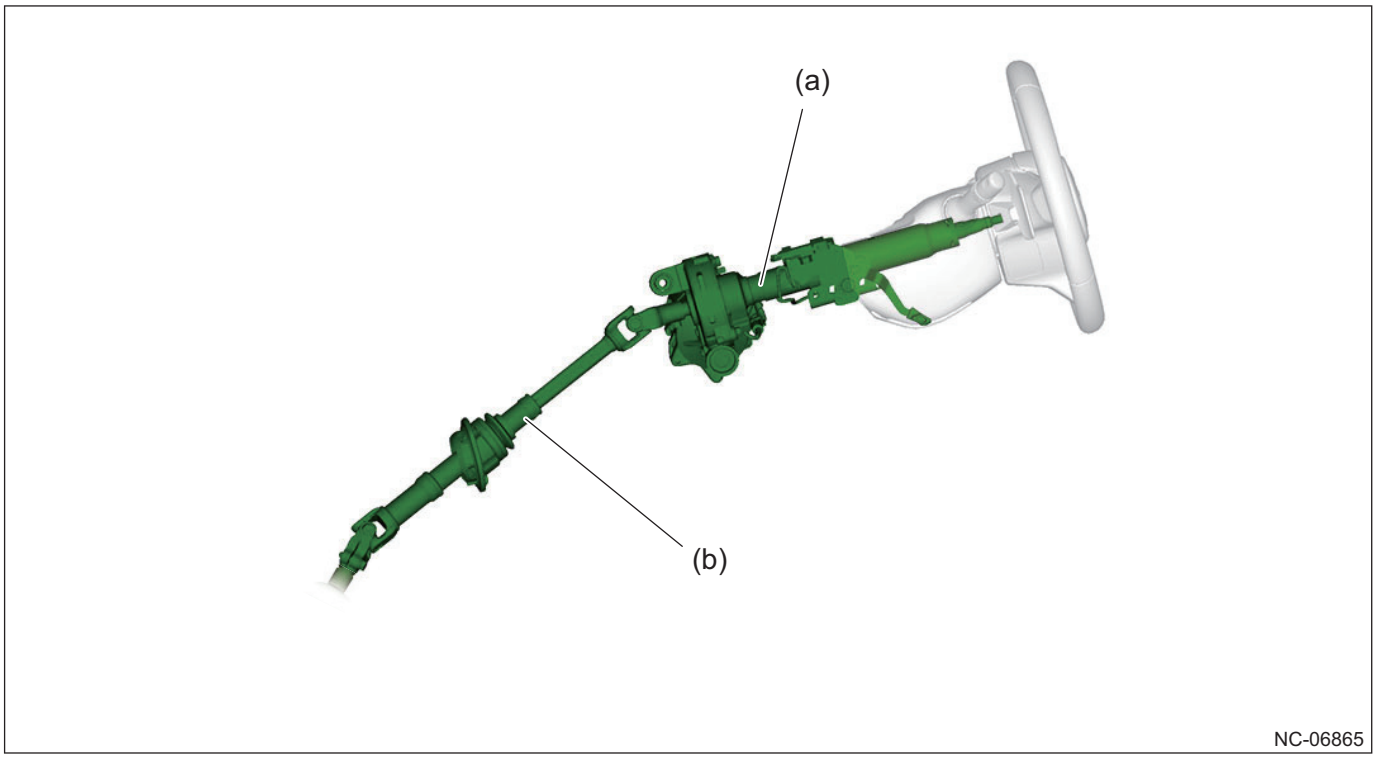
A dynamic damper (steering shake damper) is provided inside the steering wheel assembly. A dynamic damper (steering shake damper) is installed to the steering wheel assembly to reduce steering vibration due to the resonance of the steering wheel assembly and dynamic damper (steering shake damper). This improves the steering feeling.



Column assembly steering

A tilt and telescopic type column assembly steering is adopted to enable the driver to set the operation position of the steering wheel assembly as desired.

An energy absorbing mechanism is adopted for the column assembly steering and a contraction mechanism is adopted for the universal joint assembly steering in consideration of driver safety in a collision.

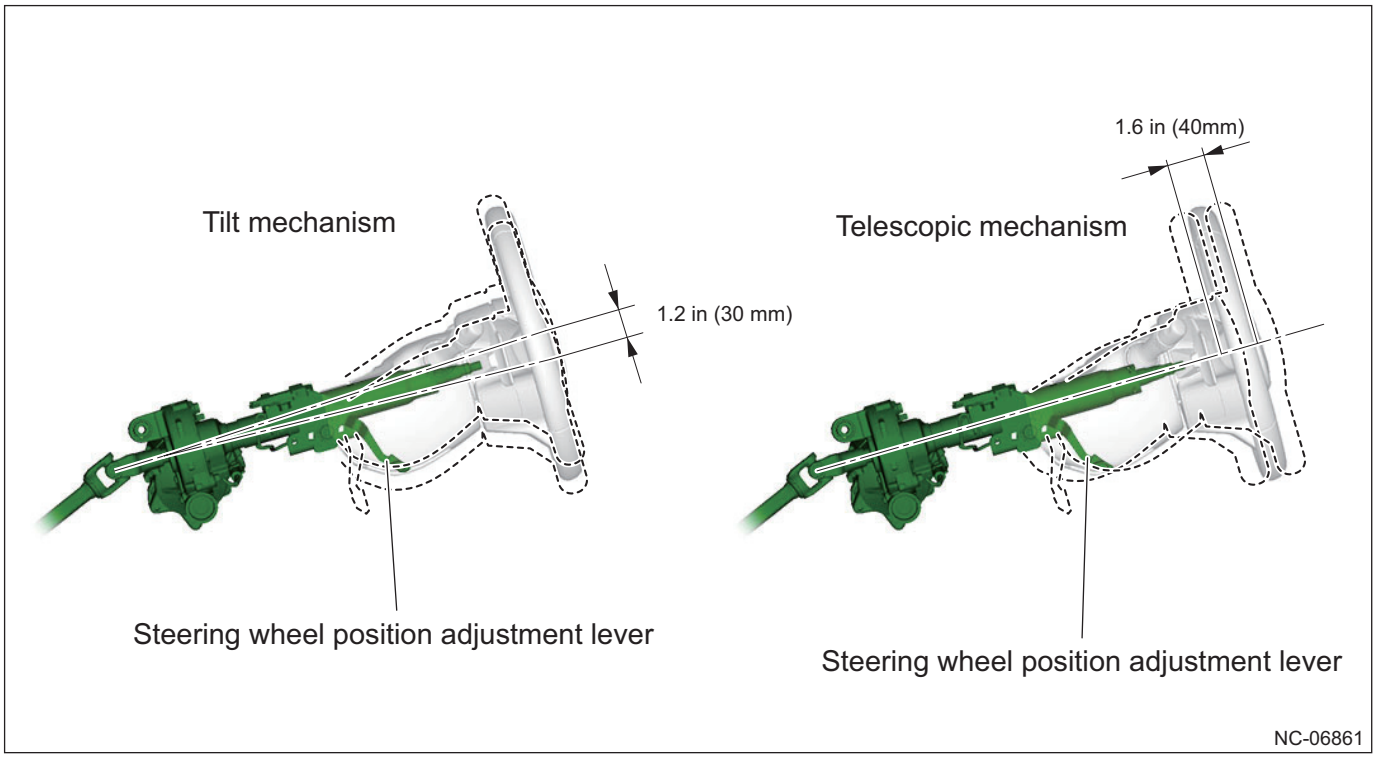


(a) Column assembly steering

(b) Universal joint assembly steering

■ Construction and operation of tilt and telescopic mechanism

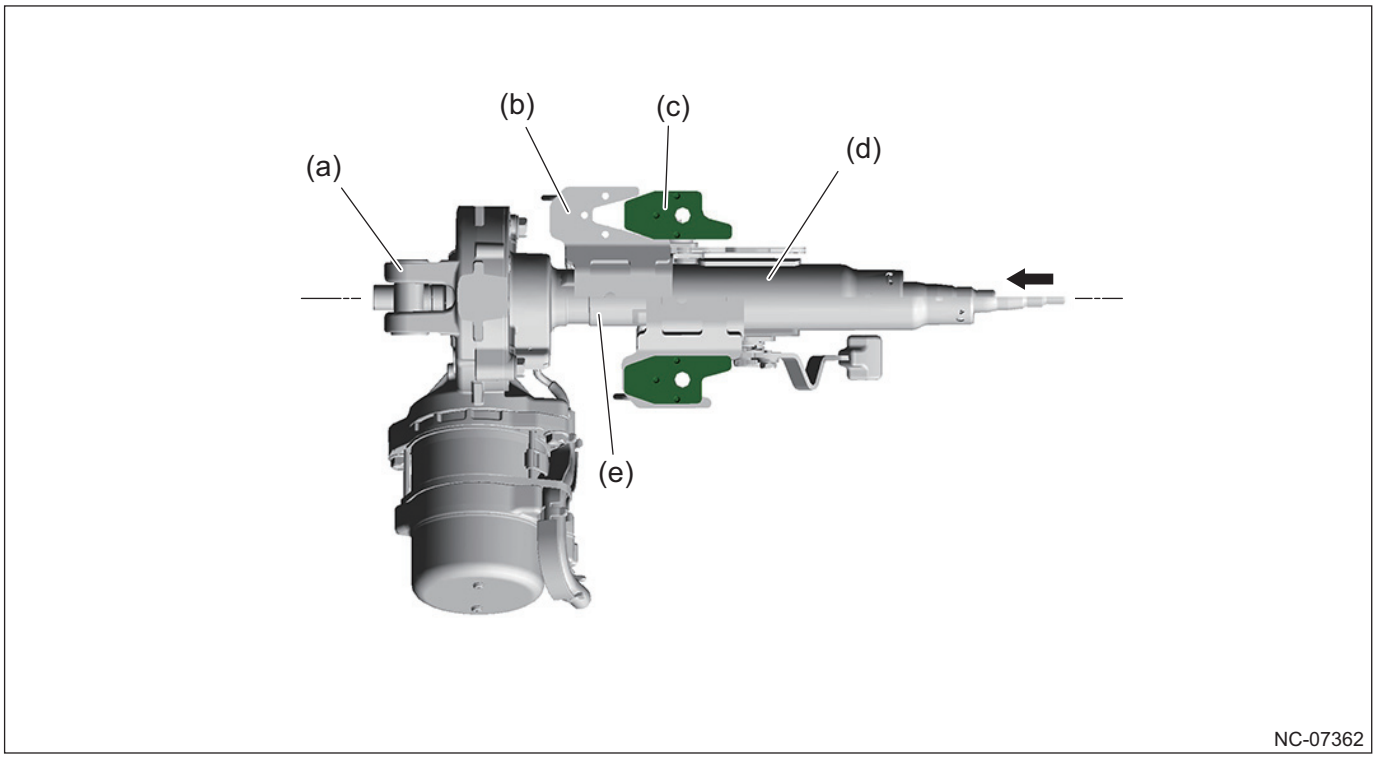
The tilt mechanism can be set in an adjustment range up to 1.2 in (30 mm) in the up/down direction, and the telescopic mechanism can be set in an adjustment range up to 1.6 in (40 mm) in the forward/rear direction.



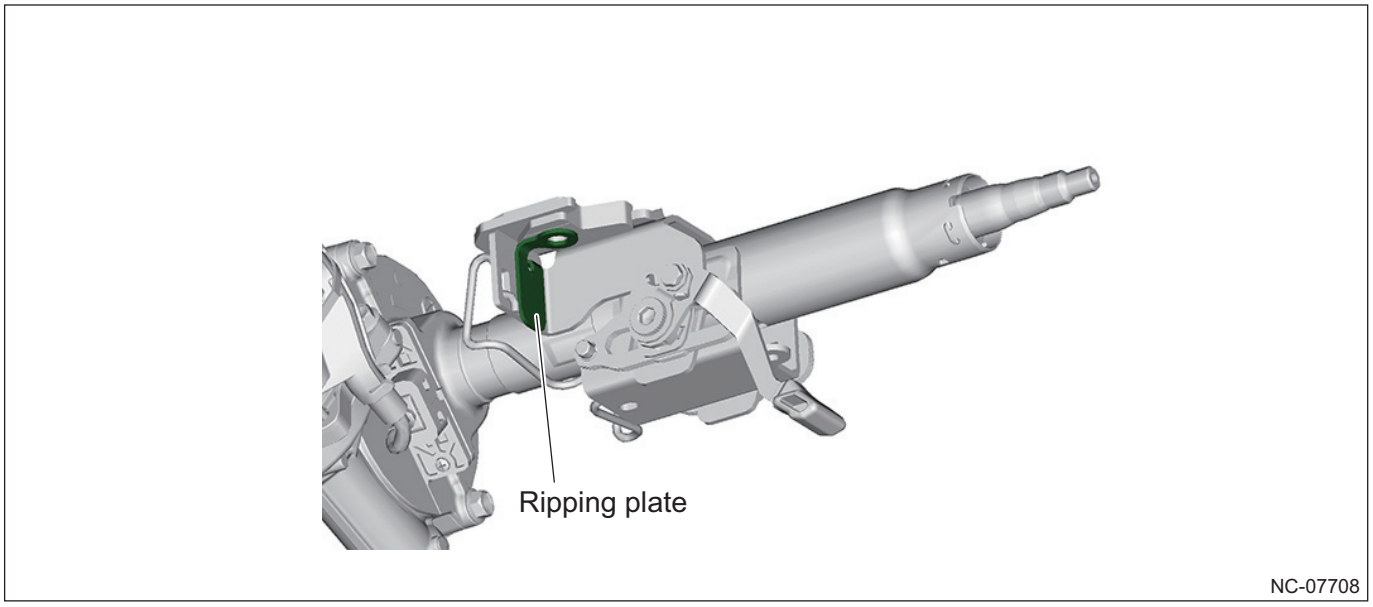
■ Energy absorbing mechanism

A tube contraction type of energy absorbing mechanism is adopted for the column assembly steering.

When the steering wheel assembly receives an impact in a secondary collision, the breakaway bracket that was fixed to the instrument panel reinforcement via the breakaway capsule separates and moves forward. At this time, the impact energy is absorbed by the deformation of the ripping plate and the sliding resistance between the inner tube and outer tube.



(a) Lower bracket
(b) Breakaway bracket
(c) Breakaway capsule
(d) Outer tube
(e) Inner tube

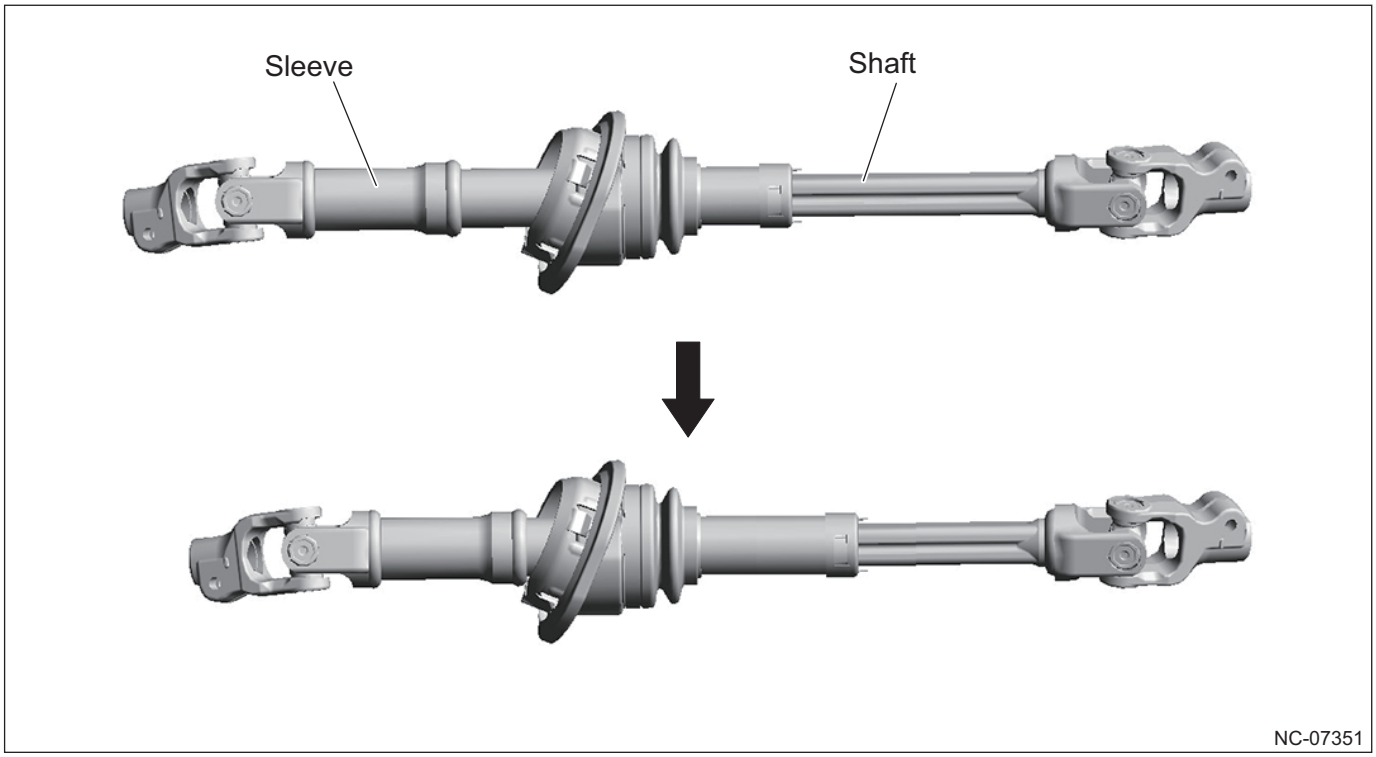


Universal joint assembly steering

A contraction mechanism is adopted for the universal joint assembly steering.

The movement of the steering gearbox assembly due to body deformation in a collision is absorbed by the shaft of the universal joint assembly steering entering the sleeve, which helps stop the column assembly steering and steering wheel assembly from being pushed into the cabin interior.

The serration specifications at the coupling of the universal joint assembly steering are optimized to accompany the integration with the EPS power pack.



Steering gearbox assembly

A lightweight and compact rack and pinion type of steering gearbox assembly with excellent operability is adopted.

A steering gear ratio of 13.5:1 is set for quick steering response.

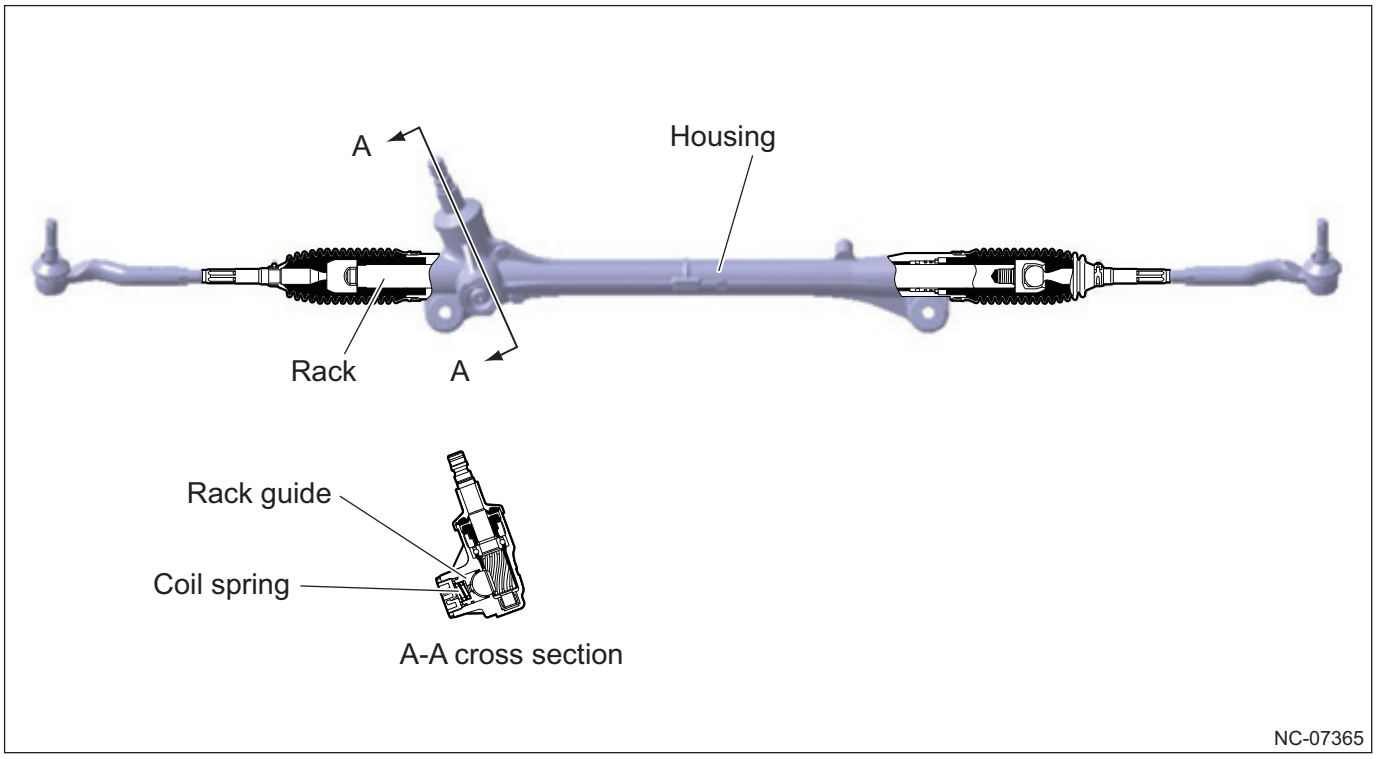
An aluminum integrated type of housing is used to reduce weight.

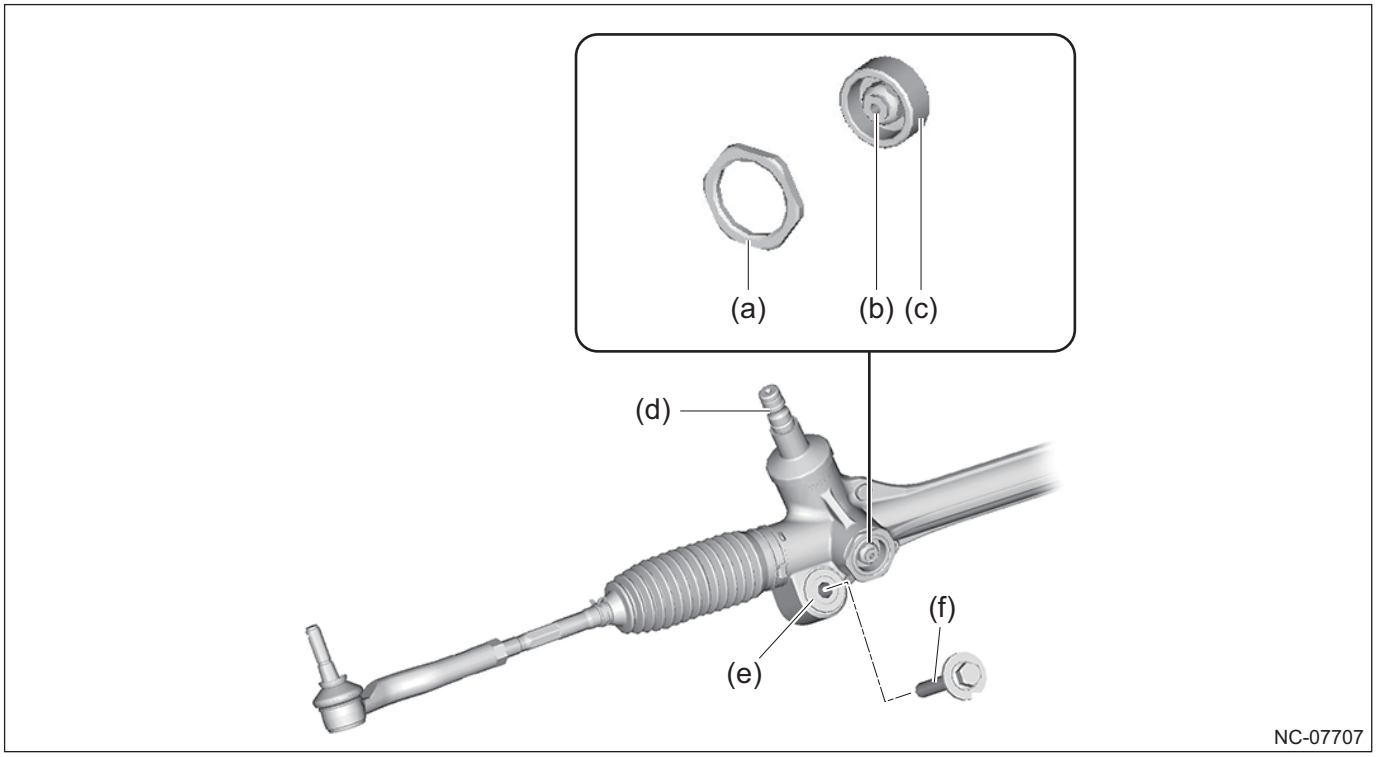
A steering gearbox assembly structure is used that is directly installed to the crossmember COMPL front to ensure steering rigidity.

A low friction type of rack guide is adopted and the coil spring is optimized.

Noise is suppressed and quietness is improved by changing the needle bearing at the end of the pinion gear shaft, the structure around the adjust plug, and the backlash adjustment method.

In order to achieve comfortable movement in response to the steering, the steering gearbox assembly installation structure is improved by increasing the hardness of the steering mount bushing and rigidity of the steering mount bolt assembly.





(a) Lock nut
(b) Cap
(c) Adjust plug
(d) Pinion gear shaft
(e) Bushing
(f) Bolt assembly

Caution
Be careful not to remove the cap from the adjust plug.

7.3 Power Assisted System

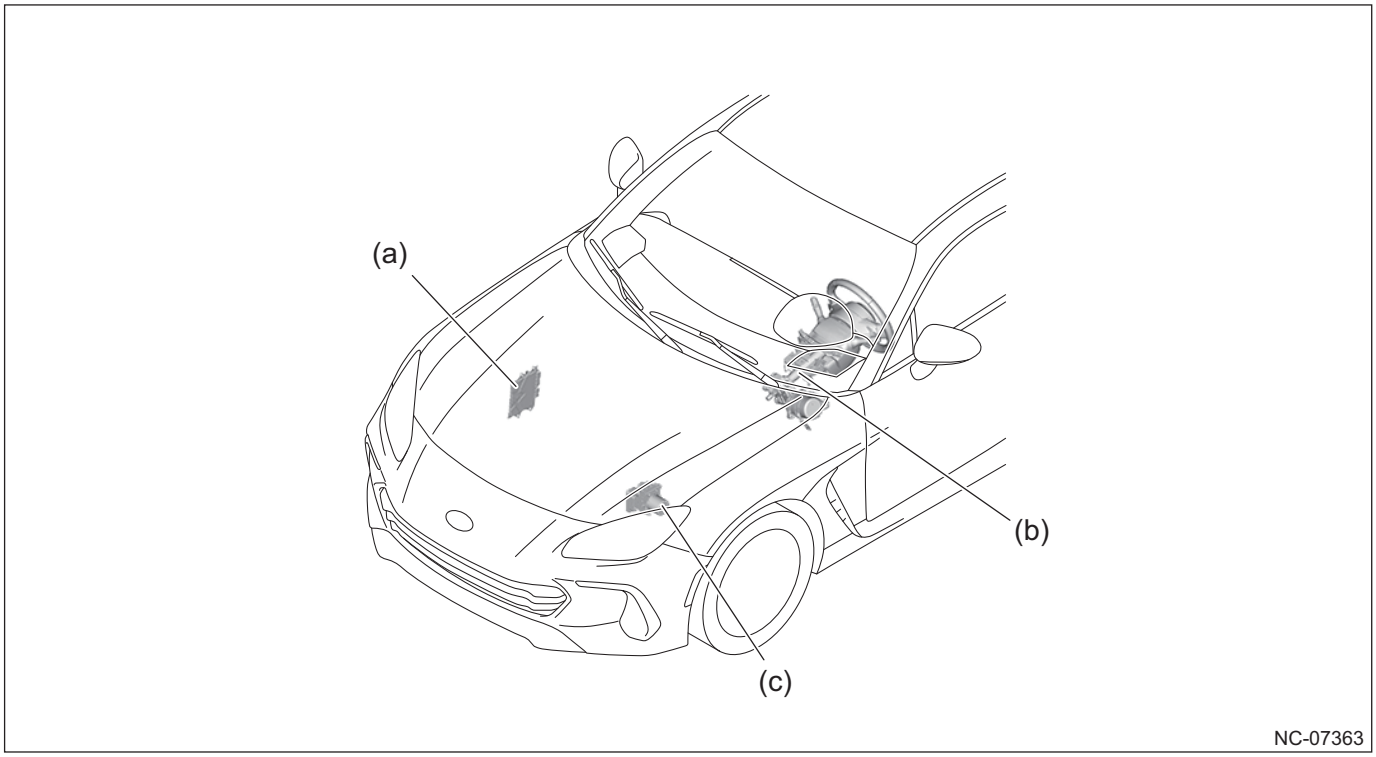
7.3.1 Overview

Overview

- A column assist type of vehicle speed sensitive electric power steering system is adopted, and a motor control UNIT (MCU) that integrates the motor and controller is adopted for the power pack.
- The assist direction and size are determined by the power steering CM based on the signals from the torque sensor built into the column assembly steering and the vehicle speed sensor. Depending on the vehicle speed, a light feel is set for low speeds and a highly responsive feel is set for high speeds to ensure an excellent steering feeling.

7.3.2 Component

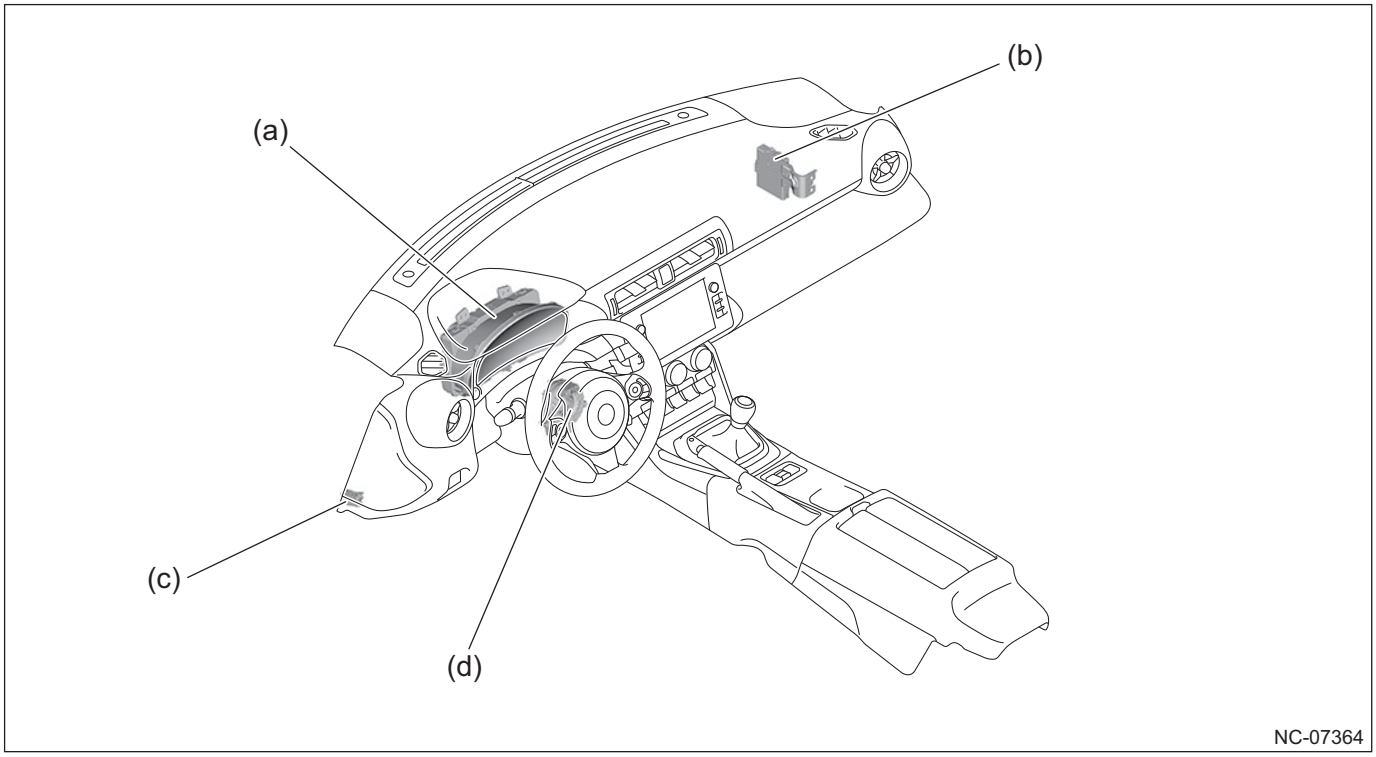
Component layout drawing



(a) Engine Control Module (ECM)

(b) Column assembly steering

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



(a) Combination meter assembly
(b) Central gateway CM (CGW)
(c) Data link connector
(d) Steering angle sensor

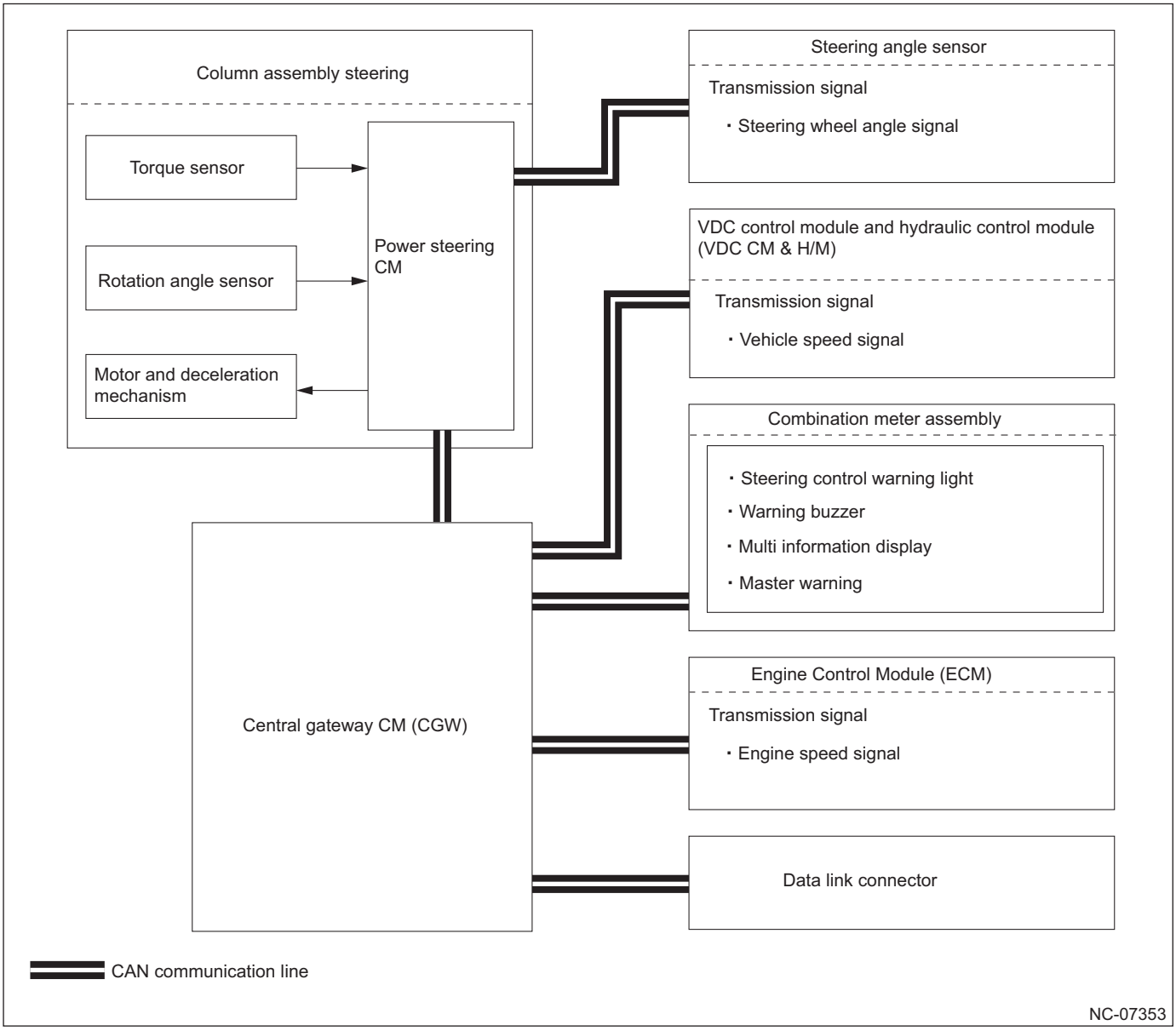
Component details

Characteristics of electric power steering system

Item	Characteristics/advantages
Low fuel consumption characteristics	The electric power steering drives the motor only for steering that requires the assist torque. This achieves excellent low fuel consumption characteristics when driving straight because energy as a power steering mechanism is not consumed.
Structure simplification	The motor, deceleration mechanism, and torque sensor that are the components of the electric power steering are built into the steering column, and the power steering CM is integrated with the motor for a simple structure.
Improvement in steering feeling	The assist characteristics are optimized according to the vehicle speed to achieve a steering feeling with a light feel for low speeds and a highly responsive feel for high speeds.

7.3.3 Construction and Operation

System diagram



System details

Power steering computer

This calculates the assist torque according to the driving conditions based on the steering torque and vehicle speed to control the motor drive current.

The fail-safe function and diagnosis function are provided in case an abnormality occurs in the system.

Item	Function
Basic control	The motor drive current is controlled based on the signals from the torque sensor and VDC control module and hydraulic control module (VDC CM & H/M) to ensure that the assist torque is appropriate for the driving conditions. This achieves a steering feeling with a light feel for low speeds and a highly responsive feel for high speeds.
Inertia compensation control	Reduces the motor dragging feel when starting to steer.
Friction compensation control	Eliminates the friction feel when steering to improve the steering feel.
Return control	Ensures the return characteristics when steering the steering wheel.
Damper control	Ensures steering astringency when driving at high speed.
System overheating protection control	Protects the motor and power steering CM from overheating.

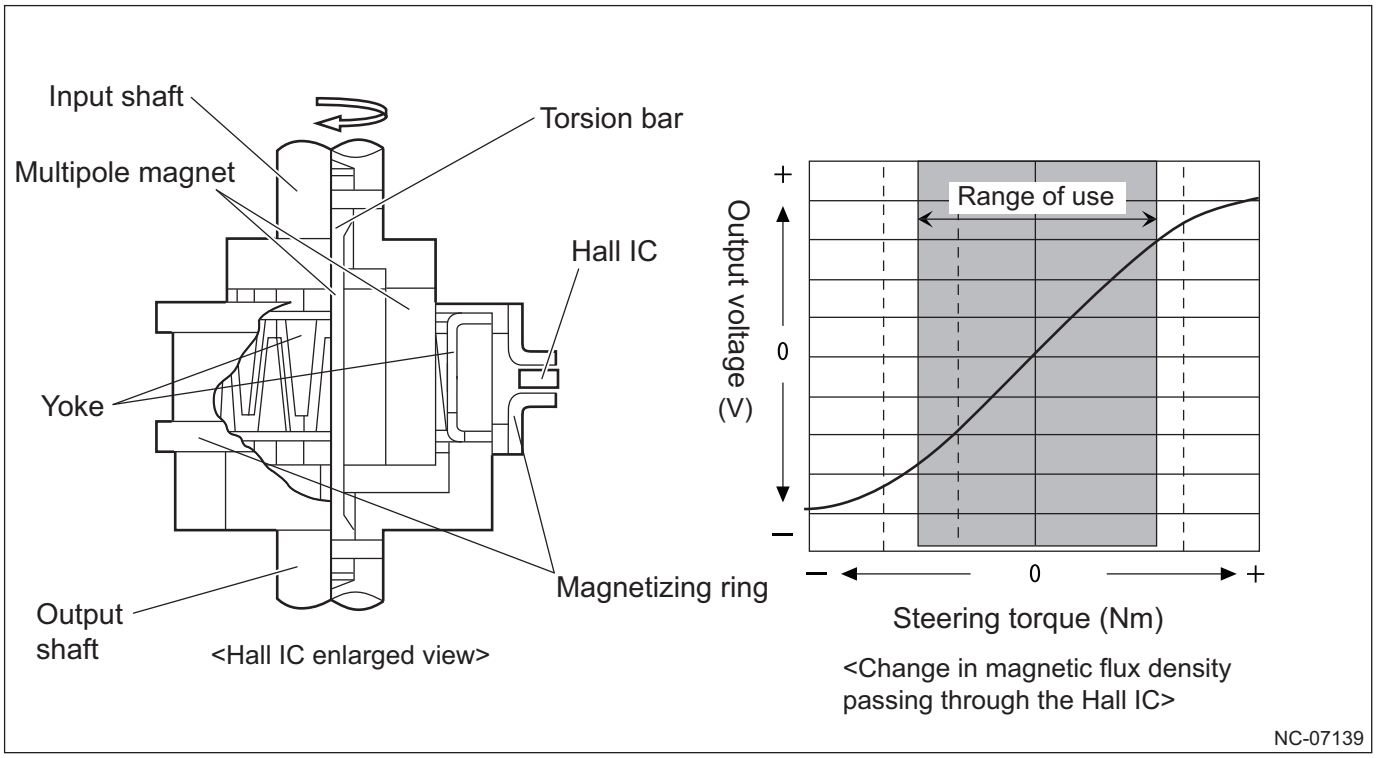
Main component functions

Component		Function
Column assembly steering	Torque sensor	Outputs the steering torque signal to the power steering CM.
	Motor and deceleration mechanism	Generates assist torque according to the motor drive current from the power steering CM, and transmits the torque to the output shaft of the column assembly steering via the deceleration mechanism.
	Rotation angle sensor	Outputs the rotation angle of the motor to the power steering CM.
Power steering CM		Calculates the motor drive current from the steering torque signal and vehicle speed signal, and outputs the information to the motor.
Steering angle sensor		Sends the steering angle to the power steering CM via CAN communication.
Engine Control Module (ECM)		Sends the engine speed signal to the power steering CM via CAN communication.
VDC control module and hydraulic control module (VDC CM & H/M)		Sends the vehicle speed signal to the power steering CM via CAN communication.
Combination meter assembly		• When there is a system anomaly, warns the driver by turning on the steering control warning light in the combination meter assembly. • When there is a system anomaly, warns the driver by turning on the steering control warning light in the combination meter assembly.

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 a steering torque value to the power steering CM.



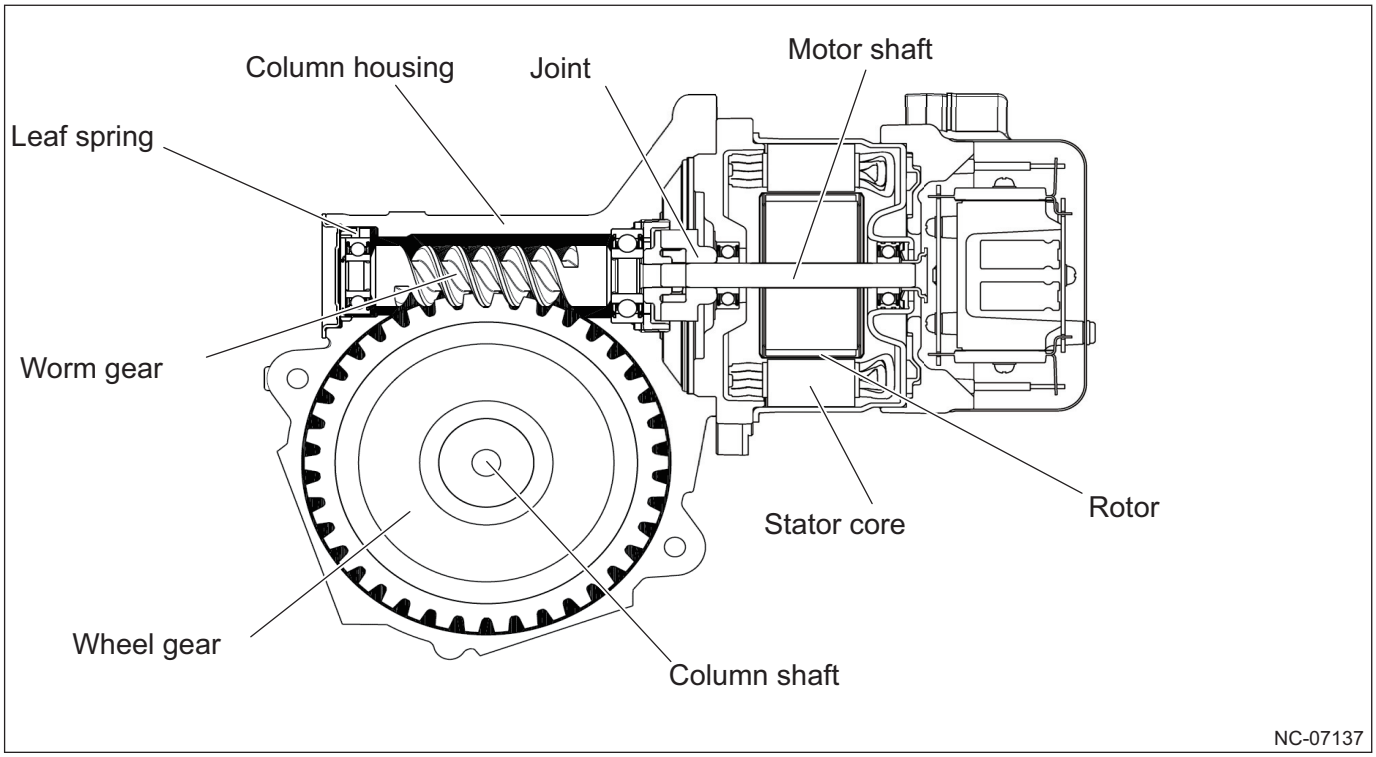
Motor and deceleration mechanism (brushless motor)

A high-output, low-inertia, and low-noise brushless motor is adopted. The motor is positioned on the column housing and is composed of parts such as the rotor, stator, and motor shaft.

The torque generated at the rotor is transmitted to the worm gear via the joint, and the torque is then transmitted via the wheel gear positioned on the column shaft.

The worm gear and wheel gear section functions as a deceleration mechanism with a deceleration ratio of 18.5:1, and is composed of a worm gear made of metal, and a wheel gear made of excellent wear resistant resin with high strength and low friction. Leaf springs are incorporated in the bearing section that supports the worm shaft, achieving robustness* and excellent reliability against deterioration over time and effects from the operating environment.

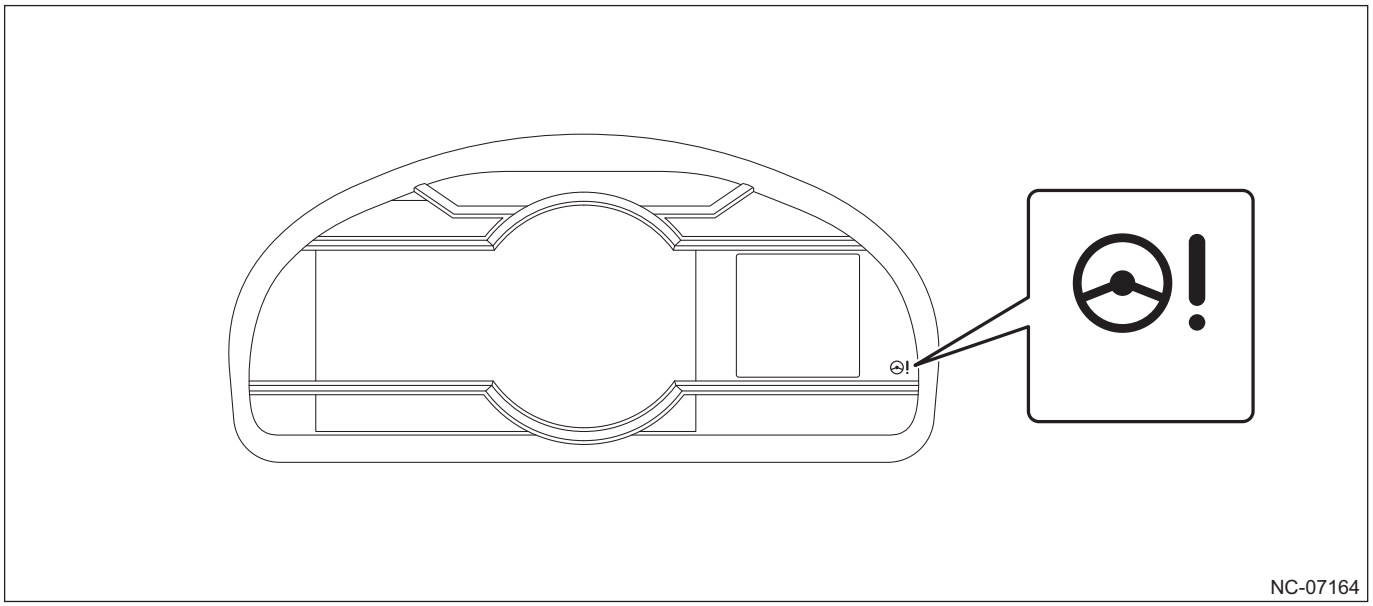
[Reference]*: System is designed to prevent instability due to disturbances or modeling errors



Fail-safe

Steering control warning light

The fail-safe function operates when an abnormality occurs in the system. At this time, the driver is notified of system abnormality by the steering control warning light turning on in the combination meter assembly and the warning buzzer sounding, and the output current shuts off or decreases gradually and the manual steering condition is entered, or the output current is limited.



■ Fail-safe list

Item	Fail-safe list
Torque sensor system abnormality	Stops the assist or limits the assist force.
Motor overheating	Limits the assist force until the motor temperature drops.
Motor short (including drive circuit system abnormality)	Stops the assist.
Motor overcurrent	Stops the assist.
Power steering CM overheating	Limits the assist force.
Temperature sensor system abnormality in power steering CM	Limits the assist force.
Power steering CM system abnormality	Stops the assist.
Vehicle speed system abnormality	Limits the assist temporarily. (Normal assist after returning to normal)
Power supply voltage abnormality	Limits the assist temporarily. (Normal assist after voltage returns)

■ Diagnosis

A diagnosis function is adopted in consideration of serviceability to make system inspections easier. For details on the diagnosis function, refer to the repair manual.

8 BODY STRUCTURE

CONTENTS

8.1 General Overview 8-2
8.1.1 Overview 8-2
8.2 Body Structure Details 8-3
8.2.1 Construction and Operation 8-3

8.1 General Overview

8.1.1 Overview

Overview

A new FR dedicated platform is adopted that incorporates, advances, and deepens the latest knowledge and concepts of Subaru Global Platform development.

The latest collision safety performance is supported, and the dynamic quality feel of driving is improved.

New FR dedicated platform

The vehicle body is stiffened in a well-balanced manner while minimizing weight increases, improving vehicle body rigidity and steering stability.

Improvement in steering stability

The vehicle body is stiffened in a well-balanced manner to improve torsional rigidity and bending rigidity, and improve steering stability even further.

Vehicle body weight reduction

By taking the following measures to minimize weight increases resulting from the improvement in vehicle body rigidity and collision safety performance, further weight reductions and lowering of the center of gravity are achieved, raising the basic performance as a sports car.

- Structural adhesive appropriate for the inner frame structure is adopted, increasing rigidity due to the continuous joints of the vehicle body framework and streamlining the structure.
- The adoption of hot press materials and high-tensile strength steel is expanded to minimize weight increases in the reinforcement materials and simplify the reinforcement structure.
- SUBARU's first aluminum roof is adopted to further lower the center of gravity.

8.2 Body Structure Details

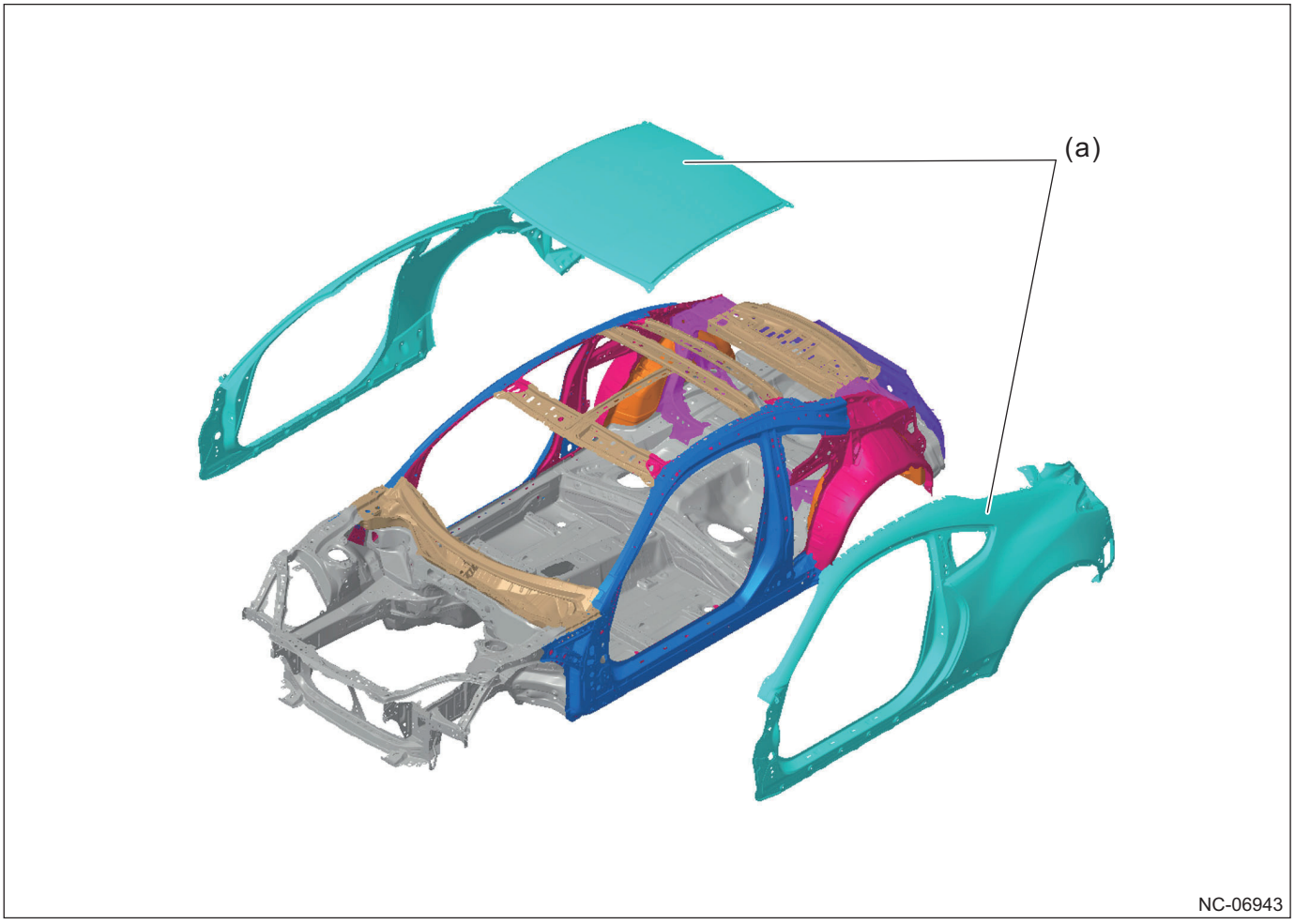
8.2.1 Construction and Operation

Body Structure that Achieves "Dynamic Quality Feel"

Inner frame structure

In the inner frame structure, the framework of the overall body is firmly assembled first, and only the outer panel is coupled in the final process.

Some part of the framework of the upper body structure is moved to the platform, and the main framework is assembled on the platform before the outer panel. This enhances the joining of the frameworks, realizing further rigidity and weight reduction.

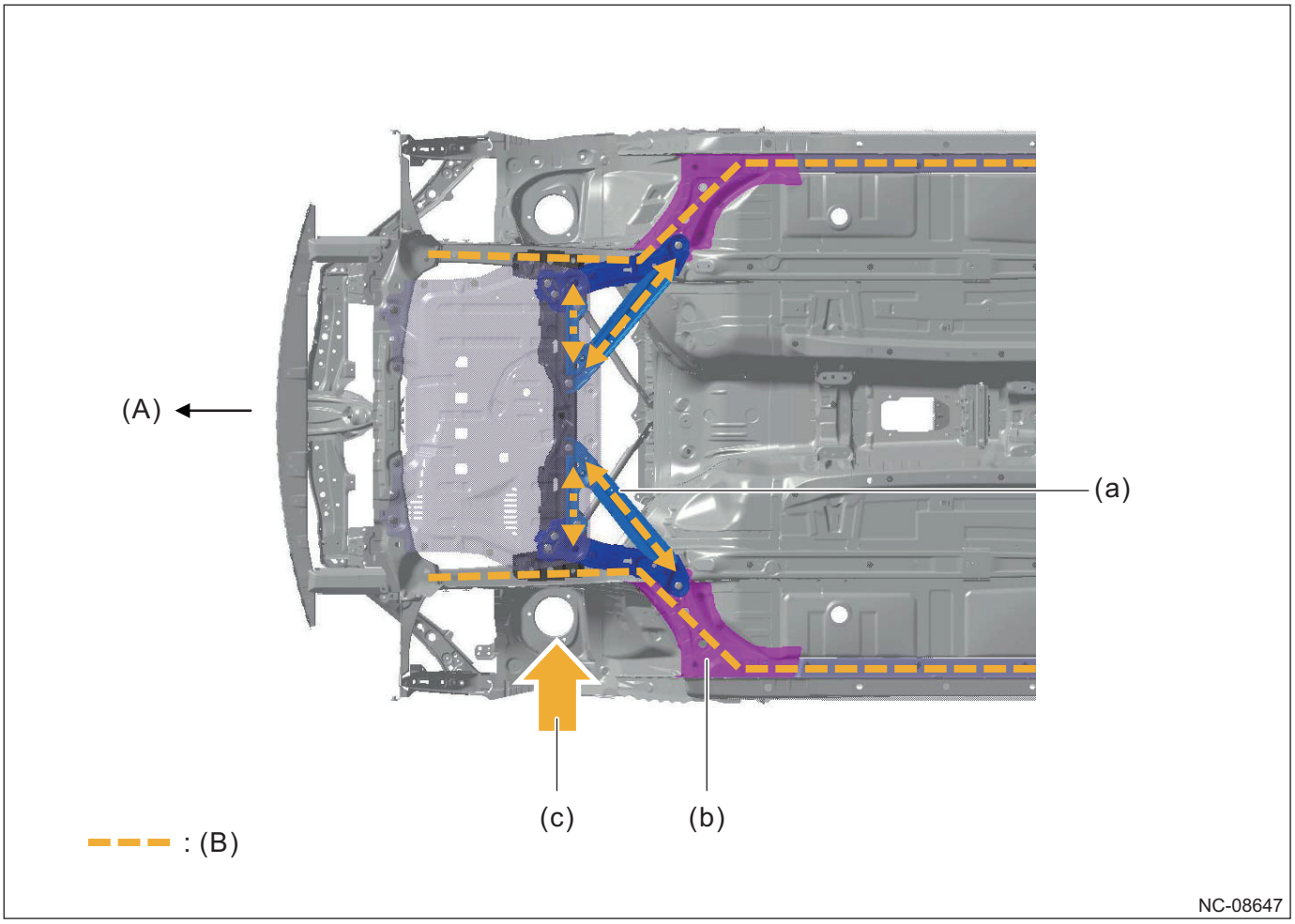


(a) Only the outer panel is welded in the final process

Improved lateral bending rigidity in vehicle body front

The lateral bending rigidity in the vehicle body front is improved.

- Tension materials are adopted in the front suspension crossmember and front frame root.
- The torque box is stiffened to improve the transmission of the load to the side sill.



(A) Front of vehicle

(B) Load transmission path

(a) Diagonal member

(b) Torque box

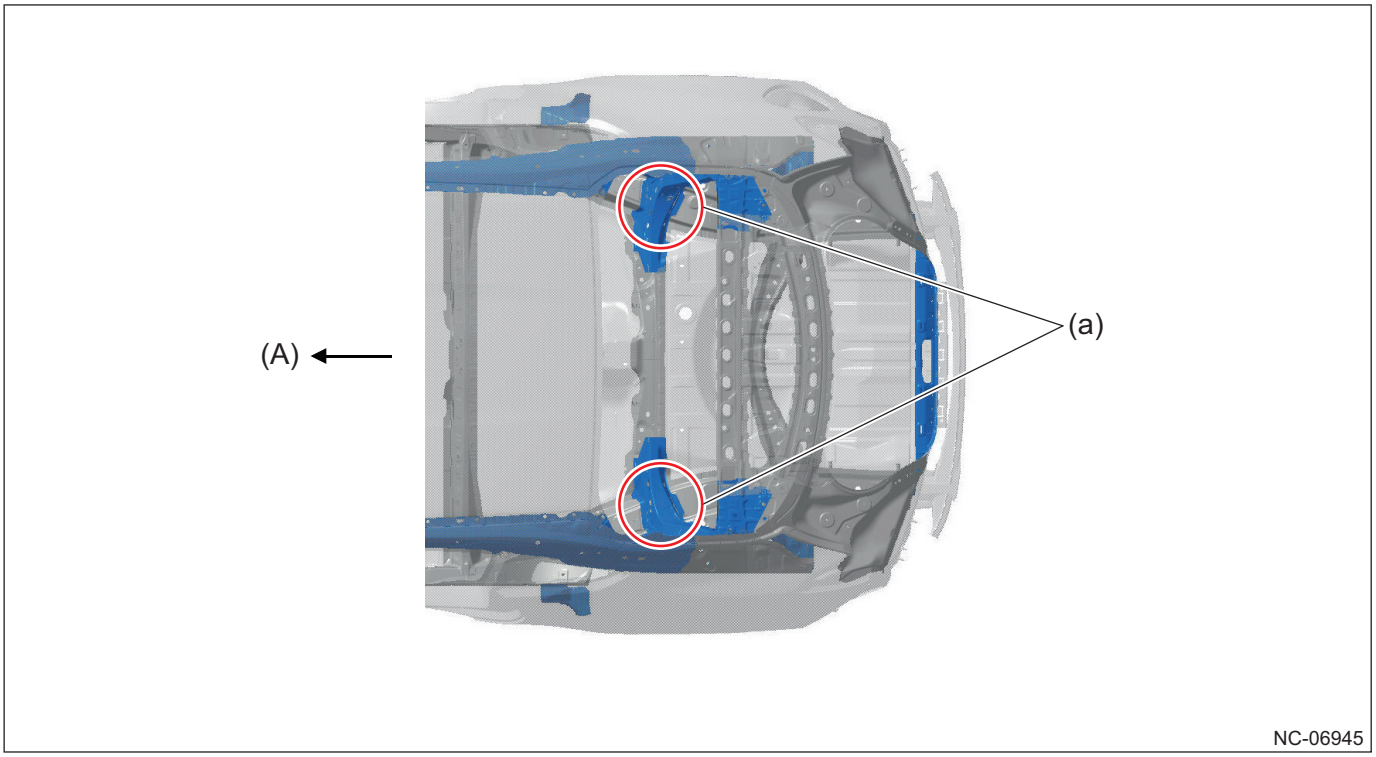
(c) Front tire ground contact surface input

Improved torsional rigidity in vehicle body rear

The torsional rigidity in the vehicle body rear is improved.

- The bent section of the rear frame is stiffened to suppress the deformation of the rear frame due to suspension input.

View from above vehicle rear

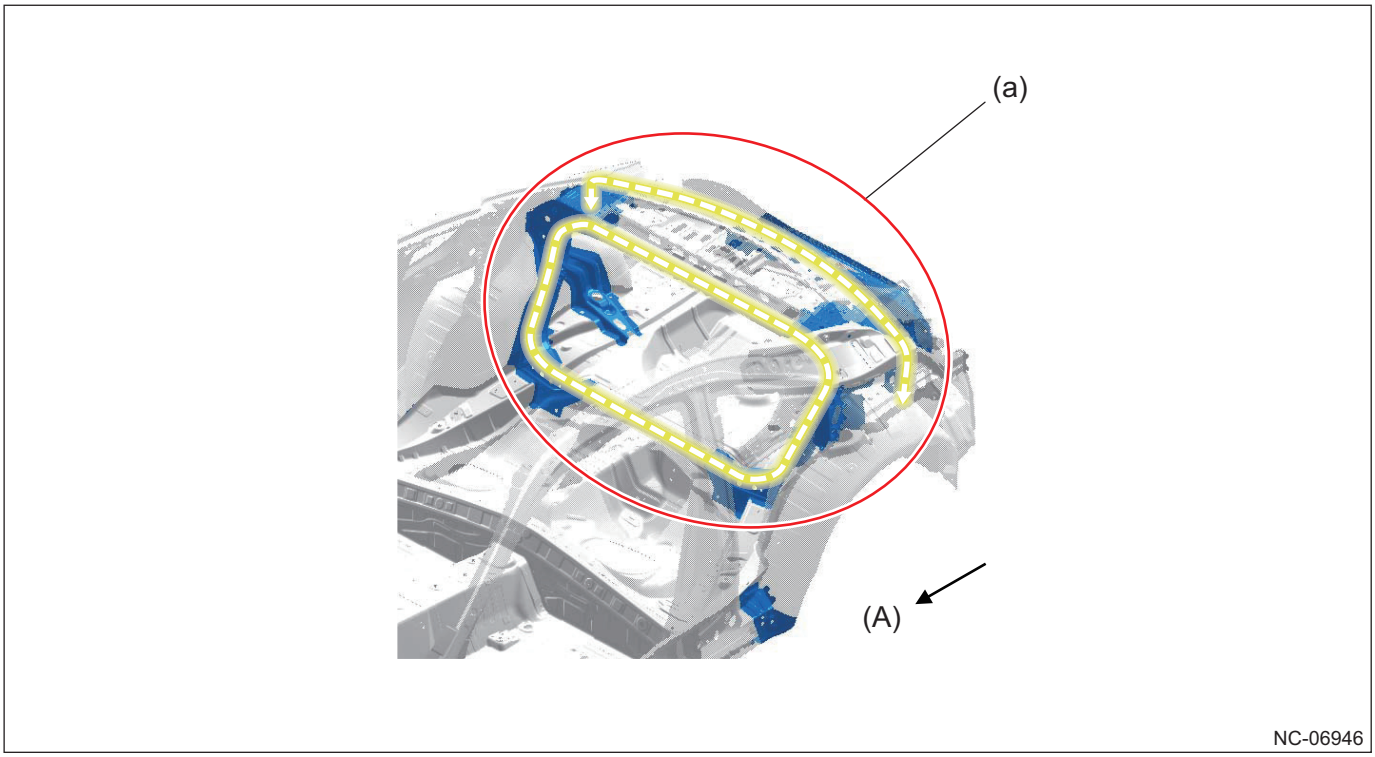


(A) Front of vehicle

(a) Bent section

- A circular framework is adopted that firmly joins the rear bulk from the rear crossmember, suppressing deformation of the rear bulk opening.

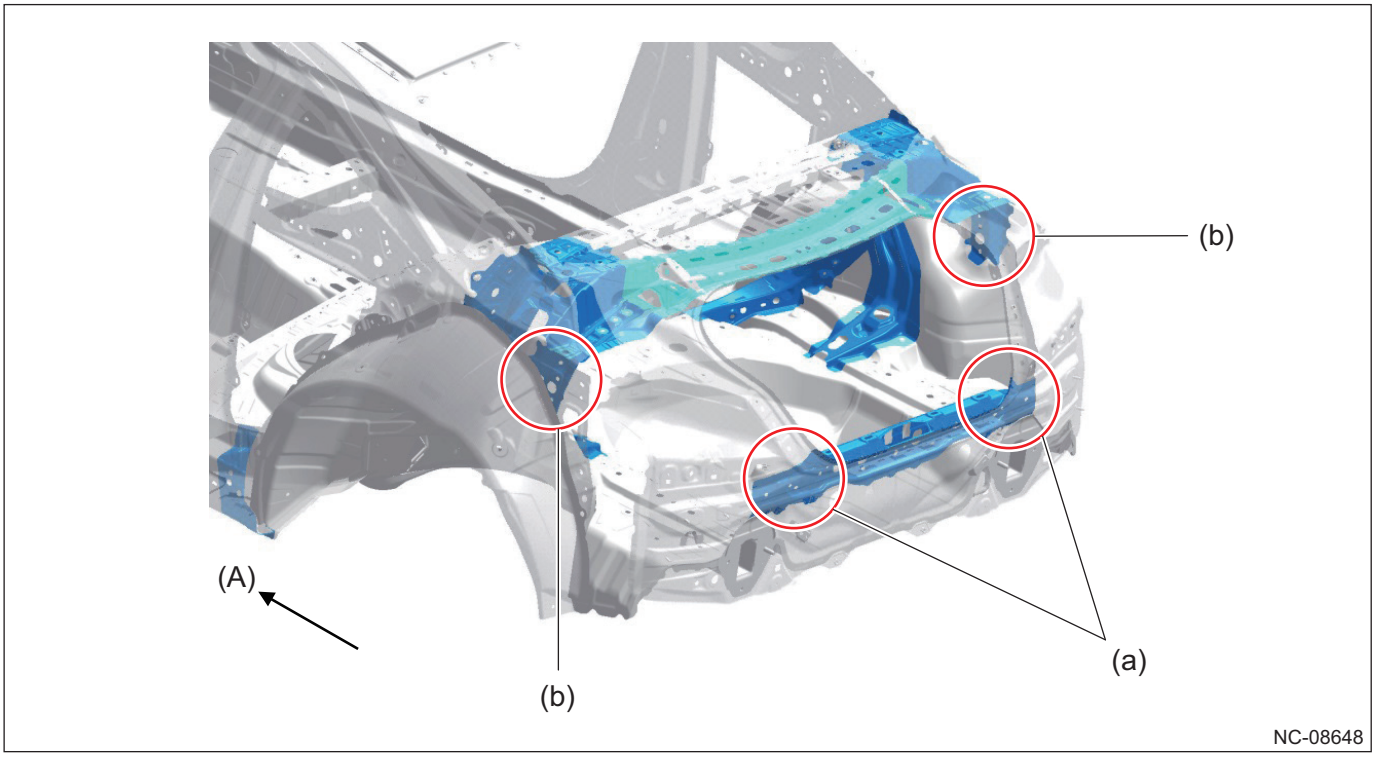
View of vehicle rear



(A) Front of vehicle

(a) Circular framework structure

- A reinforcement rear panel is added to the rear of the rear strut installation section and coupled with the framework of the trunk corner to suppress the deformation of the trunk opening. Also, the rear skirt inner is enlarged in the vehicle side direction and the lower corner shape is optimized.



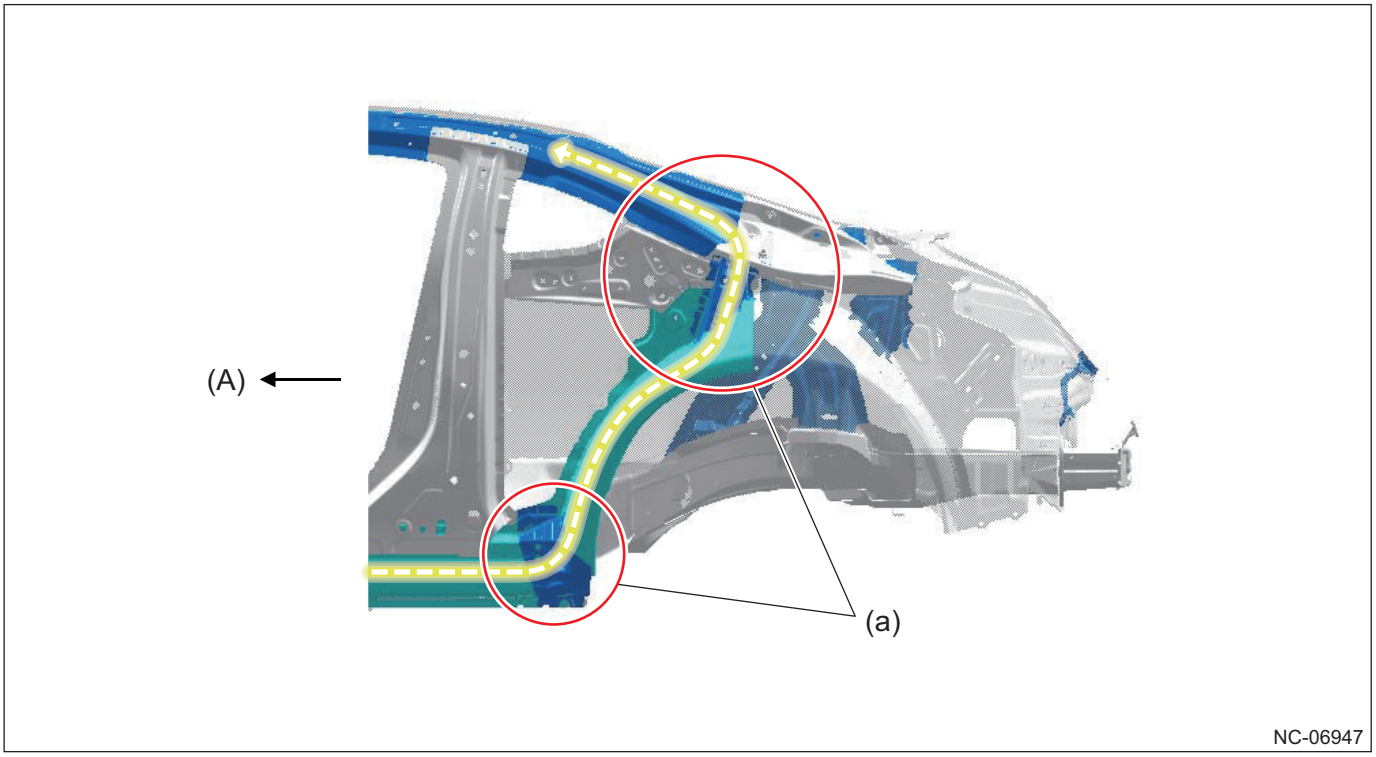
(A) Front of vehicle

(a) Rear skirt inner

(b) Reinforcement rear panel

- The continuity of the vehicle body framework is enhanced as a result of adopting the inner frame structure.

View from side at vehicle rear



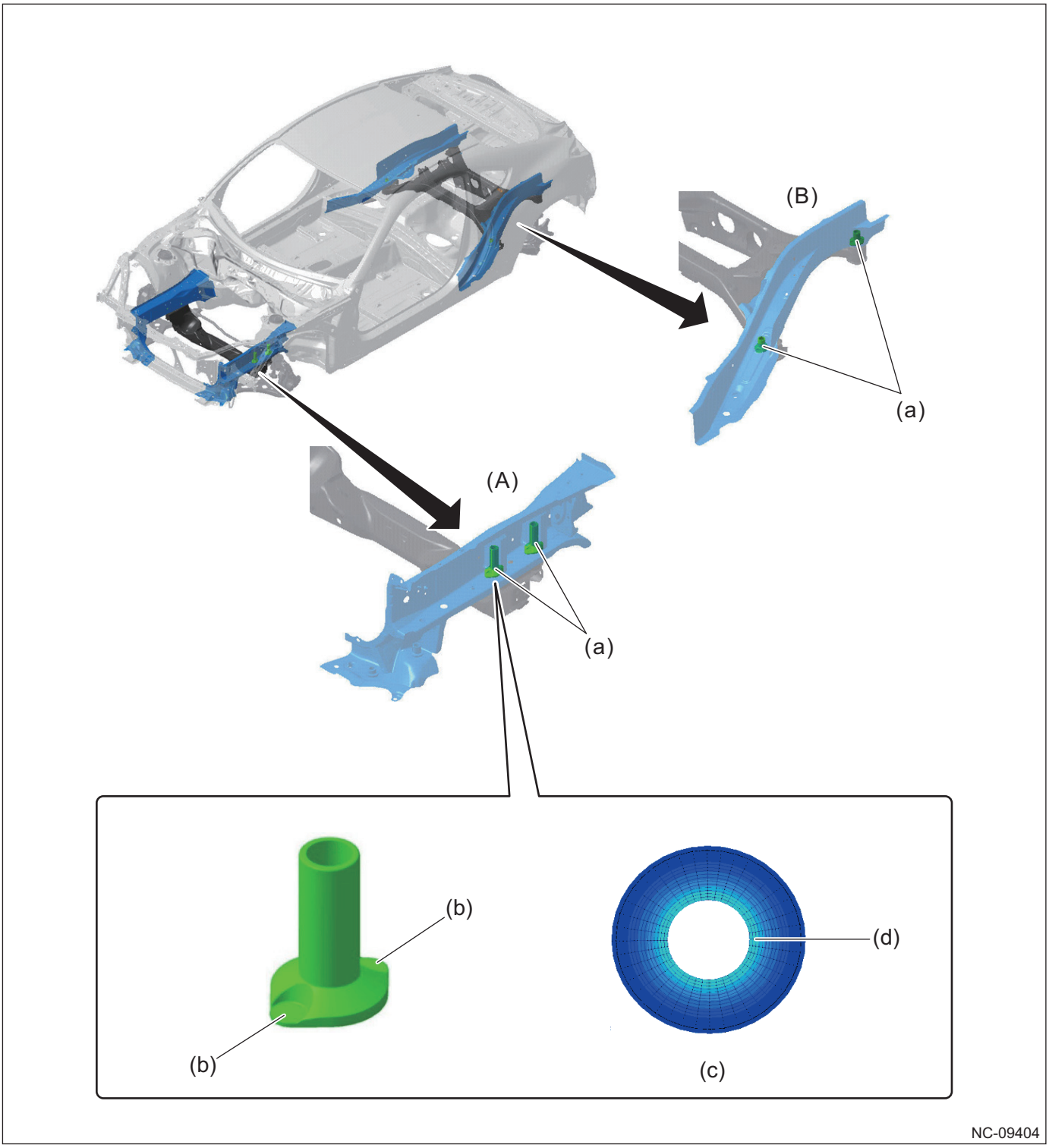
(A) Front of vehicle

(a) Adoption of continuous framework

Stronger suspension crossmember, sub frame connection

The connection structure is revised to increase the rigidity of installation sections around the suspension, achieving high steering stability.

- Spot welding is used as the welding method for the installation section weld nuts, resulting in even stress on the connection surface and suppressing local deformation.



(A) Front frame

(B) Rear frame

(a) Weld nut

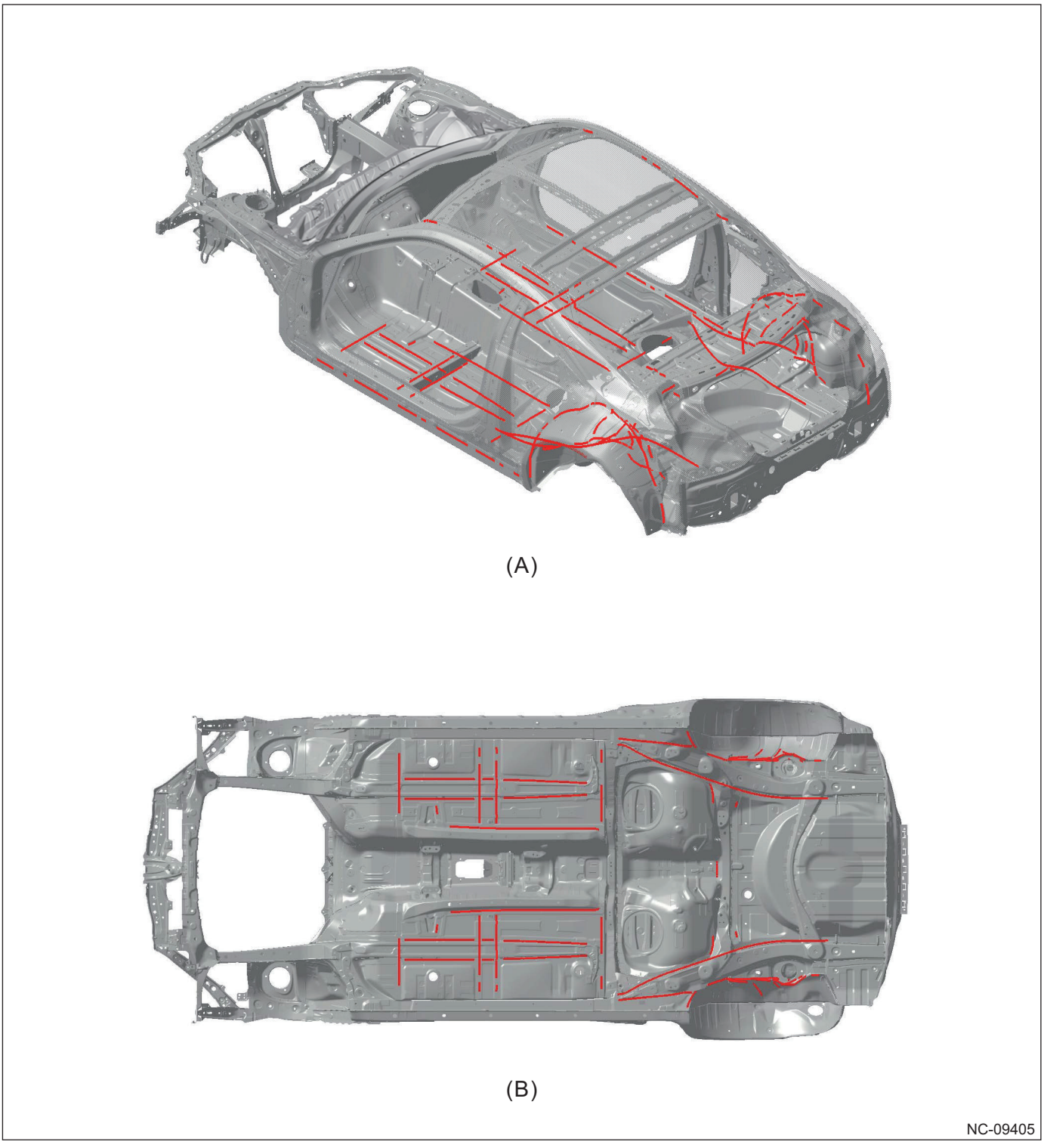
(b) Spot welding point

(c) Weld nut seat (no projection welding protrusion)

(d) Stress made even

Structural adhesive agent

Structural adhesive is adopted over 52 ft (16 m) to improve the body rigidity, reducing the load transmission loss between SPW welded joints.

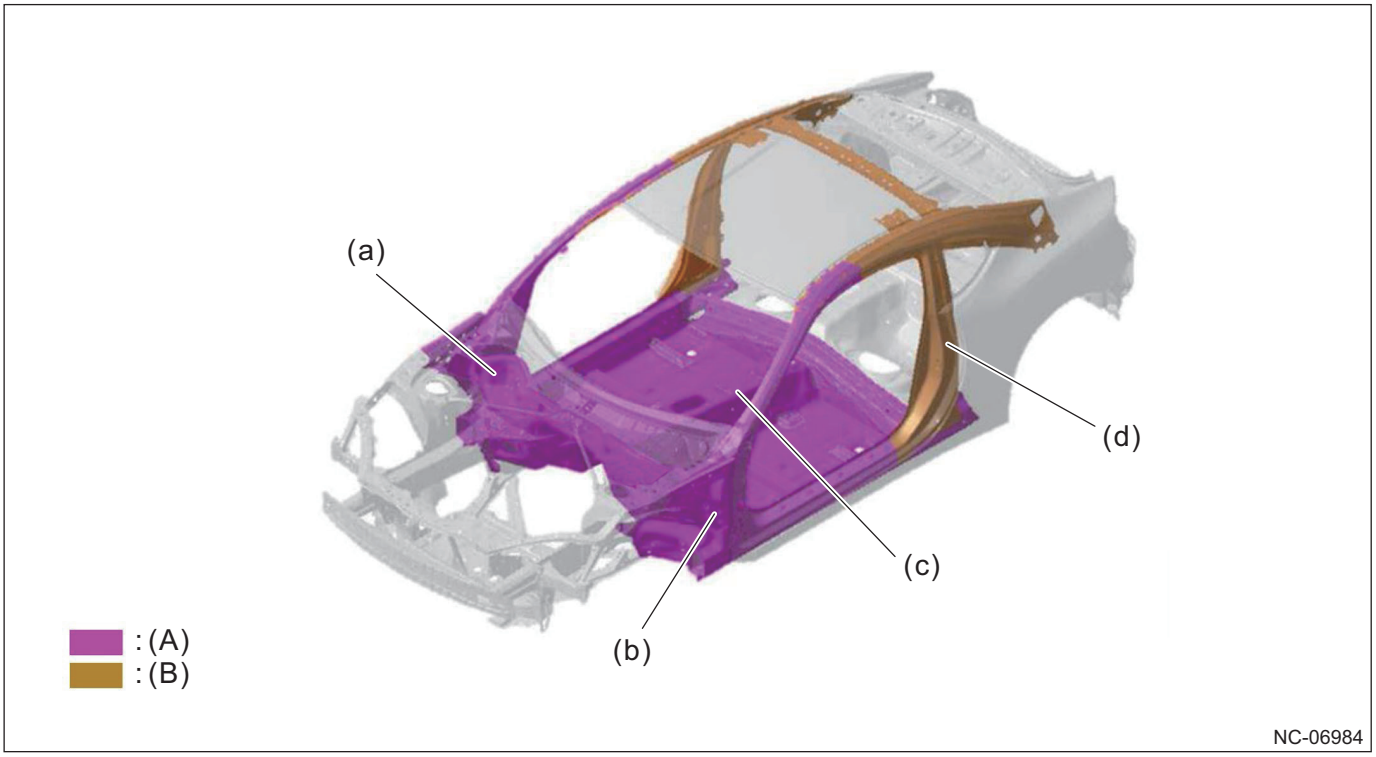


(A) View of vehicle rear

(B) View from under vehicle

Safety Performance

A lightweight and high-rigidity body is achieved while utilizing the high basic performance, enabling support for the latest collision safety performance and improving the dynamic quality feel of driving.



(A) Supports front collision

(B) Supports side collision

(a) Strengthened area around toe board

(b) Strengthened area around front pillar and side sill

(c) Strengthened area around front floor

(d) Strengthened area around center pillar

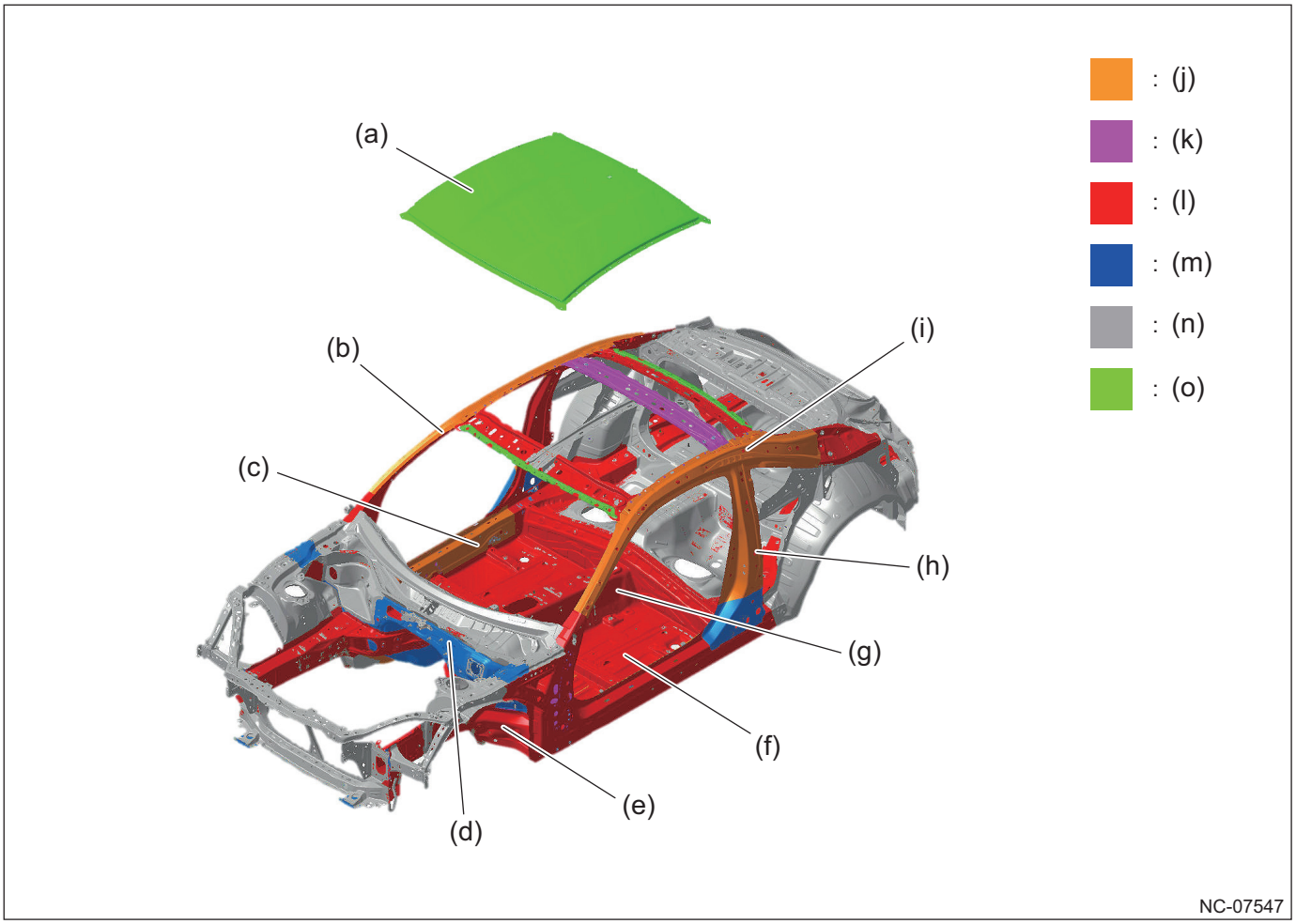
Visibility performance

The front seat packaging is optimized, ensuring front visibility that makes driving enjoyable. Rear visibility is also ensured by installing the high-mounted stop light on the trunk garnish.

Improvement of collision safety performance/usage ratio of high-tensile strength steel

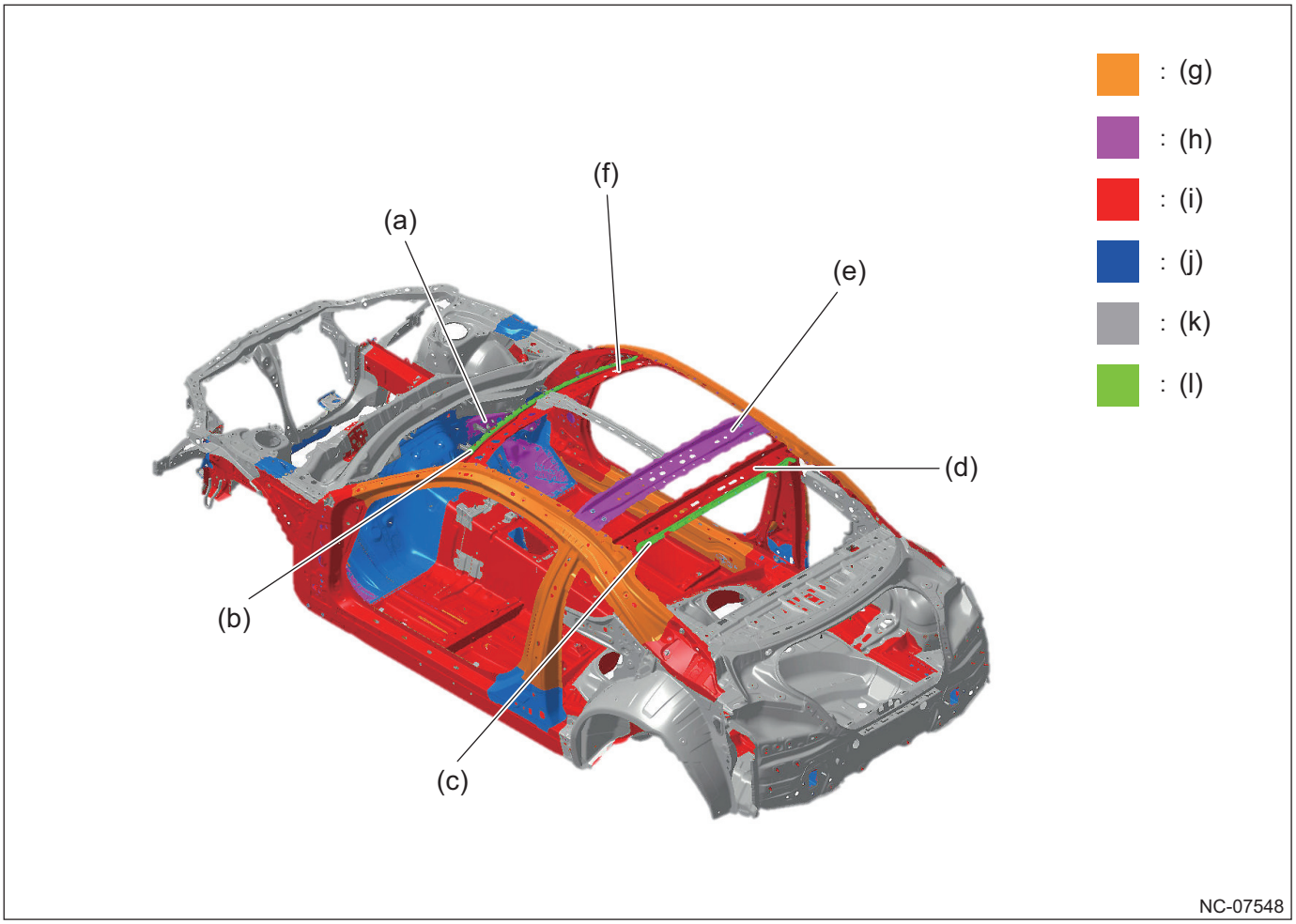
The usage ratio of high-tensile strength steel is increased to improve body strength and reduce weight.

View of vehicle front



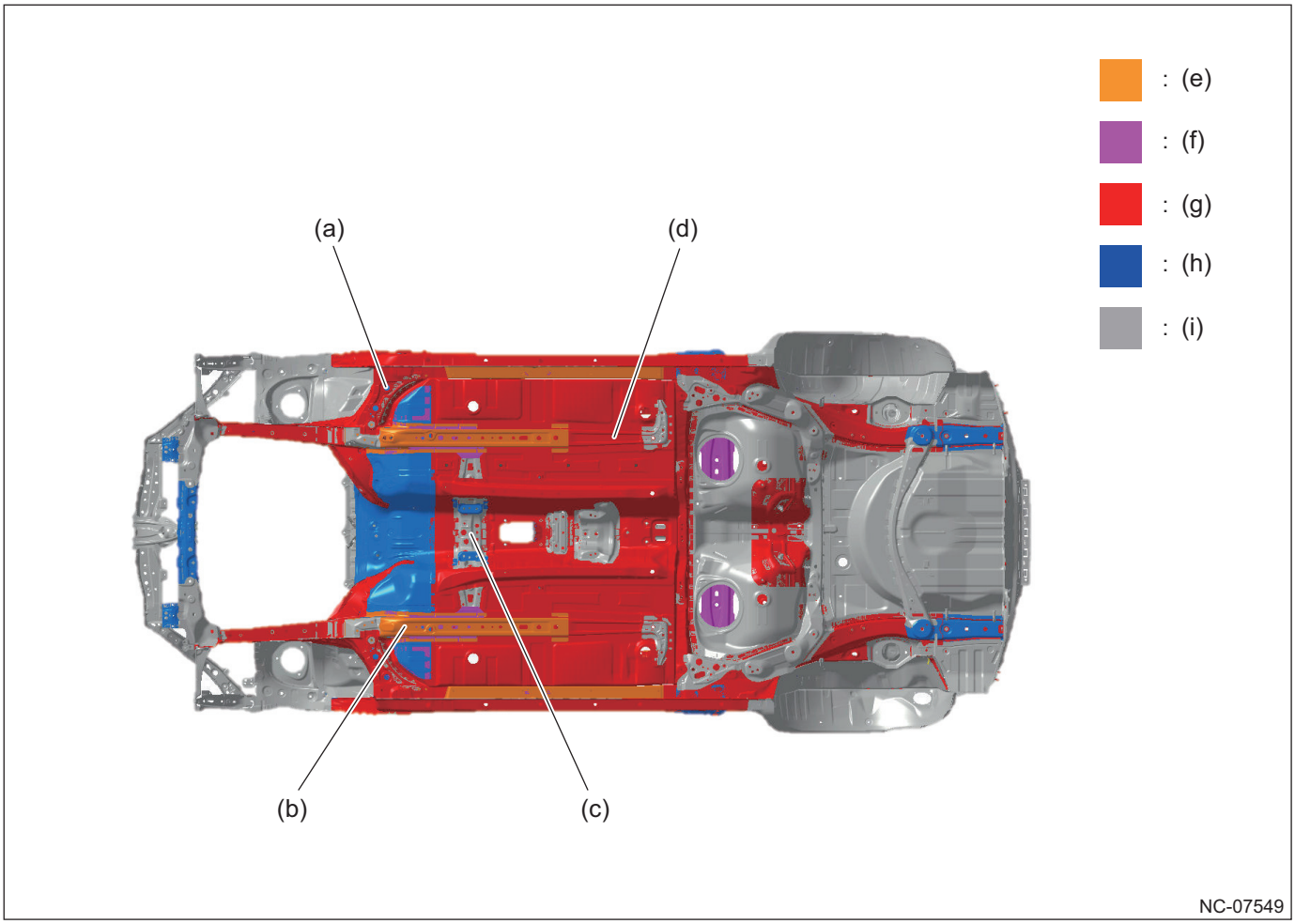
(a) Roof panel
(b) Front upper pillar reinforcement
(c) Front side sill
(d) Toe board
(e) Front lower reinforcement toe board
(f) Front side floor pan
(g) Front center floor pan
(h) Outer center pillar reinforcement
(i) Outer side rail reinforcement
(j) Hot press
(k) 142,099 psi (980 MPa, 9,993 kgf/cm2)
(l) 85,549 psi (590 MPa, 6,016 kgf/cm2)
(m) 57,999 to 63,799 psi (400 to 440 MPa, 4,079 to 4,487 kgf/cm2)
(n) 39,150 psi (270 MPa, 2,753 kgf/cm2)
(o) Aluminum material

View of vehicle rear



(a) Inner reinforcement toe board
(b) Front extension rail
(c) Rear extension rail
(d) Rear rail
(e) Center brace
(f) Front rail
(g) Hot press
(h) 142,099 psi (980 MPa, 9,993 kgf/cm2)
(i) 85,549 psi (590 MPa, 6,016 kgf/cm2)
(j) 57,999 to 63,799 psi (400 to 440 MPa, 4,079 to 4,487 kgf/cm2)
(k) 39,150 psi (270 MPa, 2,753 kgf/cm2)
(l) Aluminum material

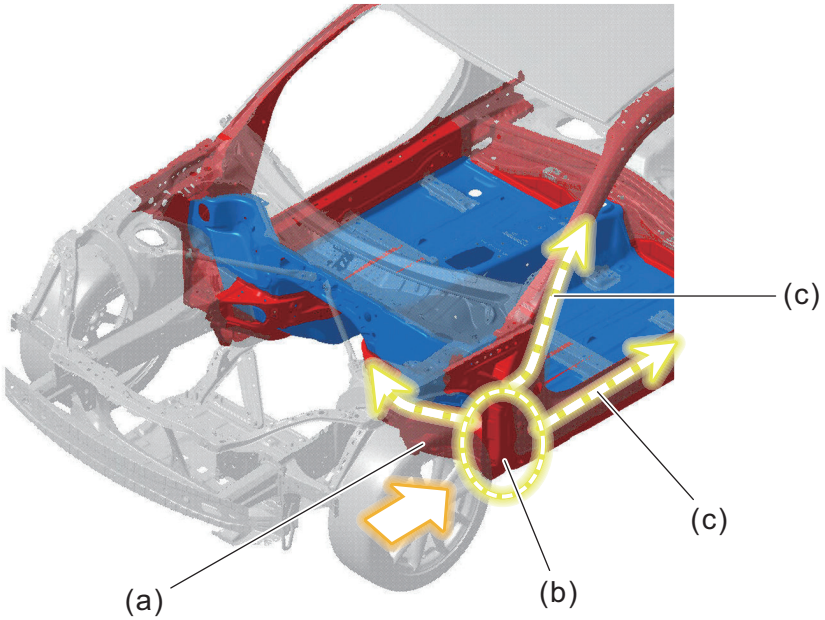
View from under vehicle



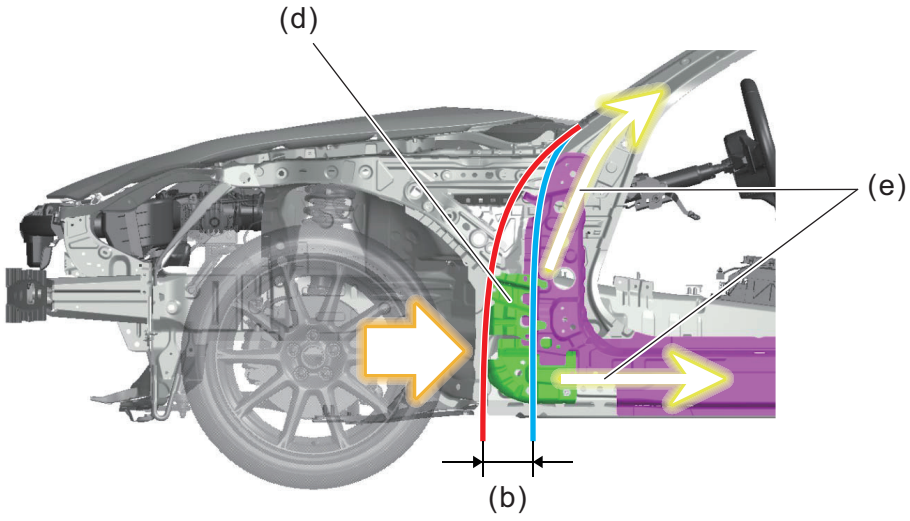
(a) Rear lower reinforcement toe board
(b) Front side frame rear
(c) Front floor crossmember
(d) Front side frame rear rear
(e) Hot press
(f) 142,099 psi (980 MPa, 9,993 kgf/cm2)
(g) 85,549 psi (590 MPa, 6,016 kgf/cm2)
(h) 57,999 to 63,799 psi (400 to 440 MPa, 4,079 to 4,487 kgf/cm2)
(i) 39,150 psi (270 MPa, 2,753 kgf/cm2)

Collision safety body (against front collision)

- The merits of the FR drive layout are utilized to improve the impact absorbing efficiency of the space in front of the front pillar.
- The cabin at the reaction force support section, and the side sill and torque box are reinforced.
- The adoption of hot press materials and high-tensile strength steel is expanded to achieve both reduced weight and better collision performance.
- Impact absorbing material is provided inside the A pillar for the first time by SUBARU.



(B)



(C)

: (A)

NC-06988

(A) Front collision input
(B) View of vehicle front
(C) View from side at vehicle front

(a) Improved torque box strength
(b) Expanded front pillar front side
(c) Collision load transmitted to front pillar and side sill
(d) Provided impact absorbing material
(e) Collision load transmitted smoothly to reaction force support section

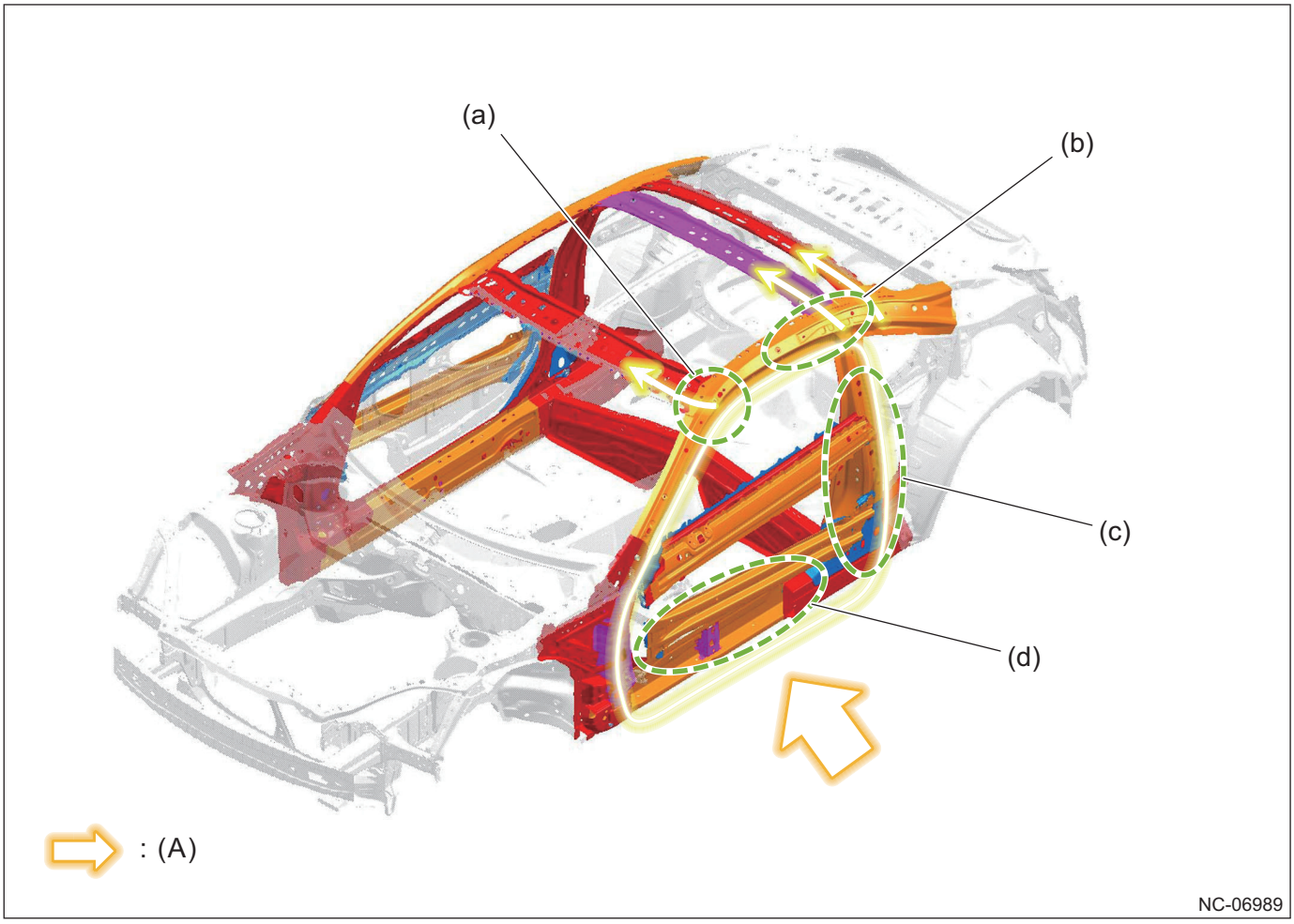
Collision safety body (against side collision)

Multiple load paths are provided and the vehicle body framework is strengthened to improve the side collision performance, transmitting the collision load smoothly and reducing vehicle body deformation.

■ BODY STRUCTURE

- Hot press materials + patchwork are adopted for the front pillar, side rail, and side sill, minimizing weight increases while improving framework strength.
- High manganese hot press (SUBARU first) + patchwork, and TWB (Tailor Welded Blanks) are adopted for the center pillar reinforcement outer, achieving both reduced weight and collision mode control.

- The reinforcement around the door ring and the joints of the inner framework are strengthened by the inner frame structure.

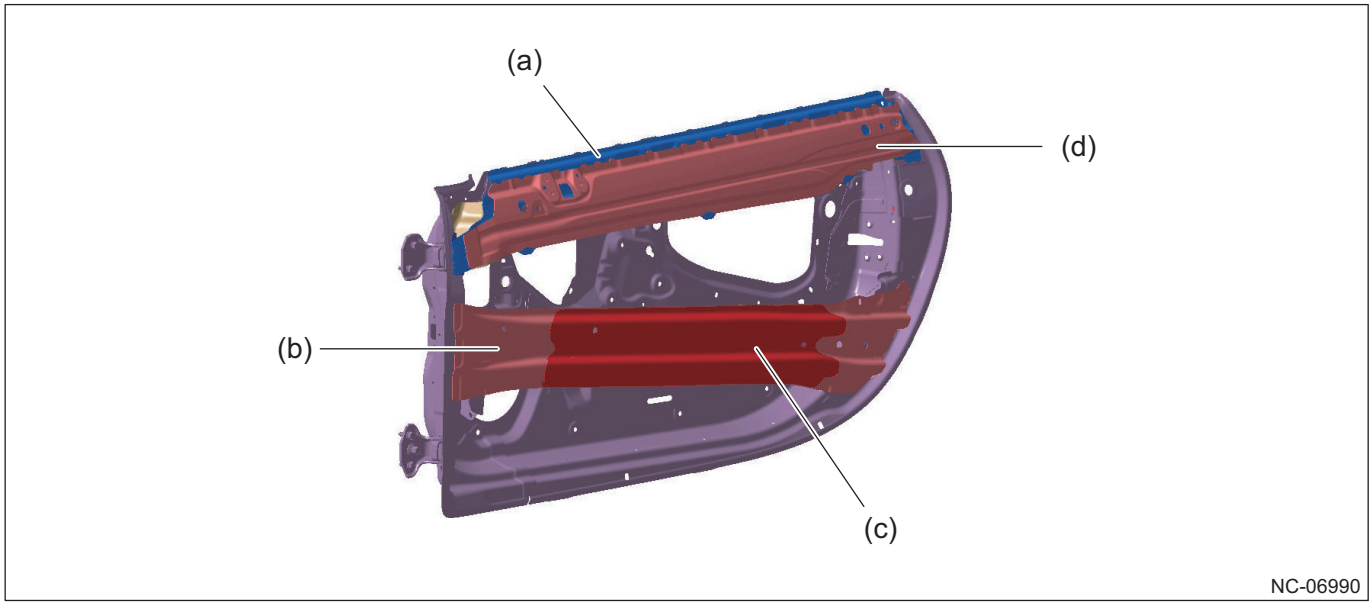


(A) Side collision input

(a) Front pillar
(b) Side rail
(c) Center pillar
(d) Side sill

■ Door

- Hot press materials and the patchwork method are adopted for the door reinforcement for the first time by SUBARU, improving the resistance to side collisions.
- The reinforced area of the door outer panel is enlarged, increasing the outer rigidity and suppressing the chattering noise when closing the door.



(a) 85,549 psi (590 MPa, 6,016 kgf/cm2) high-tensile strength steel (thickness 0.063 in (1.6 mm))

(b) Hot press material (thickness 0.055 in (1.4 mm))

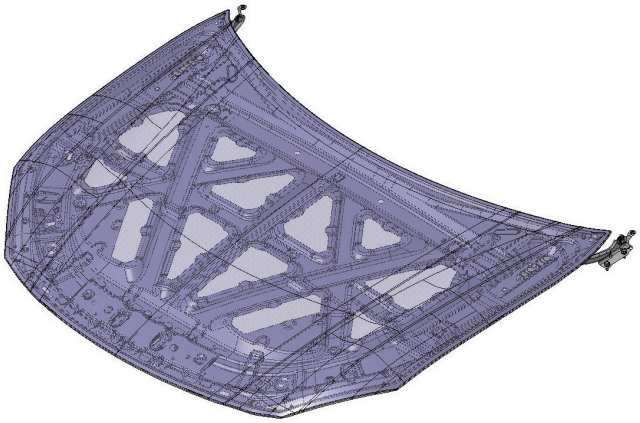
(c) Hot press material (thickness 0.047 in (1.2 mm))

(d) Hot press material (thickness 0.071 in (1.8 mm))

Pedestrian protection

Both the low vehicle height styling befitting of a sports car and pedestrian protection performance are achieved.

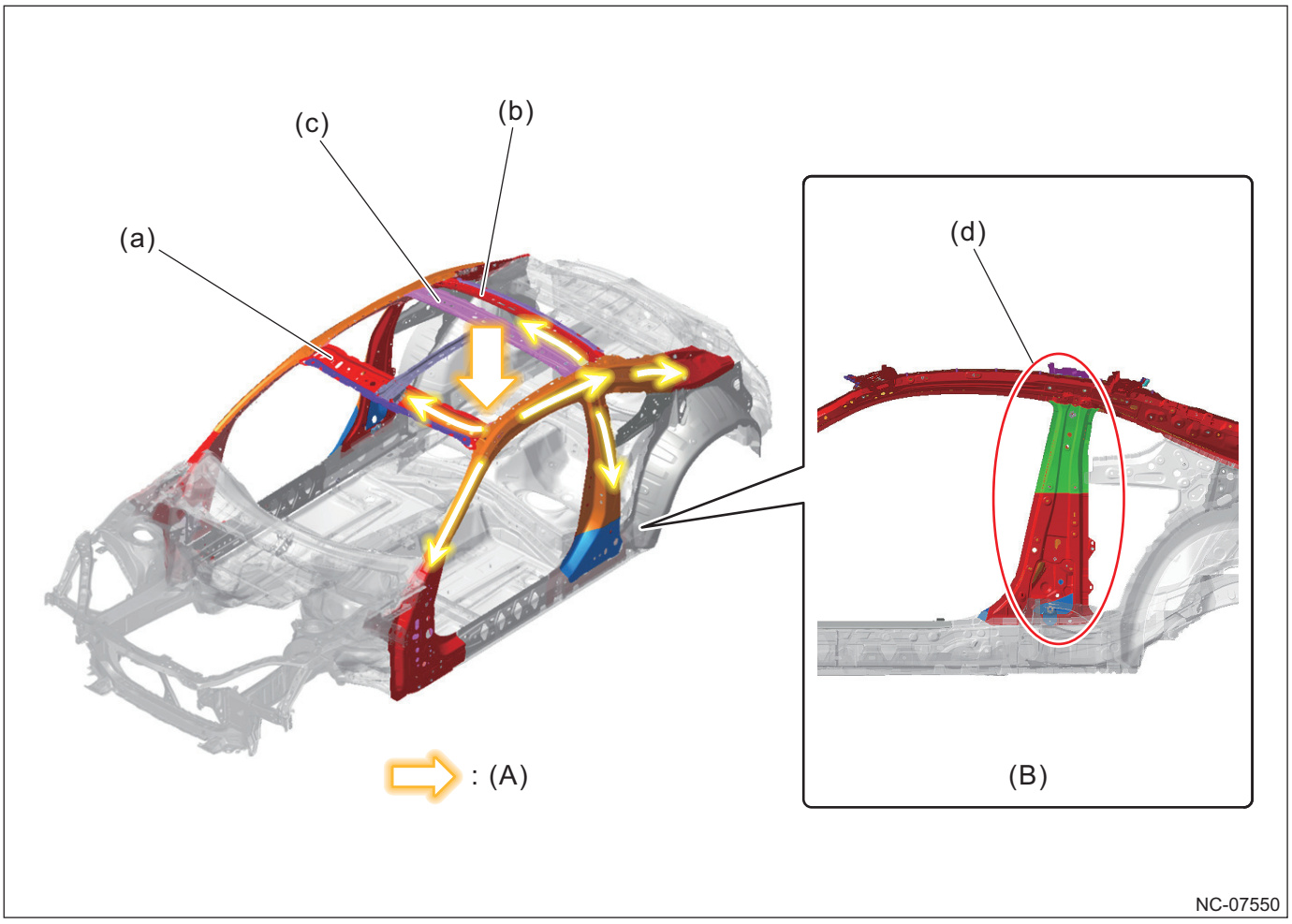
- A shock absorbing structure that proactively controls deformation in a collision is used to reduce the injury value in the event of a collision with a pedestrian.
- The structural flow of the inner framework of the front hood is revised to ensure sufficient rigidity even with a thin panel.
- The application locations of the mastic adhesive on the outer framework and inner structure are optimized to improve tensile rigidity.



NC-06991

Roof crash support

High-tensile strength steel is adopted for the front rail and rear rail, super high-tensile strength steel is adopted for the center brace, and TWB (Tailor Welded Blanks) are adopted for the center pillar inner to reduce weight and achieve roof crash performance efficiently.



(A) Roof crash input

(B) Side view

(a) Front rail

(b) Rear rail

(c) Center brace

(d) Center pillar inner

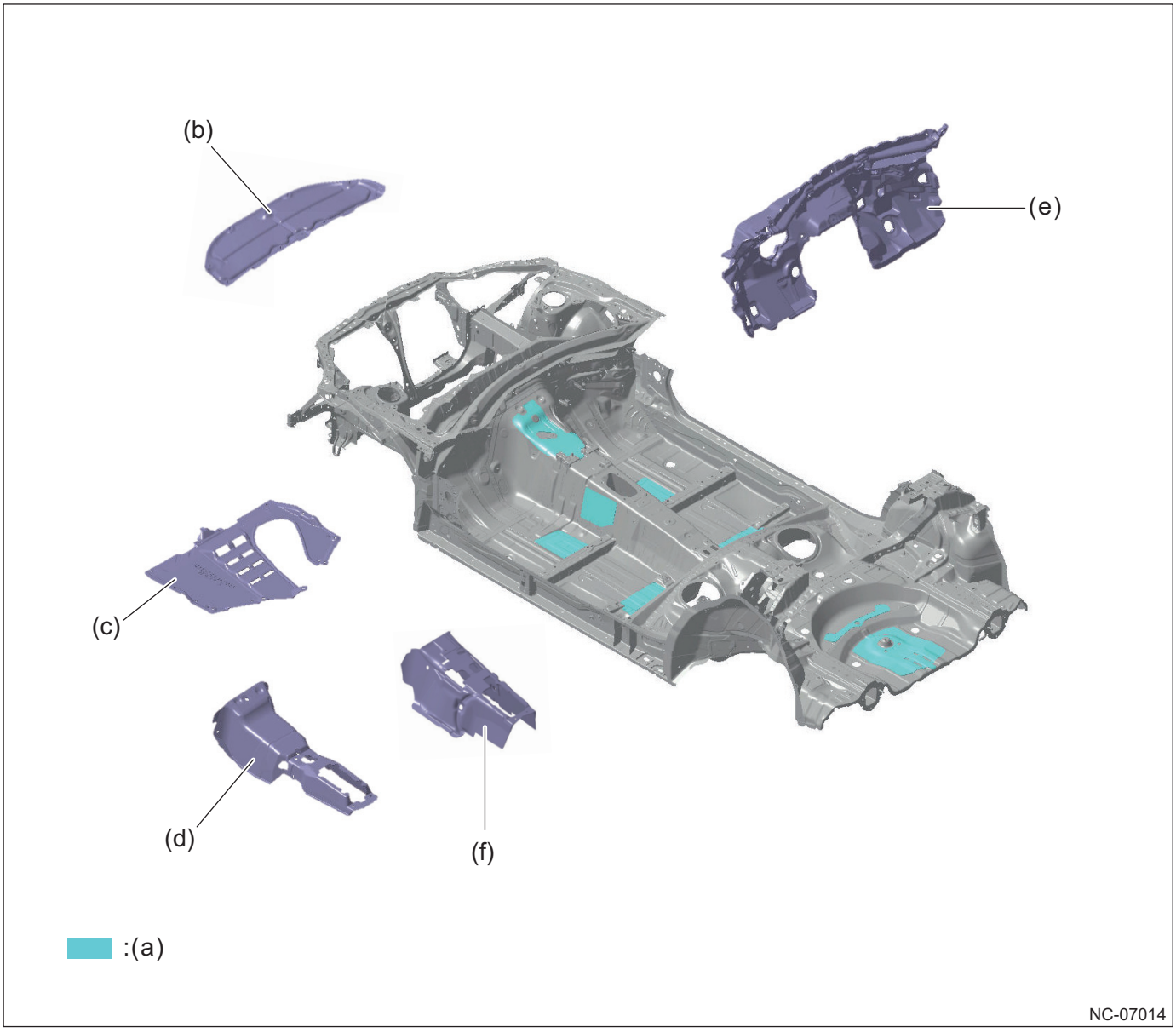
Soundproof Performance

Sound absorption/soundproofing

Compliance with the latest regulations is achieved, and noise that impairs driving enjoyment is suppressed.

■ Optimal placement of soundproofing materials

- A large tunnel insulator outer with an enlarged rear face is adopted to suppress noise generated from the transmission. (MT)
- A sound absorbing type of transmission under cover is adopted to suppress noise generated from the transmission and improve heat resistance.

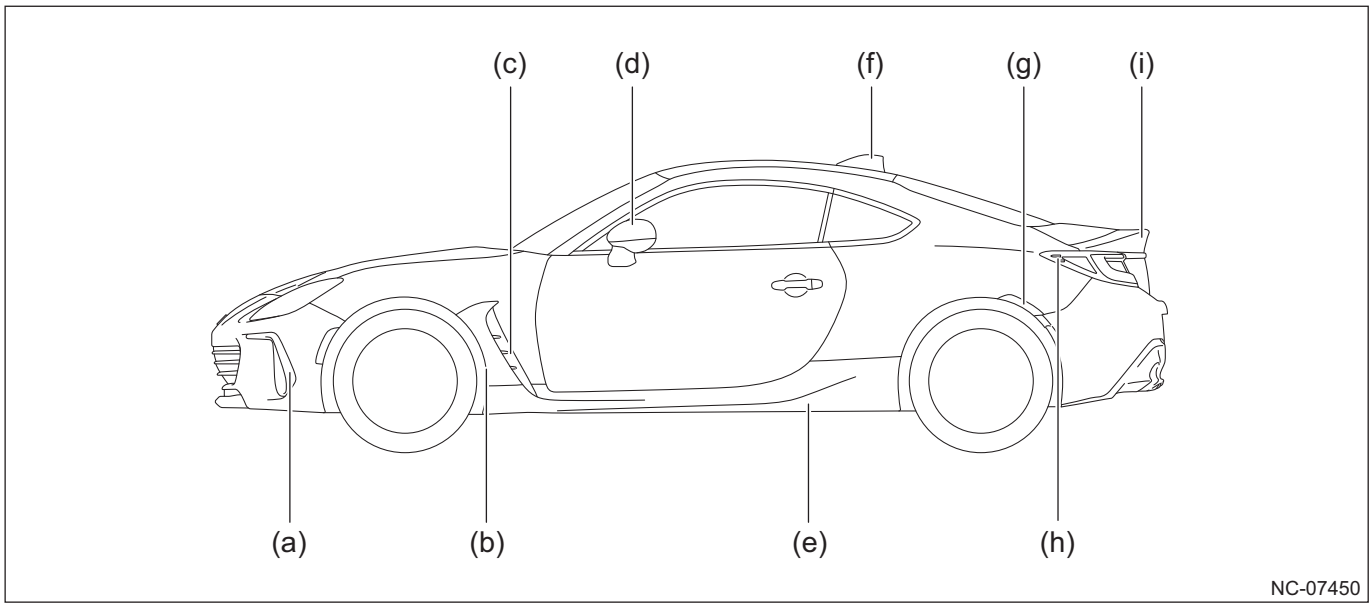


(a) Floor silencer
(b) Hood insulator
(c) Transmission under cover
(d) Tunnel insulator outer (MT)
(e) Toe board insulator
(f) Tunnel insulator

Aerodynamic performance

Upper body

Aerodynamic parts are used in various sections of the upper body, reducing air resistance and improving steering stability.

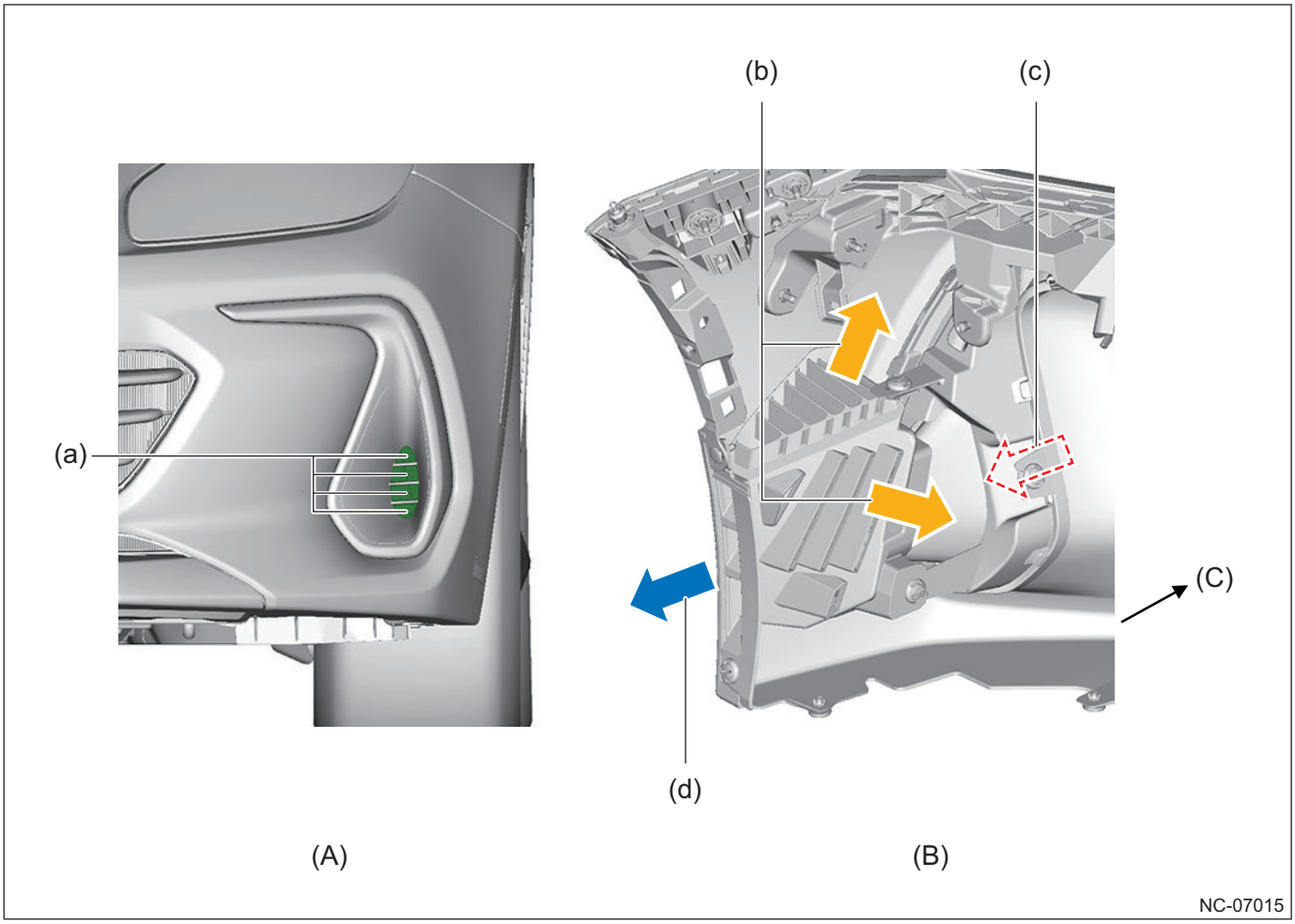


No.	Parts	Improvement in steering stability	Reduction in air resistance
(a)	Front bumper duct	○	○
(b)	Front mud guard slit	-	○
(c)	Front air outlet	○	-
(d)	Outer mirror	-	○
(e)	Side sill spoiler	○	-
(f)	Shark fin antenna	○	-
(g)	Rear arch fin	○	-
(h)	Rear combination light fin	○	-
(i)	Trunk garnish	○	-

■ Front bumper duct

A front bumper duct is adopted that discharges air contacting the front surface of the bumper face front to the rear, reducing air resistance and improving steering stability. (SUBARU first)

- Some of the discharged air is distributed inside the bumper face front, suppressing air stagnation inside the front bumper duct and improving steering stability.

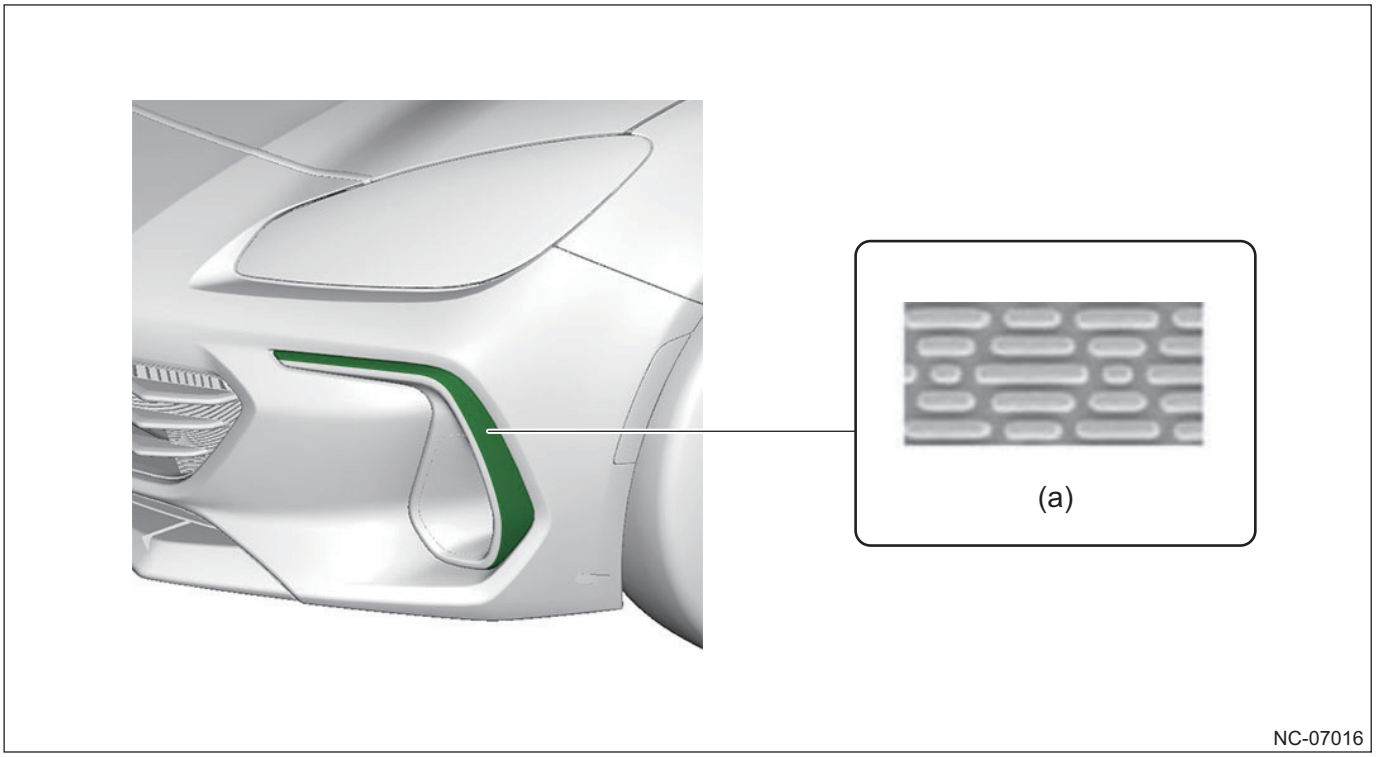


(A) Front view
(B) Inside view
(C) Front of vehicle

(a) Input hole
(b) Distributed inside bumper face front
(c) Inputs air contacting front surface of bumper face front
(d) Discharged to wheel house

Texture for improving aerodynamic performance is adopted around the outside of the front bumper duct.

- The texture generates small spiral airflows, reducing frictional resistance on the surface and suppressing air separation, which reduces air resistance.
- A rising angle relative to the vehicle travel direction is added to the rear face, generating an angle in the airflow and improving steering stability.

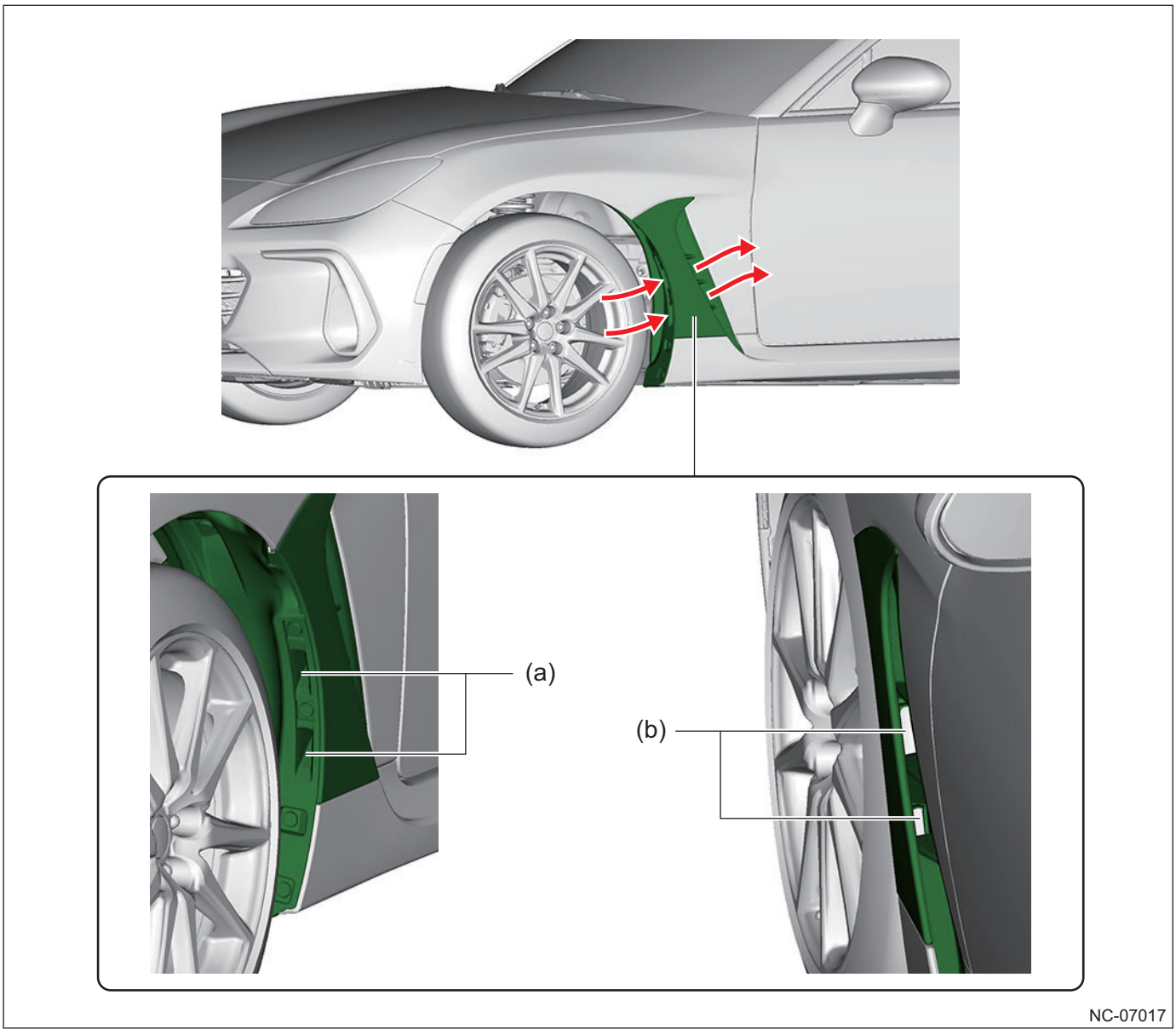


(a) Texture

■ Front mud guard slit/front air outlet

A front air outlet is adopted to suppress turbulence inside the wheel house by discharging the air flowing into the front wheel arch to the vehicle side. (SUBARU first)

- The air that has flowed into the wheel house and whose pressure has risen is discharged from the front air outlet, improving the contact of the front tires on the ground.
- The airflow is rectified and then the air is discharged by the front air outlet. This air then flows to the rear along the side of the vehicle, reducing the impact on the vehicle of pressure fluctuations and improving straight-line stability.



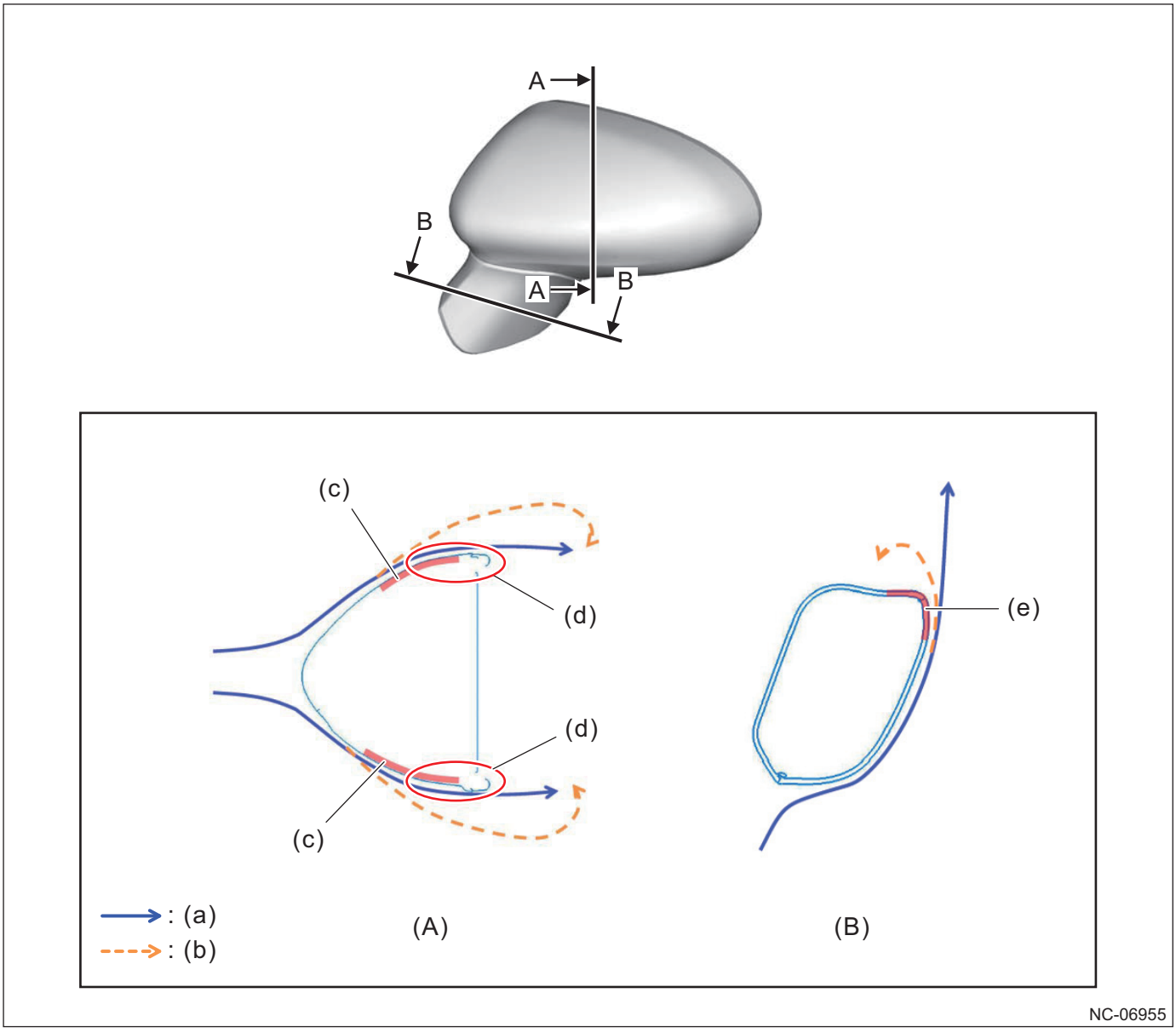
(a) Front mud guard slit (input hole)

(b) Front air outlet (discharge hole)

■ Outer mirror

The shapes of the outer mirror body top and bottom and the stay rear end are optimized to reduce air resistance and wind noise.

- The shape of the outer mirror body top and bottom has been made into a gradual convex surface to suppress air separation.
- A flat surface is provided after the convex surface to rectify the airflow toward the rear.
- A small curved surface is provided on the outer mirror stay rear end to promote air separation toward the rear of the stay and suppress air swirling on the stay rear surface.



(A) A-A cross section

(B) B-B cross section

(a) Rectified airflow

(b) Airflow that is not rectified

(c) Gradual convex surface

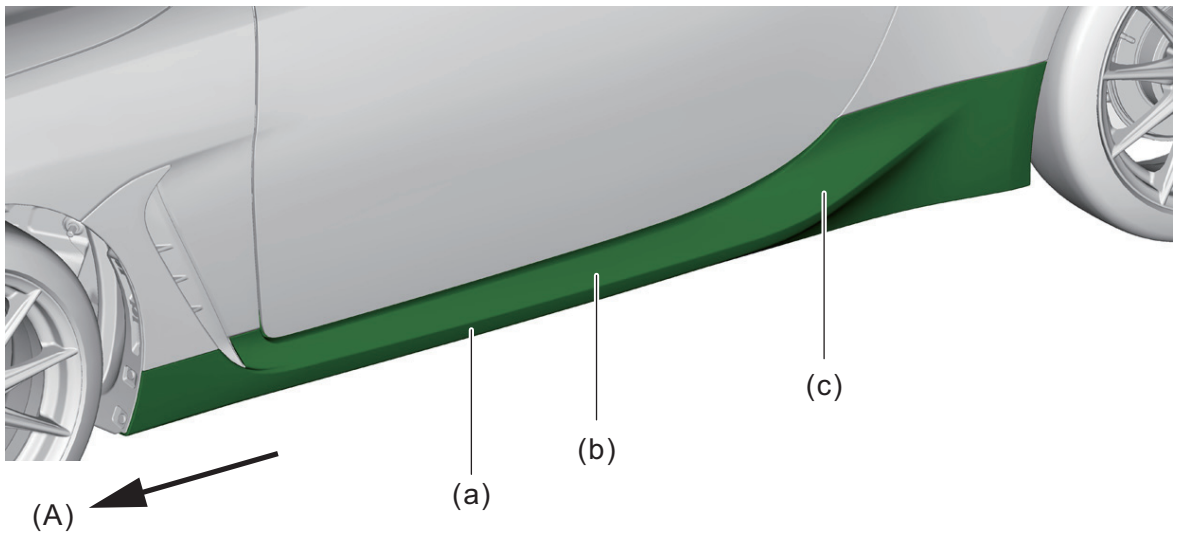
(d) Flat surface

(e) Small curved surface

■ Side sill spoiler

A side sill spoiler is adopted that improves straight-line stability and steering stability by controlling the airflow on the side of the vehicle.

- The side fin shape rectifies the airflow on the side of the vehicle to improve straight-line stability.
- The cross section angle on the top surface of the side sill spoiler is optimized to improve steering stability.
- The side angle of the rising shape on the rear section of the side sill spoiler is optimized to improve steering stability.



(A) Front of vehicle

(a) Side sill spoiler

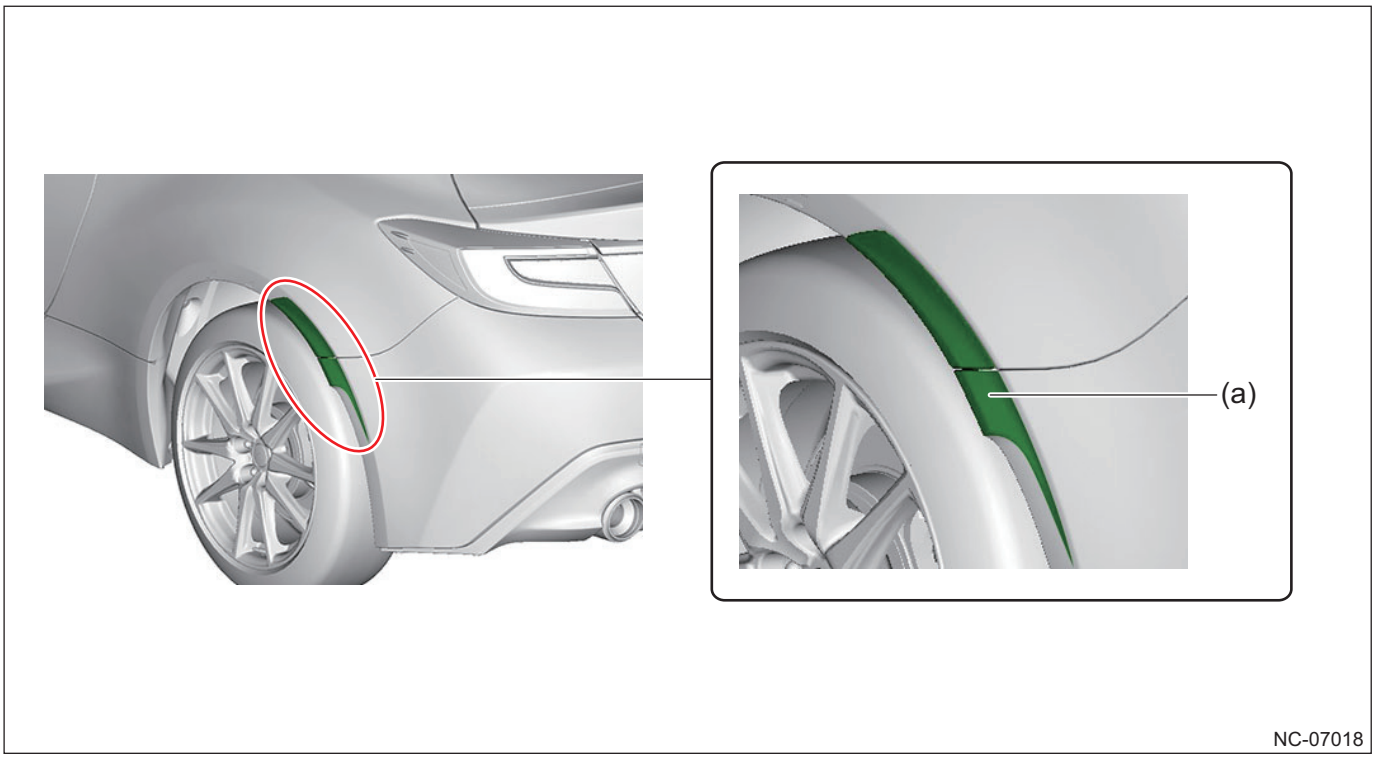
(b) Side fin shape

(c) Rising shape

■ Rear arch fin

A rear arch fin is adopted that stabilizes the behavior on the rear left and right, improving the steering responsiveness.

- Vertical air spirals are generated when air contacts the bottom face of the rear arch fin, suppressing the airflow toward the vehicle rear and improving steering stability.



(a) Rear arch fin

■ Rear combination light fin

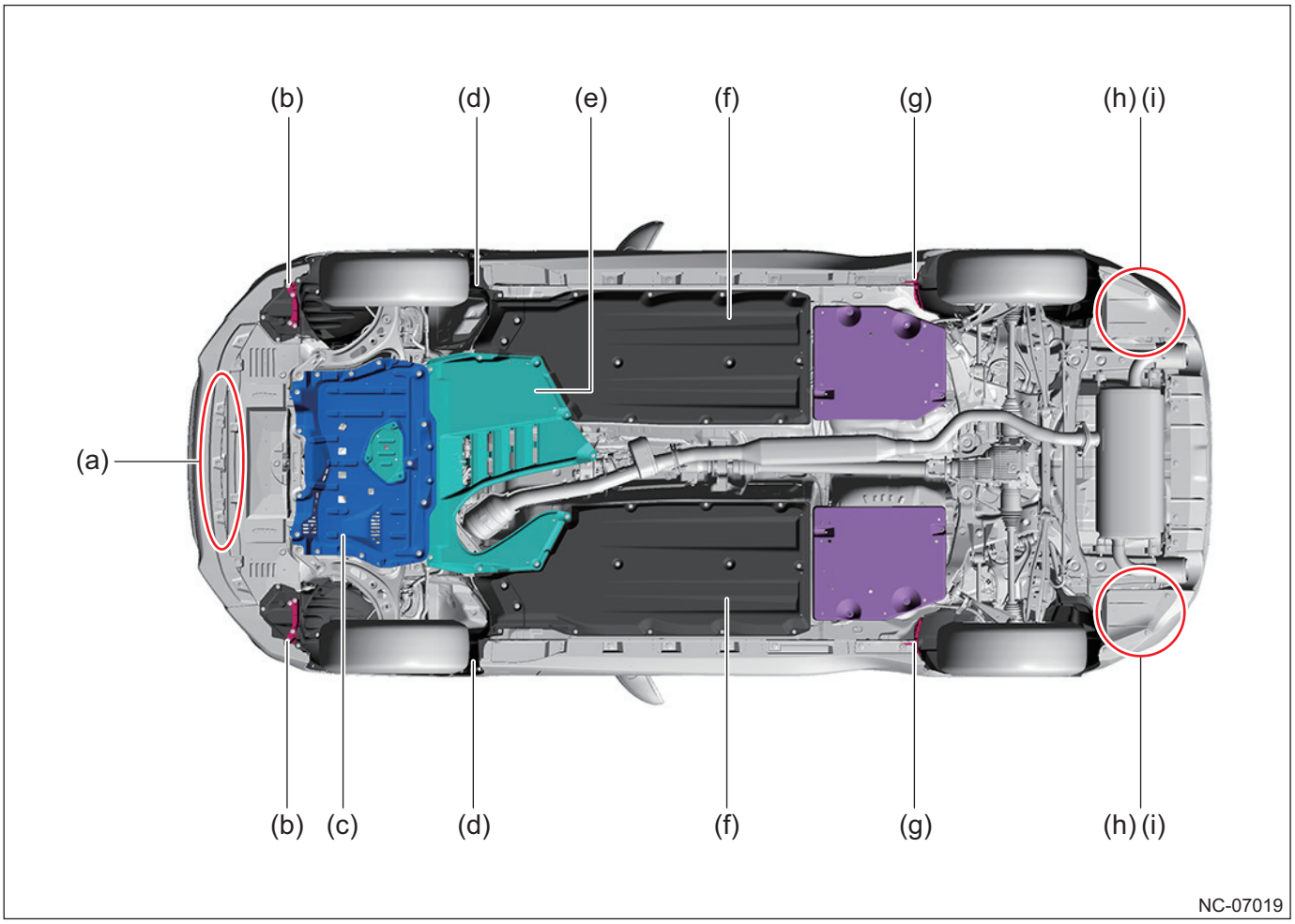
The airflow speed is increased on the side surface of the rear combination light and vertical air spirals are generated, suppressing air swirling toward the vehicle rear and improving steering stability.



(a) Rear combination light fin

Under body

Aerodynamic parts are used in various sections of the under body, reducing air resistance and improving steering stability.

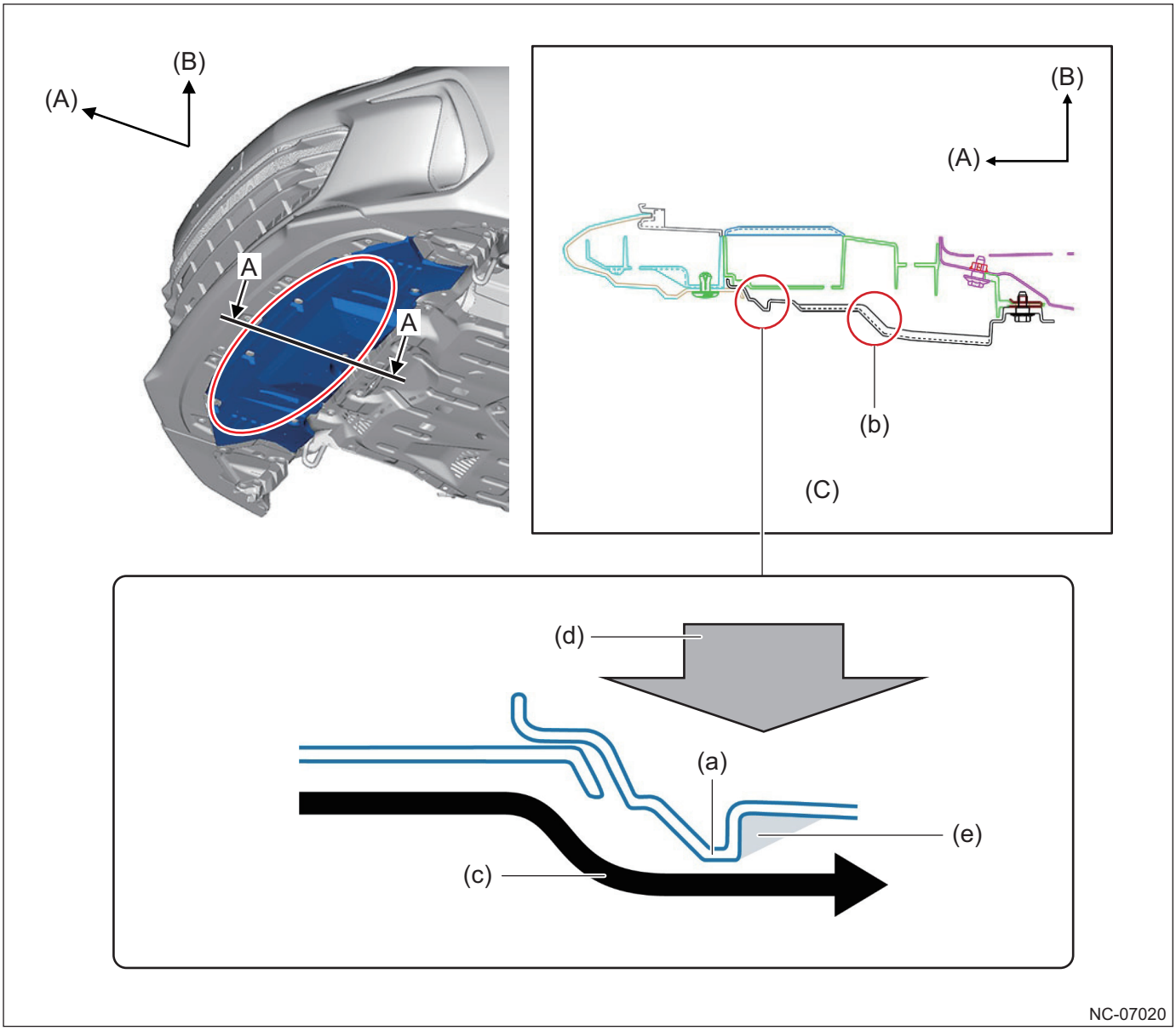


No.	Parts	Improvement in steering stability	Reduction in air resistance
(a)	Bumper cover lower	○	○
(b)	Front air flap	-	○
(c)	Front under cover	-	○
(d)	Front mud guard	-	○
(e)	Transmission under cover	-	○
(f)	Under cover under the floor	-	○
(g)	Rear air flap	-	○
(h)	Rear air outlet	○	-
(i)	Vertical fin	○	-

■ Bumper cover lower

Bead shapes are provided on the bumper cover lower to improve steering stability and aerodynamic performance.

- A bead for steering stability is added 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) Front of vehicle
(B) Top of vehicle

(C) A-A cross section

(a) Bead for steering stability

(b) Bead for aerodynamics

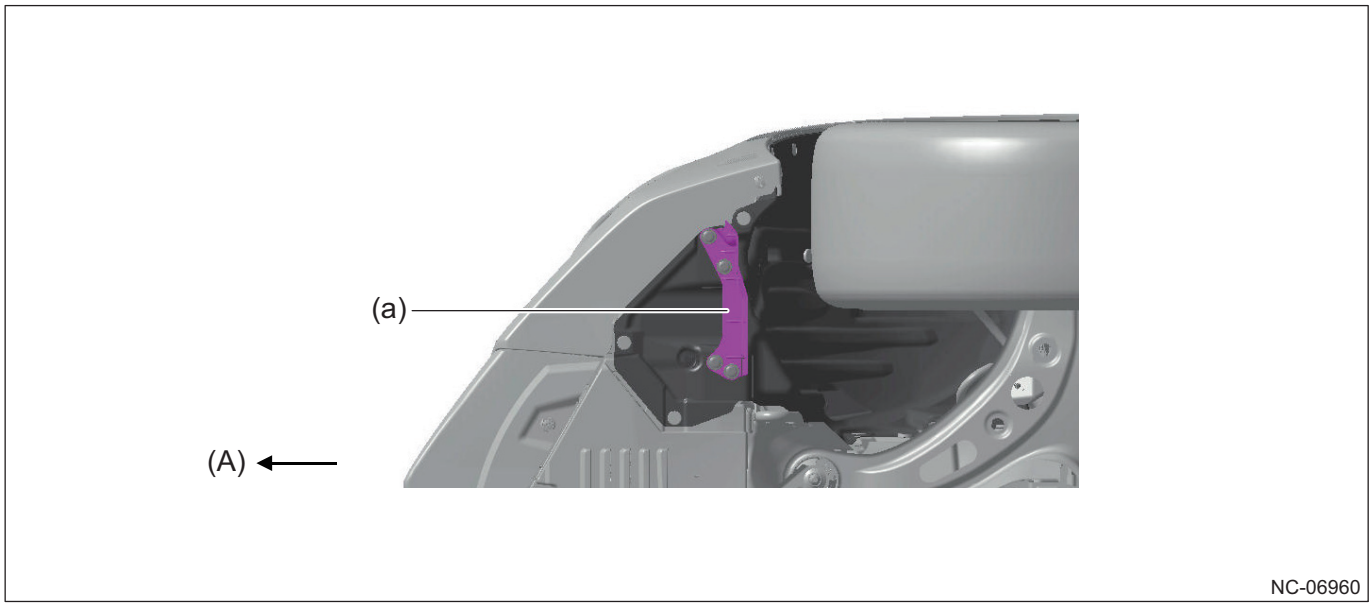
(c) Airflow

(d) Downforce generated on vehicle body by negative pressure

(e) Negative pressure is generated

■ Front air flap

The bottom face of the front air flap is moved toward the vehicle rear to control the airflow into the front wheel arch and improve aerodynamic performance.

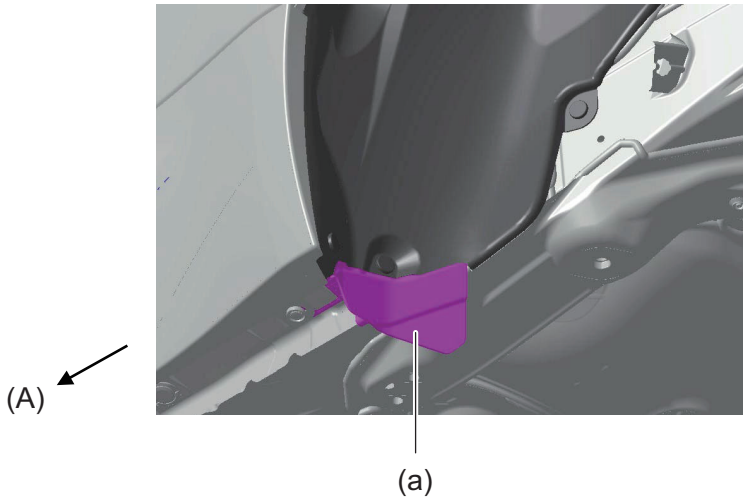


(A) Front of vehicle

(a) Front air flap

■ Rear air flap

The size of the rear air flap is enlarged toward the inside of the vehicle and the bottom surface is made smaller to control the airflow into the rear wheel arch and improve aerodynamic performance.

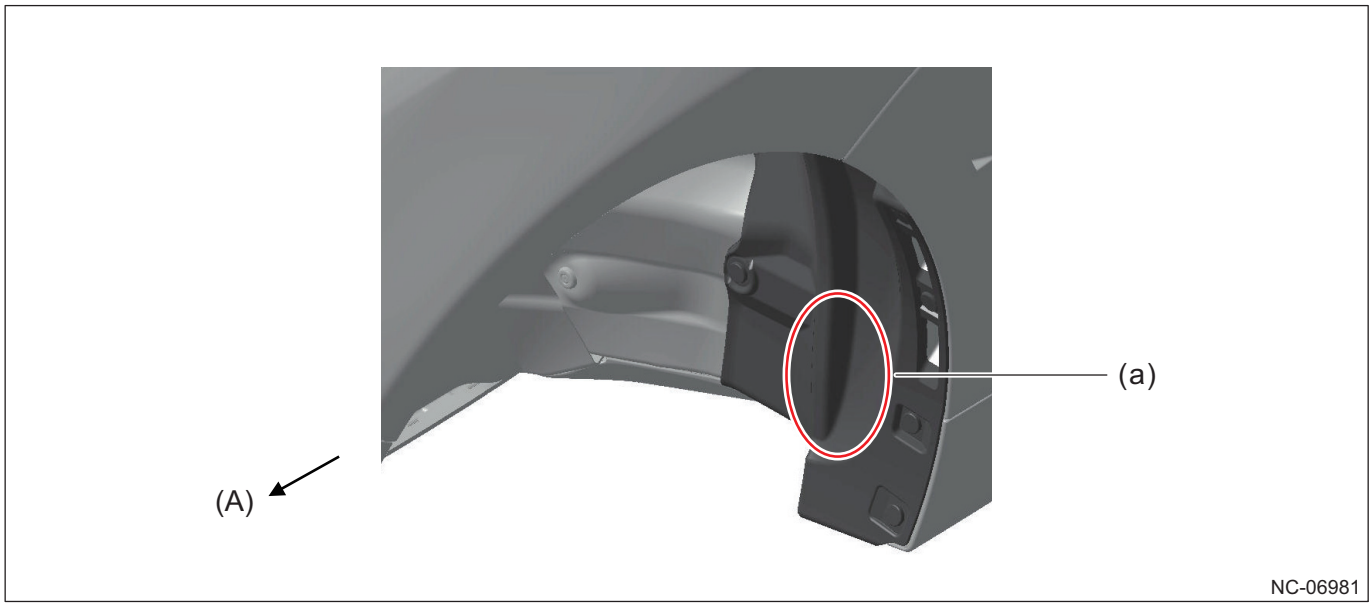


(A) Front of vehicle

(a) Rear air flap

■ Front mud guard

The level differences at the rear of the front tire are made smoother to promote the discharge of the air that enters the wheel arch.



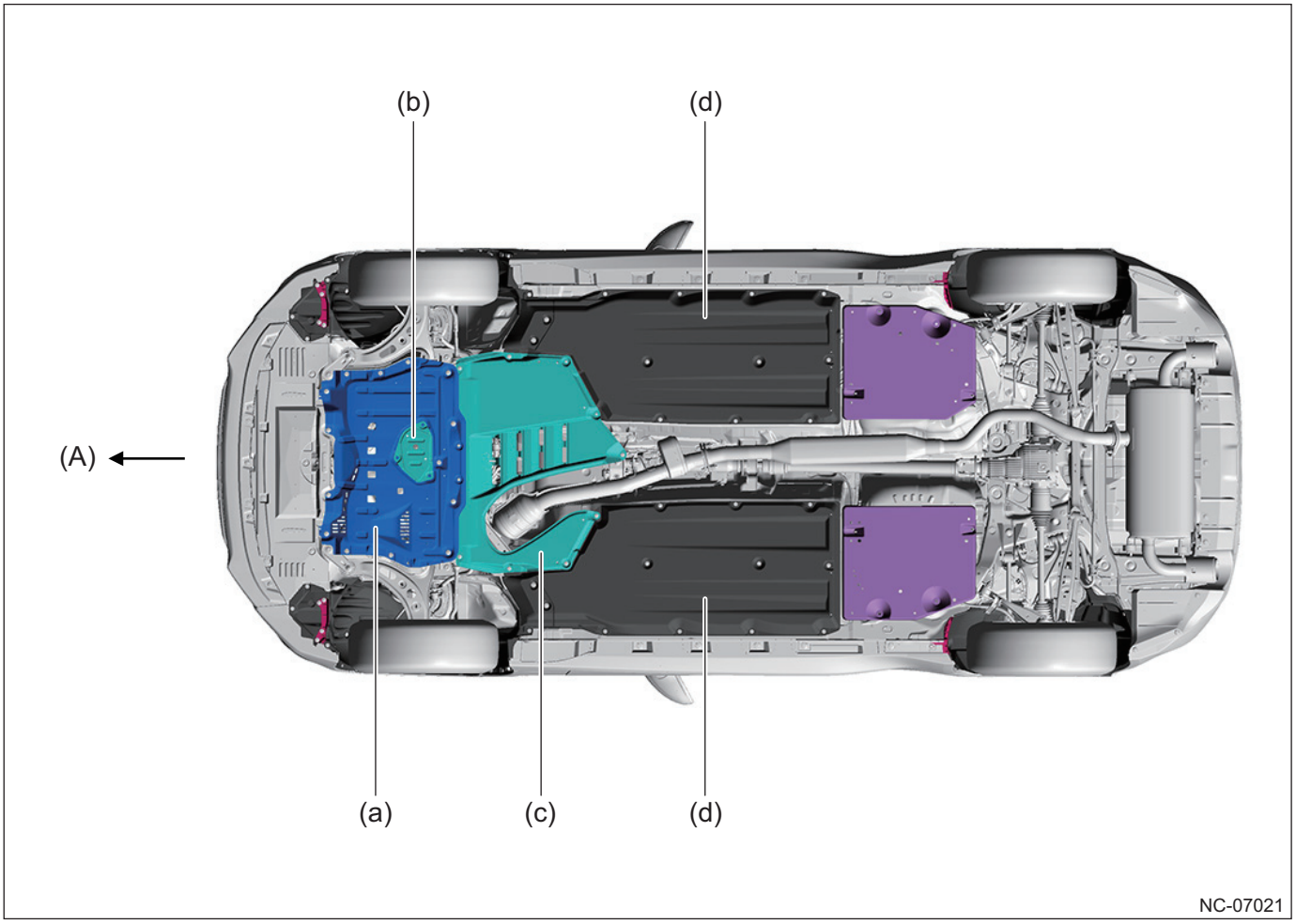
(A) Front of vehicle

(a) Level differences made smoother to promote air discharge

■ Front/transmission/under cover under the floor

A full under cover is adopted to improve aerodynamic performance.

- An oil drain cover is adopted for the front under cover for a flat shape.



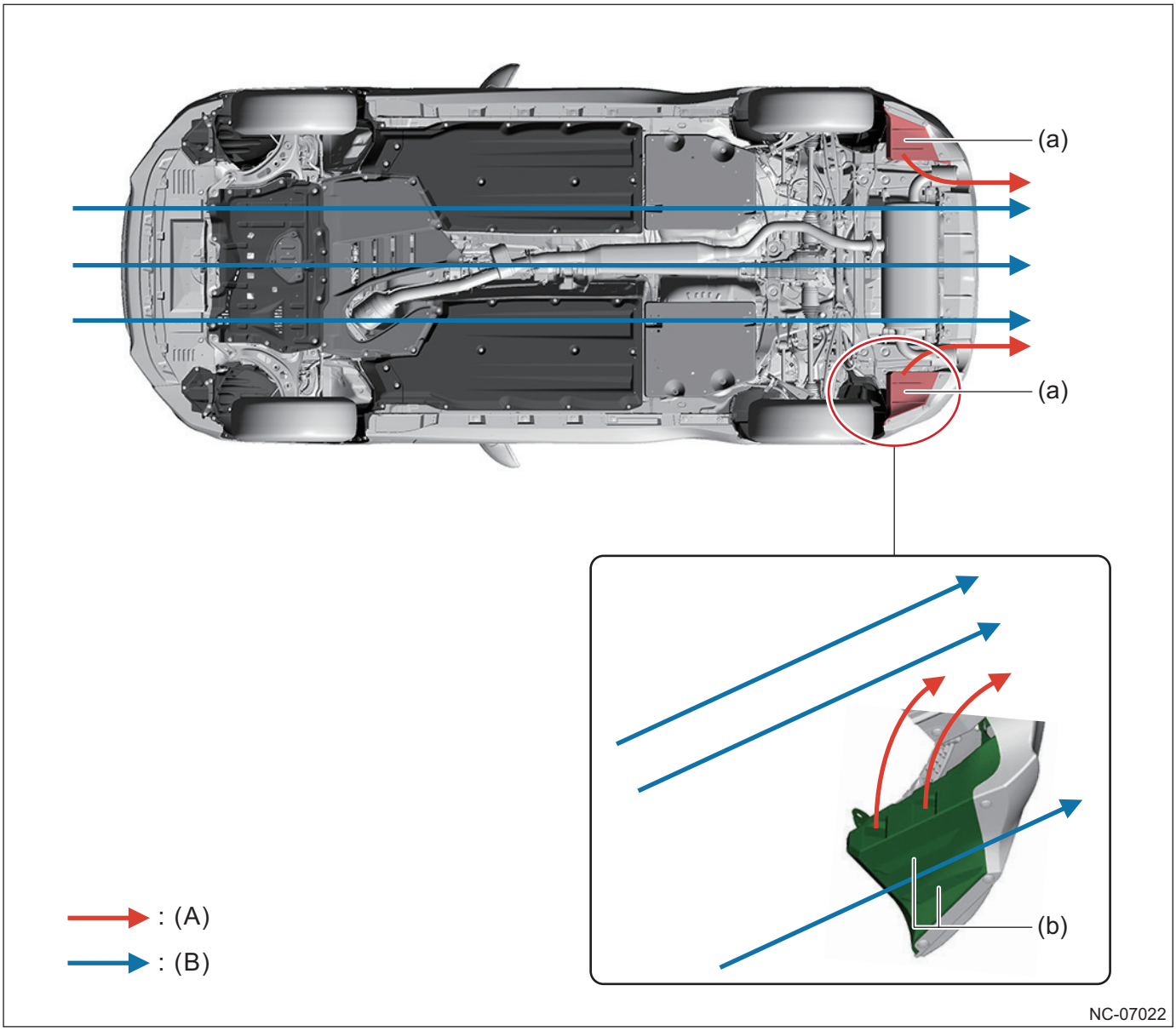
(A) Front of vehicle

(a) Front under cover
(b) Oil drain cover
(c) Transmission under cover
(d) Under cover under the floor

■ Rear air outlet/vertical fin

A rear air outlet is adopted at the bottom of the rear bumper to suppress the behavior to the left and right of the vehicle rear, improving stable driving performance.

- The airflow under the floor is used to bring out the air inside the rear bumper from the rear air outlet. As a result, some of the disturbed air near the rear suspension flows into the rear bumper, where it stagnates and rises to a high pressure, suppressing the generated turbulence.
- The airflow direction is controlled so that the airflow under the floor smoothly joins the flow on the rear surface of the vehicle.
- Vertical fins are installed on the bottom surface of the rear air outlet to rectify the airflow under the floor and improve straight-line stability.



(A) Airflow inside rear bumper brought out of rear air outlet

(B) Airflow under floor

(a) Rear air outlet

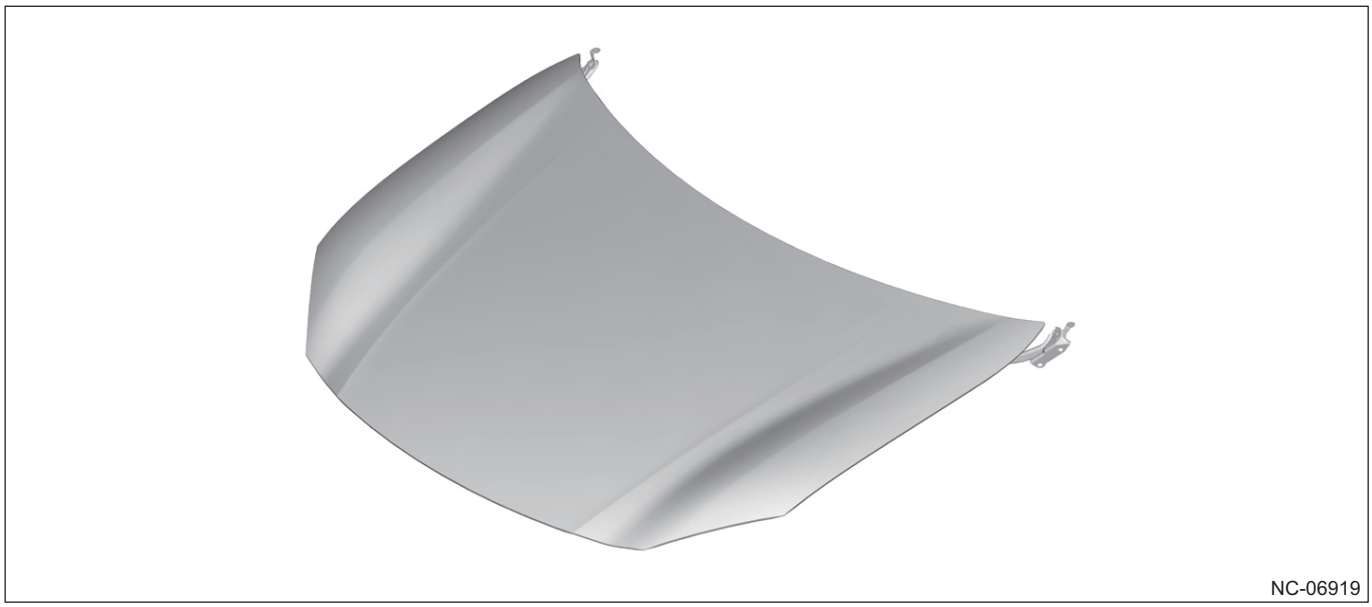
(b) Vertical fin

Other

Weight reduction

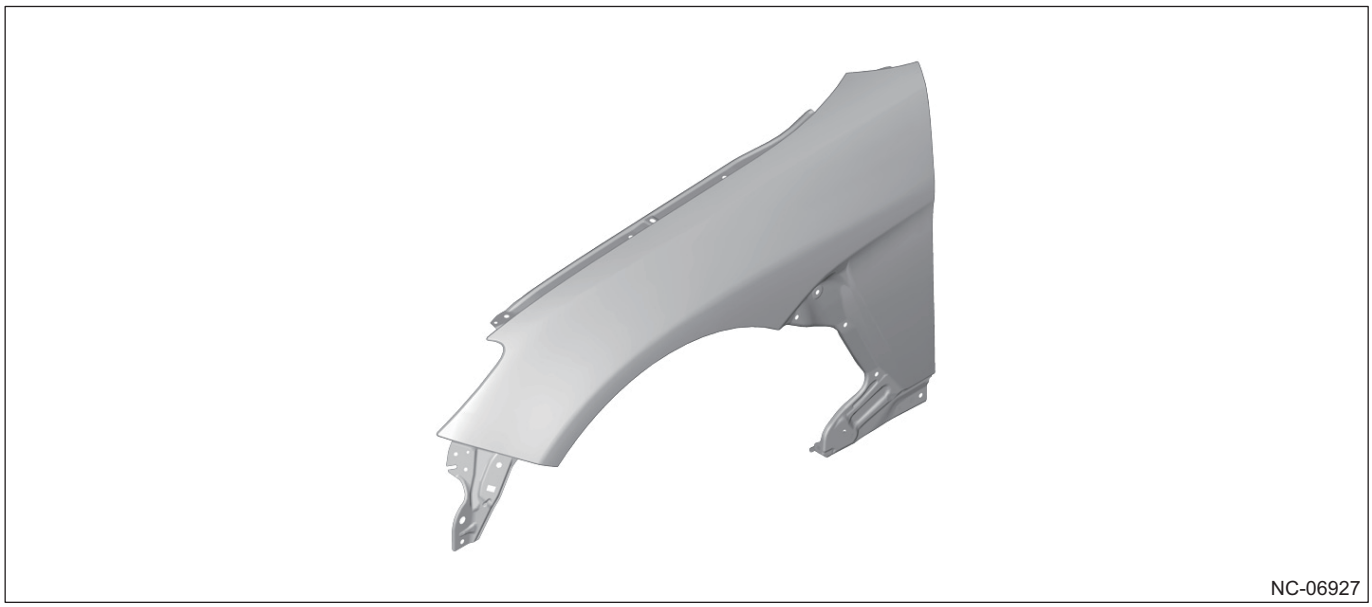
■ Front hood

Aluminum material is adopted for the front hood to reduce the weight.



■ Front fender

Aluminum material is adopted for the front fender to reduce weight and optimize the vehicle weight distribution.



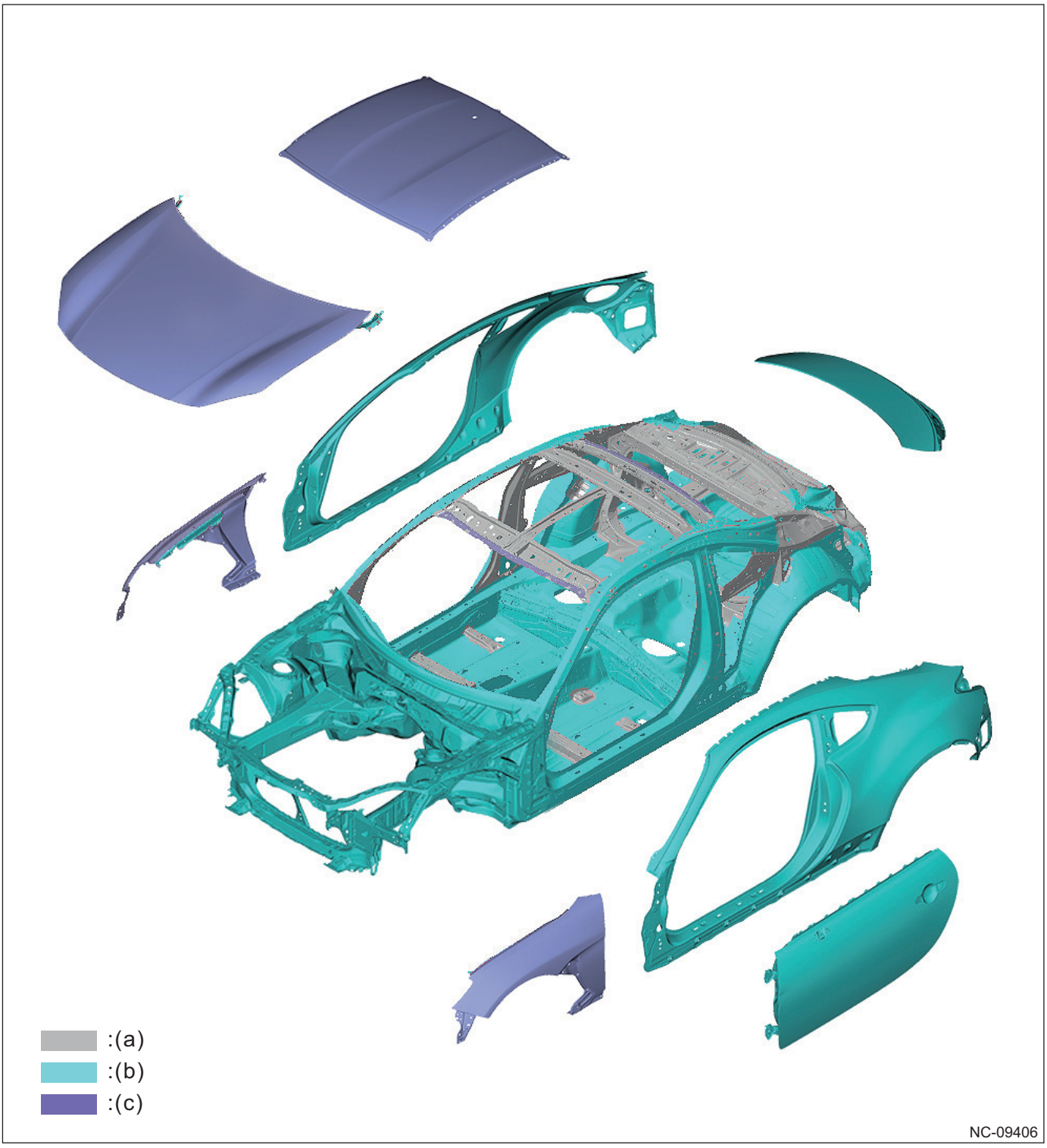
■ Roof panel

Aluminum material is adopted for the roof panel to reduce the weight and lower the center of gravity.



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.

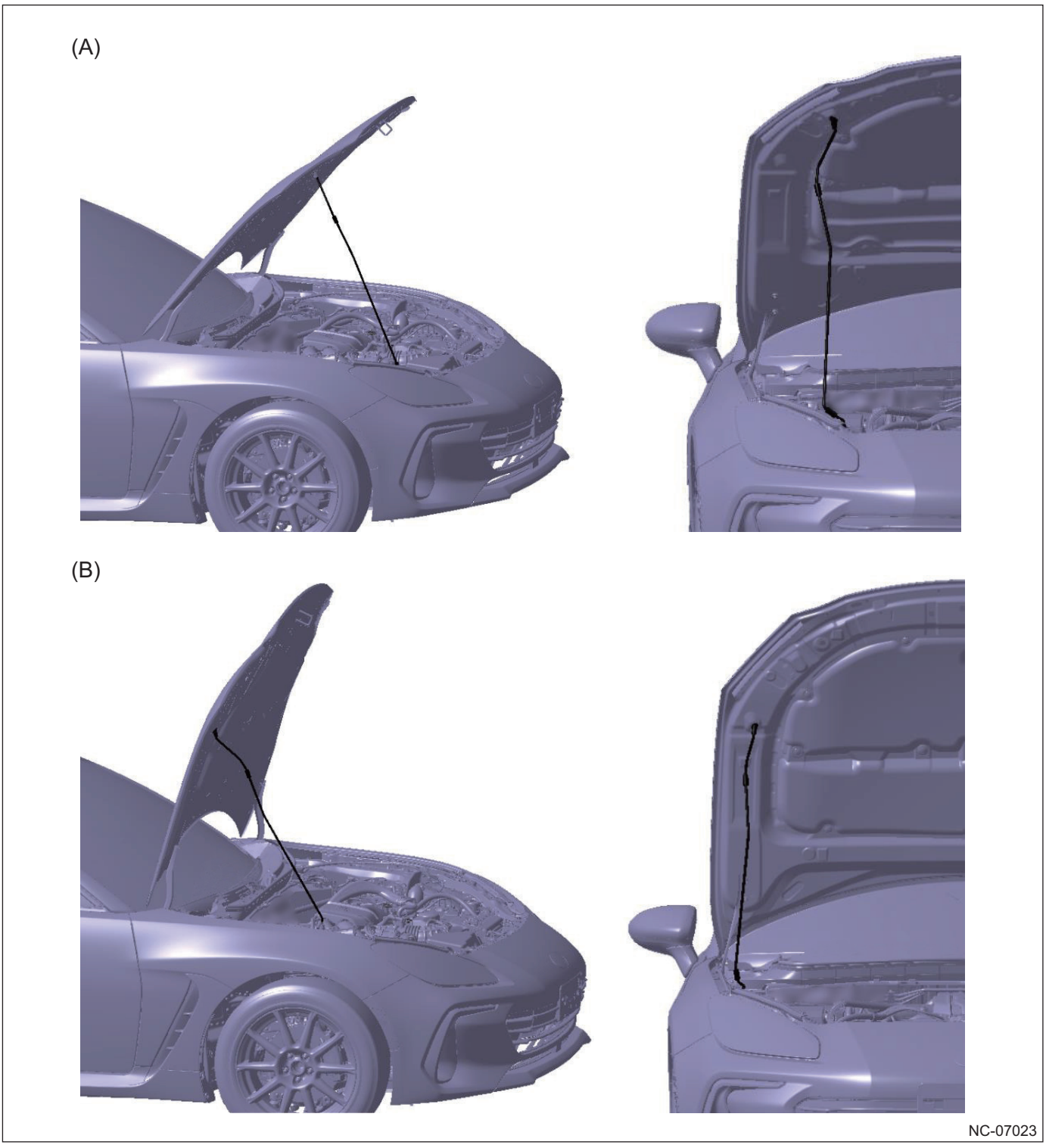


(a) General steel
(b) Anti-corrosion strength steel
(c) Aluminum material

Exterior appearance, convenience

■ Front hood dual level opening

Two insertion holes are installed, which allows the front hood to be fixed at a more open position than normal, providing better operability during heavy maintenance, etc.



(A) When supporting single level opening (during maintenance, etc.)

(B) When supporting dual level opening (during heavy maintenance, etc.)

9 EXTERIOR

CONTENTS

9.1 General Overview 9-2
9.1.1 Overview 9-2
9.2 Front Bumper/Horn/Cowl Panel 9-3
9.2.1 Overview 9-3
9.2.2 Component 9-4
9.3 Lighting System 9-12
9.3.1 Overview 9-12
9.3.2 Component 9-14
9.3.3 Construction and Operation 9-25
9.4 Wiper and Washer System 9-46
9.4.1 Overview 9-46
9.4.2 Component 9-47
9.4.3 Construction and Operation 9-52
9.5 Glass/Windows/Mirrors 9-55
9.5.1 Overview 9-55
9.5.2 Component 9-56
9.5.3 Construction and Operation 9-67
9.6 Roof Molding 9-76
9.6.1 Overview 9-76
9.7 Door/Fuel Lid 9-78
9.7.1 Overview 9-78
9.7.2 Component 9-79
9.8 Rear Bumper/Letter Mark/Muffler Cutter 9-84
9.8.1 Overview 9-84
9.8.2 Component 9-85
9.9 Trunk/Trunk Garnish 9-88
9.9.1 Overview 9-88

9.1 General Overview

9.1.1 Overview

Overview

In this chapter, the following components configuring the body exterior are described.

- Front Bumper/Horn/Cowl Panel
- Lighting System
- Wiper and Washer System
- Glass/Windows/Mirrors
- Roof Molding
- Door/Fuel Lid
- Rear Bumper/Letter Mark/Muffler Cutter
- Trunk/Trunk Garnish

9.2 Front Bumper/Horn/Cowl Panel

9.2.1 Overview

Overview

Front bumper

- A nose cone design (grille-less) is adopted for the bumper face front to create a simple yet powerful design befitting of a sports car.

Horn

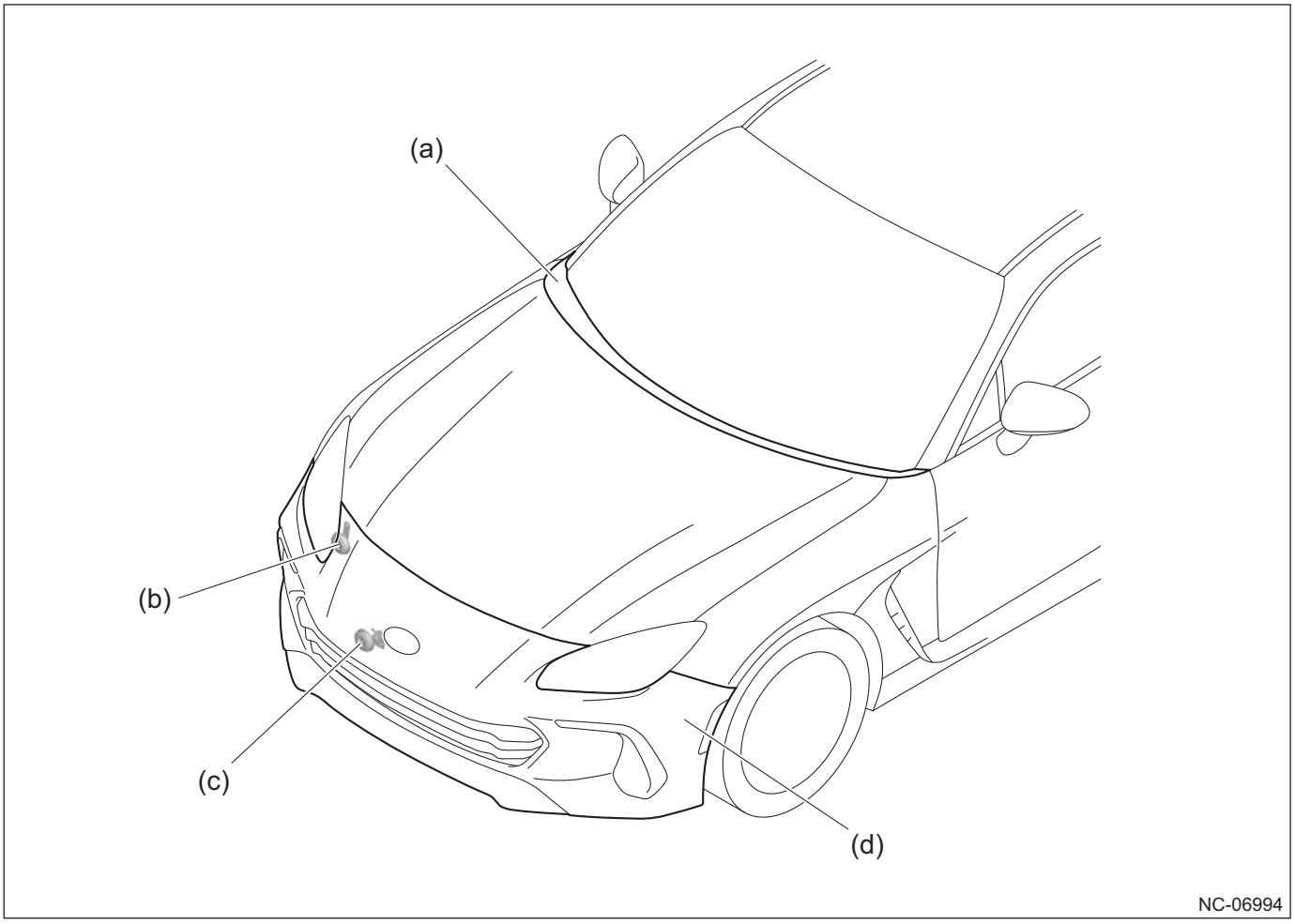
- The double horn with low pitch and high pitch is installed.

Cowl panel

- The structure and shape of the cowl panel are optimized for improved appearance.

9.2.2 Component

Component layout drawing



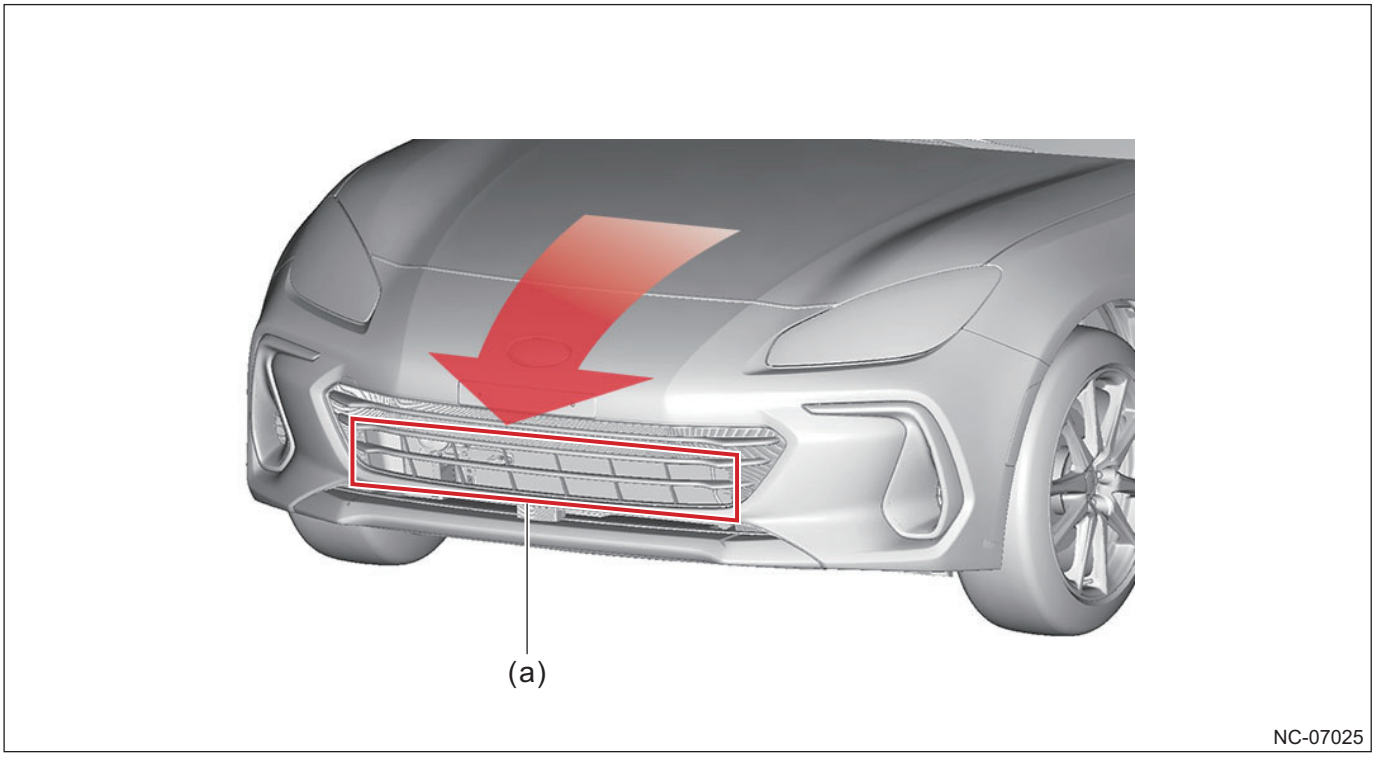
(a) Cowl panel
(b) Horn assembly Lo
(c) Horn assembly Hi
(d) Bumper face front

Component details

Front bumper

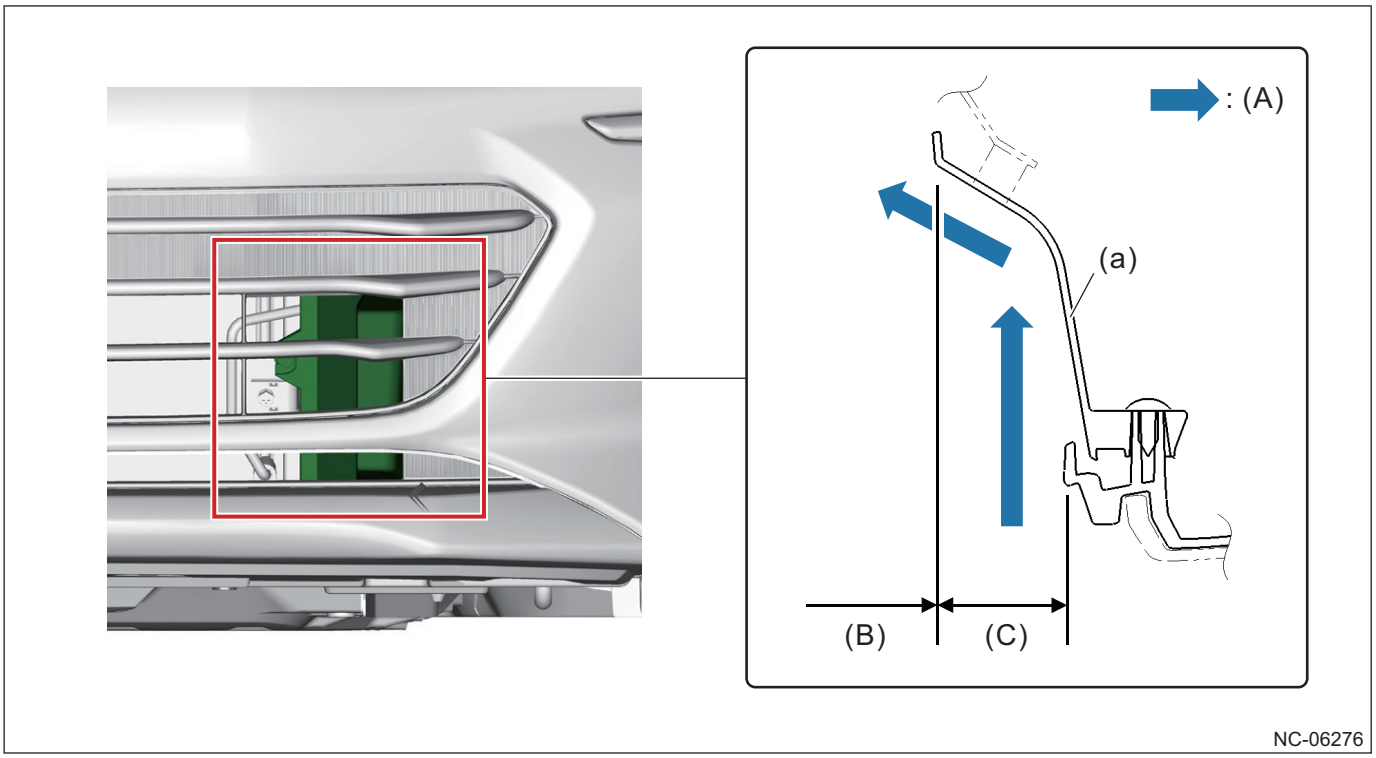
The adoption of a nose cone design (grille-less) creates a simple yet powerful shape befitting of a sports car.

- The shape of built-in parts such as the radiator are enhanced to create a solid bumper face front shape and a low nose structure with a low and wide style.
- The opening design parts are enlarged while maintaining compatibility with the bumper face front design.



(a) Enlarged opening design parts

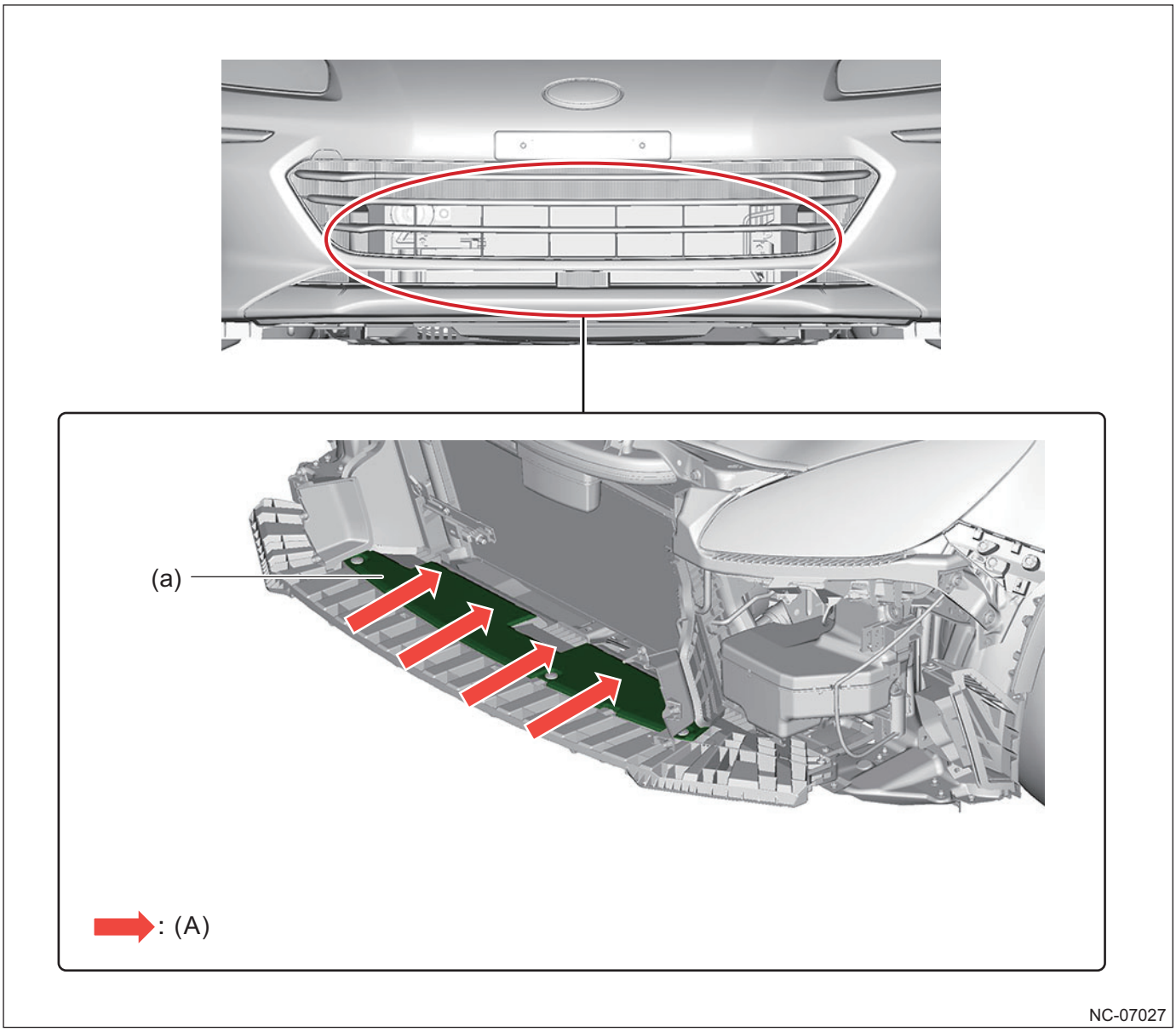
- A baffle plate structure is adopted for guiding the winds when driving that flow in from the opening to the radiator via the slanted surface on the side of the part.



(A) Winds when driving that flow in
(B) Front opening
(C) Non-front opening

(a) Baffle plate

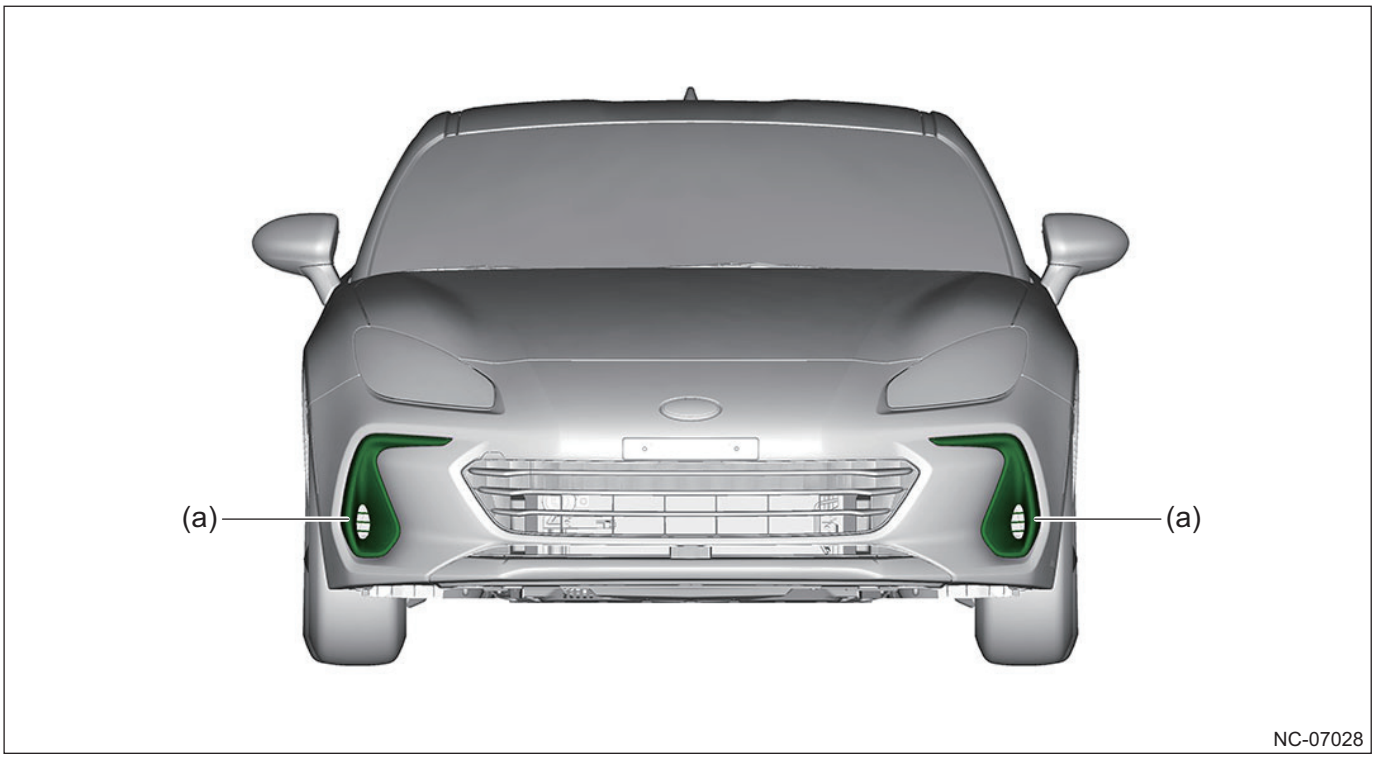
- The rectifier plate structure is adopted that rectifies the winds when driving and guides them to the radiator while sealing the underside of the bumper face front opening.



(A) Winds when driving that flow in

(a) Rectifier plate

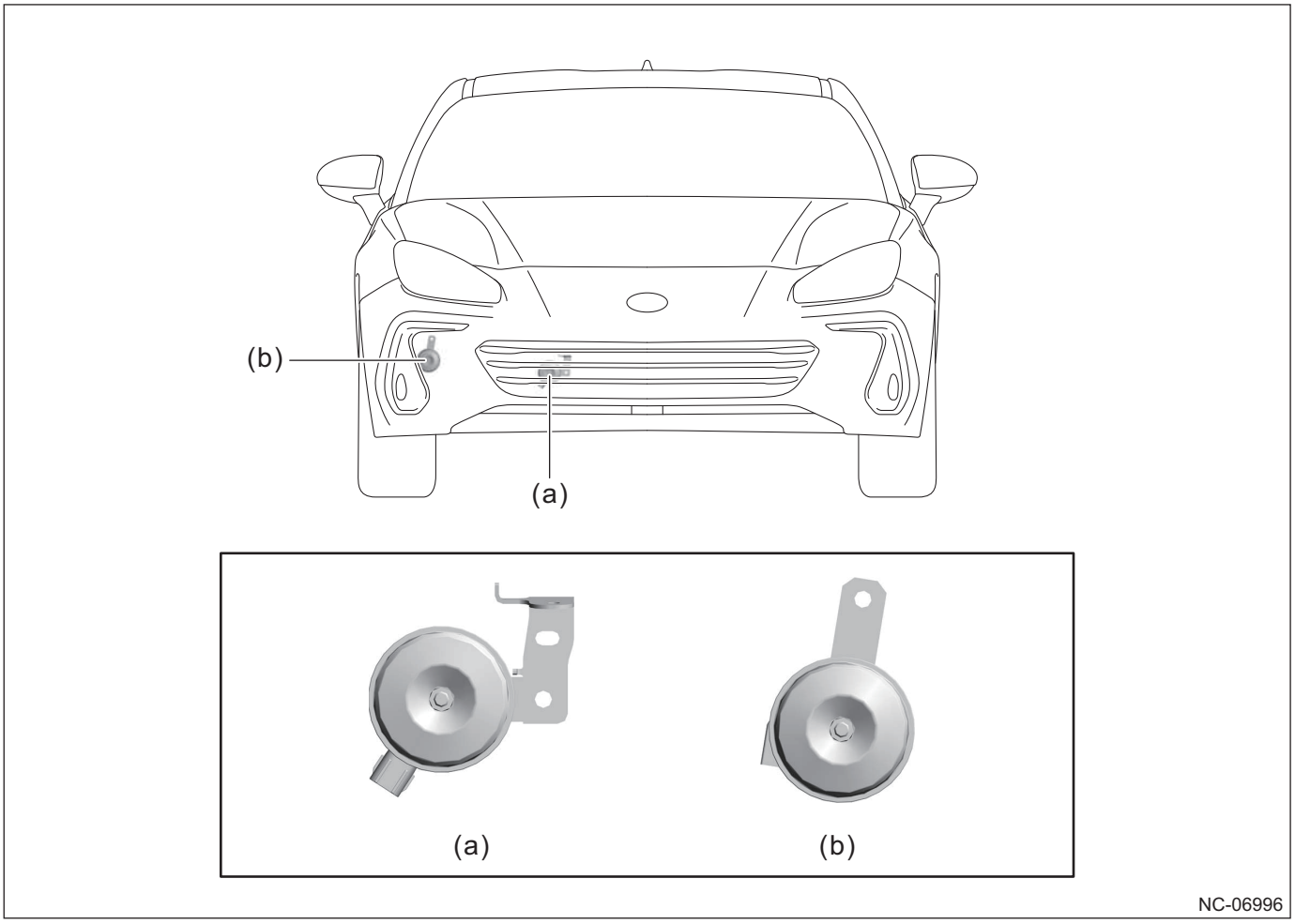
- The adoption of a front bumper duct on both sides of the bumper face front to guide the winds when driving to the wheel housings results in a front face shape befitting of a sports car while improving steering stability and aerodynamic performance. (SUBARU first)
  *For details on the aerodynamic performance, refer to "Aerodynamic performance <8-23>".



(a) Front bumper duct

Horn

The double horn with low pitch and high pitch is installed.



(a) Horn assembly Hi

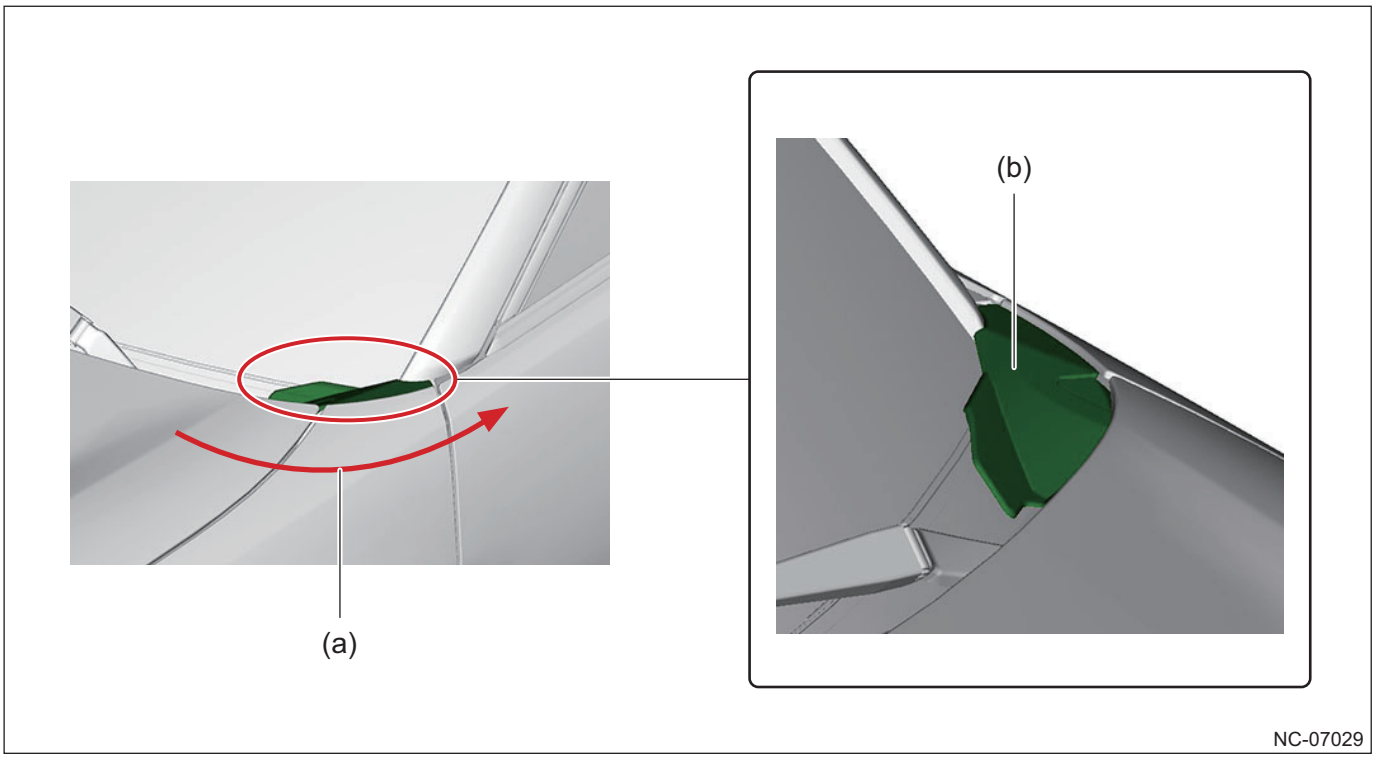
(b) Horn assembly Lo

Item	High pitch	Low pitch
Fundamental frequency [Hz]	420±20	350±20
Sound pressure level [dB]	113 (+4/-3)	113 (+3/-4)

Cowl panel

A simple structure that emphasizes the horizontal tone is adopted to match the A pillar and front fender structure.

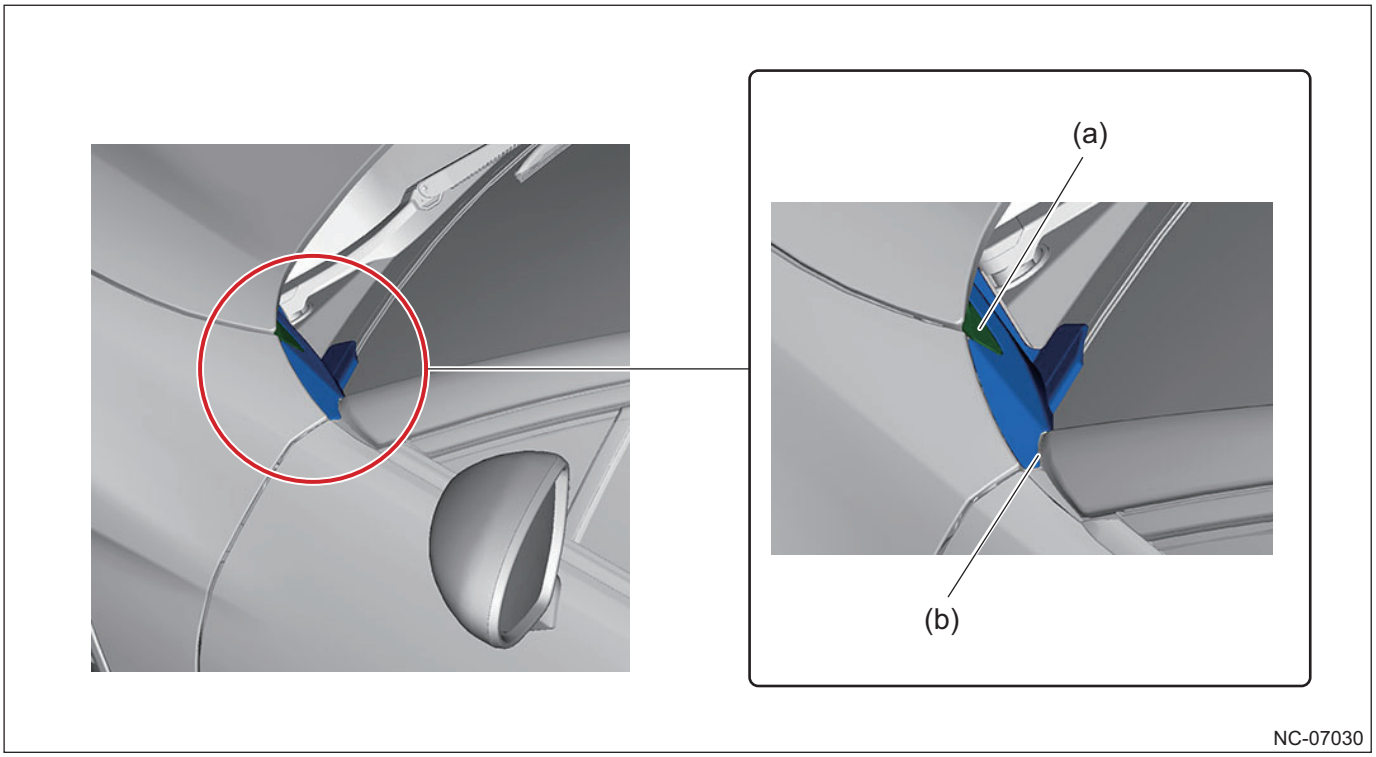
- The ridge lines of the front hood, front fender and door near the base of the A pillar are made continuous.
- The top surface of the cowl side is positioned under the top side of the front fender.



(a) Ridge lines of the front hood, front fender, and door are made continuous

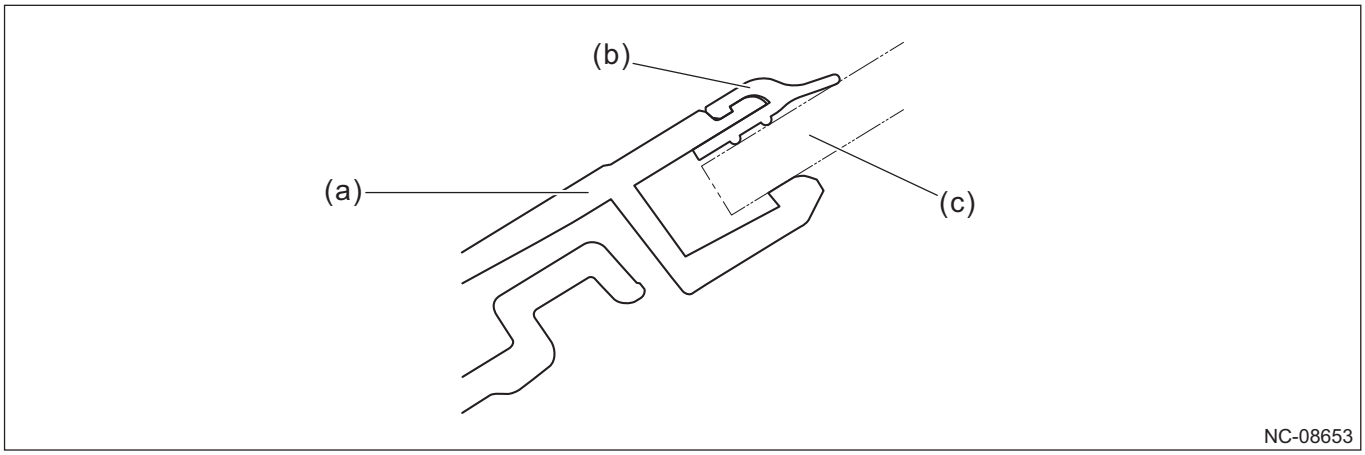
(b) Top surface of the cowl side is positioned under the top side of the front fender

- The soft parts used at the hood hinge are minimized and a lip is added at the division with the A pillar of the cowl side.



(a) Soft parts minimized at hood hinge
(b) Lip added at A pillar division

- A protector is provided at the division between the cowl panel and glass windshield to improve the appearance by following the glass with no gaps.



(a) Cowl panel
(b) Protector
(c) Glass windshield

9.3 Lighting System

9.3.1 Overview

Overview

General

A full LED headlight with the SUBARU common motif (C shape) design is adopted for the headlight.

A full LED rear combination light that expresses the SUBARU common motif (C shape) design through the light emitted by the tail light/stop light is adopted for the rear combination light.

A Daytime Running Light (DRL) is adopted to ensure conspicuousness from the surroundings when driving in daytime.

Welcome lighting 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) (for some grades)
- Steering Responsive Headlight (SRH) (for some grades)

A wiper interlocked headlight function is adopted to ensure visibility in the travel direction when driving in rain.

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 stereo camera recognition range

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 stereo camera. Therefore, the switching of the beam blocking range may be out of alignment with the senses of the driver.

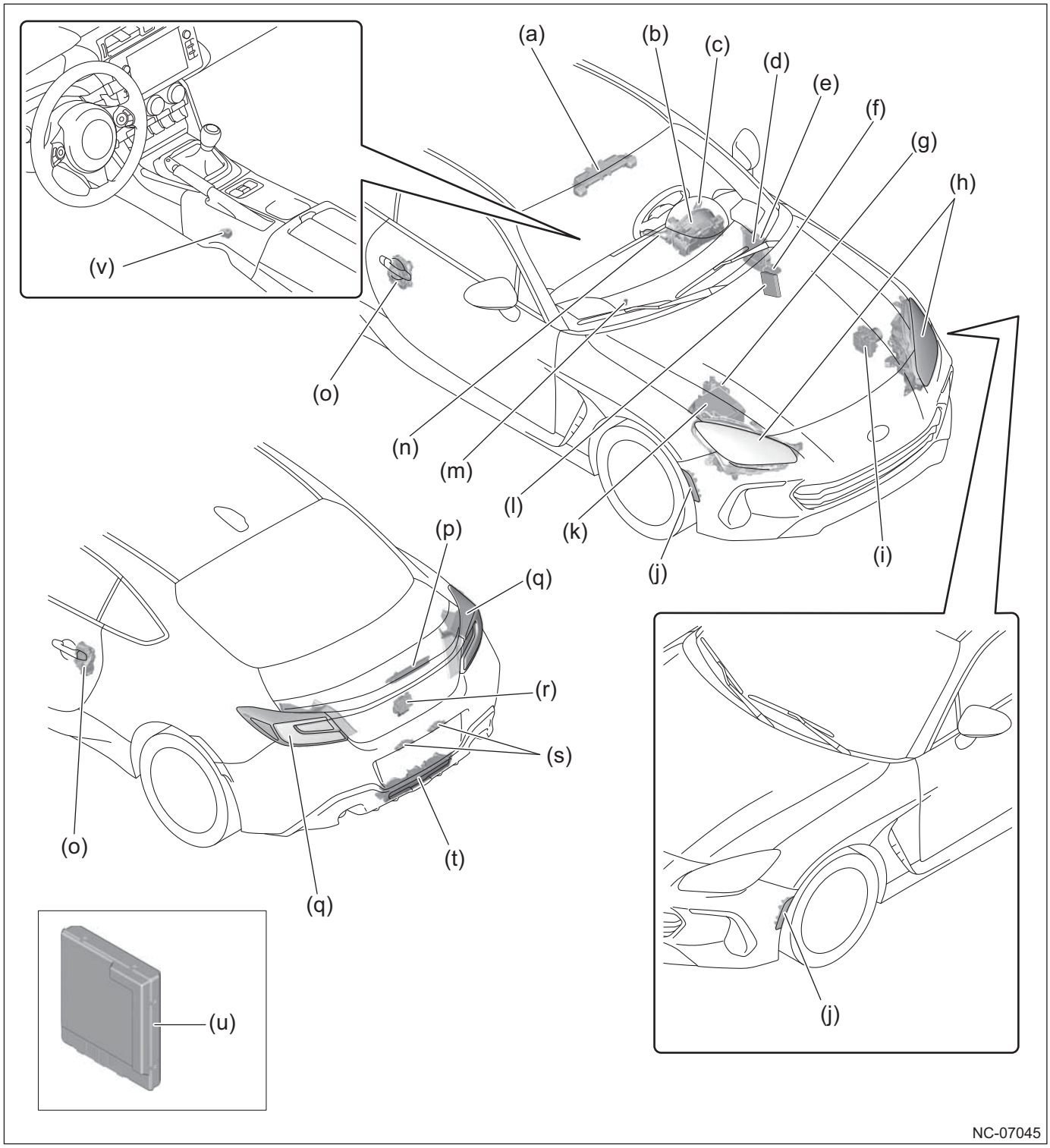
The lights of light vehicles such as a bicycle may not be detected.

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 (for some grades)

(b) Combination meter

(c) Lighting switch

(d) Body integrated unit

(e) Joint box
- Tail & illumination relay

(f) Auto headlight beam leveler CM

(g) Engine Control Module (ECM)

(h) Headlight
- Main beam (low beam/high beam)
- Parking light/Daytime Running Light (DRL)
- Front turn signal light
- Leveling actuator
- Swivel actuator (for some grades)
- LED Driver Module (LDM)

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

(j) Front side marker light/front side reflex reflector

(k) M/B (main fuse & relay box)
- Headlight relay Lo
- Headlight relay Hi
- Daytime Running Light (DRL) relay

(l) Transmission Control Module (TCM)

(m) Auto light sensor

(n) Wiper switch

(o) Latch & actuator assembly
- Door switch

(p) High-mounted stop light

(q) Rear combination light
- Tail light
- Stop light
- Rear turn signal light
- Rear side marker light
- Rear reflex reflector
- Rear side reflex reflector

(r) Trunk lid lock & switch assembly

(s) License plate light

(t) Back-up light

(u) Keyless access CM

(v) Parking brake switch

Component details

Headlight

■ Full LED headlight

A headlight is adopted that expresses the SUBARU common motif (C shape) by combining an inner lens with the vehicle name logo mark and a parking light with a Daytime Running Light (DRL) function. Also, an enlarged and expanded shape is used for the rear end for a design befitting of a sports car.

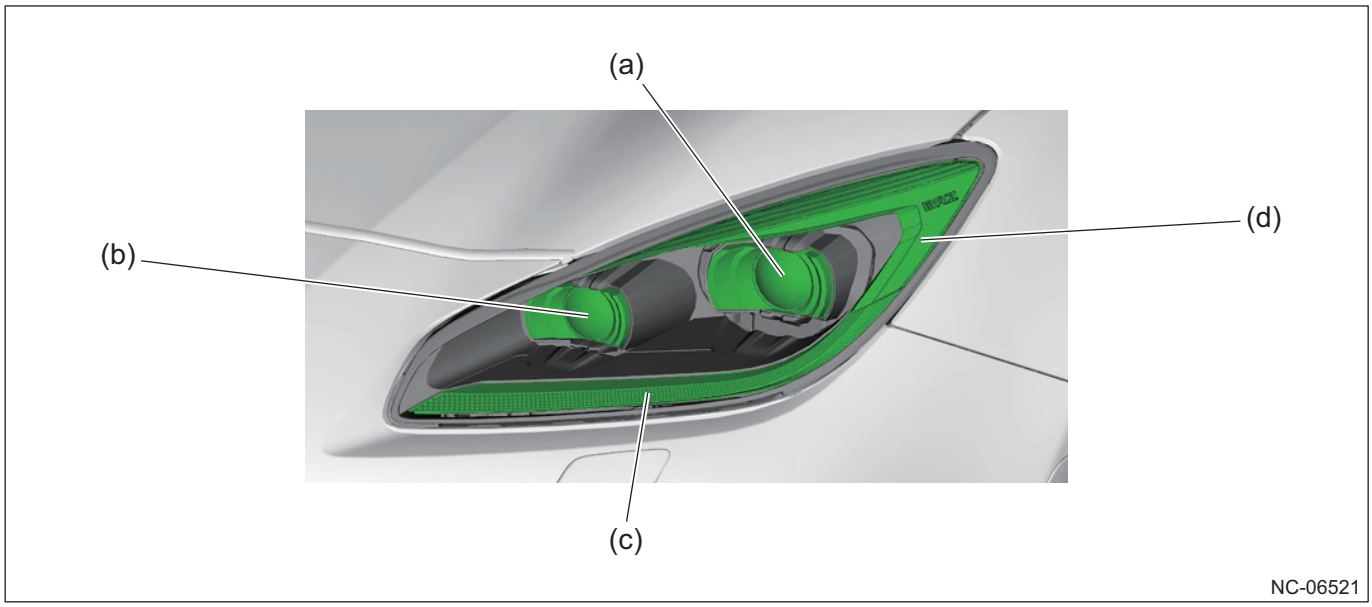
The bi-functional projector LED lights that switch between high beam and low beam with 1 light source are adopted for the main beam. The turning on of the high beam and low beam is controlled by the LED Driver Module (LDM) built into the main beam.

LED is adopted for all the light sources in the headlights to reduce power consumption.

The headlight beam leveler is adopted that adjusts the light beams automatically.

The following functions are adopted depending on the specification to improve light distribution performance.

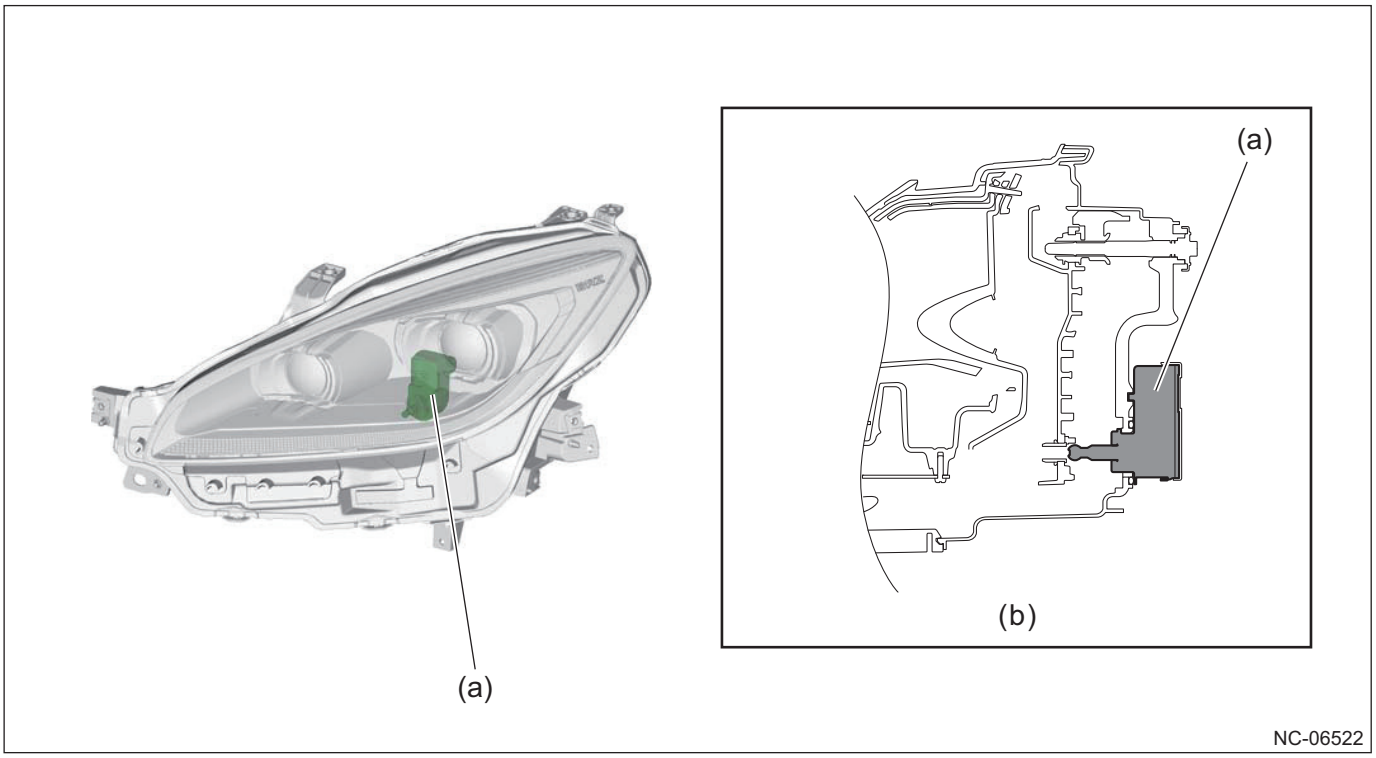
- High Beam Assist (HBA) (for some grades)
- Steering Responsive Headlight (SRH) (for some grades)



Item	Name	Specifications
(a)	Main beam (low beam/high beam)	LED
(b)	Front turn signal light	LED
(c)	Parking light/Daytime Running Light (DRL)	LED
(d)	Inner lens with vehicle name logo mark	-

■ 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.

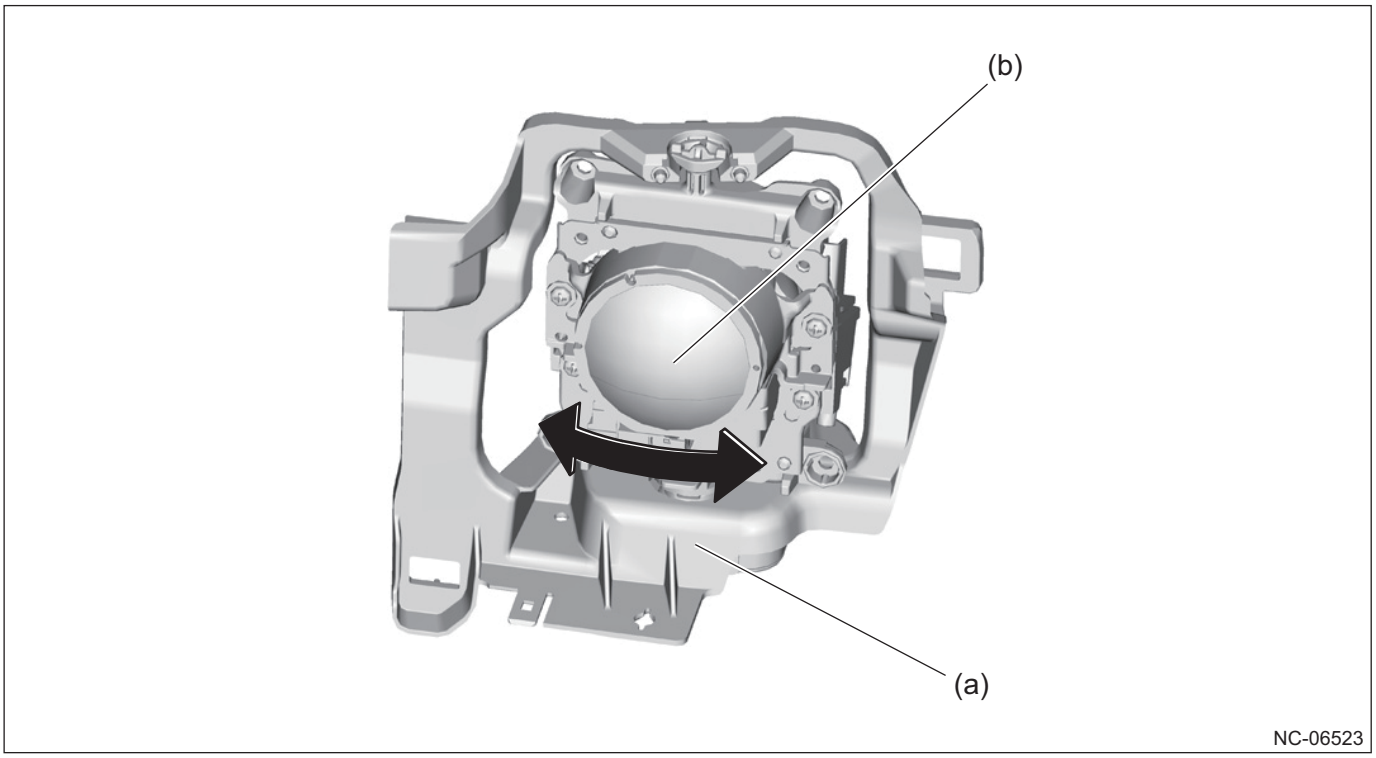


(a) Leveling actuator

(b) Headlight cross section

■ Swivel actuator (for some grades)

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.

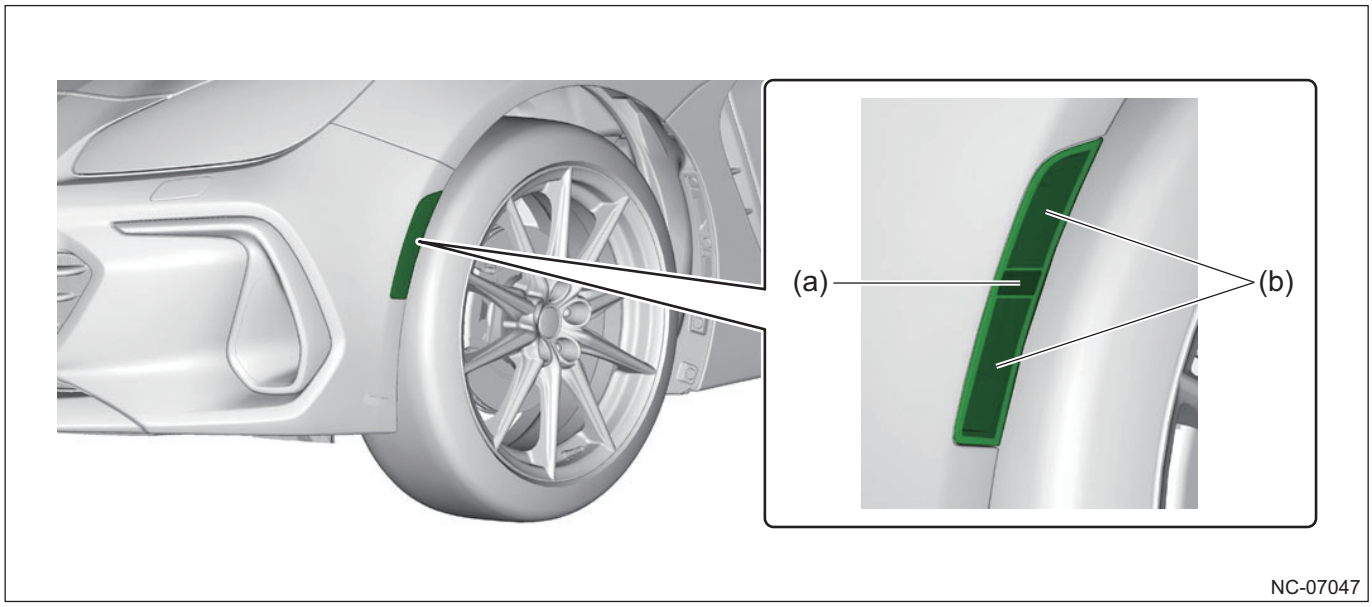


(a) Swivel actuator

(b) Main beam

Front side marker light/front side reflex reflector

The front side marker light/front side reflex reflector are positioned in the wheel arch of the front bumper. LED is adopted as the light source to lengthen the service life and reduce power consumption.



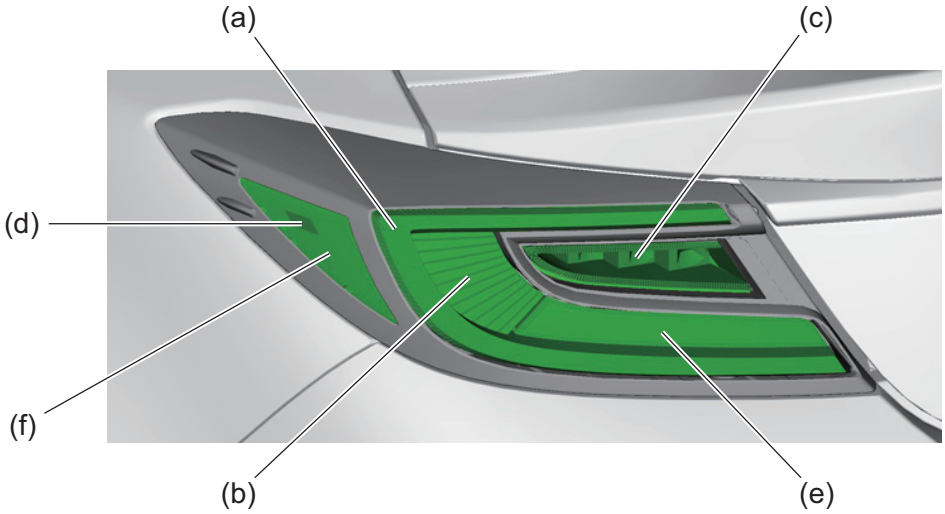
Item	Name	Specifications
(a)	Front side marker light	LED
(b)	Front side reflex reflector	-

Rear combination light

The SUBARU common motif (C shape) light guide is adopted for the tail light/stop 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 all the light sources in the rear combination lights to reduce power consumption.

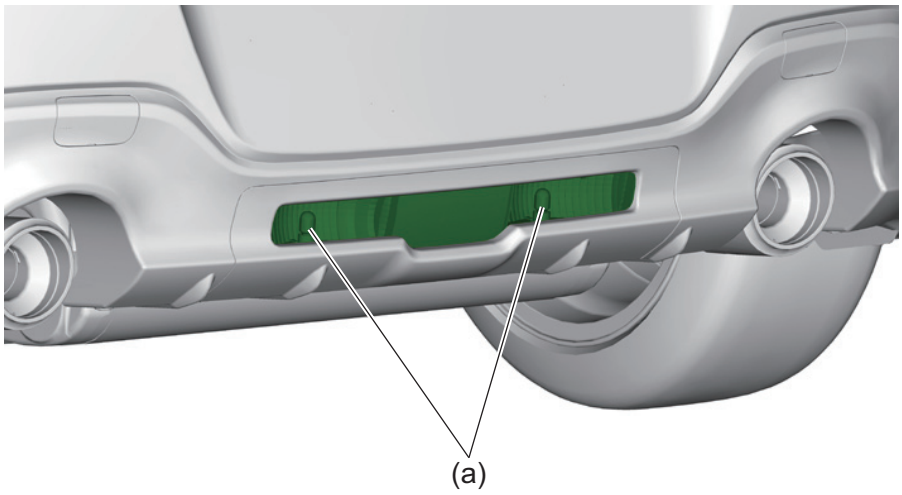


NC-07048

Item	Name	Specifications
(a)	Tail light/stop light	LED
(b)	Stop light	LED
(c)	Rear turn signal light	LED
(d)	Rear side marker light	LED
(e)	Rear reflex reflector	-
(f)	Rear side reflex reflector	-

Back-up light

The back-up light is positioned at the bumper cover center on the rear bumper lower part.



NC-07464

Item	Name	Specifications
(a)	Back-up light	12 V/16 W (W16W)

High-mounted stop light

The high-mounted stop light is positioned within the trunk garnish. LED is adopted as the light source to lengthen the service life and reduce power consumption.

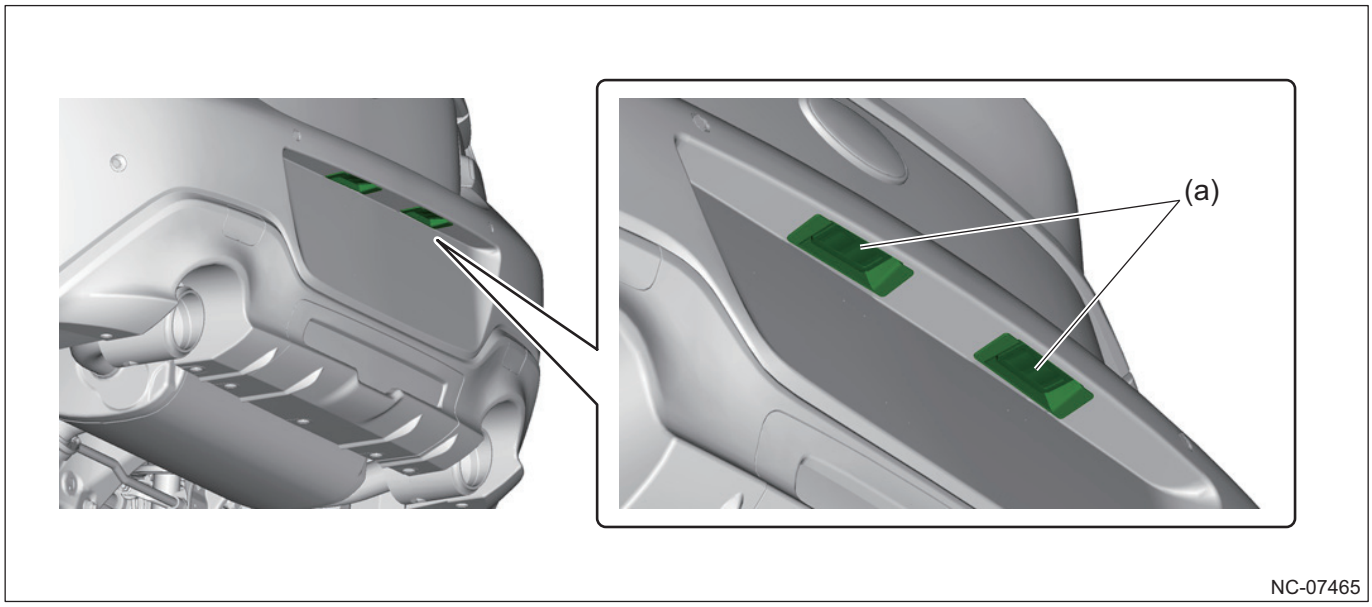


NC-06527

Item	Name	Specifications
(a)	High-mounted stop light	LED

License plate light

The license plate light is position in the rear bumper. LED is adopted as the light source to lengthen the service life and reduce power consumption.



Item	Name	Type
(a)	License plate light	LED

Lighting switch

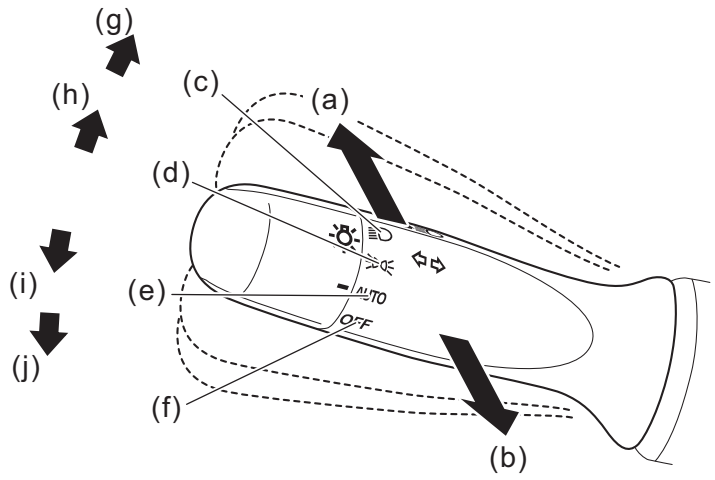
A momentary type switch is adopted for the light switch (between OFF and AUTO positions)[*1], high beam switch, passing switch, and turn signal switch. [*2]

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.*

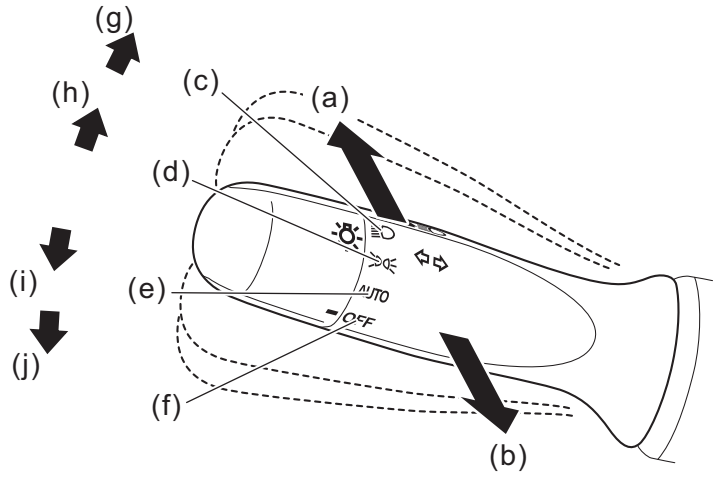
For C0



NC-07044

(a) High beam switch
(b) Passing switch
(c) Light switch (HEAD)
(d) Light switch (TAIL)
(e) Light switch (AUTO)
(f) Light switch (OFF)
(g) Turn signal switch (right side level 2)
(h) Turn signal switch (right side level 1)
(i) Turn signal switch (left side level 1)
(j) Turn signal switch (left side level 2)

Other than C0



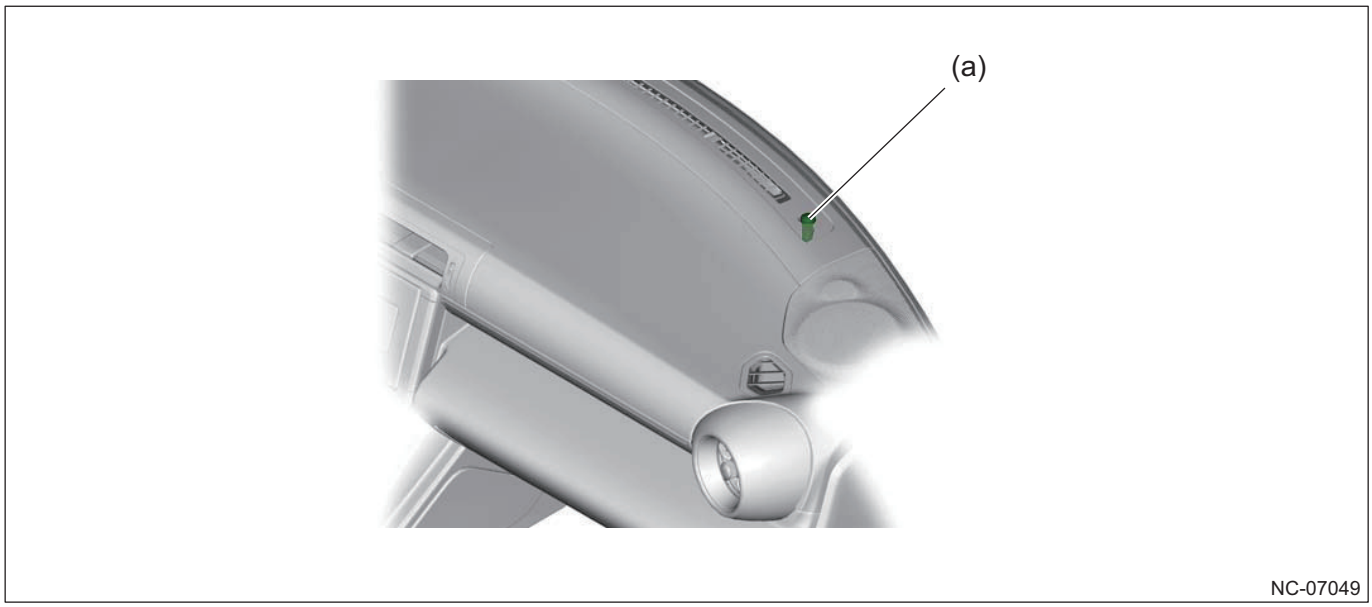
NC-07043

(a) High beam switch
(b) Passing switch
(c) Light switch (HEAD)
(d) Light switch (TAIL)
(e) Light switch (AUTO)
(f) Light switch (OFF)
(g) Turn signal switch (right side level 2)
(h) Turn signal switch (right side level 1)
(i) Turn signal switch (left side level 1)
(j) Turn signal switch (left side level 2)

Auto light sensor

The auto light sensor is positioned on the right side of the front defroster at the top of the instrument panel.

The illuminance around the own vehicle is detected by the scanner (integrated optical sensor), and the auto light function is controlled according to the frequency signal.

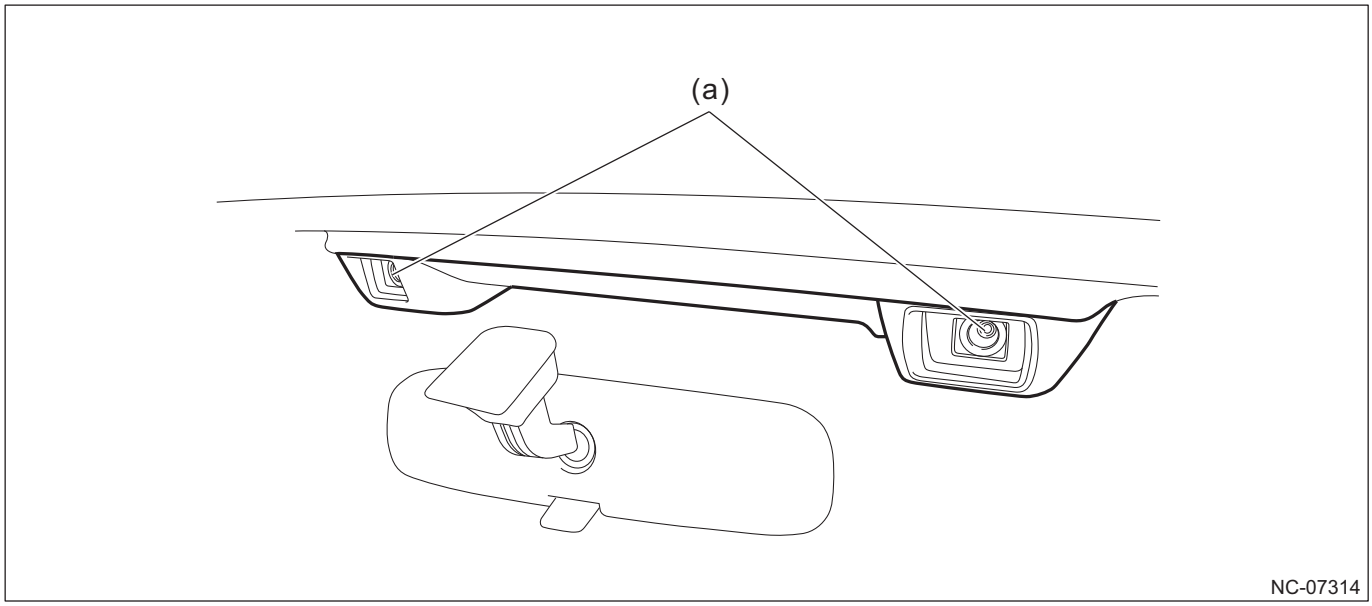


(a) Auto light sensor

Stereo camera (for some grades)

The stereo camera detects light sources emitted by preceding vehicles, oncoming vehicles, and street lights, etc.

Turning on/off the high beam is automatically controlled according to the conditions in front of the vehicle based on image information from the stereo camera.



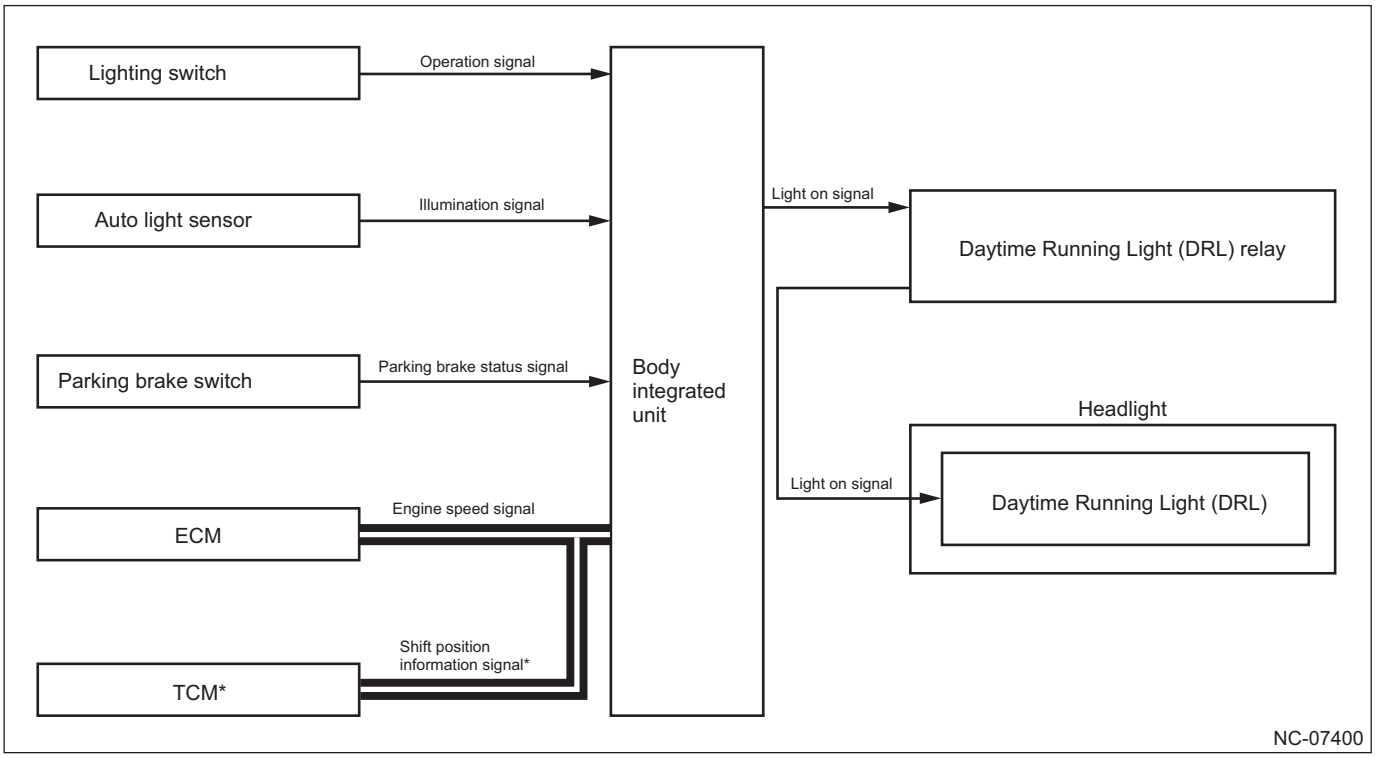
(a) Camera

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.

System diagram



*: AT

Main component functions

Component	Function
Body integrated unit	Receives signals from the units, sensors, and switches, and controls the Daytime Running Light (DRL) function.
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	Sends the parking brake status signal to the body integrated unit.
Engine Control Module (ECM)	Sends the engine speed signal to the body integrated unit via CAN communication.
Transmission Control Module (TCM)*	Sends the shift position information signal to the body integrated unit via CAN communication.
Daytime Running Light (DRL) relay	Receives the light on signal from the body integrated unit and controls the on/off of the Daytime Running Light (DRL).
Daytime Running Light (DRL)	Turns on during Daytime Running Light (DRL) operation.

*: AT

Operating conditions

The Daytime Running Light (DRL) turns on when all the following conditions are satisfied.

- Engine switch 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)
- Wiper interlocked headlight function is not operating
- Parking brake is released
- Shift position in other than P*
- Driving is possible (engine speed is 500 rpm or higher)

*: AT

Reference

When a turn signal light is operated while the Daytime Running Light (DRL) is on, the Daytime Running Light (DRL) turns off on the side with the flashing turn signal light.

Customization function

It is possible to customize Daytime Running Light (DRL) function ON/OFF at the dealer using the Subaru Select Monitor 4. (The factory setting is ON.)

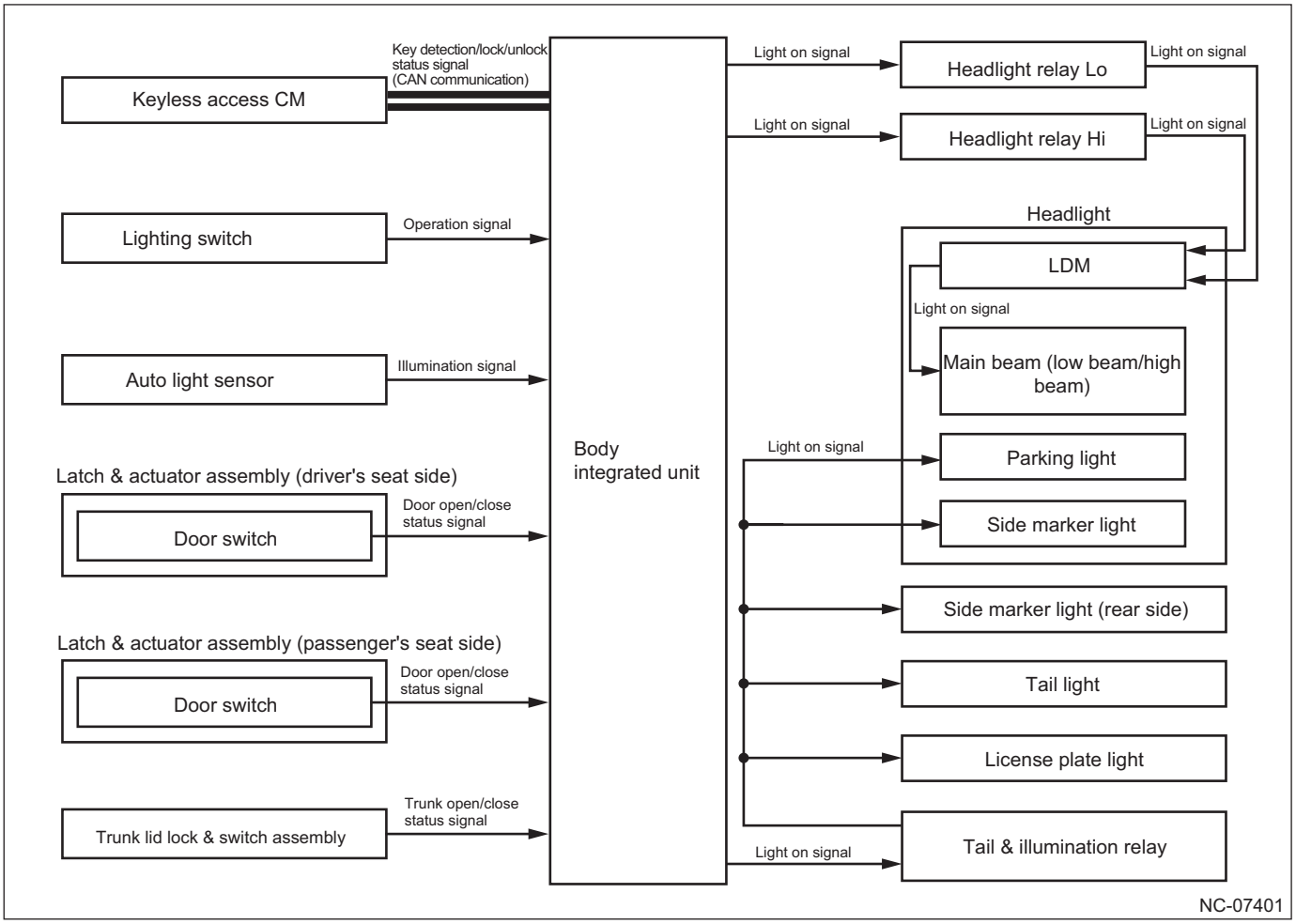
Hint

Cannot be customized for C0.

Welcome lighting

The headlight, side marker light, parking light, tail light, and license plate light are turned on or off when entering or exiting the vehicle.

System diagram



Main component functions

Component	Function
Body integrated unit	Receives signals from the units, sensors, and switches, and controls the welcome lighting function.
Keyless access CM	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.
Latch & actuator assembly (driver's seat side) • Door switch	Sends the open/close status signal for the driver's door to the body integrated unit.
Latch & actuator assembly (passenger's seat side) • Door switch	Sends the open/close status signal for the passenger's seat door to the body integrated unit.
Trunk lid lock & switch assembly	Sends the open/close status signal for the trunk to the body integrated unit.
Headlight relay Lo	Receives the light on signal from the body integrated unit and sends the signal to the LED Driver Module (LDM).
Headlight relay Hi	
LED Driver Module (LDM)	Receives the light on signal from the body integrated unit and controls the on/off of the main beam (low beam/high beam).
Tail & illumination relay	Receives the light on signal from the body integrated unit and controls the on/off of the side marker light, parking light, tail light, and license plate light.
Main beam (low beam/high beam)	Turns on during the welcome lighting operation.
Side marker light	
Parking light	
Tail light	
License plate light	

Operation when entering

Lighting condition	When all the following conditions are satisfied and the doors are unlocked with the access key or Remote Service*, the headlight, parking light, side marker light, tail light, and license plate light turn on for approximately 30 seconds. • Engine switch 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 access key, touch sensor, central door lock switch, or Remote Service*
	When the engine switch is turned ON

**: For details on Remote Service, refer to the telematics system.*

Operation when exiting

Lighting condition	When the engine switch is turned OFF while the lighting switch is in the AUTO position and the headlight is turned on, the headlight, parking light, side marker light, tail light, and license plate light turn on for approximately 30 seconds.
Lighting-off conditions after turned on	When approximately 30 seconds have elapsed with the headlight turned on and all the doors and the trunk closed
	When the doors are locked using the access key, touch sensor, central door lock switch, or Remote Service*

**: For details on Remote Service, refer to the telematics system.*

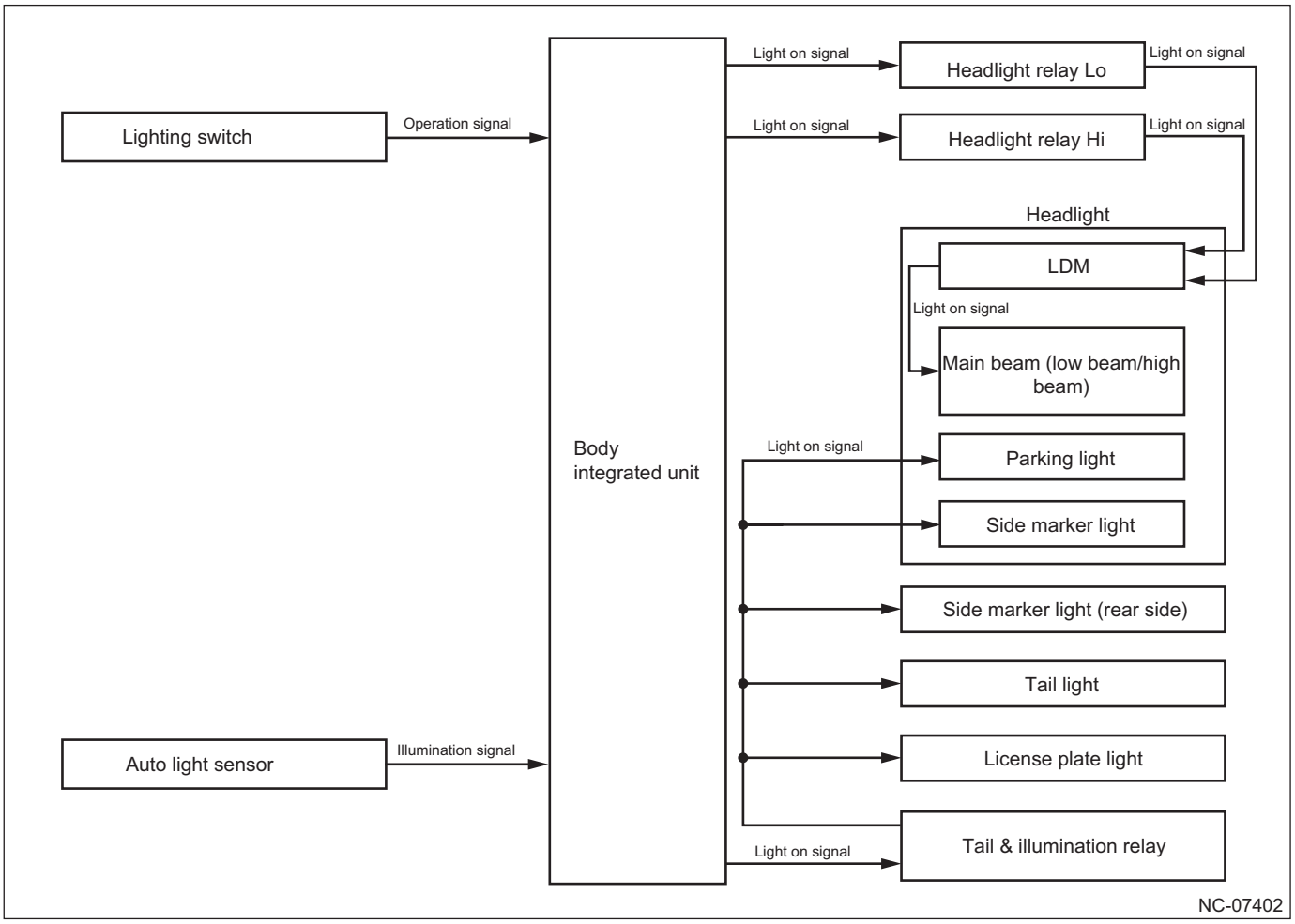
Customization function

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 (CID). (The factory setting is 30 seconds.)

Auto light

The surrounding brightness is determined by the auto light sensor installed at the top of the instrument panel. When the surroundings darken, the main beam (low beam/high beam), side marker light, parking light, tail light, and license plate light automatically turn on.

System diagram



Main component functions

Component	Function
Body integrated unit	Receives signals from the units, sensors, and switches, and controls the auto light function.
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.
Headlight relay Lo	Receives the light on signal from the body integrated unit and sends the signal to the LED Driver Module (LDM).
Headlight relay Hi	
LED Driver Module (LDM)	Receives the light on signal from the body integrated unit and controls the on/off of the main beam (low beam/high beam).
Tail & illumination relay	Receives the light on signal from the body integrated unit and controls the on/off of the side marker light, parking light, tail light, and license plate light.
Main beam (low beam/high beam)	Turns on during the auto light operation.
Side marker light	
Parking light	
Tail light	
License plate light	

Basic operations and operating conditions

When the lighting 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), side marker light, parking light, tail 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.

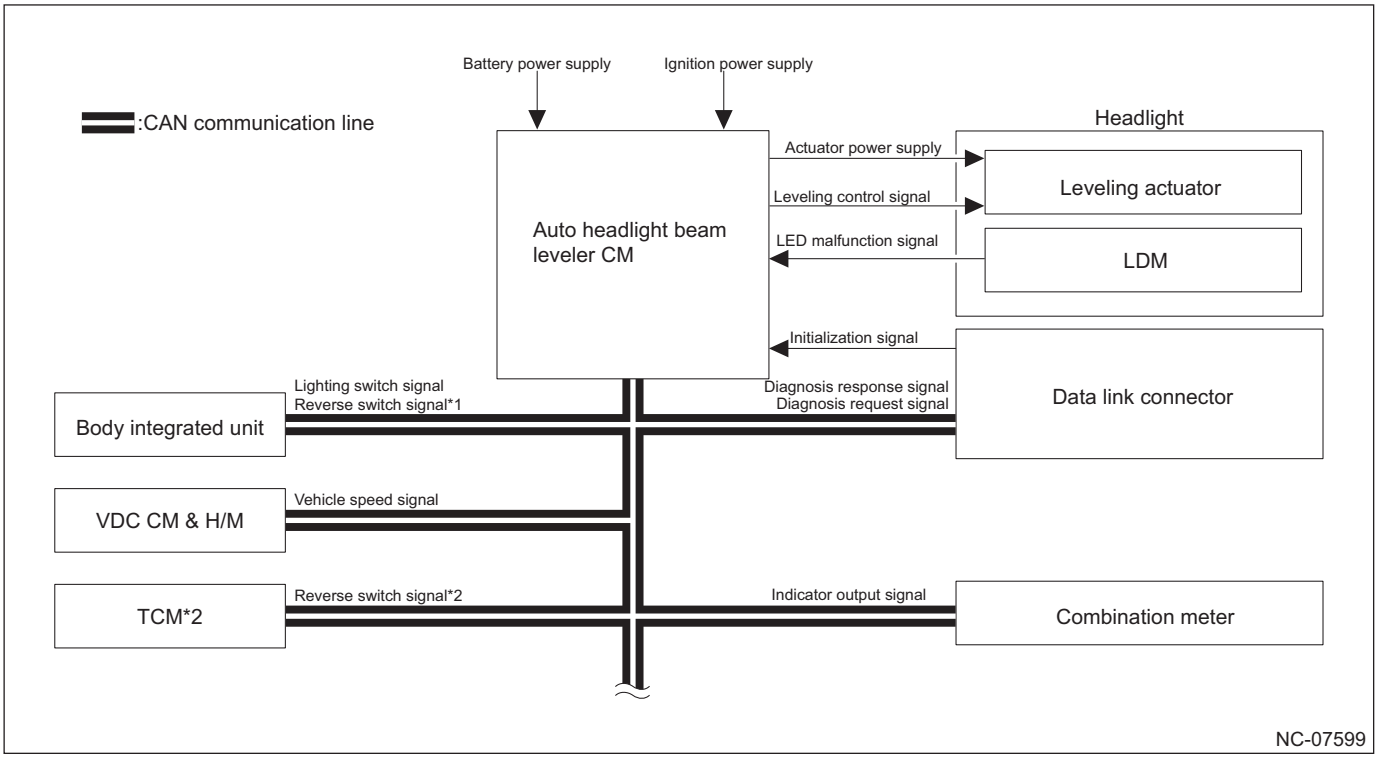
Customization function

It is possible to customize the turn on timing of the auto light by selecting from among five stages at the dealer using the Subaru Select Monitor 4 or by using the Center Information Display (CID). (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: AT*

Main component functions

Component	Function
Auto headlight beam leveler CM	• Supplies power to the leveling actuator. • 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. • When a malfunction signal from the LED Driver Module (LDM) in the headlight 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 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. *2
Leveling actuator	Receives the drive control signal from the auto headlight beam leveler CM and adjusts the headlight beams.
LED Driver Module (LDM)	Sends the malfunction signal to the auto headlight beam leveler CM when an anomaly is detected in the system.
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.
Data link connector	• Sends the initialization information to the auto headlight beam leveler CM. For details on initialization, refer to the service manual. • The diagnosis information can be read. For details on diagnosis, refer to the service manual.

**1: MT*
**2: AT*

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.

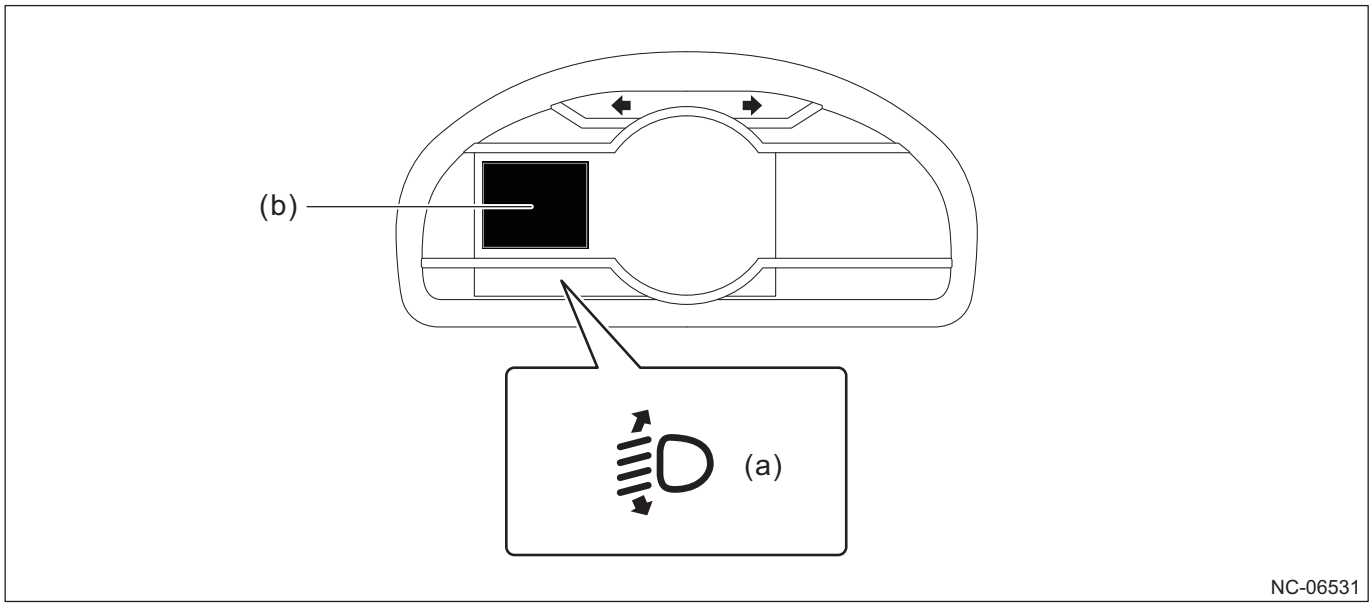
If there is a threshold value or more of difference from the currently recognized vehicle posture, the leveling actuator is driven.

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 warning indicator and warning message for the headlight beam leveler in the combination meter when an anomaly is detected in the system.



(a) Headlight beam leveler warning indicator

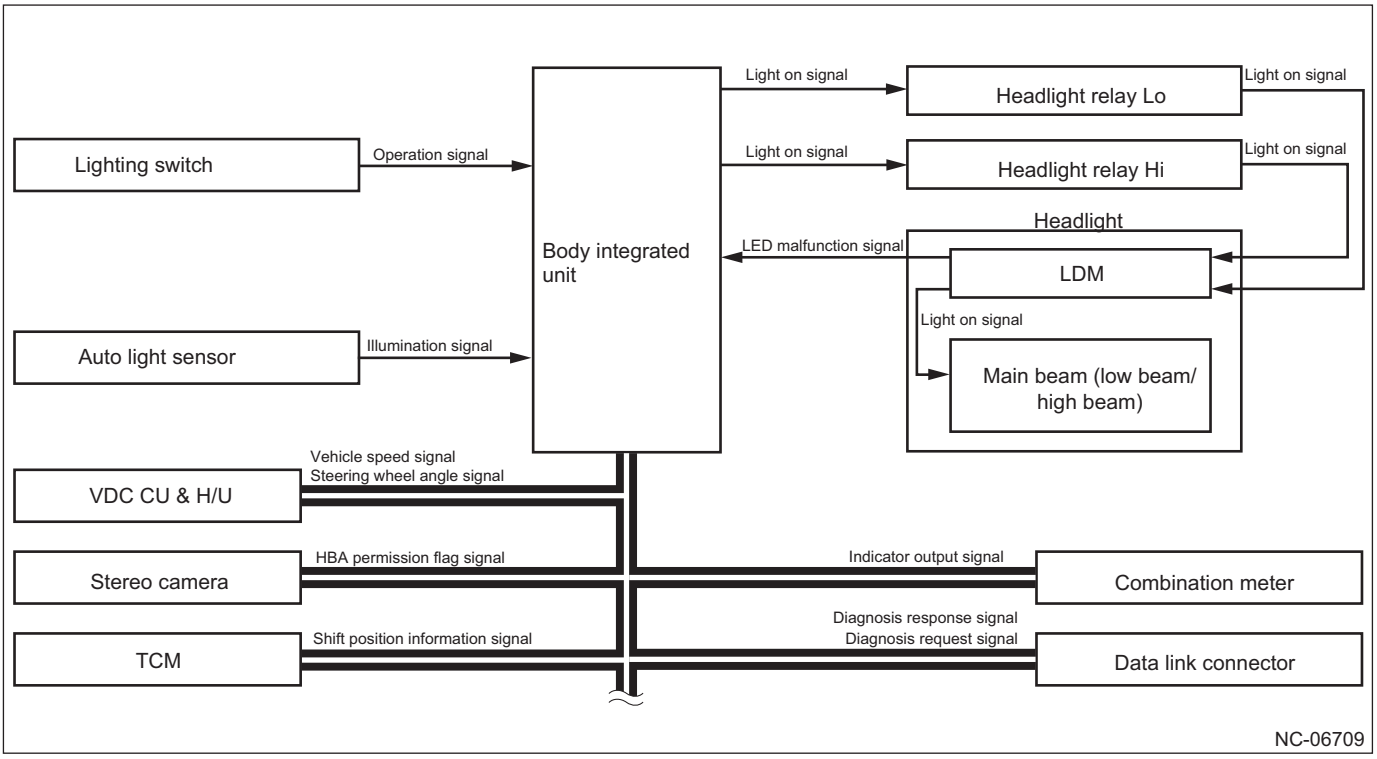
(b) Headlight beam leveler warning message

High Beam Assist (HBA) (for some grades)

Light sources of a preceding vehicle in front of the vehicle, oncoming vehicles, street lights, etc. are detected by the EyeSight stereo camera, and the headlight is switched automatically between high beam and low 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

System diagram



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 a malfunction signal from the LED Driver Module (LDM) in the headlight is detected, sends the indicator off signal to the combination meter via CAN communication.
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)	Sends the reverse switch signal to the auto headlight beam leveler CM via CAN communication.
Stereo camera	Sends the High Beam Assist (HBA) permission signal based on identification information for preceding vehicles, oncoming vehicles, street lights, etc., obtained by image processing to the body integrated unit via CAN communication.
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.
Headlight relay Lo	Receives the light on signal from the body integrated unit and sends the signal to the LED Driver Module (LDM).
Headlight relay Hi	
LED Driver Module (LDM)	• Receives the light on signal from the body integrated unit and controls the switching of the main beam (low beam/high beam). • Sends the malfunction signal to the body integrated unit when an anomaly is detected in the system.
Main beam (low beam/high beam)	Switches between low beam and high beam.
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.
Data link connector	The diagnosis information can be read. For details on diagnosis, refer to the service manual.

Operating conditions and basic operations

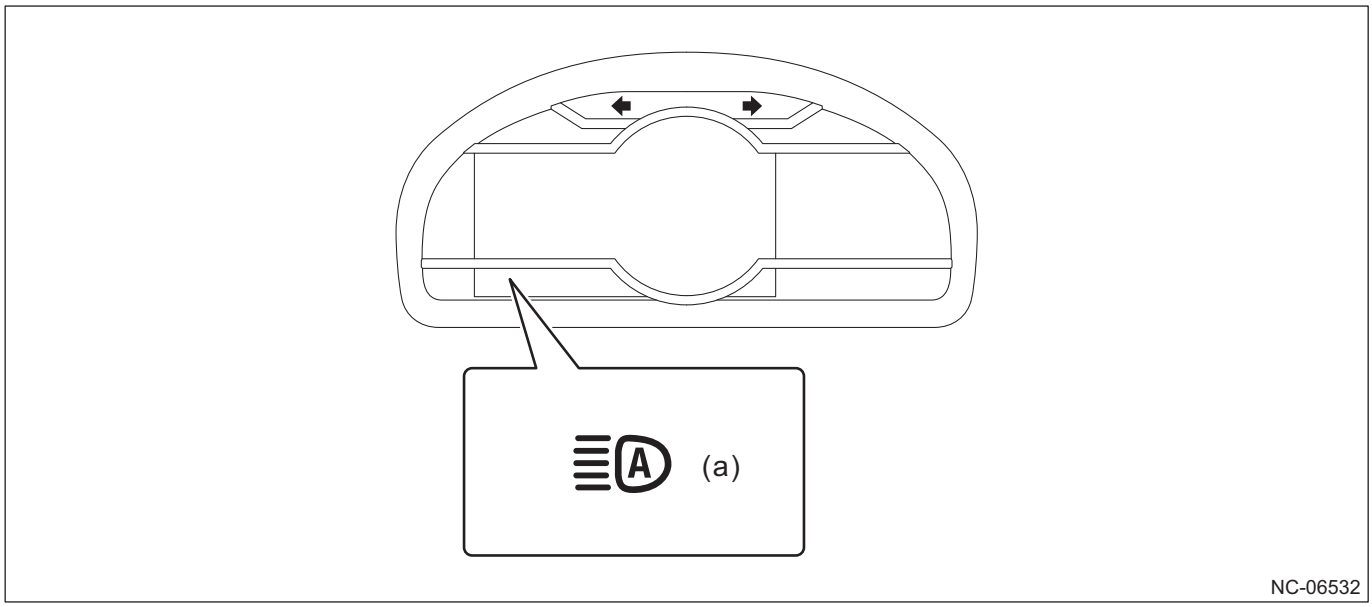
■ Operability conditions

When the following conditions are satisfied, High Beam Assist (HBA) becomes ready for operation, and the operation indicator is displayed in the combination meter.

- The lighting switch is AUTO and the headlight turns on.
- The high beam switch is ON.

Reference

When the body integrated unit or stereo camera detects a system malfunction, High Beam Assist (HBA) control is stopped and the operation indicator is turned off.

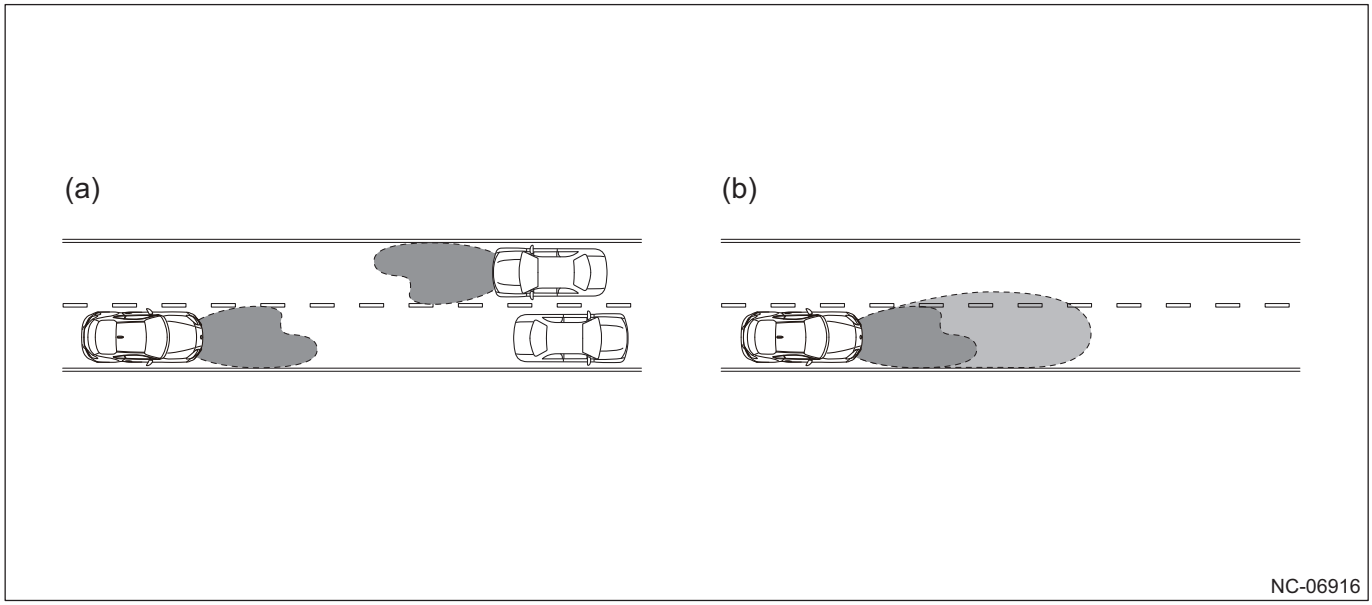


(a) Operation indicator

■ Basic operation

The EyeSight stereo camera 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.

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 • 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 EyeSight is paused
High beam on	• When vehicle speed is approximately 20 MPH (32 km/h) or more • 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

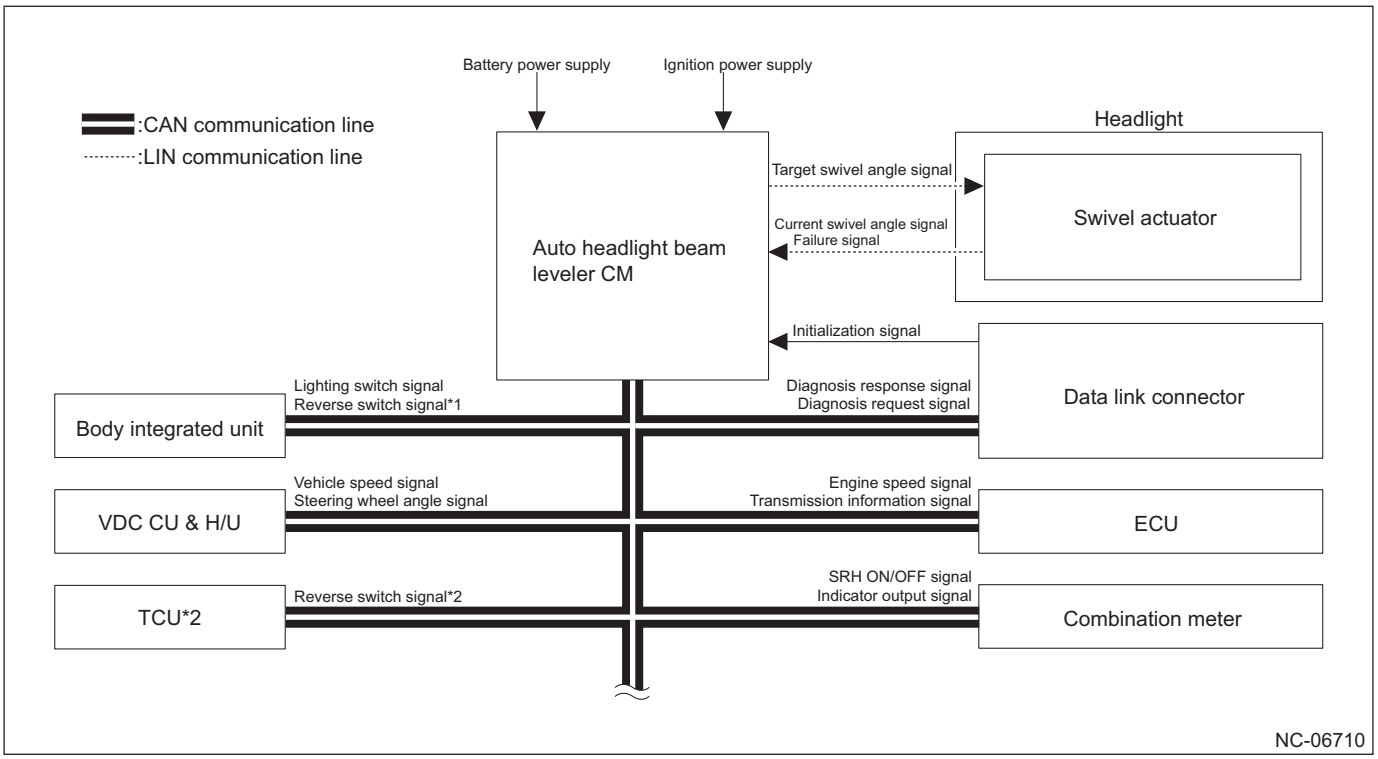
Customization function

It is possible to customize High Beam Assist (HBA) ON/OFF at the dealer using the Subaru Select Monitor 4. (The factory setting is ON.)

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 corners and intersections are changed according to the curve to improve the visibility of the traveling direction.

System diagram



**1: MT*
**2: AT*

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. *2
Engine Control Module (ECM)	Sends the engine speed signal and transmission information signal to the auto headlight beam leveler CM via CAN communication.
Swivel actuator	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 Steering Responsive Headlight (SRH) warning in the combination meter. • Sends the Steering Responsive Headlight (SRH) ON/OFF signal based on the setting screen operation in the combination meter to the auto headlight beam leveler CM via CAN communication. • Displays SRH OFF according to the OFF setting operation of the Steering Responsive Headlight (SRH).
Data link connector	• Sends the initialization information to the auto headlight beam leveler CM. For details on initialization, refer to the service manual. • The diagnosis information can be read. For details on diagnosis, refer to the service manual.

**1: MT*
**2: AT*

Operating conditions

The Steering Responsive Headlight (SRH) operates under the following conditions.

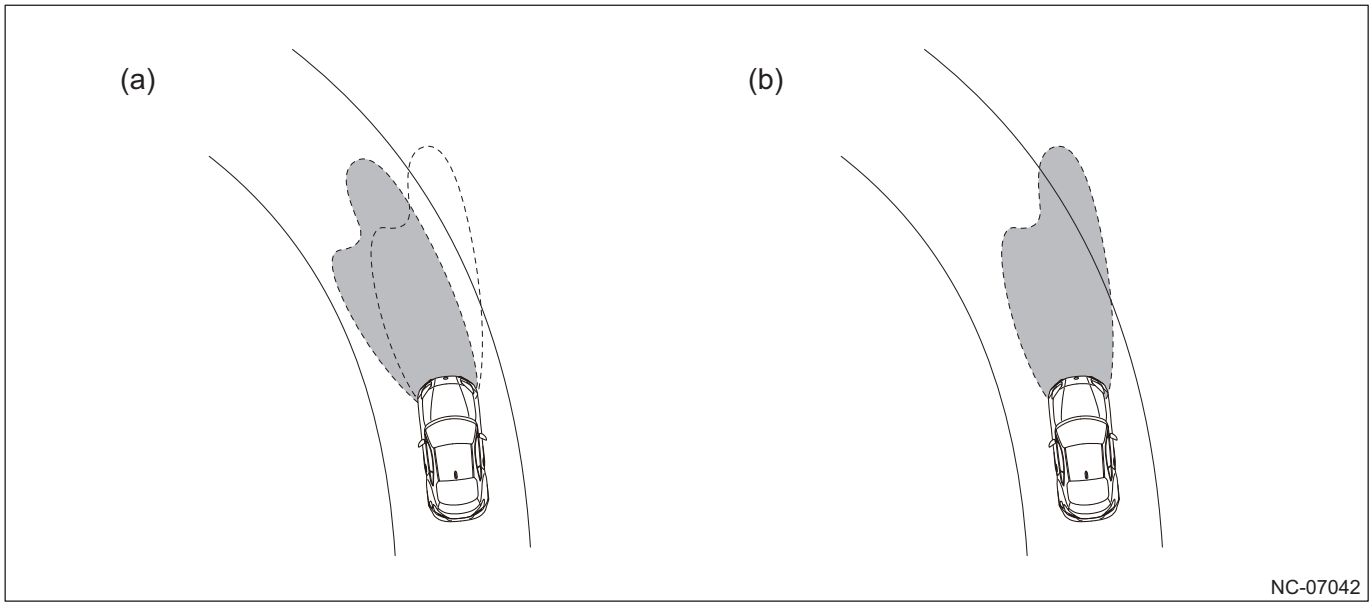
- When the vehicle is driving forward
- When vehicle speed is approximately 5 MPH (8 km/h) or more
- After initialization is complete
- When the SRH OFF indicator light is turned off

When the engine is started at a vehicle speed of 0 MPH (0 km/h), Steering Responsive Headlight (SRH) executes initialization. When initialized, the headlight beams move left and right.

Basic operation

The illumination direction of the headlight beams is adjusted by moving the swivel actuator installed in the headlights.

Operation image

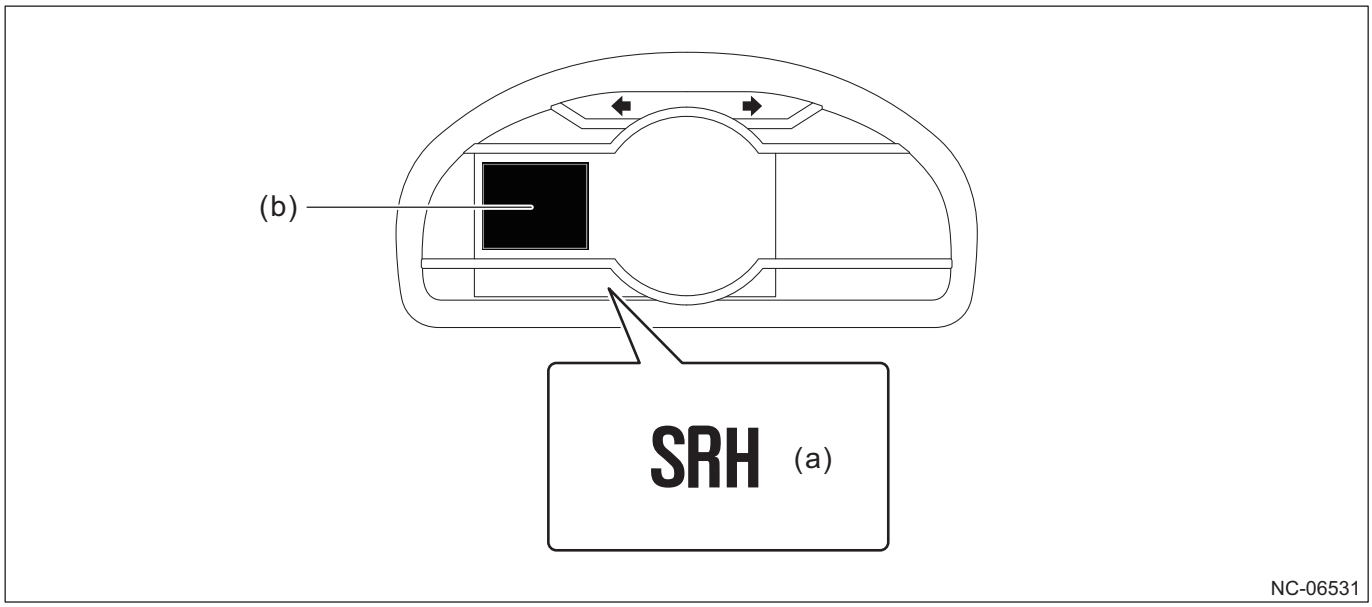


(a) When Steering Responsive Headlight (SRH) ON

(b) When Steering Responsive Headlight (SRH) OFF

System malfunction warning function

The warning indicator and warning message for the Steering Responsive Headlight (SRH) are displayed in the combination meter when an anomaly is detected in the system.

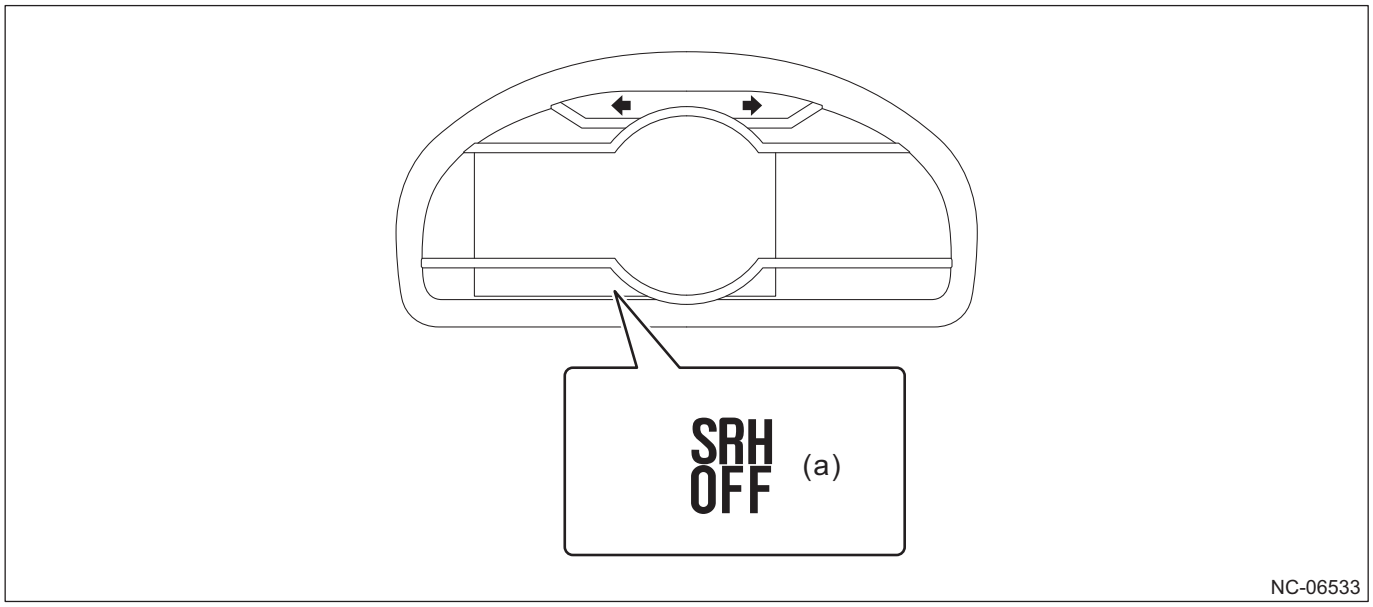


(a) Steering Responsive Headlight (SRH) warning indicator

(b) Steering Responsive Headlight (SRH) warning message

Customization function

Turning ON/OFF the Steering Responsive Headlight (SRH) can be set by the car settings screen in the combination meter. When set to OFF, the SRH OFF operation indicator is displayed in the combination meter.



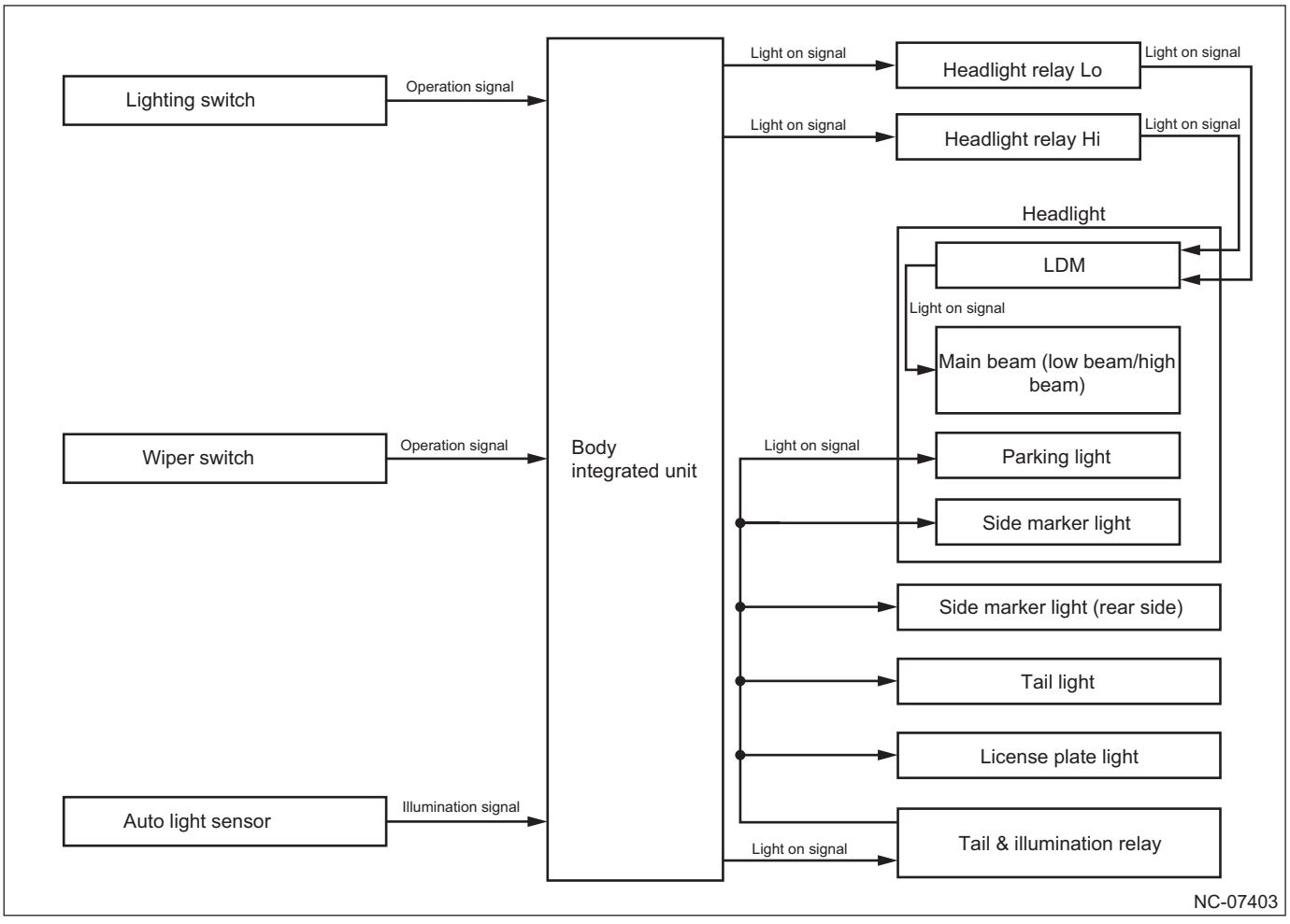
(a) SRH OFF operation indicator

Wiper interlocked headlight

When the wiper operates approximately 10 seconds 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



Main component functions

Component	Function
Body integrated unit	Receives signals from the units, sensors, and switches, and controls the wiper interlocked headlight function.
Lighting switch	Sends the switch operation signal to the body integrated unit.
Wiper 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.
Headlight relay Lo	Receives the light on signal from the body integrated unit and sends the signal to the LED Driver Module (LDM).
Headlight relay Hi	
LED Driver Module (LDM)	Receives the light on signal from the body integrated unit and controls the on/off of the main beam (low beam/high beam).
Tail & illumination relay	Receives the light on signal from the body integrated unit and controls the on/off of the parking light, side marker light, tail light, and license plate light.
Main beam (low beam/high beam)	Turns on during the wiper interlocked headlight operation.
Side marker light	
Parking light	
Tail light	
License plate light	

Operating conditions

When the lighting switch is in the AUTO position with the engine switch 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.

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. (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 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 when 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.

When the driver forgets to turn off the lights, the auto light function is prioritized and operates, and when the lighting switch is ON again after the lights turn off, the light reminder warning operates.

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 on the car settings screen in the combination meter. (The factory setting is ON.)

9.4 Wiper and Washer System

9.4.1 Overview

Overview

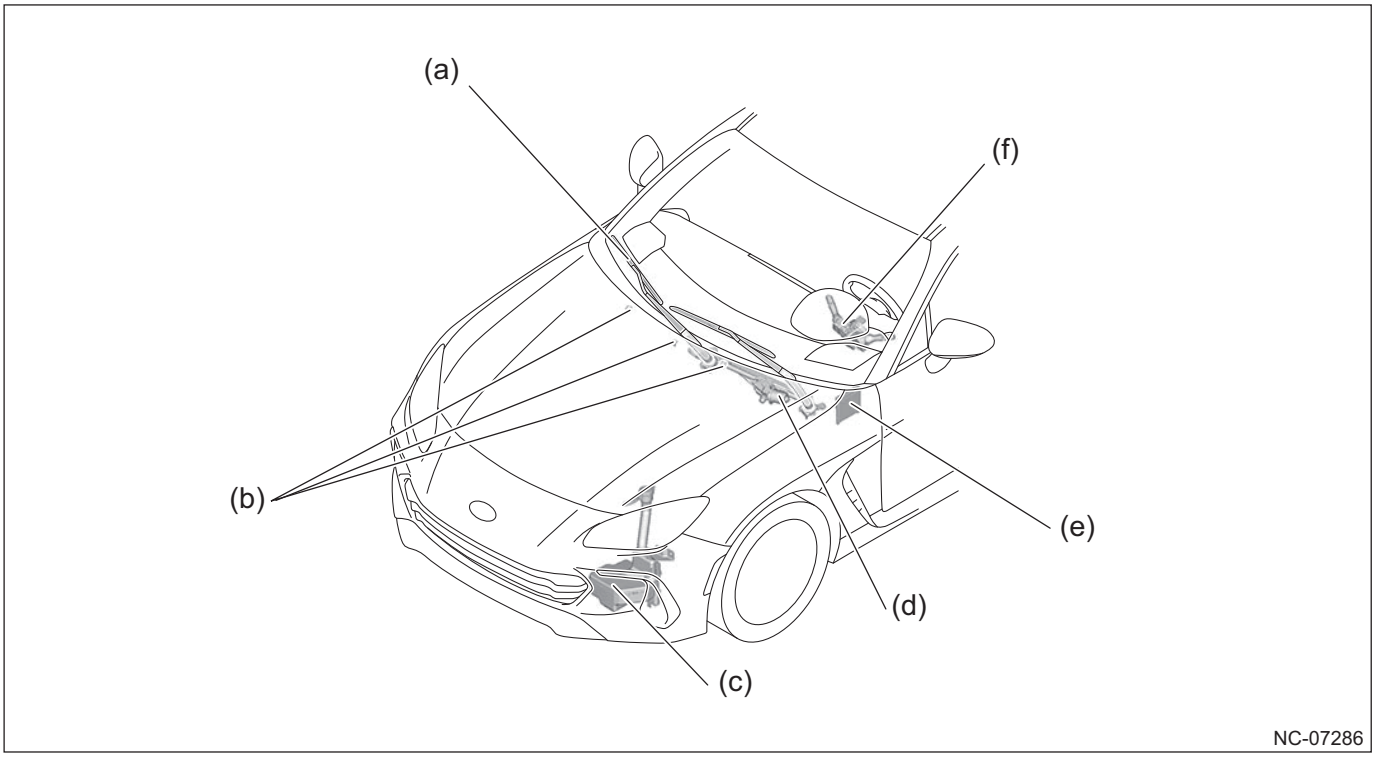
The arm assembly windshield wiper and blade assembly windshield wiper is positioned on the hood lower side to reduce wind noise.

The high-pressure pump with strong jet force is adopted for the washer system.

1 front washer nozzle is added to the vehicle center to enlarge the washer fluid contact range.

9.4.2 Component

Component layout drawing



(a) Arm assembly windshield wiper and blade assembly windshield wiper

(b) Nozzle windshield washer

(c) Washer tank assembly

(d) Motor assembly windshield wiper

(e) Body Integrated Unit (BIU)

(f) Switch assembly combination wiper

Component details

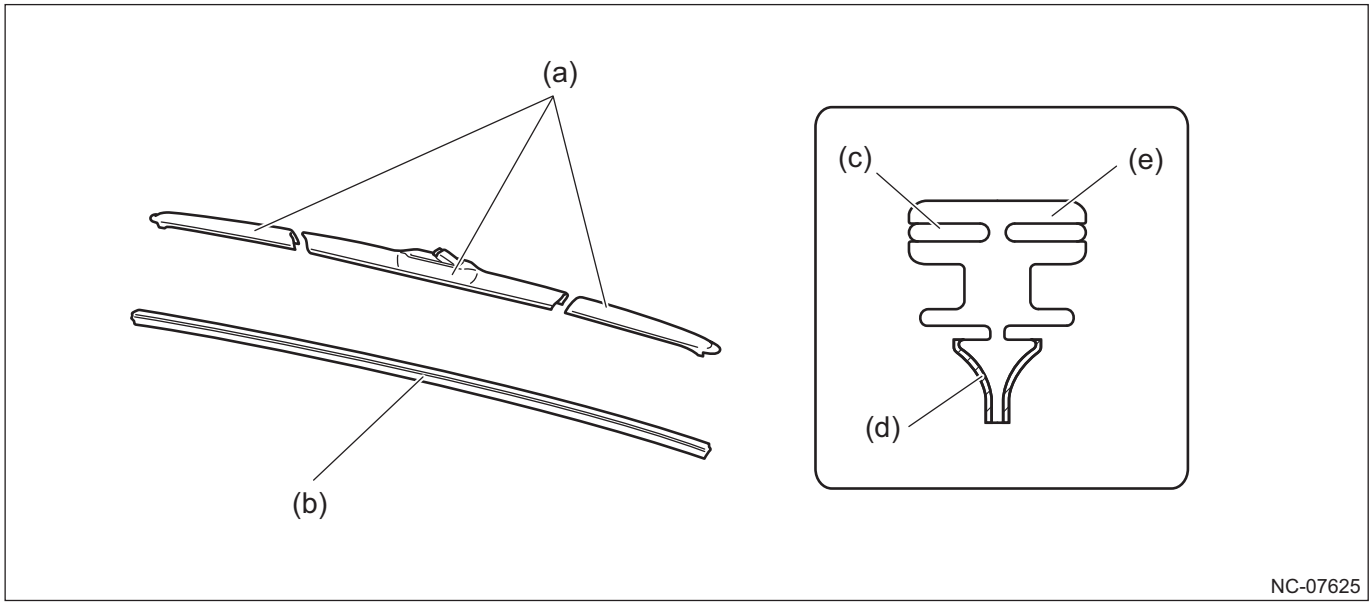
Wiper

■ Wiper blade

The length of the front wiper blade is set to 21.7 in (550 mm) on the driver's seat side and 19.7 in (500 mm) on the passenger's seat side to enlarge the wiping area and ensure excellent forward visibility.

Resin is adopted for the entire front wiper blade to reduce weight and improve the appearance through a sharp exterior with a high-quality feel.

The blade rubber surface is coated with graphite to reduce the impact noise when the blade reverses direction and lengthen the service life.

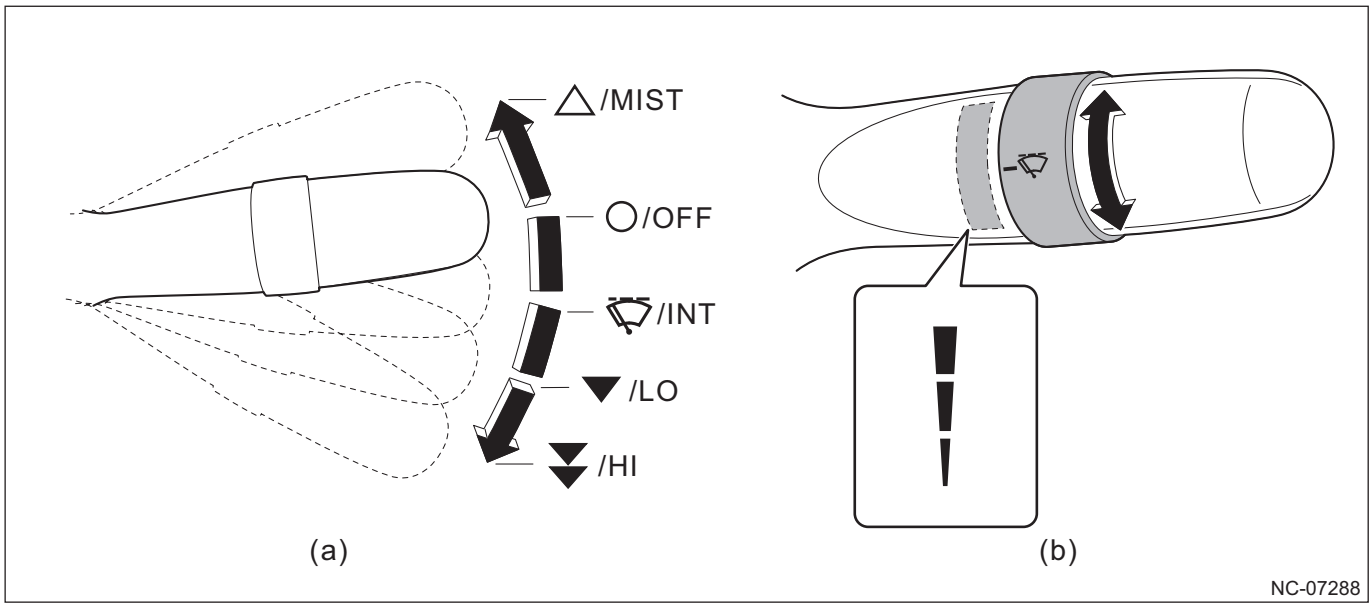


(a) Resin blade
(b) Graphite coated rubber
(c) Backing plate
(d) Graphite coating
(e) Blade rubber

■ Front wiper control switch

▮ Vehicle speed sensitive windshield wiper mode

When the engine 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 off position automatically. When the switch assembly combination wiper is set to INT, the wiper operates intermittently depending on the vehicle speed. While the intermittent windshield wiper operates, the wiper operation interval can be adjusted to four stages by switching sensitivity volume.

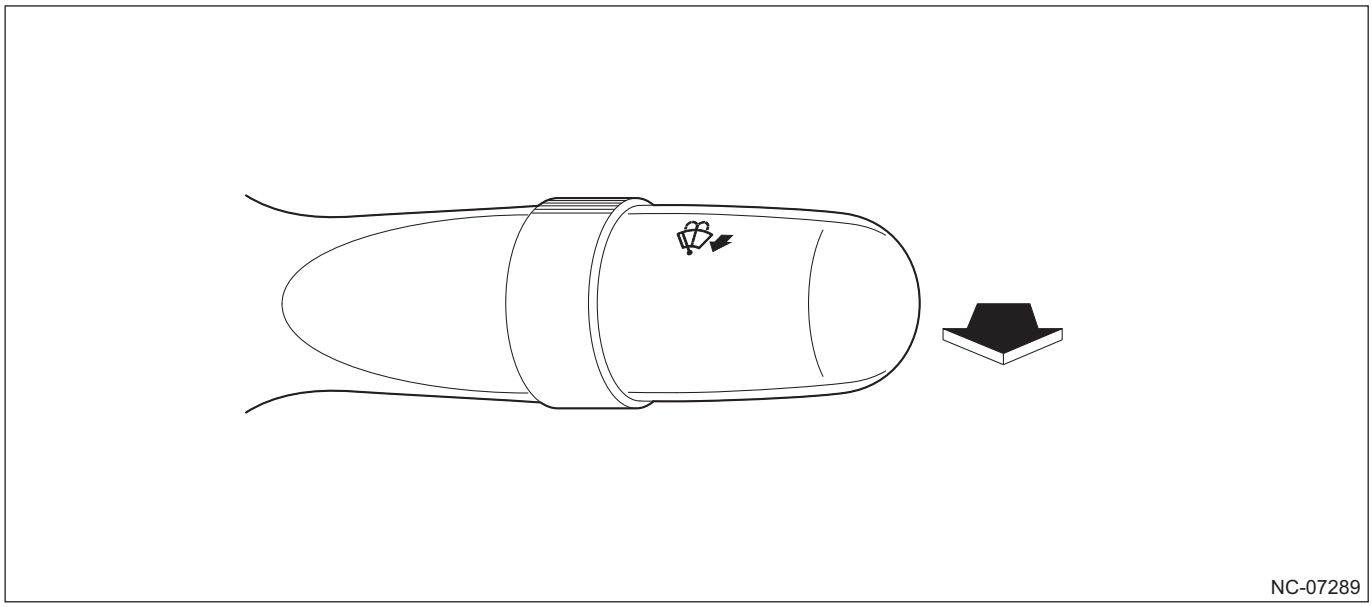


(a) Switch assembly combination wiper

(b) Sensitivity volume

■ Front washer switch

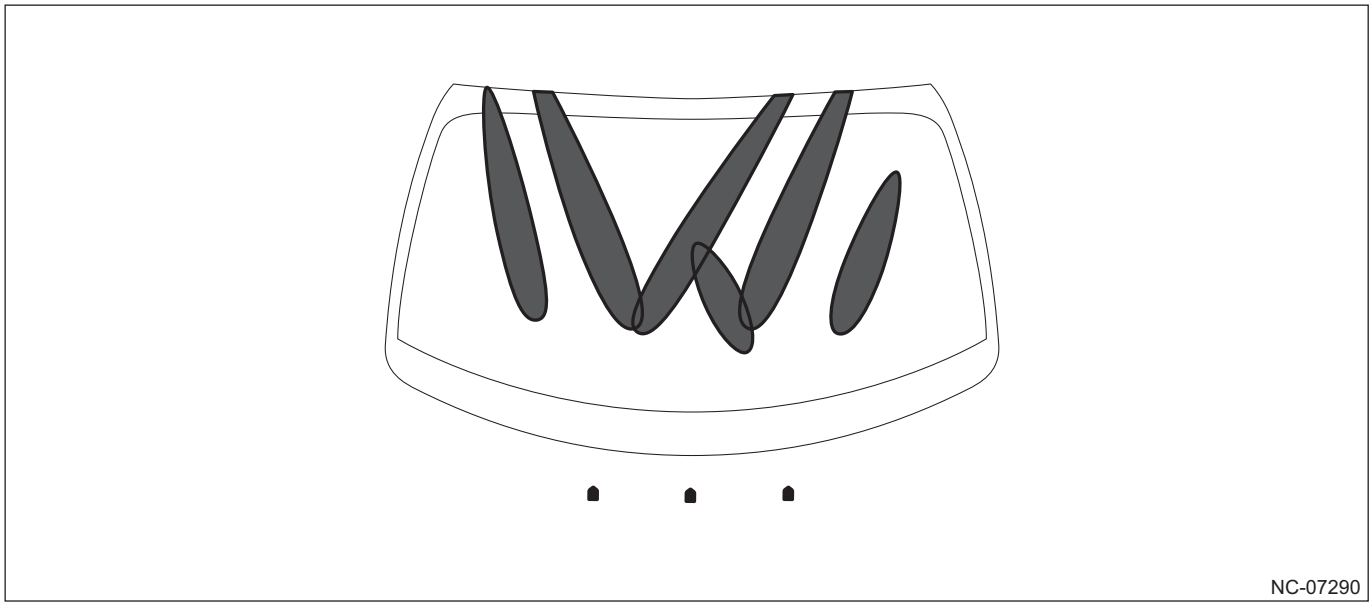
The front washer operates by pulling the switch assembly combination wiper toward the driver side. The front washer stops by returning the switch to the original position. In addition, when the Body Integrated Unit (BIU) receives the signal of the front washer switch ON, the front wiper operates in cooperation with the washer after the delay time (300 ms) has elapsed.



Washer

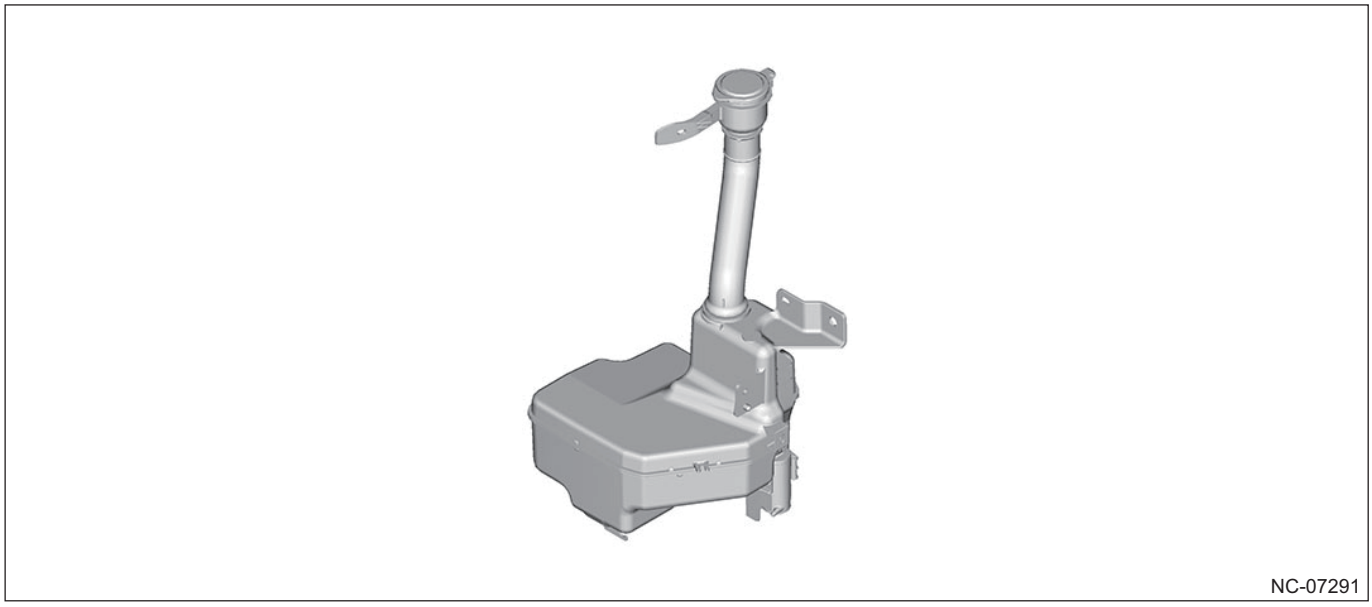
■ Nozzle windshield washer

One nozzle windshield washer is added to the vehicle center to make a total of 3 nozzles. This enlarges the washer fluid contact range to improve washability. This also ensures visibility in adverse weather.



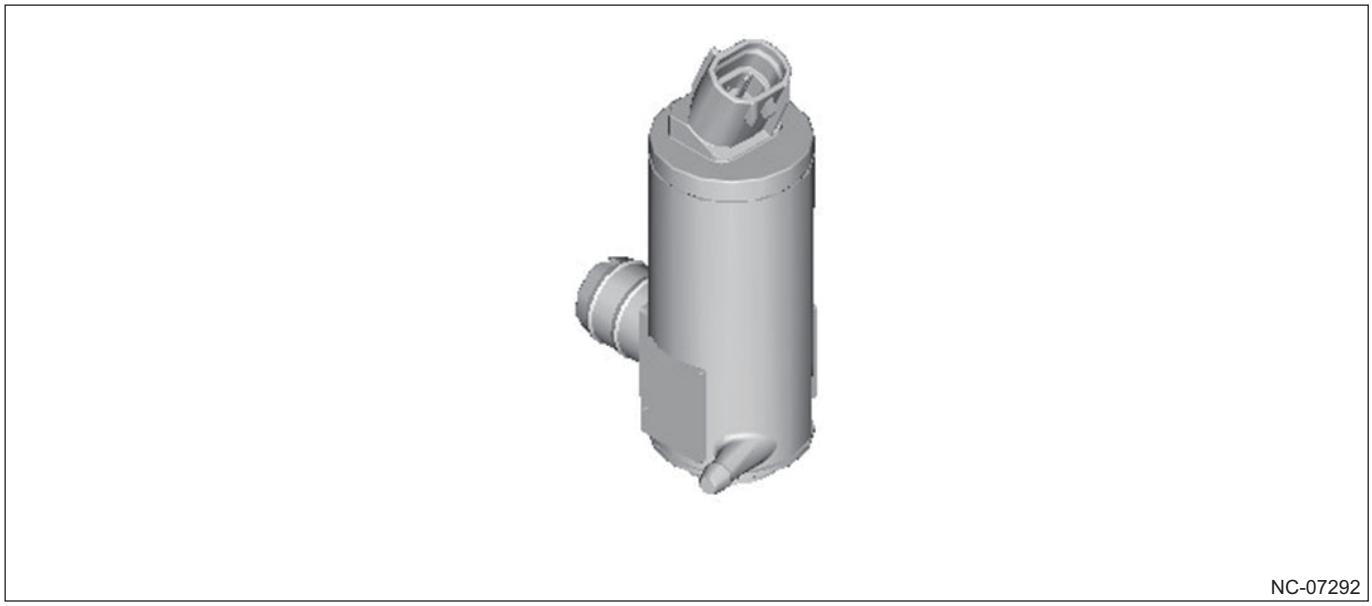
■ Washer tank assembly

The washer tank assembly with a capacity of 4.3 US qt (4.1 L, 3.6 Imp qt) is adopted.



■ Motor pump assembly washer

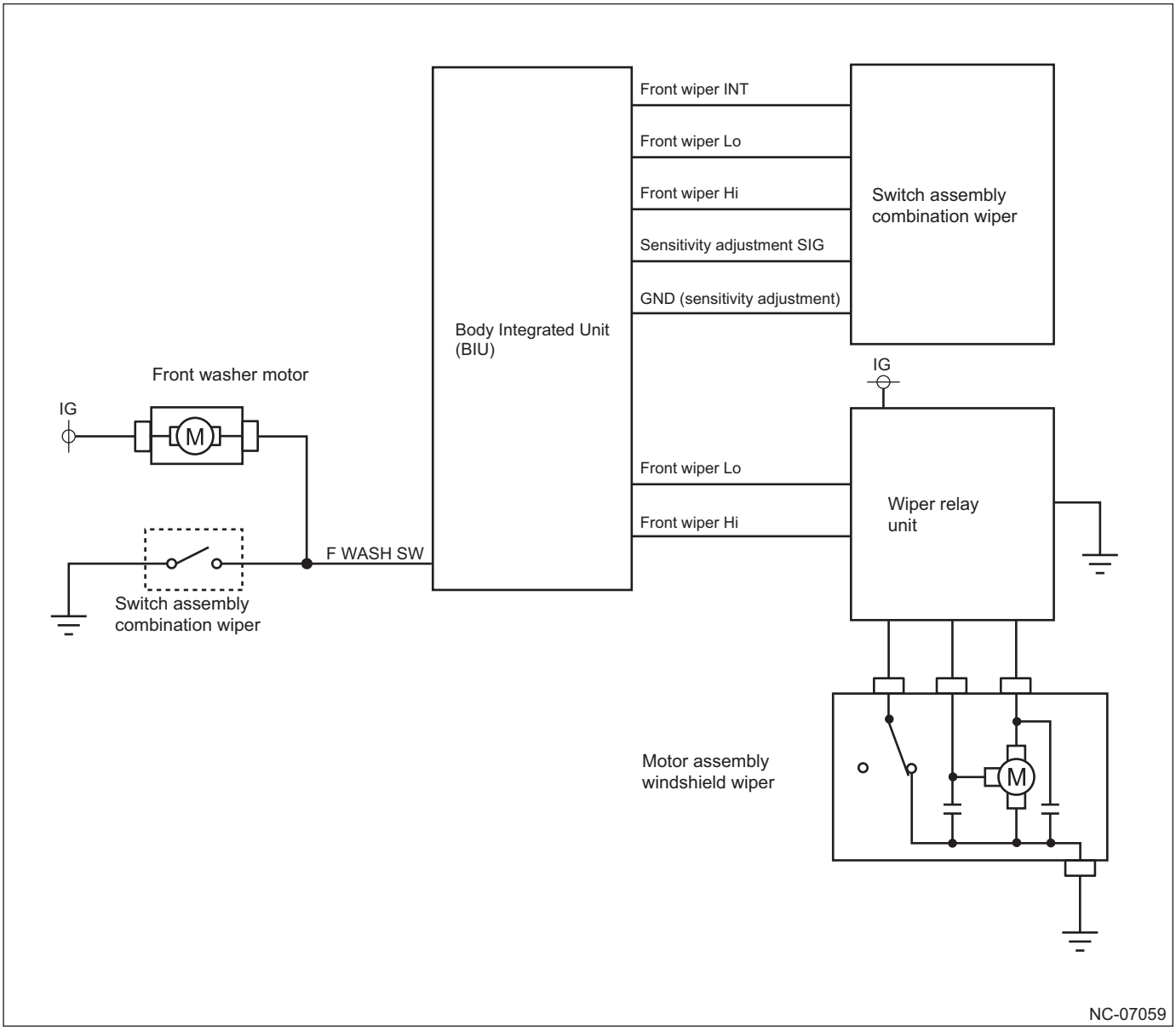
The high-pressure pump with strong jet force for washer fluid is adopted to improve washability.



9.4.3 Construction and Operation

System diagram

Front wiper and washer system



Main component functions

Name	Function and construction
Arm assembly windshield wiper and blade assembly windshield wiper	Operates by being driven by the motor assembly windshield wiper.
Motor assembly windshield wiper	Operates according to the signal from the wiper relay unit, 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 nozzle windshield washer.
Nozzle windshield washer	Sprays the washer fluid.
Washer tank assembly	A container for the washer fluid used to wash dirt from the windshield glass.
Body Integrated Unit (BIU)	Receives various signals and sends signals to the wiper relay unit.
Wiper relay unit	Receives the signal from the Body Integrated Unit (BIU) and sends the signal to the motor assembly windshield wiper.
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.

System details

Front wiper

■ Vehicle speed sensitive windshield wiper

The intermittent operation of the front wiper is controlled by the Body Integrated Unit (BIU), which controls intermittent stopping time according to vehicle speed signals sent from the VDC control module and hydraulic control module (VDC CM & H/M).

Also, when the intermittent windshield wiper operates, the wiper operation interval can be adjusted to four stages by switching the sensitivity volume.

9.5 Glass/Windows/Mirrors

9.5.1 Overview

Overview

Glass

- Glass with a UV cut function is adopted for each pane of glass.
- In addition to the UV cut function, an IR cut function is added to the windshield glass.
- Partition glass is adopted to reduce blind spots and improve visibility.

Window

- Power window with the automatic opening and closing function is adopted for all seats.
- The X arm type is adopted for the front regulator.
- The off-delay function is adopted for windows with the automatic opening and closing function, allowing window operation for a certain period even after the engine is turned OFF.
- In addition to the pinch prevention function, the snag prevention function is adopted as a safety function for the power windows to improve safety.

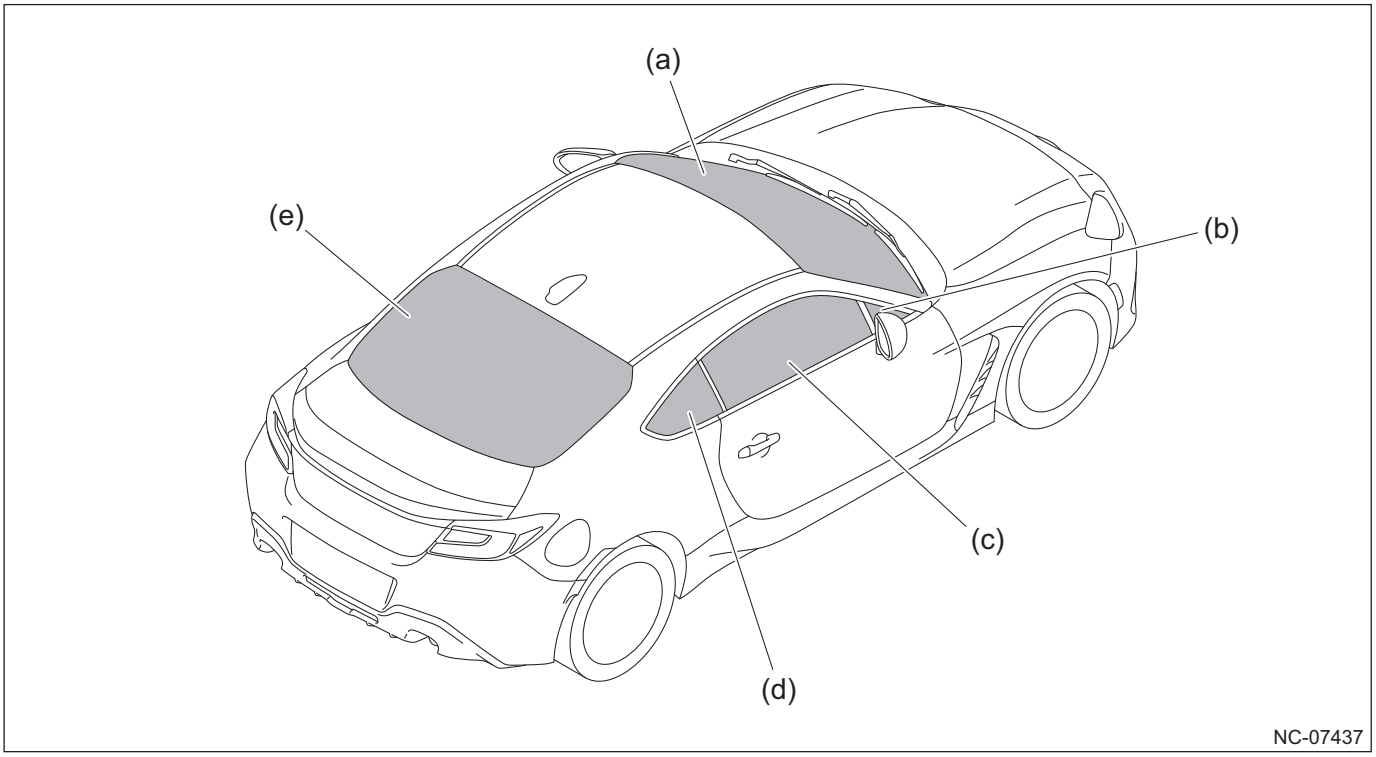
Mirror

- A new design is adopted for the outer mirror to improve aerodynamic performance.
- The door mirror shape and position are optimized to prevent blocking of the field of view, improving visibility from the triangular window.
- A mirror heater system is adopted to defrost and defog the mirror, improving visibility. (Models with mirror heater)
- The BSD/RCTA approach indicator light is located inside the mirror body of the door mirror so that the visual line of the driver moves less. (for some grades)

9.5.2 Component

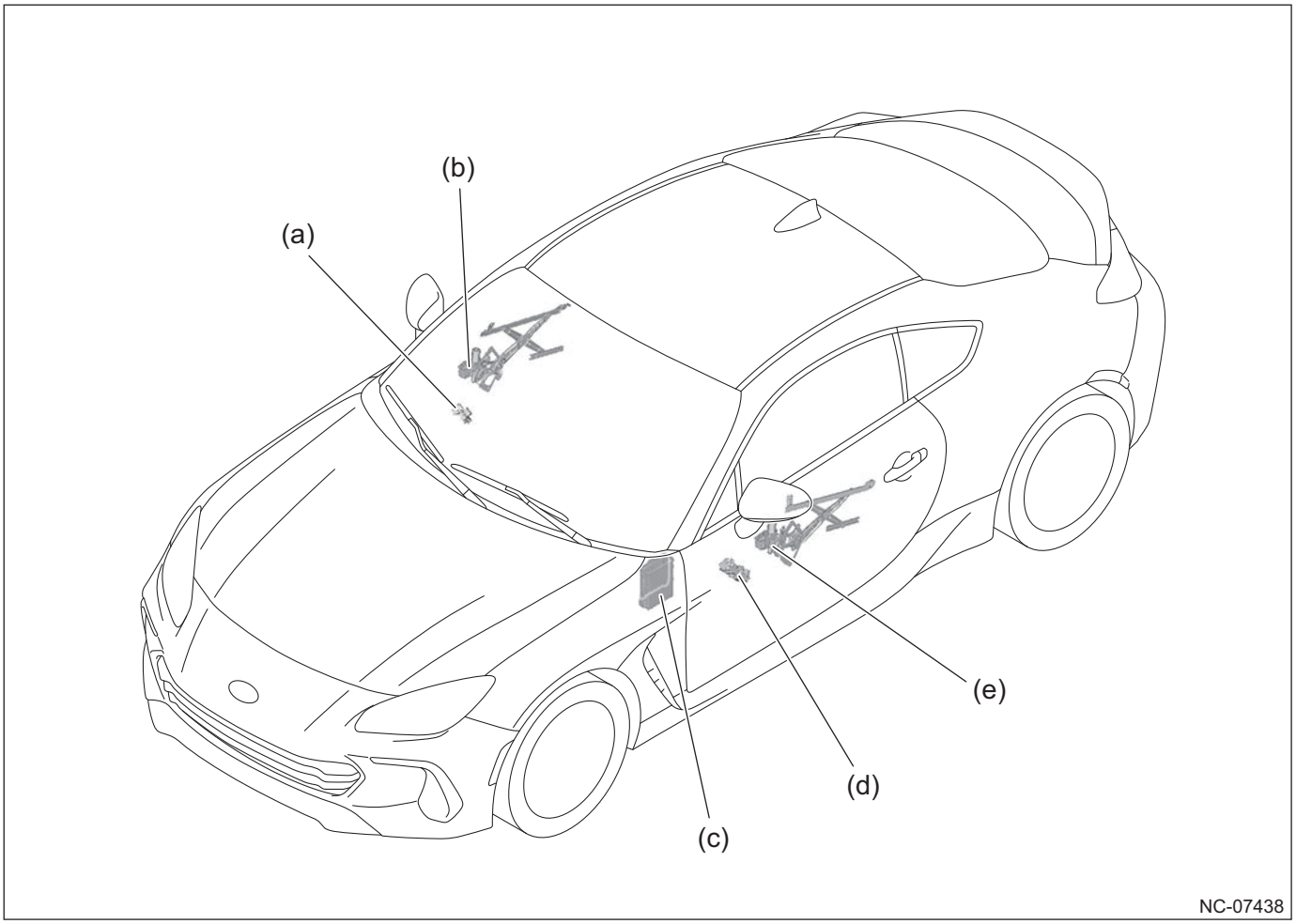
Component layout drawing

Glass



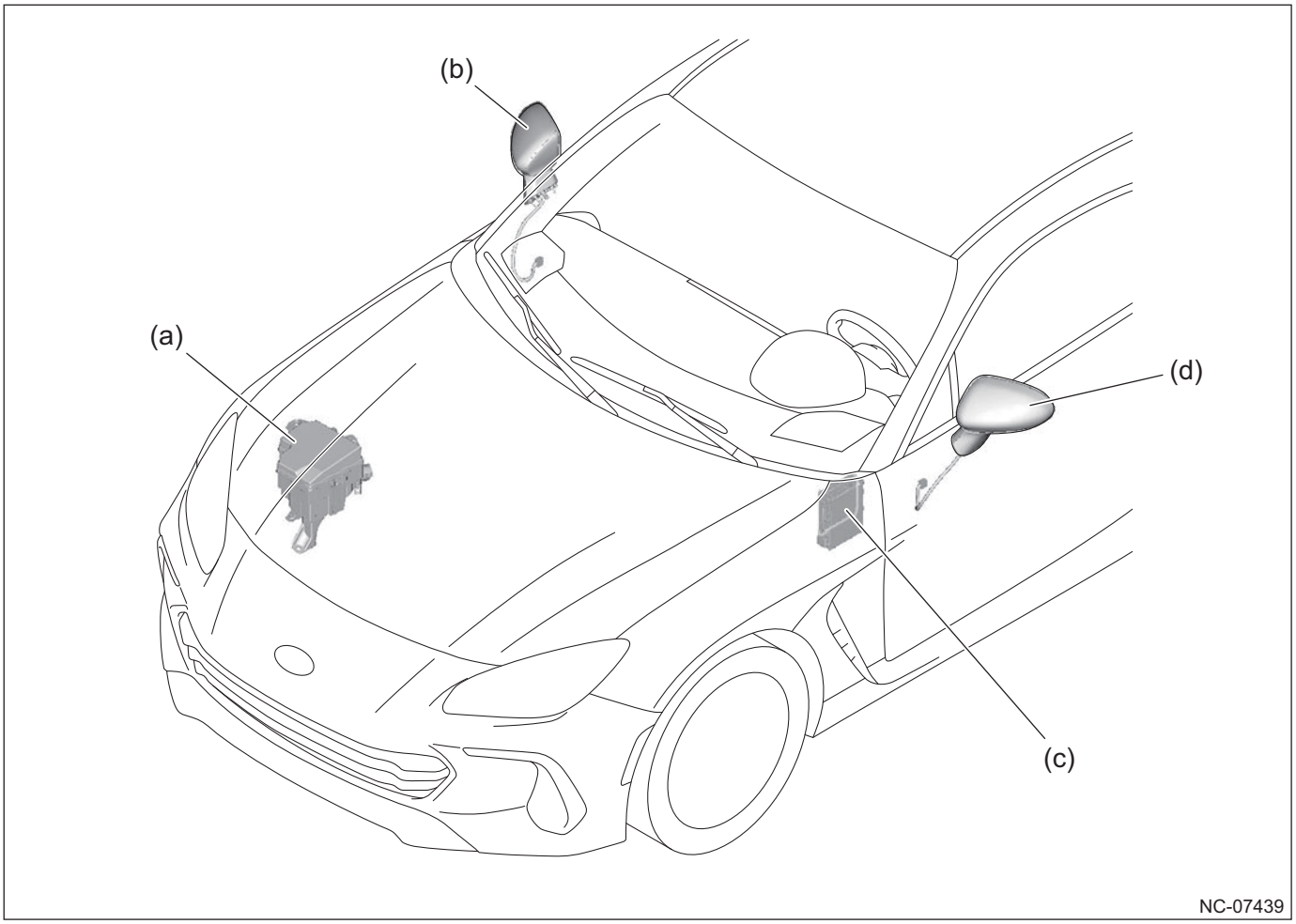
(a) Glass windshield
(b) Glass front door partition
(c) Glass front door
(d) Glass rear quarter
(e) Glass rear window

Window



(a) Power window sub switch
(b) Front regulator & motor assembly (passenger's seat)
(c) Body Integrated Unit (BIU)
(d) Power window main switch
(e) Front regulator & motor assembly (driver's seat)

Mirror



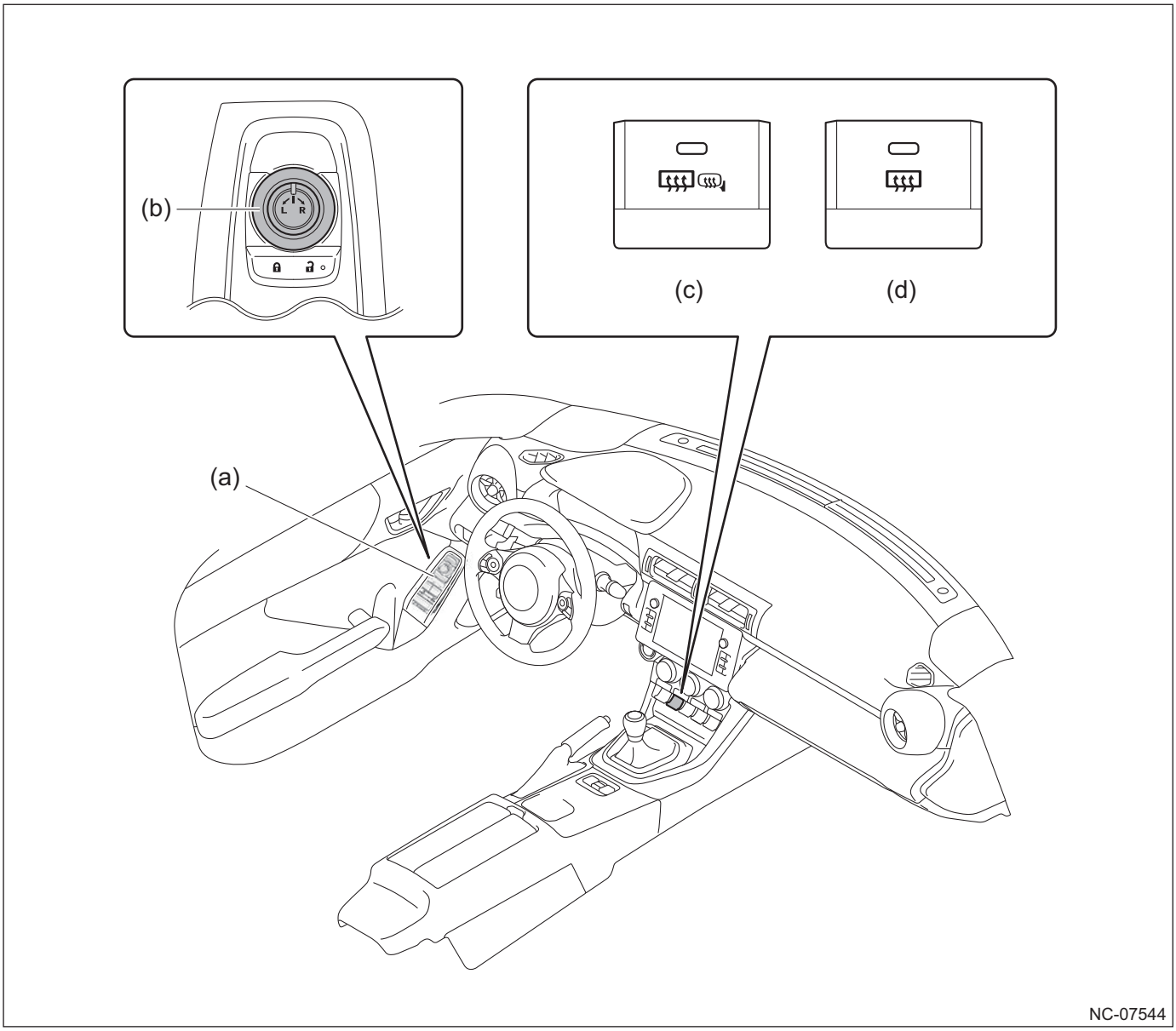
(a) Rear defogger relay/mirror heater relay (models with mirror heater) (in main fuse & relay box)

(b) Outer mirror RH

(c) Body Integrated Unit (BIU)

(d) Outer mirror LH

Mirror



(a) Power window main switch

(b) Mirror surface adjustment/left-right selector switch

(c) Rear window defogger/heated door mirror switch (models with mirror heater)

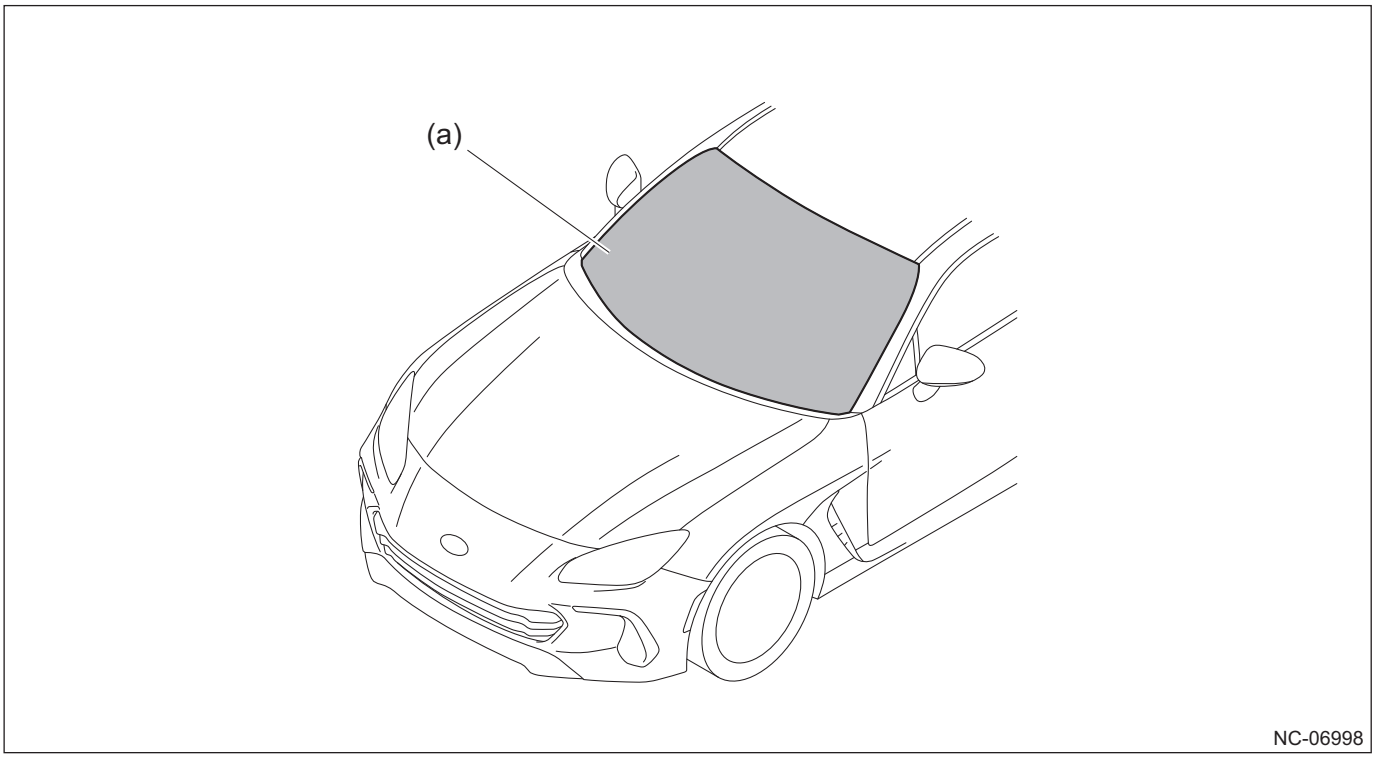
(d) Rear window defogger switch (models without mirror heater)

Component details

Glass

■ Windshield glass

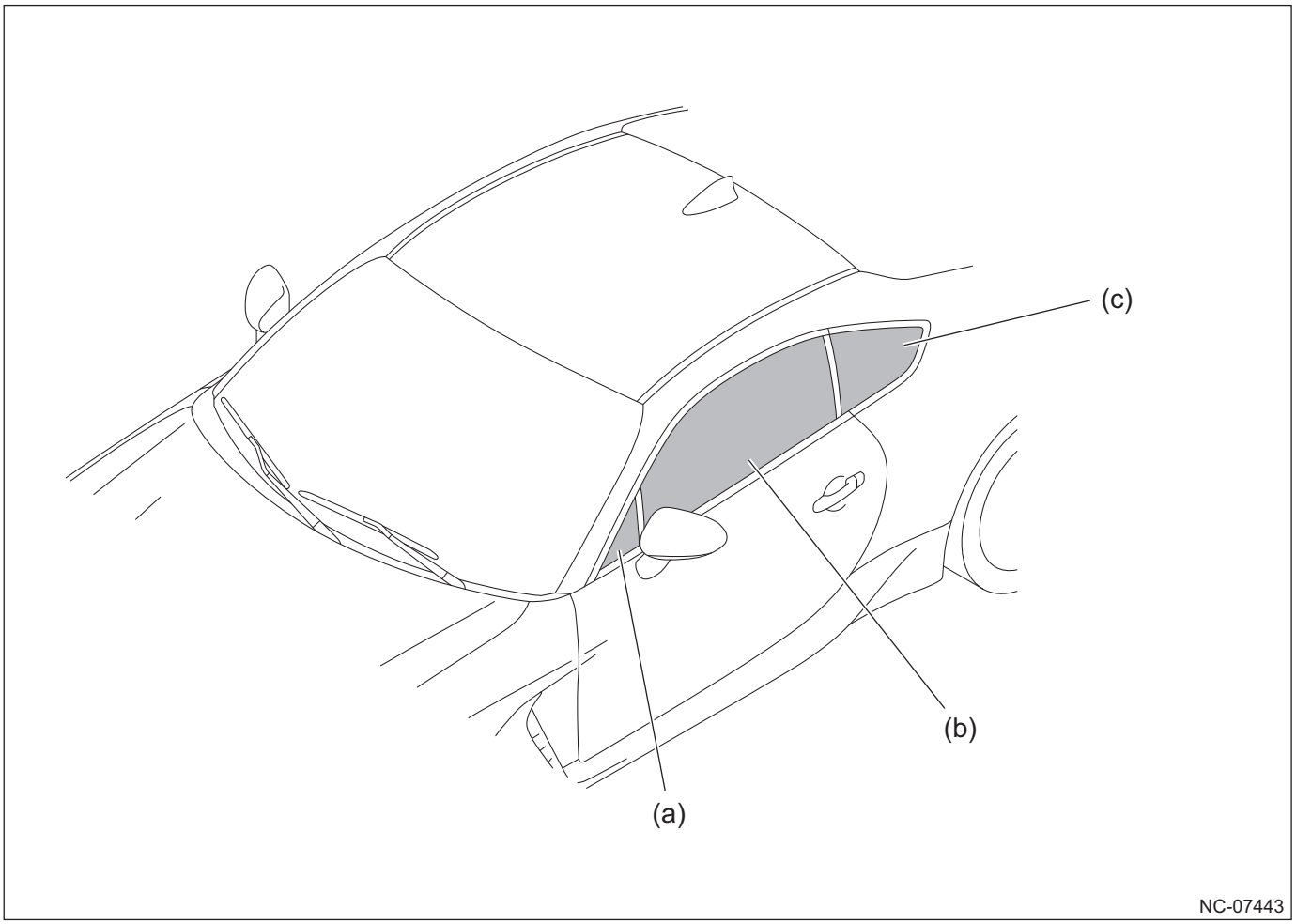
In addition to the UV cut function, green laminated glass with an added IR cut function is adopted for the glass windshield. This makes the vehicle interior more comfortable by reducing heat and "tingling feeling" on the skin caused by sunlight.



(a) Glass windshield

■ Partition glass/door glass/rear quarter glass

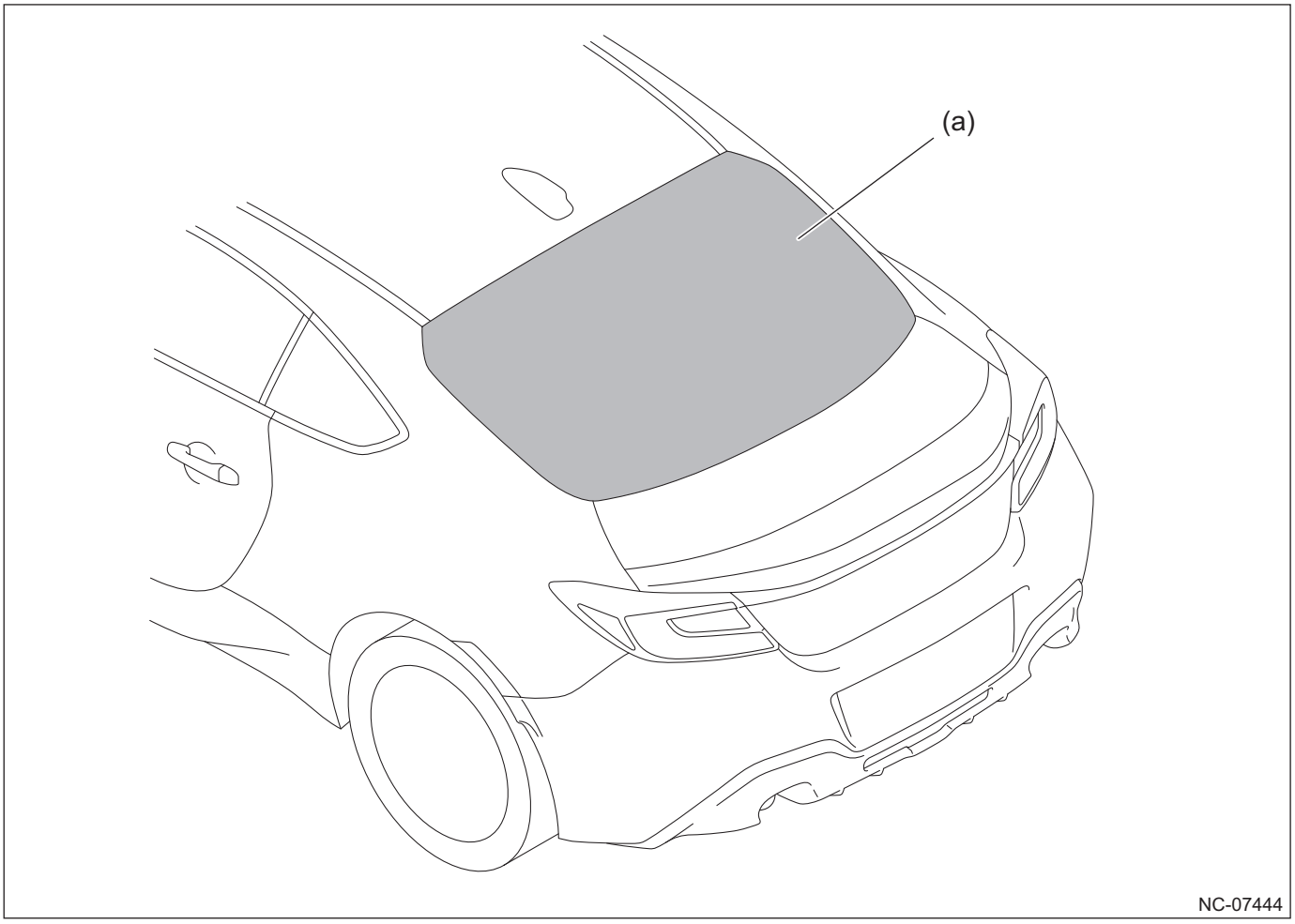
Green glass with a UV cut function is adopted for the glass front door partition, glass front door, and glass rear quarter to improve comfort.



(a) Glass front door partition
(b) Glass front door
(c) Glass rear quarter

■ Rear glass

Green glass with a UV cut function is adopted for the glass rear window to improve comfort.



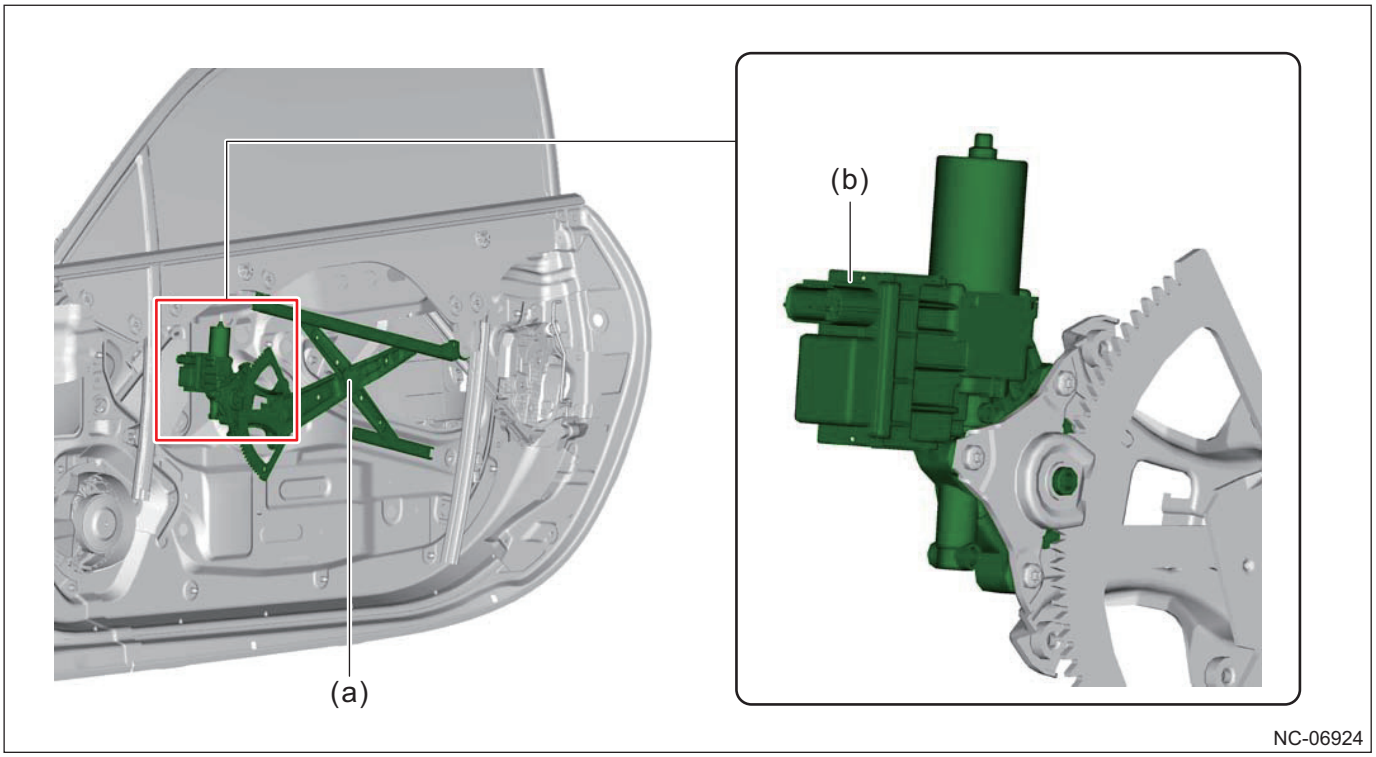
(a) Glass rear window

Window

A smart motor with an integrated rising and lowering control CM for the power window is adopted for the motor of the front regulator & motor assembly.

The off-delay function is adopted that allows power window operation until a door is opened or for a certain period (up to 40 seconds) even after the engine switch is turned OFF.

This improves convenience because it allows the user to operate the window again after forgetting to close it without needing to turn the engine switch ON again.



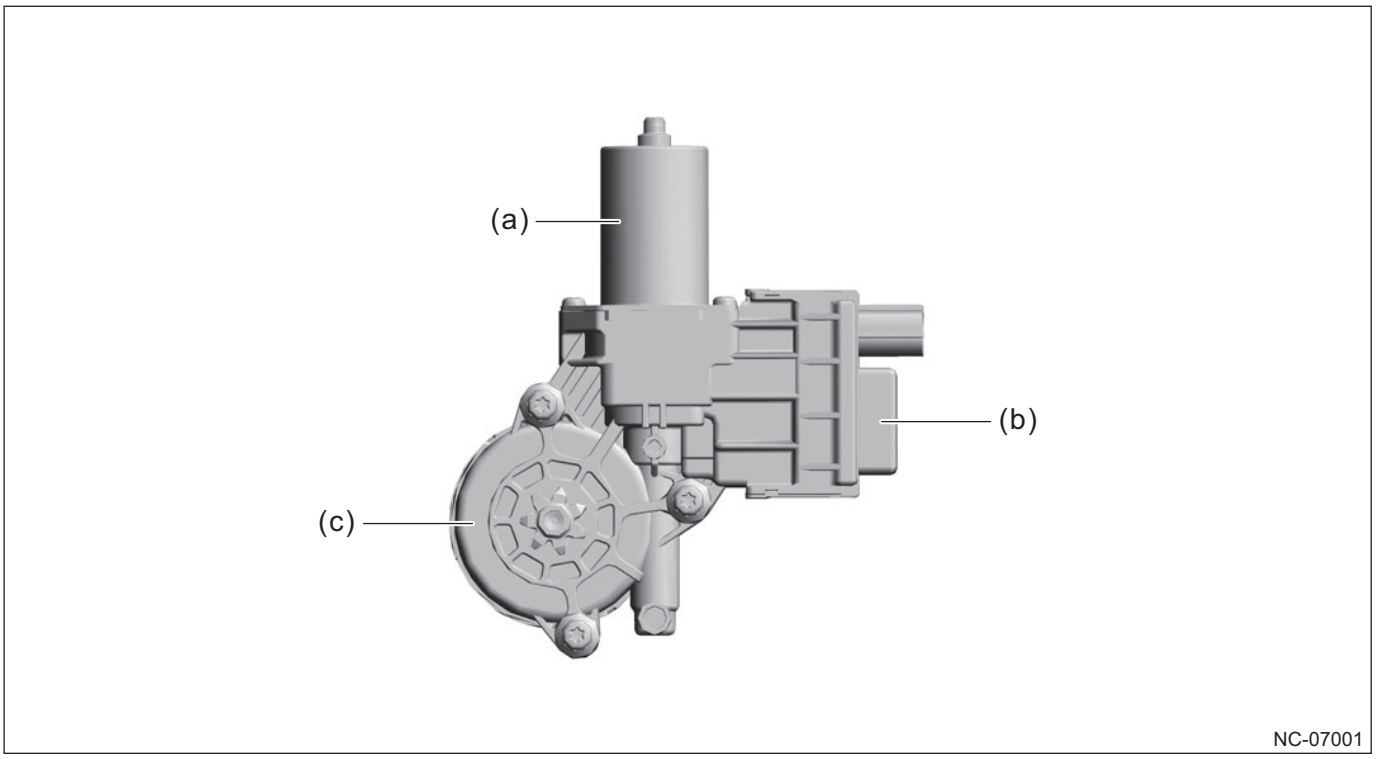
(a) Front regulator & motor assembly

(b) Smart motor with built-in CM

■ Front power window motor assembly

The front power window motor assembly is composed of a motor section, a CM section, and a gear section.

The front power window 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 motor.

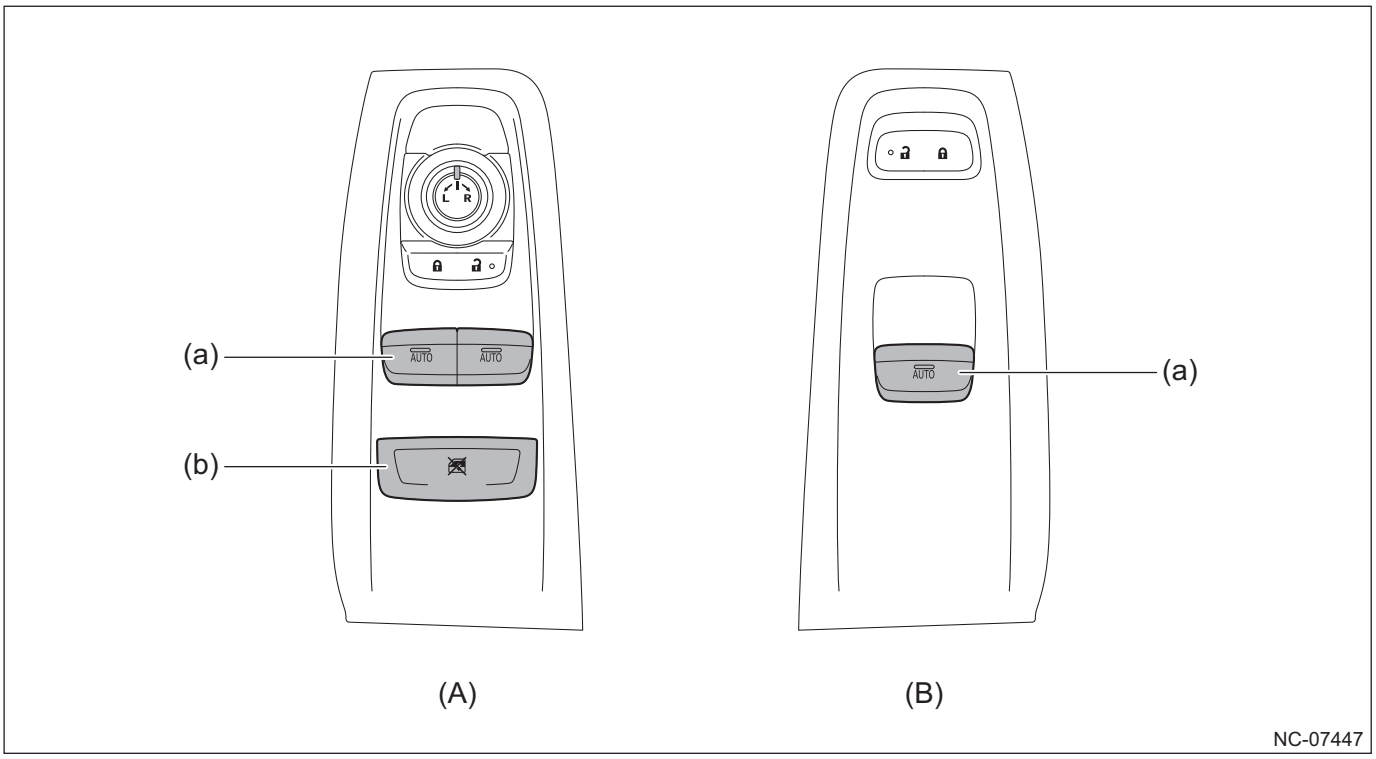


(a) Motor section
(b) CM section
(c) Gear section

■ Power window switch

The switch base is made flatter to improve appearance by making it seem more integrated with the door trim.

Texture is improved by providing the knob of the mirror control switch and the decoration of the power window switch with a combination of 2 types of high-gloss black and silver paint + chrome plating.



(A) Power window main switch

(B) Power window sub switch

(a) Power window switch

(b) Window lock switch

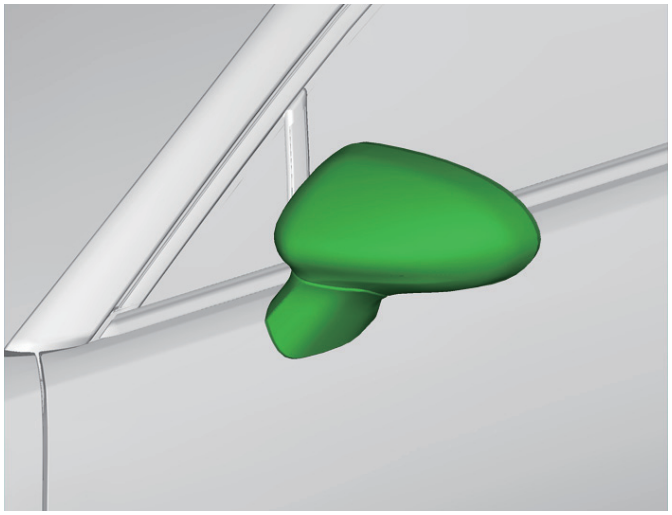
Mirror

■ Outer mirror

An outer mirror design that is compact and befitting of a sports car is achieved while maximizing visibility and maintaining aerodynamic characteristics.

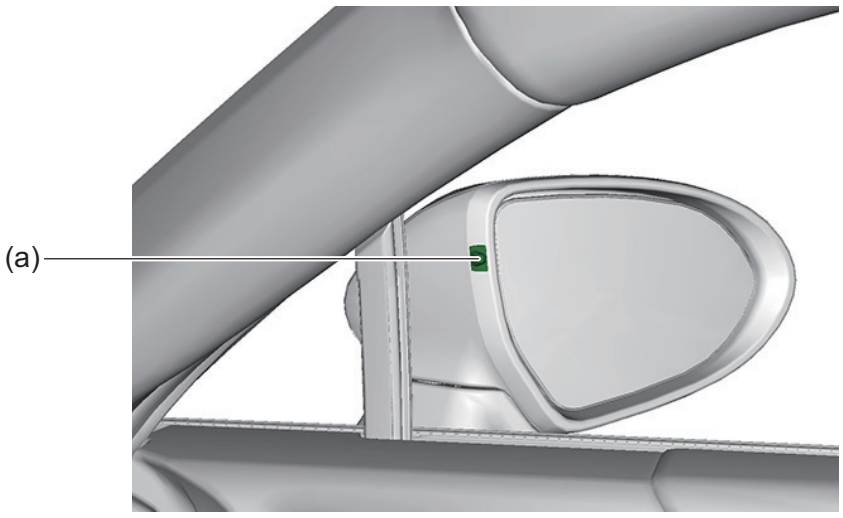
*For details on the aerodynamic performance, refer to "Aerodynamic performance <8-23>".

- The dimensions of the outer mirror surface are enlarged to increase the outward-facing and inward-facing viewing angles.
- A smaller mirror body is adopted to ensure a wide field of view from the triangular window.



NC-06925

The BSD/RCTA approach indicator light is located inside the outer mirror body to improve visual safety by limiting the movement of the driver's visual line. (for some grades)



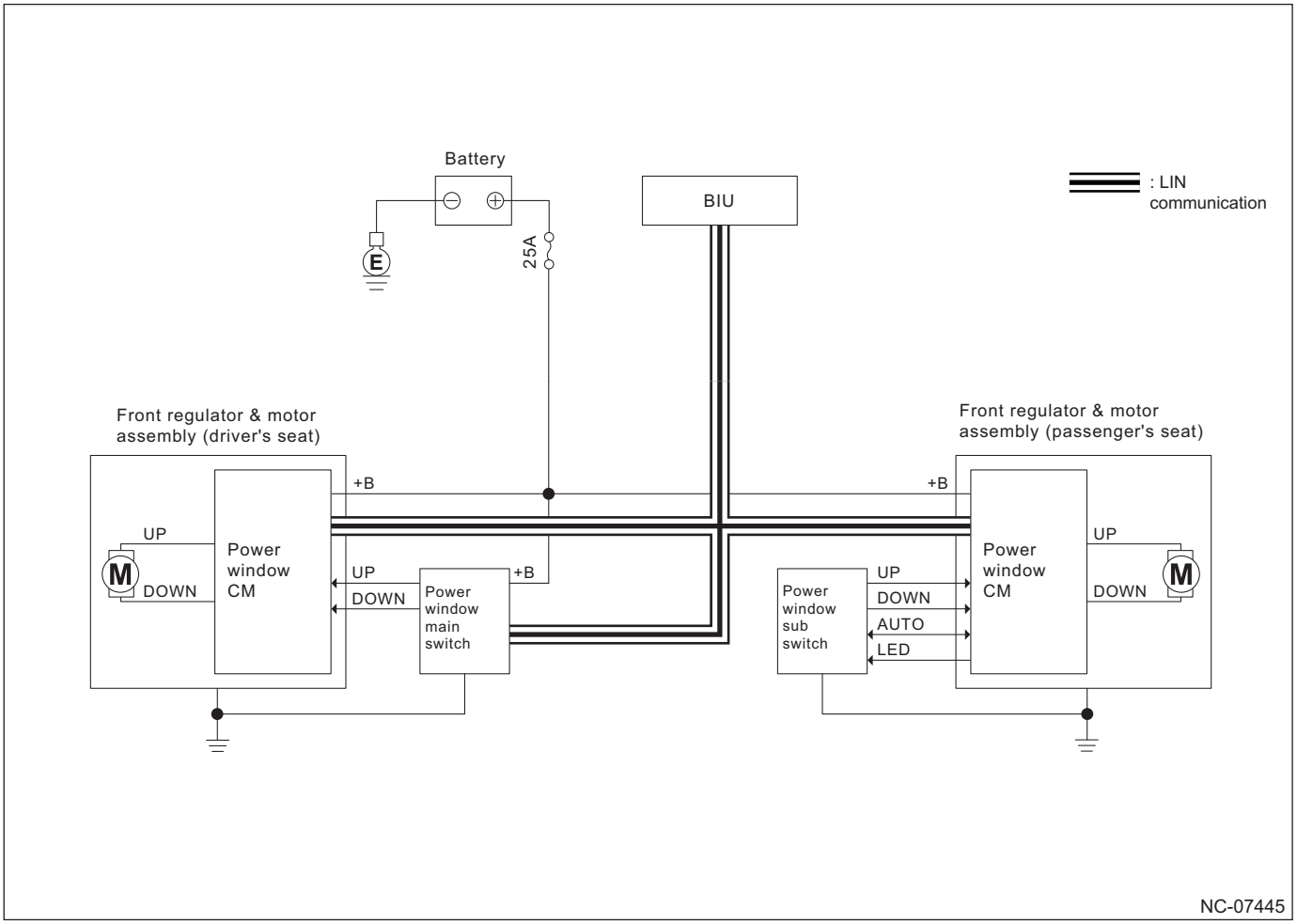
NC-07451

(a) BSD/RCTA approach indicator light

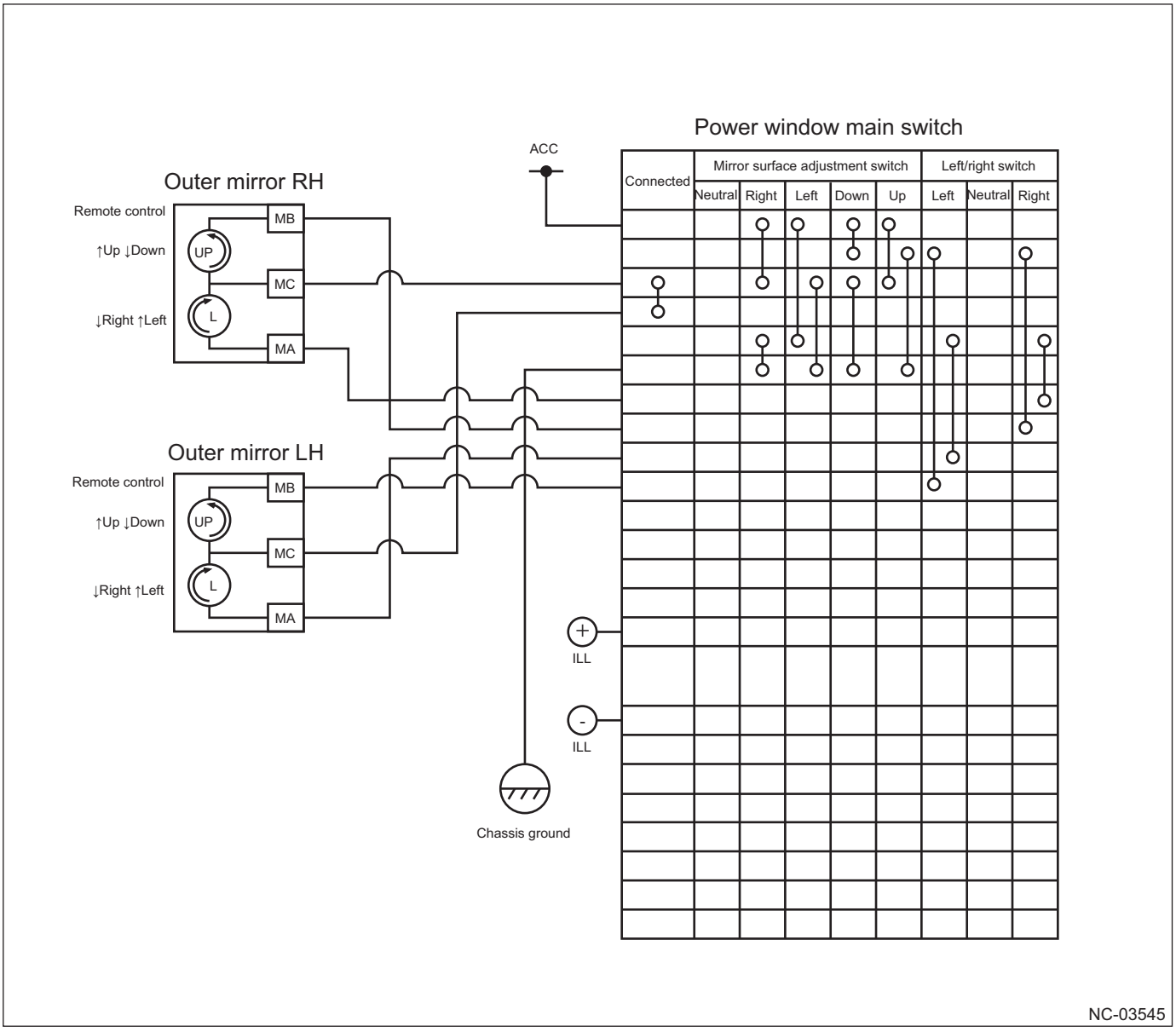
9.5.3 Construction and Operation

System diagram

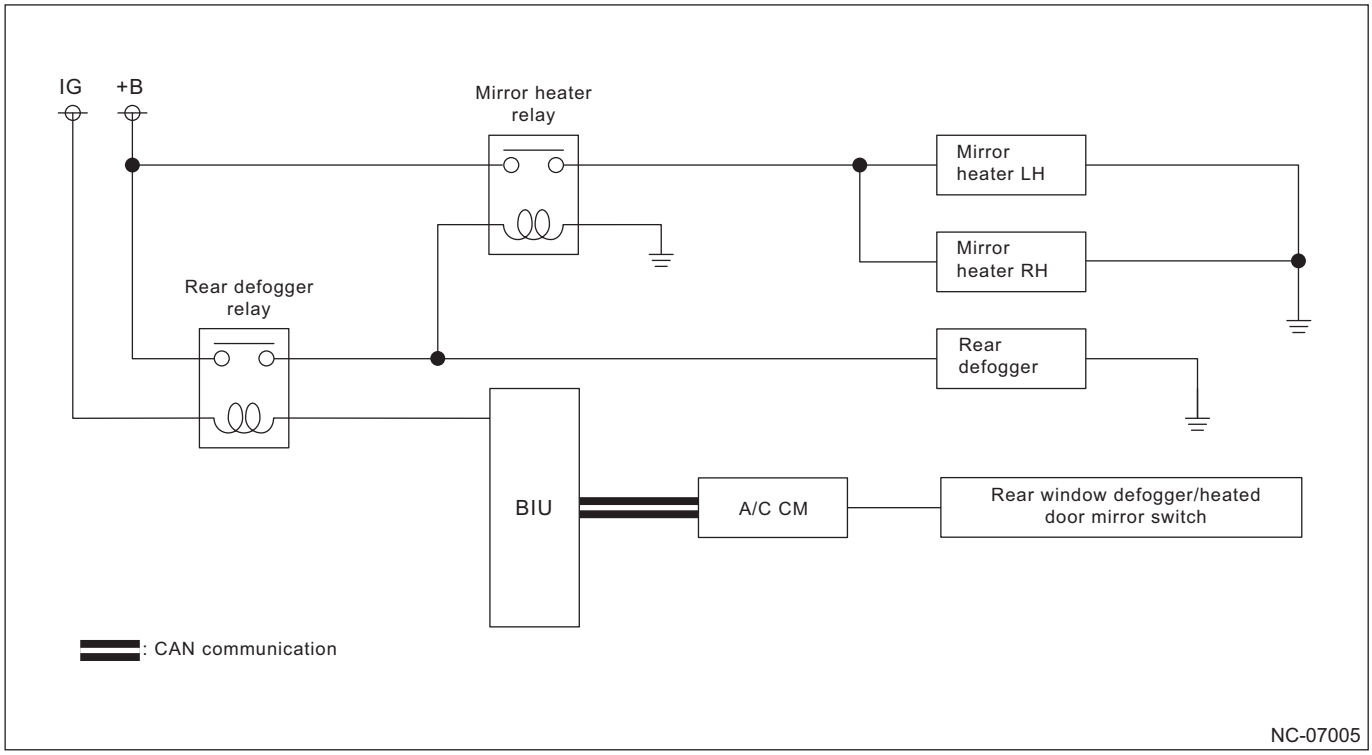
Power window system



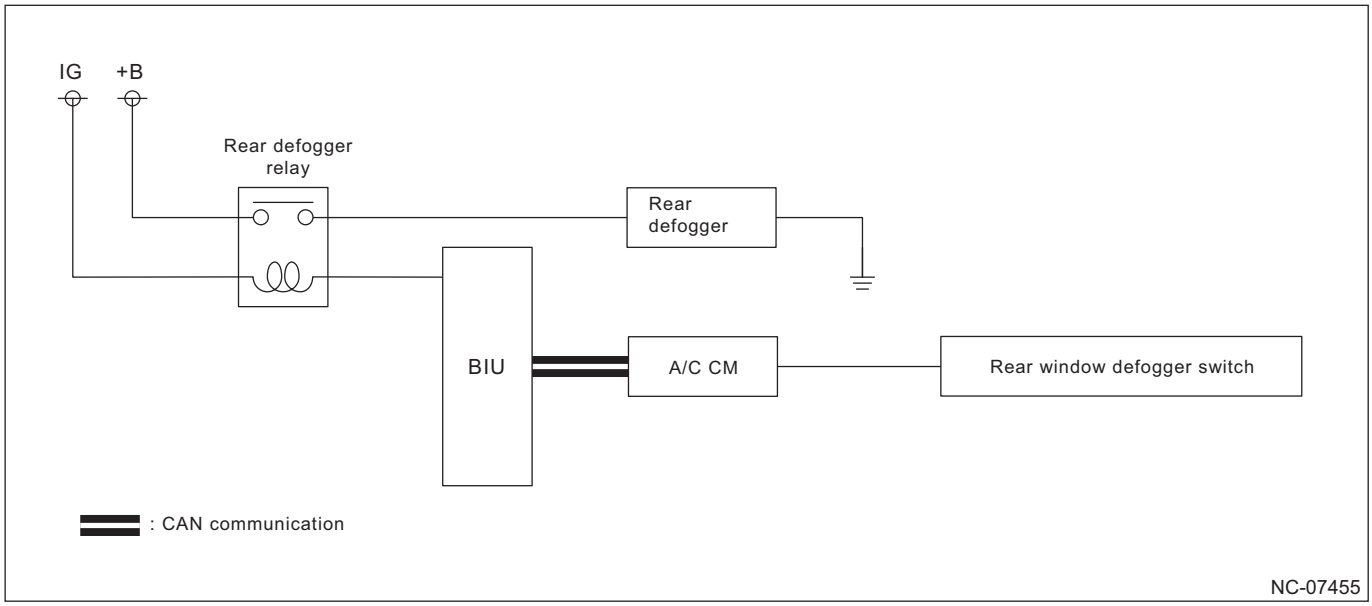
Electric mirror system



Rear window defogger/mirror heater system (models with mirror heater)



Rear window defogger system (models without mirror heater)



Main component functions

Power window system

Component	Main functions
Power window main switch	Outputs each switch signal to the power window CM of each door.
Power window sub switch	Outputs the switch operation signal to the power window CM of the passenger's seat.
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 CM	Outputs the pulse signal with a built-in pulse sensor, and determines pinching and snagging according to the rate of change.
Front regulator & motor assembly	Drives the window regulator of the front door according to the forward or reverse rotation of the power window motor.

Electric mirror system

Component	Main functions
Left-right selector switch	Selects the outer mirror for which to adjust the mirror surface angle.
Mirror surface adjustment switch	Sends the mirror surface adjustment signal to the outer mirror.
Outer mirror	Adjusts the mirror surface angle according to the control signal from the mirror surface adjustment switch.

Rear window defogger/mirror heater* system

Component	Main functions
Rear window defogger/heated door mirror* switch	Outputs the switch ON signal to the A/C CM.
A/C CM	Receives the switch ON signal input, and outputs the relay drive signal to the Body Integrated Unit (BIU).
Body Integrated Unit (BIU)	Determines the output and energizes the rear defogger relay.
Rear defogger relay	Supplies rear defogger drive current according to the ON/OFF control of the Body Integrated Unit (BIU).
Rear defogger	Heats the defogger (heating wires) of the glass rear window according to the rear defogger operation request signal.
Mirror heater relay*	Supplies mirror heater drive current according to the ON/OFF control of the rear defogger relay.
Mirror heater*	Heats the heater of the mirror surface according to the mirror heater operation request signal.

**: Models with mirror heater*

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	Window lock function	Remote operation for the passenger's seat when the window lock switch is on	Operation after the engine switch is turned OFF (timer operation)	Pinch prevention mechanism	Snag prevention mechanism	Fail-safe function
Driver's seat	●	●	●	-	-	-	●	●	●	●
Passenger's seat	●	●	●	●	●	●	●	●	●	●

● : Applicable
- : Not applicable

■ LIN communication

LIN (Local Interconnect Network) communication is adopted for the communication between power window switches. LIN communication is a multiplex communication network for the data communication mainly between body system control CM, and each system is composed of a bus. 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 smart motor assemblies 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 switch is operated upward (downward) by 1 stage with the engine switch turned ON, a manual up (down) signal is output to the corresponding front regulator & motor assembly. The front 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 power window switch in the power window main switch is operated upward (downward) by 1 stage with the engine switch turned ON and window lock switch turned OFF, a remote control manual up (down) signal is output to the passenger's seat regulator & motor assembly. The passenger's 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 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 engine switch turned ON, an auto up (down) signal is output to the driver's seat power window CM (built into the power window smart 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 power window sub switch is operated upward (downward) by two stages with the engine 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 smart 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).

The power window CM (built into the power window smart motor assembly) counts a pulse signal from the Hall IC within the power window smart 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 engine 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 smart 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.

▮ 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

■ Window lock operation

When the window lock switch is set to ON while the engine switch is ON or during a post-engine switch OFF operation, a window lock signal is sent from the power window main switch to the passenger's seat power window CM.

While the passenger's seat power window CM receives the window lock signal, operation by the power window sub switch is prohibited. Power window switch indicator, the operation of which is prohibited, turns off.

> **Reference**
> 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 the engine switch is turned OFF (timer operation)

If the engine switch is switched from ON to OFF, the Body Integrated Unit (BIU) detects this and begins a post-engine switch OFF operation count and sends the post-engine switch OFF operation signal to the driver's seat and passenger's seat power window CM. This makes the power window operation of each seat possible. The pinch prevention mechanism also operates for the driver's seat and passenger's seat.

When 40 seconds elapse after the engine switch is turned OFF or the Body Integrated Unit (BIU) receives a "Close" to "Open" signal of the driver's seat or passenger's seat door switch, the Body Integrated Unit (BIU) sends a post-engine switch OFF operation signal as OFF. When the post-engine switch 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-engine switch 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-engine switch 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, 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="2">● (*1)</td><td rowspan="2">●</td><td rowspan="2" colspan="2">● /X (*2)</td><td colspan="4">-</td><td rowspan="2">● /X (*2)</td><td rowspan="2">● /X (*2)</td></tr>
<tr><td>Passenger's seat</td><td colspan="2">● /X (*2)</td><td colspan="2">● /X (*2)</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*

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 changeover 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.

Rear defogger/mirror heater system (models with mirror heater)

■ ON Operation

If the rear window defogger/heated door mirror switch is turned ON with the engine switch turned ON, a rear window defogger/heated door mirror switch ON signal is output to the A/C CM.

After receiving the signal input, the A/C CM outputs the relay drive signal to the Body Integrated Unit (BIU), and the Body Integrated Unit (BIU) energizes the rear defogger relay (mirror heater relay linked) to heat the rear defogger and mirror heater LH/RH.

■ OFF Operation

When the rear defogger and mirror heater continue operation for 15 minutes, the rear defogger and mirror heater are turned OFF by the relay drive OFF signal.

■ Customize

The operation of the rear defogger and mirror heater can be customized to 15-minute drive mode or continuous operation mode in the Subaru Select Monitor. (The factory setting is 15-minute drive mode.)

Rear defogger system (models without mirror heater)

■ ON Operation

If the rear window defogger switch is turned ON with the engine switch turned ON, a rear window defogger switch ON signal is output to the A/C CM.

After receiving the signal input, the A/C CM outputs the relay drive signal to the Body Integrated Unit (BIU), and the Body Integrated Unit (BIU) energizes the rear defogger relay to heat the rear defogger.

■ OFF Operation

When the rear defogger continues operation for 15 minutes, the rear defogger is turned OFF by the relay drive OFF signal.

■ Customize

The operation of the rear defogger can be customized to 15-minute drive mode or continuous operation mode in the Subaru Select Monitor. (The factory setting is 15-minute drive mode.)

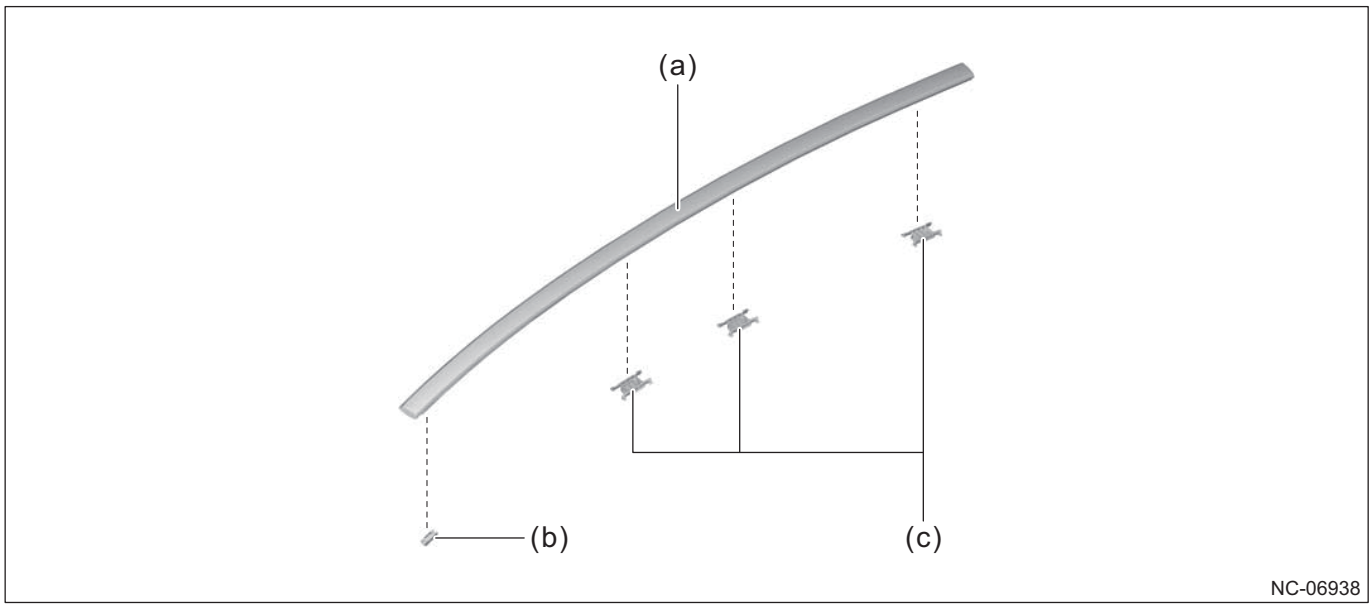
9.6 Roof Molding

9.6.1 Overview

Overview

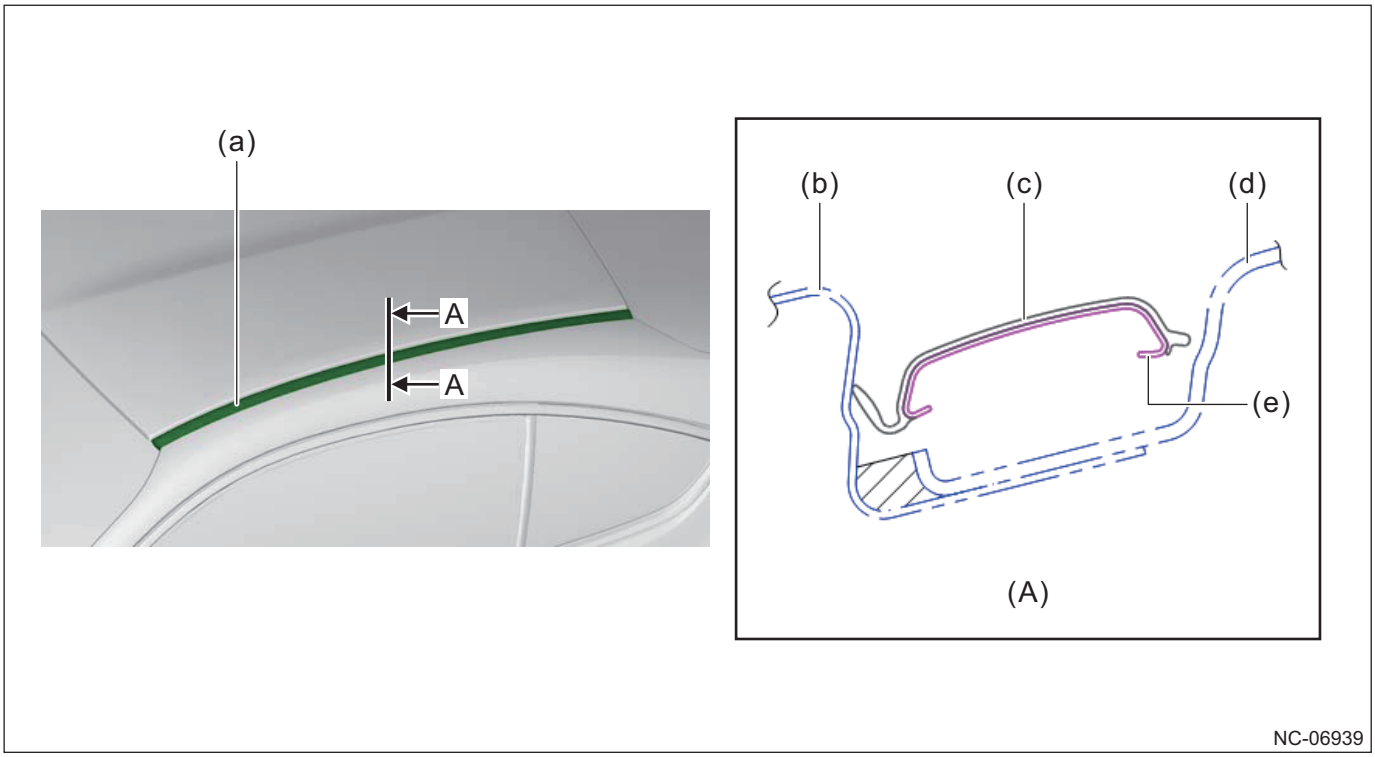
Roof molding with a clip installation structure is adopted to support the adoption of the aluminum roof panel.

- A clip that can be fixed by heat during paint baking is adopted for an installation structure that can set the fixing points of the roof molding without welding.



(a) Roof molding
(b) Heat hardening clip
(c) Heat welding clip

- Stainless steel is adopted for the core material of the roof molding.



(A) A-A cross section

(a) Roof molding
(b) Outside panel
(c) Roof molding design surface (PVC)
(d) Aluminum roof panel
(e) Roof molding core material (SUS430)

9.7 Door/Fuel Lid

9.7.1 Overview

Overview

Door

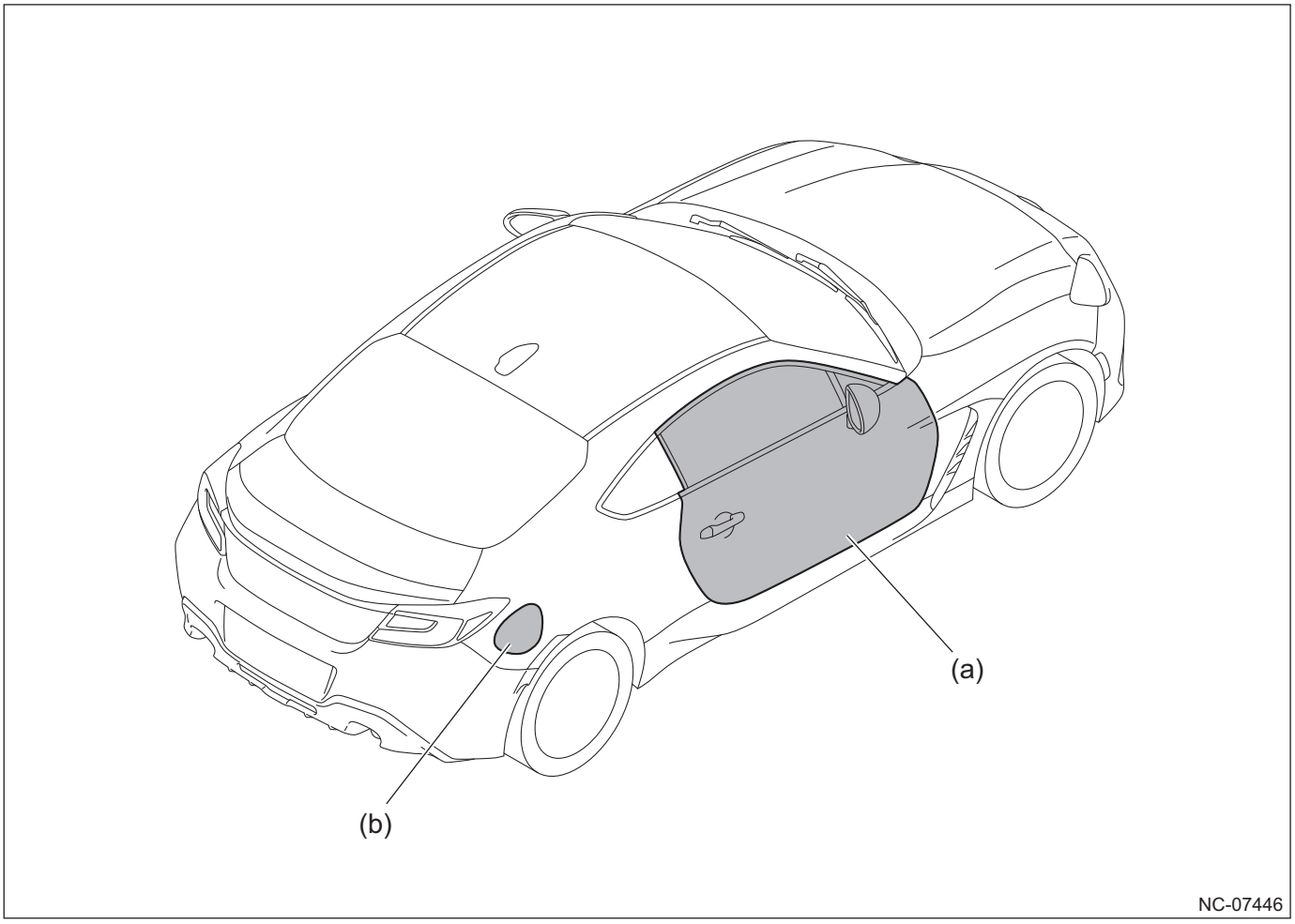
- The door switch is built in to improve appearance when the door is open.

Fuel lid

- A push-open type resin fuel lid is adopted.

9.7.2 Component

Component layout drawing



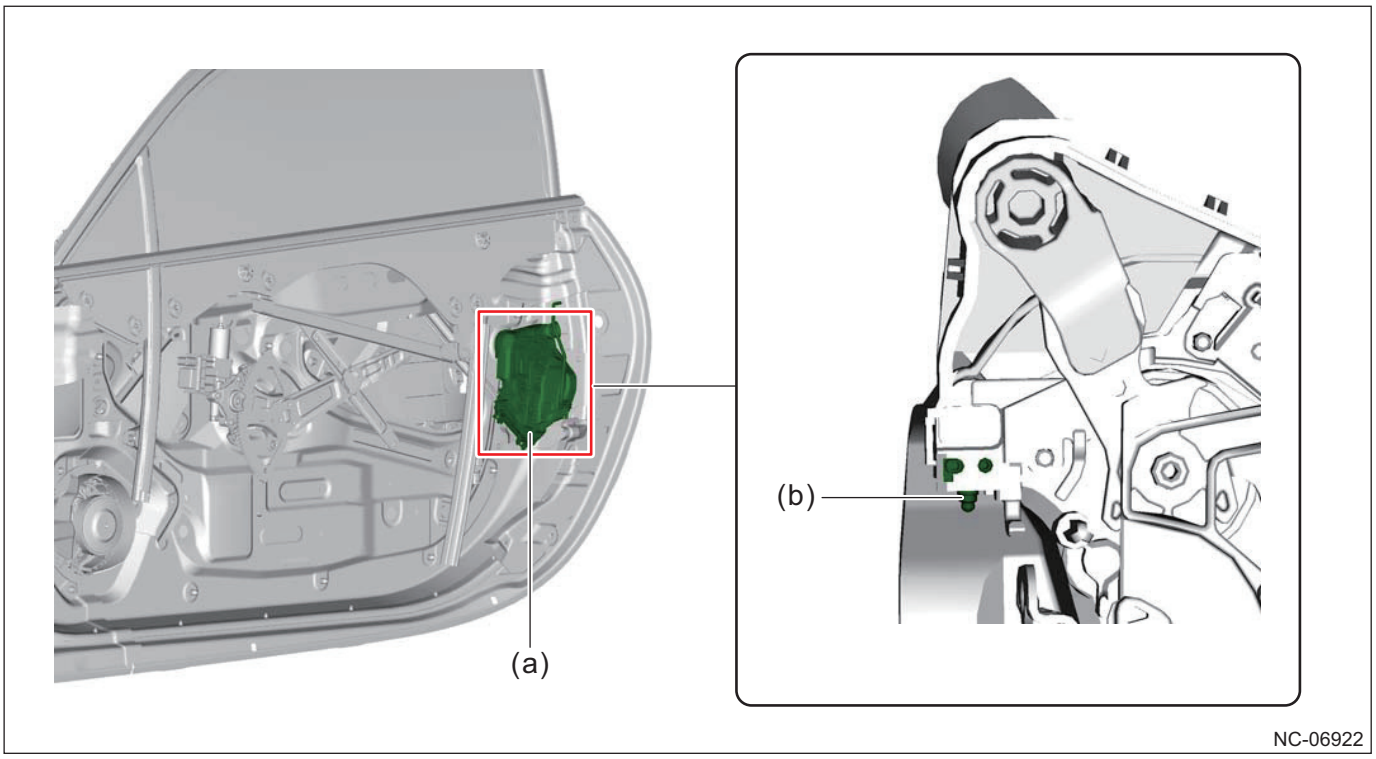
(a) Front door

(b) Fuel lid

Component details

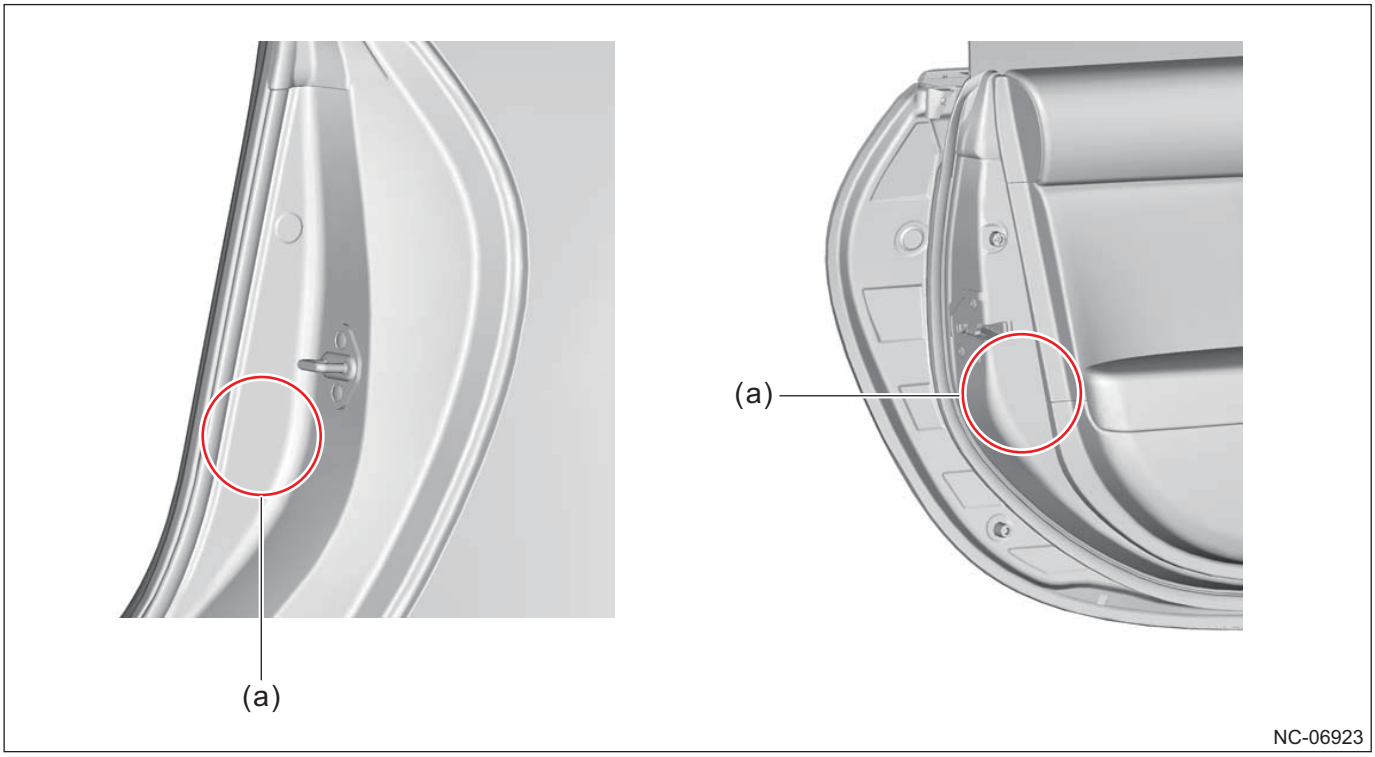
Door

The door switch is built into the latch & actuator and the switch receiver surface on the door side is discontinued to improve appearance when the door is open.



(a) Latch & actuator

(b) Door switch

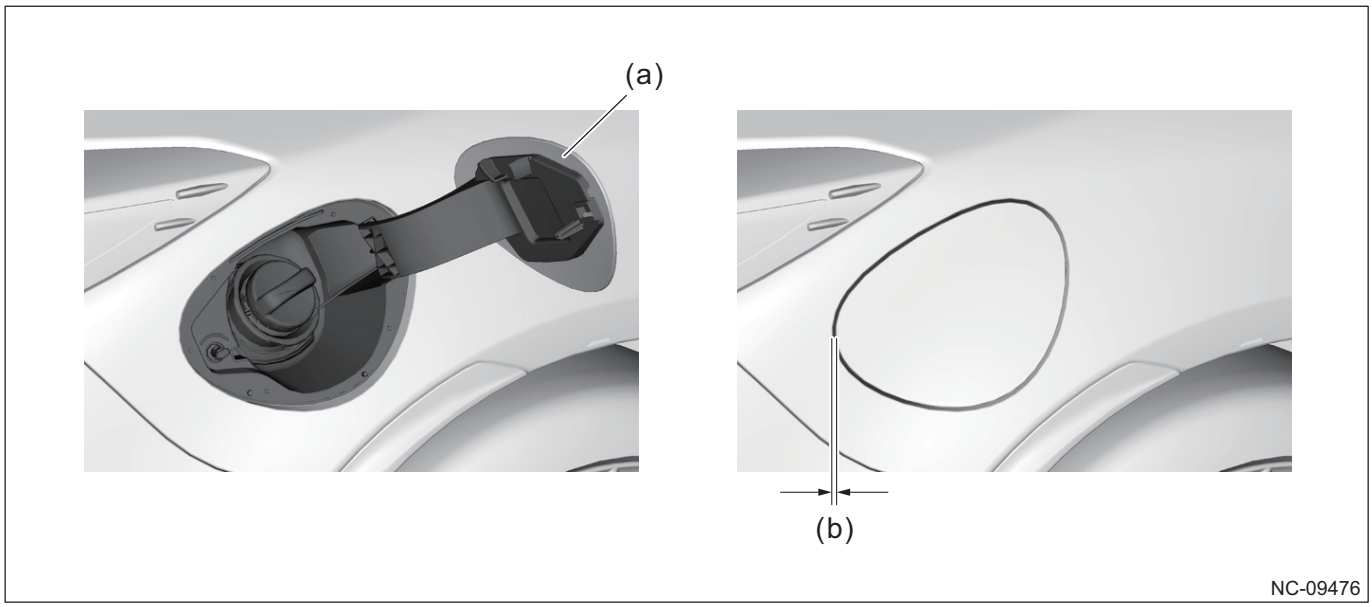


(a) Door switch on body side eliminated to improve appearance when door is open

Fuel lid

Resin is adopted in the area around the fuel lid and an electric lock/unlock system is adopted to reduce weight and improve the appearance when the fuel lid is open.

The division width of the fuel lid opening and closing area is reduced to improve appearance.



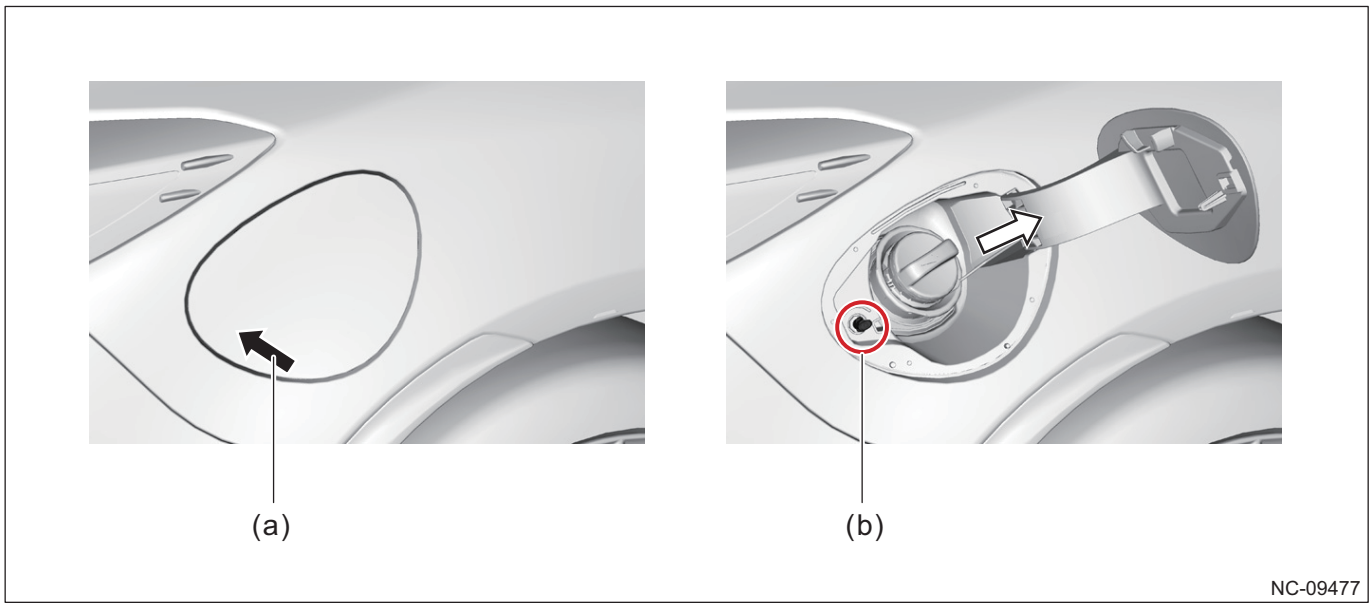
(a) Fuel lid

(b) Division width

The interior opener lever of the fuel lid is discontinued and an electric lock/unlock system with actuator is adopted.

The discontinuance of the opener lever improves convenience while making the foot area of the driver's seat feel more streamlined.

A push-open type of fuel lid is adopted that is opened by directly pushing the lid. This improves convenience while also improving practicality if the fuel lid freezes in a cold region.



(a) In an unlocked state, push the fuel lid

(b) The push lifter pushes the fuel lid open

■ Fuel lid lock/unlock

The fuel lid is locked in the following conditions.

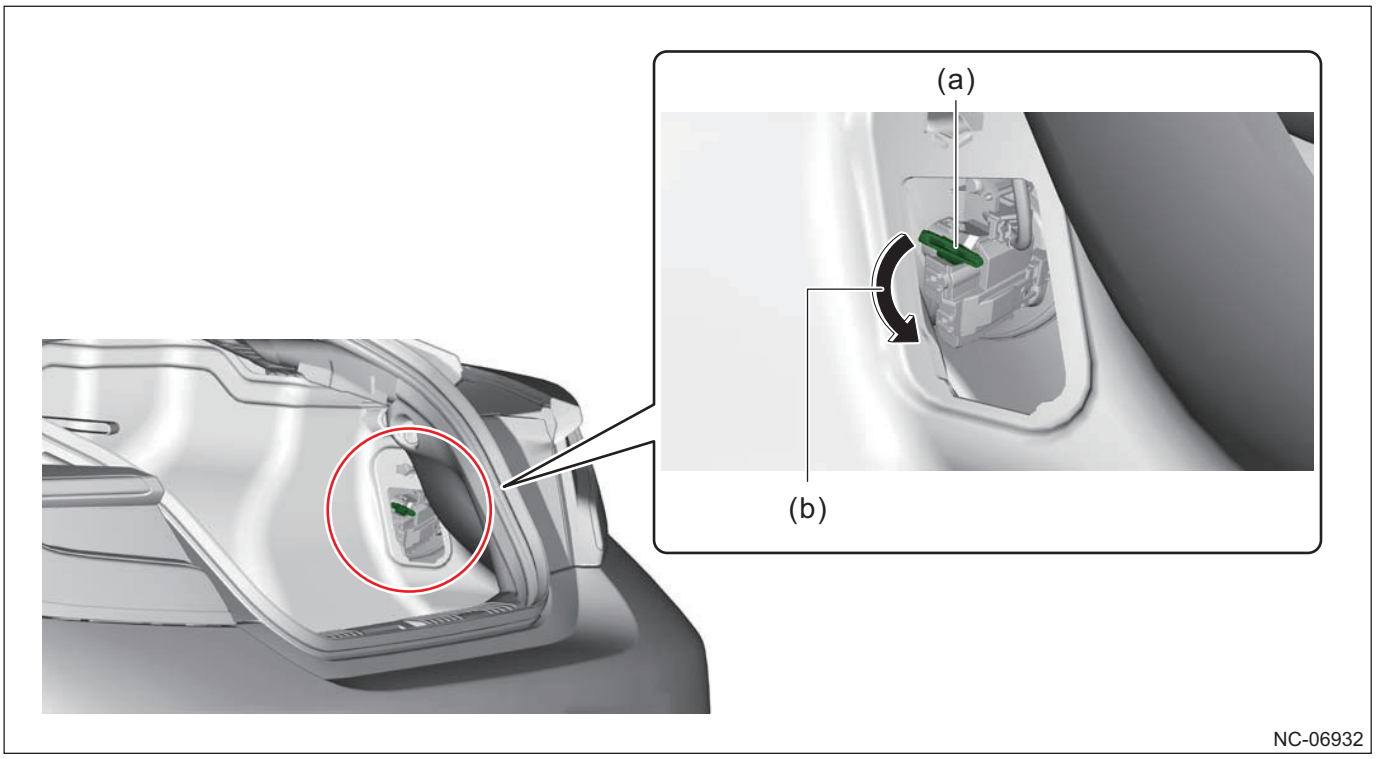
- When the door is locked by the keyless transmitter/access key operation, keyless access, or central door lock
- When the door is locked by the remote locking of the telematics system

The fuel lid is unlocked in the following conditions.

- When the door is unlocked by the keyless transmitter/access key operation, keyless access, or central door lock
- When the door is unlocked by the remote unlocking of the telematics system

■ Emergency lever

An emergency lever is adopted in the trunk room right side trim as a measure for emergencies, such as the battery going dead, actuator failure, and wire harness disconnection.



(a) Emergency lever

(b) Press down and rotate the lever to unlock the fuel lid, and then push the lid to open

9.8 Rear Bumper/Letter Mark/Muffler Cutter

9.8.1 Overview

Overview

Rear bumper

- A rear bumper with integrated arch fins is adopted.
- A design is adopted that positions the license plate in the rear bumper.

Letter mark

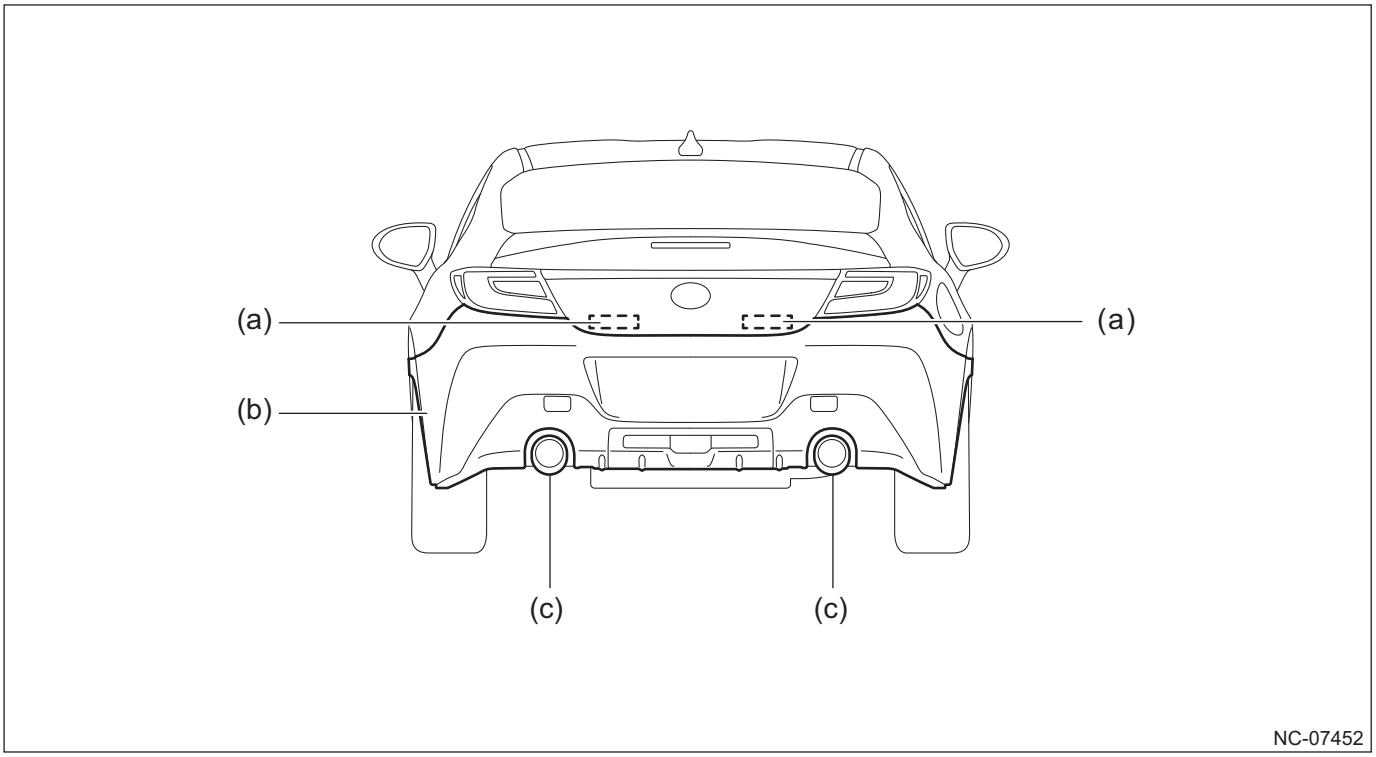
- The letter mark is placed in appropriate positions at the rear of the vehicle.

Muffler cutter

- A muffler cutter is provided for a sporty rear view.

9.8.2 Component

Component layout drawing



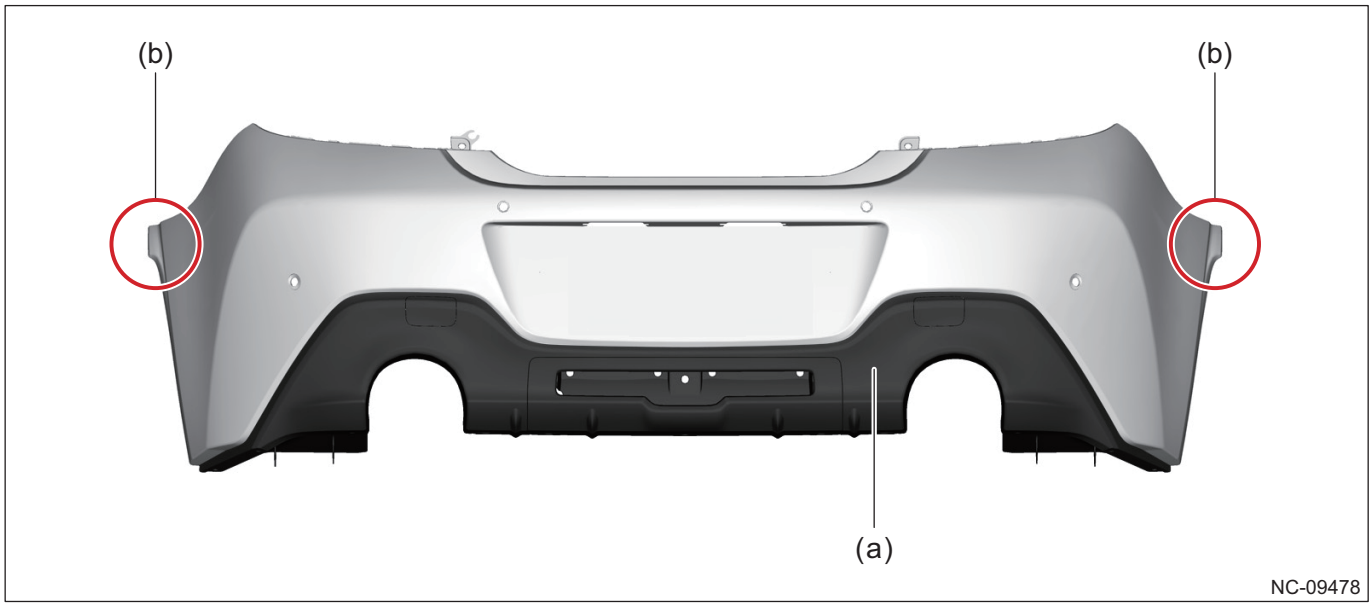
(a) Letter mark
(b) Rear bumper
(c) Muffler cutter

Component details

Rear bumper

A bumper cover with a design befitting of a sports car is positioned in the lower area and a rear bumper with integrated arch fins is adopted.

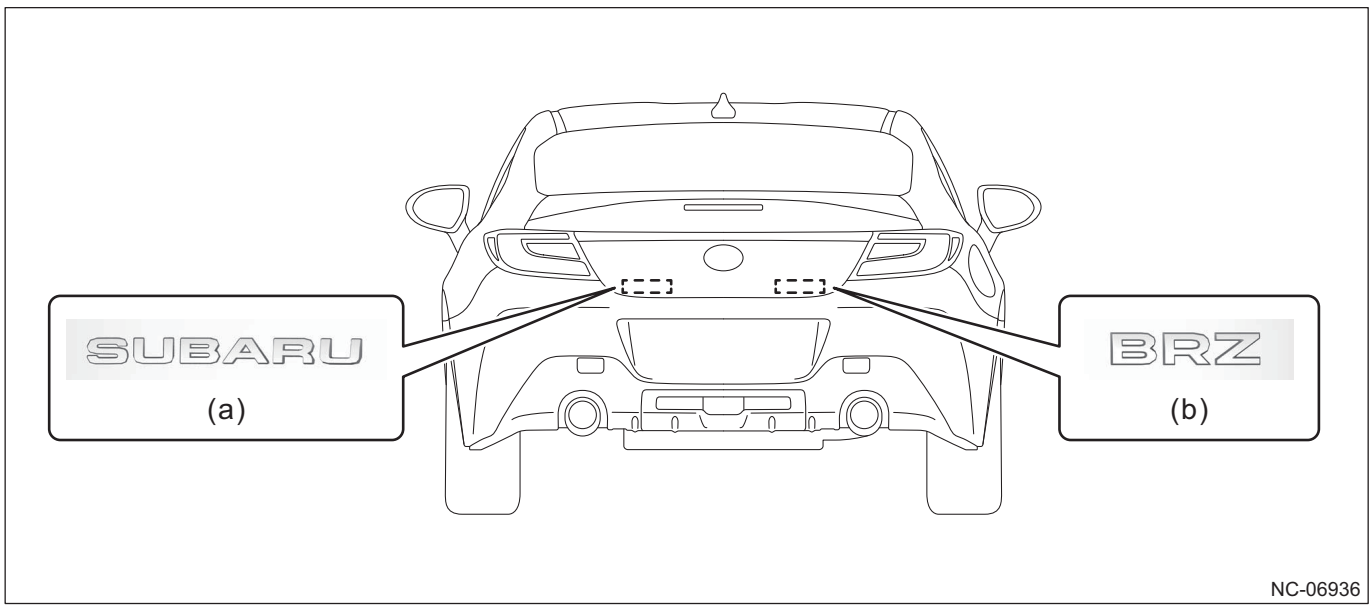
- The same color as the body is used for the arch fins to integrate the design with the side fins, and a structure is adopted that enables the wide positioning of the rear tires.
- The rear bumper shape is enhanced to emphasize the narrowing of the body for powerful styling befitting of a sports car.



(a) Bumper cover
(b) Arch fin

Letter mark

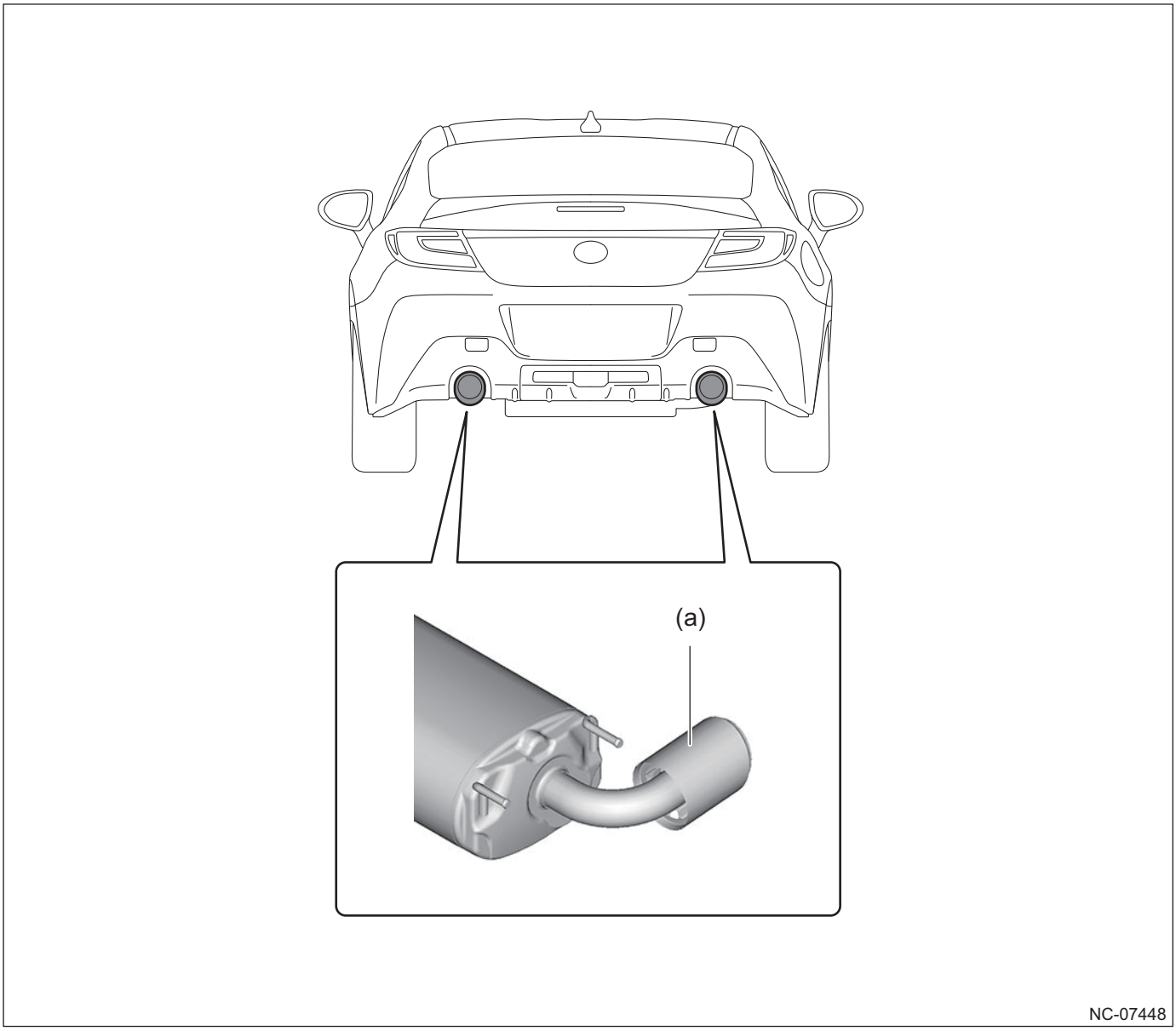
The SUBARU mark is positioned on the left side of the trunk and the vehicle name mark is positioned on the right side.



(a) SUBARU mark
(b) Vehicle name mark

Muffler cutter

A sporty and powerful muffler cutter is provided.



(a) Muffler cutter

9.9 Trunk/Trunk Garnish

9.9.1 Overview

Overview

Trunk

- A luggage compartment height and opening width is provided with sufficient space for storing 2 stacked 18-inch tires.
- A link hinge for installing to the vehicle side is adopted to eliminate projection into the luggage compartment, ensuring ease of loading and reducing weight.
- The geometry of the trunk hinge and the reaction force of the gas dampers are optimized for a natural trunk opening and closing speed that does not feel like it opens suddenly.
- The reaction force of the gas dampers and stopper settings are optimized to reduce the trunk closing speed for an operation that feels light.
- The license plate is moved to the rear bumper for a streamlined and sporty appearance.

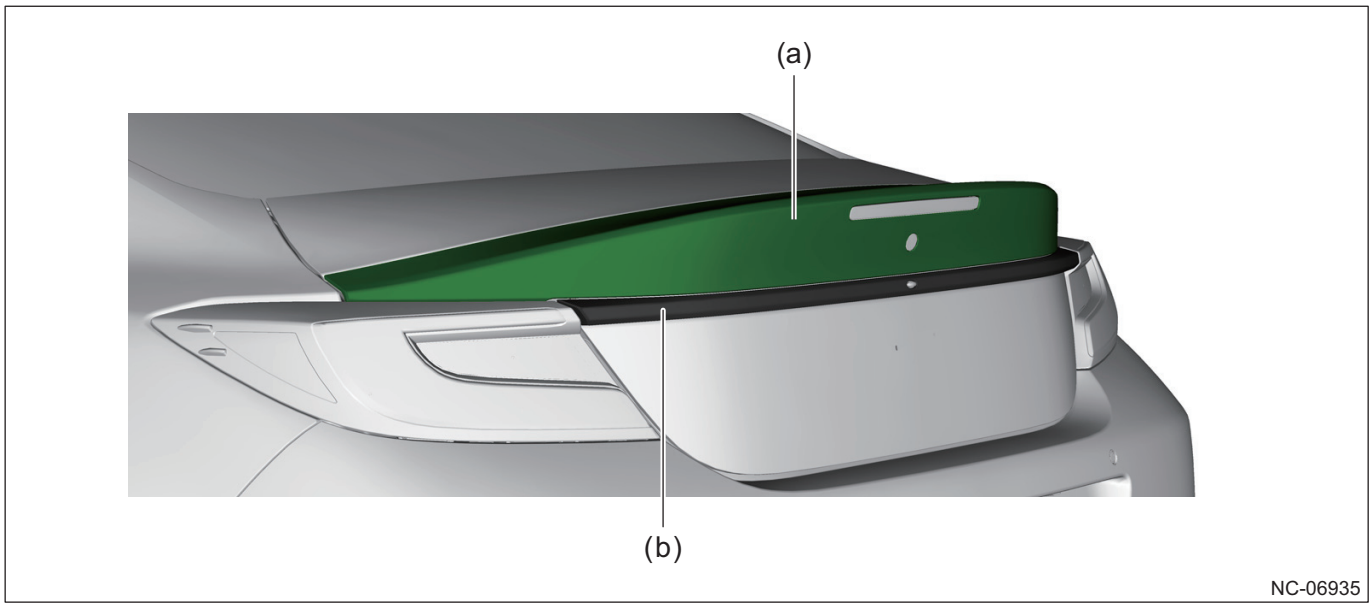


NC-08654

Trunk garnish

A resin trunk garnish with a ducktail shaped design befitting of a sports car is adopted on the rear end of the trunk.

- The ducktail shape ensures high aerodynamic performance.
- The position does not impair the view from within the vehicle interior, ensuring visibility for the upper rear end of the trunk, which improves recognition of the vehicle rear end when reversing.
- High-gloss black garnish molding is adopted for a design with a sense of integration that continues from the rear combination light.



(a) Trunk garnish

(b) Garnish molding

10 INTERIOR TRIM

CONTENTS

10.1 General Overview 10-3
10.1.1 Overview 10-3
10.2 Air conditioning system 10-4
10.2.1 Overview 10-4
10.2.2 Component. 10-6
10.2.3 Construction and Operation. 10-22
10.3 Airbag system 10-28
10.3.1 Overview 10-28
10.3.2 Component. 10-29
10.3.3 Construction and Operation. 10-42
10.4 Seat and Seat belt 10-53
10.4.1 Overview 10-53
10.4.2 Component. 10-54
10.4.3 Construction and Operation. 10-65
10.5 Instrument Panel 10-67
10.5.1 Overview 10-67
10.5.2 Component. 10-67
10.6 Interior Trim/Interior Equipment 10-76
10.6.1 Overview 10-76
10.6.2 Component. 10-76
10.7 Door Lock and Security System 10-88
10.7.1 Overview 10-88
10.7.2 Component. 10-89
10.7.3 Construction and Operation. 10-95
10.8 Lighting System 10-114
10.8.1 Overview 10-114
10.8.2 Component. 10-115
10.8.3 Construction and Operation. 10-120

10.9 Inner Mirror. 10-123
10.9.1 Overview 10-123
10.9.2 Component. 10-123

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.

- Adoption of fully automatic air conditioning for all grades
- Addition of "VENT II" mode to "multistage outlet mode" for improved comfort of interior environment
- Addition of MAX A/C function to improve convenience
- Addition of air flow volume gradual change control for manual operation to improve air conditioning quality
- Adoption of A/C control panel with additional buttons and mode displays to support new functions
- Adoption of an air conditioning system that supports a new refrigerant (HFO-1234yf) for compliance with environmental regulations in consideration of preventing global warming
- Operations for the air conditioning system are enabled before entering the vehicle from a device such as a smartphone. (For U4, C0 (AT models only))

Specifications

HVAC system

Heater system

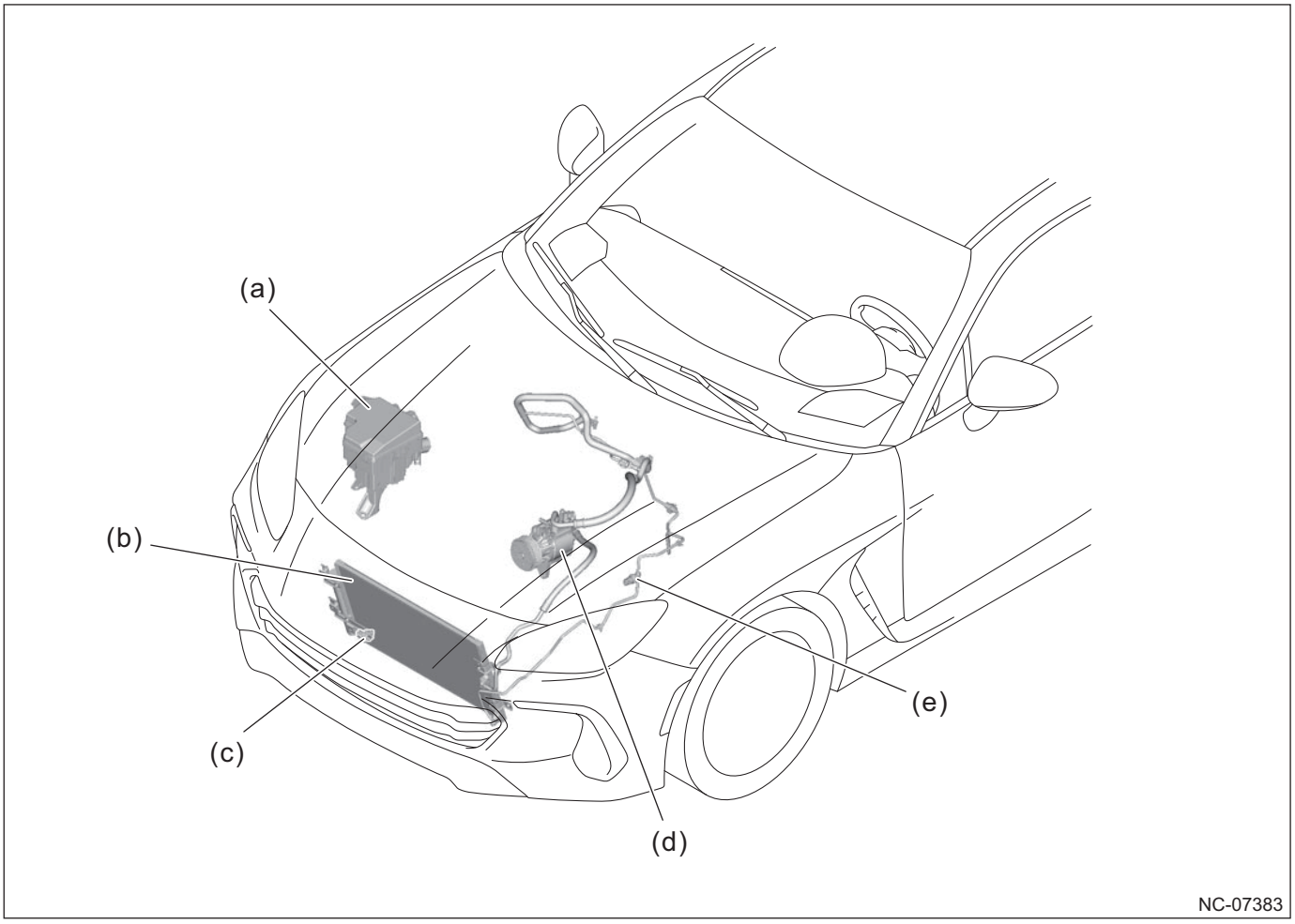
Item	Specifications	Condition
Air flow amount	290 m^3/h	Temperature setting: HI (warmest) Fan speed: HI (MAX) Fresh air and recirculation switching position (FRESH) Mode switching position (FOOT)

Air conditioning system

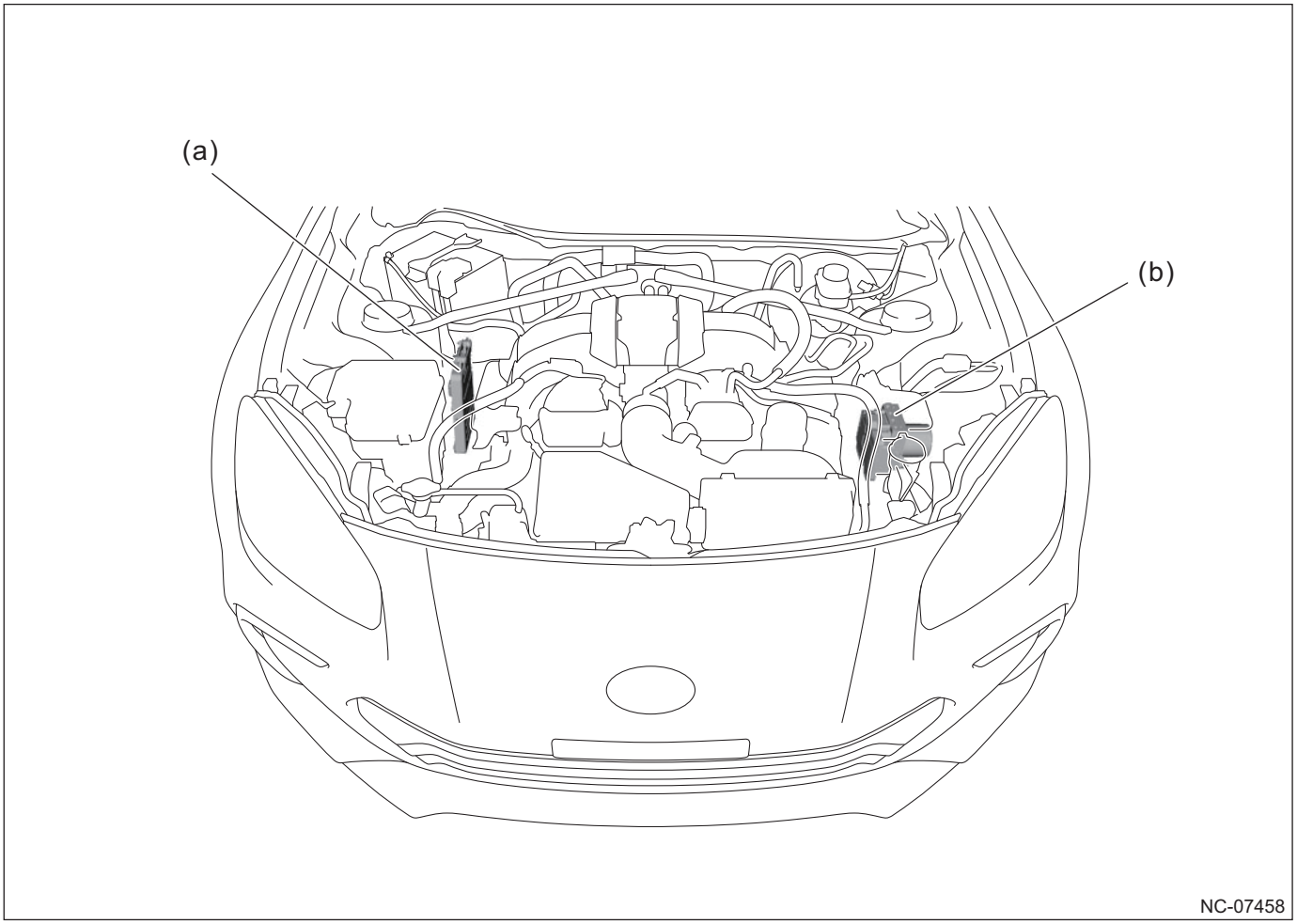
Item	Specifications	Condition
Air flow amount	445 m^3/h	Temperature setting: LO (coolest) Fan speed: HI (MAX) Fresh air and recirculation switching position: RECIRC Mode switching position: VENT
Compressor	Fixed capacity with clutch type (SCSA08H)	-
Type of air conditioner type	Reheat air-mix type	-
Refrigerant	HFO-1234yf (CH2=CFCF3) [0.450±0.030 kg]	-

10.2.2 Component

Component layout drawing

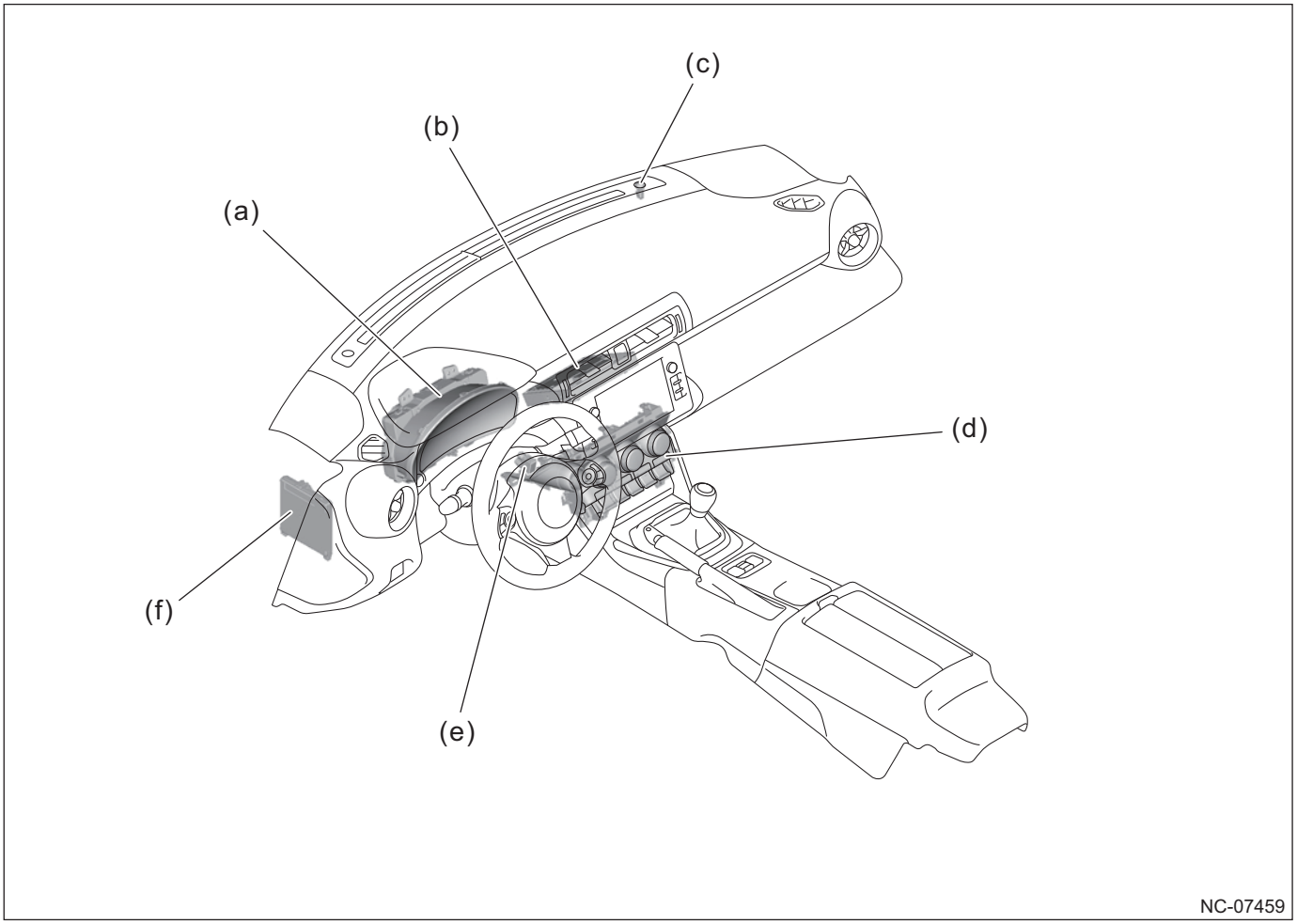


(a) M/B (main fuse & relay box)
(b) Condenser assembly
(c) Ambient sensor
(d) Compressor assembly
(e) Pressure switch

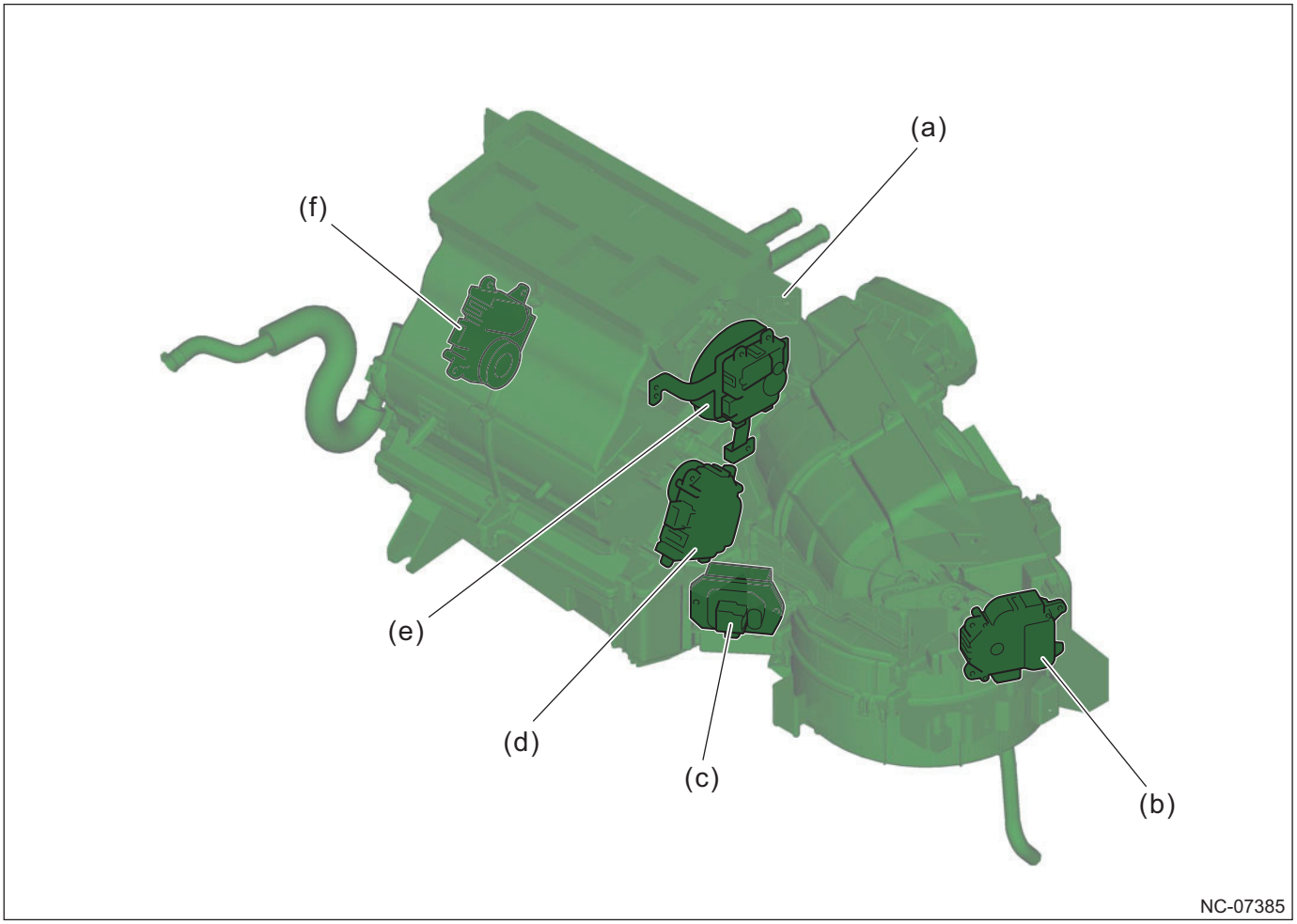


(a) Engine Control Module (ECM)

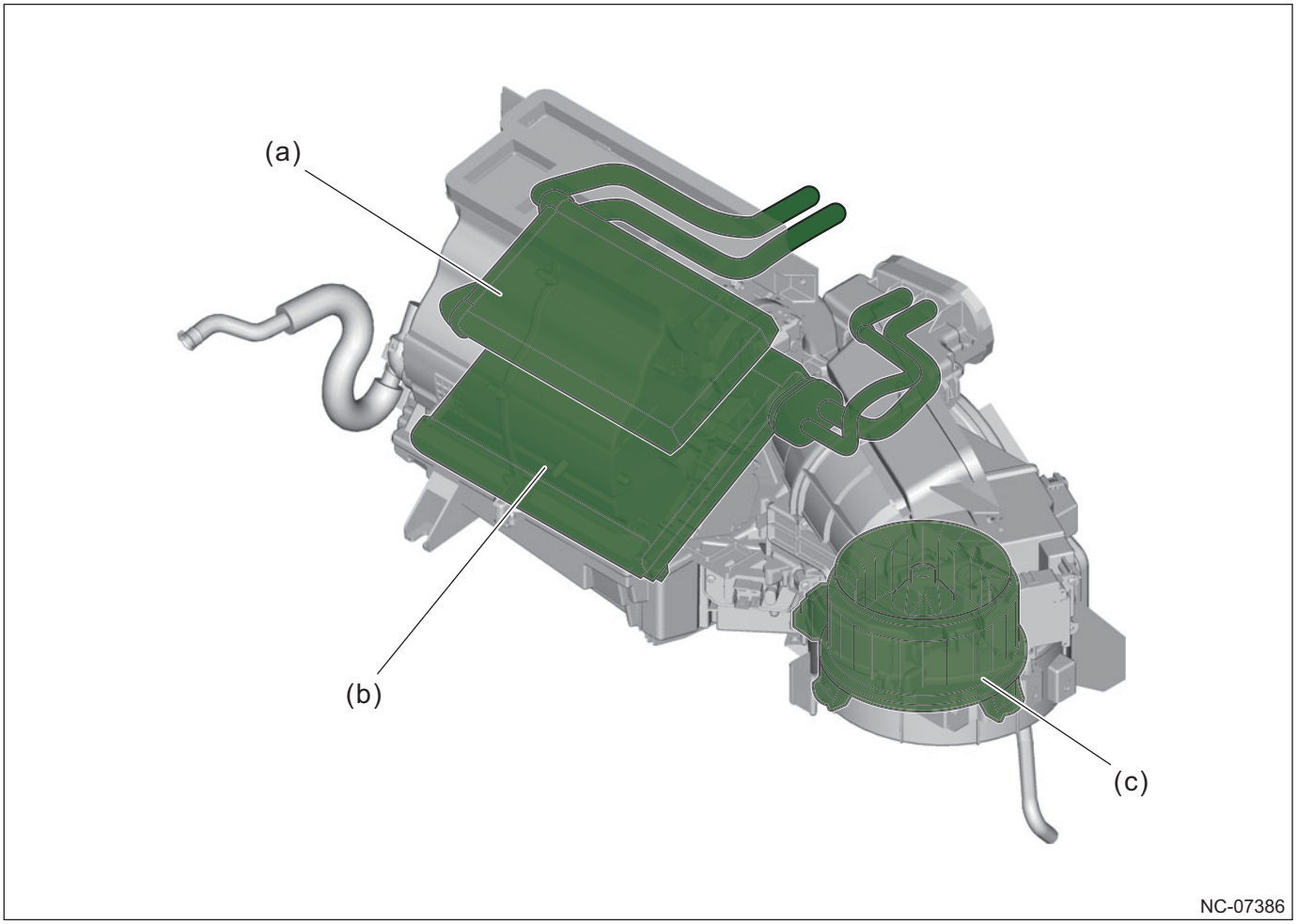
(b) VDC CM & H/M



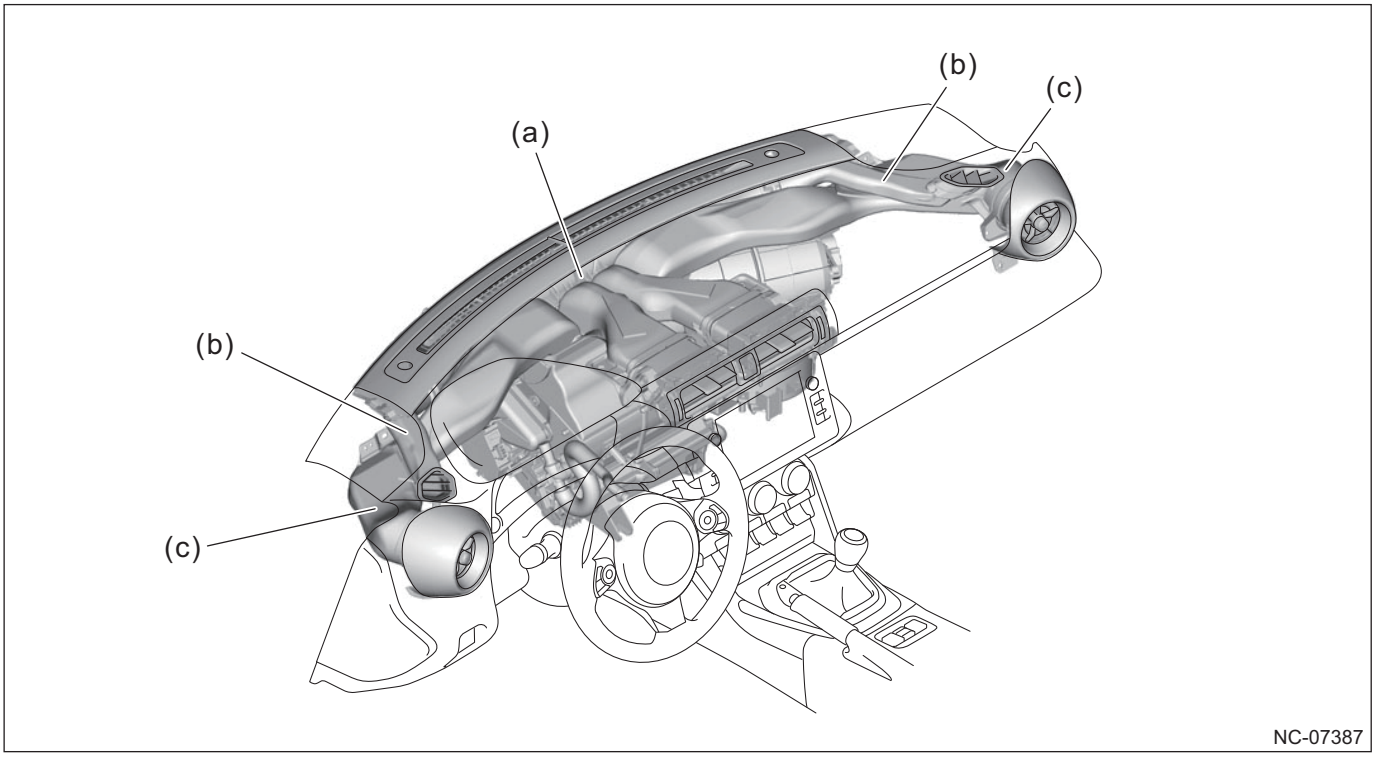
(a) Combination meter
(b) DCM
(c) Sunload sensor
(d) A/C control panel
(e) Interior temperature sensor
(f) Body Integrated Unit (BIU)



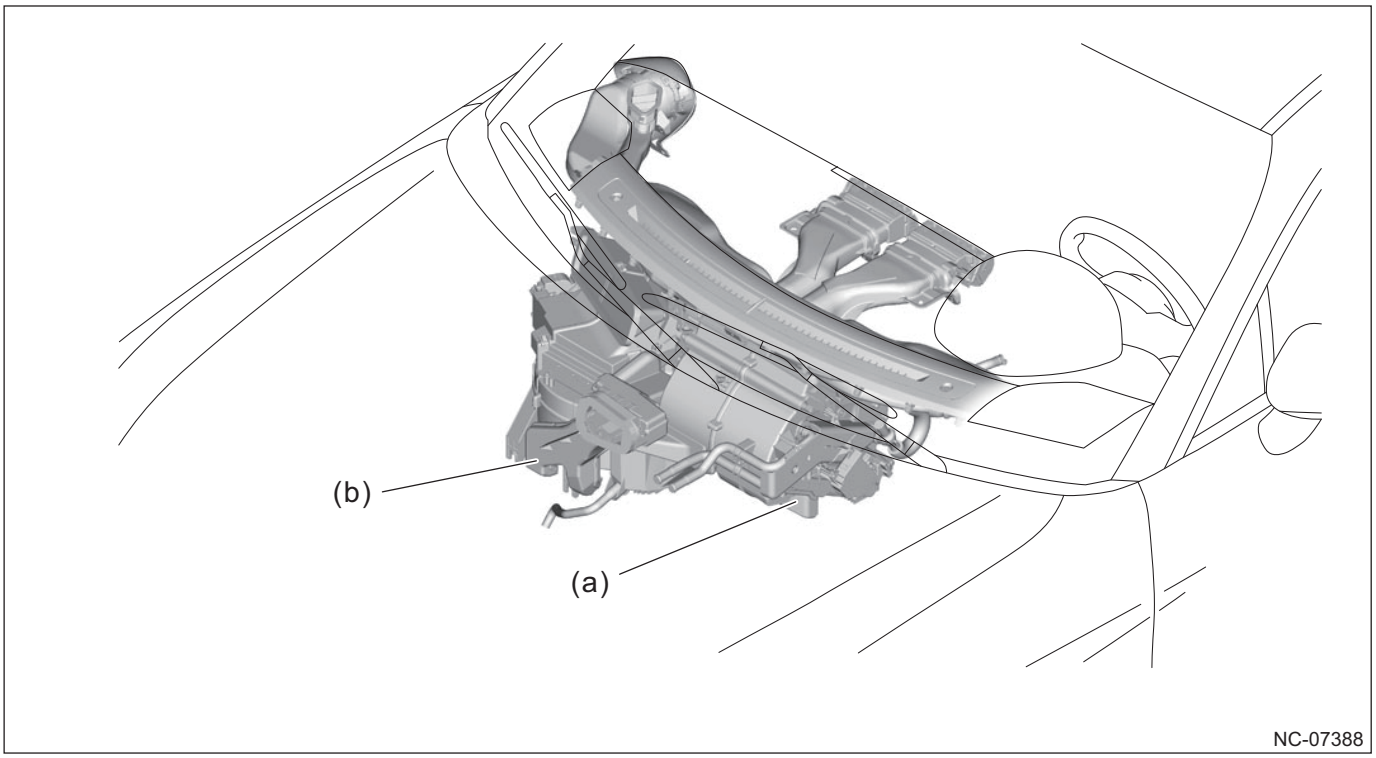
(a) Air conditioning module (HVAC)
(b) Fresh air flap control door actuator
(c) Power transistor
(d) Air mix door actuator RH
(e) Mode door actuator
(f) Air mix door actuator LH



(a) Heater core
(b) Evaporator assembly
(c) Blower motor assembly



(a) Nozzle front defroster assembly
(b) Duct side defroster
(c) Duct ventilation

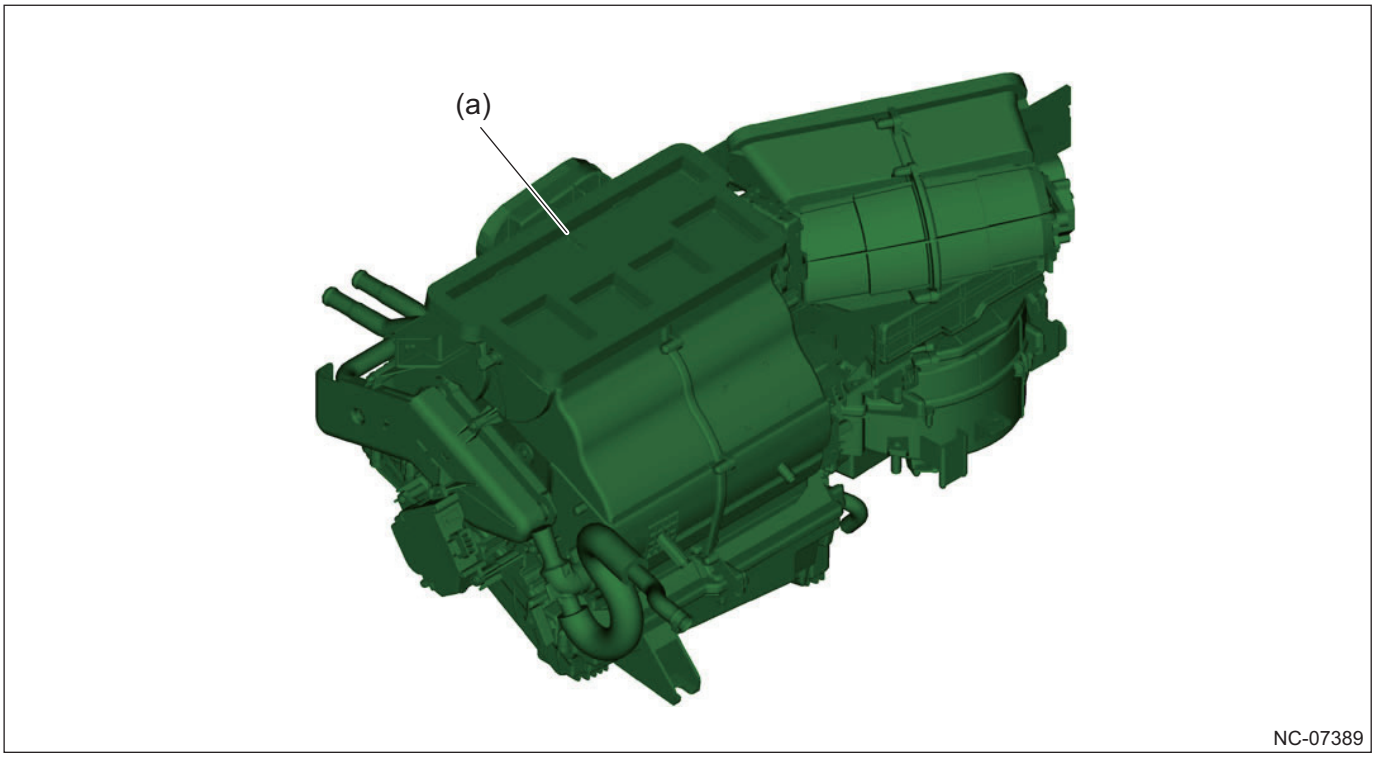


(a) Duct foot driver
(b) Duct foot passenger

Component details

Air conditioning module (HVAC)

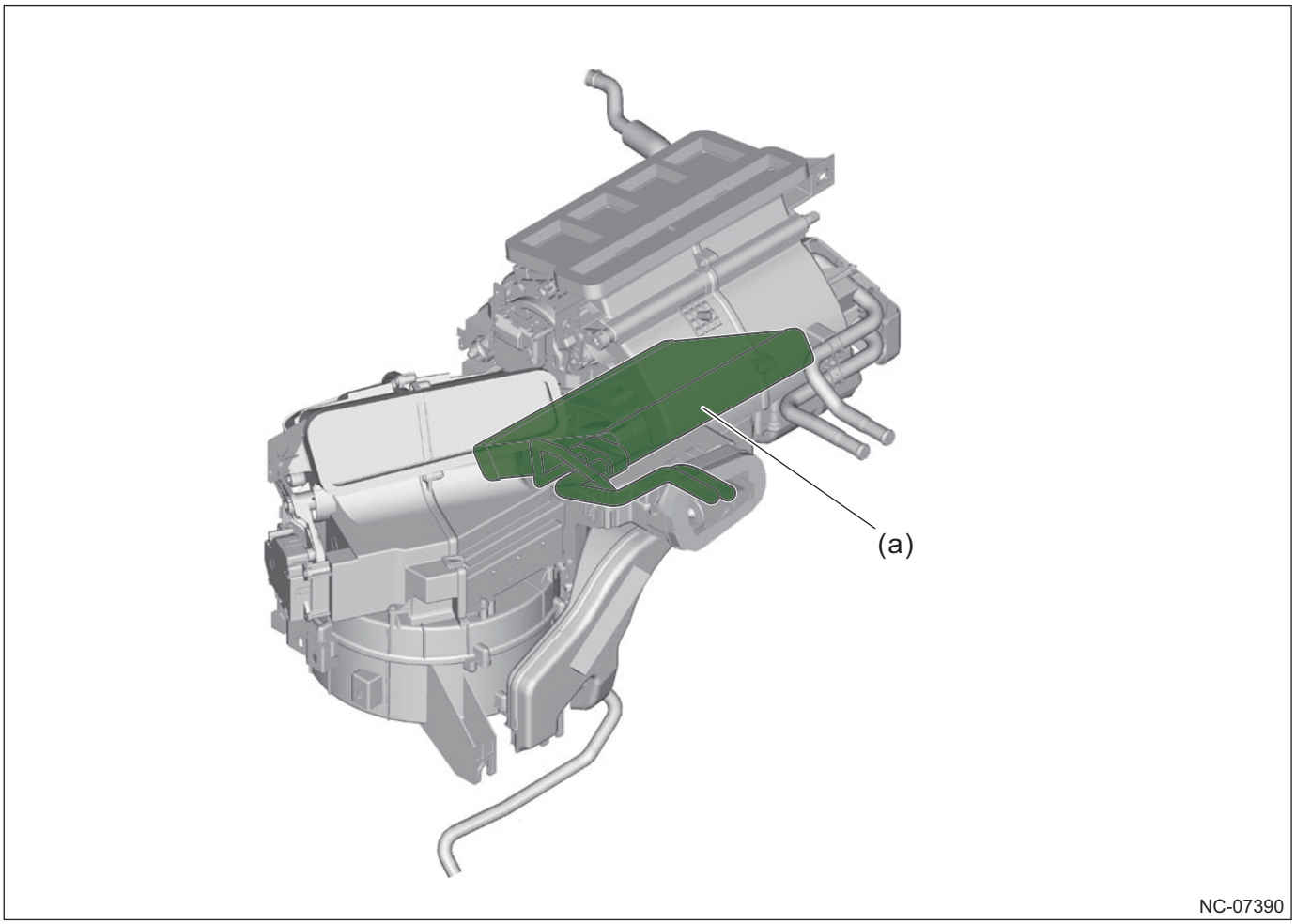
An air conditioning system that supports a new refrigerant (HFO-1234yf) is adopted for compliance with environmental regulations.



(a) Air conditioning module (HVAC)

■ Evaporator

In order to ensure the cooling performance for the air conditioning module (HVAC), an evaporator with excellent heat exchange performance is adopted.

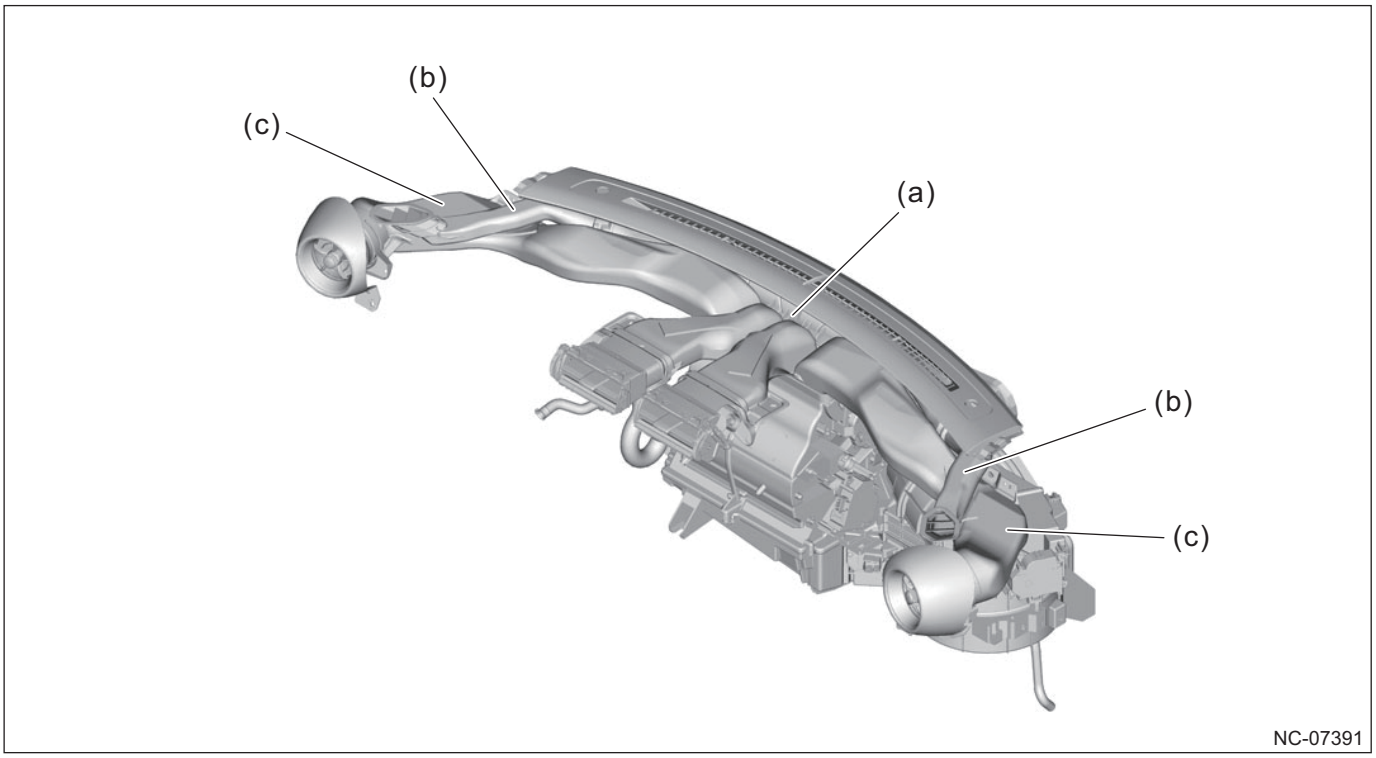


(a) Evaporator

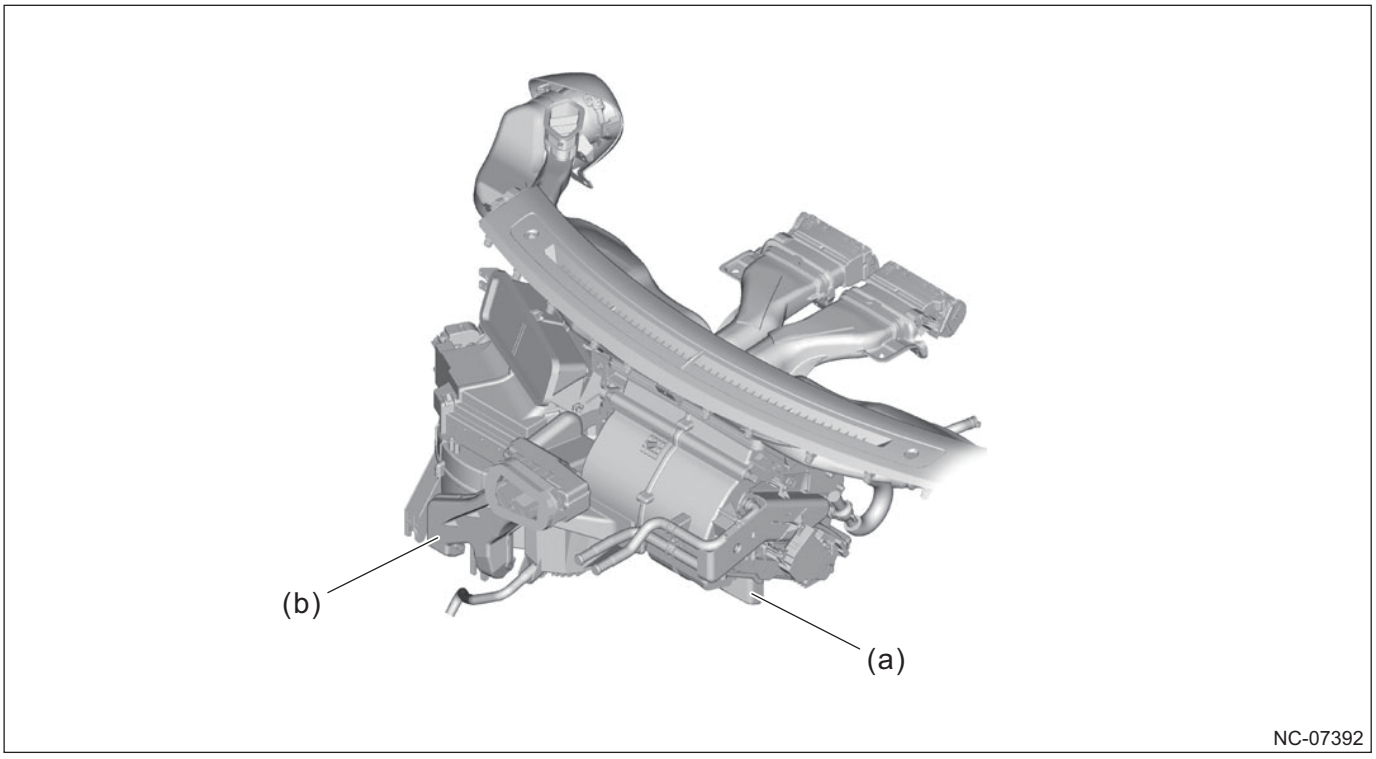
Duct for air conditioning

■ Front

The air conditioning duct shape is optimized to reduce pressure loss, ensuring sufficient air flow volume.



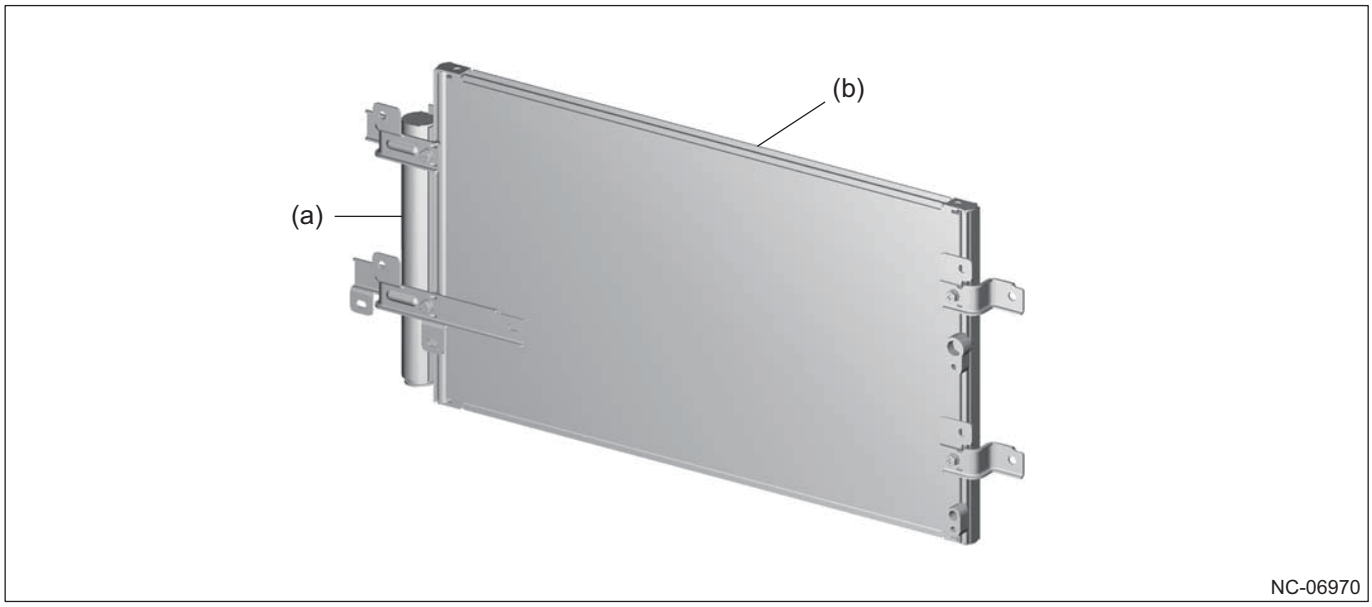
(a) Nozzle front defroster assembly
(b) Duct side defroster
(c) Duct ventilation



(a) Duct foot driver
(b) Duct foot passenger

Condenser assembly

A part is adopted that has excellent heat exchange efficiency by integrating the multi flow condenser and gas-liquid separator (modulator), and adopting a cooler condenser with a sub cool cycle.

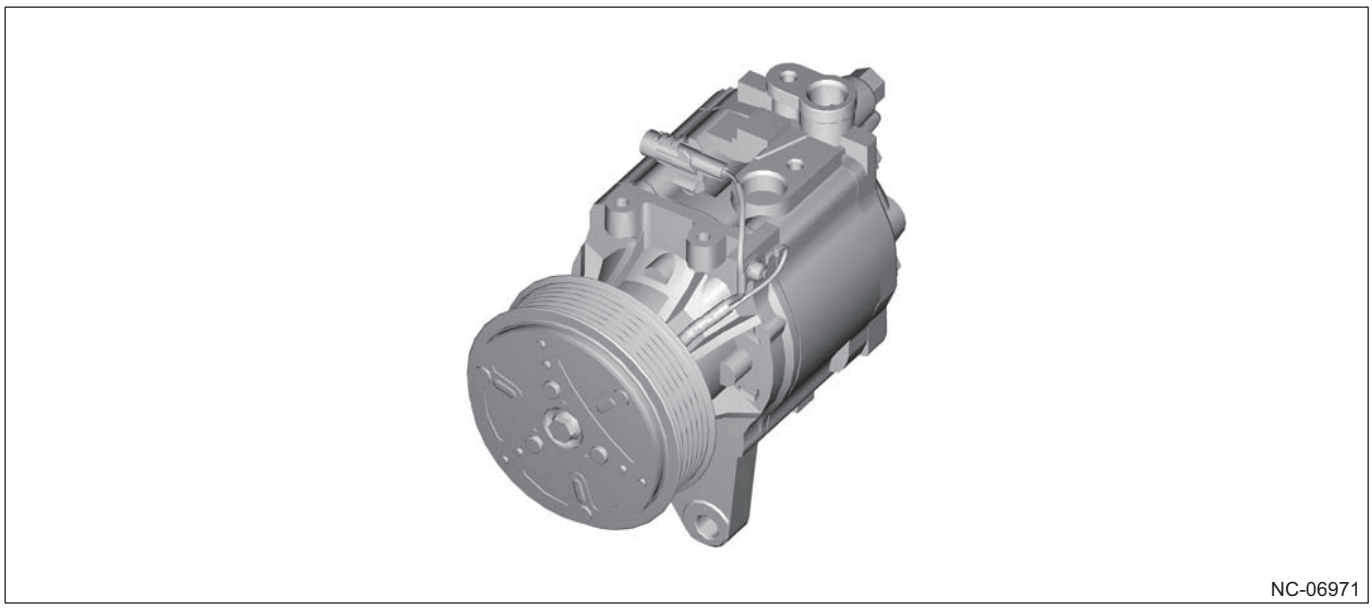


(a) Gas-liquid separator (modulator)

(b) Condenser

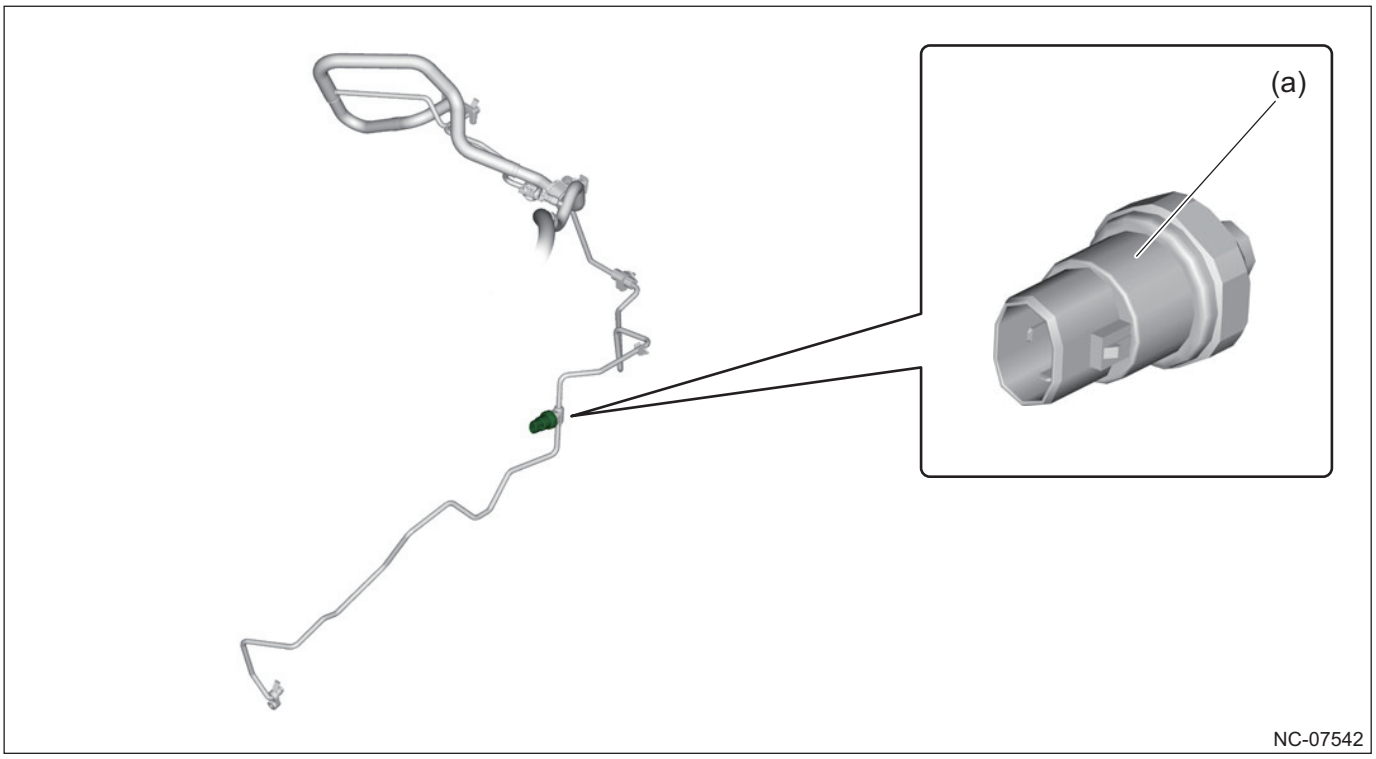
Compressor assembly

A scroll type compressor is adopted that is small, lightweight, and highly efficient.



Pressure switch

A pressure switch is provided for the pipe and information expressing the pressure status of the sealed refrigerant is transmitted to the A/C CM and Engine Control Module (ECM), enabling cooling fan control as appropriate for the air conditioning status.

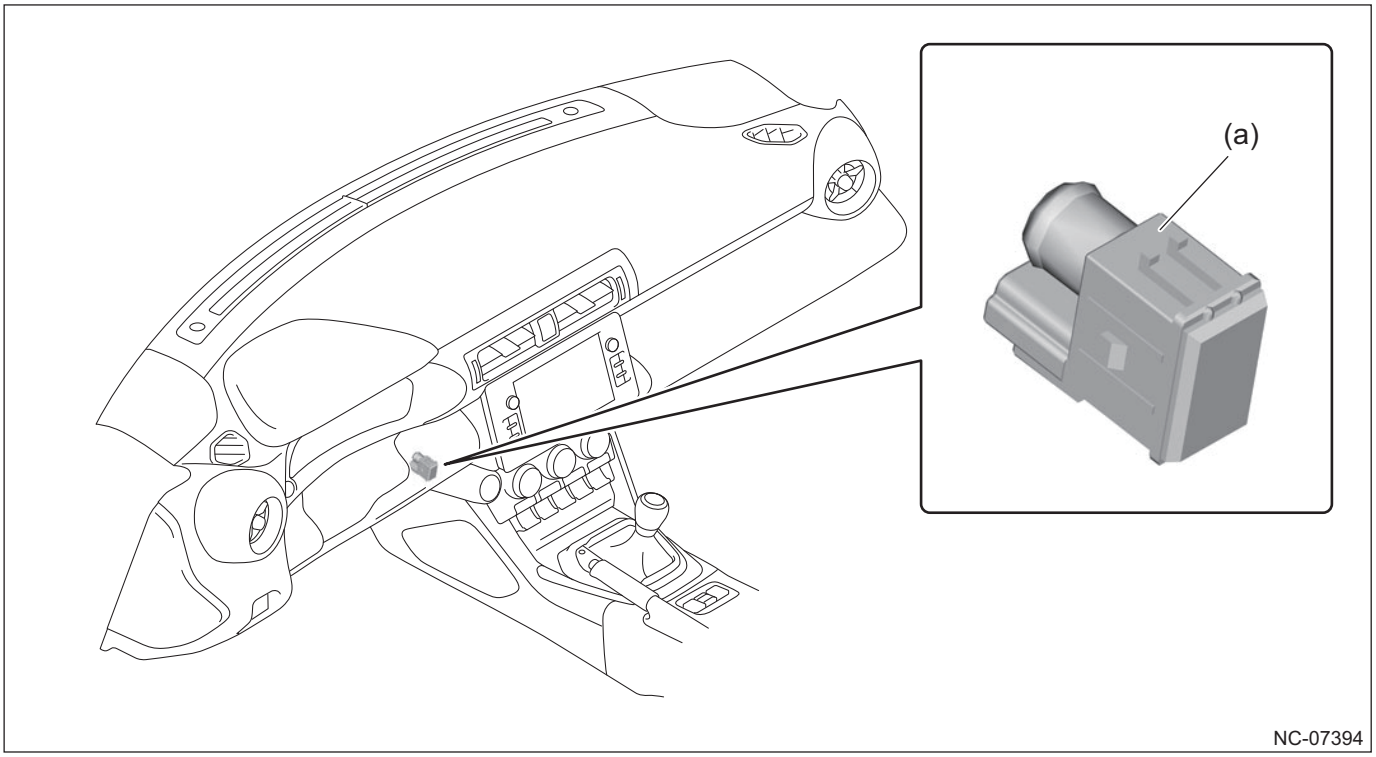


(a) Pressure switch

Interior temperature sensor

An interior temperature sensor is adopted to improve comfort.

The resistance value changes by using the air flow volume within the air conditioning module to make the vehicle interior air pass through the sensor. By applying the voltage obtained from the A/C CM to the sensor, the changing voltage value is output to the A/C CM.

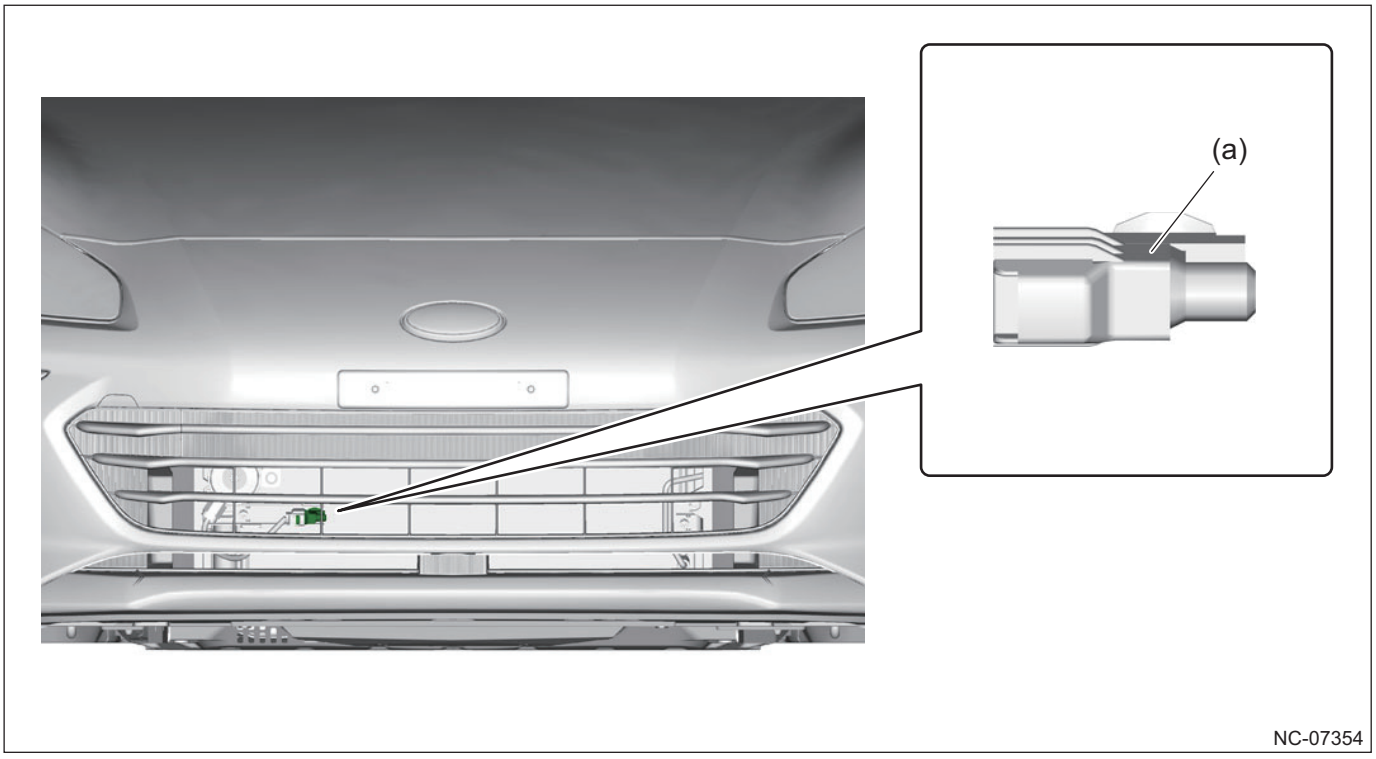


(a) Interior temperature sensor

Ambient sensor

An ambient sensor is adopted to improve comfort.

By applying the voltage obtained from the combination meter to the sensor, the changing voltage value is output to the combination meter, and the information is received by the A/C CM via CAN communication.

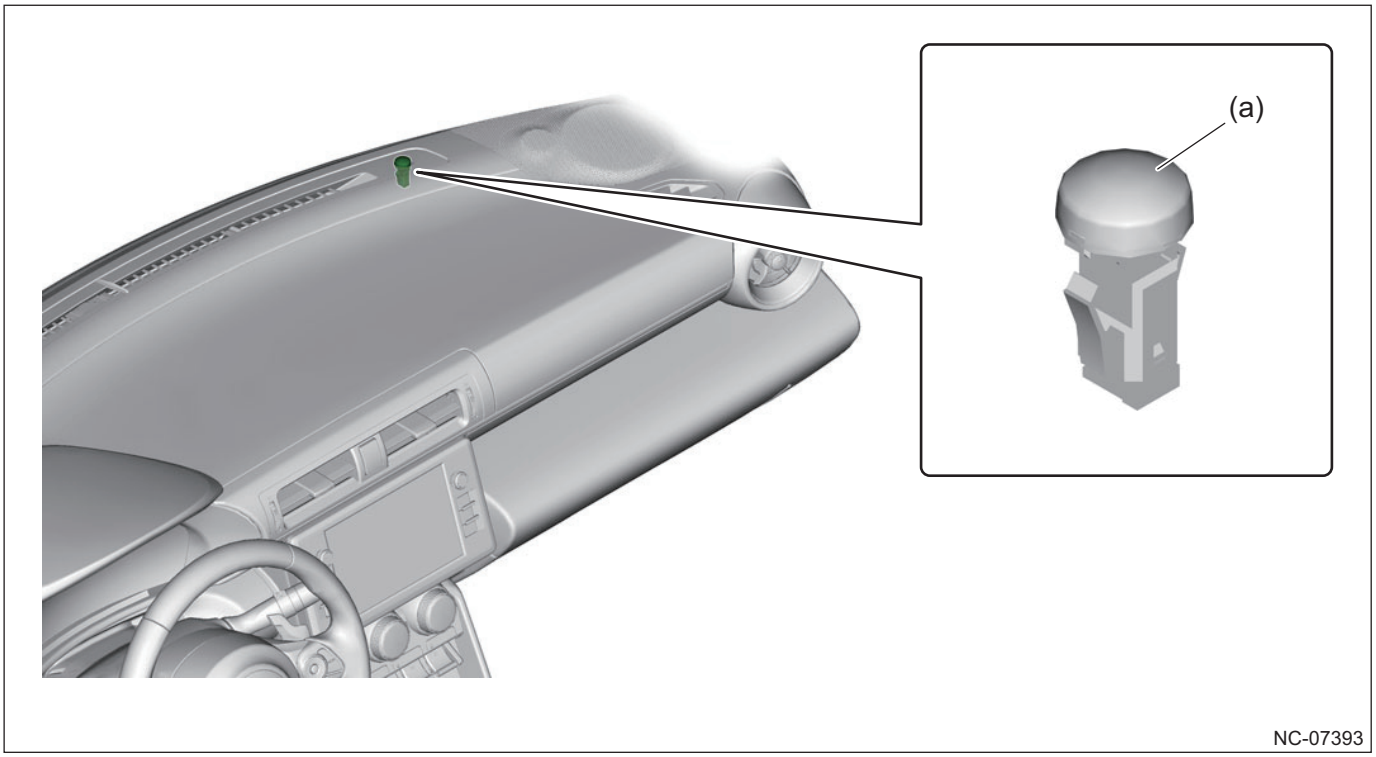


(a) Ambient sensor

Sunload sensor

A sunload sensor integrated with an automatic light control sensor is adopted.

Changes in the sunload amount are detected by the scanner (integrated optical sensor) and the information is output to the A/C CM.



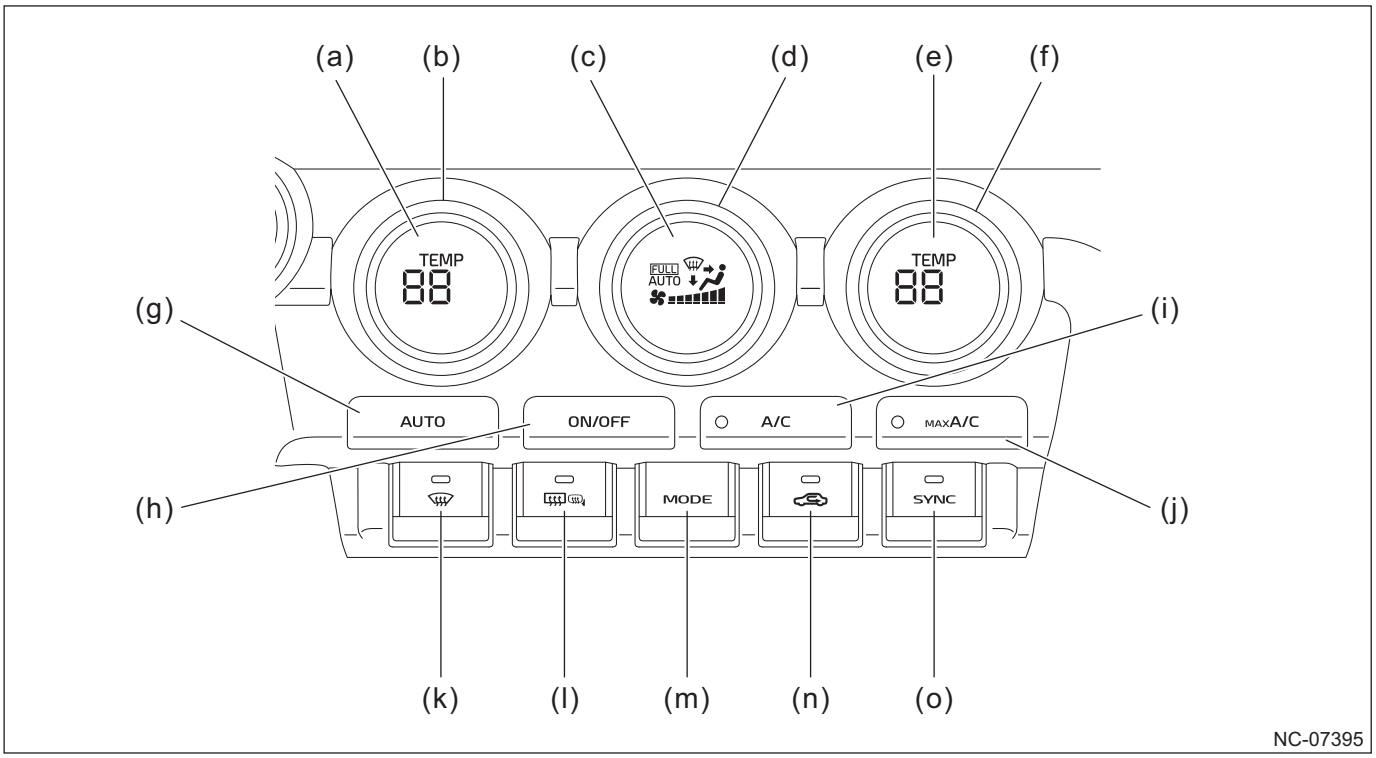
(a) Sunload sensor

A/C control panel

The part has been renewed as an A/C control panel with additional buttons and mode displays to support new functions.

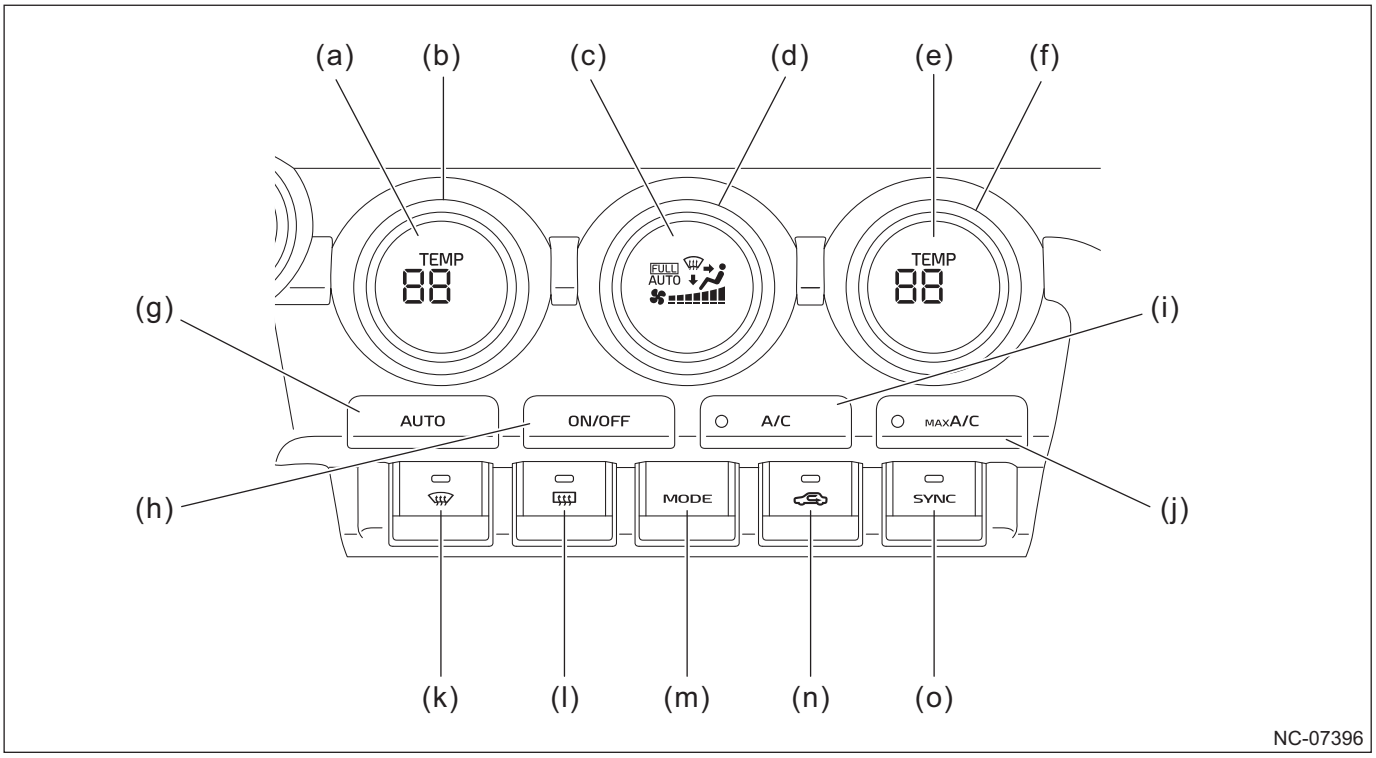
LCD screens are installed inside the dials to improve daytime visibility.

Models with mirror heater



(a) Temperature display (driver's seat side)
(b) Temperature adjustment dial (driver's seat side)
(c) Air flow volume/air flow outlet display
(d) Air flow volume adjustment (fan) dial
(e) Temperature display (passenger's seat side)
(f) Temperature adjustment dial (passenger's seat side)
(g) AUTO switch
(h) ON/OFF switch
(i) A/C switch
(j) MAX A/C switch
(k) Defroster switch
(l) Rear window defogger/heated door mirror switch
(m) Air flow outlet switch
(n) Fresh air and recirculation switch
(o) SYNC switch (link mode switch)

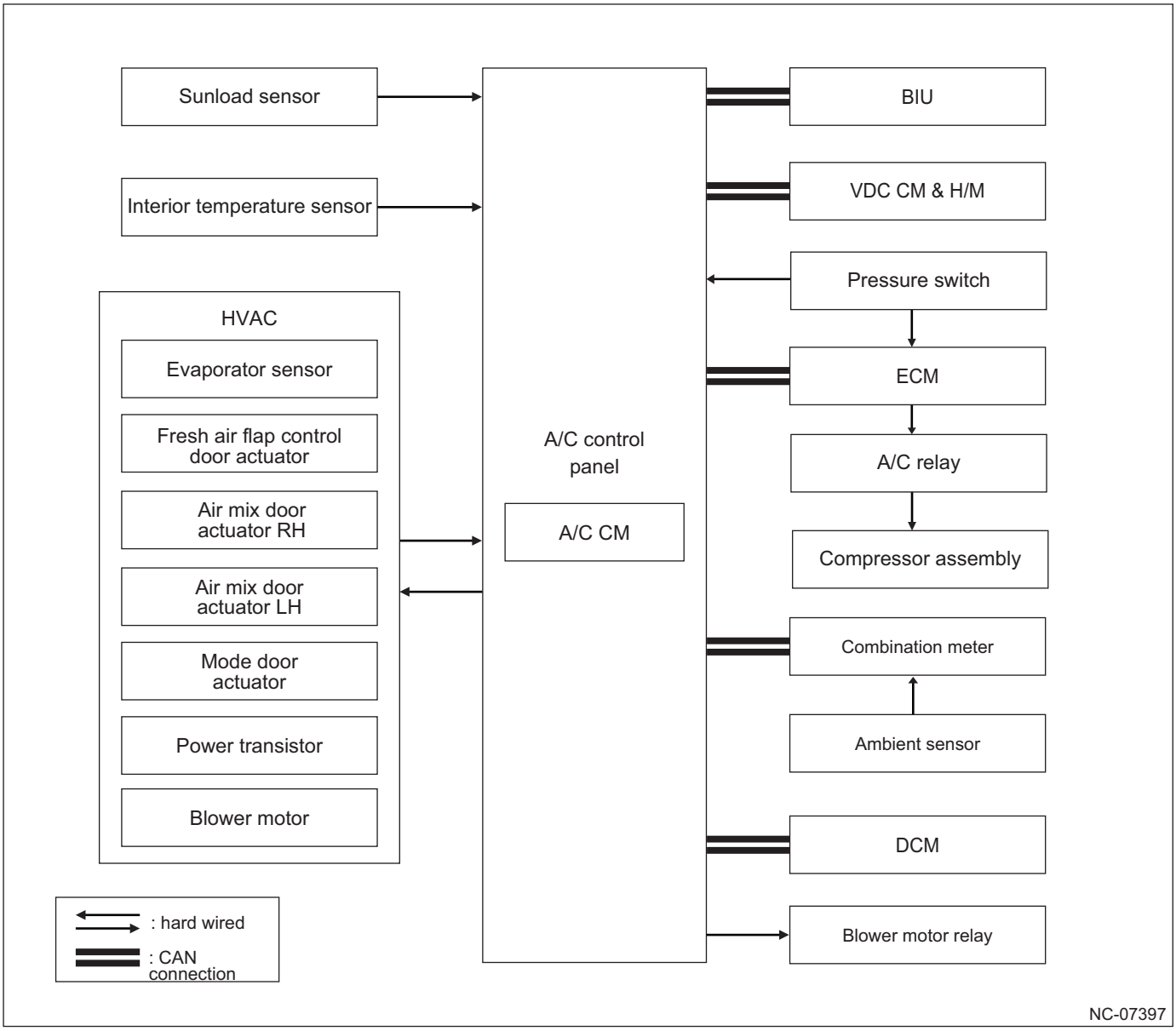
Models without mirror heater



(a) Temperature display (driver's seat side)
(b) Temperature adjustment dial (driver's seat side)
(c) Air flow volume/air flow outlet display
(d) Air flow volume adjustment (fan) dial
(e) Temperature display (passenger's seat side)
(f) Temperature adjustment dial (passenger's seat side)
(g) AUTO switch
(h) ON/OFF switch
(i) A/C switch
(j) MAX A/C switch
(k) Defroster switch
(l) Rear window defogger switch
(m) Air flow outlet switch
(n) Fresh air and recirculation switch
(o) SYNC switch (link mode switch)

10.2.3 Construction and Operation

System diagram



Main component functions

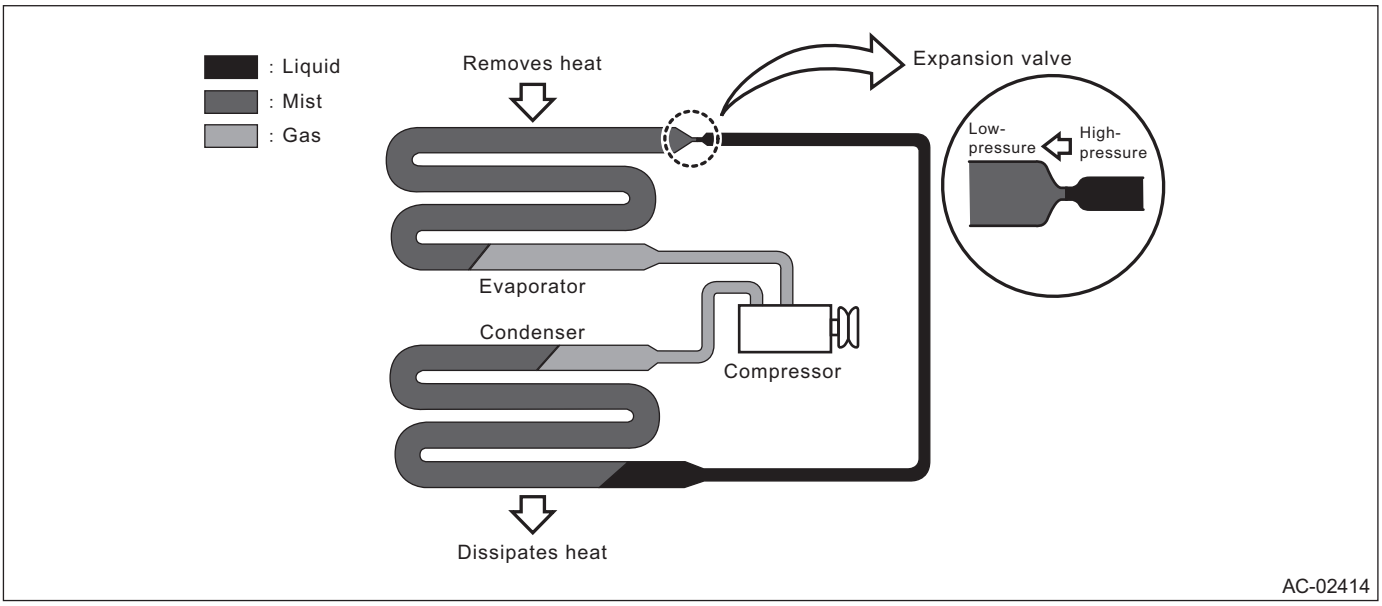
Air conditioning system

Component	Main functions
Sunload sensor	Detects the sunload amount and sends the information to the A/C CM.
Interior temperature sensor	Detects the interior temperature and sends the information to the A/C CM.
Pressure switch	Detects the refrigerant pressure status and sends the information to the A/C CM and Engine Control Module (ECM).
Compressor assembly	Performs refrigerant intake, compression, and discharge.
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.
Air mix door actuator	Opens and closes the air mix door.
Mode door actuator	Opens and closes the mode switching door.
Power transistor	Controls the blower motor speed according to A/C CM control.
Blower motor	Driven according to the target air flow volume calculated by the A/C CM. Blows air into the vehicle interior.
A/C control panel	• Sends the signal of each switch to the A/C CM. • Displays the control status of the air conditioning system.
A/C CM	Controls the air conditioning system according to the signals from the switches, sensors, and computers.
Body Integrated Unit (BIU)	Sends rear defogger operation information to the A/C CM.
VDC CM & H/U	Sends the average speed signal 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. • Drives the compressor assembly according to the ON/OFF request signal from the A/C CM.
Ambient sensor	Detects the ambient temperature and sends the information to the combination meter.
Combination meter	Sends the ambient temperature signal to the A/C CM.
DCM	Sends the air conditioning setting value received from the server to the A/C CM.

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 comfortable cabin temperature

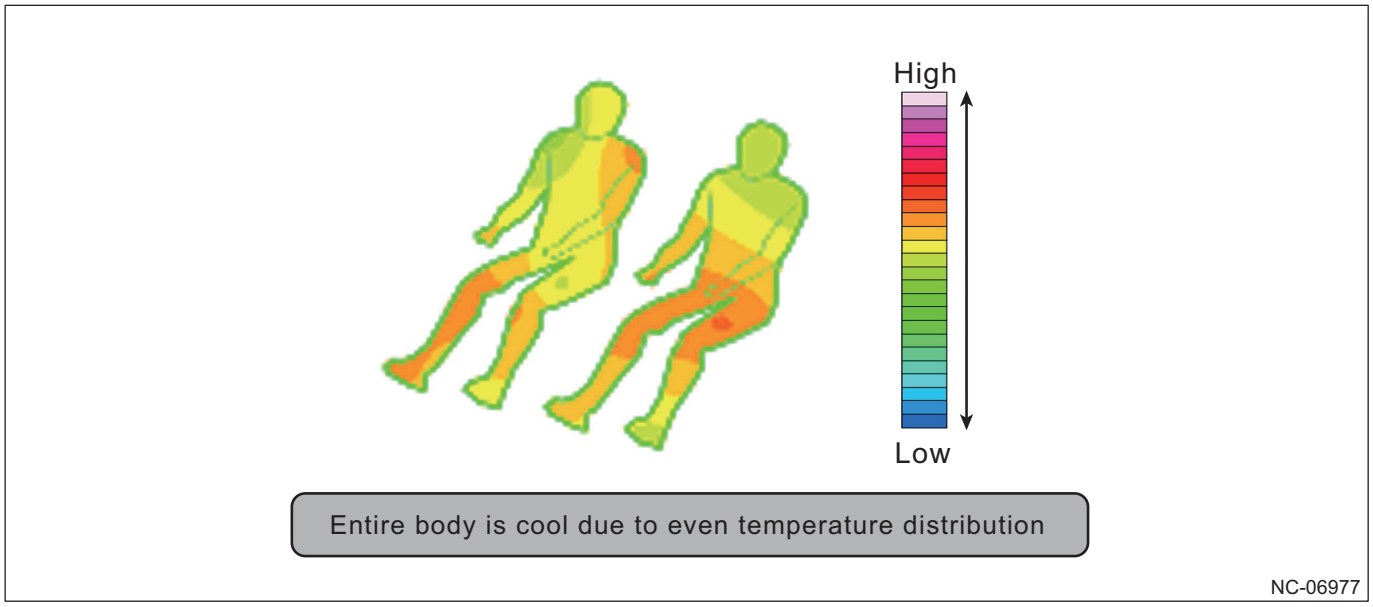
■ Multistage outlet mode

The multistage outlet mode is adopted to create a comfortable temperature space.

Outlet mode control list

Mode					
VENT	VENT Ⅱ	B/L	FOOT	F/D	DEF
					

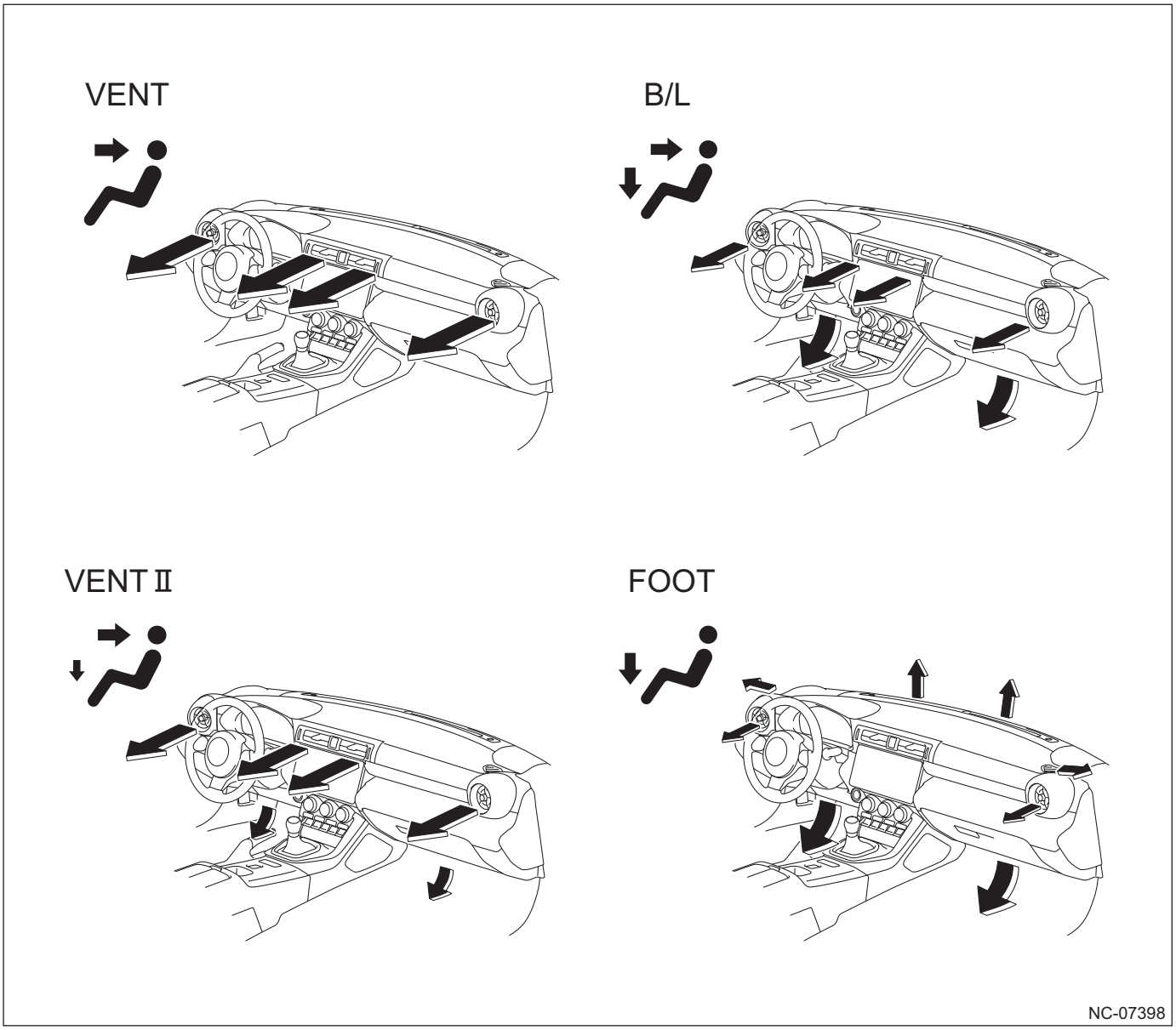
In particular, "VENT II" mode that sends a small amount of cool air around the feet during cooling is adopted to solve the moist feeling around the feet when hot.



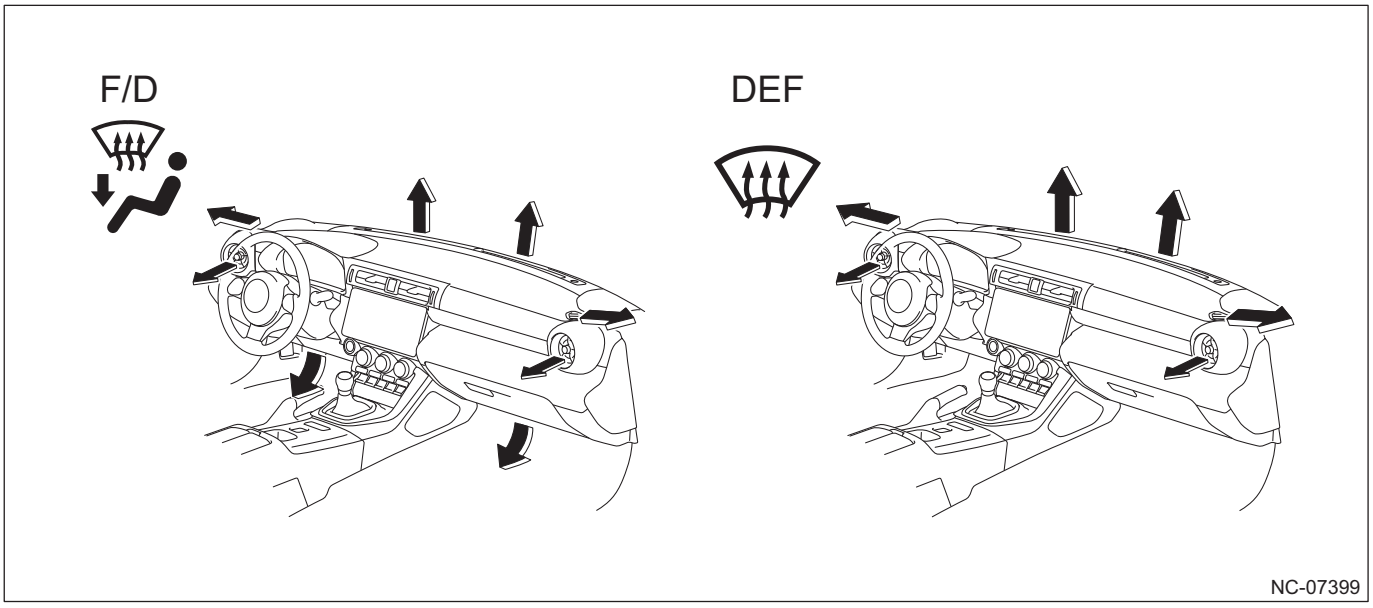
■ Mode display and air flow outlet

Each mode display and air conditioning air flow outlet are shown.

Driver's seat/passenger's seat



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.

■ Air flow volume gradual change control for manual operation

The air flow volume change when the air flow volume is set with a manual operation has been made smoother to improve the air conditioning quality.

■ Telematics remote engine starter system air conditioning control (for U4, C0 (AT models only))

Operations for the air conditioning system are enabled before entering the vehicle from a device such as a smartphone by linking to telematics.

Specifying the air conditioning settings in detail, such as defrosting the front windshield or turning on the heating or cooling in advance to adjust the interior temperature, provides the peace of mind of a comfortable interior as soon as the user enters the vehicle.

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
- Pretensioner (driver's seat, passenger's seat shoulder belt)
- Adaptive force limiter (passenger's seat)

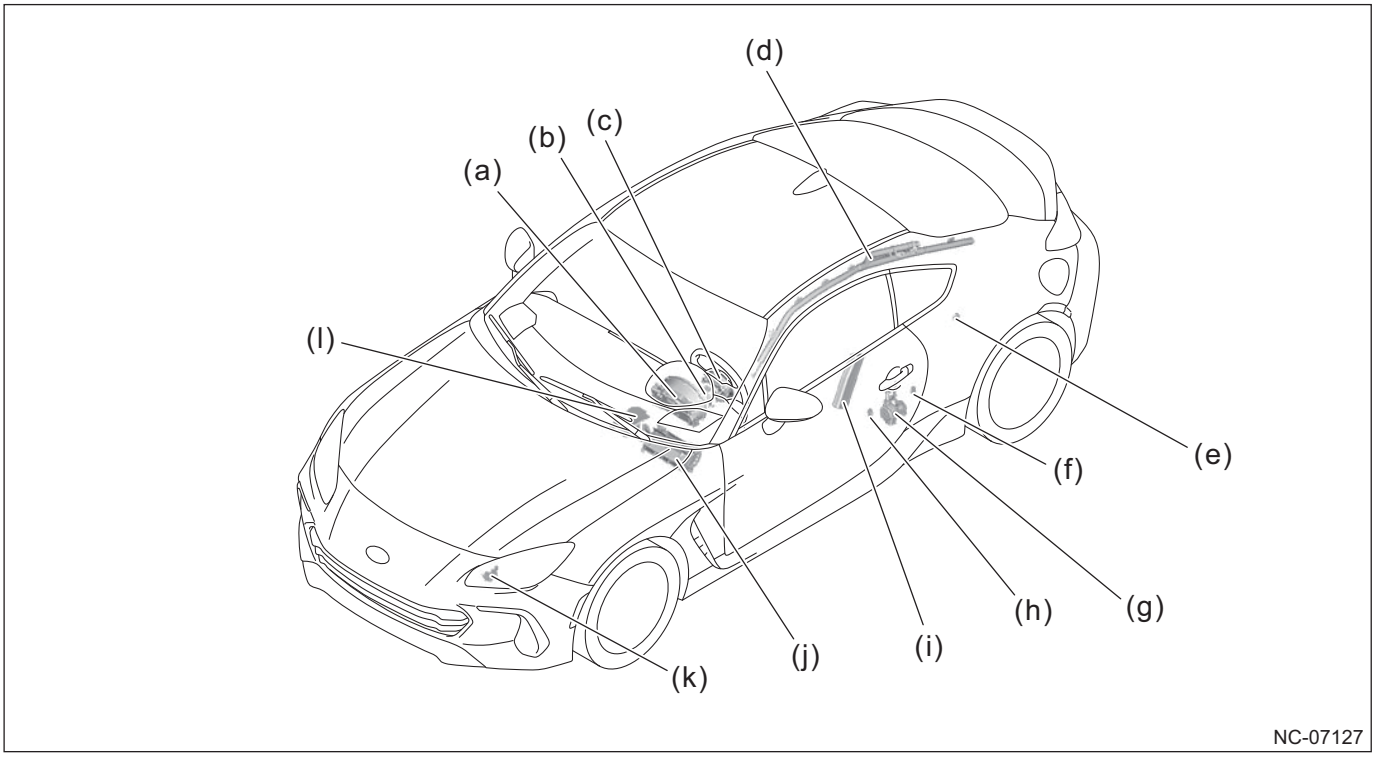
In the layout of each sensor, the pressure sensor is arranged within the front door to enable early and stable collision sensing and operate the airbag safely to improve passenger protection performance.

An occupant detection sensor is adopted for the passenger's seat.

10.3.2 Component

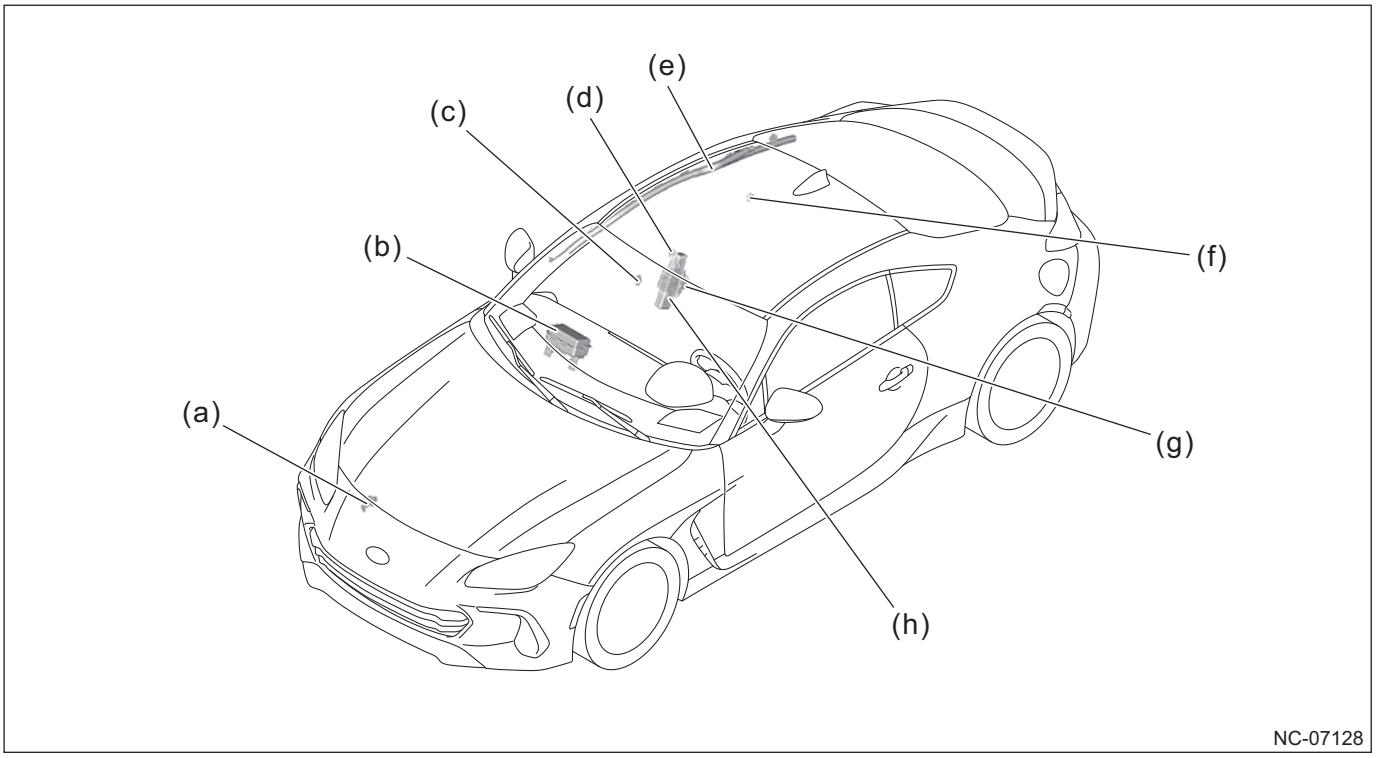
Component layout drawing

Airbag system, Seat belt pretensioner 1



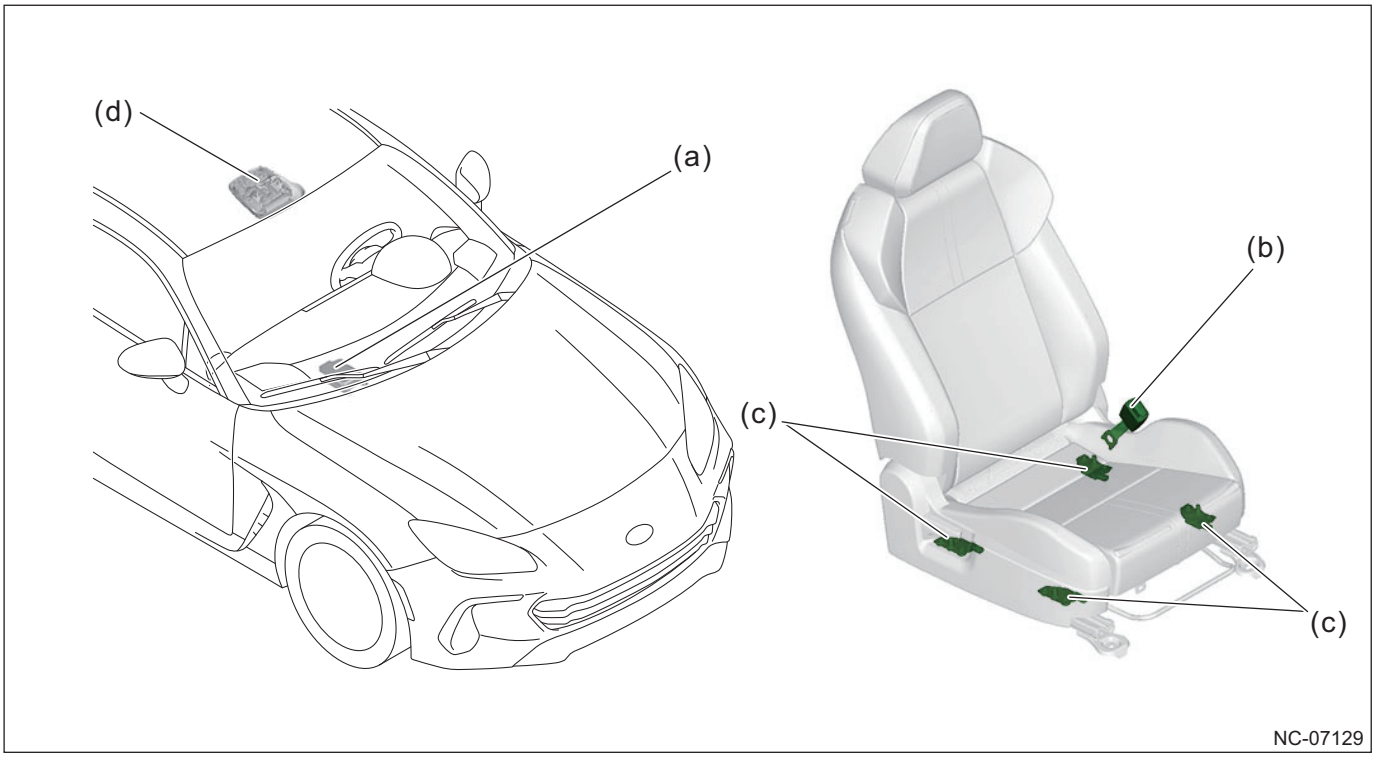
(a) Airbag warning light (in combination meter)
(b) Steering roll connector
(c) Driver's airbag module
(d) Curtain airbag module LH
(e) Side impact sensor LH (rear wheel house)
(f) Side impact sensor LH (center pillar)
(g) Front seat belt pretensioner LH
(h) Side impact sensor LH (front door)
(i) Side airbag module LH
(j) Knee airbag module
(k) Front impact sensor LH
(l) 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) Front seat belt pretensioner and adaptive force limiter RH
(e) Curtain airbag module RH
(f) Side impact sensor RH (rear wheel house)
(g) Side impact sensor RH (center pillar)
(h) Side airbag module RH

Occupant detection system (passenger's seat)



(a) Airbag control module

(b) Buckle switch (passenger's seat)

(c) Occupant detection sensor (passenger's seat)

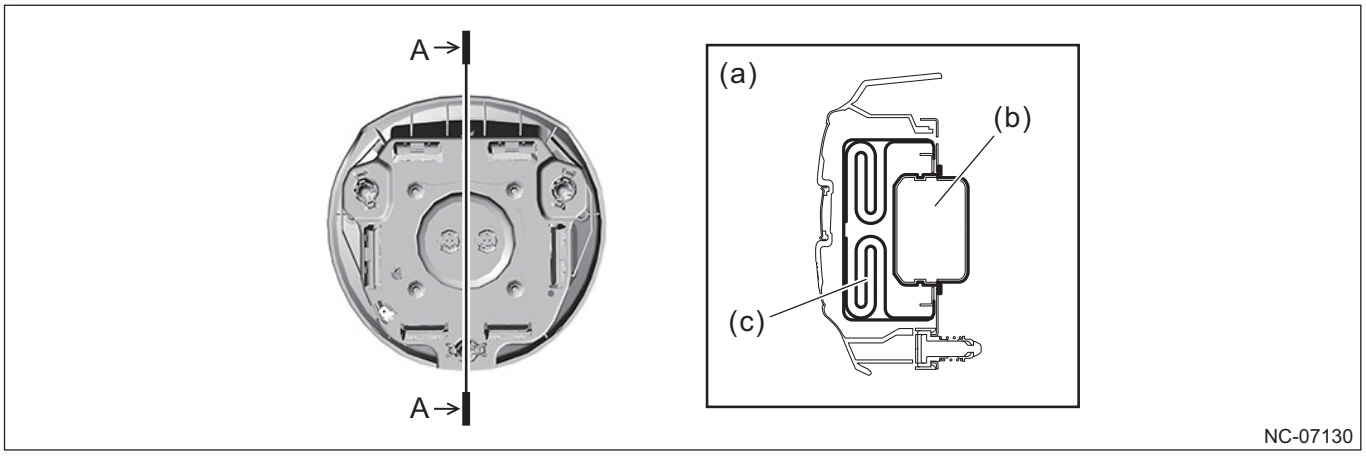
(d) Passenger's airbag ON/OFF indicator light (in warning box)

Component details

Driver's airbag module

The driver's airbag module is built into the steering wheel pad.

The driver's airbag module is a non-disassembling type, and is composed of a cover, case, inflator, airbag, etc.

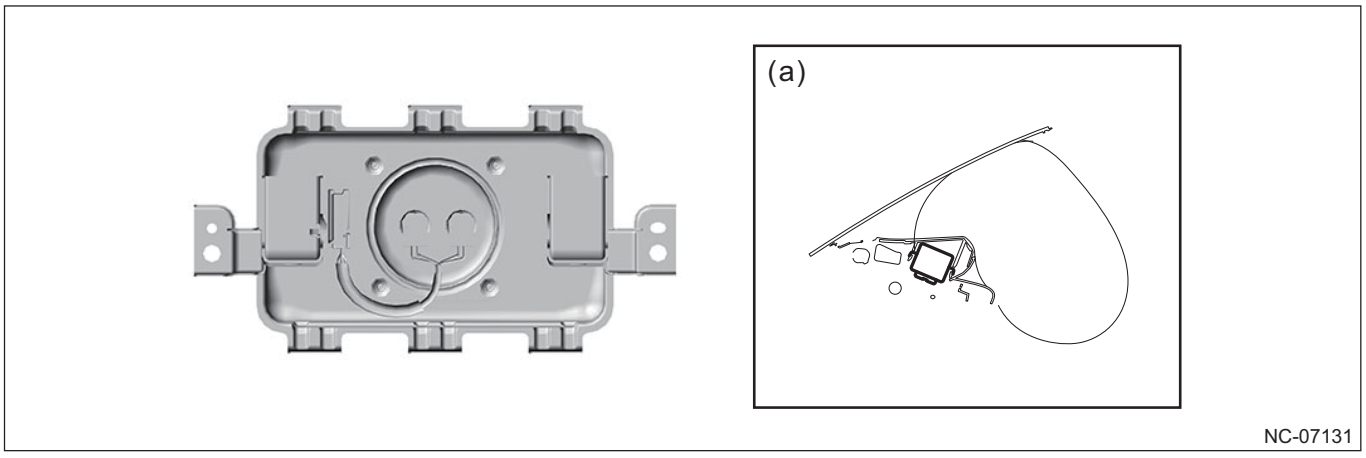


(a) A-A cross section
(b) Inflator
(c) Airbag

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.

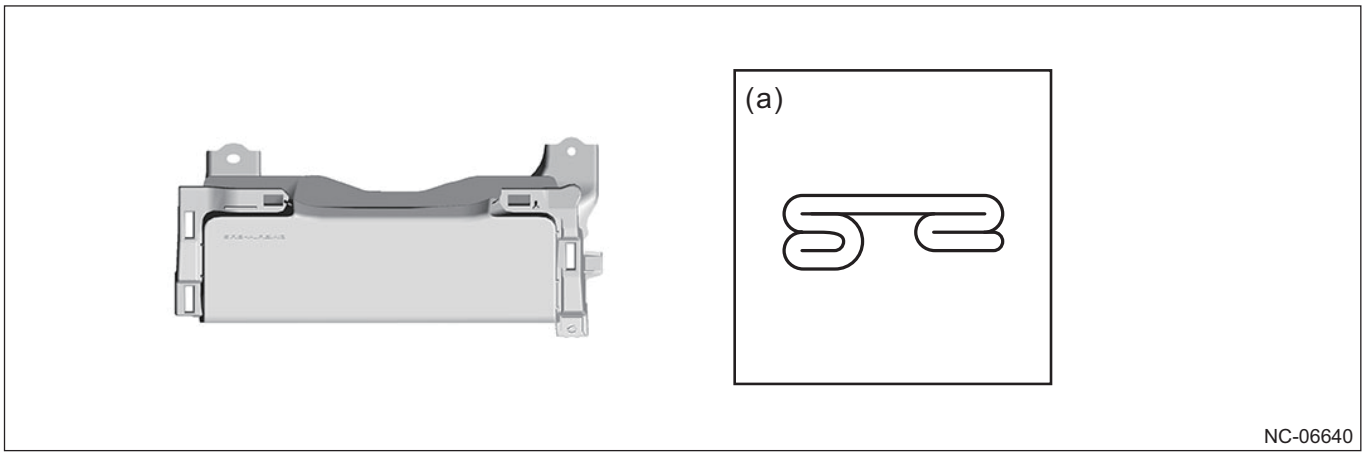


(a) When airbag deployed

Knee airbag module

The knee airbag module is a non-disassembling type, and is composed of a cover, case, inflator, airbag, etc.

A knee airbag module is adopted with a changed folding method when the airbag is stored and a changed shape when deployed. This enables stable airbag deployment even when the space between the knee airbag module and legs is narrow, improving the occupant protection performance.

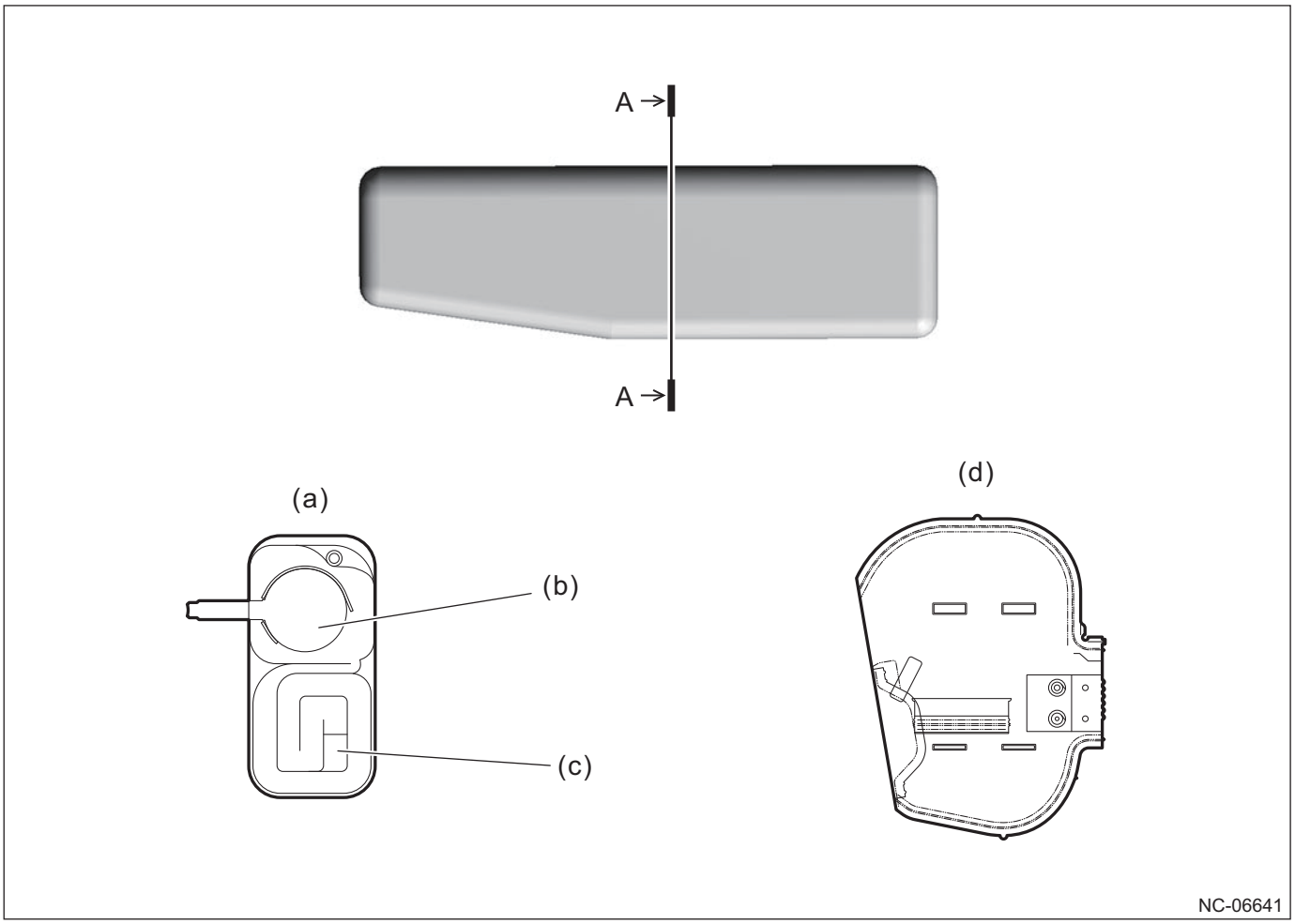


(a) Airbag front view

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.

In a side collision, the thick airbag that deploys with high internal pressure pushes the shoulder area to reduce the speed of the occupant's upper body. This reduces chest injuries and achieves high occupant protection performance.

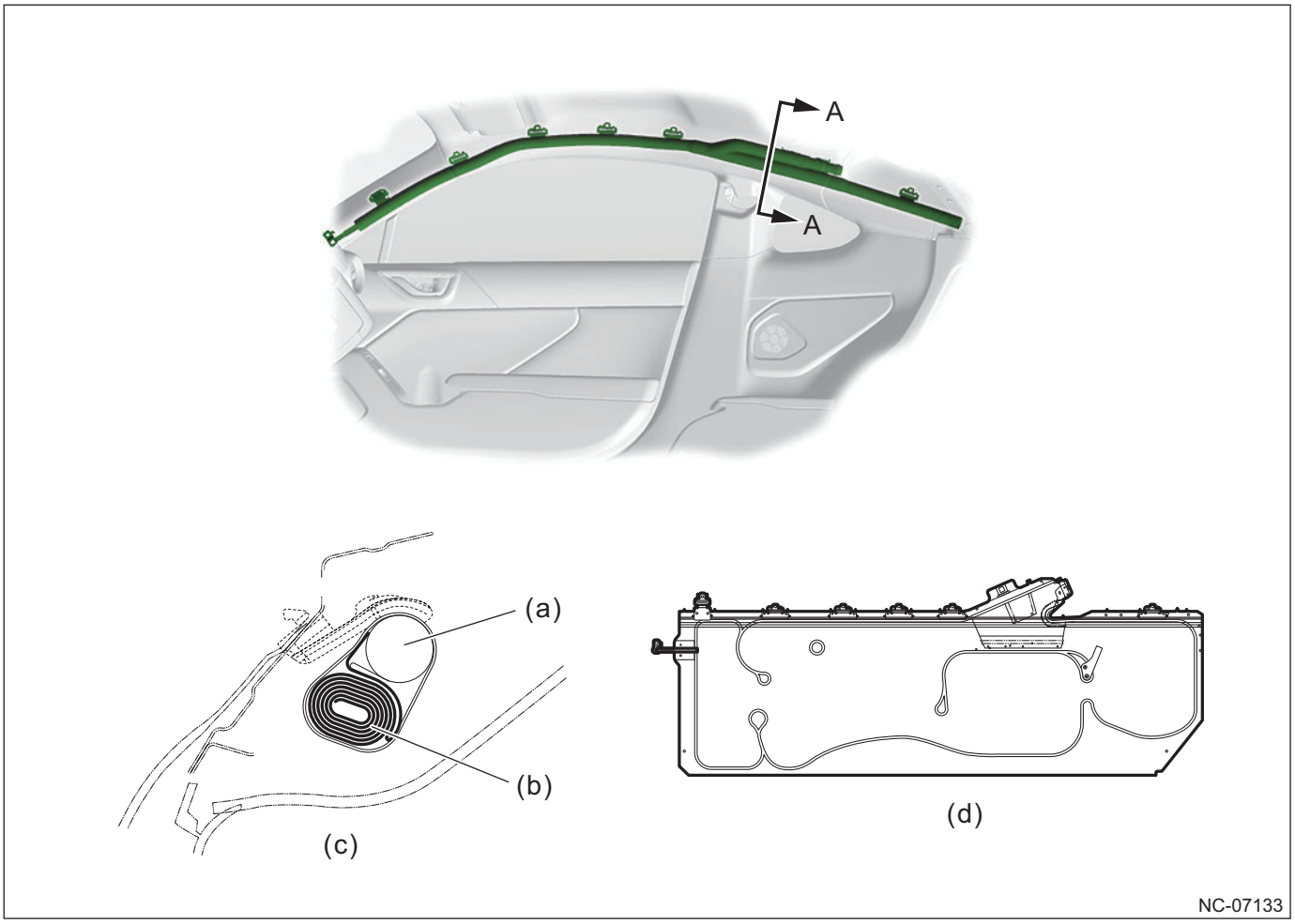


(a) A-A cross section
(b) Inflator
(c) Airbag
(d) When airbag deployed

Curtain airbag module

The curtain airbag module is a non-disassembling type, and is composed of an inflator, airbag, etc.

The thickness is increased at the side of the occupant's head to increase the amount of absorbed energy in a collision and achieve high occupant protection performance.

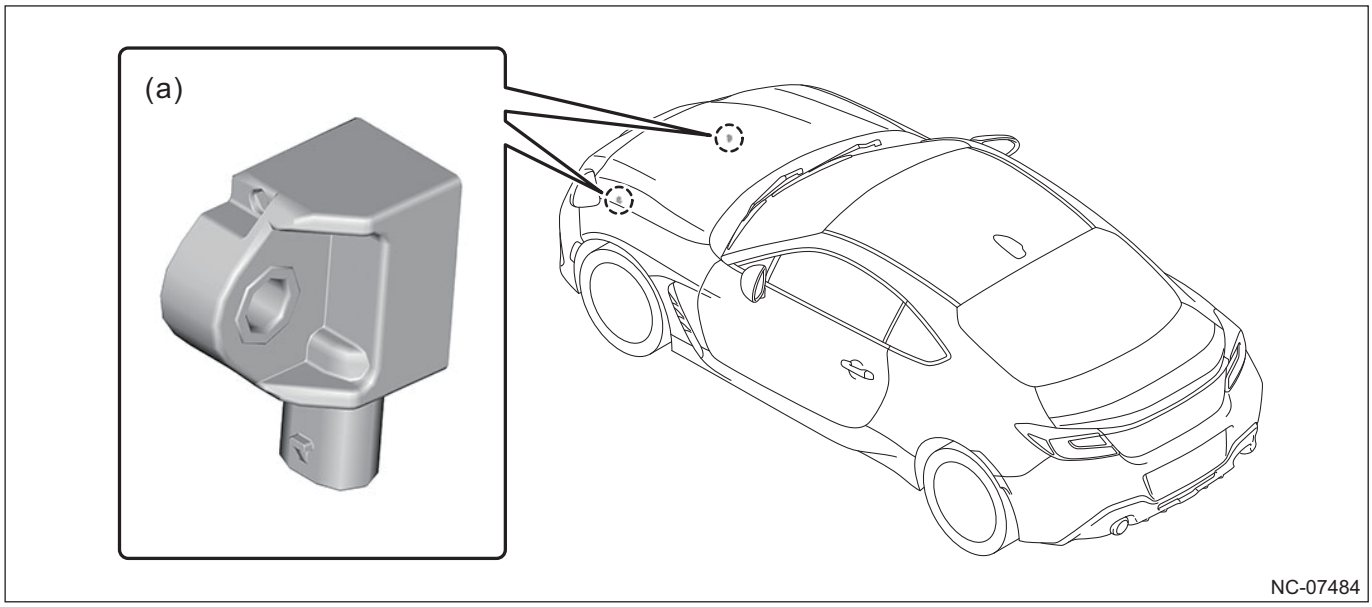


(a) Inflator
(b) Airbag
(c) A-A cross section
(d) When airbag deployed

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.

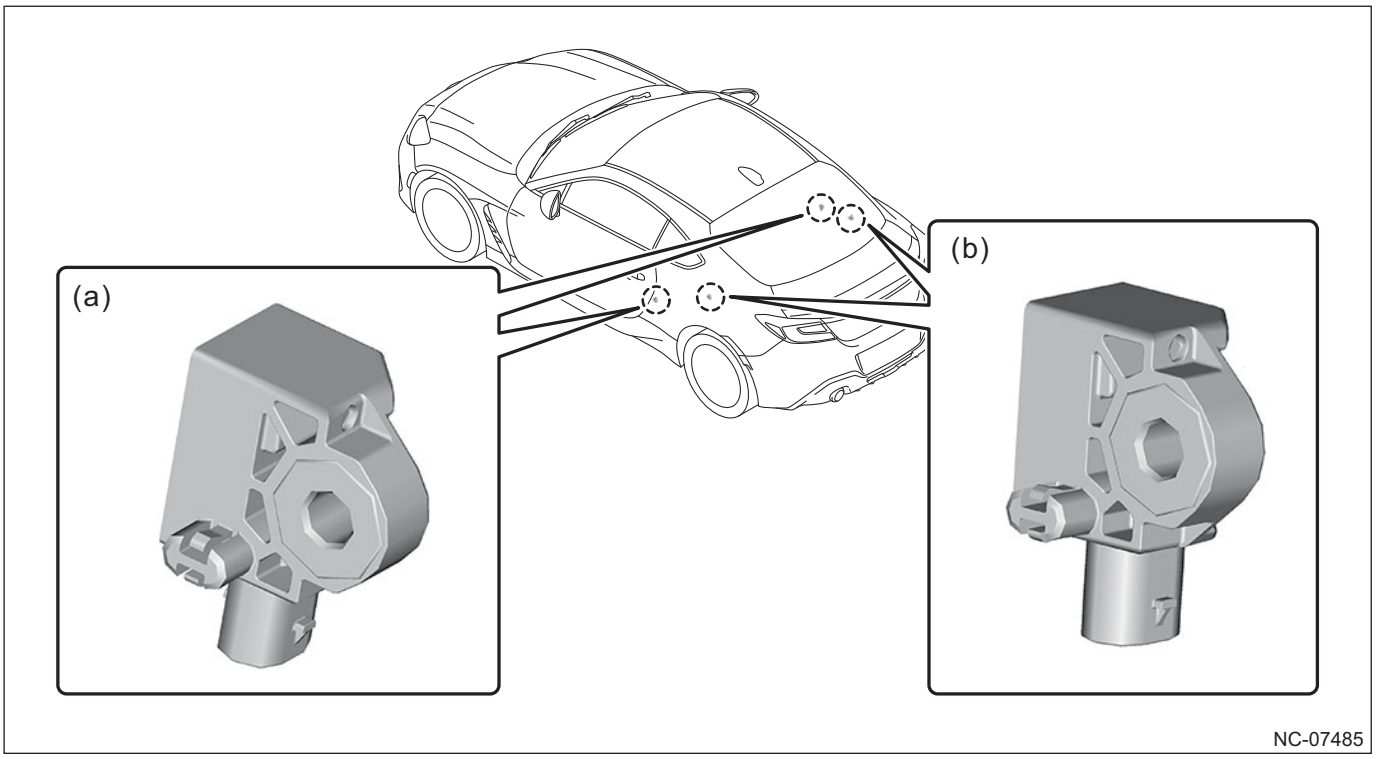
By adding the Y-axis (lateral direction) sensor to the front impact sensor and using two axes, the optimal airbag deployment control suitable for wider collision conditions is achieved.



(a) Front impact sensor

Side impact sensor (center pillar), Side impact sensor (rear wheel house)

The side impact sensors (center pillar) are 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.

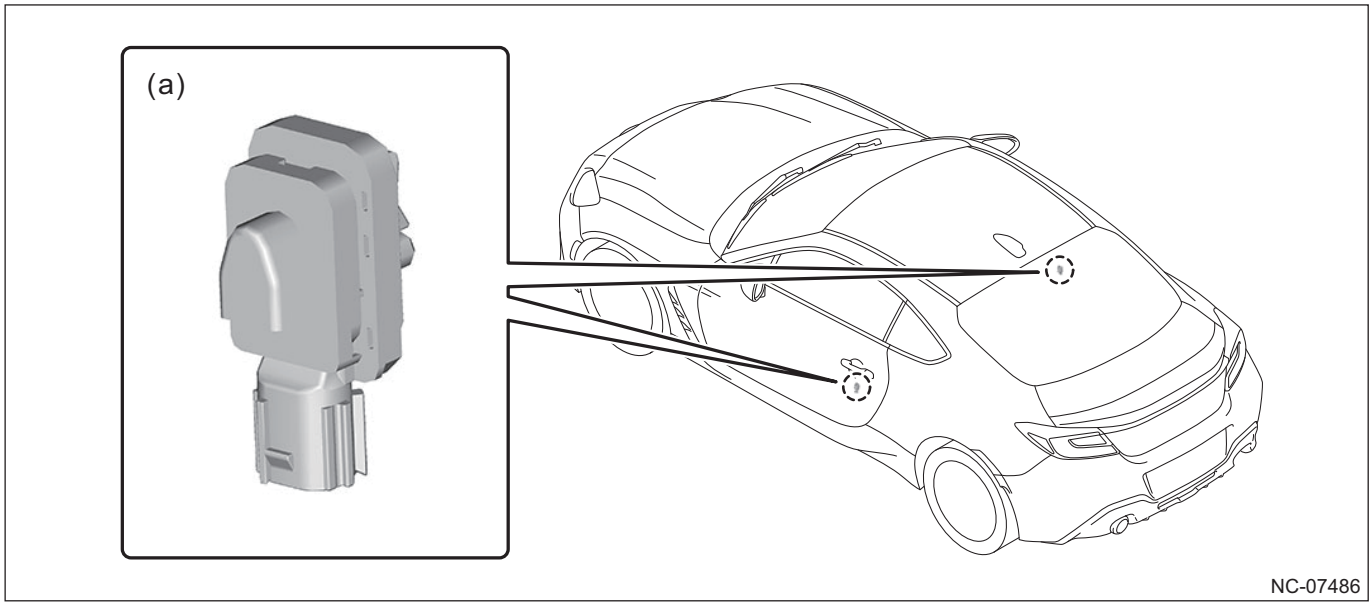


(a) Side impact sensor (center pillar)

(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.

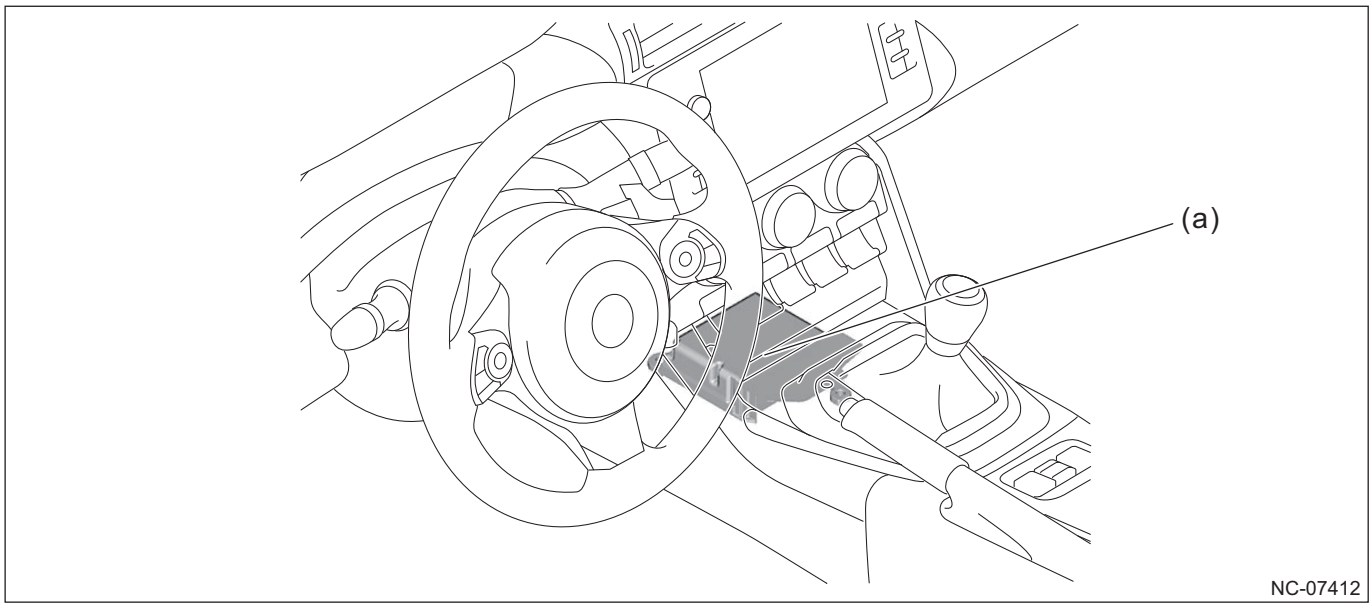


(a) Side impact sensor (front door)

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 the seat belt pretensioners, depending on conditions. The airbag control module is also provided with a diagnosis function and performs self diagnosis when there is a system anomaly.

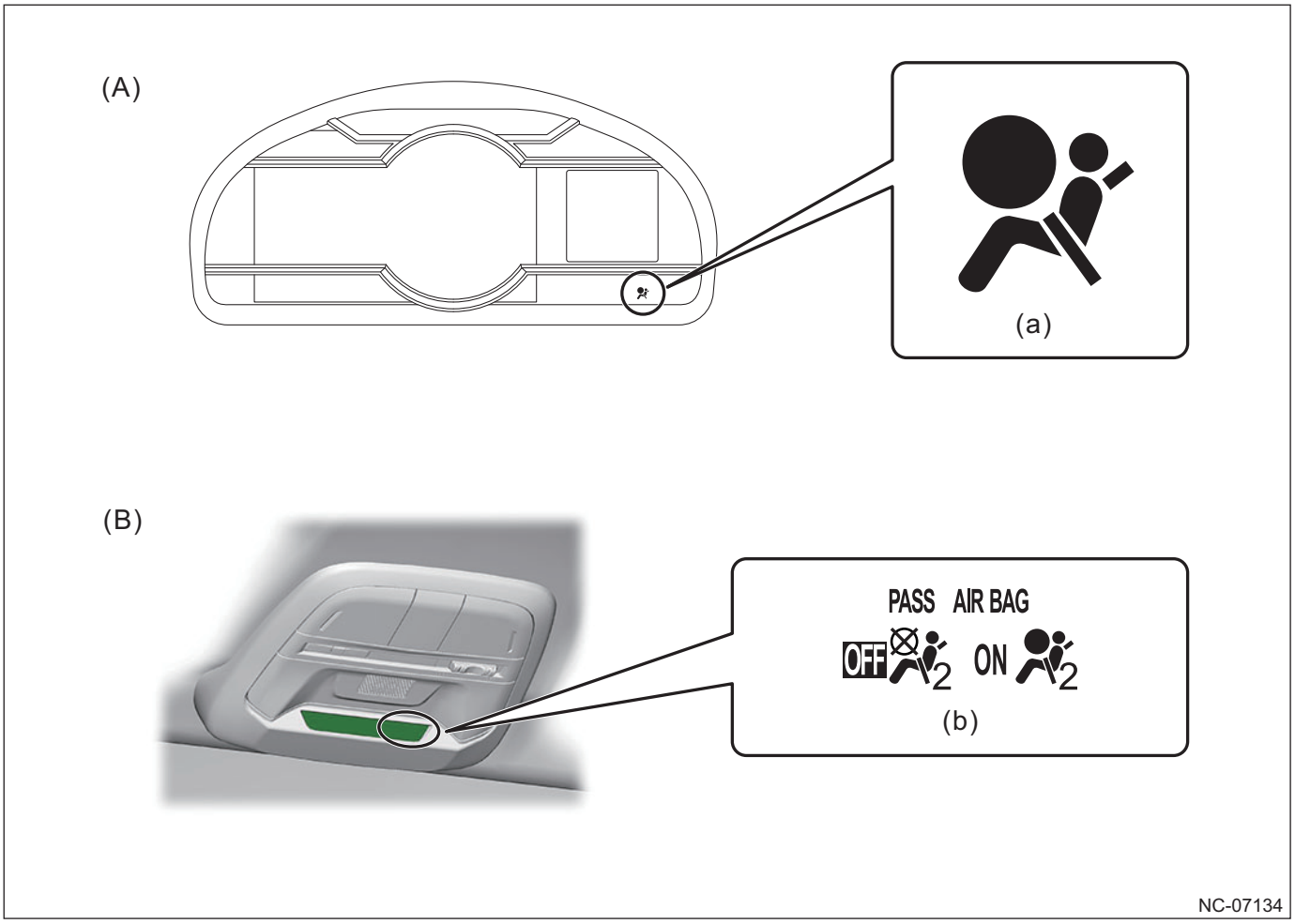


(a) Airbag control module

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

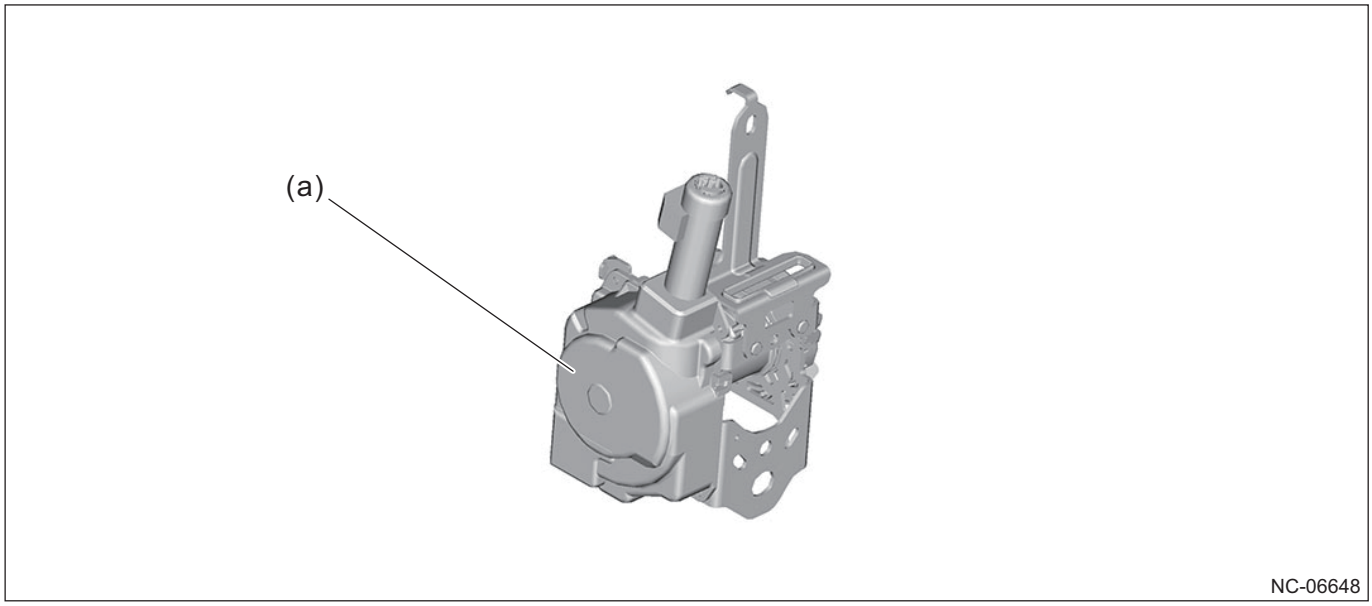
(a) Airbag warning light

(b) Passenger's airbag ON/OFF indicator light

Seat belt pretensioner (driver's seat/passenger's seat)

The seat belt pretensioner that increases passenger restraint to reduce injury value on collision is adopted for the driver's seat and passenger's seat.

Seat belt pretensioner

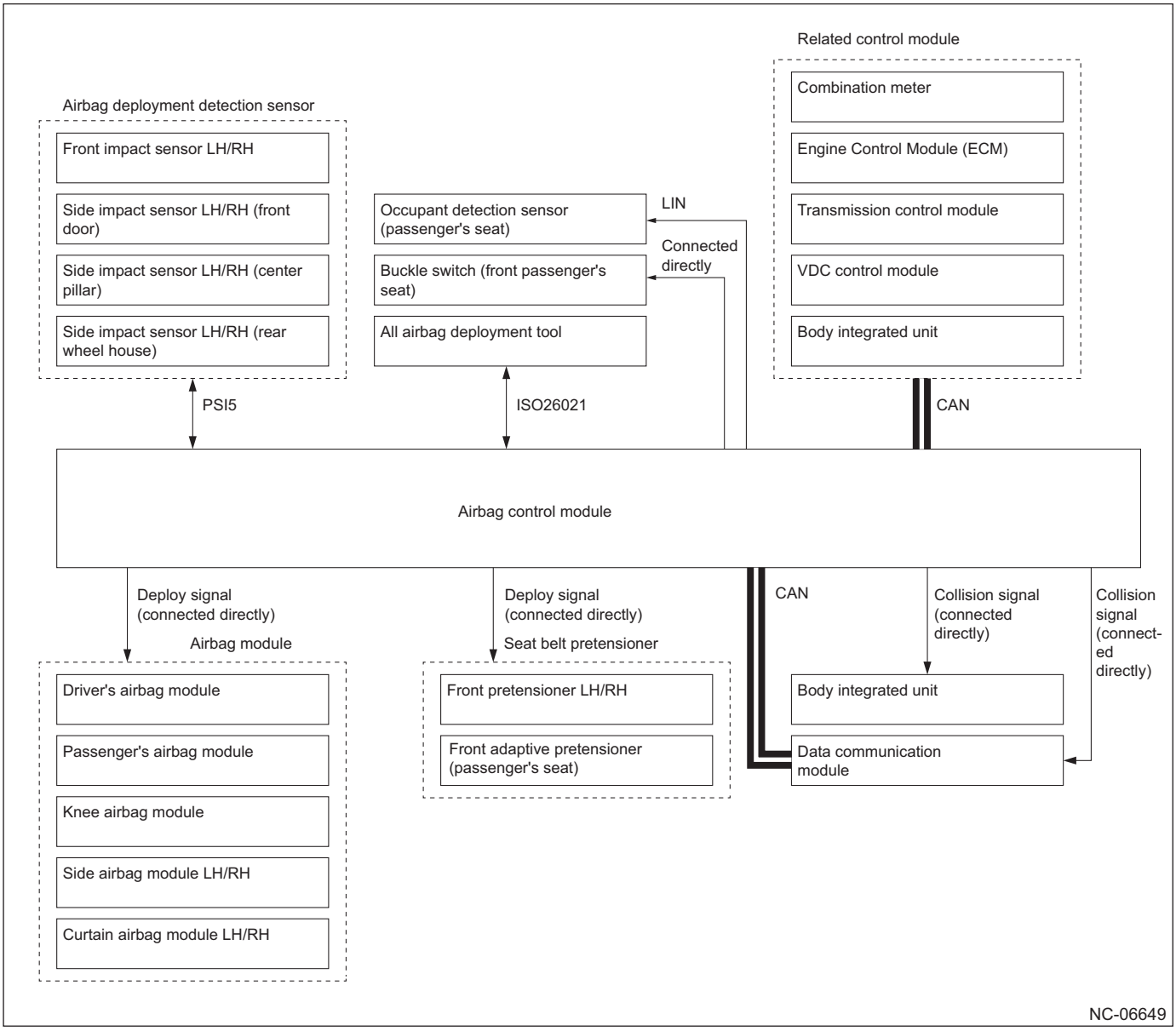


(a) Seat belt pretensioner

10.3.3 Construction and Operation

System diagram

Airbag system



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 airbag. 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 airbag. 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 airbag. 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 airbag. 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.
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	
Combination meter		When there is a system anomaly, the airbag warning light turns on to warn the driver.
Passenger's airbag ON/OFF indicator light (in warning box)		Displays the passenger's airbag status (ON or OFF).
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 each 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.

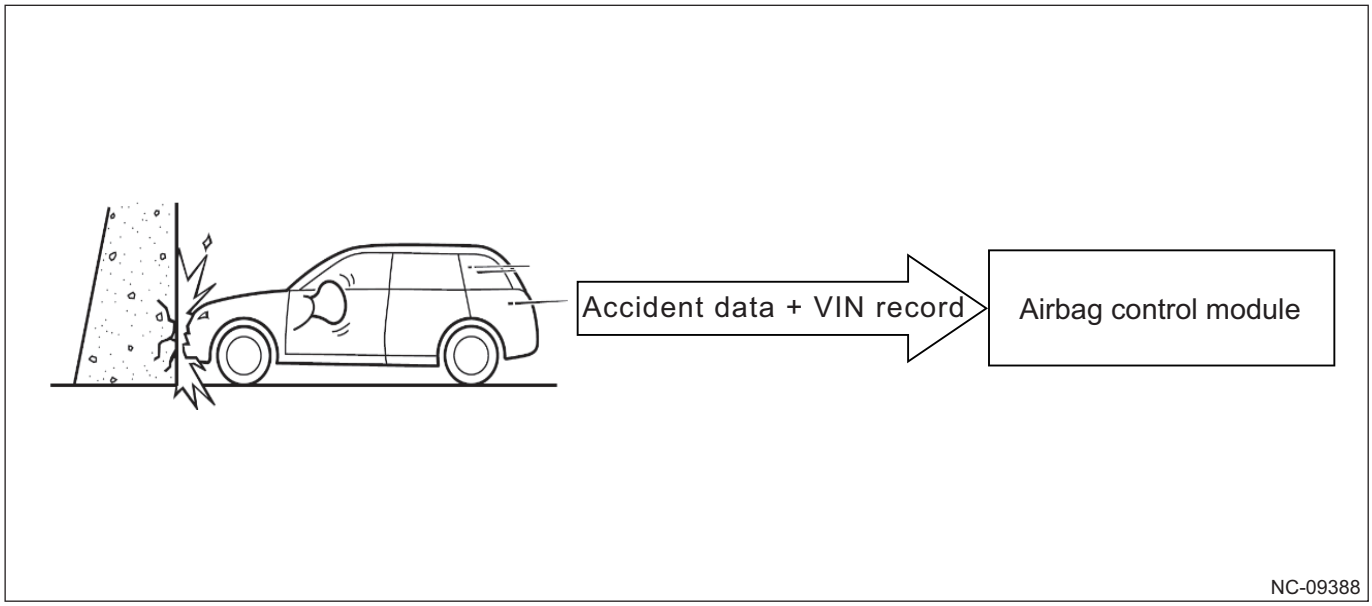
■ EDR (Event Data Recorder)

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

The correspondence between the EDR information and VIN at the time of an accident has been clarified by recording the VIN (Vehicle Identification Number) in the airbag control module.



■ 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.

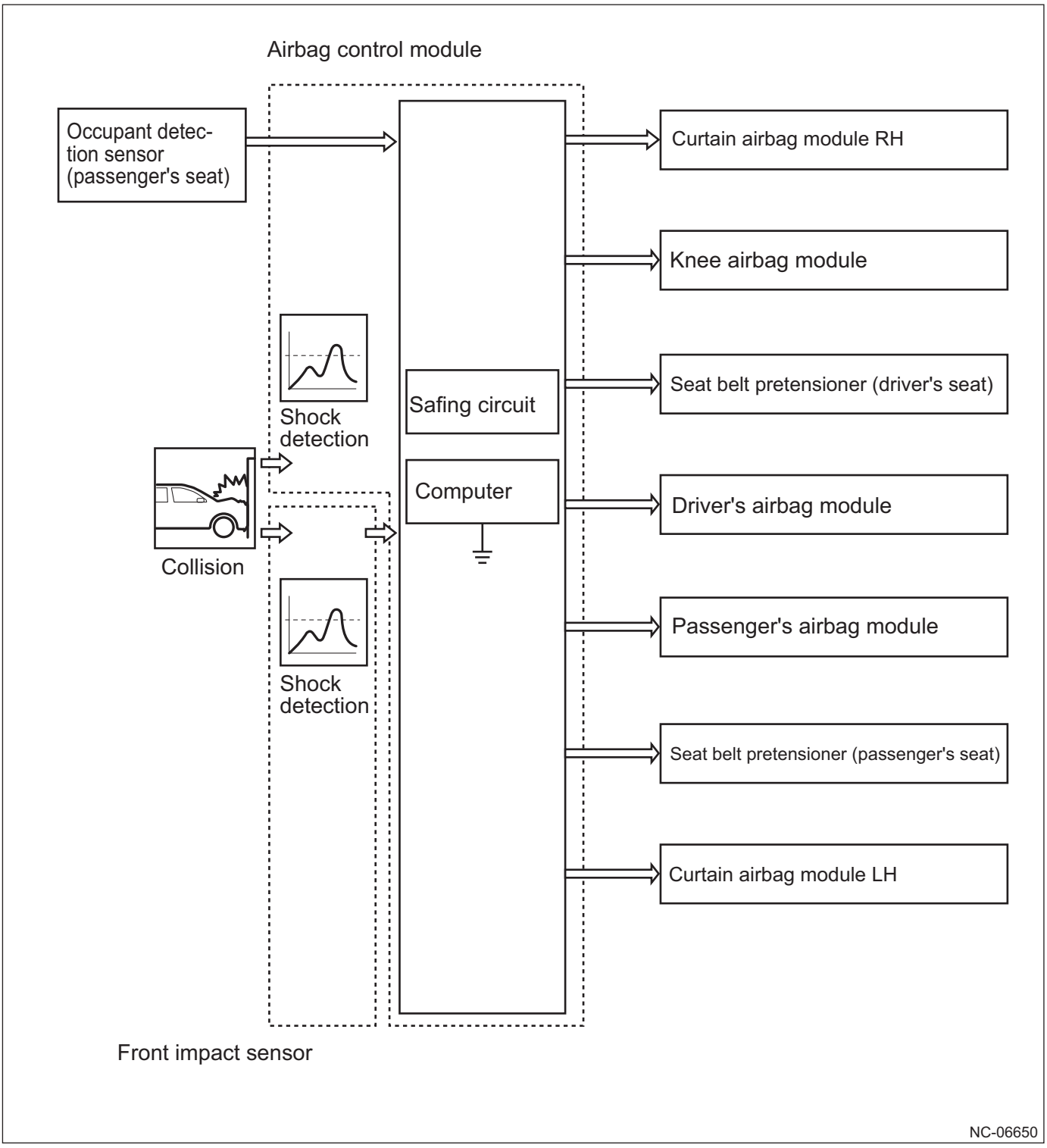
On front collision

Ignitions of the driver's airbag module, passenger's airbag module, knee airbag module, curtain airbag module, and seat 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).

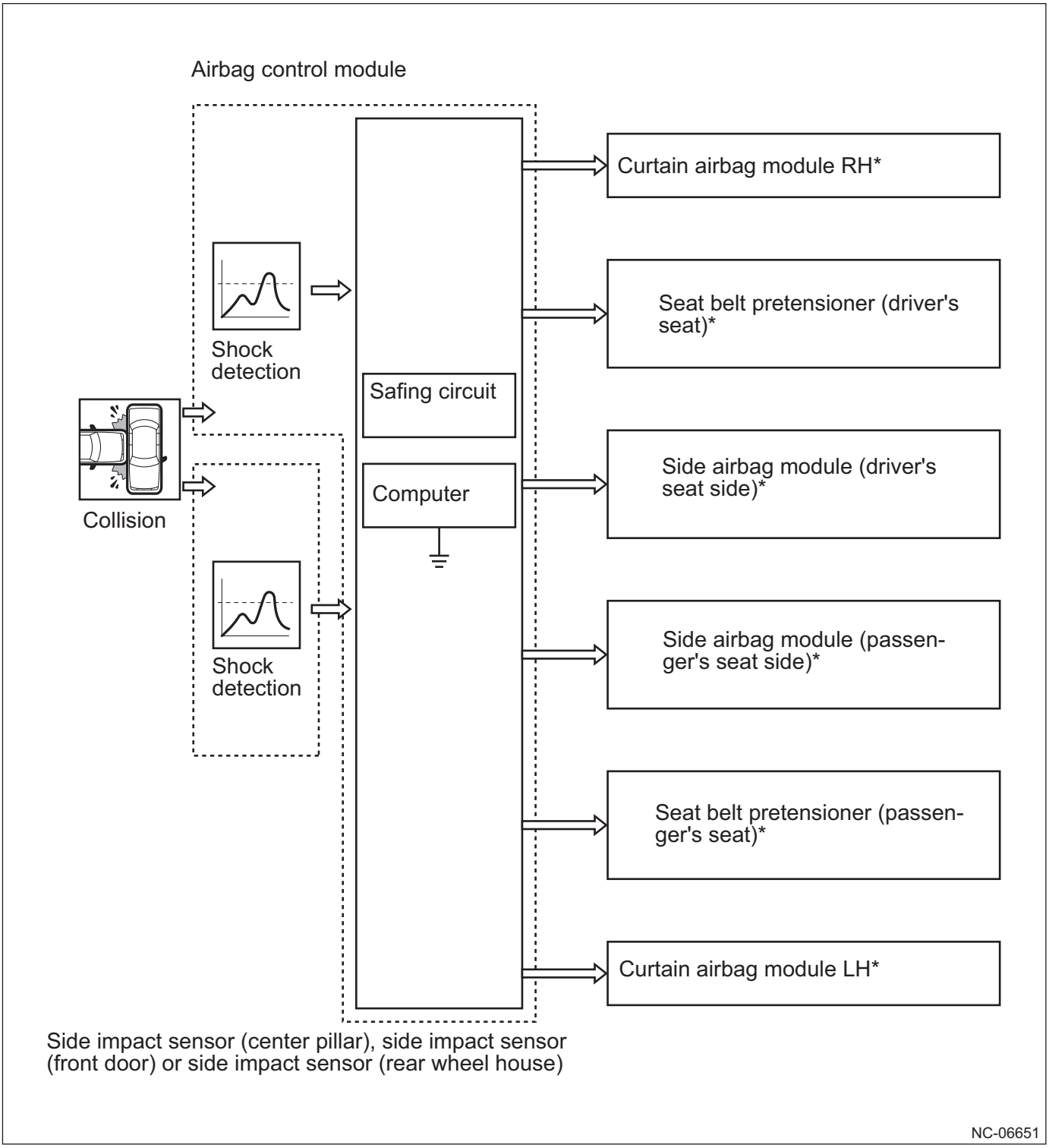
Reference

The airbag deployment/non-deployment control may differ depending on the collision condition.



On side collision

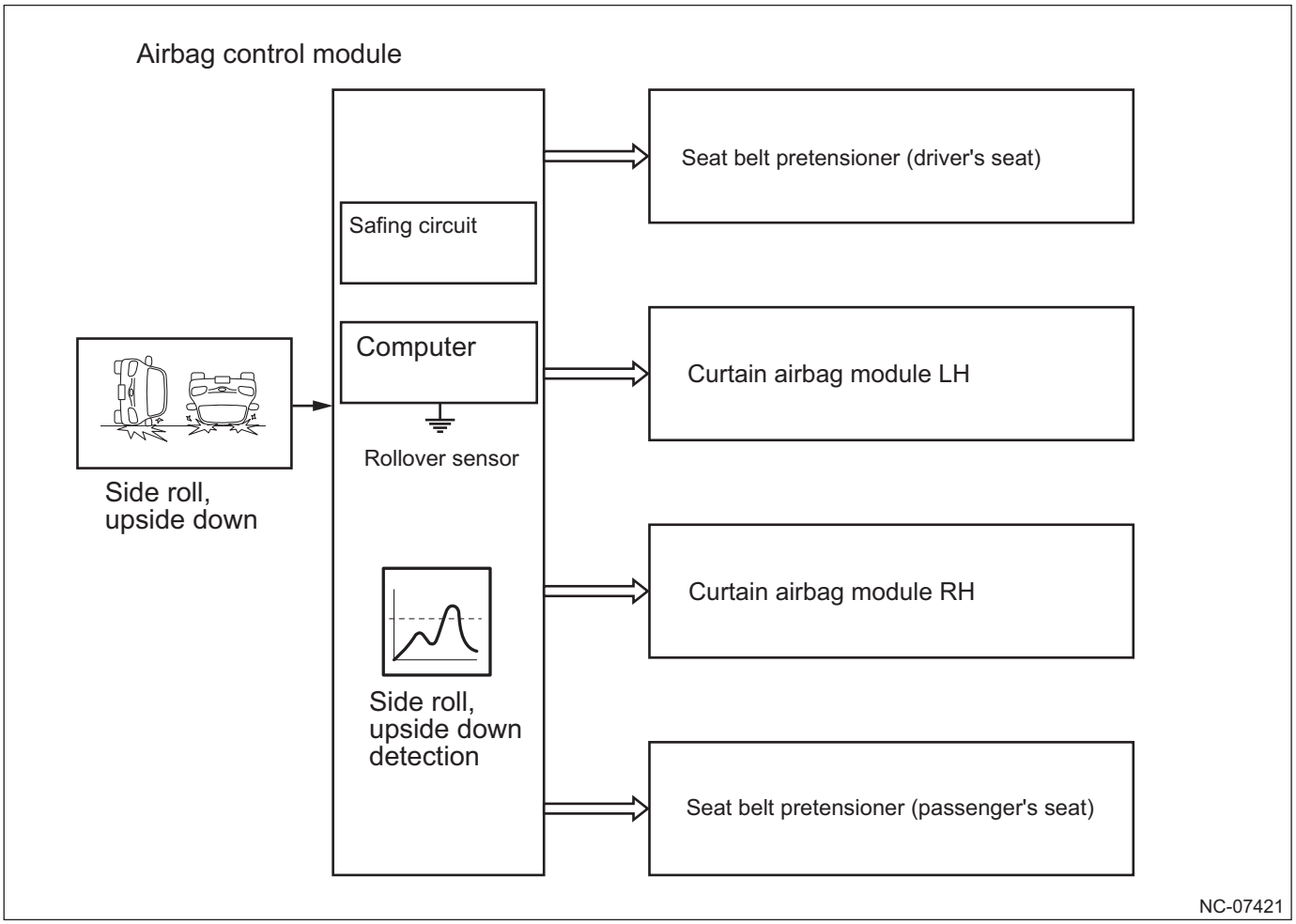
The system determines whether to ignite the side airbags, curtain airbags, and seat belt pretensioners on the collision side according to the signals from the side impact sensor (center pillar), side impact sensor (front door), and side impact sensor (rear wheel house).



*: Operation is on impact side only.

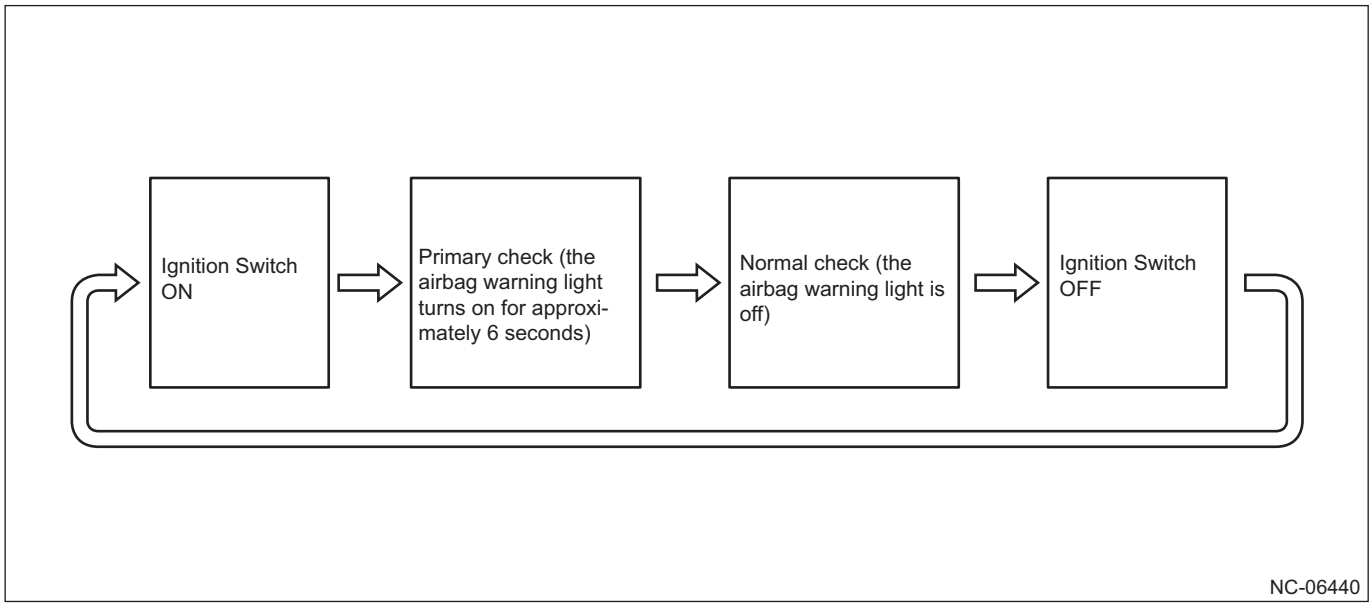
▮ Side roll/upside down

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.)

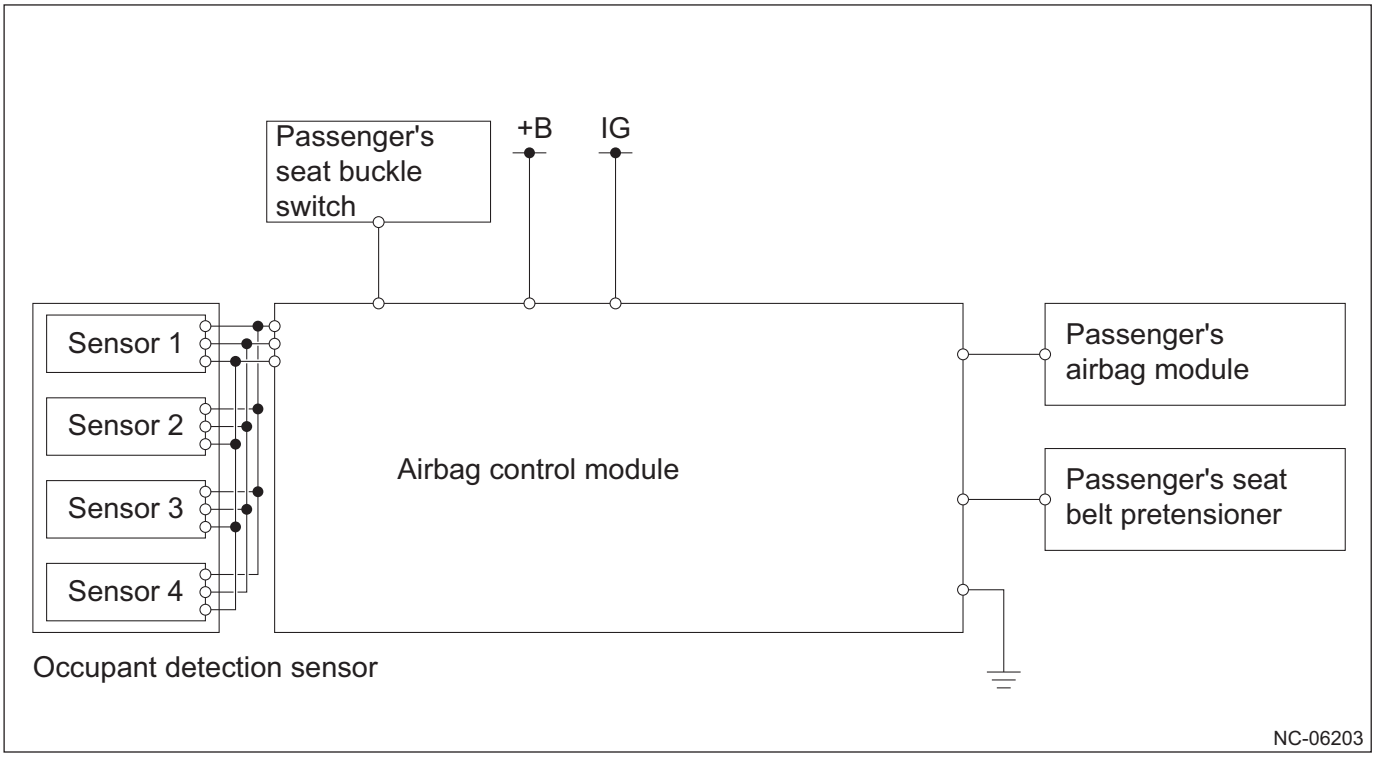
■ Occupant detection system (passenger's seat)

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).

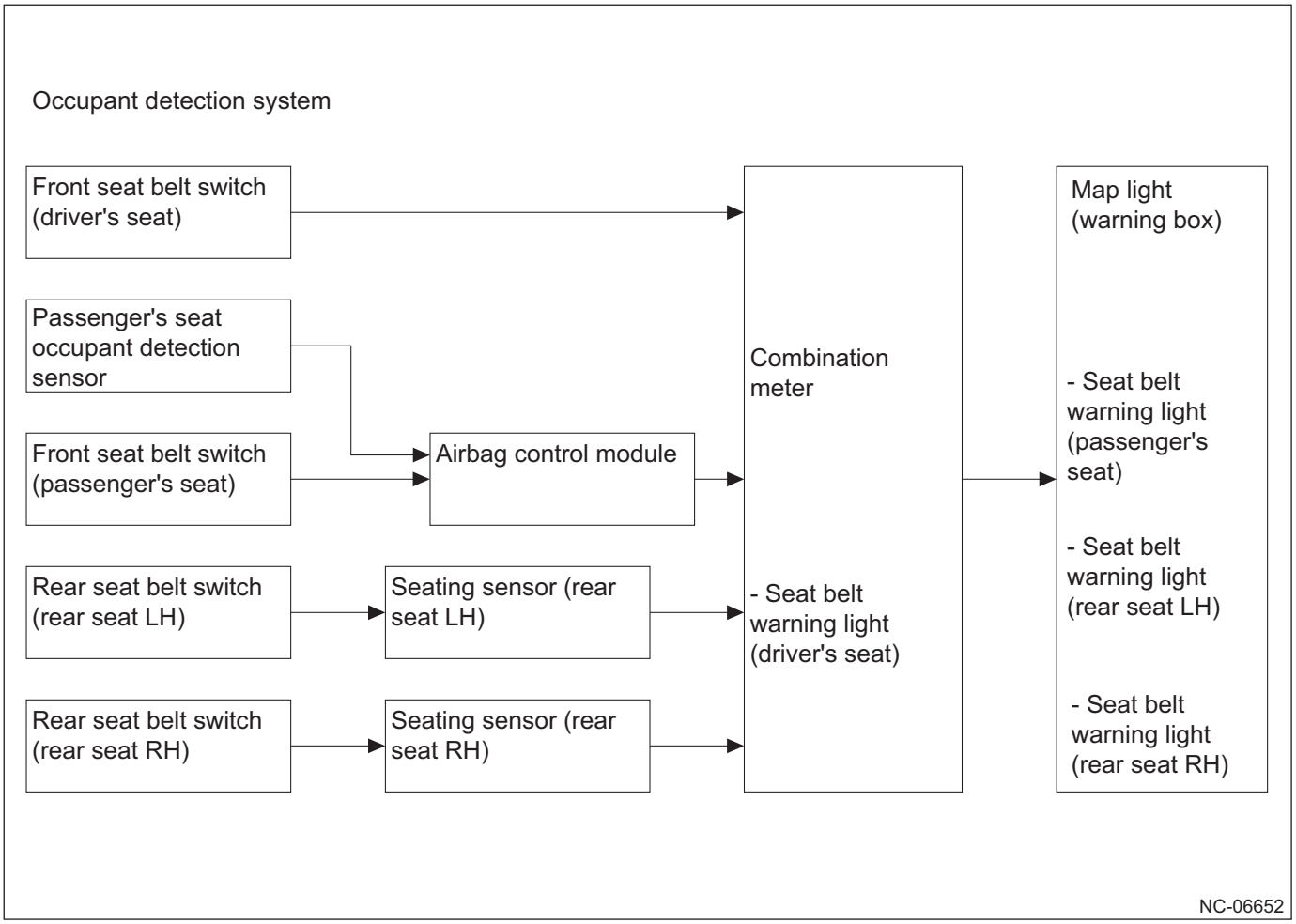
The occupant detection sensors detect distortion of the seats as weight when occupants are present, and send the information to the airbag control module.

The airbag control module automatically determines the status of the passenger's seat occupant (empty, infant + child seat, child + child seat, or adult), and selects the seat belt load on collision.

Occupant detection system diagram 1



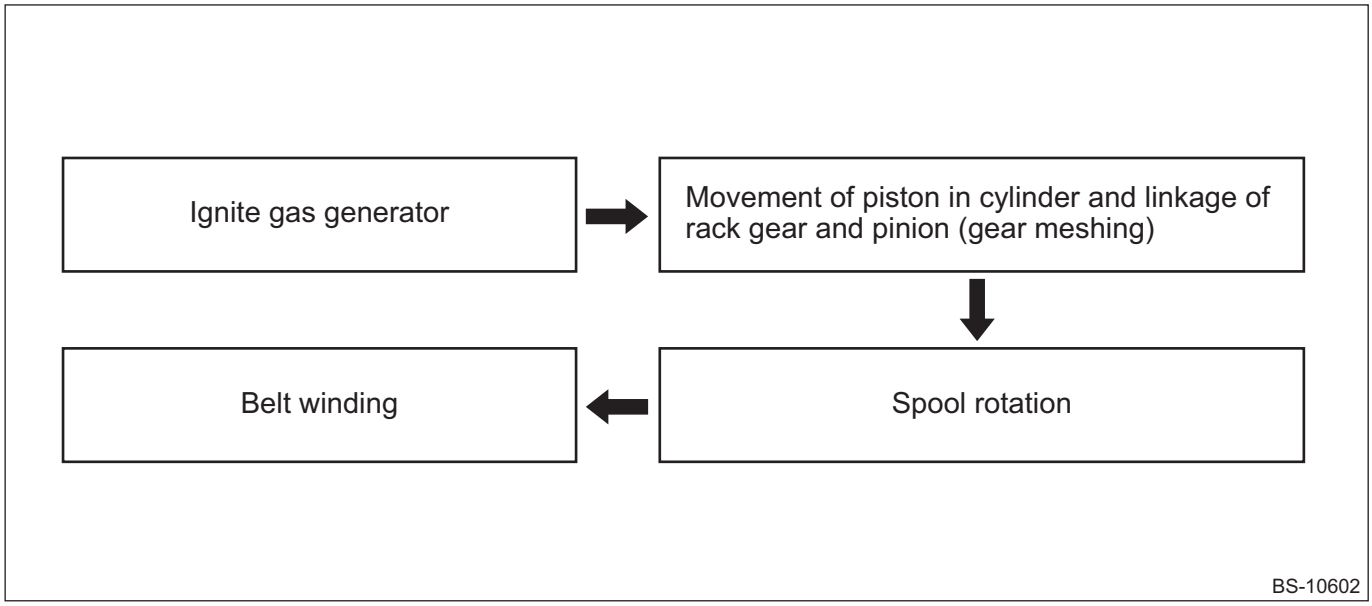
Occupant detection system diagram 2



Seat belt pretensioner

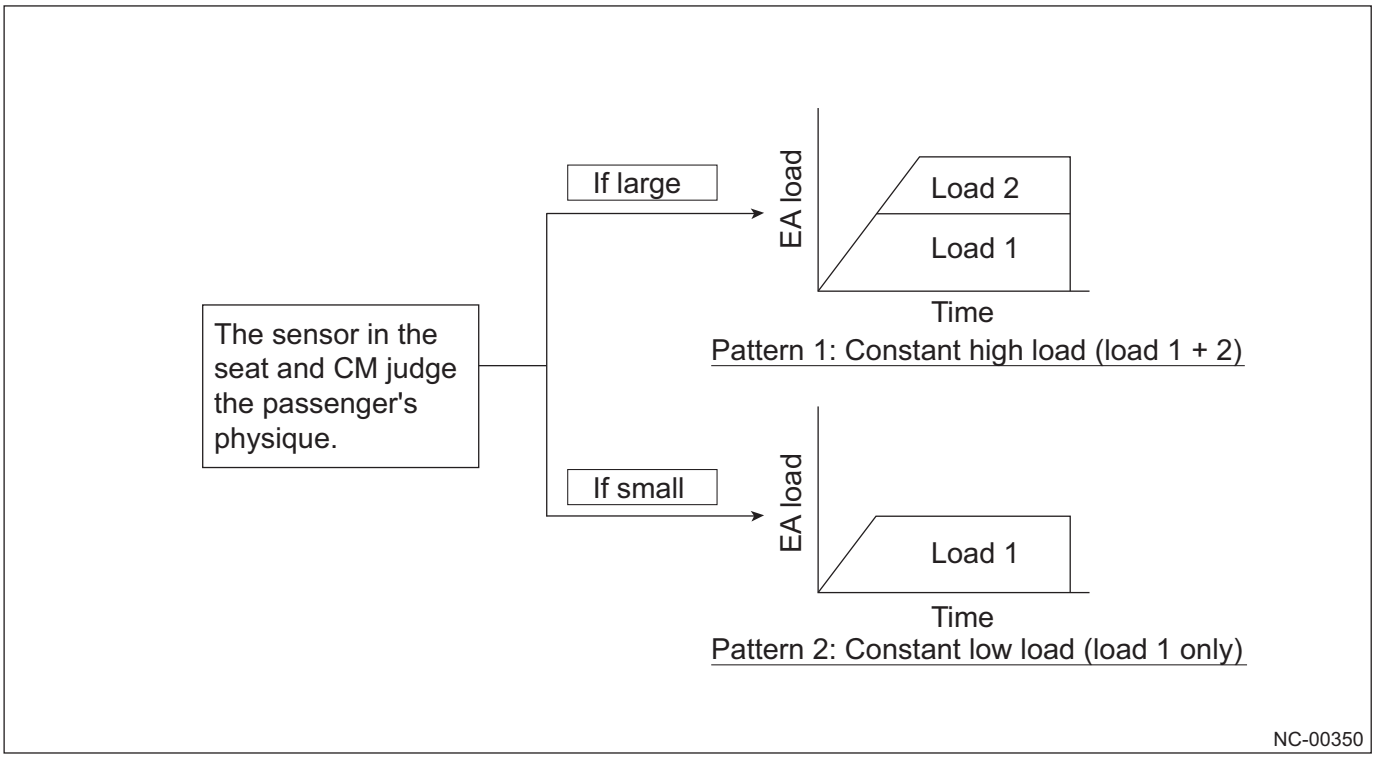
The pretensioner and force limiter are installed for the driver's seat belt and the pretensioner and adaptive force limiter are installed for the passenger's seat belt to improve the occupant restraining on collision.

Diagram of pretensioner operation



■ Adaptive force limiter mechanism

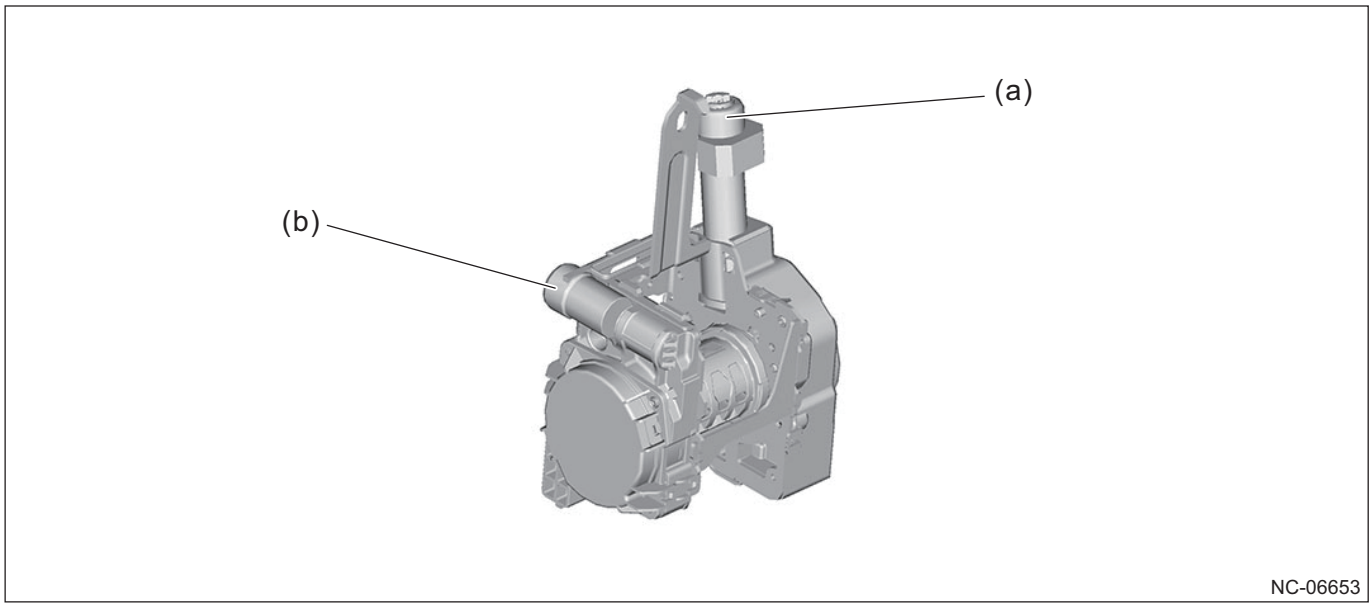
The adaptive force limiter is adopted that can switch the optimal energy absorption load by determining body type of a passenger according to the signals from the vehicle.



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

- Adoption of lightweight frame made with new construction method
- Stronger support for shoulders and thighs
- Optimization of cushion stroke and repulsive force
- Increased adjustment amount of driver's seat lifter
- Adoption of walk-in lever
- Reduced spacing between left and right seats

Rear seat

- Adoption of lock release knob (interior side) and operation strap (luggage compartment side)
- Adoption of forward deviation prevention function

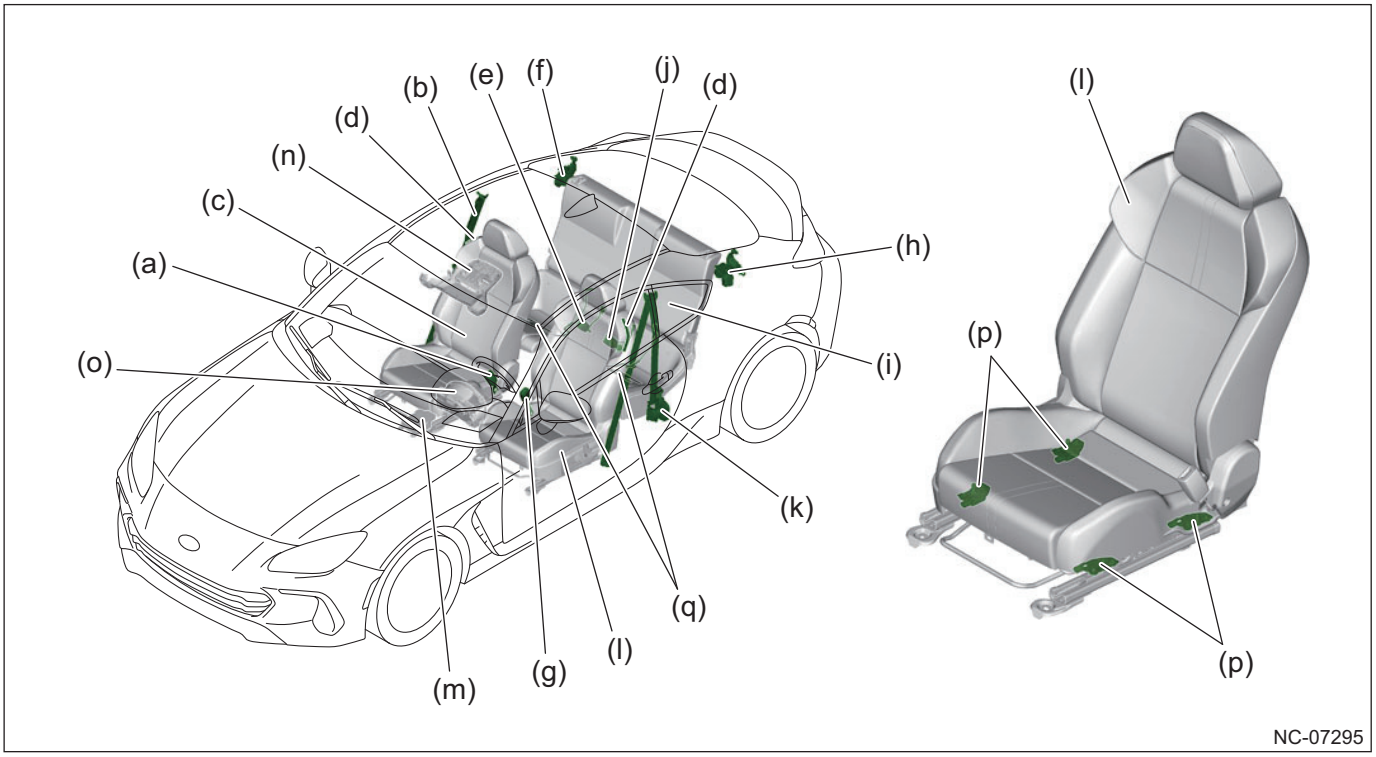
Seat belt

- Adoption of rear seat belt reminder function
- Adoption of adaptive force limiter mechanism
- 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 (passenger's seat))

(b) Belt assembly front OUT RH

(c) Front seat RH

(d) Seat belt guide

(e) Belt assembly INN RH (rear seat belt switch)

(f) Belt assembly rear OUT RH

(g) Belt assembly front INN LH (front seat belt switch (driver's seat))

(h) Belt assembly rear OUT LH

(i) Rear seat

(j) Belt assembly rear INN LH (rear seat belt switch)

(k) Belt assembly front OUT LH

(l) Front seat LH

(m) Airbag CM

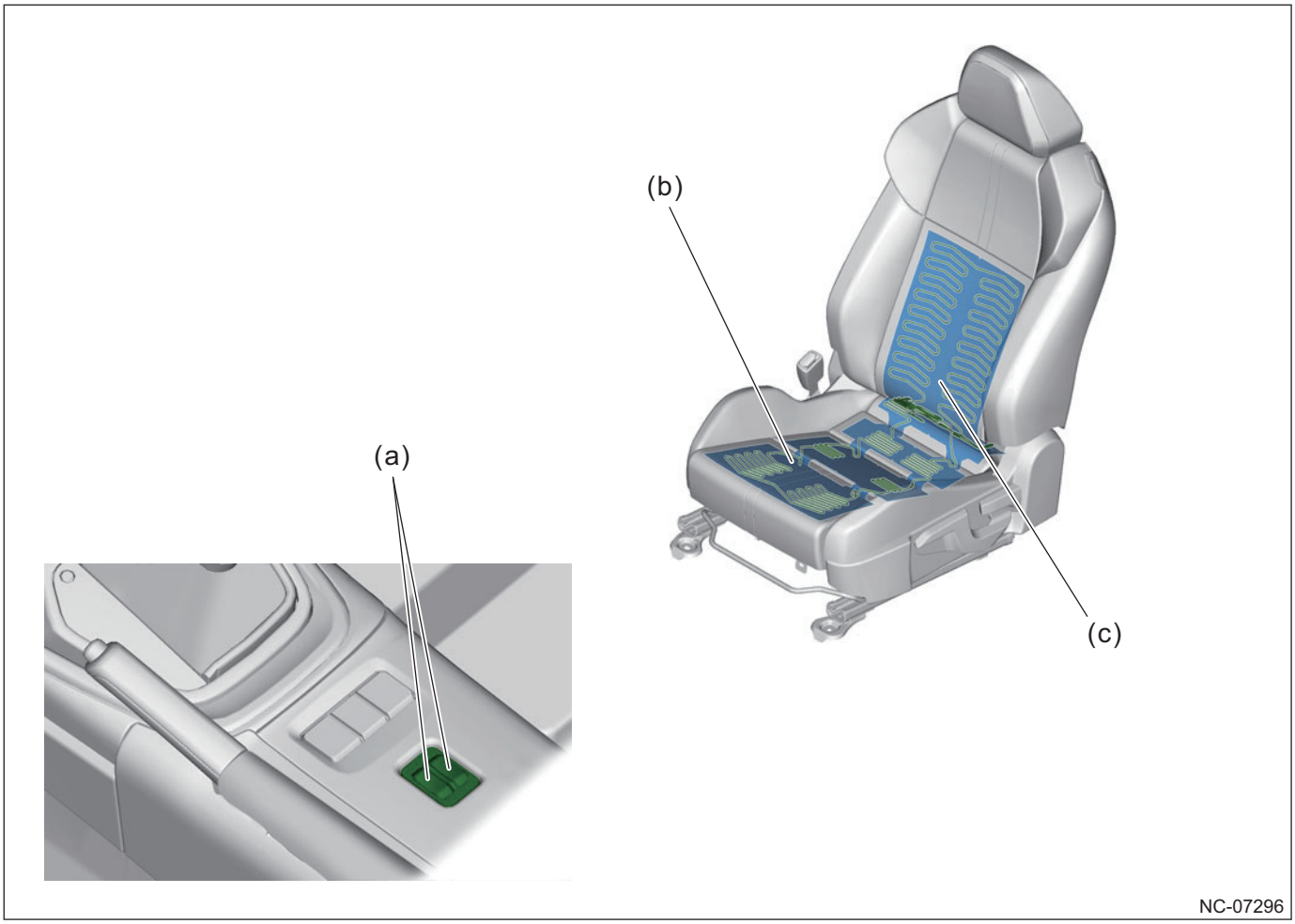
(n) Map light (warning box)

(o) Combination meter

(p) Passenger's seat occupant detection sensor

(q) Seating sensor

Front seat heater system



(a) Seat heater switch
(b) Seat cushion heater
(c) Seat back heater

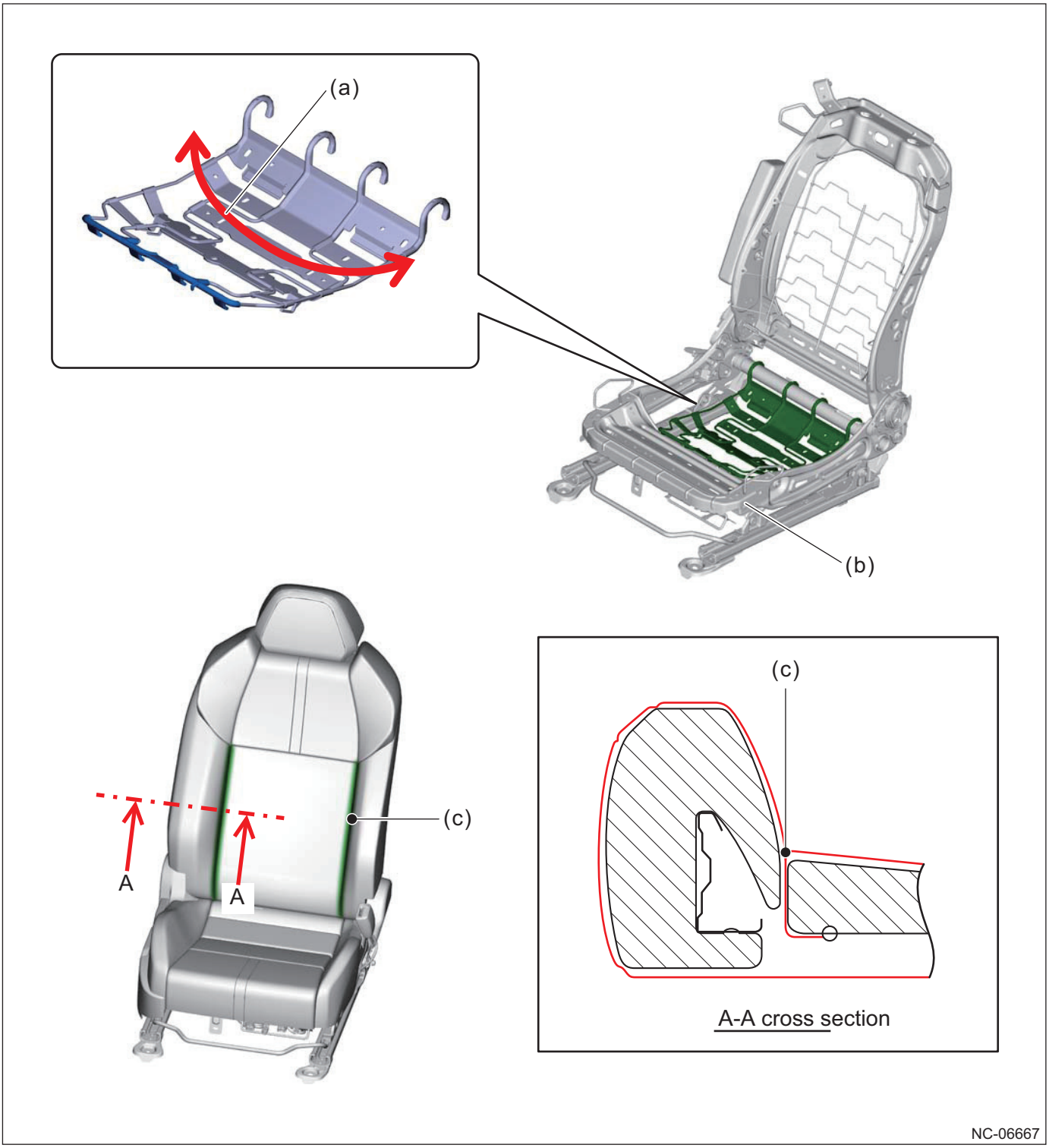
Component details

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.
- A mortar bowl shape (a) is used for the spring shape in the seat section to fit the body of the occupant, and to realize an embracing and supportive feel.
- The latest laser welding is deployed for the seat frame to revise the materials and thickness, realizing a seat frame with high connectivity, light weight, and good allowance for different body types.
- A slit (c) is provided at the boundary between the main section of the seat back and the side support section, and the stroke and body pressure distribution of the lower back section have been optimized for an integrated feel with the vehicle.



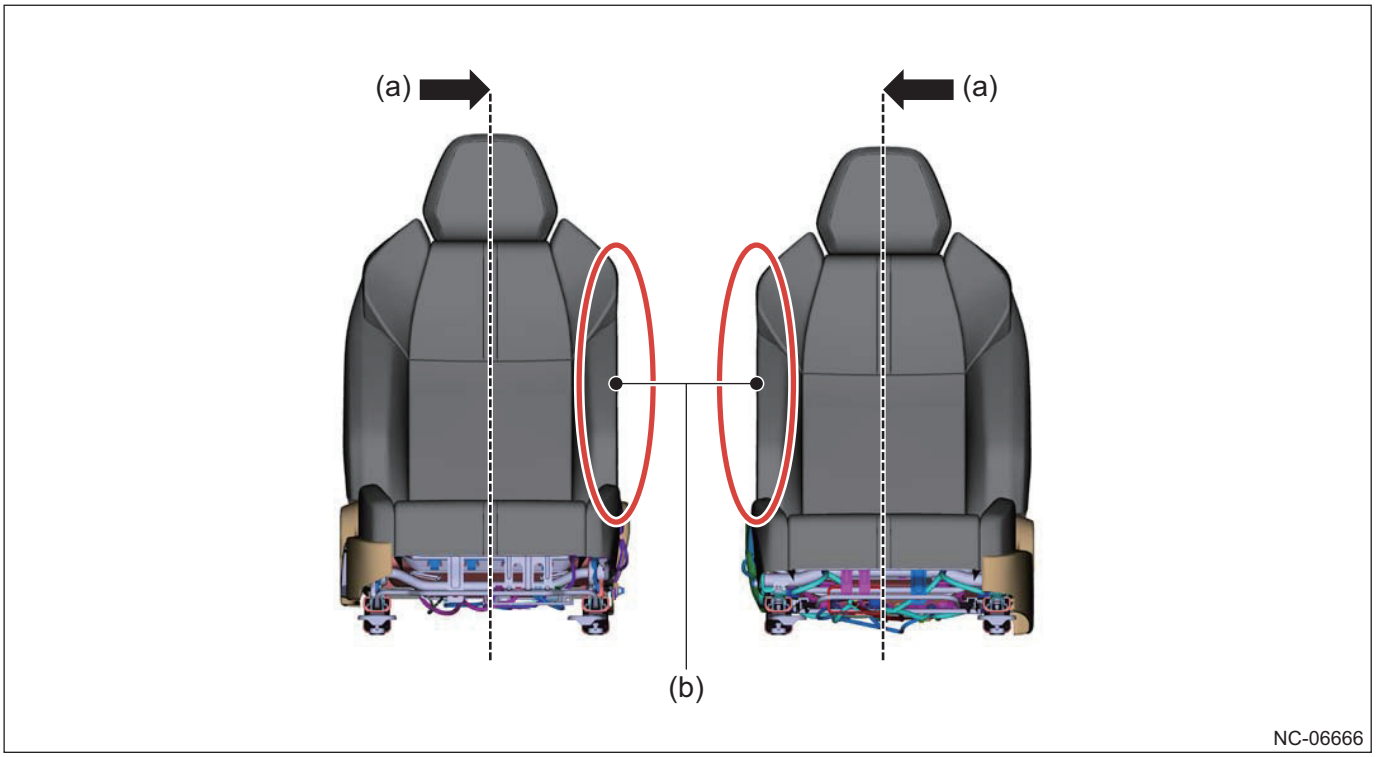
(a) Mortar bowl shape that embraces the body of the occupant when seated

(b) New lightweight frame

(c) Slit

Side support

By thinning the side support shape on the vehicle inner side, the seat centers are positioned closer to the vehicle center, by 0.146 in (3.7 mm) for the driver's seat and 0.146 in (3.7 mm) for the passenger's seat. The resulting concentrated mass improves the motive performance and shortens the reach for operating the shift lever.



(a) 0.146 in (3.7 mm)

(b) Thinned side support

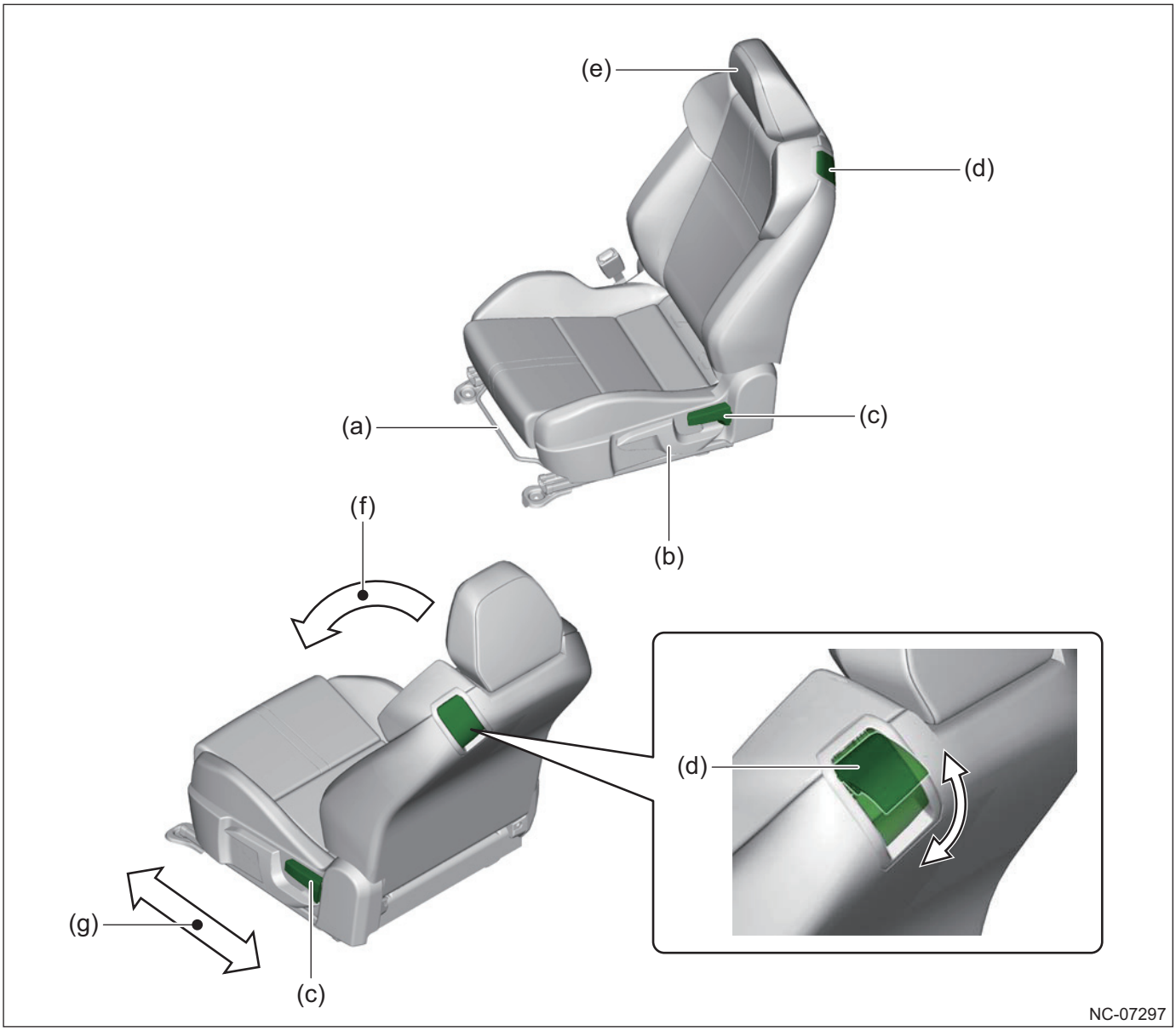
■ Improvement in comfort

▮ Seat heater system

The seat heater with 2-level temperature adjustment is provided. The heating wires are also arranged to efficiently warm the occupant according to the body pressure, improving comfort.

▮ Walk-in lever

In addition to accessing the rear seats using a reclining lever, a walk-in lever is adopted. The adoption of the walk-in lever at the optimal position at the top of the front seat improves access to the rear seats and convenience.



(a) Slide lever
(b) Lifter lever
(c) Reclining lever
(d) Walk-in lever
(e) Headrest
(f) Folds forward
(g) Slides forward and back

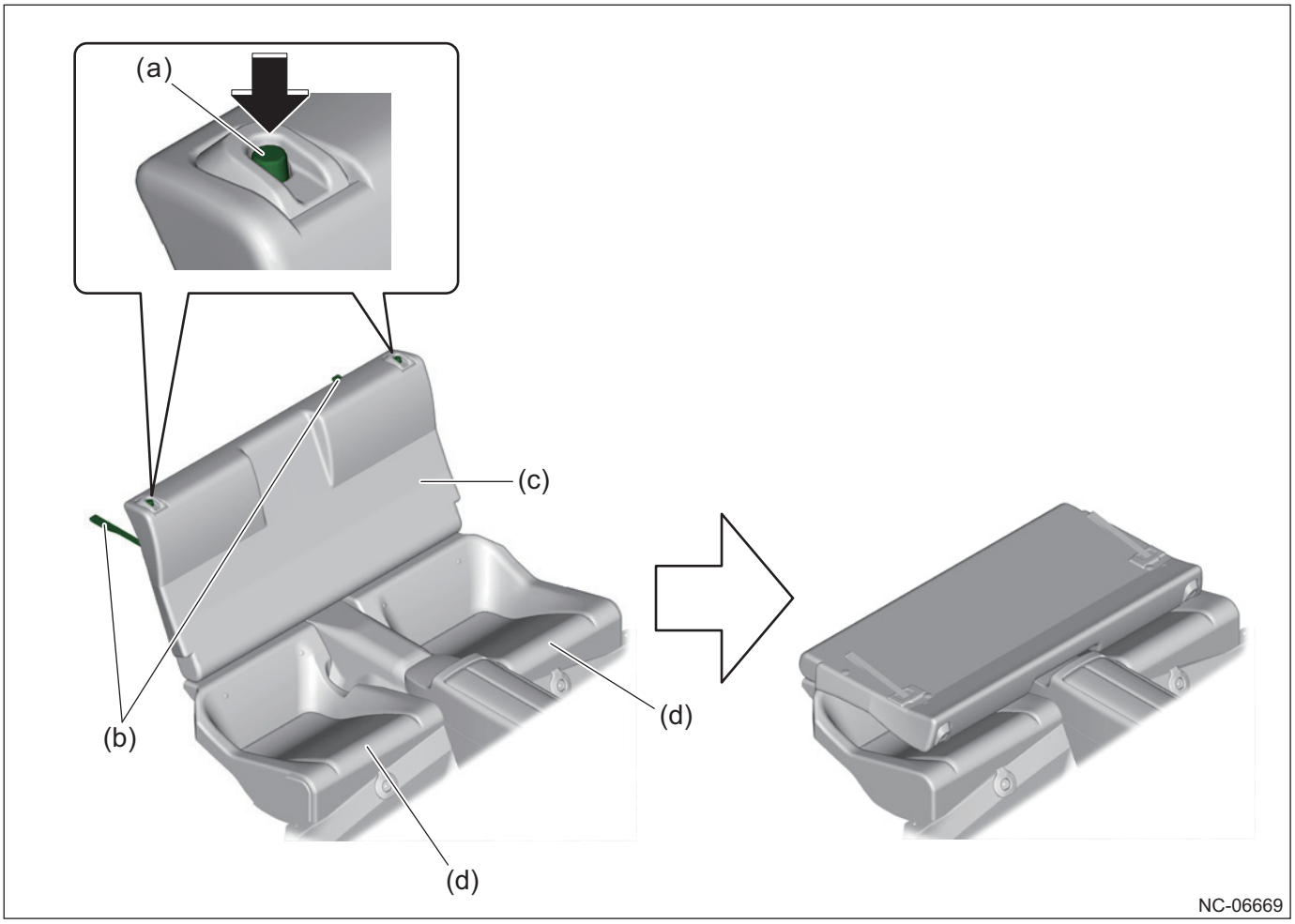
Rear seat

■ Improvement of convenience

▮ Integrated foldable rear seat

An integrated foldable rear seat is adopted that is equipped with a mechanism for folding the seat back forward.

An operation button at the top of the backrest is adopted. The backrest can also be folded forward with an operation (operation strap) from the luggage compartment, improving the operability of the trunk-through space and convenience when loading luggage.

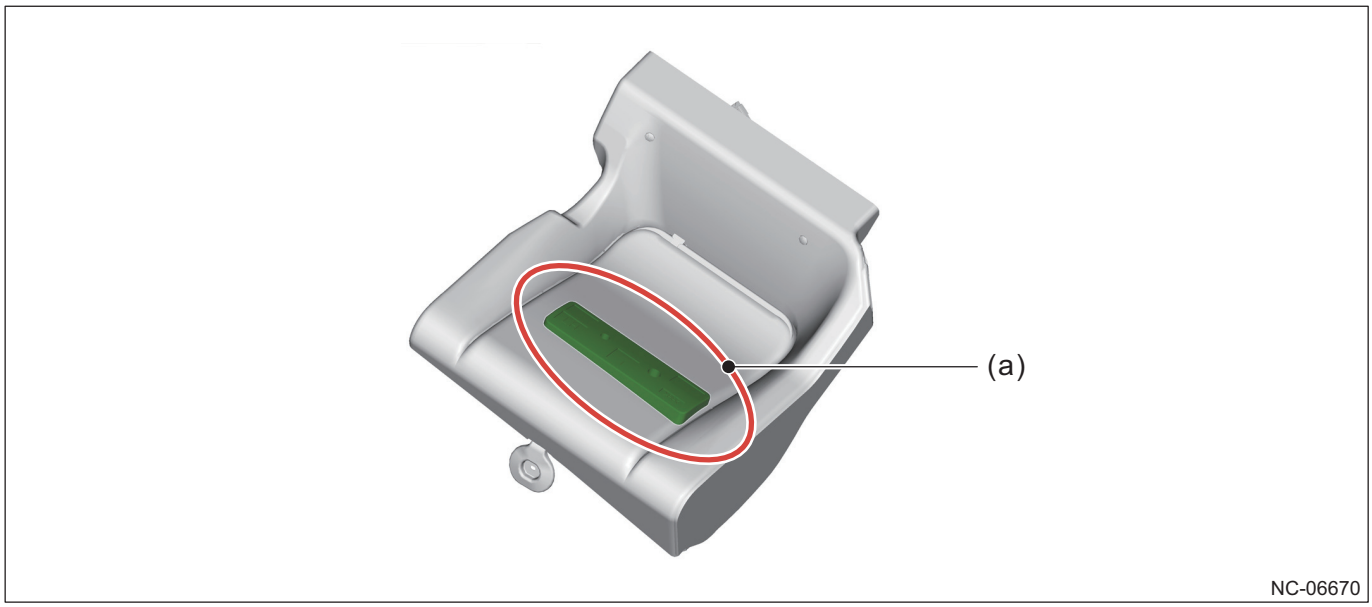


(a) Operation button
(b) Operation strap
(c) Seat back
(d) Seat cushion

■ Improvement of safety

▮ Forward deviation prevention function

EPP (Expanded Polypropylene) is adopted to prevent the occupant's lower back from deviating forward on the rear seat LH or RH to reduce the impact on the occupant in a collision.



(a) EPP (Expanded Polypropylene)

Seat surface

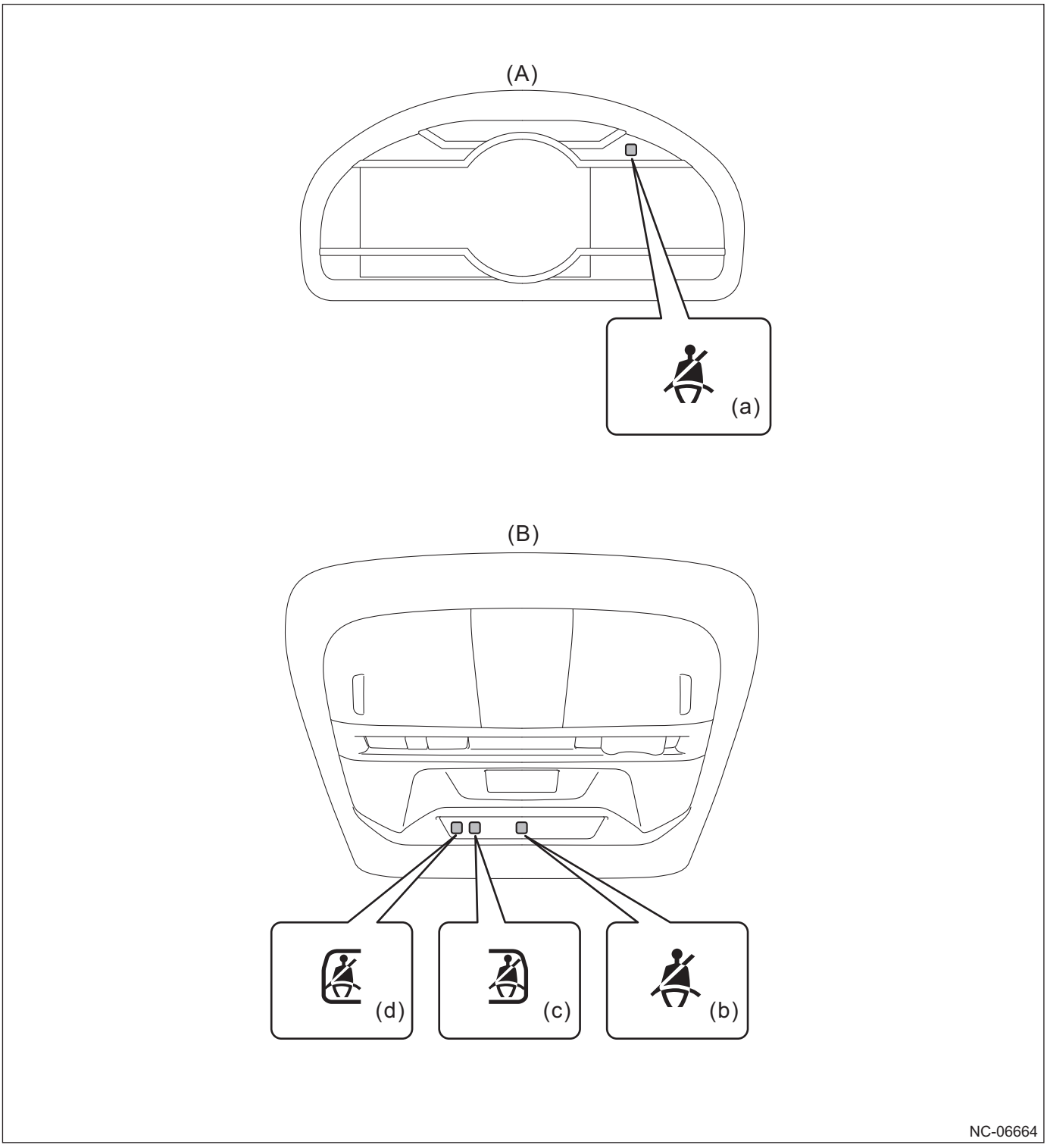
2 types of seat surface are provided to differentiate the grades. (for some grades)

- Sports fabric
- Leather + PVC & 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 map light.



(A) Combination meter

(B) Map light (warning box)

(a) Driver's seat belt warning light

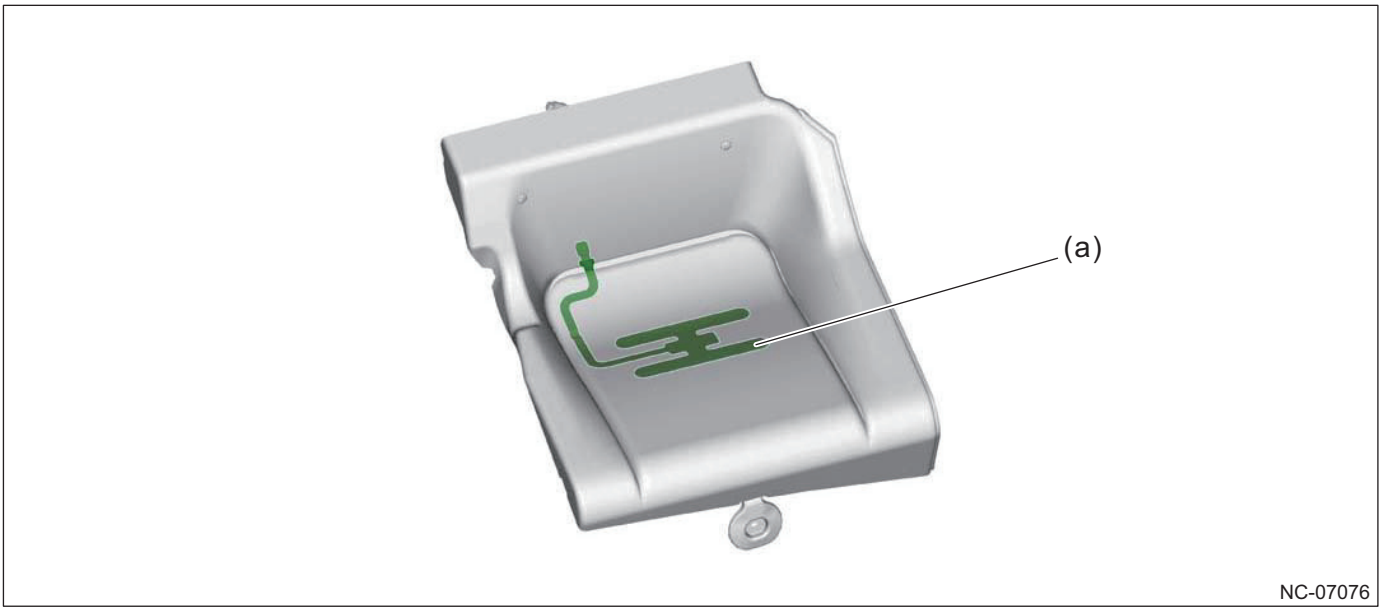
(b) Passenger's seat belt warning light

(c) Rear seat RH seat belt warning light

(d) Rear seat LH seat belt warning light

■ Seating sensor

A seating sensor is adopted for the rear seat LH and RH. The sensor detects whether a rear seat occupant is present, and detects if the seat belt is unfastened.



(a) Seating sensor

■ Equipment list

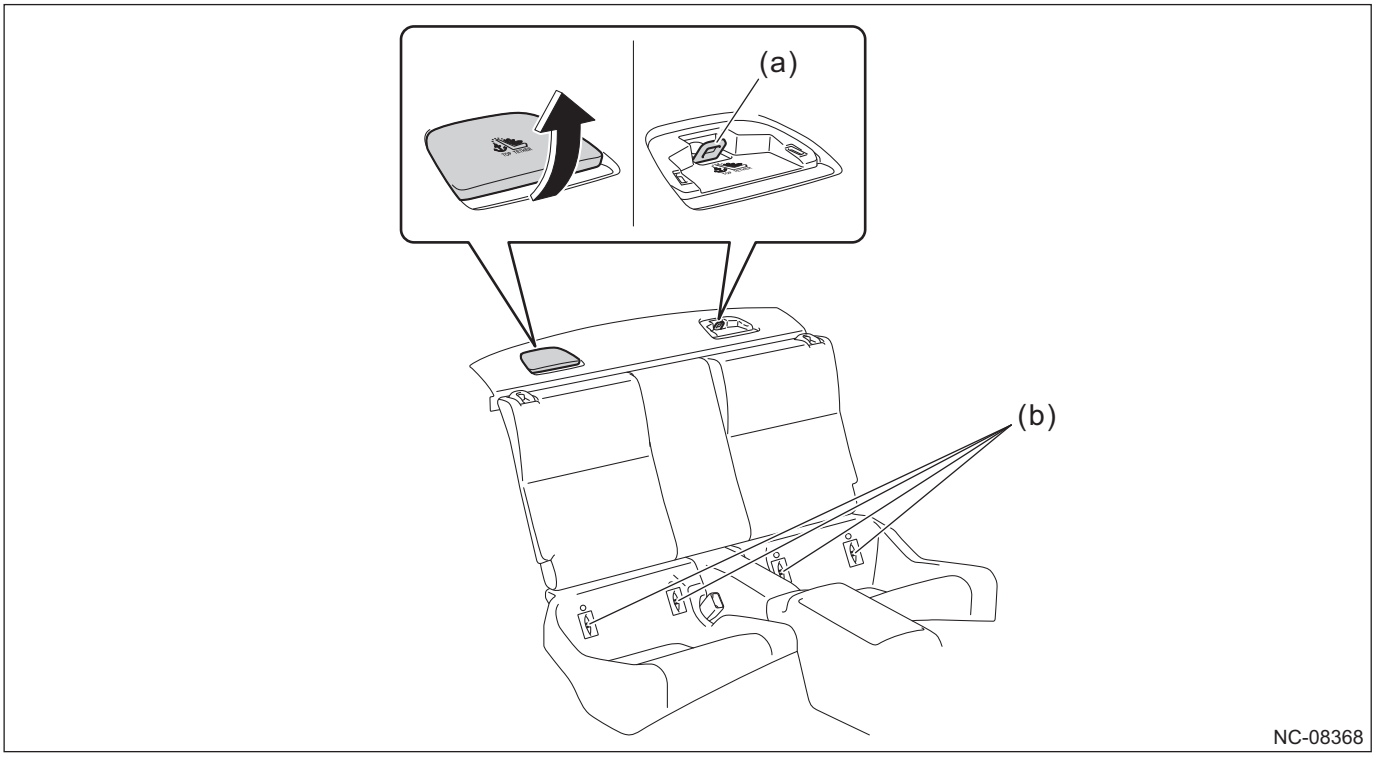
Equipment	Front seat (Driver's seat)	Front seat (Passenger's seat)	Rear seat
Adaptive force limiter	-	✓	-
Pretensioner & force limiter	✓	✓	-

Refer to "10.3 Airbag System" for the following equipment.

- Adaptive force limiter
- Seat belt pretensioner
- Force limiter

■ Anchor for installing child seat

Layout of anchor for installing child seat



(a) Tether anchor

(b) Lower anchor

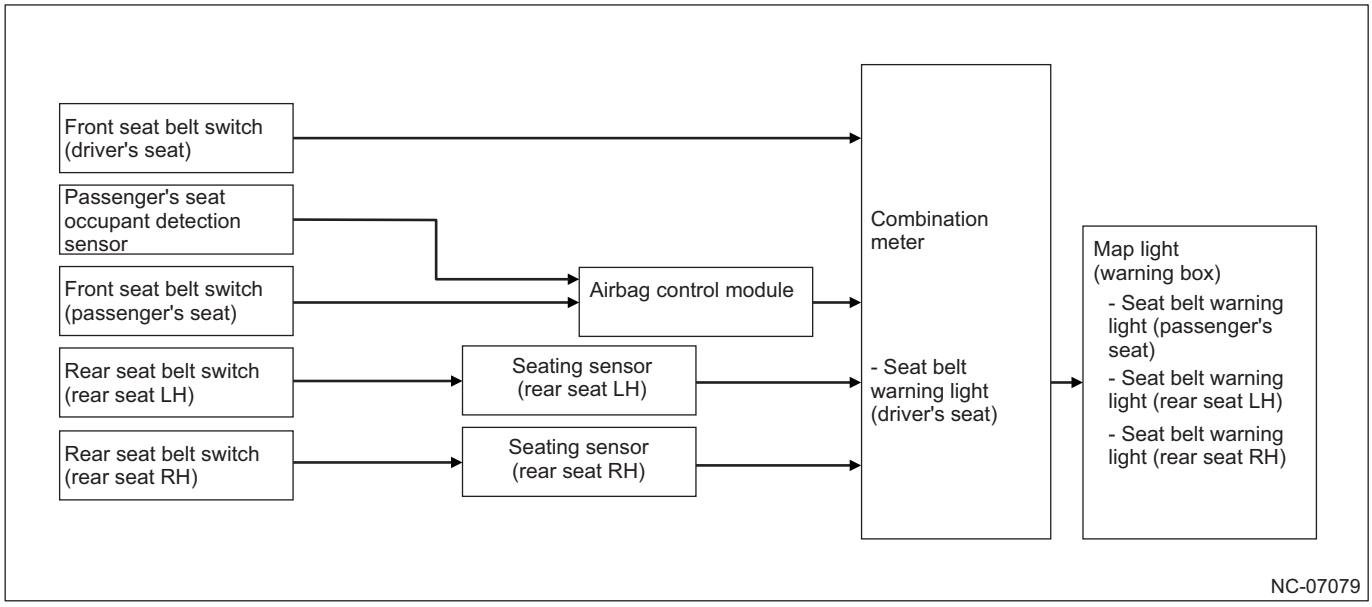
- The specification about the anchor for installing child seat (lower anchor, tether anchor) is in accordance with ISO FIX.

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 3.8 MPH (6.1 km/h) or higher), the seat belt warning light turns on, and the buzzer sounds (low volume) as a warning. When the vehicle is driven further (at a vehicle speed of 12.5 MPH (20 km/h) or higher or when 35 seconds elapse), the seat belt warning light flashes, and the buzzer sounds (high volume) as a warning.

System diagram



Main component functions

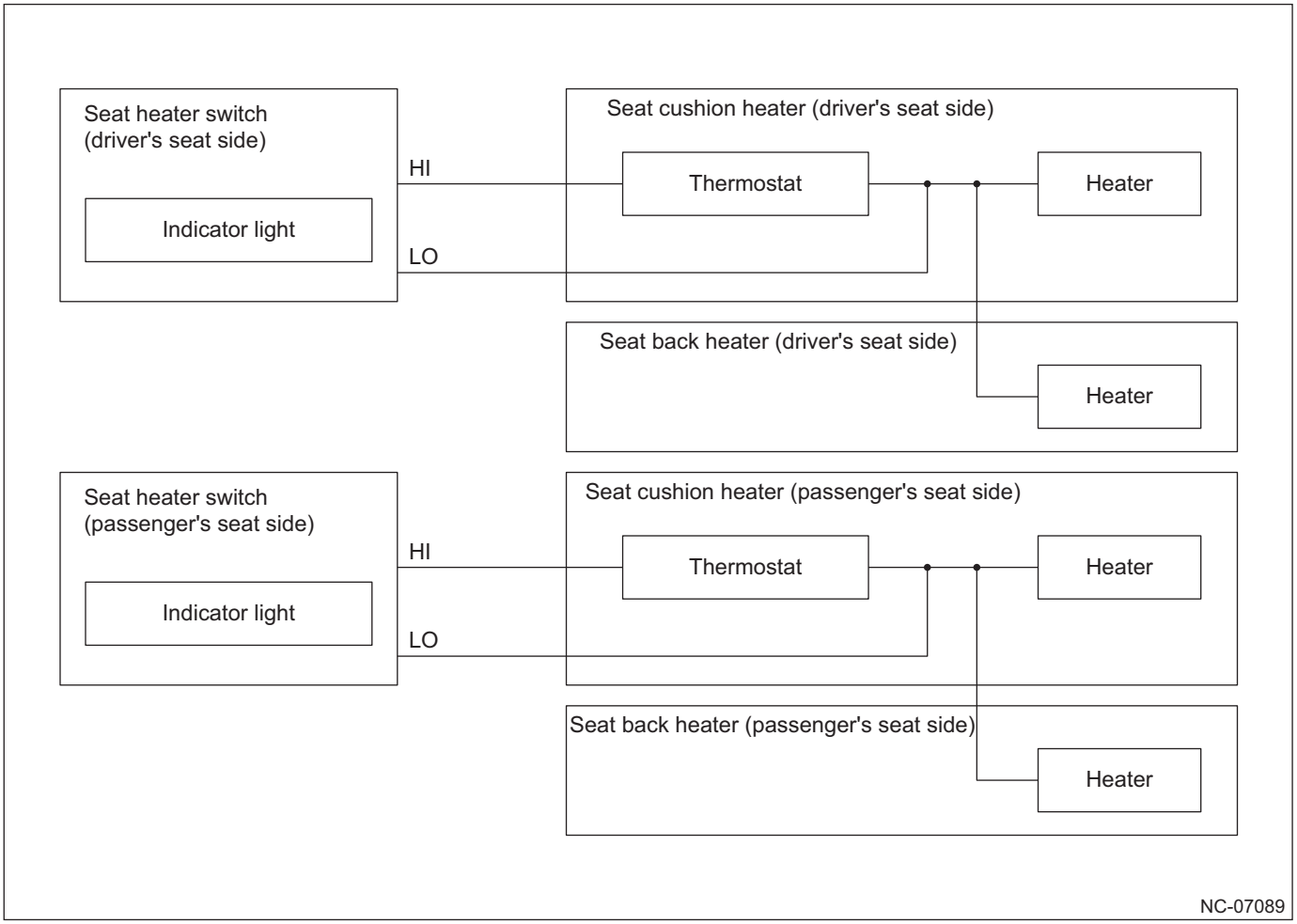
Component	Function
Combination meter	• Turns on the driver's seat belt warning light to warn the driver if the driver is not wearing the seat belt. • Sends the seat belt warning light on signal to the map light based on the information received from the airbag control module and seating sensor.
Map light (warning box)	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 (for some grades)

The front seat heater is composed of the seat heaters installed in the seat back and seat cushion, and the seat heater switches on the center console.

The seat heater switch enables adjustment between 2 levels, LO and HI.

System diagram



Main component functions

Component	Function
Seat heater switch	Outputs the current according to the switch operation to each seat heater.
Seat cushion heater	• The seat heater is operated according to the current from the seat heater switch. • The temperature of the seat heater is adjusted by the thermostat installed in the seat heater.
Seat back heater	The seat heater is operated according to the current from the seat heater switch.

10.5 Instrument Panel

10.5.1 Overview

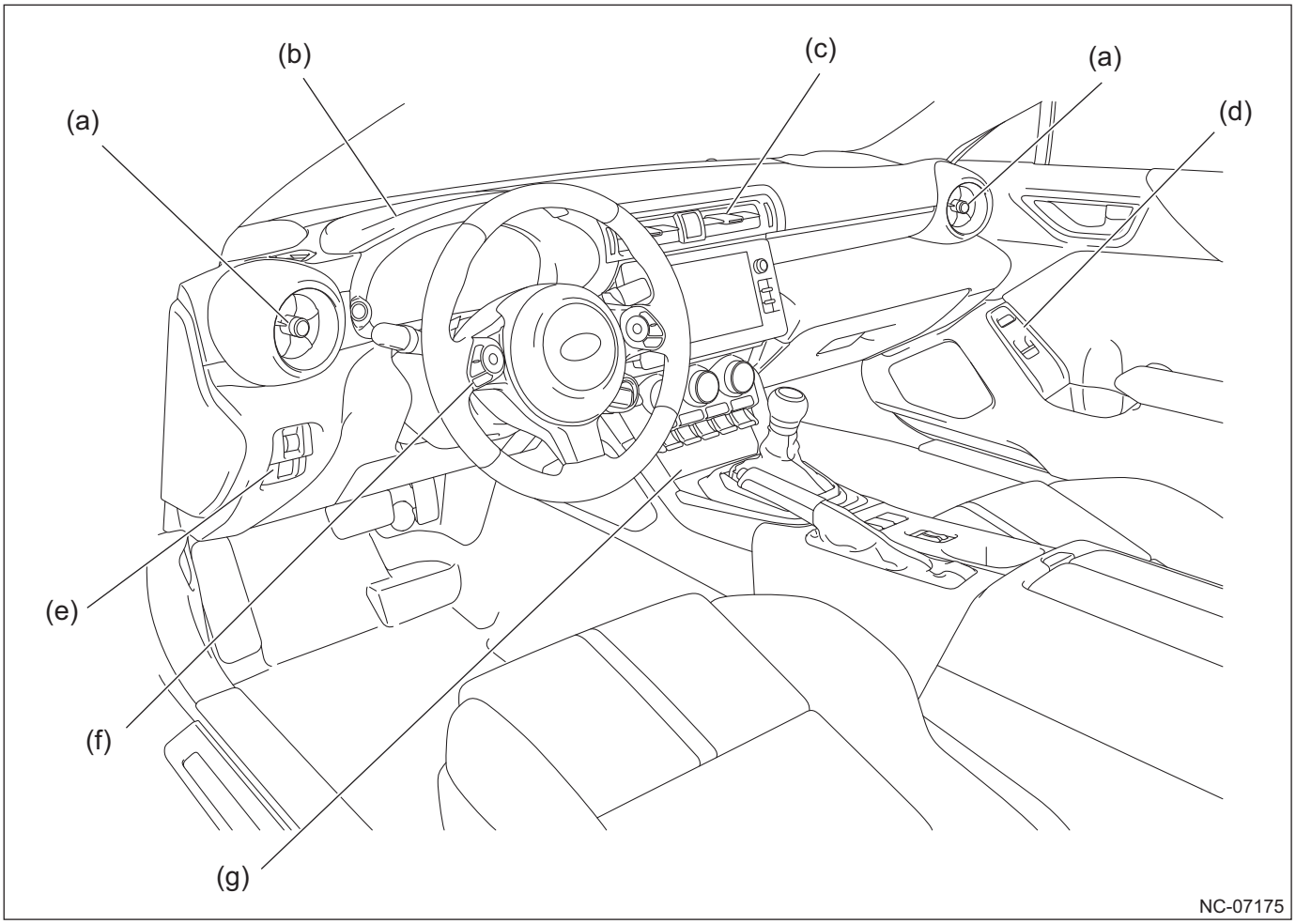
Overview

An instrument panel with a simple horizontal tone is adopted, with consideration given to the driver's driving enjoyment through the wide field of view and ease of sensing the driving conditions.

The operation switches are positioned functionally around the steering wheel in consideration of operability.

10.5.2 Component

Component layout drawing



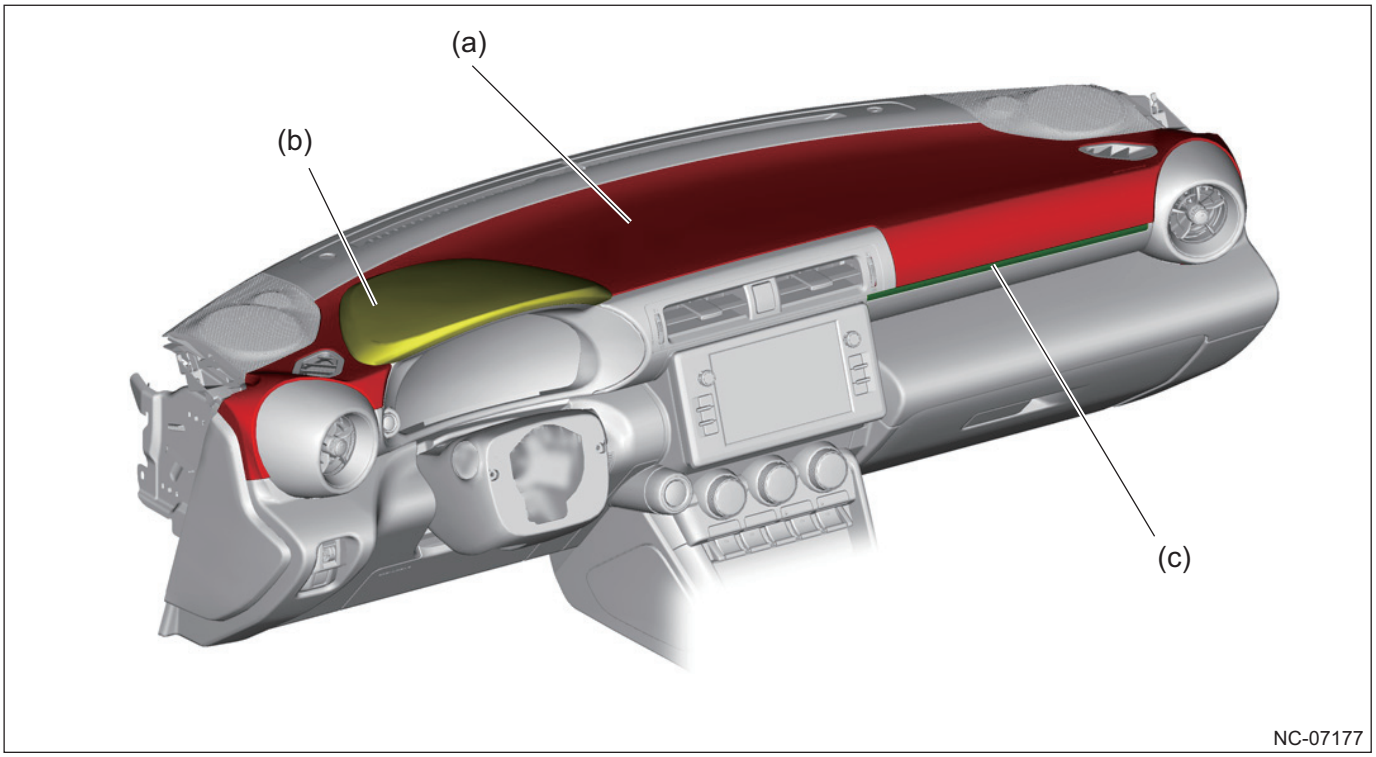
(a) Side register grille
(b) Meter shield
(c) Center register grille
(d) Power window sub switch
(e) Instrument panel combination switch
(f) Satellite switch
(g) Shift panel

**: The illustration shows a typical example.*

Component details

Instrument panel

- The soft pad thickness of the panel COMPL instrument is optimized for a soft feel and reduced weight.
- Two surface types are provided for the shield assembly UPR, a PVC surface and nubuck style surface. (for some grades)
- Molding decorations are used in the center of the instrument panel on the passenger's seat side to create a luxurious feel. Satin-like silver with reduced brightness is adopted for the molding to prevent visual obstruction while driving.



(a) Panel COMPL instrument (soft pad)

(b) Shield assembly UPR (PVC or nubuck style surface) (for some grades)

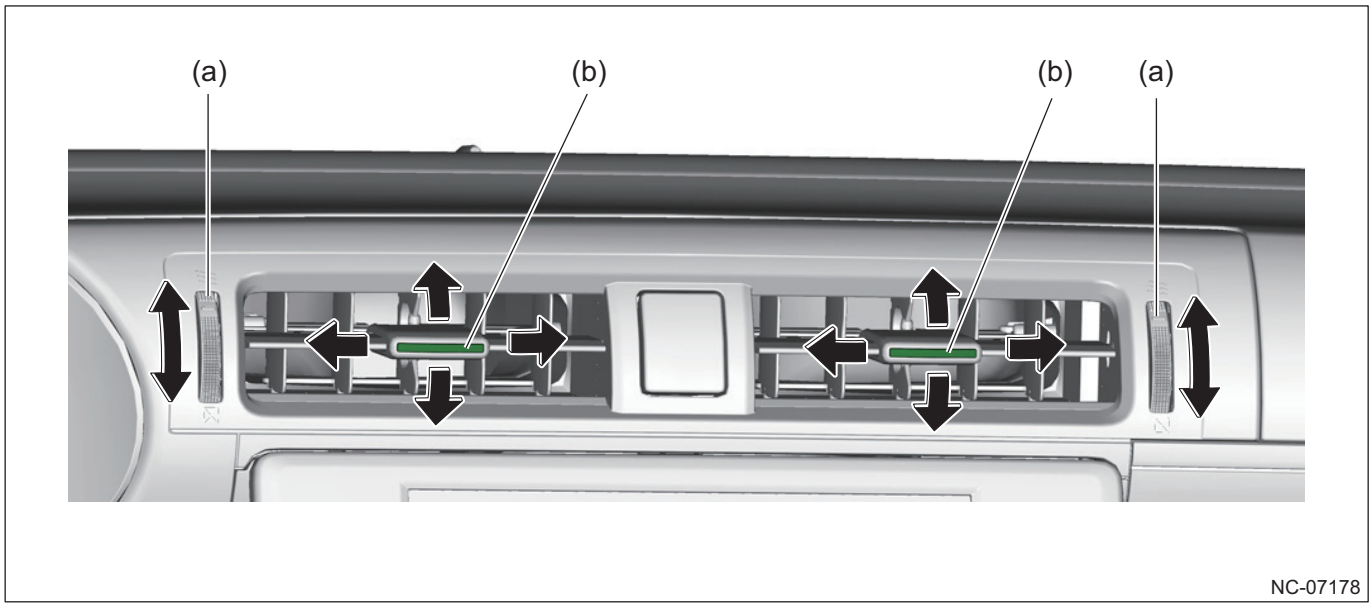
(c) Molding decoration (satin-like silver)

■ Register grille

▮ Center register grille

An air flow outlet open/close dial is provided on the left and right of the center register grille. The air flow outlet can be opened and closed independently on the driver's seat side and passenger's seat side.

A plated decoration is used at the center of the air flow direction fin operation knob to create a luxurious feel.



(a) Air flow outlet open/close dial

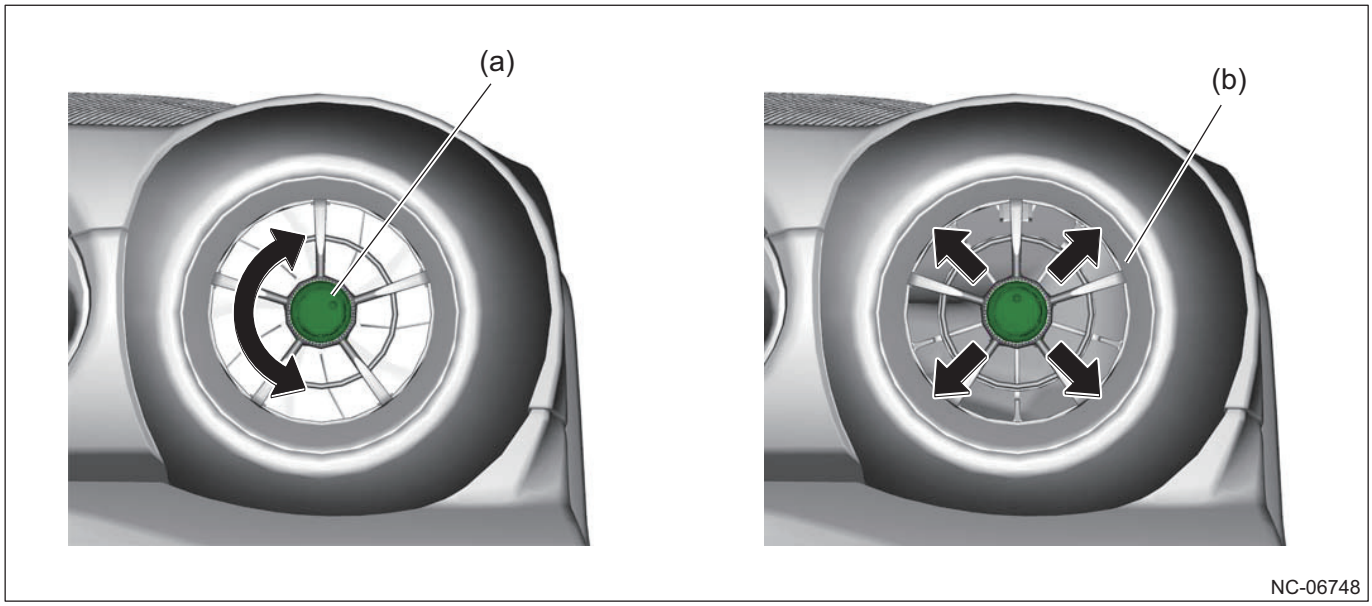
(b) Air flow direction fin operation knob (plated decoration)

Side register grille

A side register grille is adopted whose air flow direction can be adjusted and shutter opened and closed with a single knob in consideration of usability.

- Shutter opening/closing: Turn the operation knob
- Air flow direction adjustment: Move the operation knob up, down, left, or right

Cast black paint is used on the side register grille and a plated decoration is used around the outer circumference of the operation knob to create a luxurious feel.



(a) Operation knob (plated decoration ring)

(b) Side register grille (cast black paint)

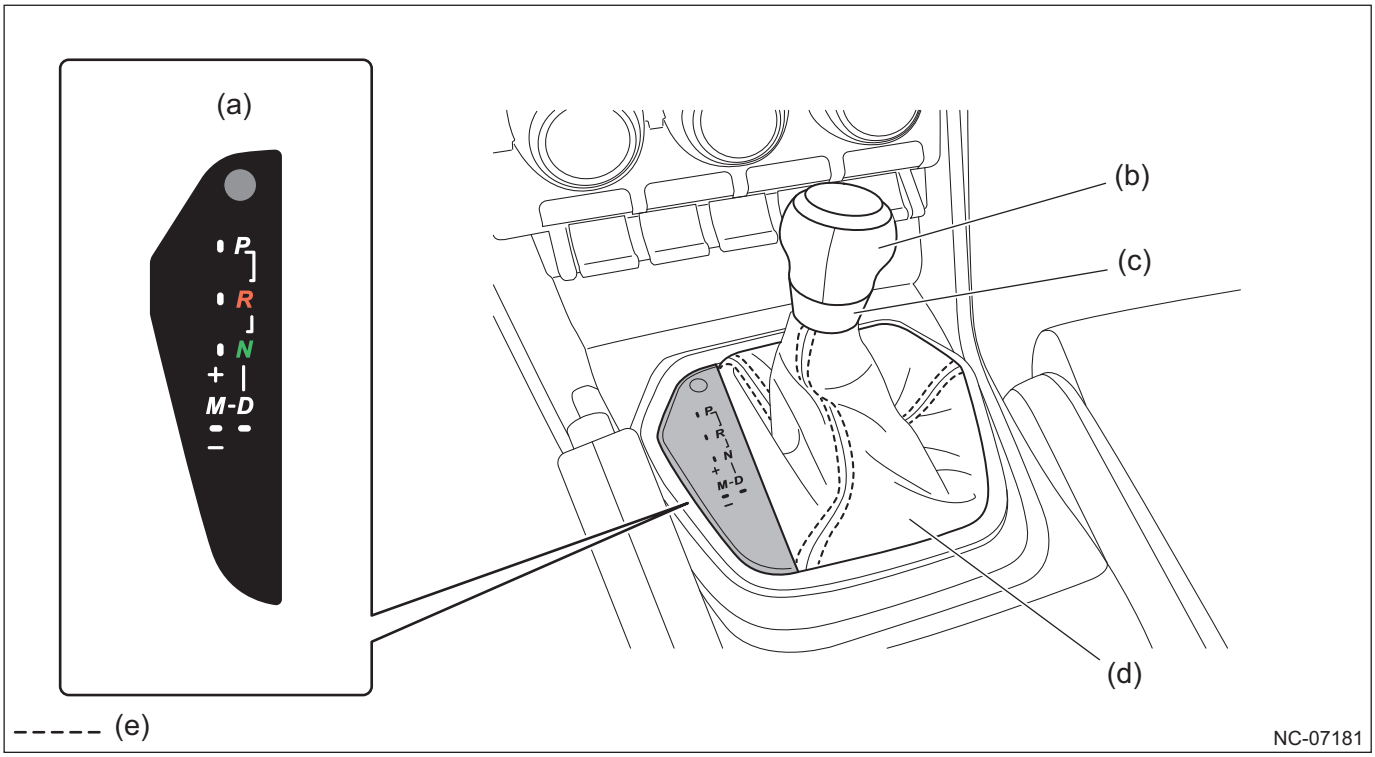
■ Shift panel

▮ AT shift panel/select lever grip

An indicator with pointer is adopted for the shift panel in AT models to improve visibility for shift operations.

A leather-wrapped select lever grip is provided and an ornament ring with a gun-metal base color is installed to create a luxurious feel.

Double stitching is used in the boot section of the cover assembly front (AT model) to coordinate the design with the seats and trim.



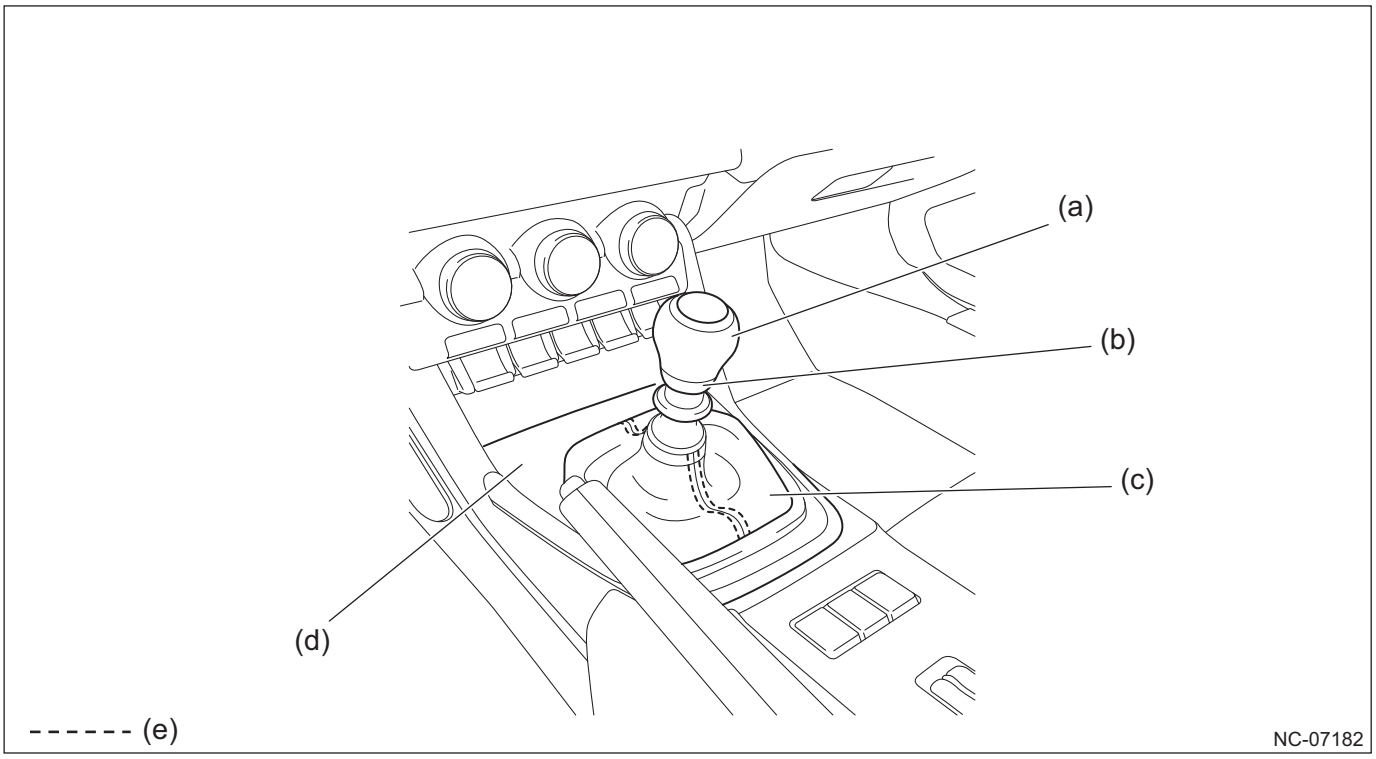
(a) Indicator with pointer
(b) Select lever grip (wrapped with real leather)
(c) Ornament ring (gun-metal base color)
(d) Cover assembly front (AT model)
(e) Double stitching

MT shift panel/shift lever knob

A shift knob wrapped in real leather and an ornament ring painted in cast black are provided.

Two types of shift ornament panel are provided, base color black and high-gloss black paint. (for some grades)

Double stitching is used in the boot section of the cover assembly front (MT model) to coordinate the design with the seats and trim.



(a) Shift lever knob (wrapped with real leather)

(b) Ornament ring (cast black paint)

(c) Cover assembly front (MT model)

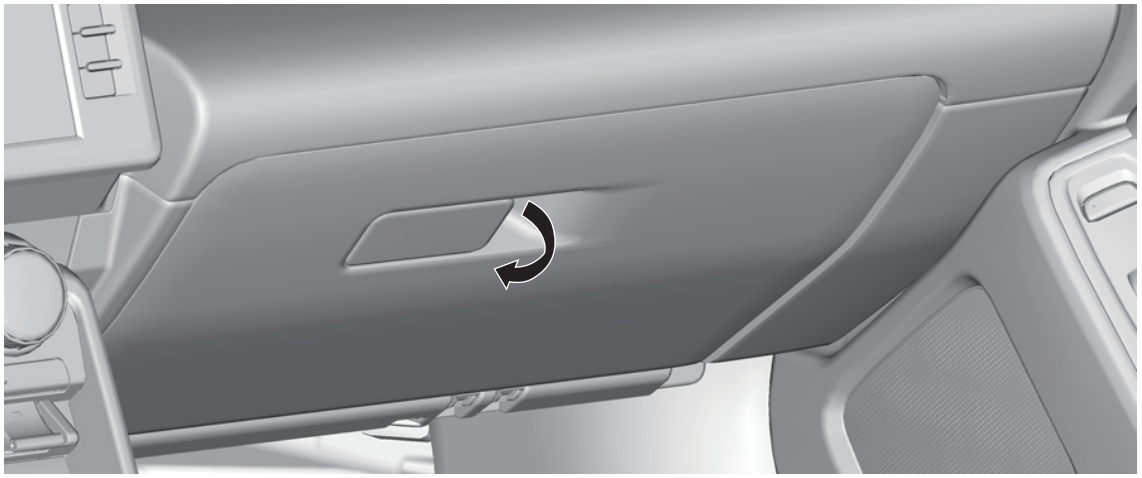
(d) Shift ornament panel (base color black/high-gloss black paint) (for some grades)

(e) Double stitching

■ Glove box

A lock release knob with a horizontal operation direction is adopted to make operation easier from the driver's seat side. The lock release knob is pulled down to open the glove box door.

When closing the glove box door, the pad surface is pressed up to the specified position to fix the glove box door automatically.

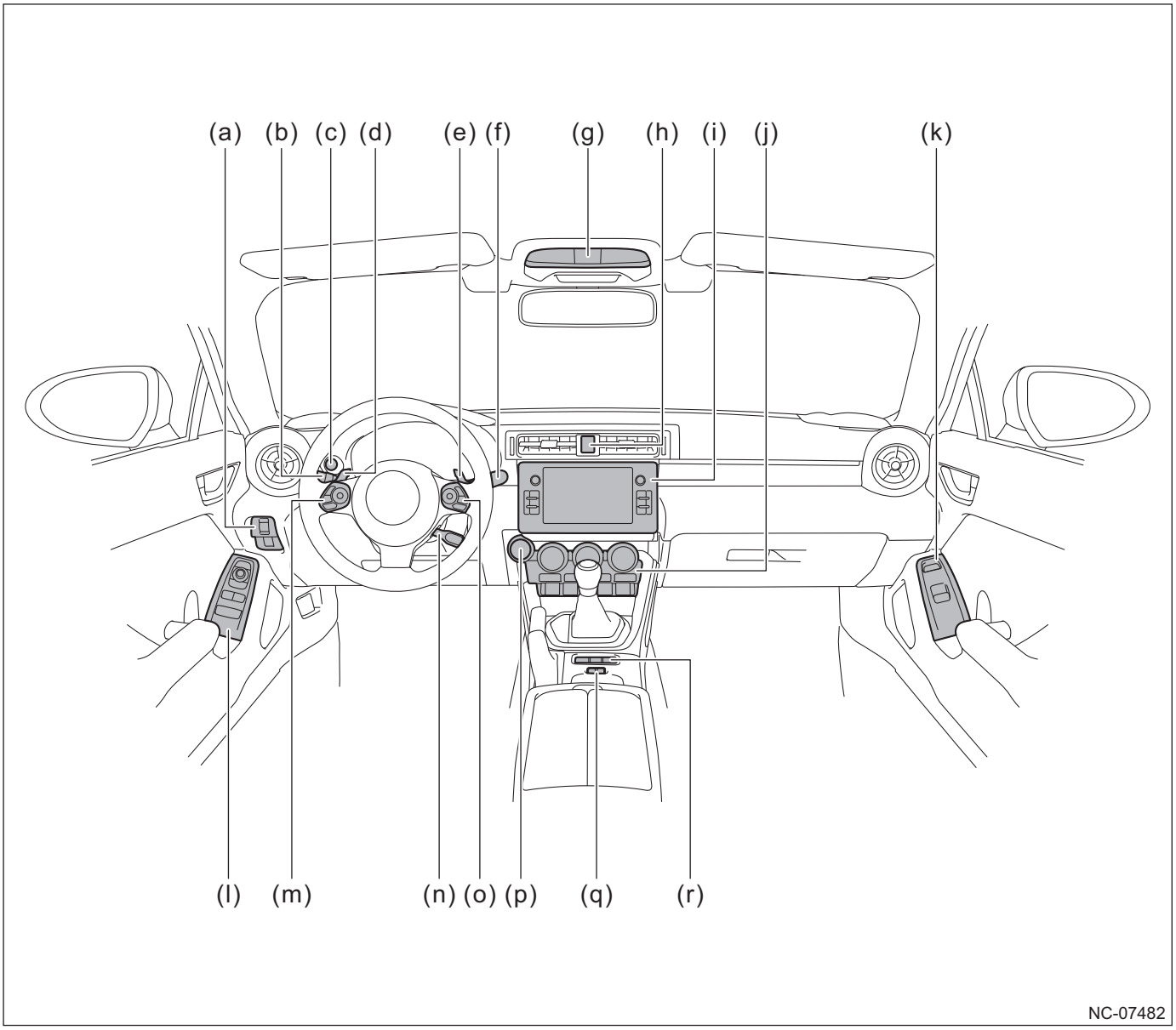


NC-07179

(a) Lock release knob

Switch

The switches are positioned functionally around the driver's seat for excellent usability and operability.



Symbol	Switch name	Reference location
(a)	Instrument panel switch cluster • Illumination control switch • Trunk opener switch	• "ENTERTAINMENT" - "Combination Meter/MID" - "Component" • "INTERIOR TRIM" - "Door Lock and Security System" - "Construction and Operation"
(b)	Lighting switch	"EXTERIOR" - "Lighting System" - "Component"
(c)	TRIP/RESET switch	"ENTERTAINMENT" - "Combination Meter" - "Component"
(d)	Paddle shift switch (-)	"DRIVE TRAIN" - "Control System" - "Component"
(e)	Paddle shift switch (+)	
(f)	Switch assembly combination wiper • Front wiper control switch • Front washer switch	"EXTERIOR" - "Wiper and Washer System" - "Component"
(g)	Spot map light • Door interlocked function switch • Telematics button	• "INTERIOR TRIM" - "Lighting System" - "Component" • "ENTERTAINMENT" - "Telematics System" - "Construction and Operation"
(h)	Hazard switch	When the switch is turned ON, all the turn signal lights flash.
(i)	Center information display	"ENTERTAINMENT" - "Audio and Speaker System" - "Component"
(j)	A/C control panel	"INTERIOR TRIM" - "Air Conditioning System" - "Component"
(k)	Power window sub switch (passenger's seat) • Power window switch (passenger's seat) • Central door lock switch	• "EXTERIOR" - "Glass/Windows/Mirrors" - "Component" • "INTERIOR TRIM" - "Door Lock and Security System" - "Component"
(l)	Power window main switch • Outer mirror surface adjustment/left-right selector switch • Power window switch (driver's seat/ passenger's seat) • Window lock switch • Central door lock switch	• "EXTERIOR" - "Glass/Windows/Mirrors" - "Component" • "INTERIOR TRIM" - "Door Lock and Security System" - "Component"
(m)	Satellite switch (LH) • Audio control switch (Source, +/-/Left/Right, Enter button) • Hands-free switch	"ENTERTAINMENT" - "Audio and Speaker System" - "Component"
(n)	Cruise Control switch	"ADVANCED SAFETY SYSTEM" - "EyeSight" - "Component"
(o)	Satellite switch (RH) • Meter display switch (Up/Down/Left/Right, Enter, Back button) • Distance between vehicles setting switch (AT only) • Talk switch	• "ENTERTAINMENT" - "Combination Meter" - "Component" • "ADVANCED SAFETY SYSTEM" - "EyeSight" - "Component" • "ENTERTAINMENT" - "Audio and Speaker System" - "Component"
(p)	Engine switch	"INTERIOR TRIM" - "Door Lock and Security System" - "Component"
(q)	Seat heater switch (driver's seat/passenger's seat)	"INTERIOR TRIM" - "Seat and Seat belt" - "Component"
(r)	Drive mode switch • AT pattern select switch (AT only) • VDC OFF switch • TRACK switch	• "DRIVE TRAIN" - "TX6A Automatic Transmission" - "Construction and Operation" • "BRAKE SYSTEM" - "Vehicle Dynamics Control (VDC)" - "Component"

10.6 Interior Trim/Interior Equipment

10.6.1 Overview

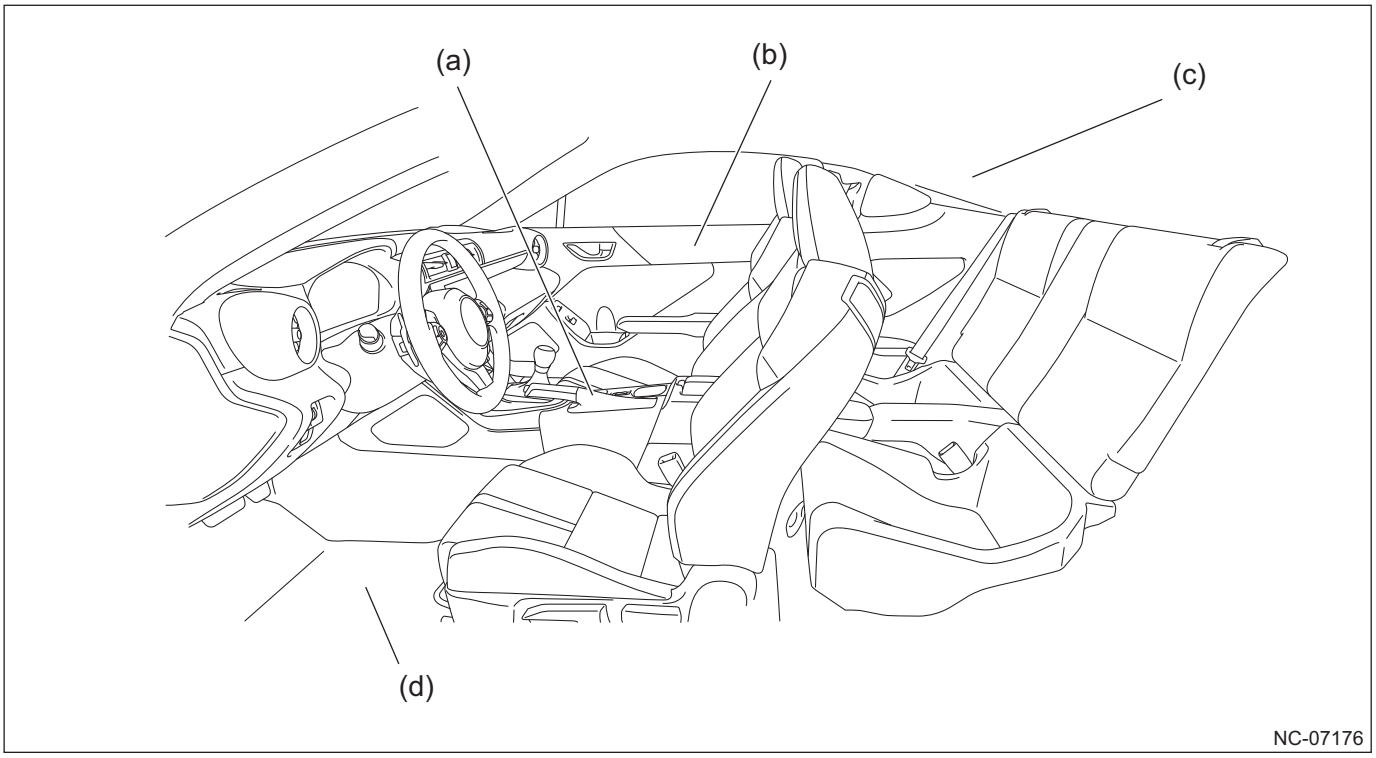
Overview

Interior colors and materials are adopted with black as the basic tone to express high functionality and a high-quality feel.

The ubiquitously placed red accent color stimulates a feeling of "wanting to drive together with this vehicle."

10.6.2 Component

Component layout drawing



(a) Center console
(b) Door trim
(c) Roof trim
(d) Floor carpet

**: The illustration shows a typical example.*

Component details

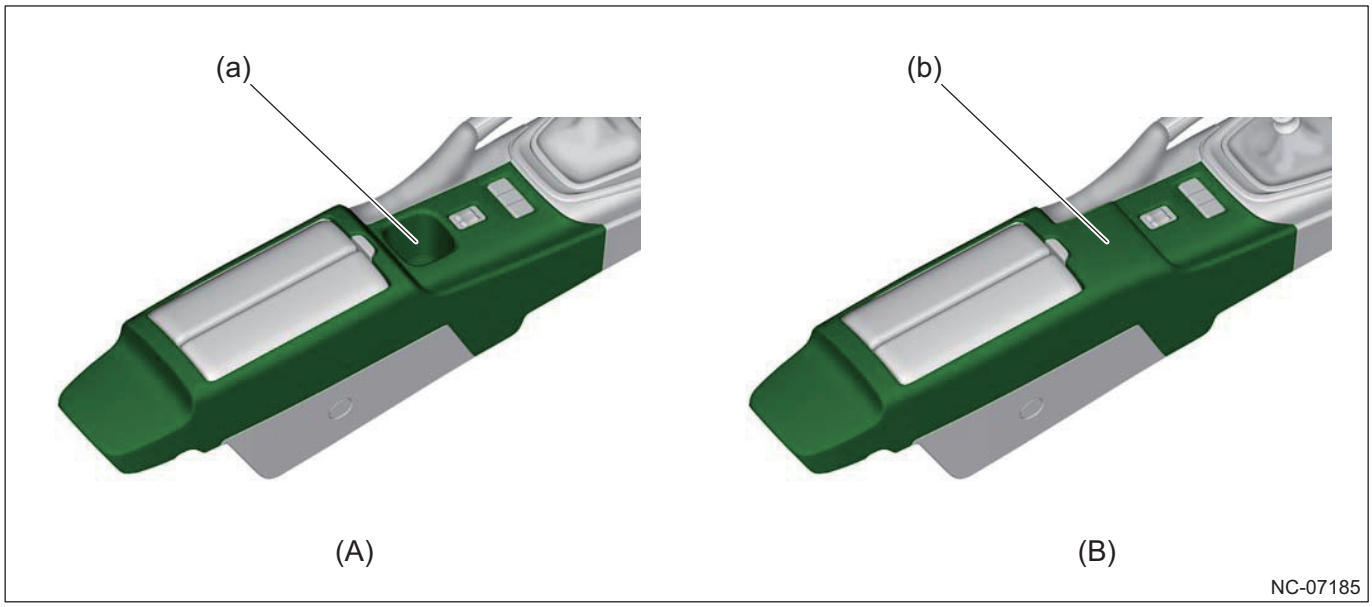
Center console

A center console is adopted that combines comfort and practicality to achieve an interior space befitting of a sports car.

■ Console armrest

A cushioned surface-wrapped armrest (console lid) is adopted.

In MT models, the upper surface of the armrest is 0.4 in (10 mm) lower than in AT models to prevent elbow contact when operating the shift. Also, no cup holder is provided at the front of the console lid to make the armrest surface smoother and longer.



(A) Console box assembly (AT model)

(B) Console box assembly (MT model)

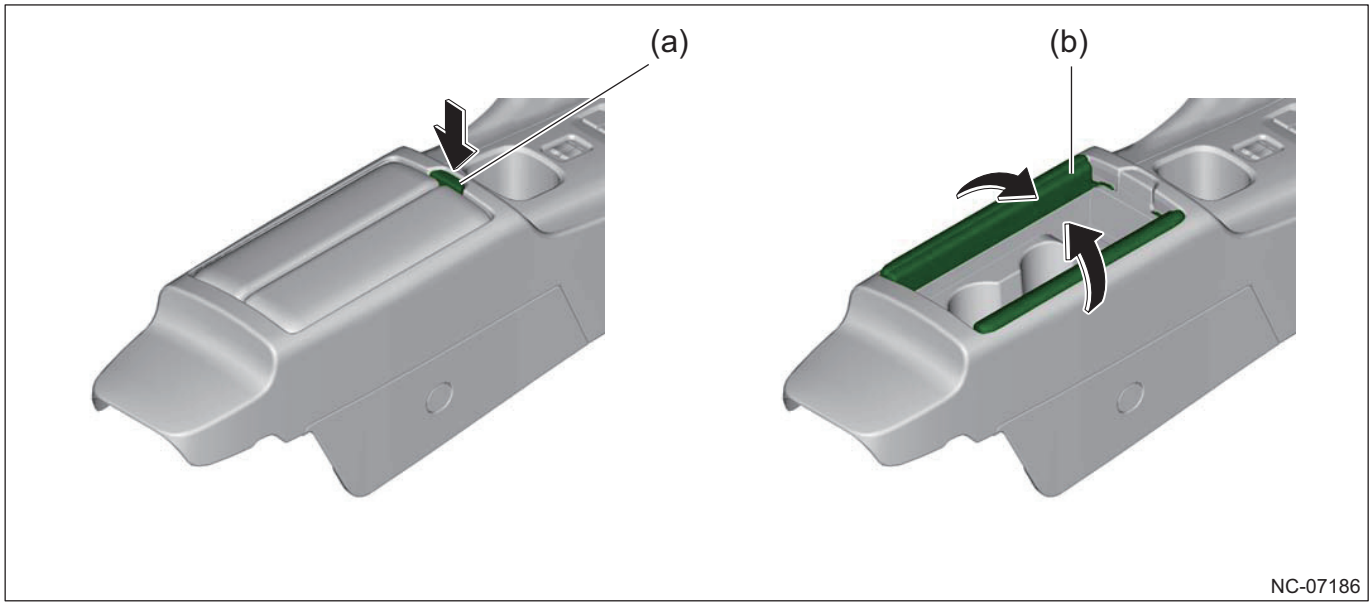
(a) Cup holder

(b) Armrest

■ Console lid

A double door type of console lid is adopted to prevent elbow contact when operating the shift regardless of whether the lid is open or closed, with a construction where the open console lids are stored within the console.

- The console lids open to both sides when the front button is pressed.
- When either of the console lids is lifted up, the other console lid also closes in a linked operation.



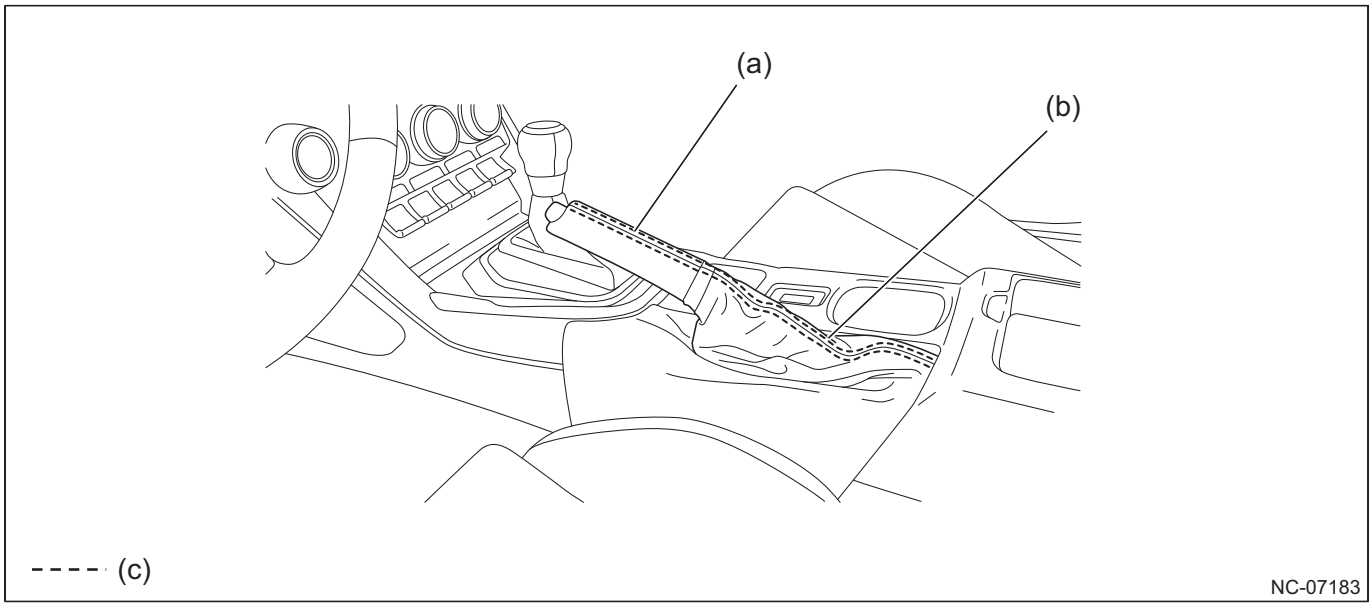
(a) Button

(b) Console lid

An AUX input terminal, USB terminal, and cup holder are provided within the console lid.

■ Parking brake lever boot

A parking brake lever and boot assembly parking brake wrapped in real leather are provided with continuous double stitching on both.



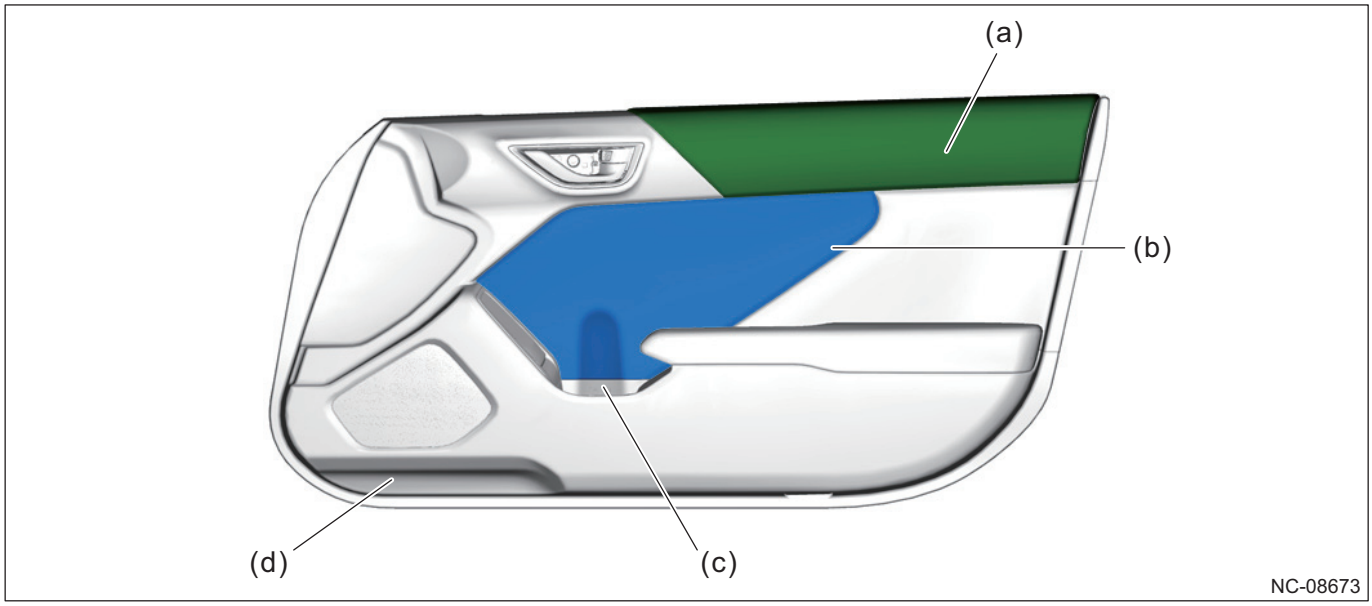
(a) Parking brake lever
(b) Boot assembly parking brake
(c) Double stitching

**: The illustration shows a typical example.*

Trim

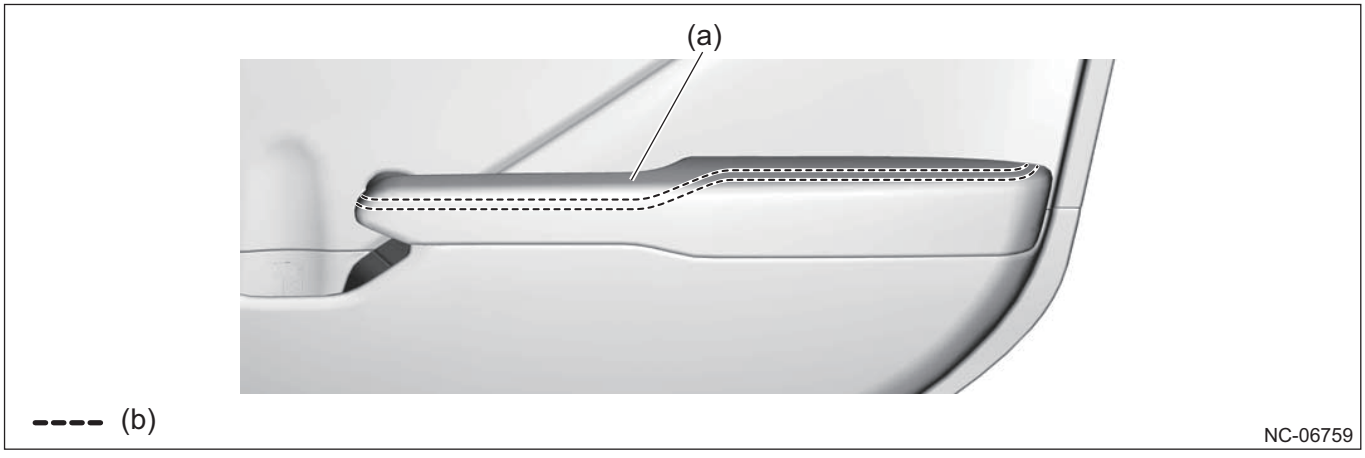
■ Door trim

- Two surface types are provided for the door trim upper, a PVC surface and nubuck style surface. (for some grades)
- 2 surface types are provided for the door trim mid, fabric and a PVC surface. (for some grades)
- The lower front surface of the door trim is chamfered to reduce interference between feet and the trim when the occupant enters and exits.
- The shape of the trim on the inner side of the door pocket is changed to a rounded shape to make a bottle holder shape that can store a plastic bottle or other object.



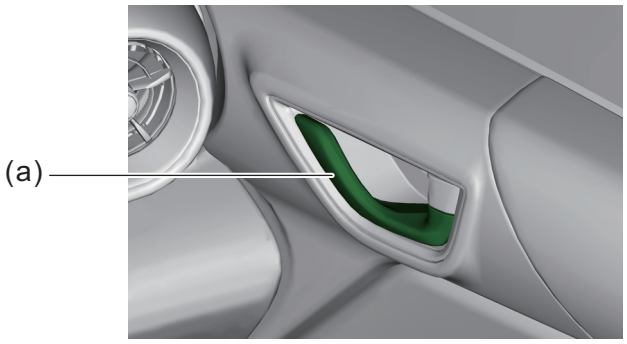
(a)	Door trim upper (PVC surface or nubuck style surface) (for some grades)	(c)	Bottle holder shape
(b)	Door trim mid (fabric or PVC surface) (for some grades)	(d)	Chamfer shape (reduces interference with feet when entering or exiting)

A PVC surface is adopted for the armrest of the door trim and double stitching is used to express a sporty, high-quality interior space.



(a)	Door trim armrest	(b)	Double stitching

A luxurious feel is created by the plating on the inner remote lever.

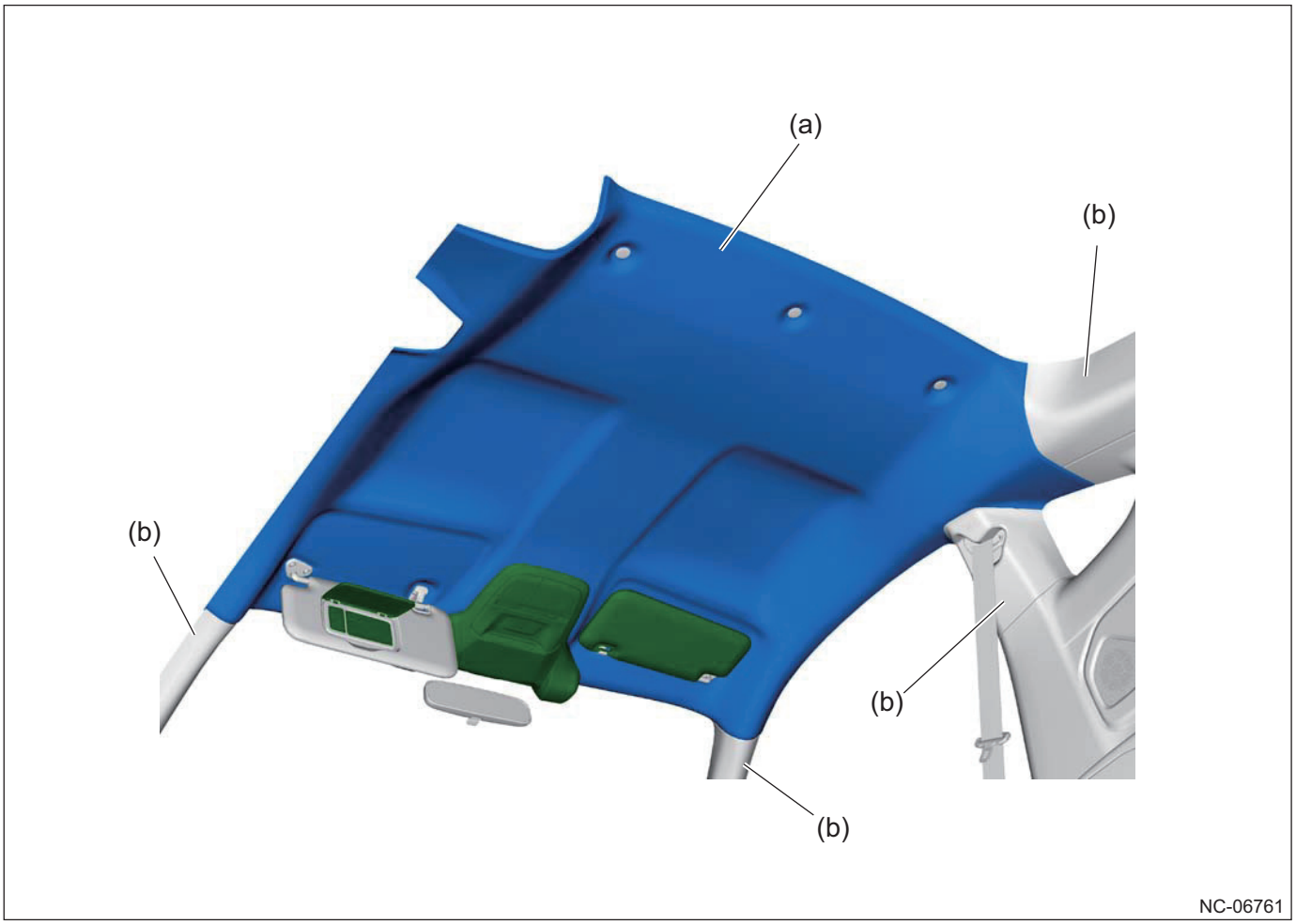


NC-08628

(a) Inner remote lever

■ Roof trim

The layout and construction of the roof trim and pillar trim are optimized to combine them in a streamlined exterior appearance while ensuring driving visibility.



(a) Trim panel roof assembly

(b) Pillar trim

**: The illustration shows a typical example.*

▮ Sun visor

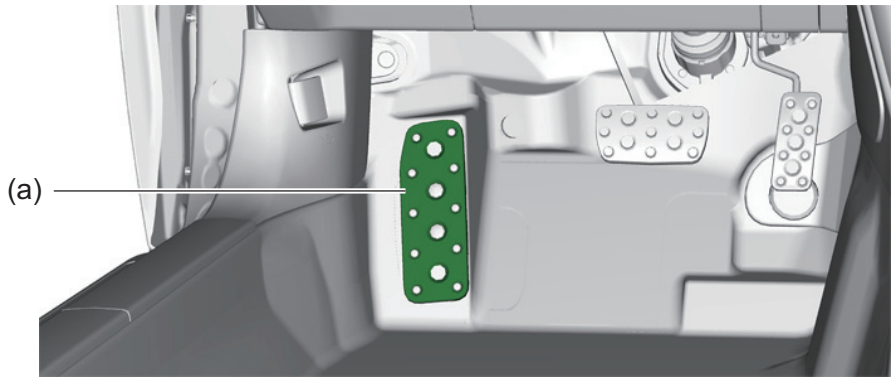
A sun visor with vanity mirror or sun visor with vanity mirror + illumination is provided for the driver's seat and passenger's seat. (for some grades)

A ticket holder is provided for the driver's seat sun visor.

Around the floor

■ Footrest

An aluminum pad is provided for the footrest.



NC-07180

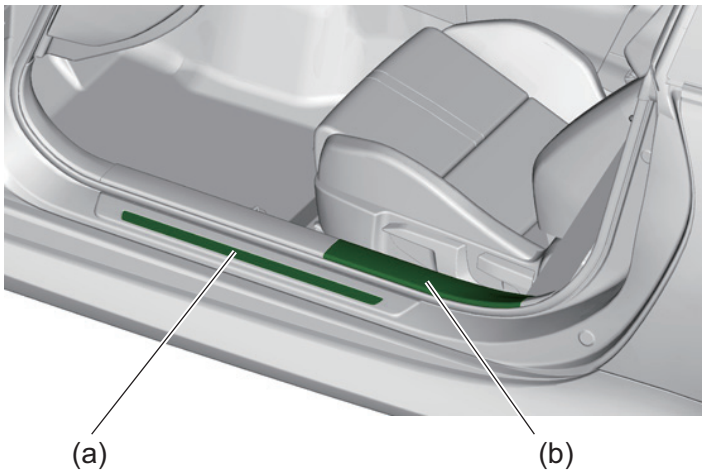
(a) Footrest (pad)

**: The illustration shows a typical example.*

■ Side sill cover

A stainless steel plate is provided for the cover side sill front Out in consideration of styling. (for some grades)

An elastic hand resting pad is provided at the rear of the cover side sill front Rr in consideration of ease of entering and exiting. (for some grades)



NC-07187

(a) Cover side sill front Out (with stainless steel plate) (for some grades)

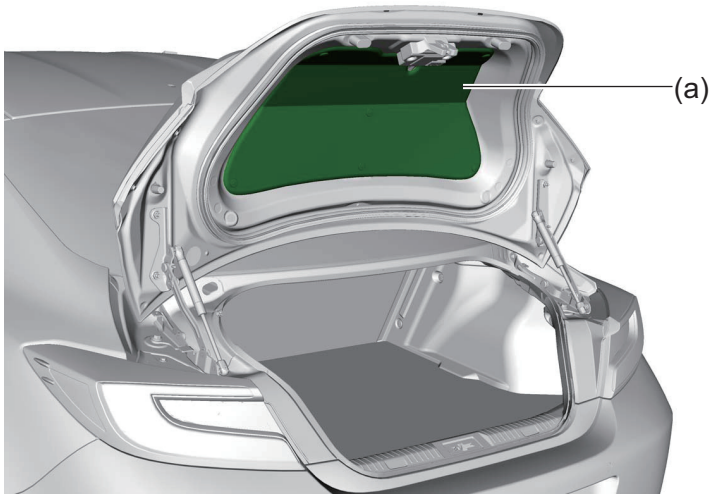
(b) Cover side sill front Rr (for some grades)

**: The illustration shows a typical example.*

Trunk room

■ Luggage compartment door cover

A luggage compartment door cover is provided in consideration of appearance when the trunk is open.



NC-06763

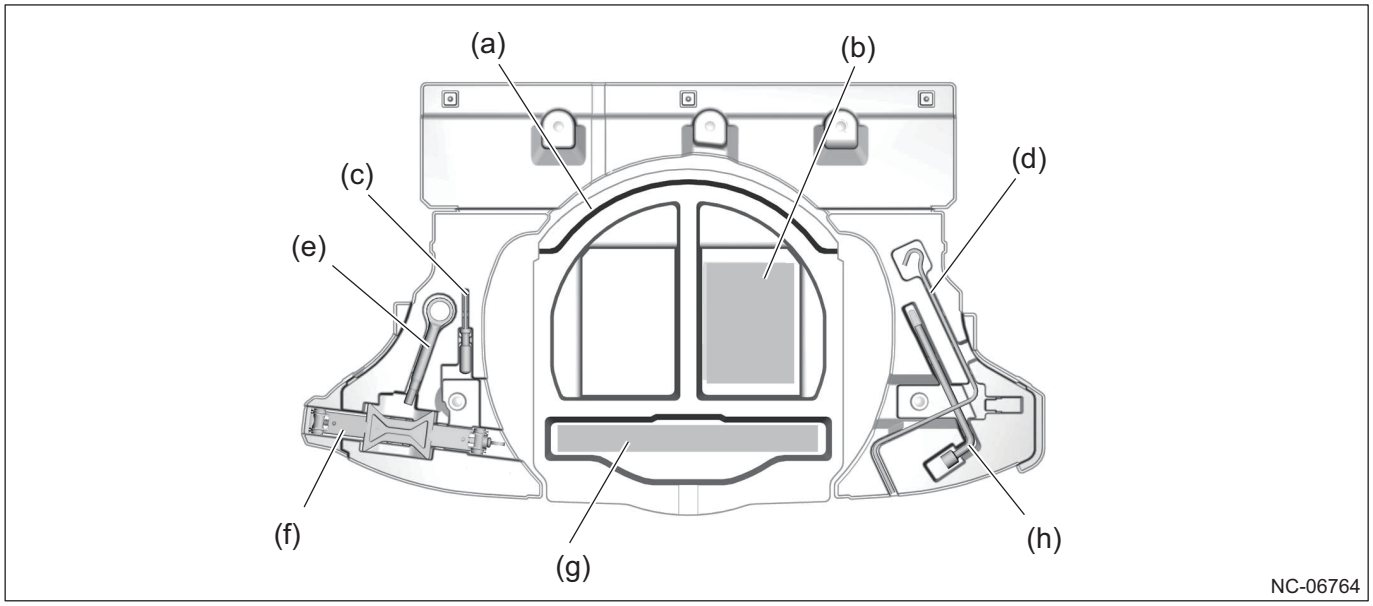
(a) Luggage compartment door cover

**: The illustration shows a typical example.*

■ Sub trunk (Underfloor storage)

Underfloor storage space is provided under the floor that is located under the floor mat in the trunk room, and a tray is provided that can store a jack or other tools.

A sub trunk box that can store items such as a puncture repair kit is provided in the installation space for the spare tire. (Except for C4)



(a)	Sub trunk box (Except for C4)	(e)	Towing hook
(b)	Storage space (Puncture repair kit [Except for C4])	(f)	Storage space (Reference: Jack, etc.)
(c)	Driver	(g)	Storage space (Reference: Triangular warning sign, etc.)
(d)	Storage space (Reference: Jack handle, etc.)	(h)	Wheel nut wrench

Other

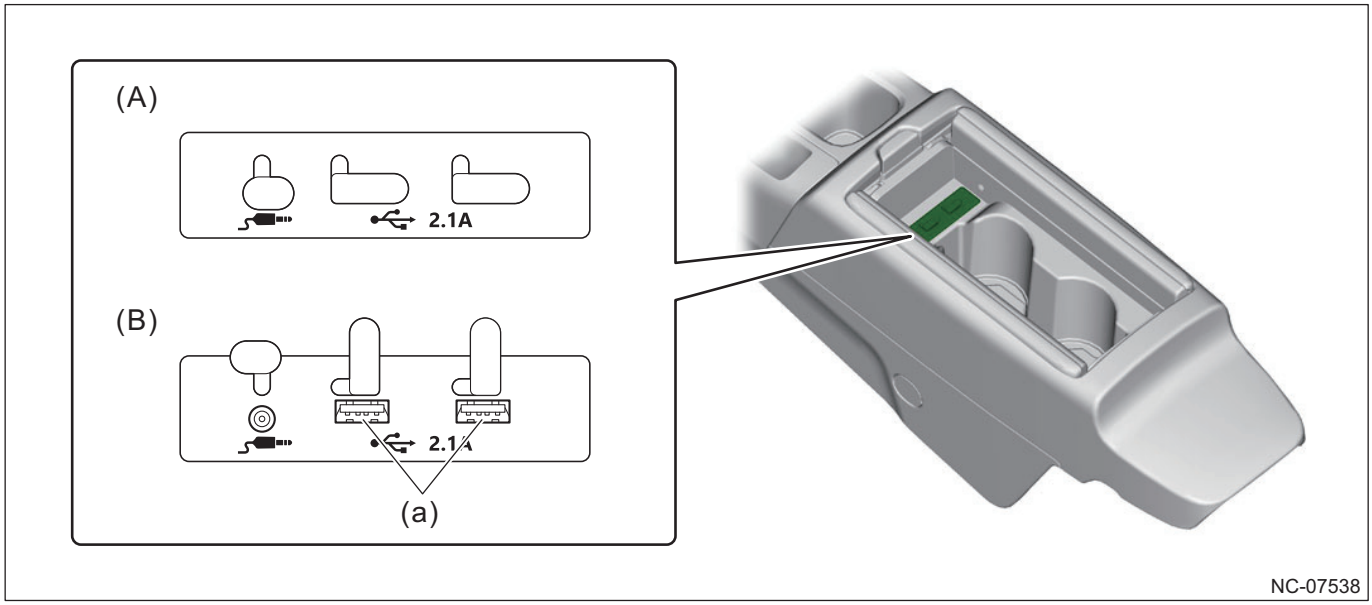
■ Power supply and external input terminals

▮ USB power supply

Two terminal ports for connecting audio USB are provided within the console lid of the center console.

When the engine switch is turned to ACC or ON, the USB terminal can be used as USB power supply.

An opening and closing type cover is provided for each terminal for dust prevention.



(A) Terminal cover closed condition

(B) Terminal cover open condition

(a) USB terminal (5 VDC/2.1 A) [Total 4.2 A]

Warning

Observe the following precautions to prevent electric shock or incorrect operation.

- Do not connect a USB hub.
- Do not insert foreign matter such as metal into the USB terminal.
- Do not pour water or other liquid into the USB terminal.

Caution

- The type of USB connector that can be used is Type A. Connecting a terminal of a different specification may prevent the charging of the power supply or damage the device.
- Be careful not to pull the connected cable. The USB terminal or connected device may be damaged.
- Connecting a device for a long time while the engine is stopped may cause excessive discharge of the vehicle battery.
  (Not connecting a device for longer than is necessary is recommended even while the engine is running.)
- Do not connect a malfunctioning device. Smoke emission or fire may result.
- Close the lid when not in use.

Reference

The charging USB may not operate correctly in the following situations.

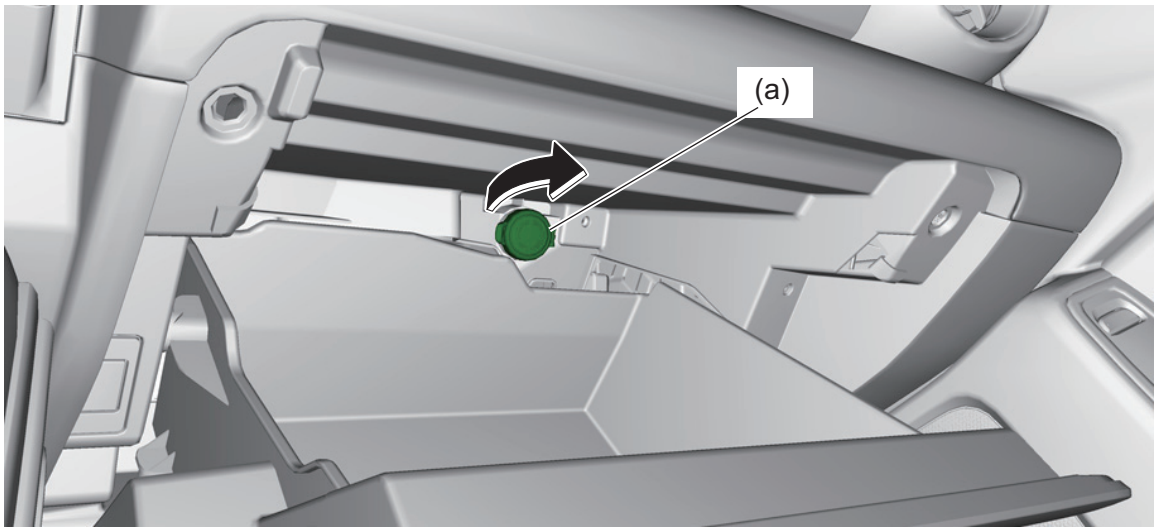
- When a device is connected that requires power exceeding the capacity
- When a device is connected that communicates with a computer or other device
- When the power supply of the connected device is OFF (a device that cannot charge or operate unless the power supply is ON, etc.)
- When the interior temperature is high after parking in the sun, etc.

Some external devices may stop charging temporarily and then restart charging again, but this is not a malfunction.

▮ 12 VDC power socket

A 12 VDC power socket with lid is provided in the glove box.

When the engine switch is turned to ACC or ON, the socket can be used as a 12 VDC power supply.



NC-07188

(a) 12 VDC power supply (12 VDC/10 A, power consumption 120 W)

Caution

- Do not insert foreign matter into the 12 VDC power socket; in particular, metallic objects such as a coin or aluminum foil.
  Close the lid when not in use.
- Use only electronic devices designed for 12 VDC, and do not use electronic devices that exceed the capacity.
- Using a device for a long time while the engine is not operating may cause excessive discharge of the vehicle battery.
- Since the device is used inside the glove box, do not use a device that operates at a high temperature, such as a cigar lighter.

10.7 Door Lock and Security System

10.7.1 Overview

Overview

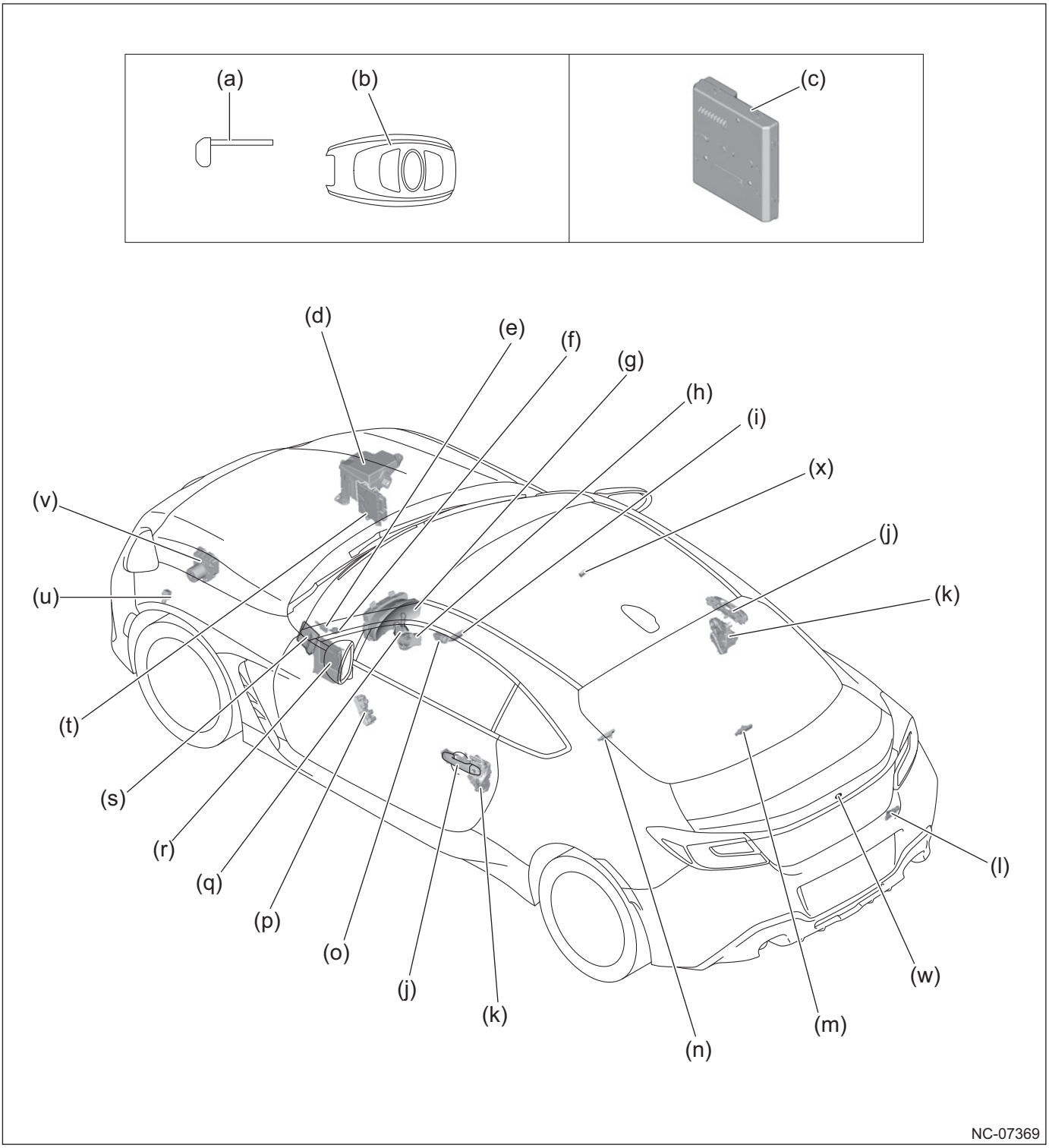
The electric door lock system and keyless access & push button start system are provided for the door lock system.

The immobilizer system and security alarm system are provided for the security system.

10.7.2 Component

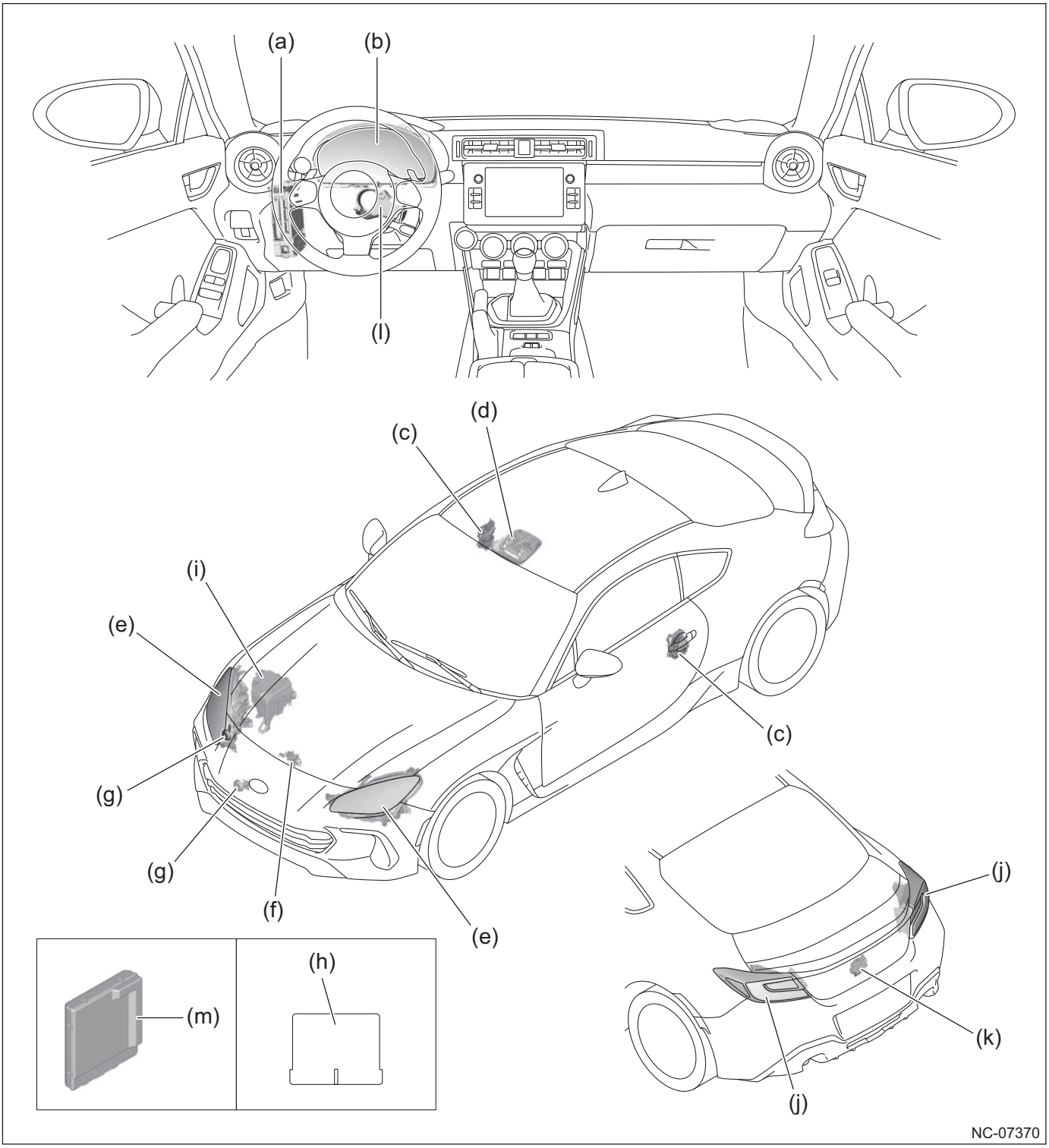
Component layout drawing

Door lock system



(a) Mechanical key
(b) Access key
(c) Keyless access CM
(d) M/B (main fuse & relay box)
(e) Clutch start switch (MT)
(f) Stop light switch
(g) Combination meter
(h) Steering lock CM
(i) Front interior antenna
(j) Front outer handle
(k) Latch & actuator assembly front
(l) Rear exterior antenna
(m) Rear interior antenna
(n) Center interior antenna
(o) Engine switch
(p) Power window main switch
(q) Inhibitor switch
(r) Body integrated unit
(s) Transmission Control Module (TCM) (AT)
(t) Engine Control Module (ECM)
(u) Keyless buzzer
(v) VDC CM & H/M
(w) Trunk request switch
(x) Passenger door lock switch

Security system

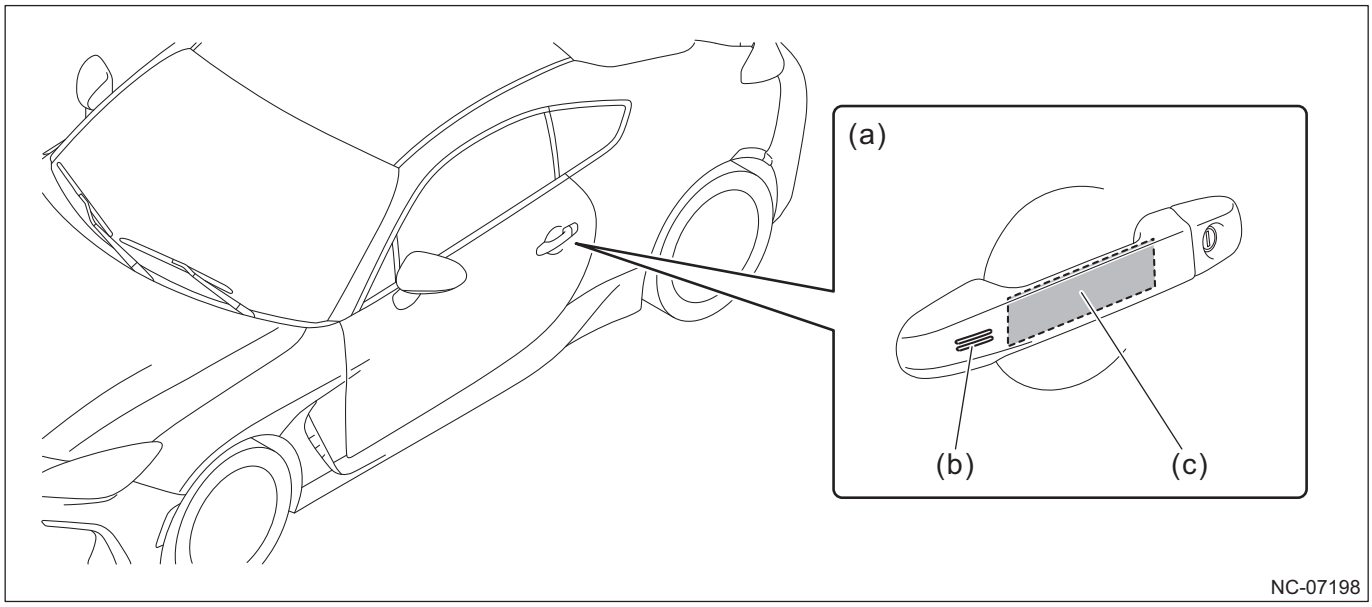


(a) Body integrated unit
(b) Combination meter
(c) Latch & actuator assembly front
(d) Light assembly map
(e) Light assembly head
(f) Hood switch (front hood lock assembly)
(g) Horn assembly
(h) ID code BOX (for Canada only)
(i) Horn relay (in main fuse & relay box)
(j) Light assembly rear combination
(k) Lock assembly trunk lid
(l) Steering lock CM
(m) Keyless access CM

Component details

Door outer handle

A touch sensor is adopted for the request switch (lock sensor) of the front outer handle.



(a) Front outer handle
(b) Lock sensor
(c) Unlock sensor (handle reverse side)

Access key

The access key has a lock button, unlock button, and trunk unlock 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 (AT)/clutch pedal (MT), the engine switch is set to ACC or the ignition switch is set to ON.

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.

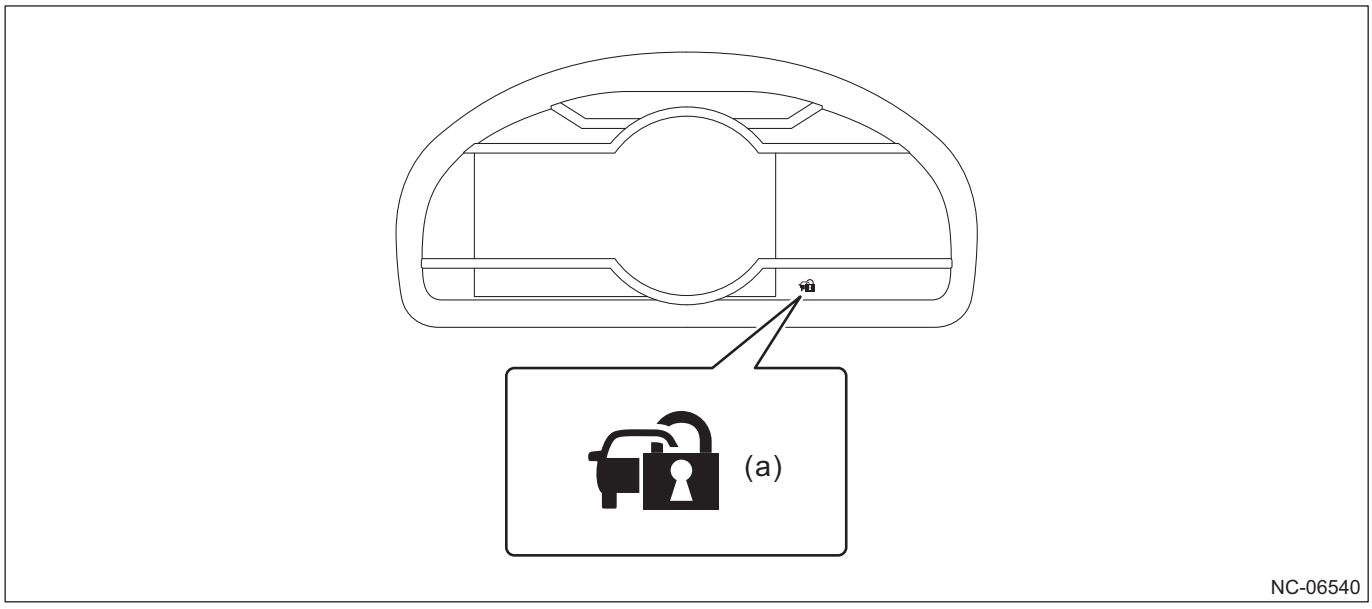
■ Precautions for people using implanted cardiac pacemakers etc.

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 door handles when all of the doors are closed and locked. Radio waves are output from the interior antennae by door opening and closing, brake pedal (AT)/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.

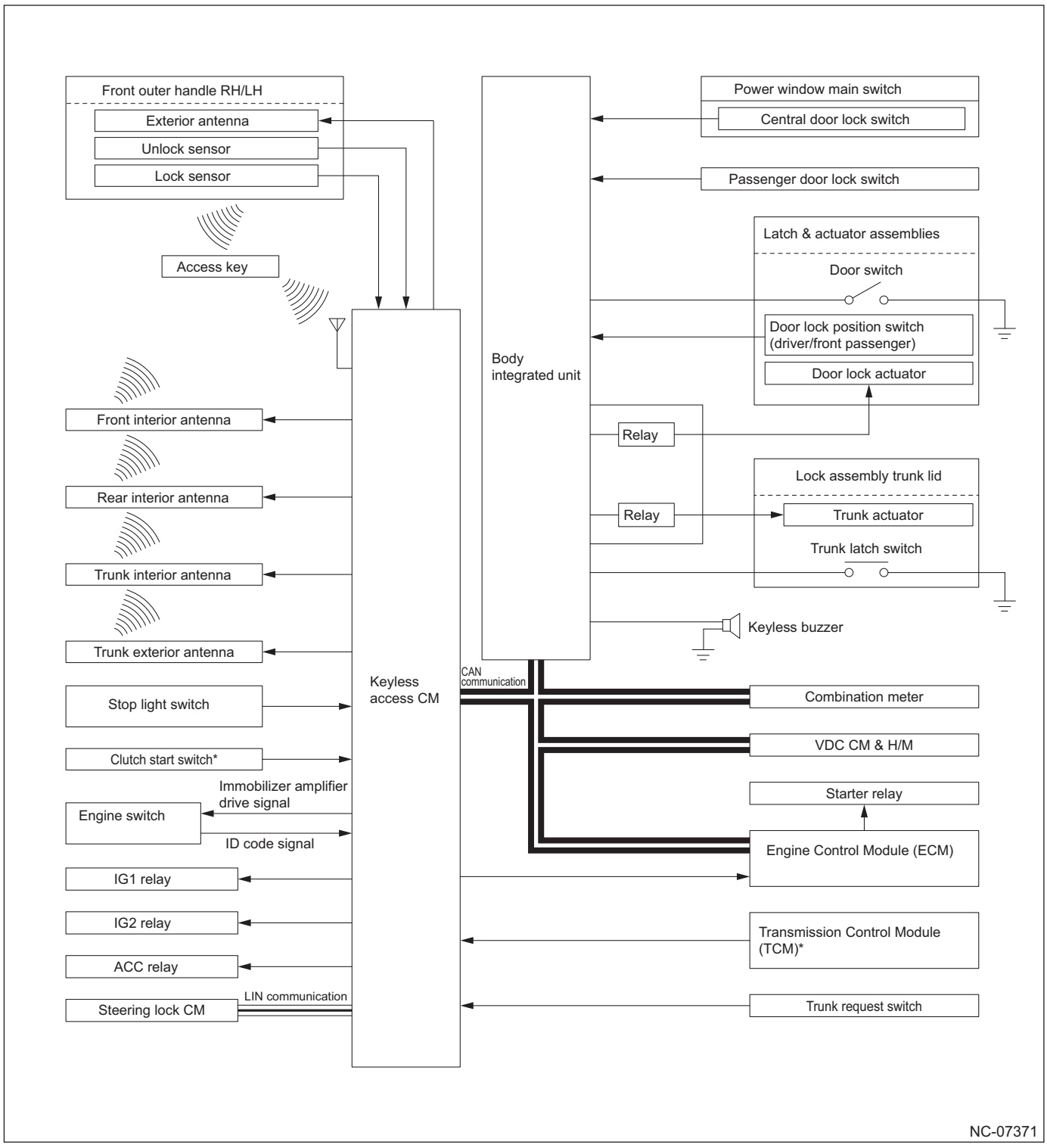


(a) Security indicator light

10.7.3 Construction and Operation

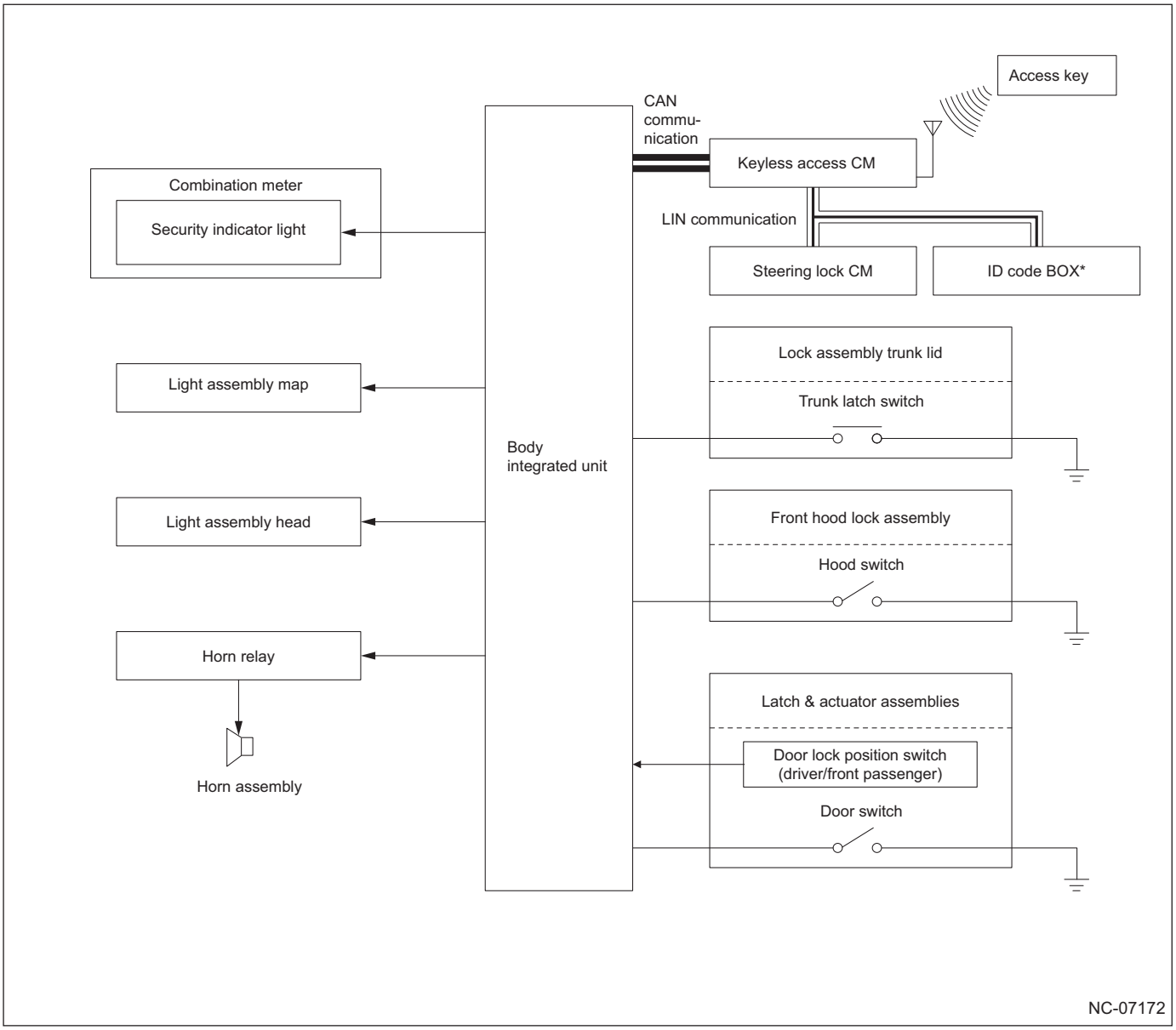
System diagram

Door lock system



**: For some grades*

Security system



*: For Canada only

Main component functions

Door lock 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 operation.
	Lock sensor	Detects lock operations by the keyless access operation.
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		
Rear interior antenna		Transmits radio waves for determining whether or not the access key is in the trunk.
Rear 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.
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 security 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 lid latch & actuator assembly by the keyless access trunk open function. • Controls the drive of the door lock actuator by the door lock system. • Sounds the keyless buzzer of the door lock system.
Power window main switch	Central door lock switch	Outputs the central door lock switch signal to the body integrated unit.
Passenger door lock 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.
Trunk request switch		Outputs the trunk request switch signal to the body integrated unit.
Keyless buzzer		Sounds during door lock system operation.
Combination meter		Performs security 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) (MT)		Detects the shift position signal and outputs the information to the keyless access CM.

Security system

Security alarm system

Component		Function
Combination meter	Security indicator light	Displays the security indicator light according to the operation of the security system.
Light assembly map		Turns on during the alarm operation of the security alarm system. *
Light assembly head		Flashes during the alarm operation of the security alarm system.
Horn relay		Supplies power to the horn assembly 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 security 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.

Component		Function
Front hood lock assembly	Hood switch	Detects the open/close status of the front hood and outputs the information to the body integrated unit.
Door switches (latch & actuator assembly)		Detects the open/close status of each door and outputs the information to the body integrated unit.
Keyless access CM		• Verifies the access key. • Sends the operation signals of security system control to the body integrated unit via CAN communication.
Access key		After receiving a request signal transmitted from an antenna via radio waves, outputs the ID code.
Steering lock CM		Detects the steering lock/unlock status and sends the information to the keyless access CM via LIN communication.

**: When the "DOOR" door interlocked function switch is selected*

Immobilizer system

Component	Function
Keyless access CM	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	Compares the keyless access CM and ID code.

Door lock system

Electric door lock 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.

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, all the doors are unlocked. (This function can be changed by the customization function to a specification where only the driver's door is unlocked when the unlock button of the access key is pressed once, and all the doors are unlocked when the button is pressed once again within 5 seconds.) 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, all the doors are unlocked. (This function can be changed by the customization function to a specification where only the driver's door is unlocked when the driver's front outer handle is gripped while carrying the access key.)

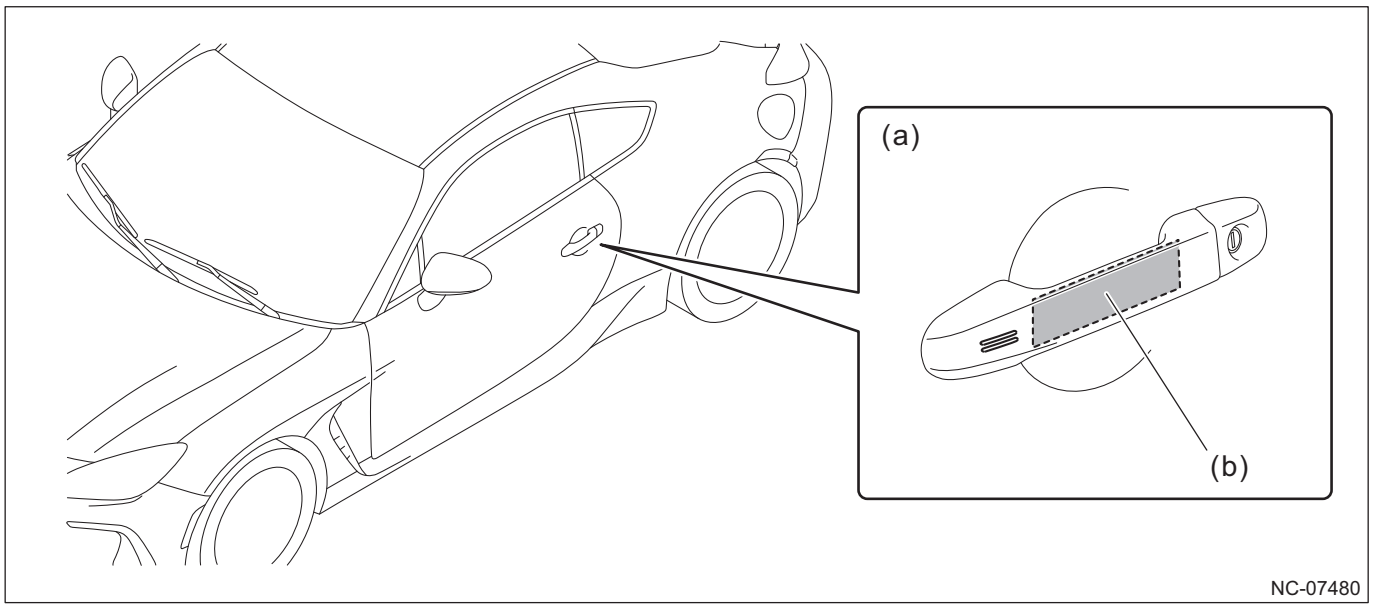
If the passenger's front outer handle is gripped while carrying the access key, all the doors are unlocked.

When the doors and trunk 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 front 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

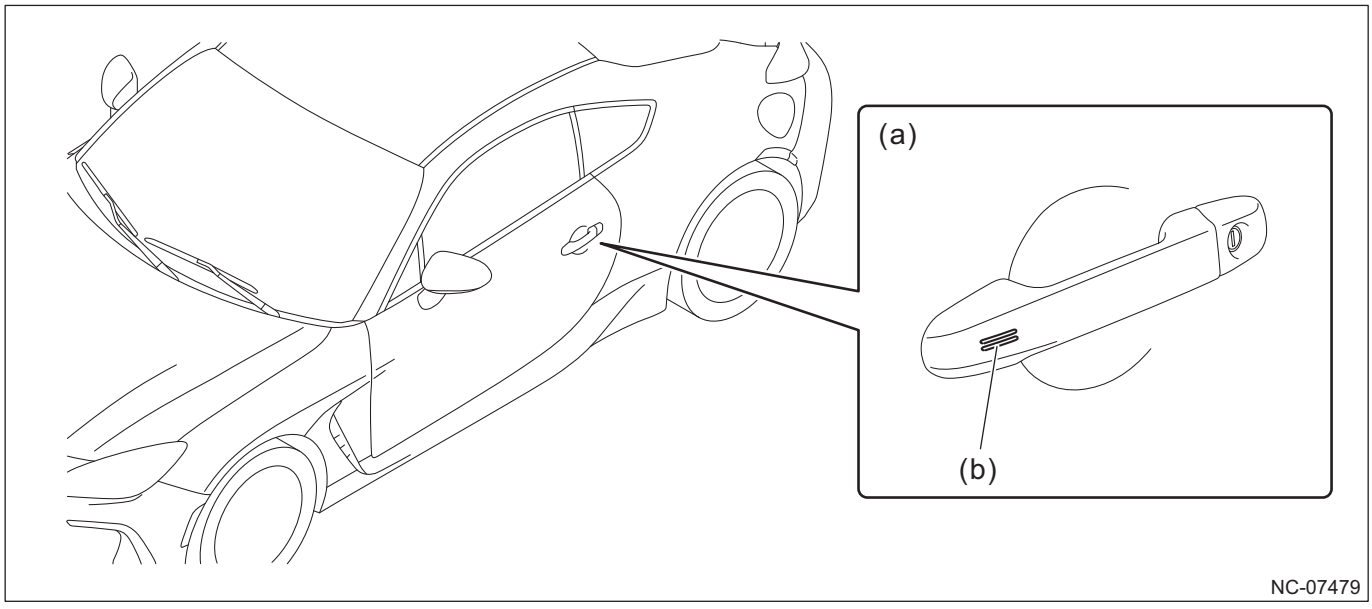
The keyless access door lock function is valid up to three consecutive times and becomes inoperative at the fourth time or more. If the doors do not lock when you touch the lock sensor on the surface of the front outer handle, touch the lock sensor with your palm to lock the doors.

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.

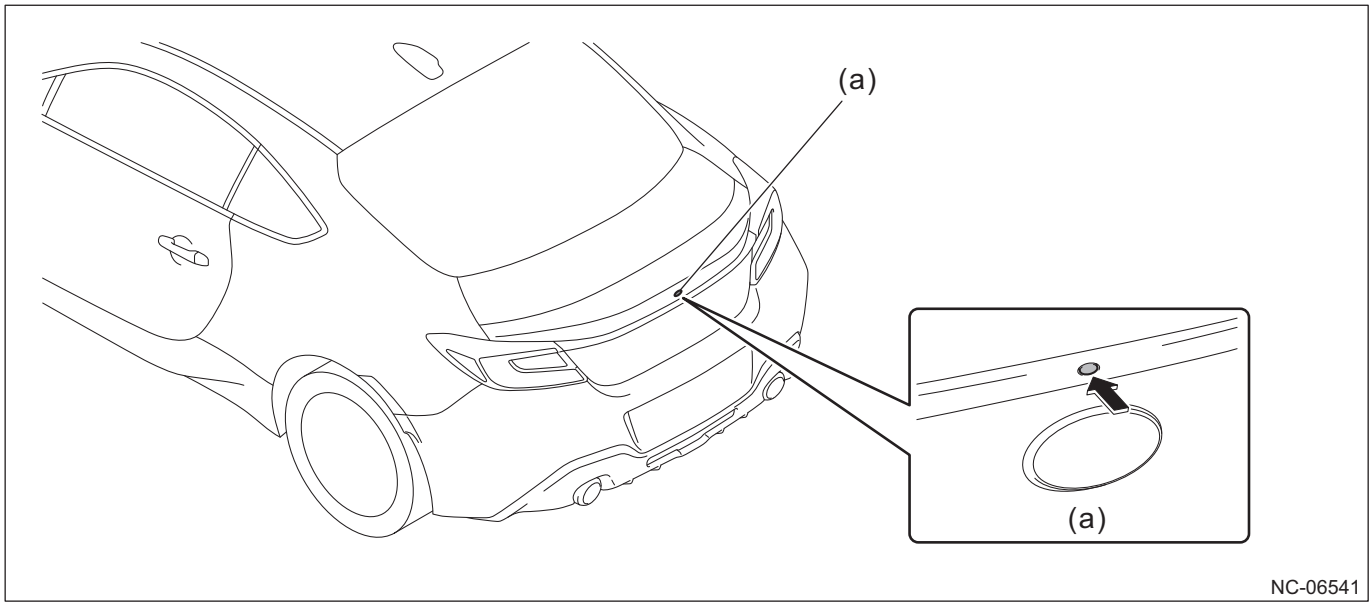


(a) Front outer handle

(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

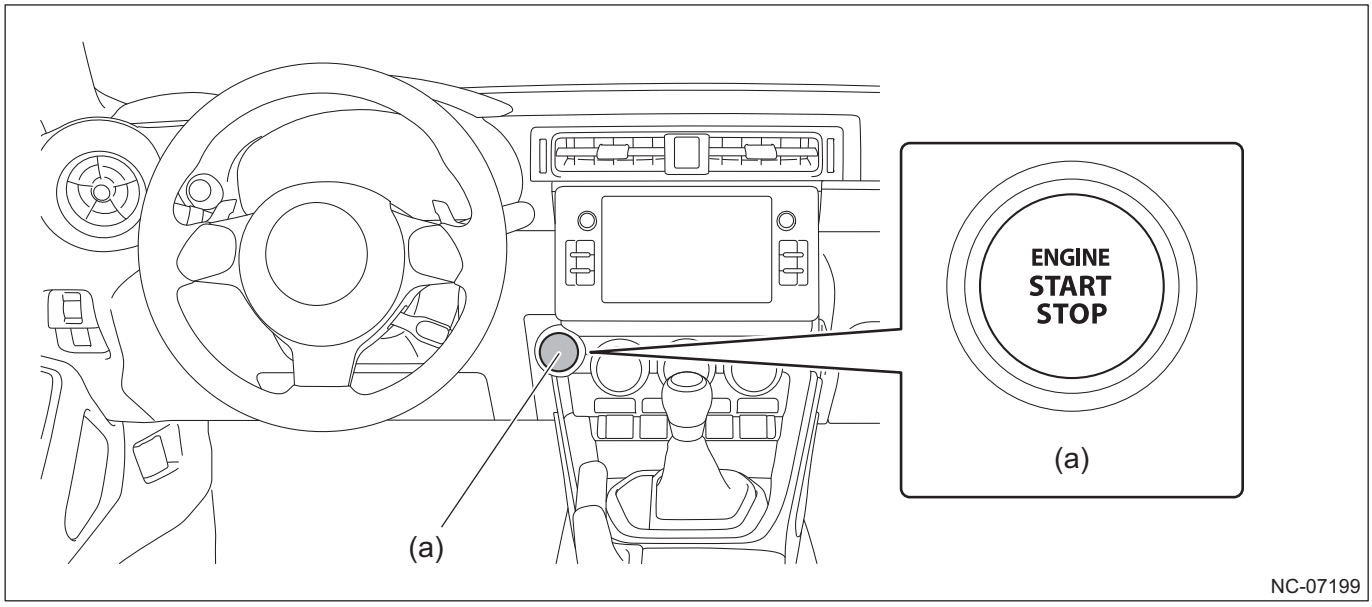
■ Push button start function

By pressing the engine switch in combination with brake pedal (AT)/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 (AT)/clutch pedal (MT) after entering the vehicle while carrying the access key with the power turned OFF, the power transitions to ACC and "Accessory" is displayed on the combination meter. If you then press the engine switch again, "Ignition ON" is displayed on the combination meter. Each time the engine switch is pressed, the power supply position switches to OFF to ACC to ignition switch ON to OFF (repeated).

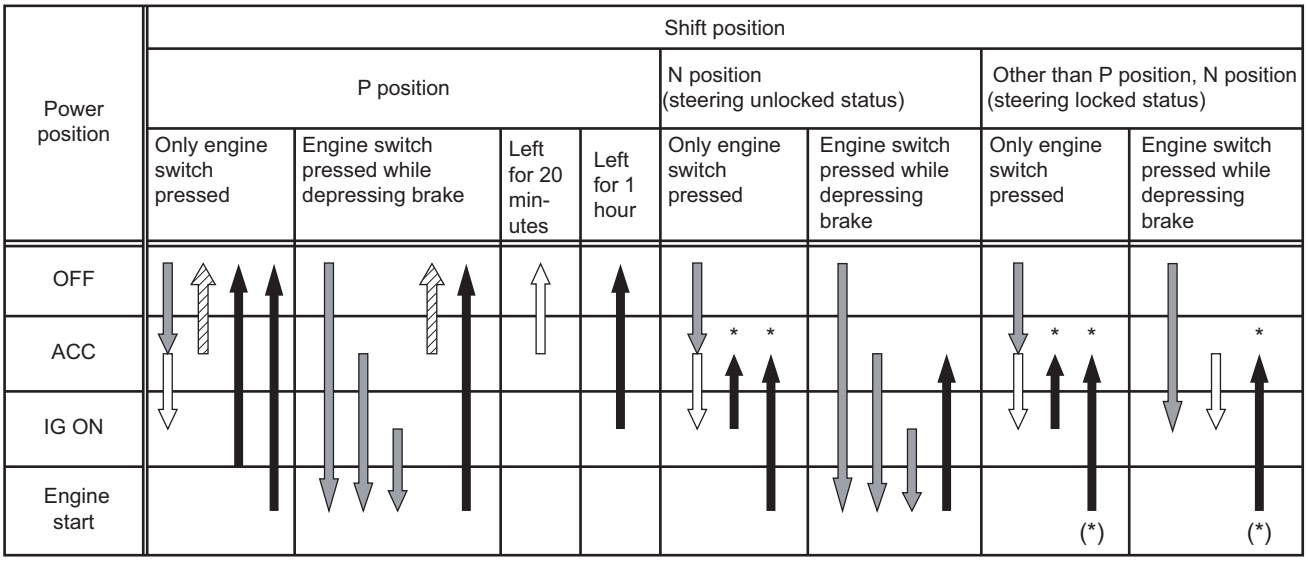
If you enter the vehicle while carrying the access key with the power turned OFF and then press the engine switch while depressing the brake pedal (AT)/clutch pedal (MT) with the shift position in "P" (AT) (only when in the steering unlock condition), the engine starts.

When the vehicle has stopped, if the engine switch is pressed with the shift position in "P" (AT) 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" (AT), the power position transitions to ACC.



(a) Engine switch

Power position transition diagram (AT)



: Power transition

: Power transition available when key comparison OK

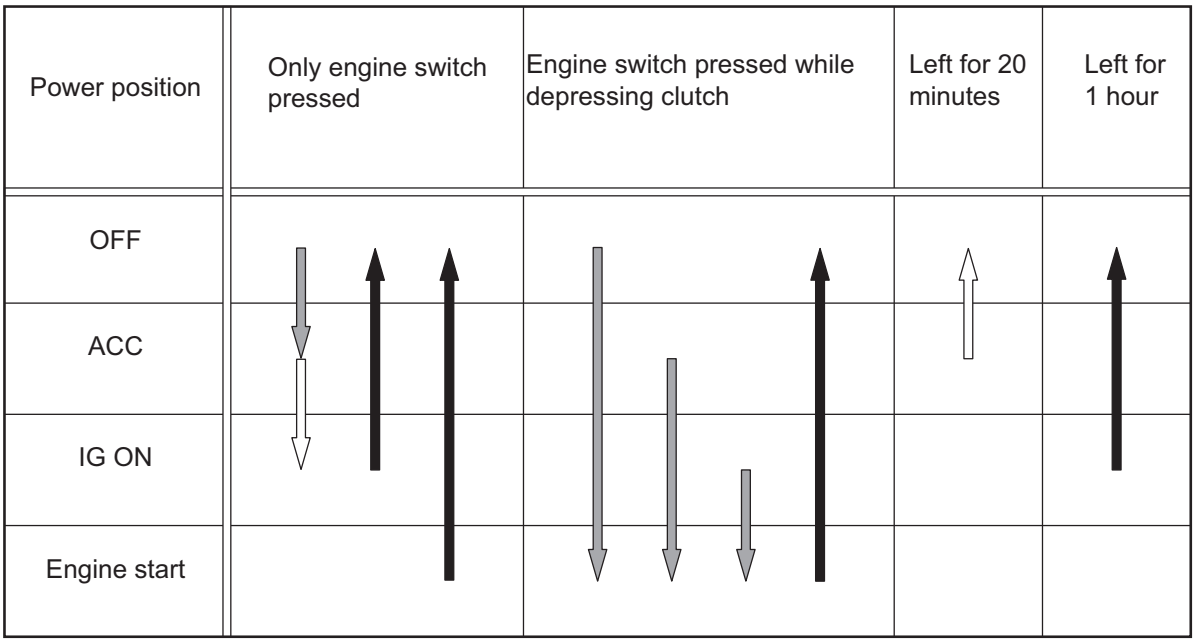
: Power transition available when vehicle stopped (while driving, press the engine switch quickly 3 times or more, or press and hold for 2 seconds or more to stop the engine and transition to ACC)

: Power transition available only after * is established and the shift position is changed to the "P" position

*: Except for N position (steering locked status)

NC-07358

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 (AT)/clutch pedal (MT) with the shift position in "P" (AT), 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 (AT)/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 (AT)/clutch pedal (MT) with the shift position in "P" (AT) to turn ON the ignition switch.

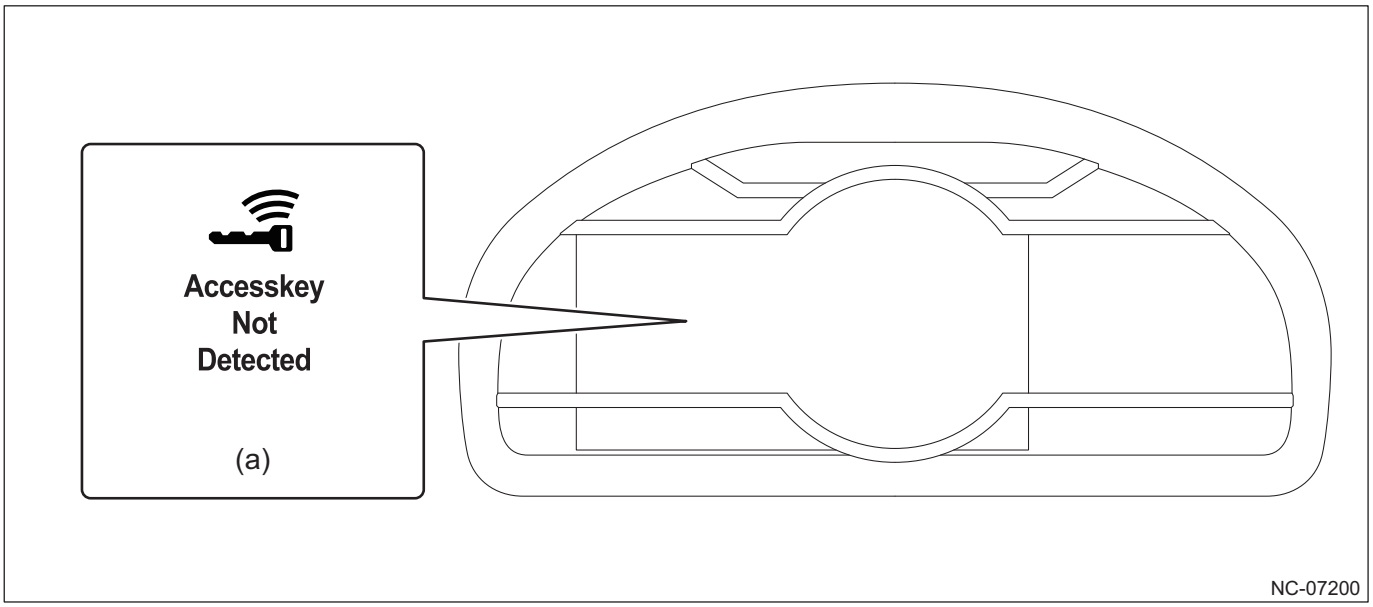
If the engine switch is pressed while depressing the brake pedal, the engine starts.

■ 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)

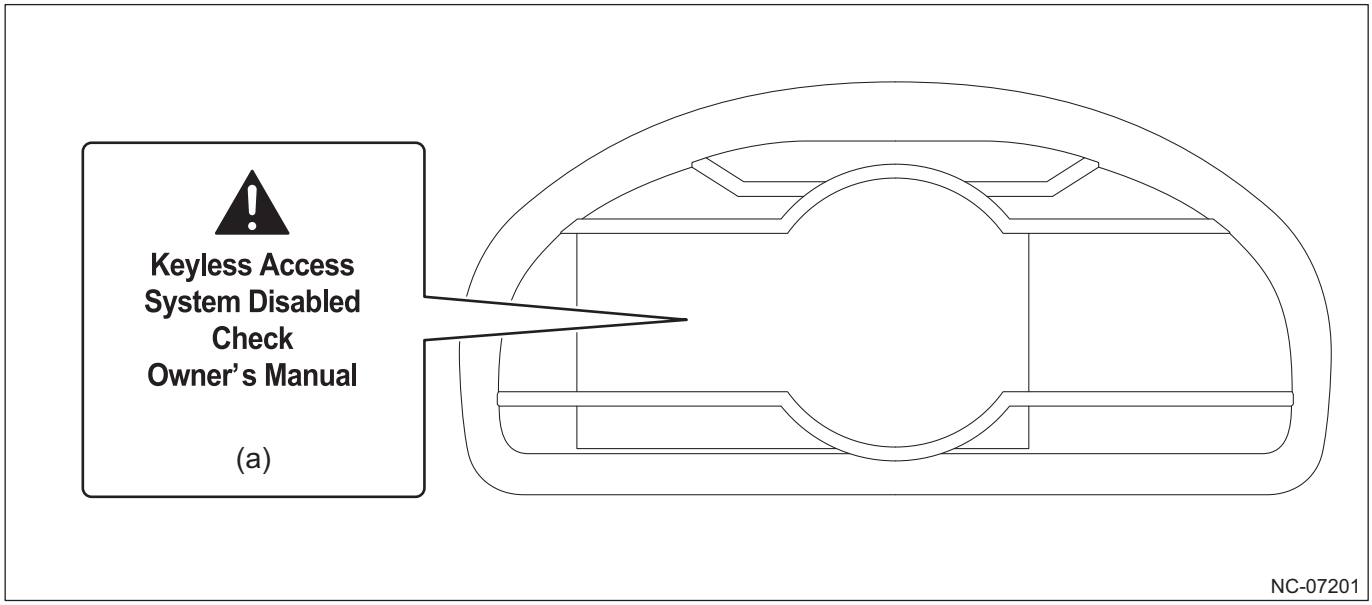
Warning function list

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 an exterior 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 (AT 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.

Item	Function
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 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 display (interrupt display) is shown in the combination meter, notifying the driver of the fault before the vehicle gets into danger during travel.



(a) 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 front outer handle (driver's seat).
- 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 front 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 "Open" and "Close" 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 of the front outer handle and the trunk exterior antenna 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 and rear bumper central area.

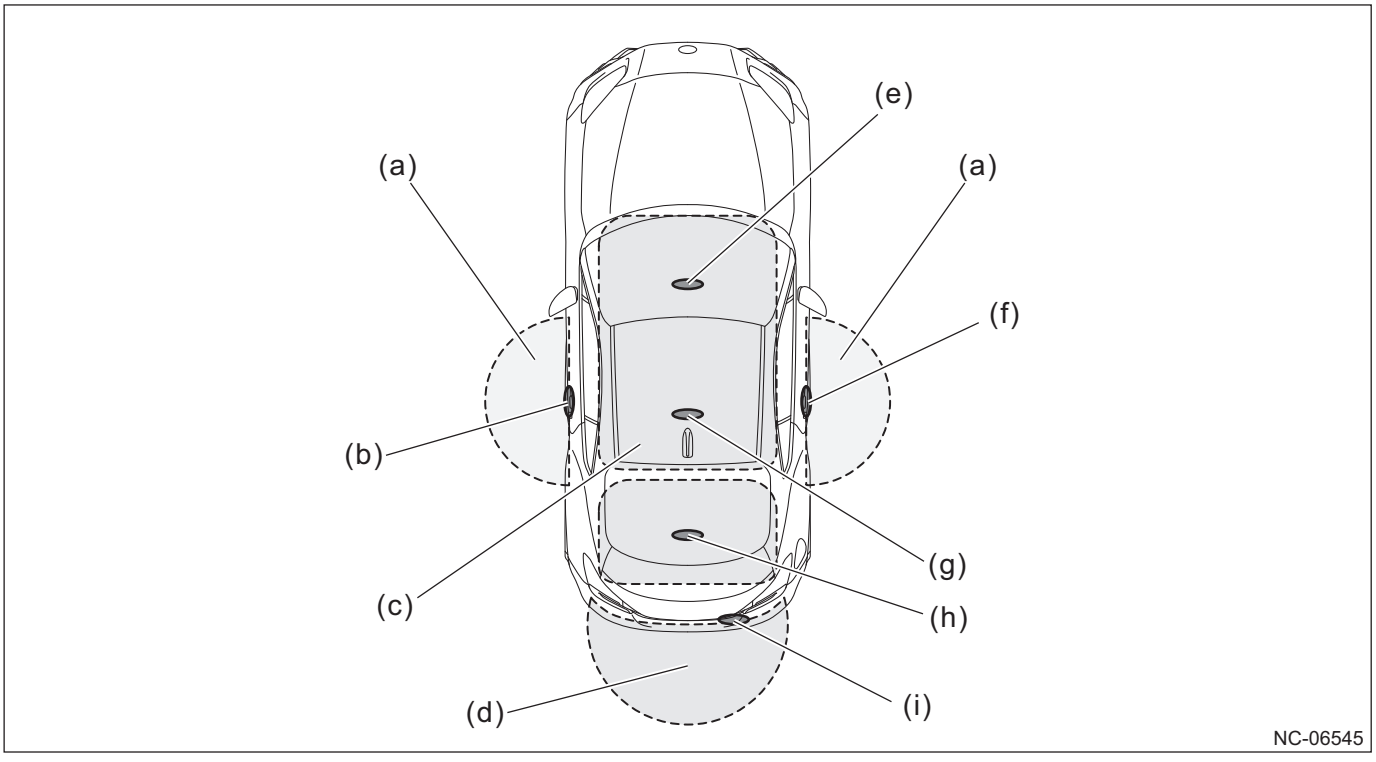
The detection area of the front exterior antenna is formed by request signals periodically transmitted about every 0.25 seconds when parked (power OFF, door locked) to sense the approach of the access key (person carrying the key). Also, by touching the lock sensor when the doors are locked, the existence 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 (AT)/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) Rear exterior detection area
(e) Front interior antenna
(f) Front outer handle LH (front exterior antenna)
(g) Center interior antenna
(h) Rear interior antenna
(i) Rear exterior antenna

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	Turns on
When warning activated (alarm is operating)	After approximately 30 seconds elapse since standby	Flashes slowly
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 spot map light, door step light, and trunk room light according to operations such as door opening and closing, and locking and unlocking.

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.

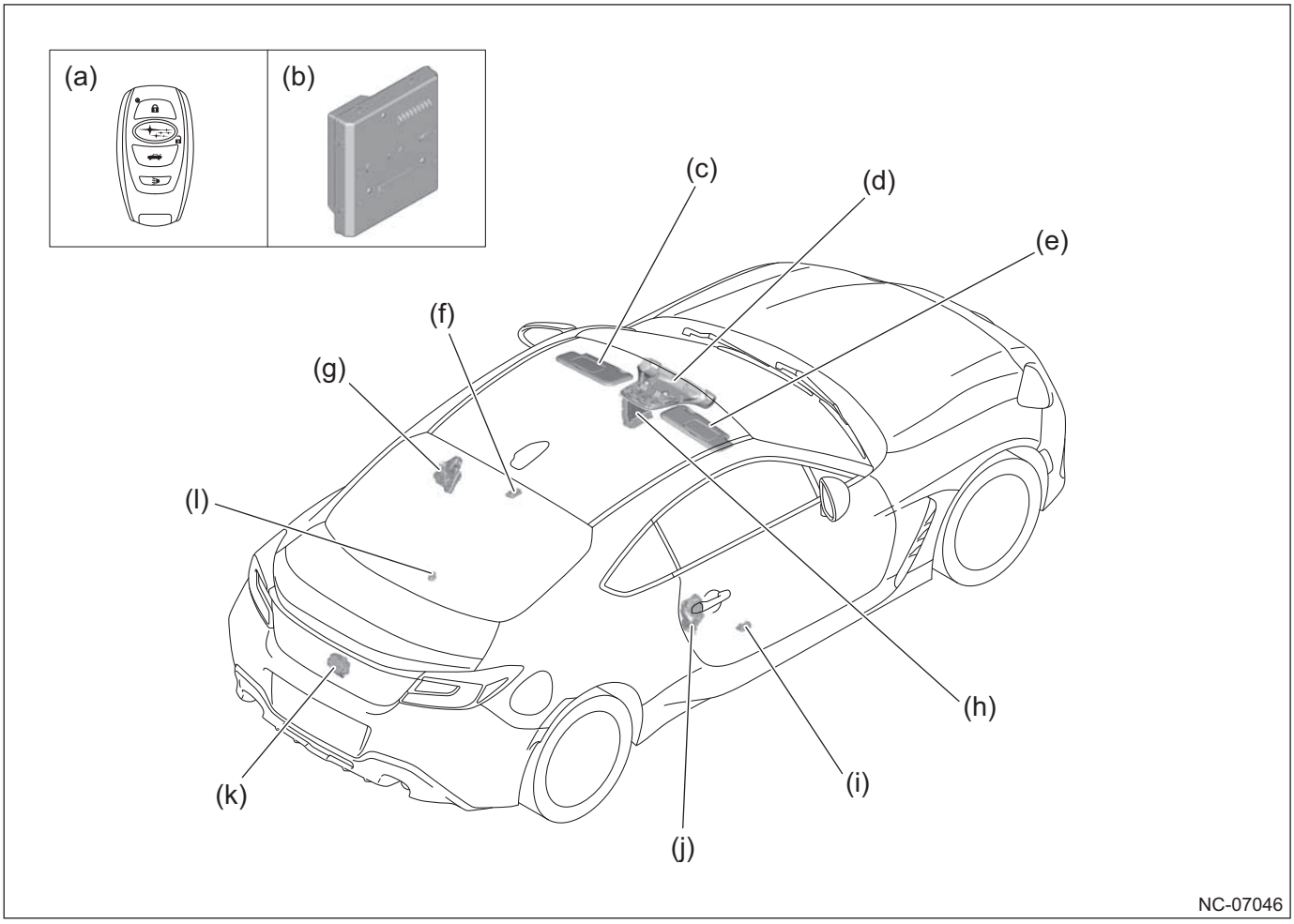
Specifications

Light name	Specifications
Spot map light	12 V/8 W (T10)
Vanity mirror light (driver's seat side/passenger's seat side)*	12 V/2 W (SF6/7)
Door step light (driver's seat side/passenger's seat side)*	12 V/5 W (T10)
Trunk room light	12 V/3.8 W (T10)

**: For some grades*

10.8.2 Component

Component layout drawing



(a) Access key
(b) Keyless access CM
(c) Driver's seat side vanity mirror light (in sun visor) (for some grades)
(d) Spot map light
(e) Passenger's seat side vanity mirror light (in sun visor) (for some grades)
(f) Driver's seat side door step light (for some grades)
(g) Driver's seat side latch & actuator assembly
(h) Body integrated unit (in joint box)
(i) Passenger's seat side door step light (for some grades)
(j) Passenger's seat side latch & actuator assembly
(k) Trunk lid lock & switch assembly
(l) Trunk room light

Component details

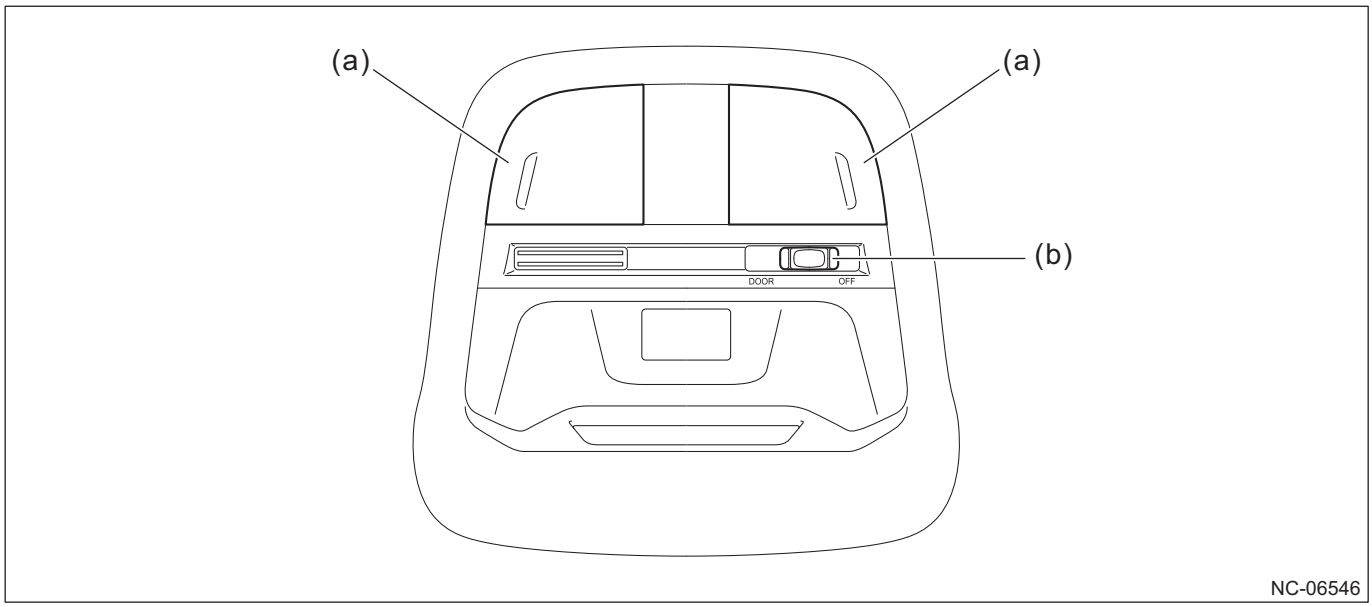
Spot map light

A spot map light with door interlocked function switch is positioned in the overhead console.

A light is adopted on the driver's seat side and passenger's seat side to ensure visibility when the light is turned on.

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."



** The illustration shows a typical example.*

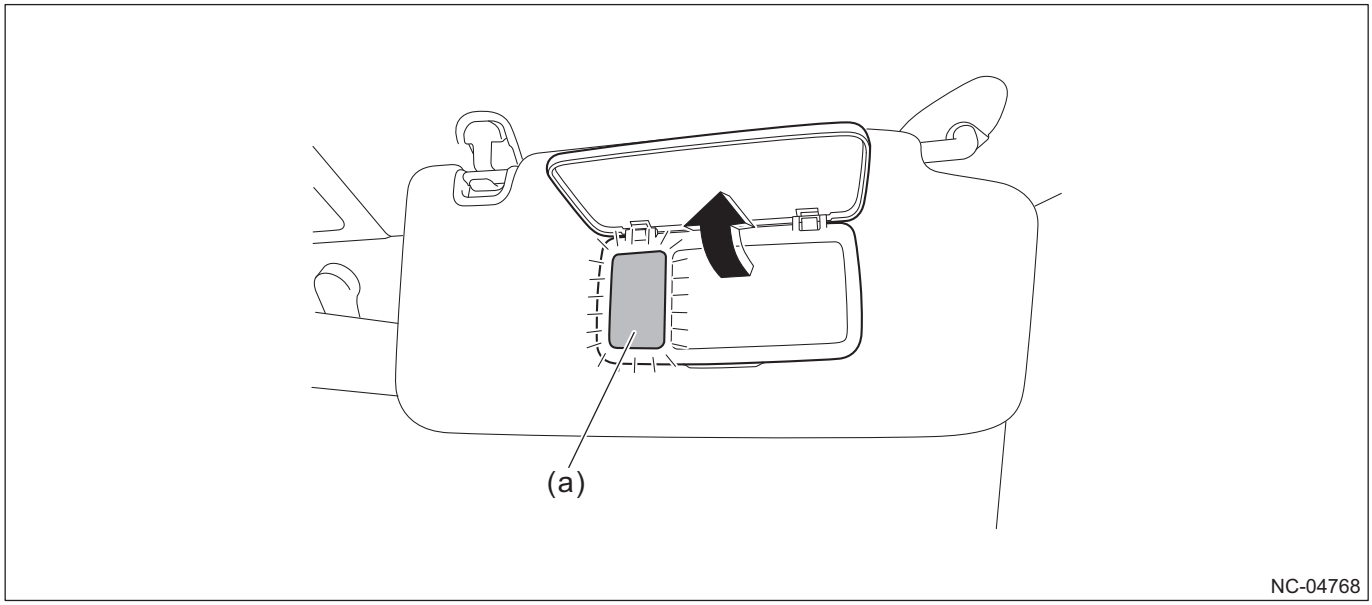
(a) Front seat map light (with ON/OFF switch)

(b) Door interlocked function switch

Vanity mirror light (for some grades)

A vanity mirror 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.



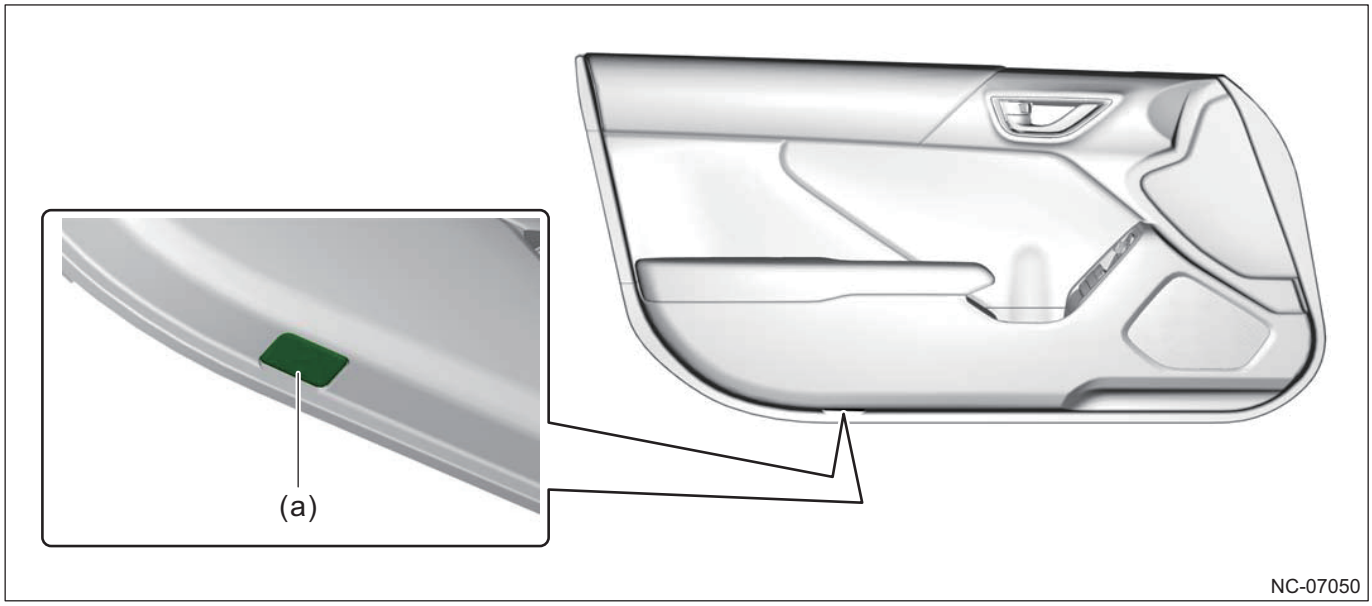
(a) Vanity mirror light

Door step light (for some grades)

A door step light is positioned at the bottom of the driver's seat and passenger's seat door panel.

This light turns on in an interlocked operation with the opening of the door.

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) Door step light

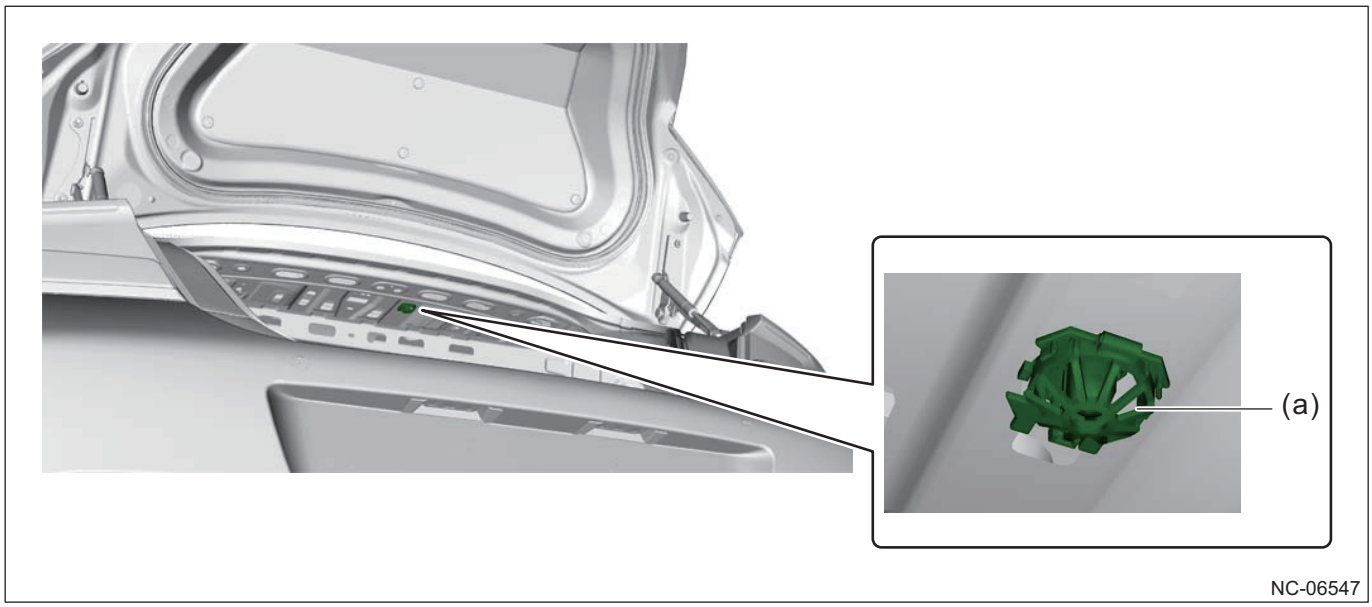
Trunk room light

A trunk room light is positioned in the luggage compartment.

The installation position of the light is set at the center to ensure an illumination range across the entire luggage compartment.

This light turns on in an interlocked operation with the opening of the trunk.

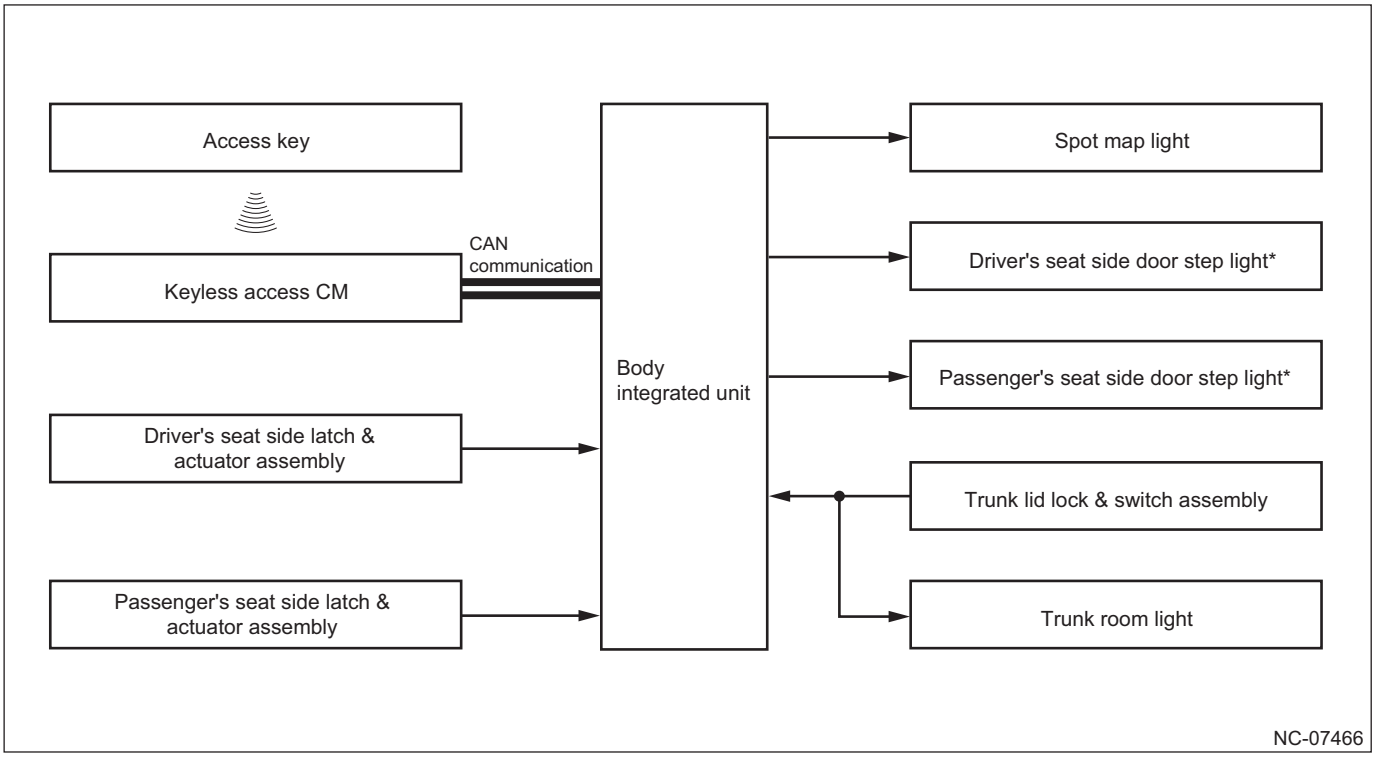
For details on the control of the door interlocked function for turning the light on and off, refer to "System details" in "Construction and Operation."



(a) Trunk room light

10.8.3 Construction and Operation

System diagram



*: For some grades

Main component functions

Component	Function
Access key	• 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	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.
Driver's seat side latch & actuator assembly	Sends the open/close status signal for the driver's seat side door to the body integrated unit.
Passenger's seat side latch & actuator assembly	Sends the open/close status signal for the passenger's seat side door to the body integrated unit.
Trunk lid lock & switch assembly	Sends the open/close status signal for the trunk to the body integrated unit.
Body integrated unit	Receives the signals of each unit and controls the on/off of each interior illumination.
Spot map light	Turns on/off when the operating conditions are met.
Driver's seat side door step light*	
Passenger's seat side door step light*	
Trunk room light	

**: For some grades*

System details

Door interlocked function

■ Spot map light

This light turns on when a door (excluding the trunk) is opened while the door interlocked function switch of the spot map light is in the DOOR position.

While the interlocked function switch 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 (15 seconds) elapses.

- Any of the doors (excluding the trunk) is opened and closed.
- The doors are unlocked with the keyless access function or access key button operation.
- The access key is carried close to the car while the doors are locked.

The light turns off when any of the following operations is performed.

- The engine switch is turned to ACC or ON.
- The doors are locked with the keyless access function or access key button operation.

It is possible to customize the interior light off time to OFF, 7.5 seconds, 15 seconds, or 30 seconds via the vehicle settings in the combination meter. (The factory setting is 15 seconds.)

■ Door step light (for some grades)

When an open door is detected on the driver's seat side or passenger's seat side, the door step light on the open side turns on, and the light turns off when the door is closed.

■ Trunk room light

When an open trunk is detected, the trunk room light turns on, and the light turns off when the trunk is closed.

Door ajar response function

When the engine switch 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.)

10.9 Inner mirror

10.9.1 Overview

Overview

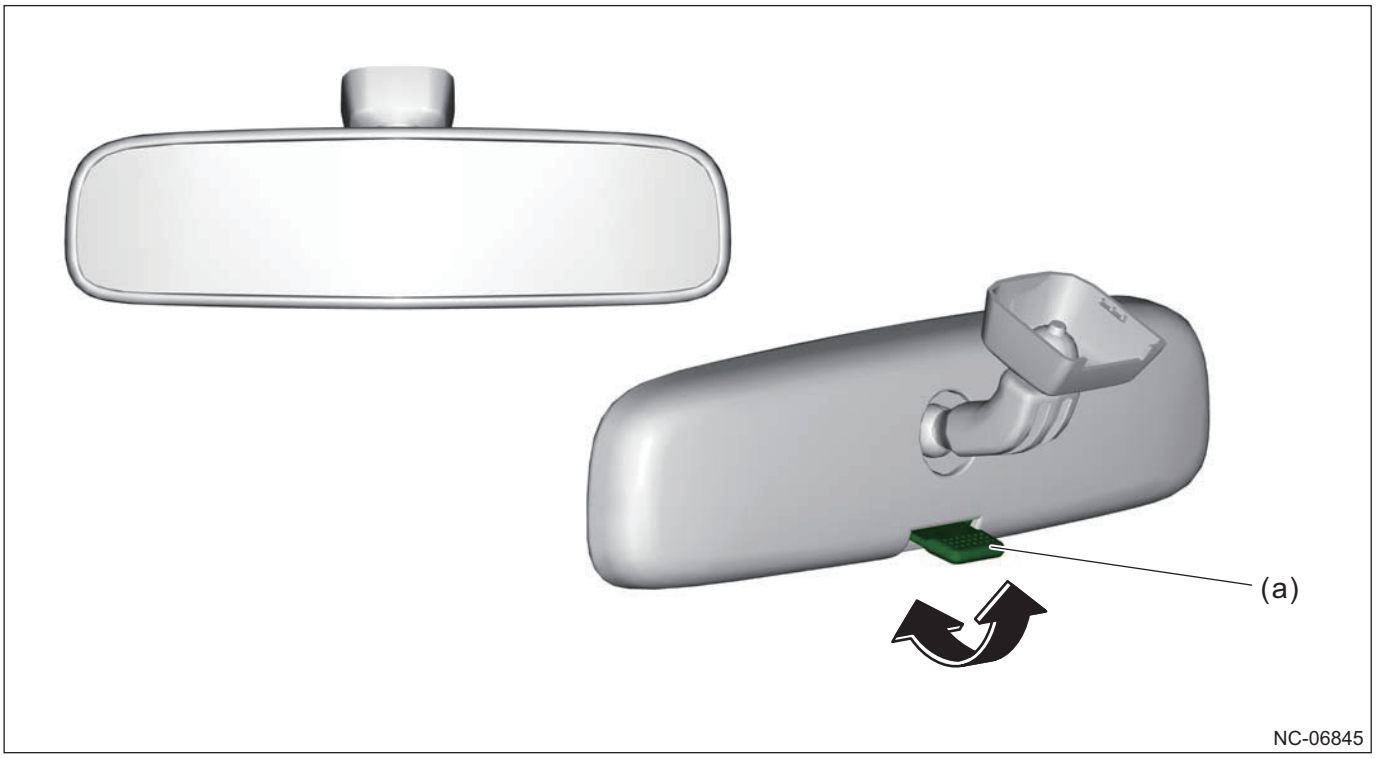
A manual anti-glare inner view mirror type that is installed on the windshield glass is adopted.

10.9.2 Component

Component details

Anti-glare mirror

The positions of the anti-glare mirror can be switched between the normal position for daytime driving and the anti-glare position for nighttime to reduce glare caused by the reflection of a headlight of a vehicle that is coming from behind.



(a) Switching lever

11 ENTERTAINMENT

CONTENTS

11.1 General Overview 11-2
11.1.1 Overview 11-2
11.2 Audio and Speaker System 11-3
11.2.1 Overview 11-3
11.2.2 Component 11-11
11.2.3 Construction and Operation 11-16
11.3 Combination Meter/MID 11-38
11.3.1 Overview 11-38
11.3.2 Component 11-41
11.3.3 Construction and Operation 11-47
11.4 Active Sound Control 11-88
11.4.1 Overview 11-88
11.4.2 Component 11-91
11.4.3 Construction and Operation 11-93
11.5 Telematics System 11-100
11.5.1 Overview 11-100
11.5.2 Component 11-107
11.5.3 Construction and Operation 11-113
11.6 Information 11-174
11.6.1 Overview 11-174
11.6.2 Component 11-177
11.6.3 Construction and Operation 11-180
11.7 Rearview Camera 11-190
11.7.1 Overview 11-190
11.7.2 Component 11-191
11.7.3 Construction and Operation 11-193
11.8 Antenna 11-194
11.8.1 Overview 11-194
11.8.2 Component 11-195

11.1 General Overview

11.1.1 Overview

Overview

In this chapter, the following items configuring the entertainment system are described.

- Audio and Speaker System
- Combination Meter/MID
- Active Sound Control
- Telematics System
- Information
- Rearview Camera
- Antenna

11.2 Audio and Speaker System

11.2.1 Overview

Overview

The Cockpit Gen.1.0 infotainment system is adopted for the audio system.

The Cockpit Gen.1.0 infotainment system is mainly equipped with the following features.

- A display audio system with a 8-inch WVGA display that adopts a SUBARU first-ever floating structure.
- 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



**The illustration shows a typical example that may differ from the actual display.*

Type	Overview
Display audio system	An 8-inch display audio system.

6 speakers or 8 speakers are available for the speaker system, and are set according to the specifications.

Speaker settings

Speaker system	Installed speakers
6 speakers	• Tweeter • Door speaker • Rear speaker
8 speakers	• Tweeter • Side speaker • Door speaker (audio amplifier drive) • Rear speaker

Specifications

List of display audio system specifications

Display	Size/resolution		8-inch/WVGA
Touch screen	Electrostatic, multi-touch capable		O
Remote operation	Satellite switch		8 buttons
Radio tuner	AM/FM		O
	Radio Broadcast Data System (RBDS)		O
	HD Radio (ver.1.5 dual tuner)		O
	SiriusXM Radio		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 12.2 or later)
	Google Android Auto		O (supports Android 9.0 or later)
Server service	SUBARU STARLINK	Clarion Cloud Service	O
SiriusXM Travel Link	Fuel prices, Sports, Stocks, Weather, Weather alerts, Parking		O
Voice recognition control	Audio functions		O
	Hands-free function		O
Vehicle system control	Combination meter (multi information display)		O
	Data Communication Module (DCM)		O
Supported languages	Display screen		English (USA), French (Canadian), Spanish (Mexican)
	Voice recognition		English (USA), French (Canadian), Spanish (Mexican)
Software updates	USB memory		O
	Wi-Fi		O
Update Server	Redbend		O*

Specification list codes [O: Available]
**: For models equipped with Data Communication Module (DCM)*

Speaker function list (6 speakers)

Speaker	Size, type	Number installed	Usage	Playback frequency range
Tweeter	25 mm Tweeter	2	Treble	8 kHz to 20 kHz
Door speaker	160 mm Full range speaker	2	Bass to treble	68 Hz to 15 kHz
Rear speaker	65 mm Squawker	2	Medium treble to treble	2 kHz to 20kHz

Speaker function list (8 speakers)

Speaker	Size, type	Number installed	Usage	Playback frequency range
Tweeter	25 mm Tweeter	2	Treble	8 kHz to 20 kHz
Side speaker	90 mm Squawker	2	Medium treble to treble	2 kHz to 20 kHz
Door speaker	160 mm Full range speaker	2	Bass to treble	68 Hz to 8 kHz
Rear speaker	90 mm Squawker	2	Medium treble to treble	2 kHz to 20 kHz

Audio amplifier specifications (8 speakers)

Channel	Rated output (maximum output)
2 ch	25 (33) W

Hardware specifications

CPU	Name	Intel Apollo Lake
	Spec.	37,944 MIPS 4-Core 1.8 GHz
Main memory	Main	16 GB
	RAM	3 GB
Display	LCD size	8-inch WVGA (800x480)
	Touch panel	Electrostatic
SiriusXM module (model No.)		X40HA
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)

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	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	.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

Characteristics

Panel design

■ Display audio system

- As 8-inch display has been adopted, together with a simple design that places only the dial knobs and hardware buttons which are used frequently on a panel that features SUBARU's first floating structure, giving it a feeling of floating independent from the instrument panel.
- 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)	Electrostatic touch operation display	(f)	Dial knob (TUNE)
(b)	Dial knob (VOLUME)	(g)	RADIO button
(c)	HOME button	(h)	Tuning/track selection buttons
(d)	PHONE button	(i)	NFC symbol (NFC detection area)
(e)	APPS button		

Operation

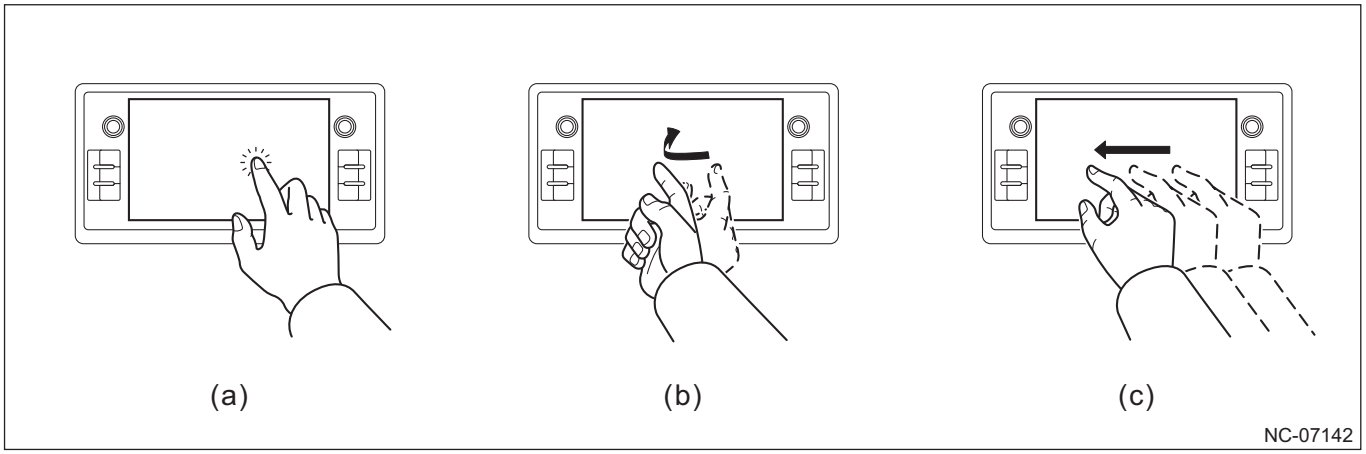
- The following functions or displays are selected by operating a dial knob or physical button.

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.
HOME button		Press	Displays the Home Screen.
PHONE button		Press	Displays the Hands-free Screen.
APPS button		Press	Displays the App Selection Screen.
RADIO button		Press	Displays the Radio Screen.
Tuning/track selection buttons		Press	Short press: Use to select the frequency or track. Long press: Used to search for a station or FF/REW the track.

- The display shows the audio screen, Bluetooth hands-free screen, settings screen and other screens. Touch, flick, or drag on the screen to perform various operations.

Reference

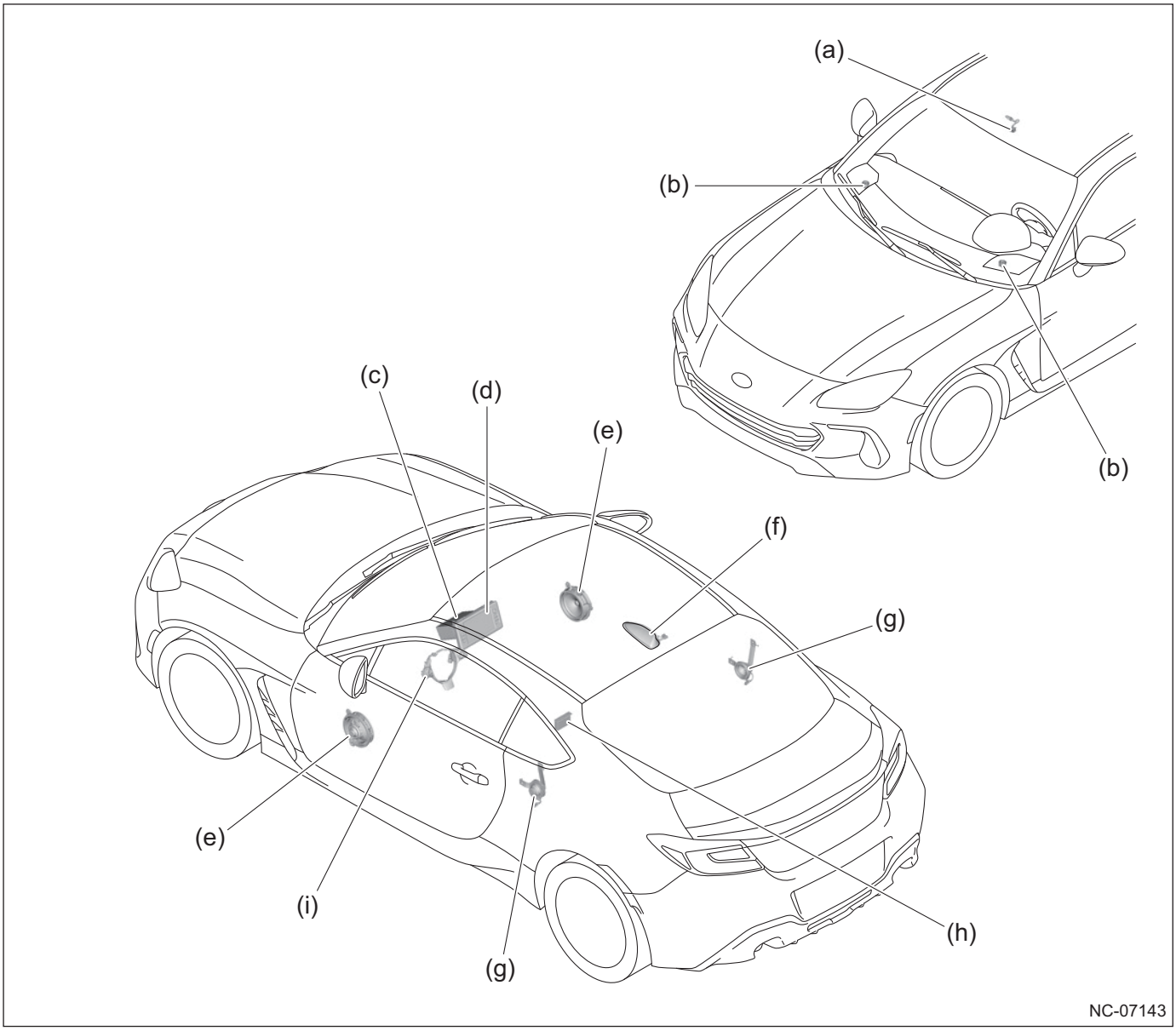
Depending on the screen display contents, flick and drag operations may not be possible.



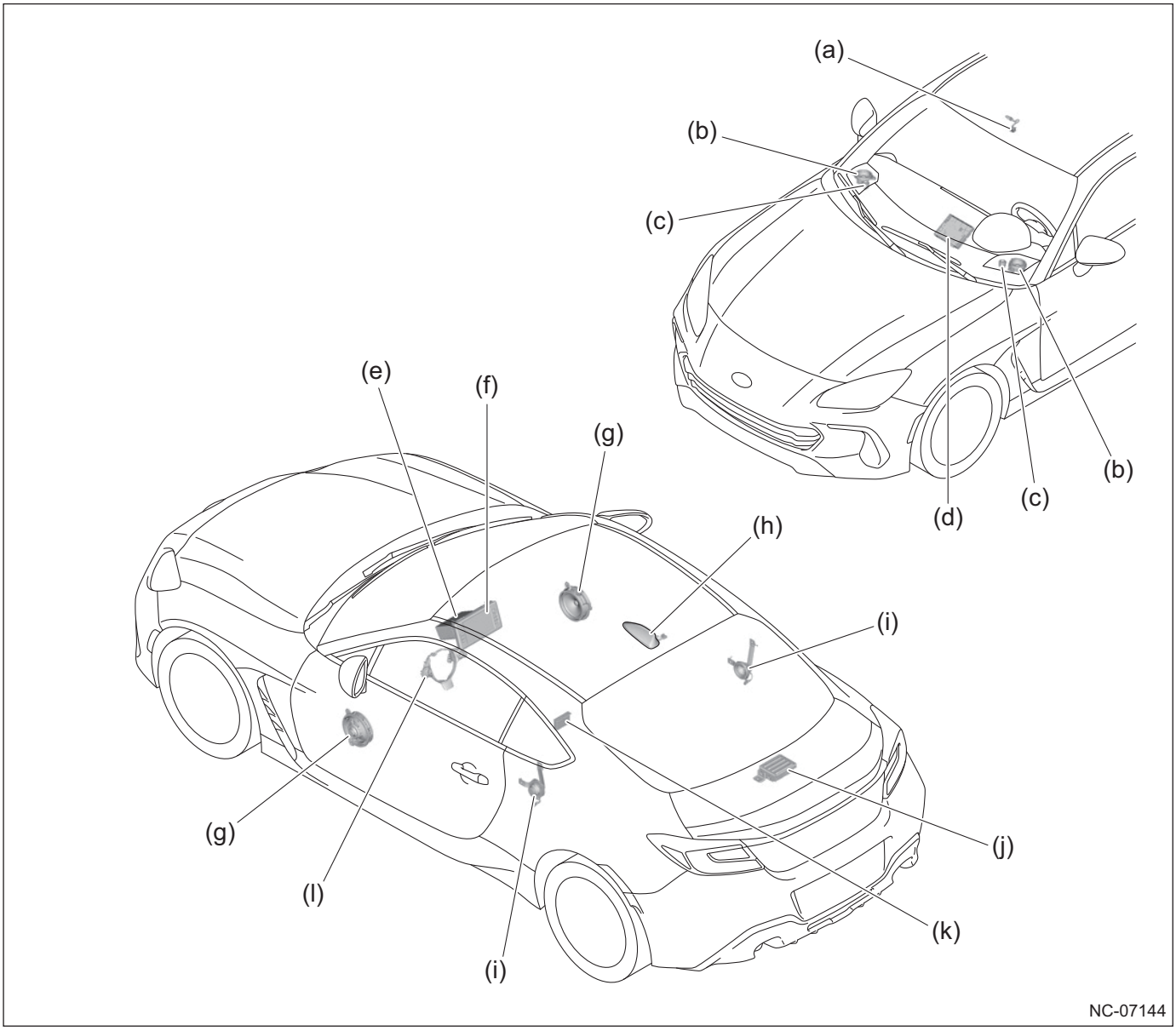
(a) Touch operation
(b) Flick operation
(c) Drag operation

11.2.2 Component

Component layout drawing



(a)	Microphone	(f)	Roof antenna • AM • FM • SXM • Radio antenna amplifier
(b)	Tweeter	(g)	Rear speaker
(c)	Cockpit Control Module (CCM)	(h)	AUX BOX
(d)	Center Information Display (CID)	(i)	Satellite switch
(e)	Door speaker		

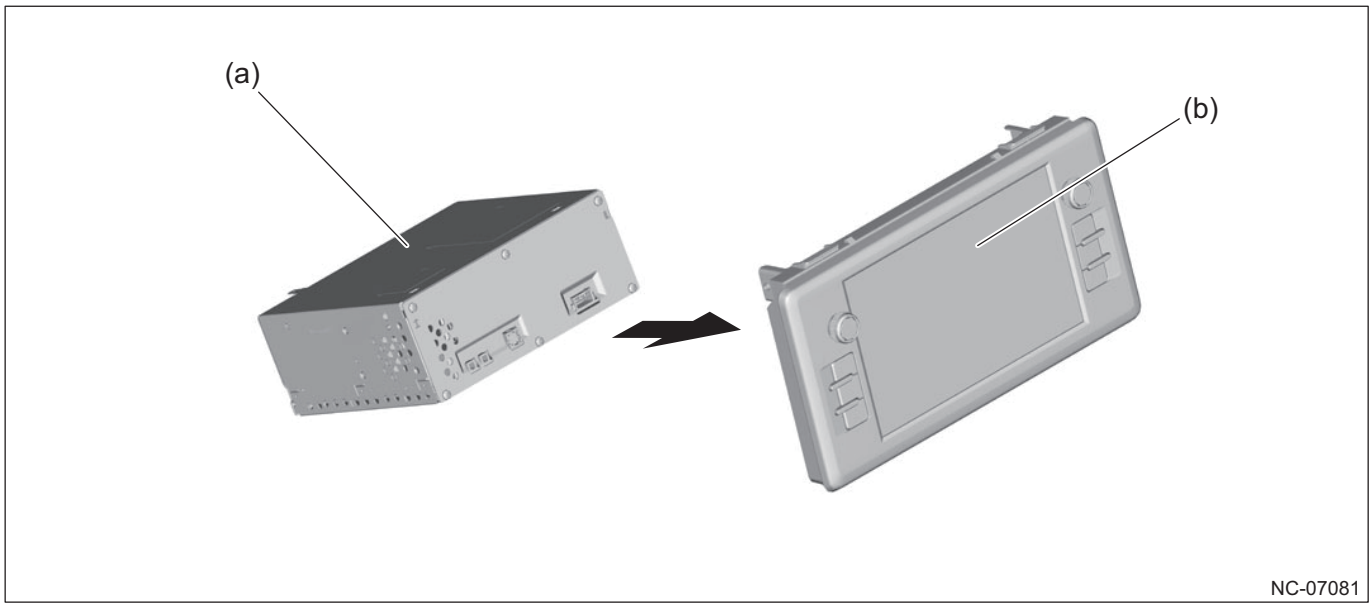


(a)	Microphone	(g)	Door speaker
(b)	Side speaker	(h)	Roof antenna • AM • FM • SXM • Radio antenna amplifier
(c)	Tweeter	(i)	Rear speaker
(d)	Data Communication Module (DCM)	(j)	Audio amplifier
(e)	Cockpit Control Module (CCM)	(k)	AUX BOX
(f)	Center Information Display (CID)	(l)	Satellite switch

Component details

Infotainment system hardware

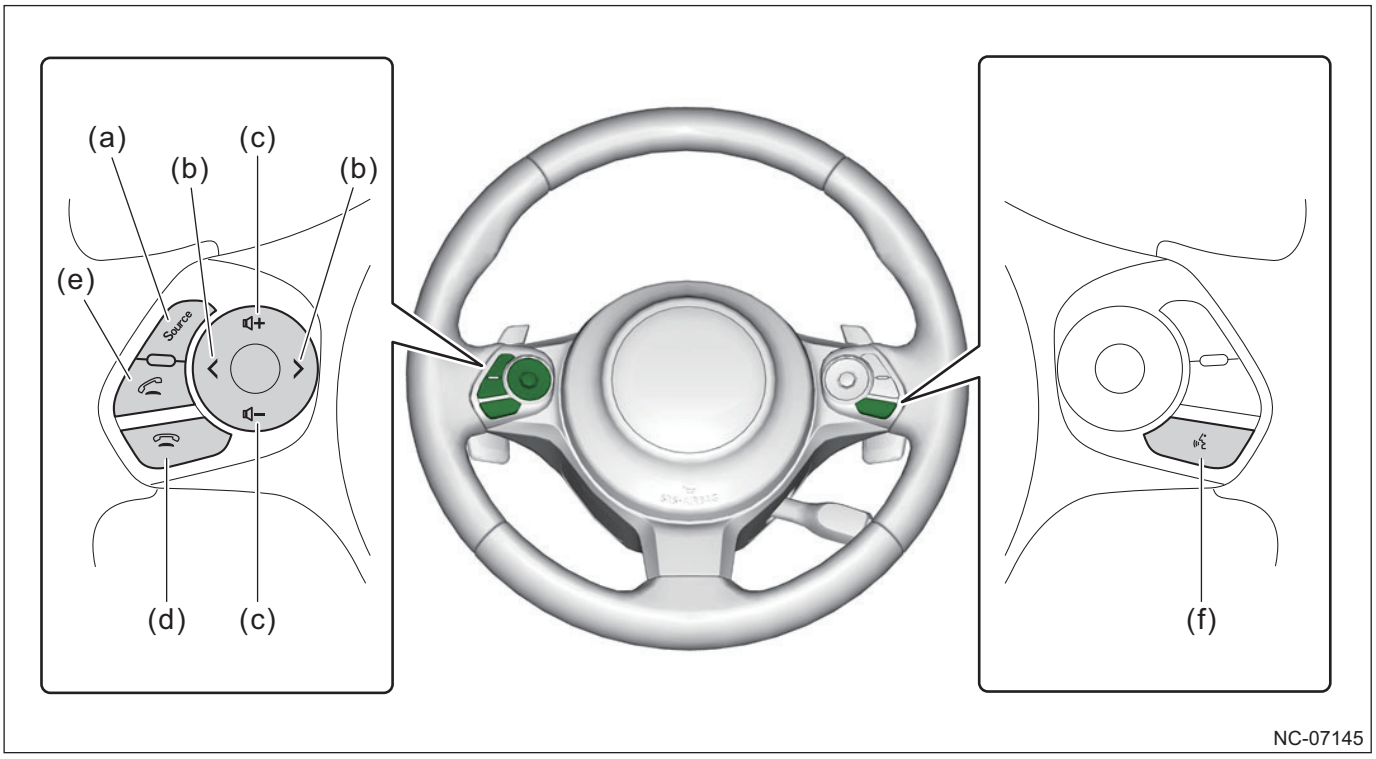
The Cockpit Gen.1.0 Infotainment System is composed of the Cockpit Control Module (CCM) that controls the system as a whole and the Center Information Display (CID) providing a user interface.



Symbol	Part name	Function
(a)	Cockpit Control Module (CCM)	• Adopts a System on Chip (SOC) method, and designed to enable display linked between the center information display and multi information display via the hypervisor system. • 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 audio and other functions just by speaking.
(b)	Center Information Display (CID)	• Equipped with an 8-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 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.



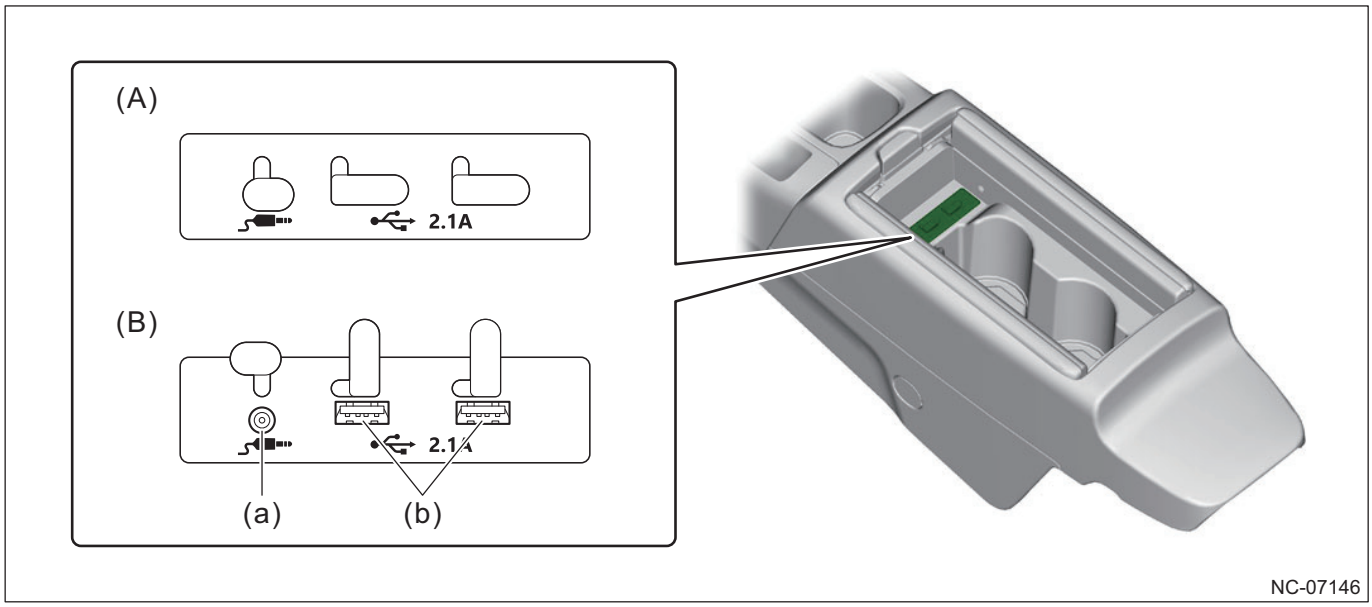
(a)	'Source' switch	(d)	Hands-free switch (on-hook)
(b)	Tuning/track selection switch	(e)	Hands-free switch (off-hook)
(c)	Volume switch	(f)	Talk switch

AUX BOX

Inside the console box is provided with the AUX BOX that include USB ports which can be connected to USB memory, an iPod, or an iPhone or other smartphone, as well as an AUX port that can be connected to a portable audio device or other device.

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.

For dust protection, each terminal includes an open/close type terminal cover, and the structure prevents the terminals from being exposed when not in use.



(A)	Terminal cover closed condition	(B)	Terminal cover open condition
(a)	AUX port	(b)	USB port

Speaker

6 speakers or 8 speakers are available for the speaker system and are set according to the specifications.

■ 6 speaker system

- The distance between the speaker and the speaker grille, and the speaker grille opening ratio, have been optimized in order to achieve high audio quality with flat frequency characteristics.

■ 8 speaker system

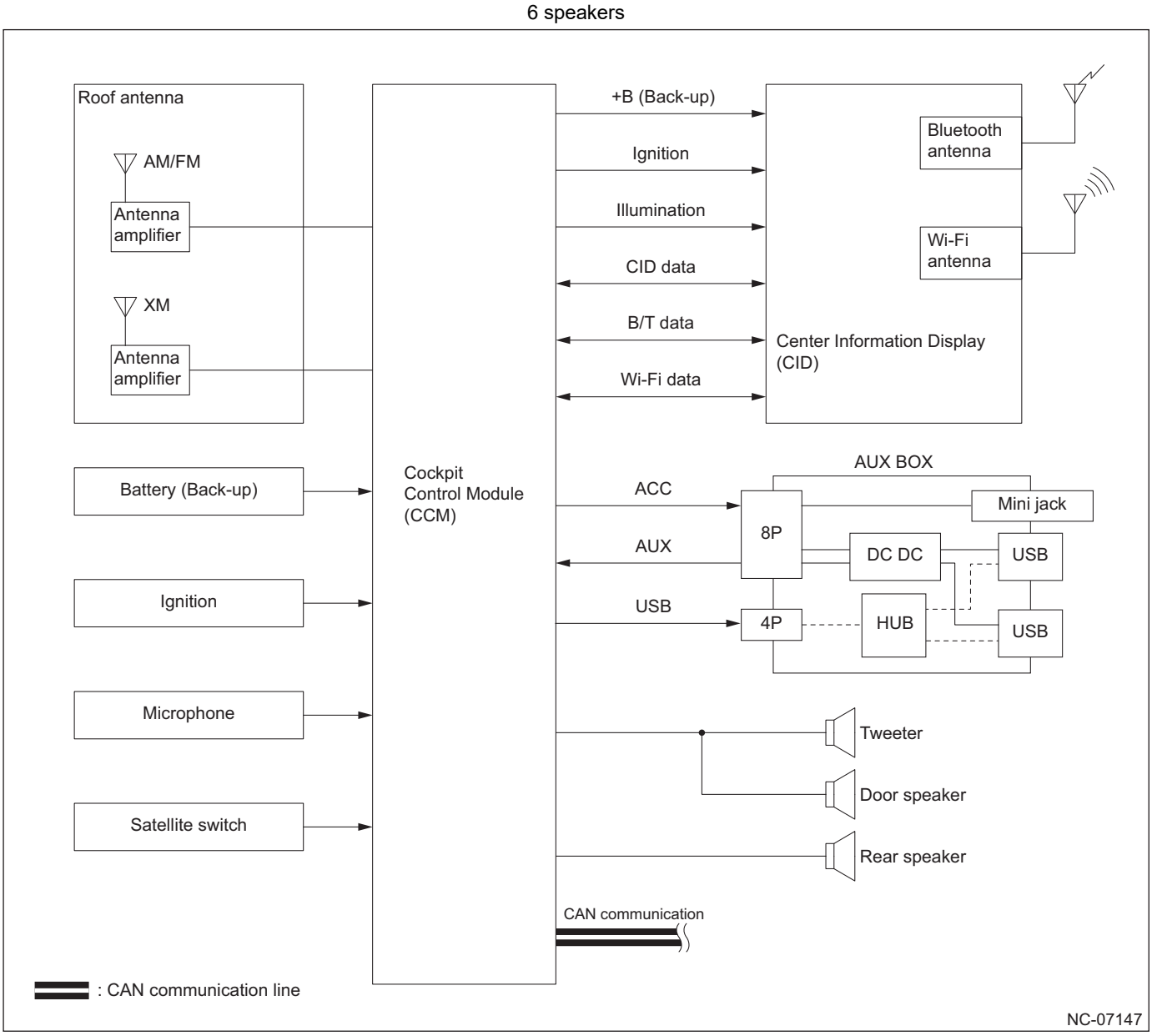
- The distance between the speaker and the speaker grille, and the speaker grille opening ratio, have been optimized in order to achieve high audio quality with flat frequency characteristics.
- Squawker type mid-range speakers are positioned in the front and rear for high positioning. In combination with the amplifier-driven full-range door speakers, they produce a 3D sound field with the feeling of a unified whole.

Audio amplifier

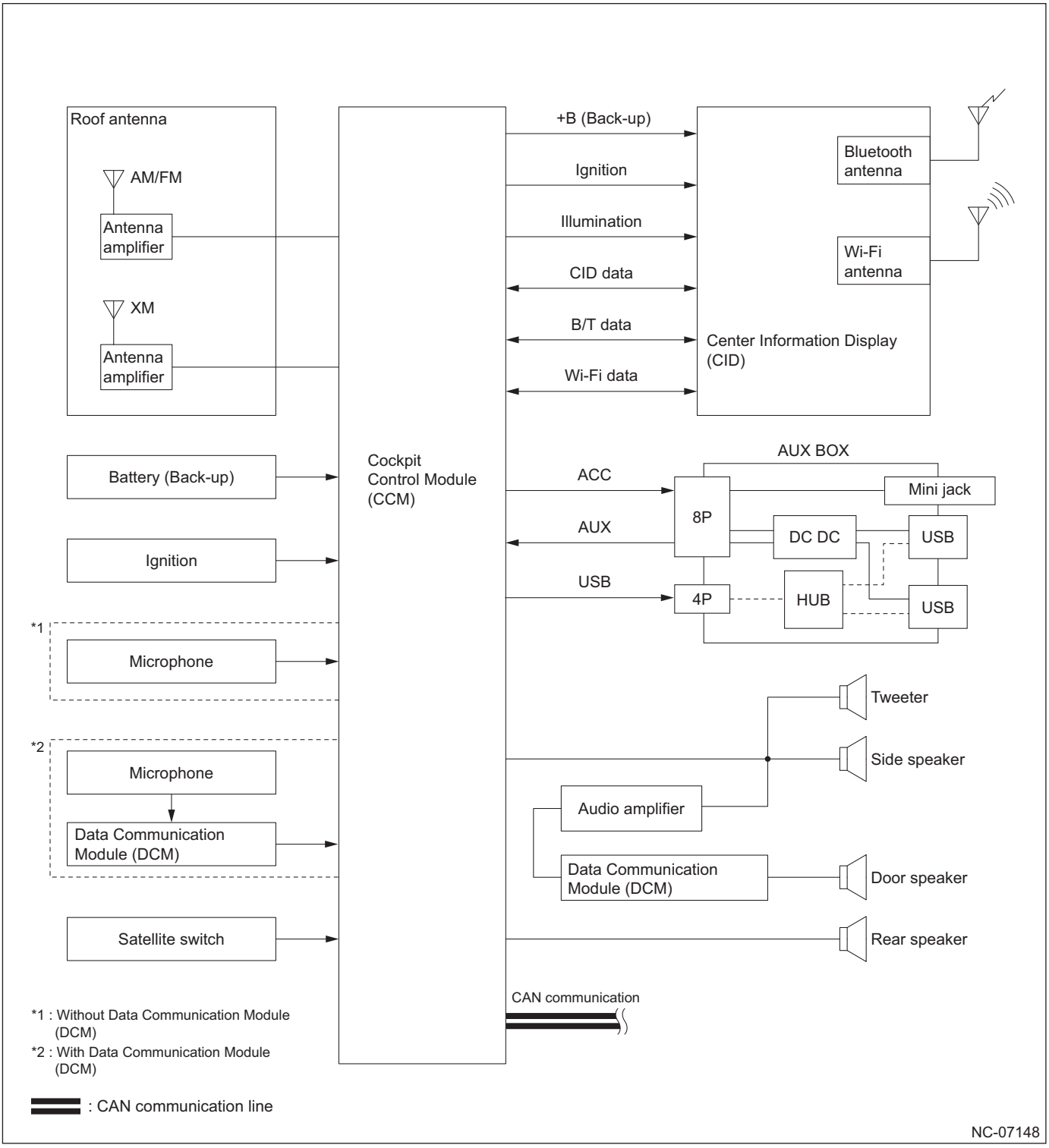
- In the 8 speaker system, 2 ch type audio amplifiers are installed to drive the door speakers.
- With consideration for sound image localization, the interior acoustic characteristics were optimized for the output to achieve dynamic high-quality sound.

11.2.3 Construction and Operation

System diagram



8 speakers


Roof antenna
AM/FM
Antenna amplifier
XM
Antenna amplifier
Battery (Back-up)
Ignition
*1
Microphone
*2
Microphone
Data Communication Module (DCM)
Satellite switch
Cockpit Control Module (CCM)
+B (Back-up)
Ignition
Illumination
CID data
B/T data
Wi-Fi data
Bluetooth antenna
Wi-Fi antenna
Center Information Display (CID)
AUX BOX
ACC
AUX
USB
8P
4P
Mini jack
DC DC
USB
HUB
USB
Tweeter
Side speaker
Audio amplifier
Data Communication Module (DCM)
Door speaker
Rear speaker
CAN communication
*1 : Without Data Communication Module (DCM)
*2 : With Data Communication Module (DCM)
: CAN communication line
NC-07148

Main component functions

Audio system (6 speakers) (for some grades)

Part name	Function
Cockpit Control Module (CCM) (Product of DENSO Corporation)	• Controls the Cockpit Gen.1.0 8-inch display audio system 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 spot 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).
AUX BOX	• 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.
Tweeter	Audio is output based on the audio signal input from the Cockpit Control Module (CCM).
Door speaker	
Rear speaker	

Audio system (8 speakers) (for some grades)

Part name	Function
Cockpit Control Module (CCM) (Product of DENSO Corporation)	• Controls the Cockpit Gen.1.0 8-inch display audio system 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 airwaves received with the radio antenna and forwards them to the Cockpit Control Module (CCM). (Radio antenna amplifier)
Microphone	• Located inside the spot 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).
AUX BOX	• 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.
Audio amplifier	Amplifies the audio signal output from the Cockpit Control Module (CCM), and outputs signals to the Data Communication Module (DCM).
Data Communication Module (DCM)	• Outputs the microphone audio signal to the Call Center when using the SUBARU STARLINK service. • Outputs the audio signal input from the audio amplifier to the door speakers. • Outputs the audio signal received from the Call Center to the door speakers when using the SUBARU STARLINK service.
Door speaker	Outputs audio based on the audio signal input amplified by the audio amplifier and input from the Cockpit Control Module (CCM), and the audio signal input from the Data Communication Module (DCM).
Tweeter	Audio is output based on the audio signal input from the Cockpit Control Module (CCM).
Side speaker	
Rear speaker	

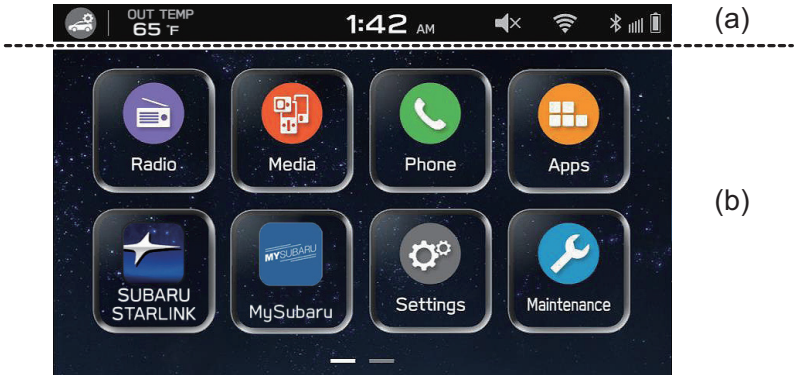
**1: Without Data Communication Module (DCM)*
**2: With Data Communication Module (DCM)*

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.

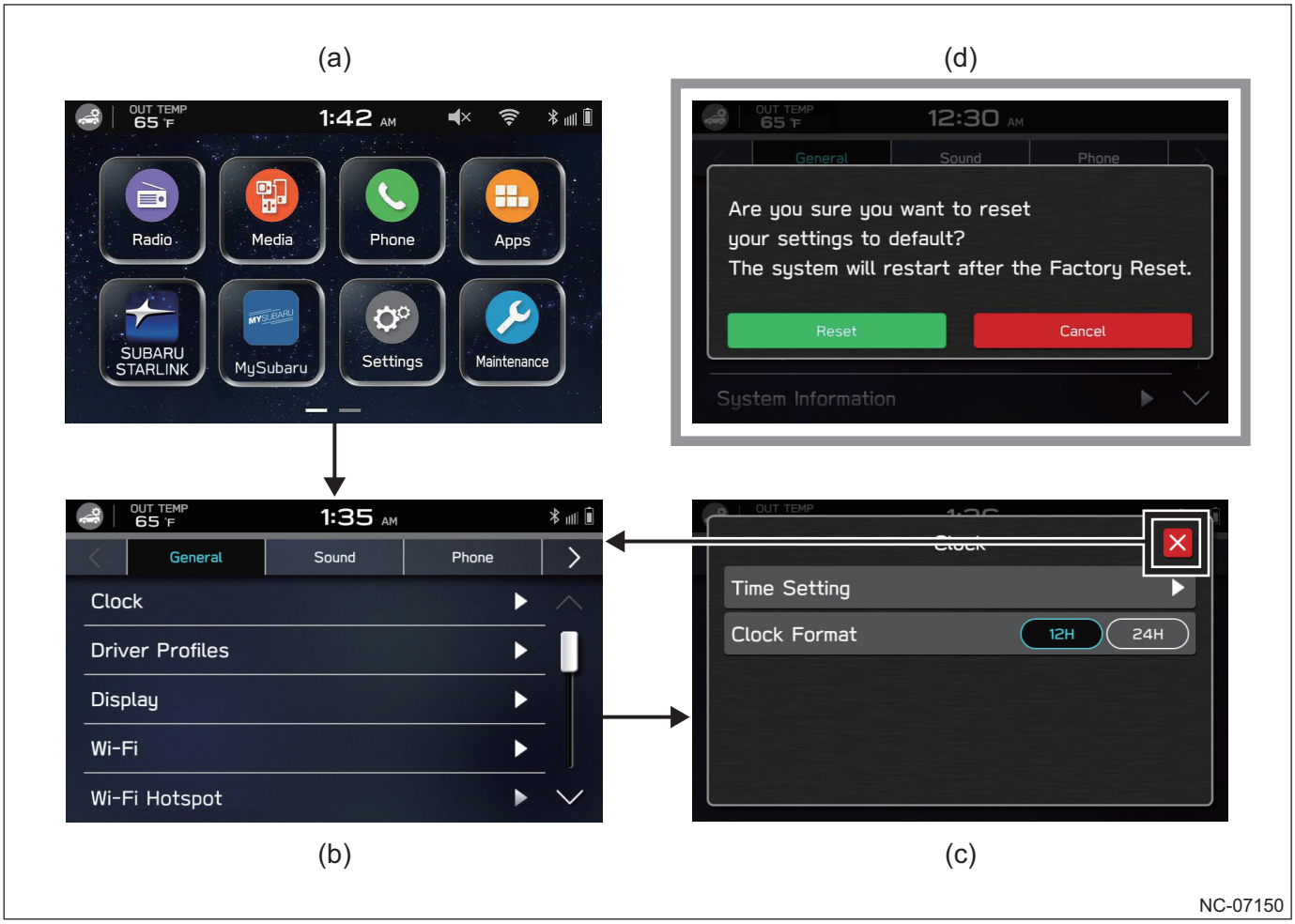
- A Home Screen is provided that is composed of categorized icons that are designed to make it easy for the user to understand the main infotainment functions.
- Touch operations such as drag and swipe can be used.
- The Customize menu supporting customization of the vehicle functions is integrated in the Center Information Display (CID). The user can use all the customization functions by operating the screen.
- 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 vehicle setting shortcut buttons, 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)	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.

- 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.



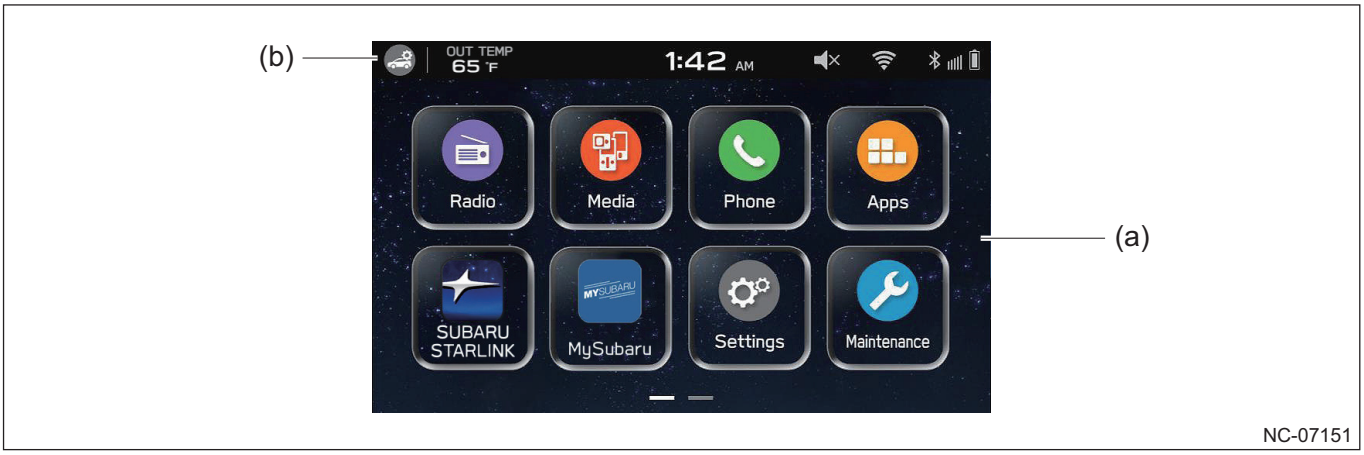
**The illustration shows a typical example that may differ from the actual display.*

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.



**The illustration shows a typical example that may differ from the actual display.*

(a) Home Screen

(b) Vehicle settings shortcut 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.
<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.
<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.
<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.
<Maintenance>	• Used to operate the maintenance function. • See the information section for details on <Maintenance> {11-184}.
<Add Shortcut>	Used to select, add, or delete shortcut icons to/from the Home Screen.

Infotainment system settings

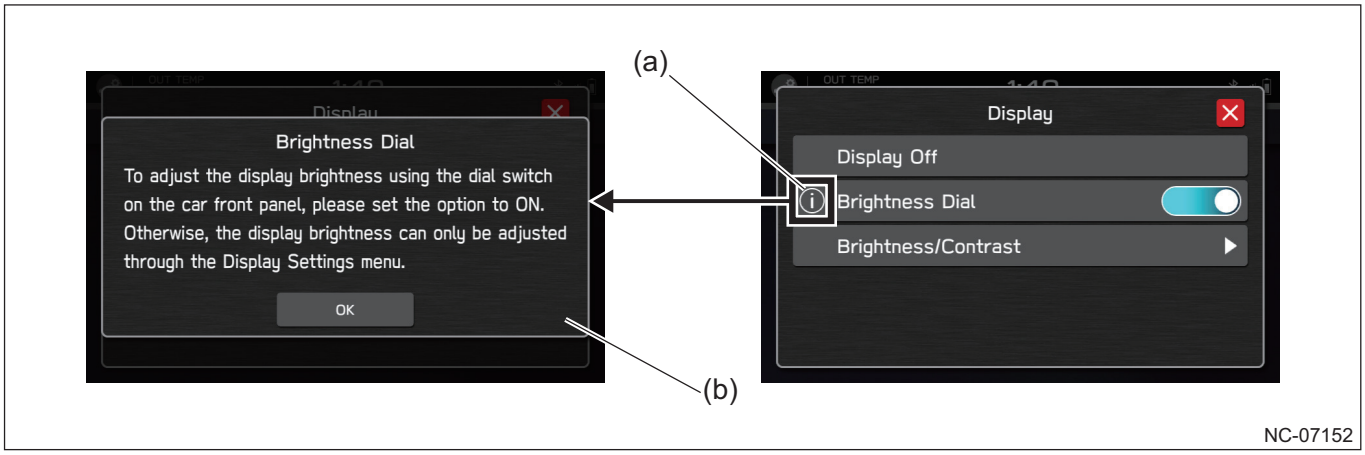
By touching the <Settings> icon on the Home Screen, the setting items for the Infotainment System are displayed. Each setting item is categorized according to the functions on separate tabs.

Tab	Set item
<General>	• Used to configure the settings for <Clock>, <Driver Profiles>, <Display>, <Wi-Fi>, <Wi-Fi Hotspot>, <Reminder Screen>, <Meter Screen>, <Camera>, <Language>, <Home Screen Shortcuts>, <Birthday List>, and <Anniversary List>. • <Software Update> setting and operation are available. • Used to operate and configure the settings for <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>.
<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 display



**The illustration shows a typical example that may differ from the actual display.*

(a) Information mark

(b) Operation guidance display

Entertainment functions

The 8-inch display audio 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.



NC-07153

**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.



NC-07154

**The illustration shows a typical example that may differ from the actual display.*

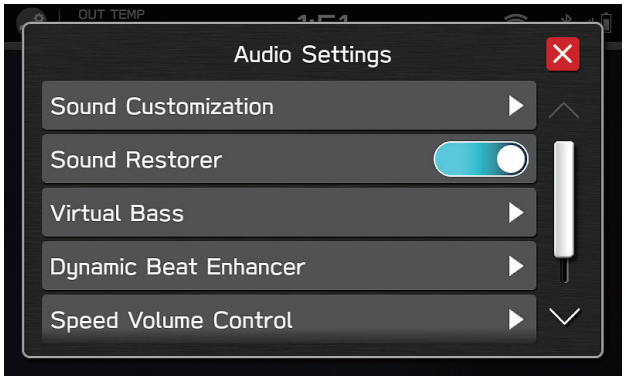
Mode	Description
<Bluetooth>	• Used to operate a portable audio player that is connected by Bluetooth from the display. • The audio is output from the vehicle speakers.
<USB>	Used to play audio files that are recorded on the USB memory that is connected to the USB terminal.
<iPod/iPhone>*1	Used to play 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



NC-07155

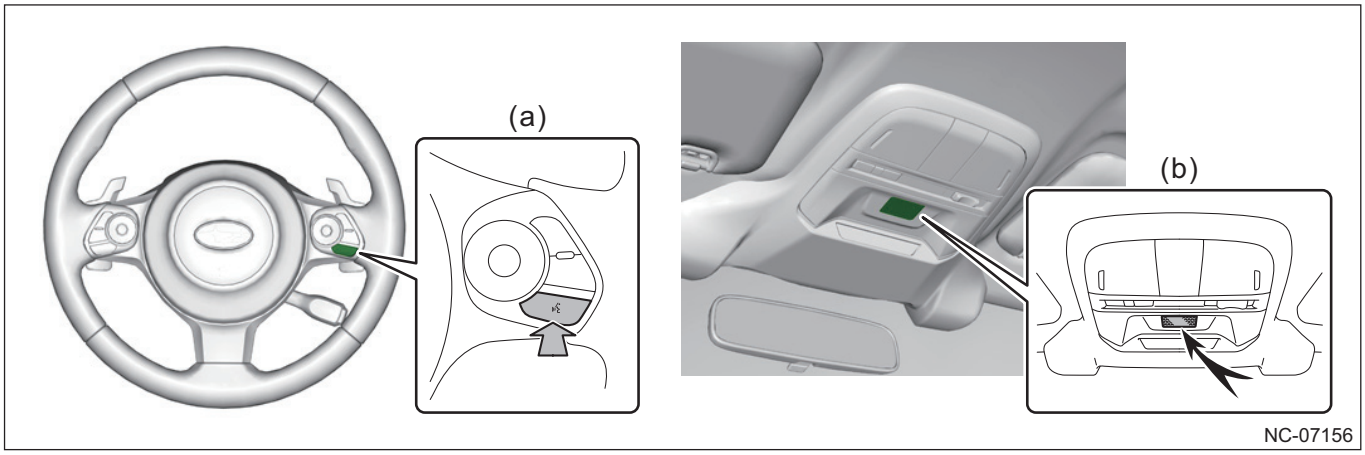
**The illustration shows a typical example that may differ from the actual display.*

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.*

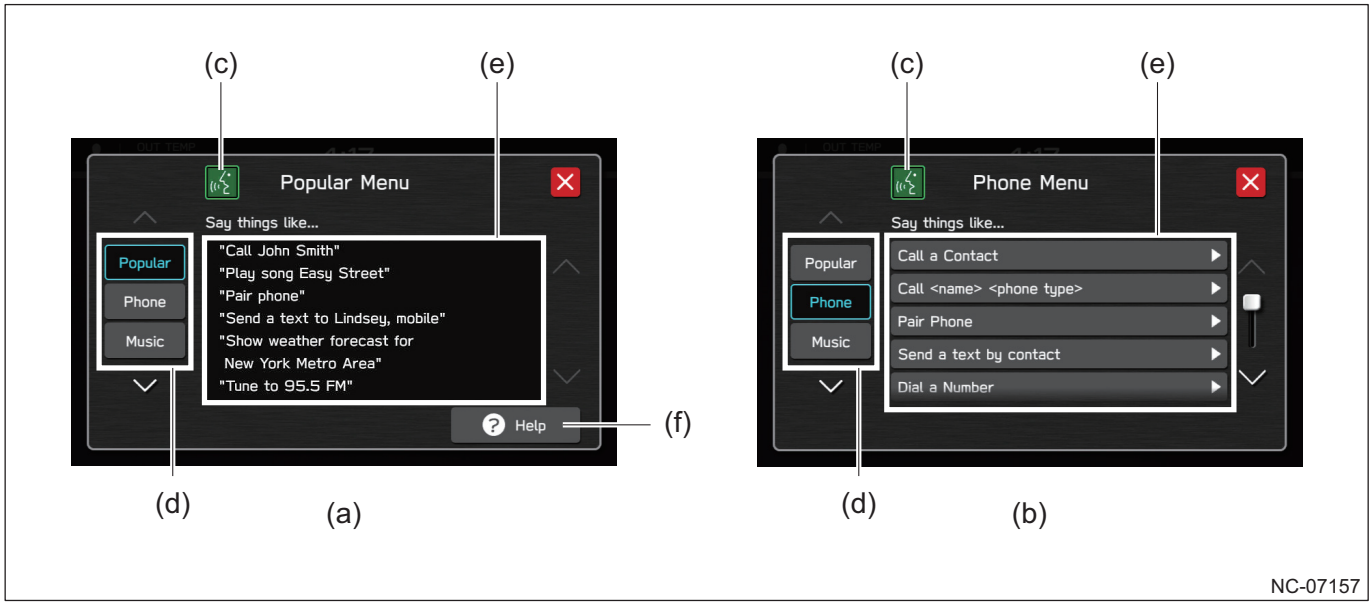
Voice recognition function

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 spot 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



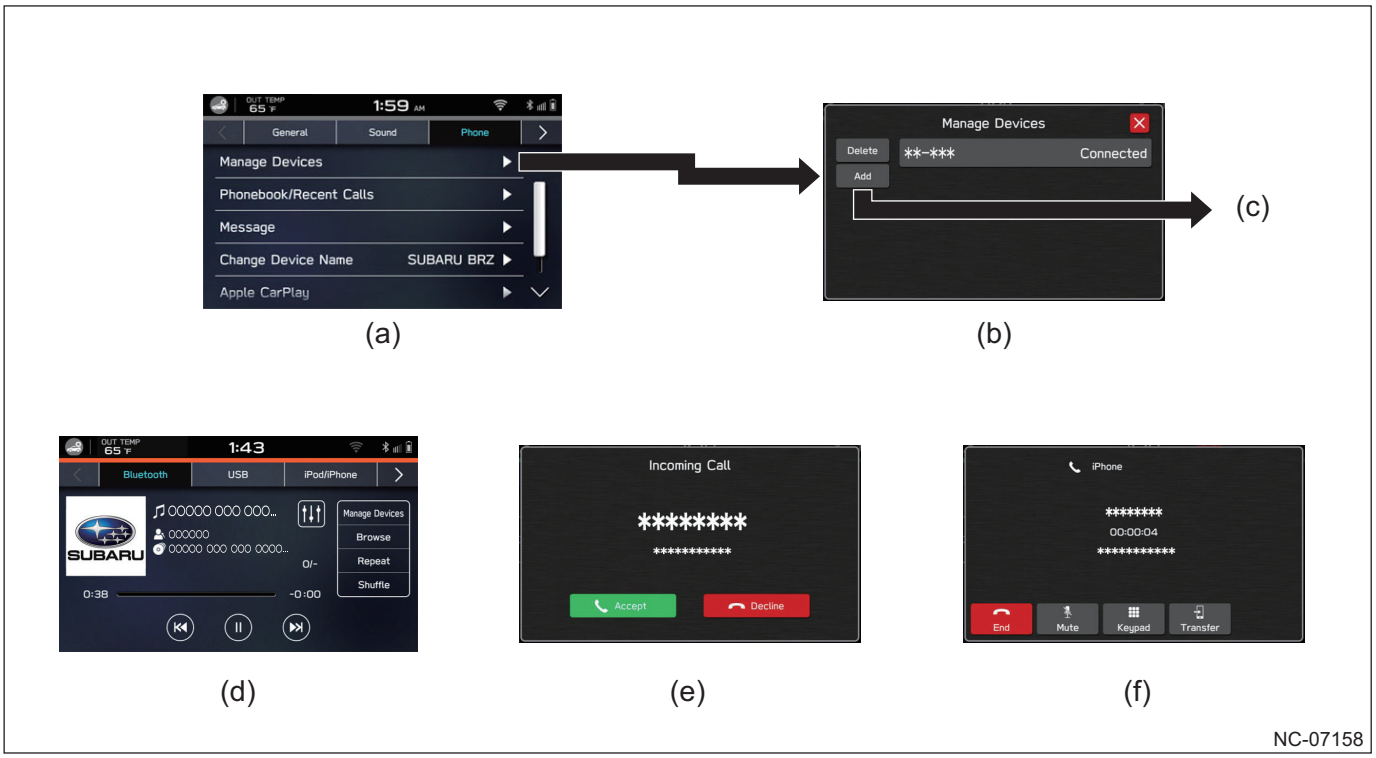
**The illustration shows a typical example that may differ from the actual display.*

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.
		<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.



**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.
- 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 favourites list	A call can be made by selecting a telephone number preregistered in the favourites list.
Calling from phone book	A telephone number can be displayed from the phone book and called.
Calling a message sender*	When a received message was sent using a telephone number, the sender can be called using this number.
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.

**: Only when the Bluetooth mobile phone supports the message function*

- 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*

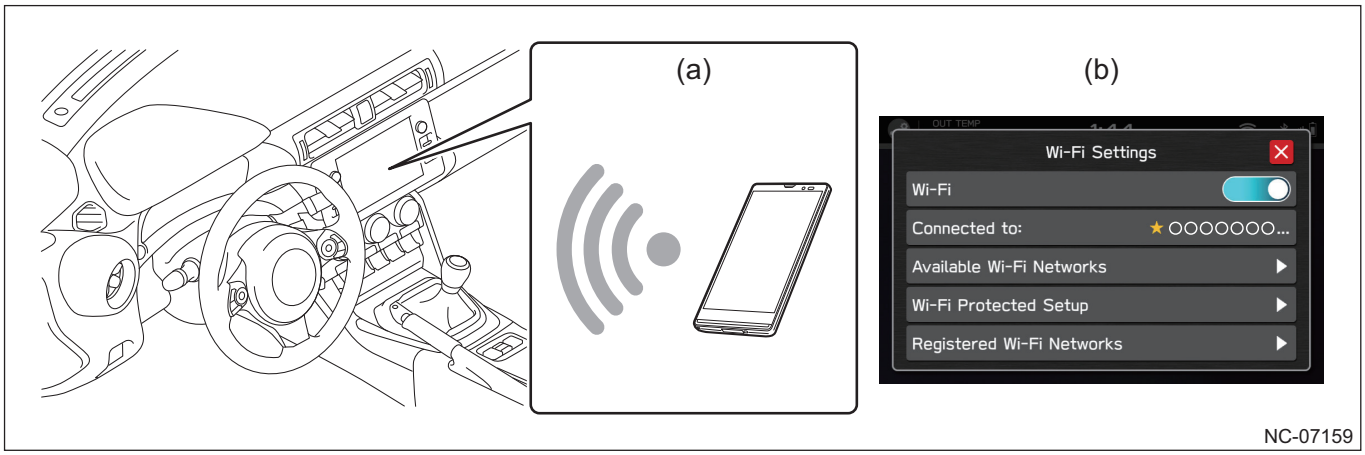
- If the Bluetooth mobile phone supports the message function, received messages can be checked or replied to, and short messages can be sent.

Wi-Fi function

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	Description
Software updates	Used to update the Infotainment System program.



**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

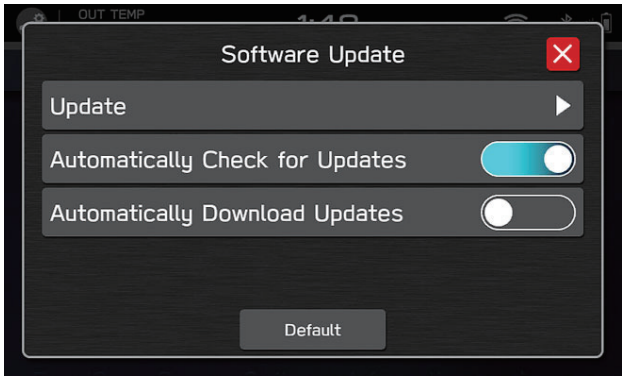
- A wireless client (tethering mobile phone or mobile Wi-Fi router) is registered in the in-vehicle device by operating the display.
- The registration operation is easier for wireless clients compatible with Wi-Fi Protected Setup (WPS).

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-07160

**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 at the center. • 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.

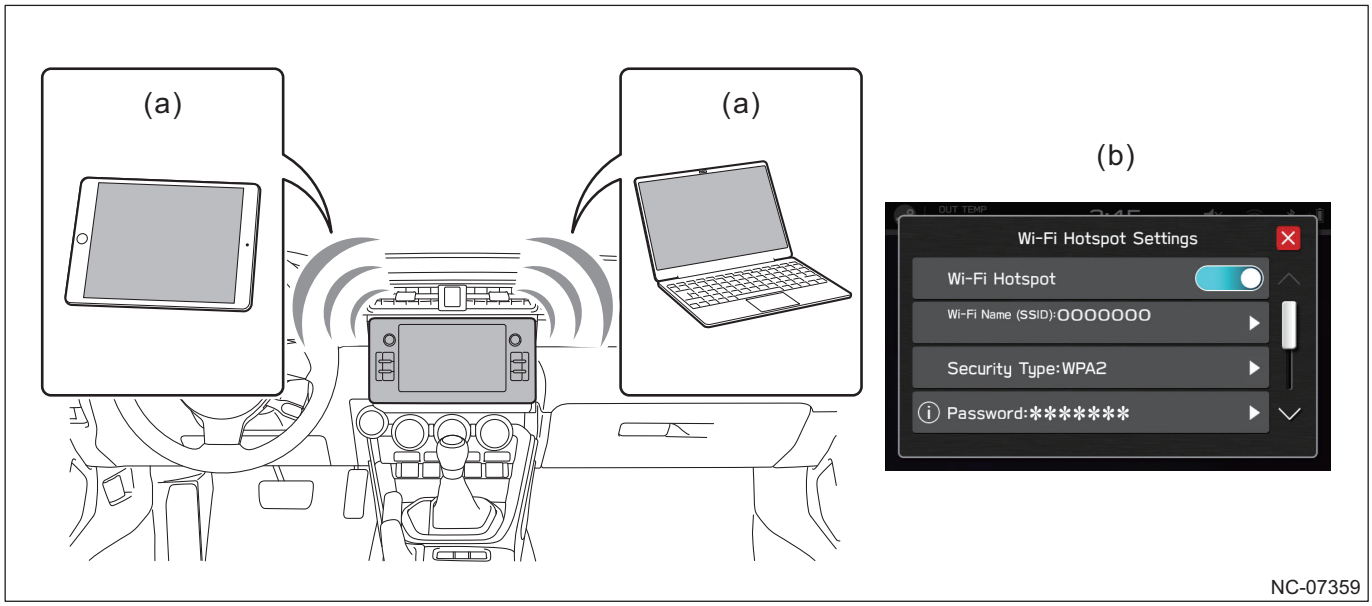
Wi-Fi Hotspot function (models for U4 equipped with Data Communication Module (DCM))

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". {11-100}



**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.

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 {11-187}.

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 {11-188}.

11.3 Combination Meter/MID

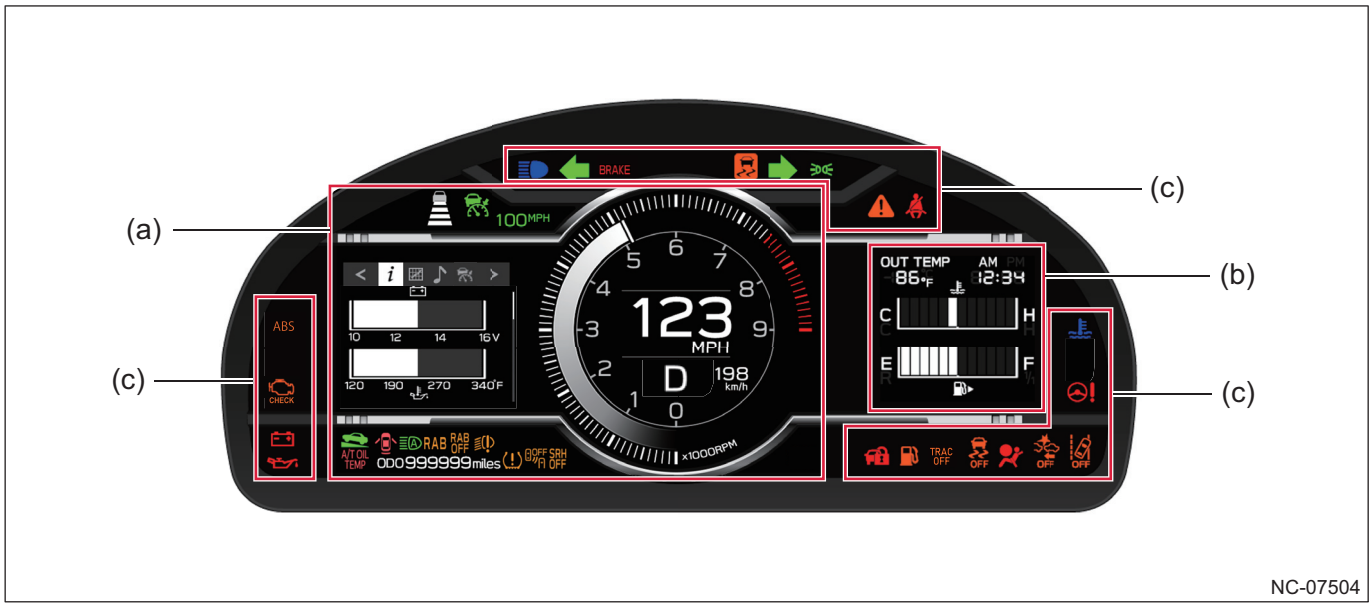
11.3.1 Overview

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.

Specifications

A full LCD meter that combines a 7-inch TFT color LCD with a LCD segment display has been adopted.



**The illustration shows a typical example that may differ from the actual display.*

(a) 7-inch TFT color LCD
(b) LCD segment display
(c) LED warning/indicator lights

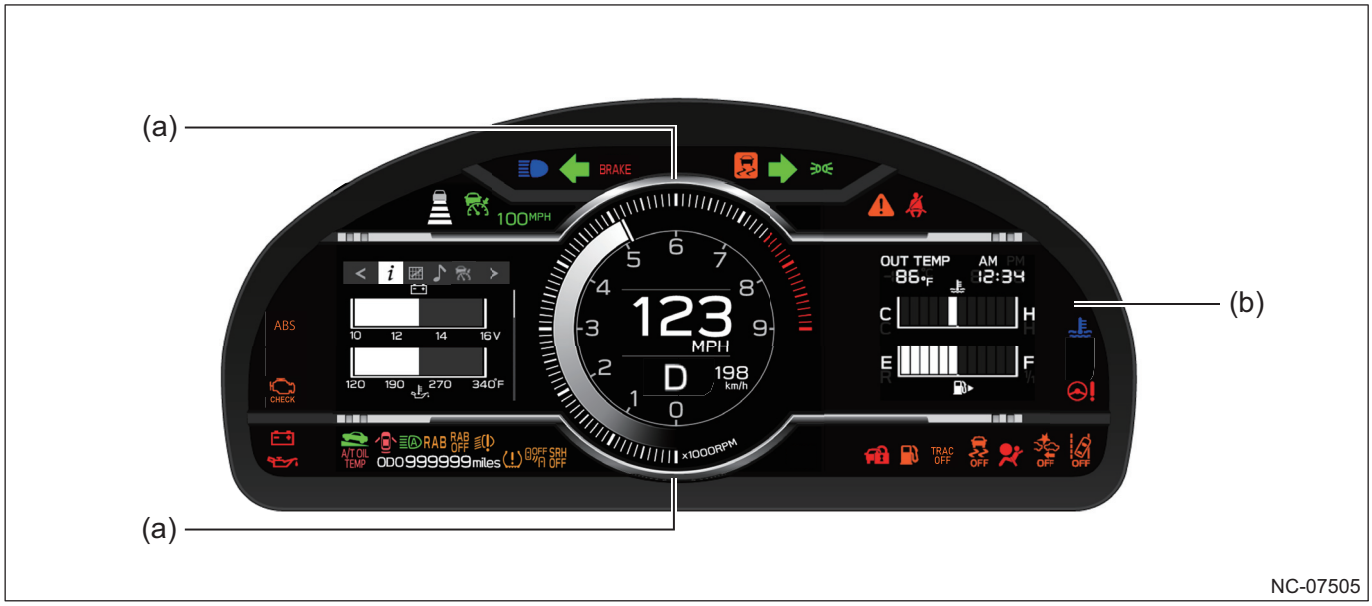
TFT display specifications

LCD	WVGA full-color
Pixel size	0.1905 mm
Number of pixels	Vertical 480 × Horizontal 800

LCD display specifications

LCD	LCD (negative)
Light source	LED (white)
Quantity	9

- The meter design adopts smoked meter glass, a seamless dial face, and a silver meter ring shaped to resemble the piston of a horizontally opposed Boxer engine.



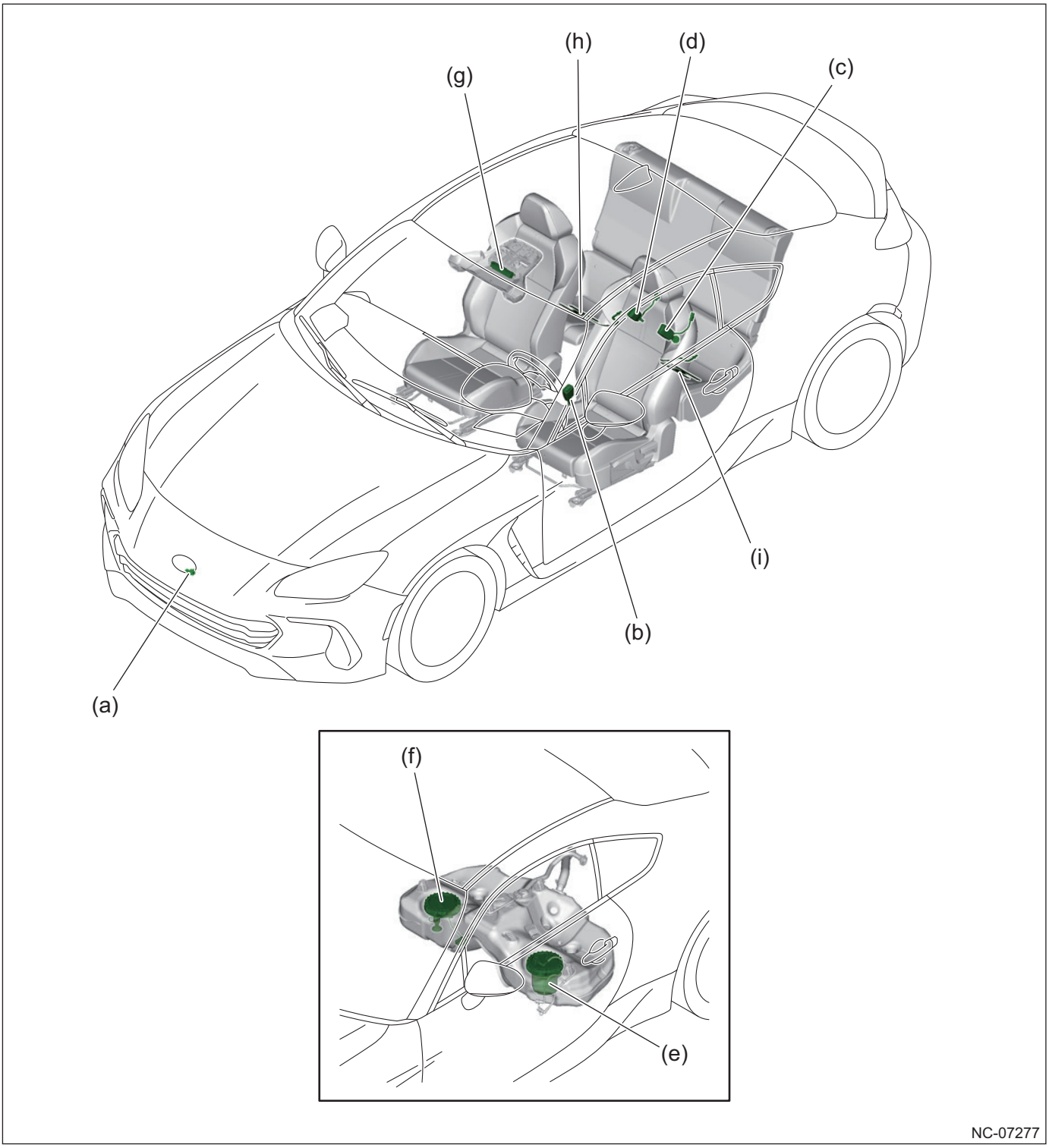
(a) Meter ring (b) Dial face

Meter design

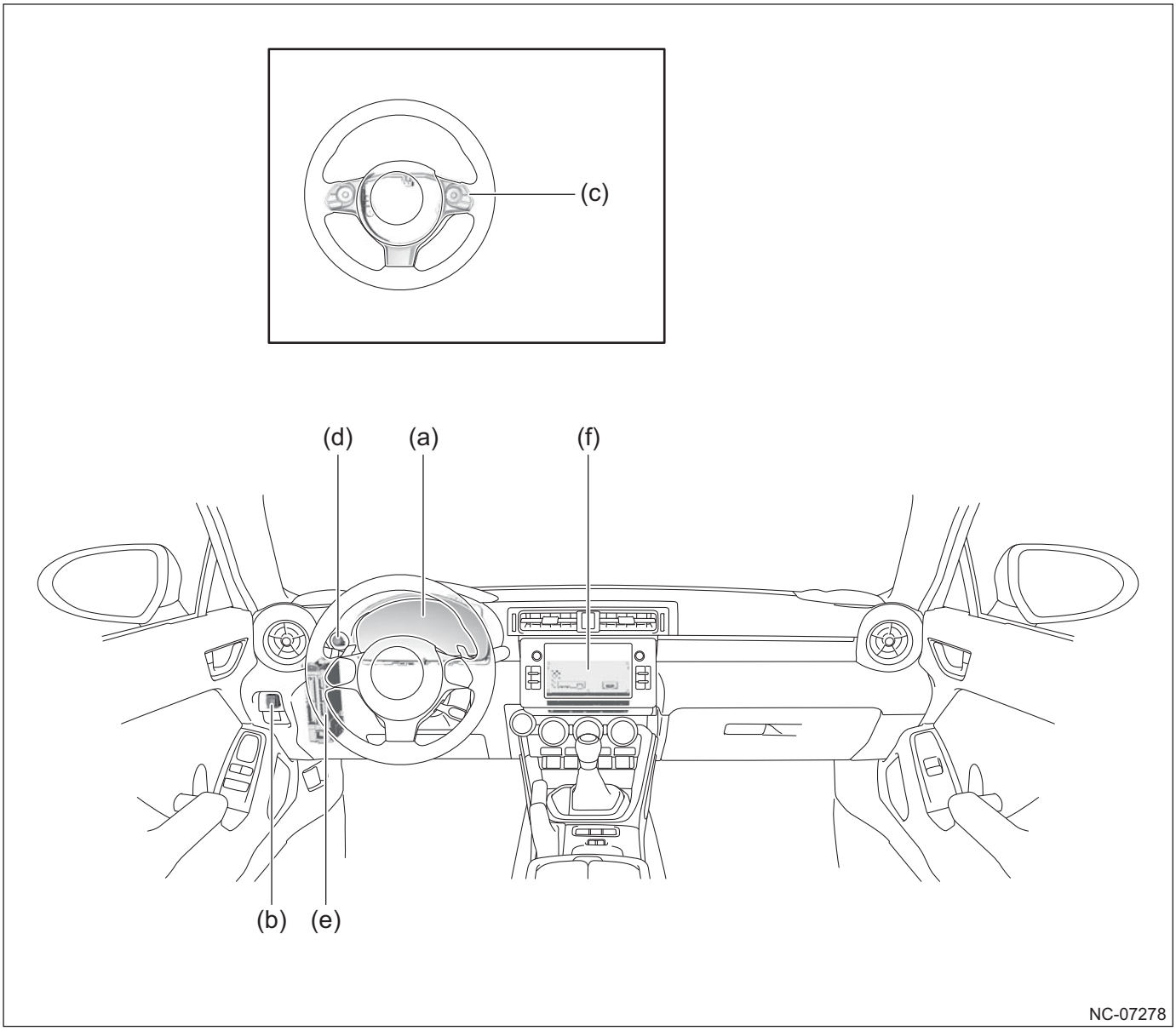
Meter ring	Silver (painted)
Dial face	Seamless printing
Meter glass	Smoked glass

11.3.2 Component

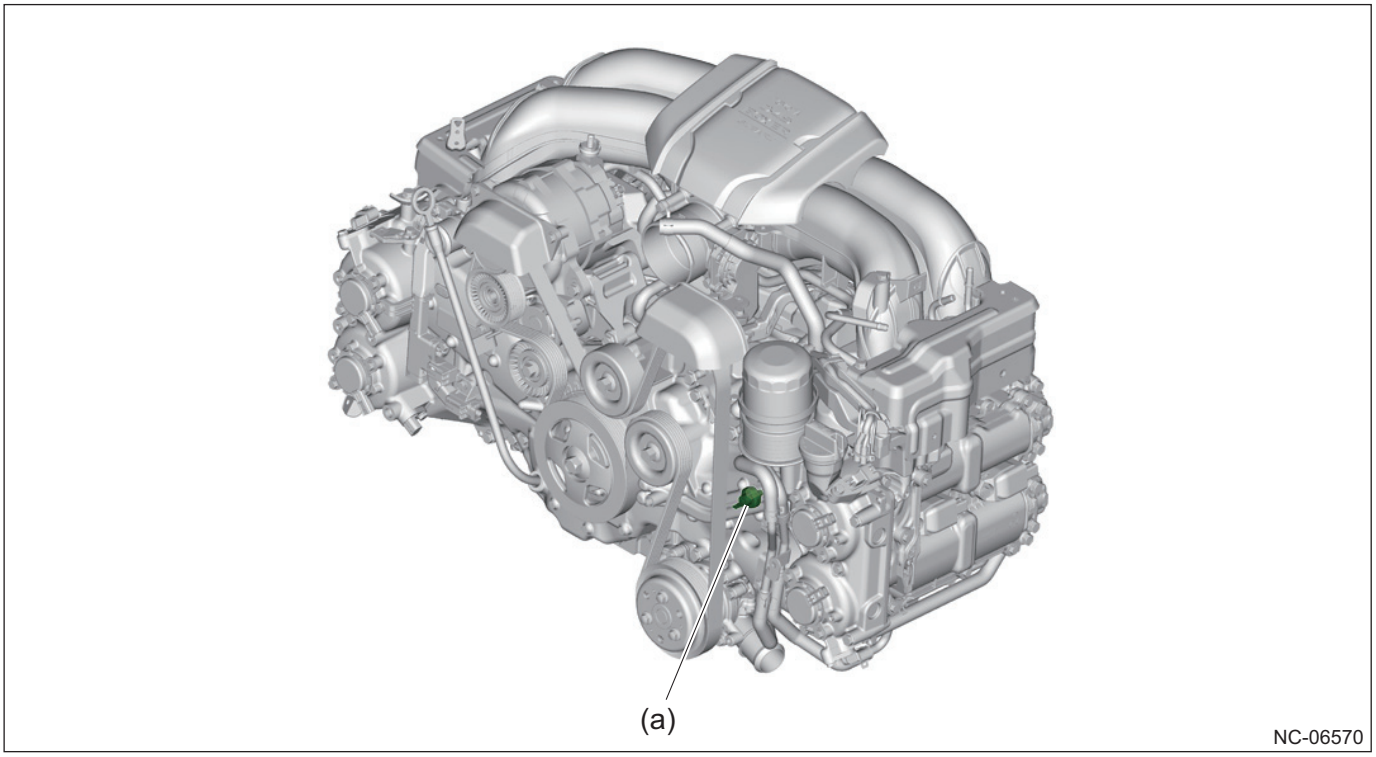
Component layout drawing



(a) Ambient sensor
(b) Front seat belt switch LH
(c) Rear seat belt switch LH
(d) Rear seat belt switch RH
(e) Fuel pump assembly (fuel level sensor)
(f) Fuel sub level sensor
(g) Warning box
(h) Rear seating switch RH
(i) Rear seating switch LH



(a) Combination meter
(b) Illumination control switch
(c) Satellite switch
(d) TRIP/RESET switch
(e) Body Integrated Unit (BIU)
(f) Cockpit Control Module (CCM)



(a) Oil pressure switch

Component details

Combination meter

The single-lens type full LCD meter with a simple display features a white main color on a black background.

The meter screen includes a large single-lens type tachometer/speedometer at the center, for the visibility and instant readability needed by a sports car. The Multi Information Display (MID) and basic content are arranged to the left and right of the tachometer/speedometer respectively. Appropriately communicating information needed by the driver creates a clear understanding, advanced feel, and feeling of high quality.

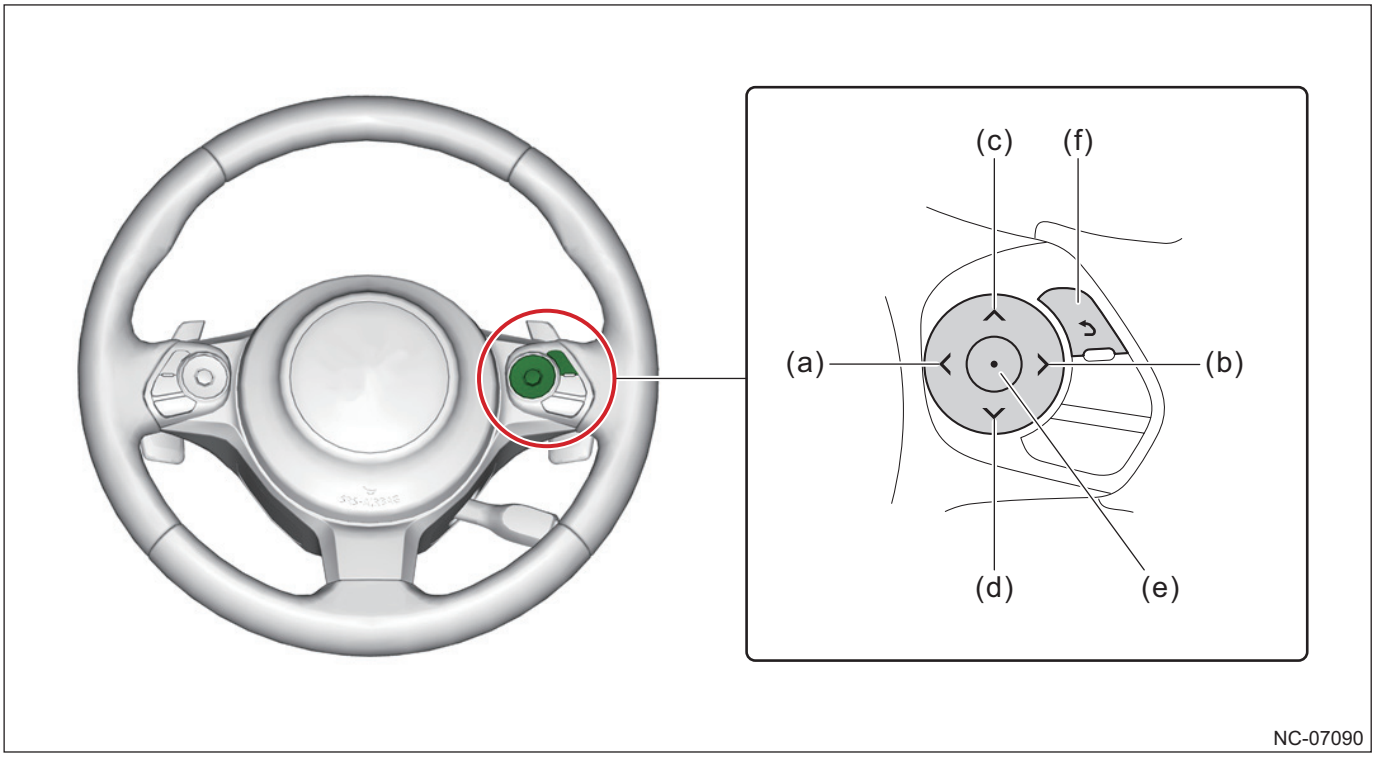


**The illustration shows a typical example that may differ from the actual display.*

(a) Tachometer/speedometer
(b) Multi Information Display (MID)
(c) Basic content

Satellite switch

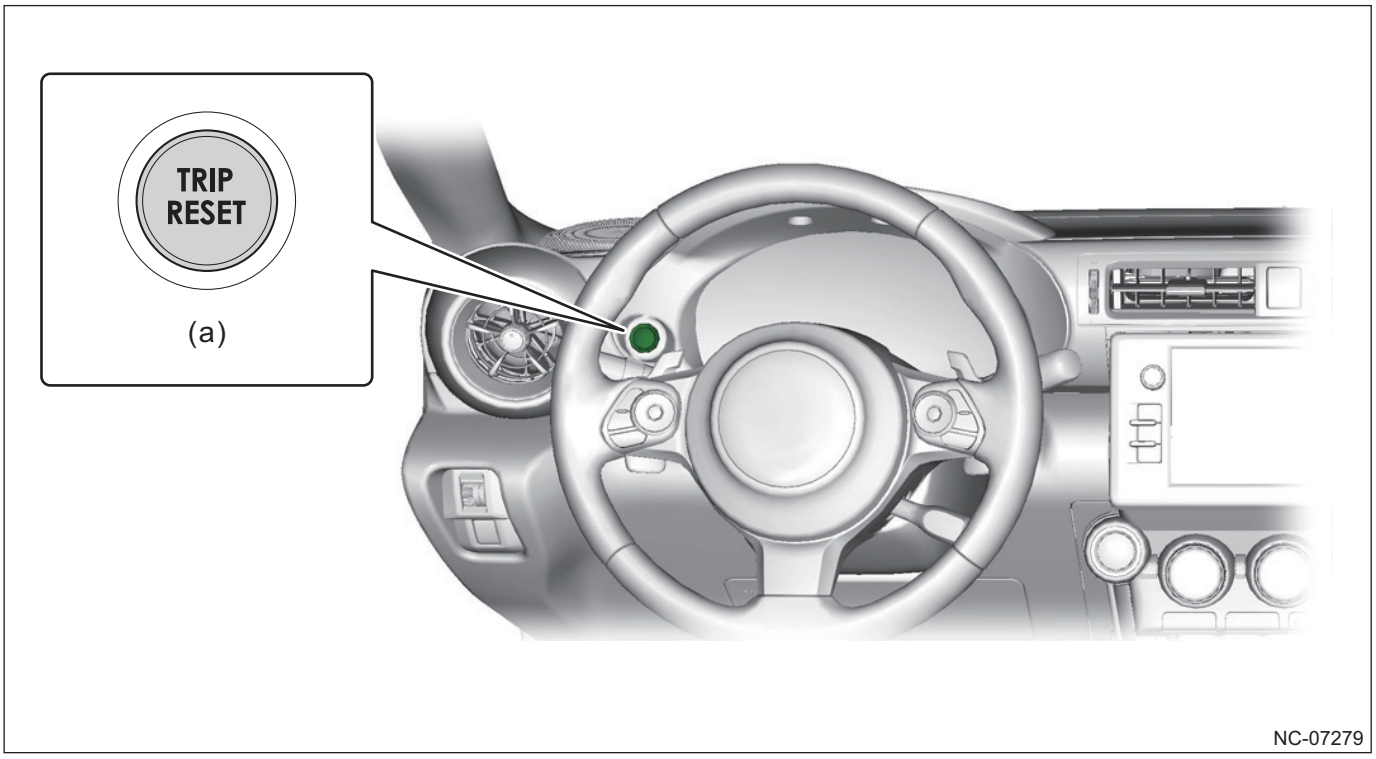
The satellite switches contain the meter operation buttons which can change the meter screen display.



(a) Left button
(b) Right button
(c) Up button
(d) Down button
(e) Enter button
(f) Back button

TRIP/RESET switch

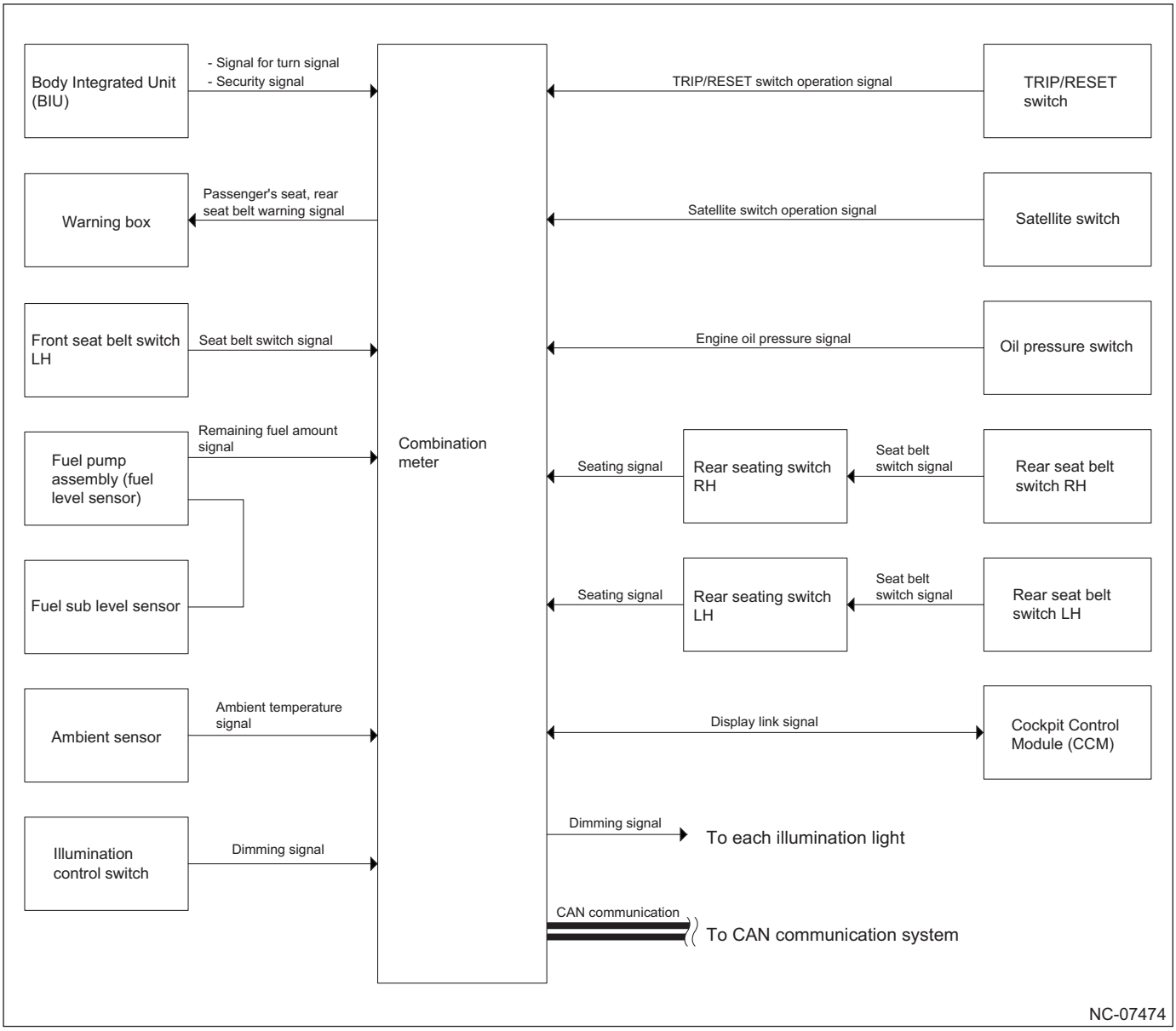
The TRIP/RESET switch that changes between the odometer and trip meter is located on the instrument panel to the right side of the driver's seat.



(a) TRIP/RESET switch

11.3.3 Construction and Operation

System diagram



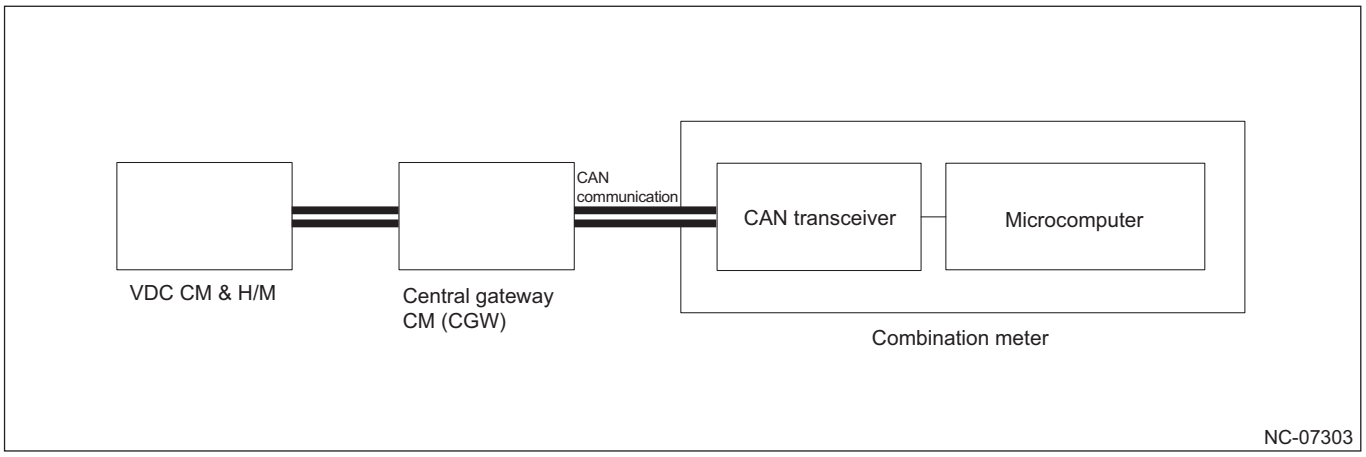
Main component functions

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.
Satellite switch	Detects operation of the meter operation buttons, and sends satellite switch operation signals to the combination meter.
Body Integrated Unit (BIU)	Sends the turn signal signals and security signals 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.
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 pump assembly (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.
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.
Oil pressure switch	Detects the engine oil pressure and sends the engine oil pressure signal to the combination meter.
• Rear seat belt switch RH • Rear seat belt switch LH	Detects the rear seat belt fastening status and sends the seat belt switch signal to the combination meter.
• Rear seating switch RH • Rear seating switch LH	Detects the presence of an occupant in each rear seat and sends the seating signal to the combination meter.
Cockpit Control Module (CCM)	Sends and receives display-linked signals between the combination meter and Cockpit Control Module (CCM).

System details

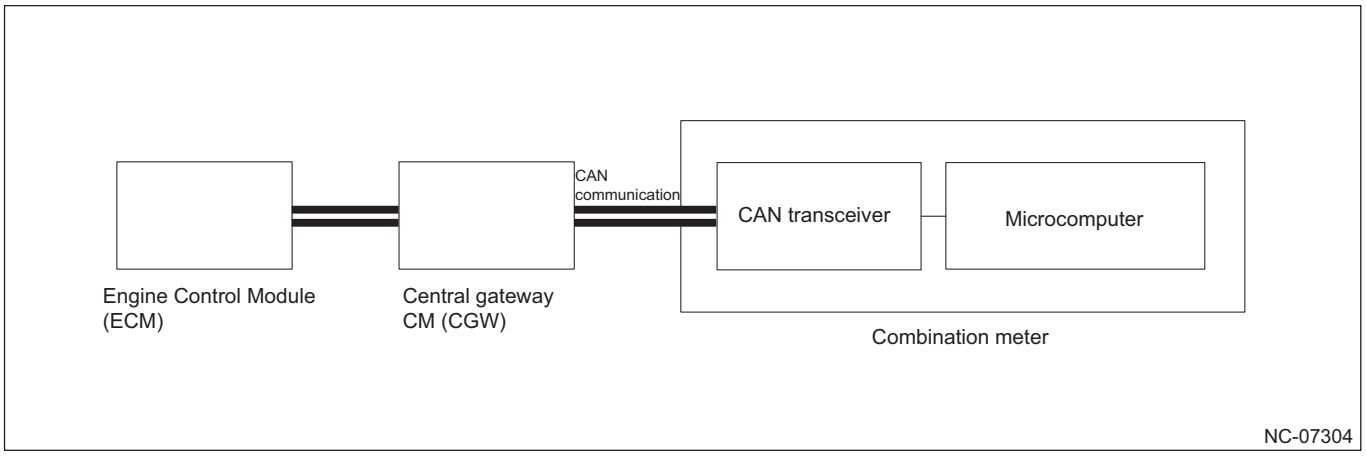
Speedometer operation

The combination meter microcomputer displays the speedometer based on the vehicle speed signal sent from the VDC CM & H/M via CAN communication.



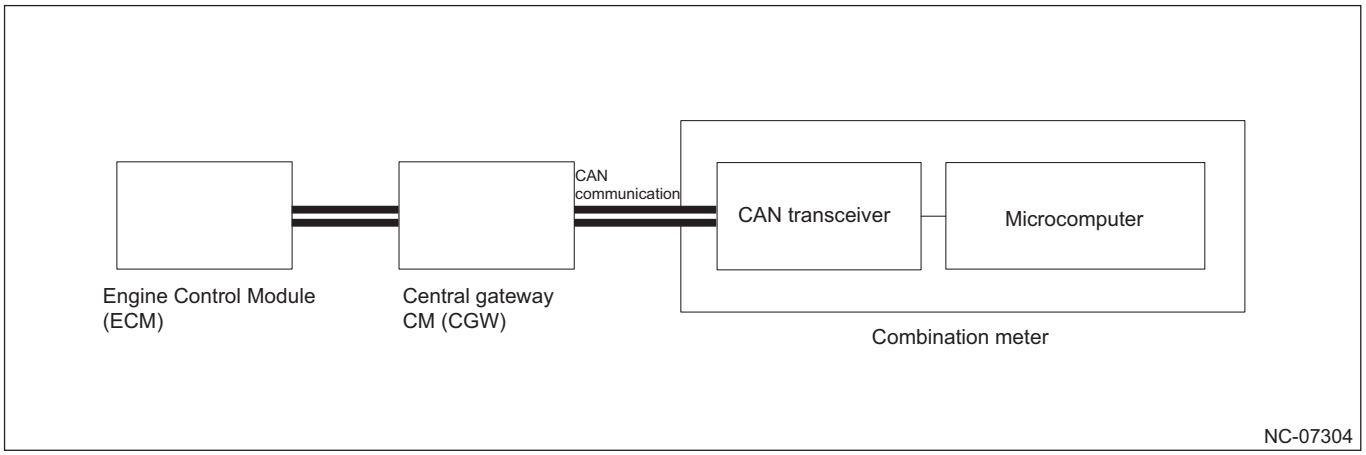
Tachometer operation

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

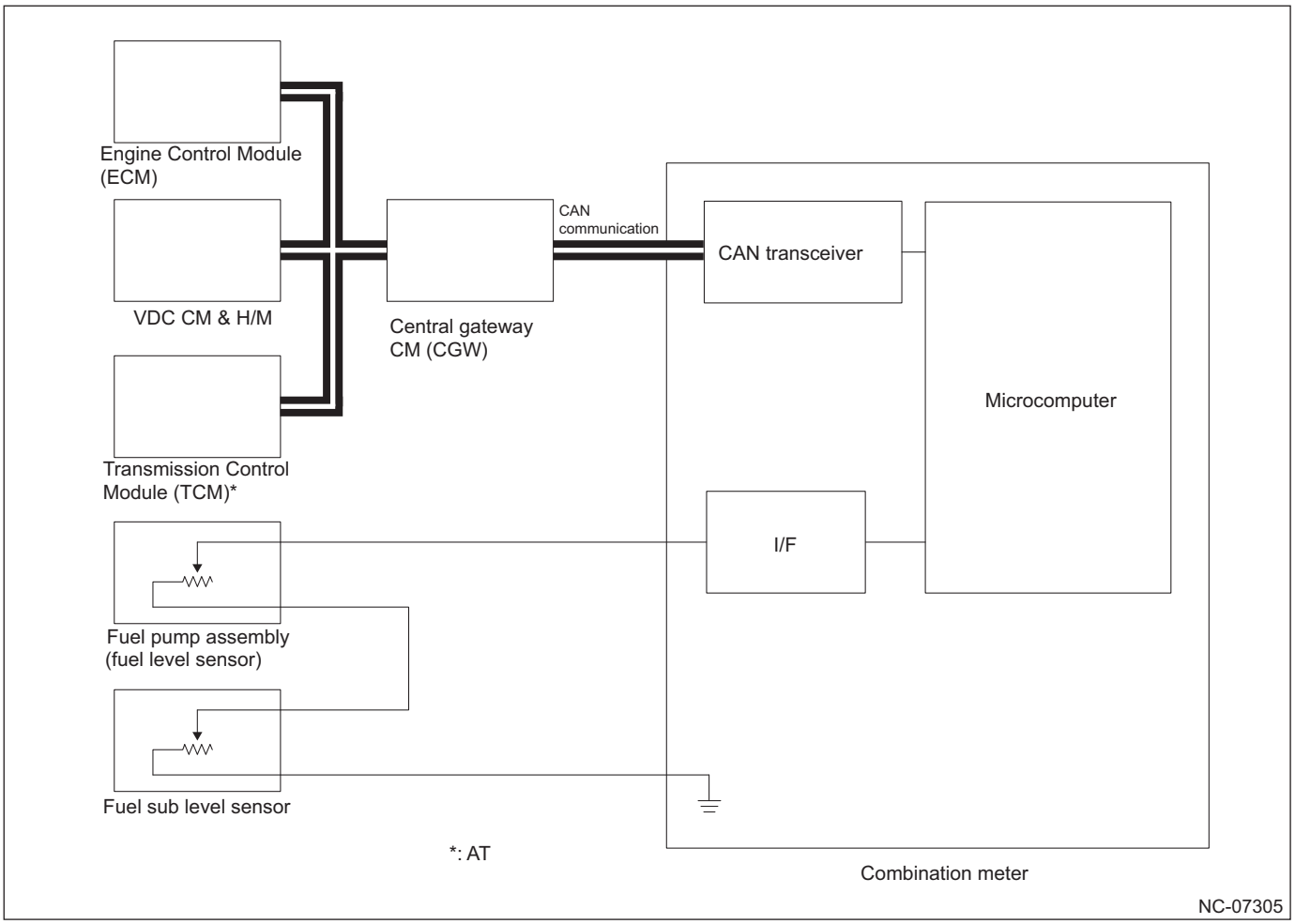
The combination meter microcomputer displays the coolant temperature gauge based on the engine coolant temperature signal sent from the Engine Control Module (ECM) via CAN communication.



Fuel gauge operation

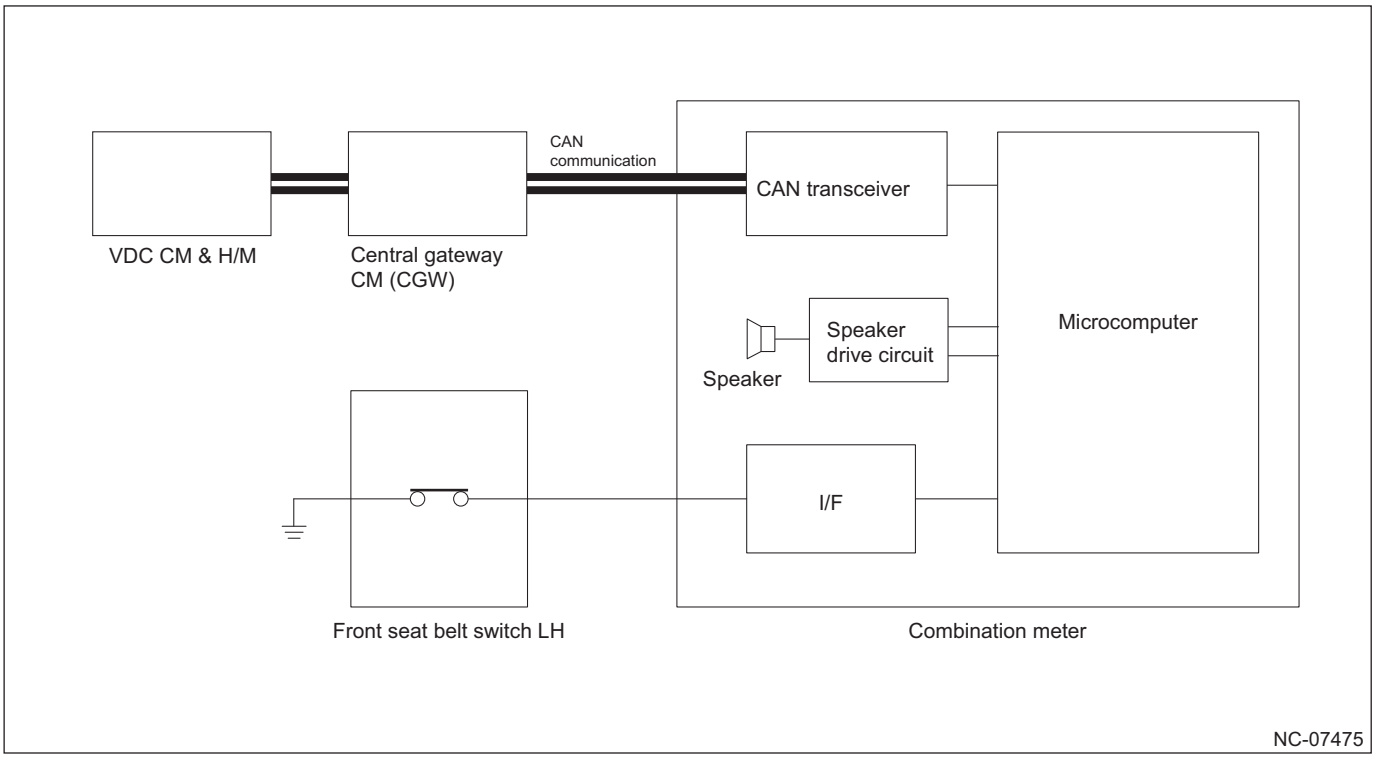
The combination meter microcomputer displays the fuel gauge based on the remaining fuel amount signal sent from the fuel pump assembly (fuel level sensor) and fuel sub level sensor, and on the following signals sent via CAN communication.

- Engine speed signal/fuel consumption signal sent from the Engine Control Module (ECM)
- Shift position signal/sports shift gear position signal sent from the Transmission Control Module (TCM)
- Drive wheel shaft average wheel speed signal sent from the VDC CM & H/M



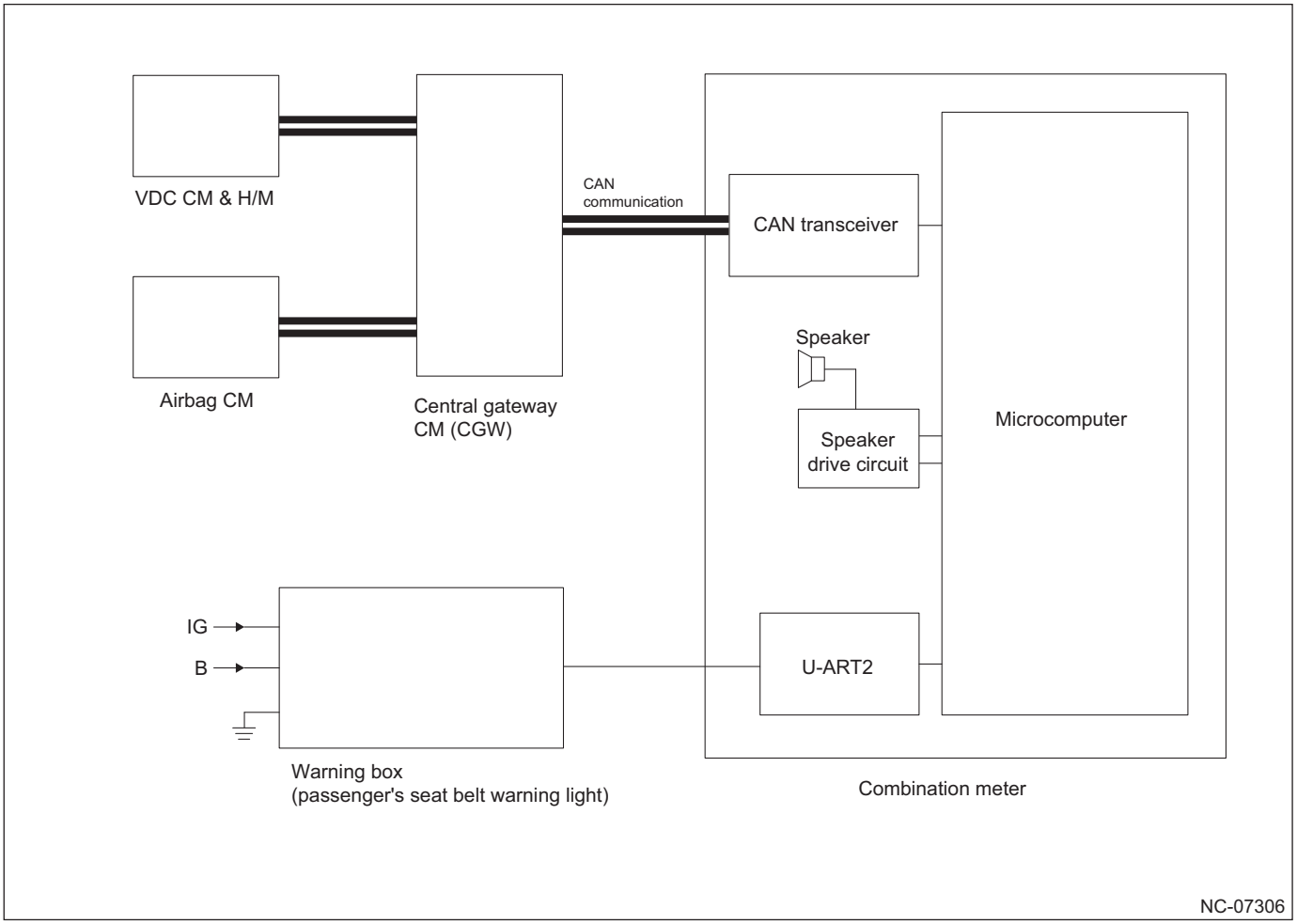
Driver's seat belt reminder operation

- 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.



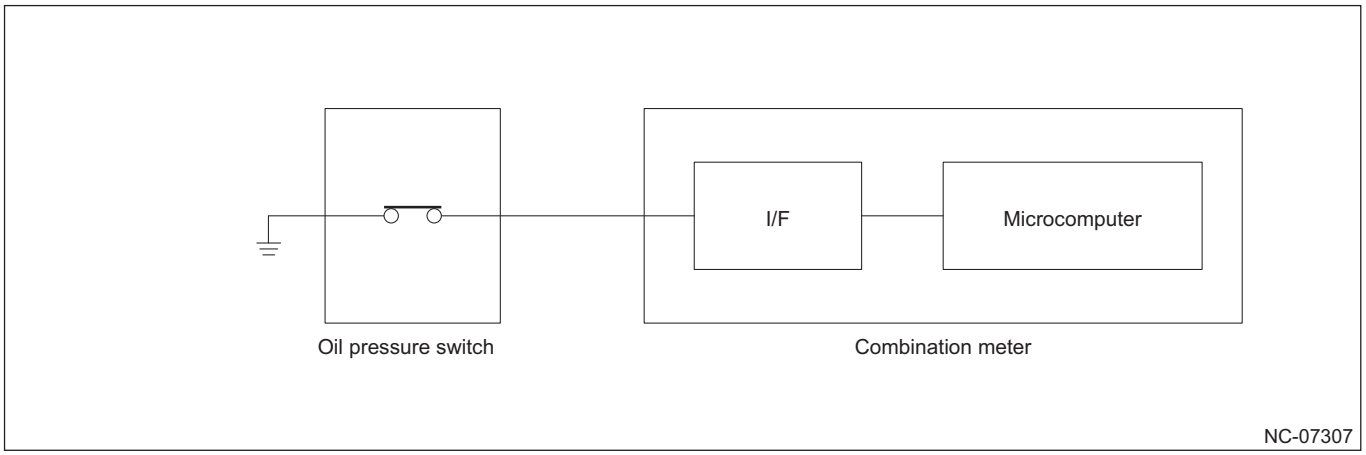
Passenger's seat belt reminder operation

- 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.



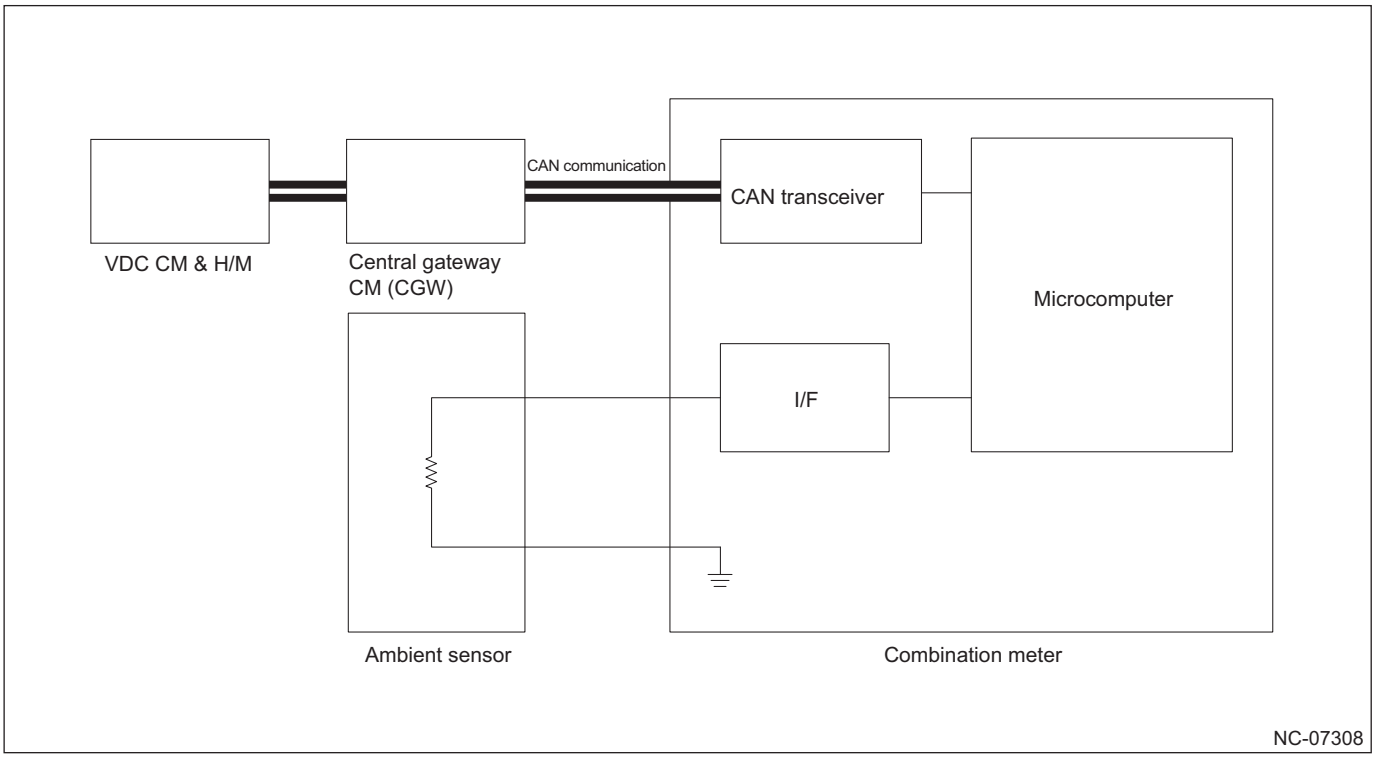
Oil pressure switch operation

The combination meter microcomputer turns on the oil pressure warning light based on the engine oil pressure signal sent from the oil pressure switch.



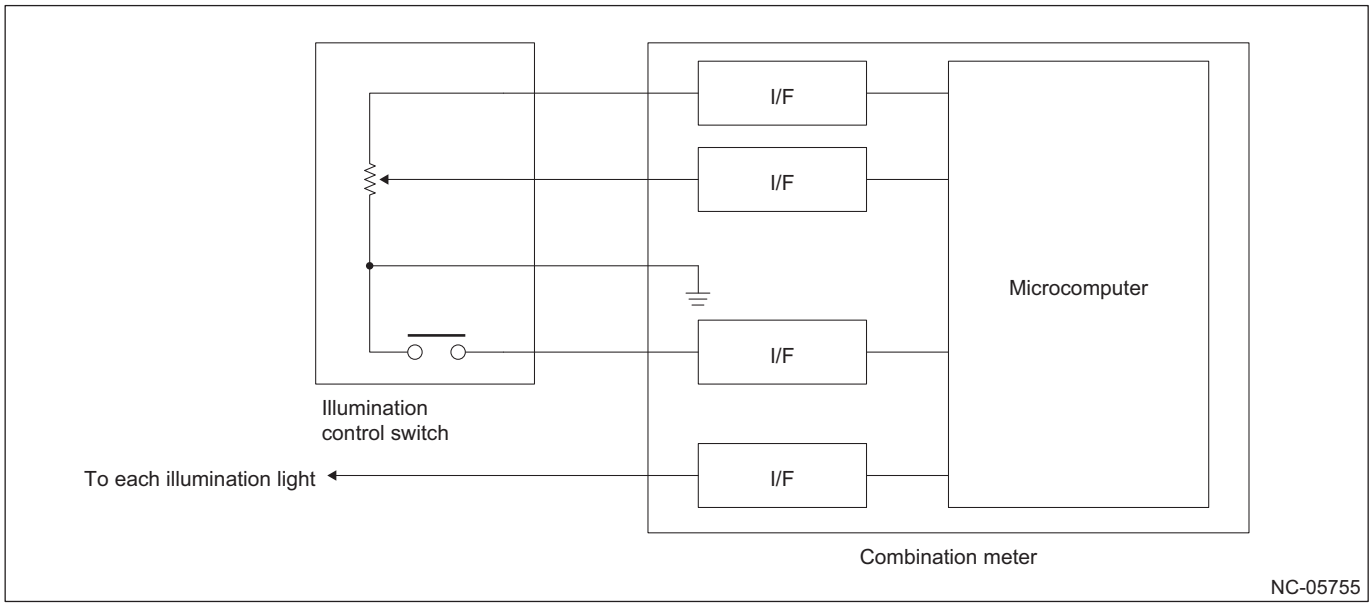
Ambient sensor operation

The combination meter microcomputer displays the current ambient temperature based on the ambient temperature signal sent from the ambient sensor and the drive wheel shaft average vehicle speed sent from the VDC CM & H/M via CAN communication.



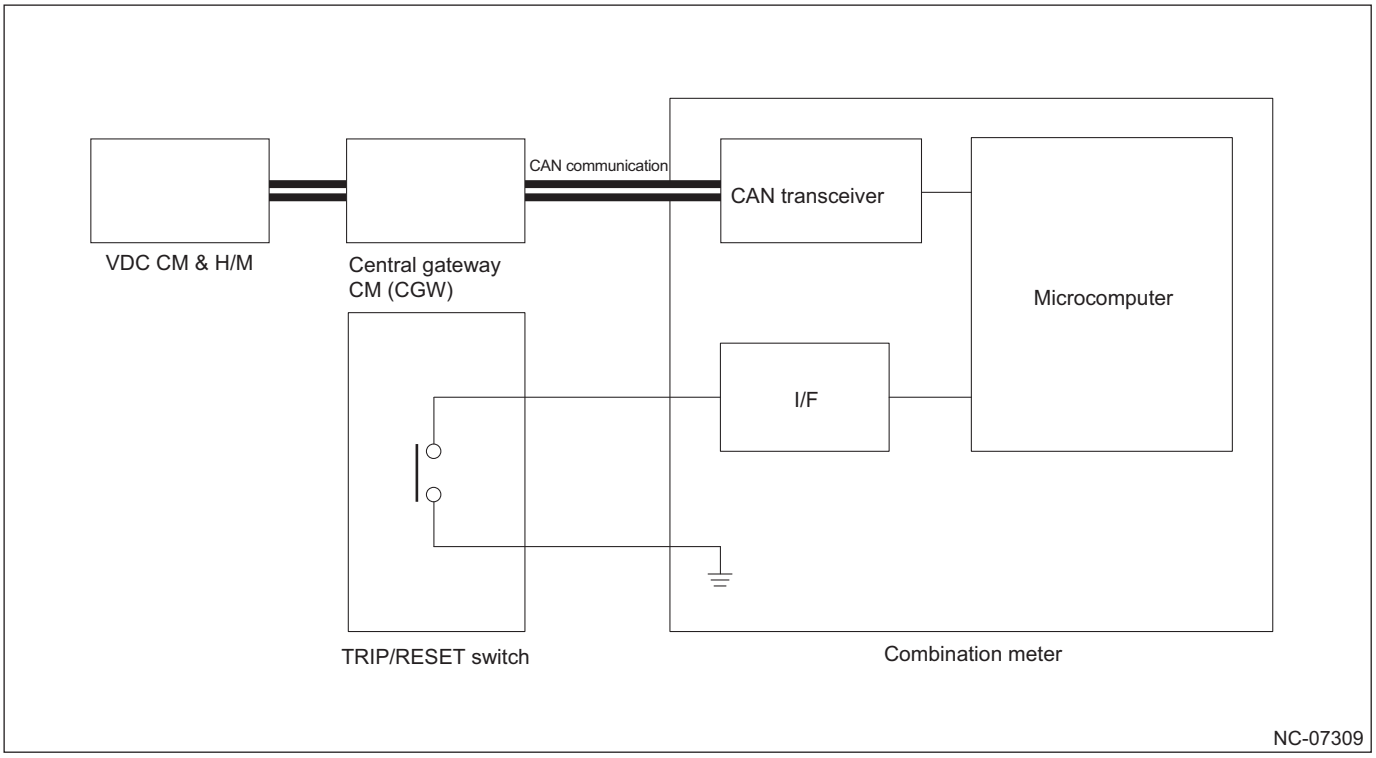
Illumination dimming operation

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.



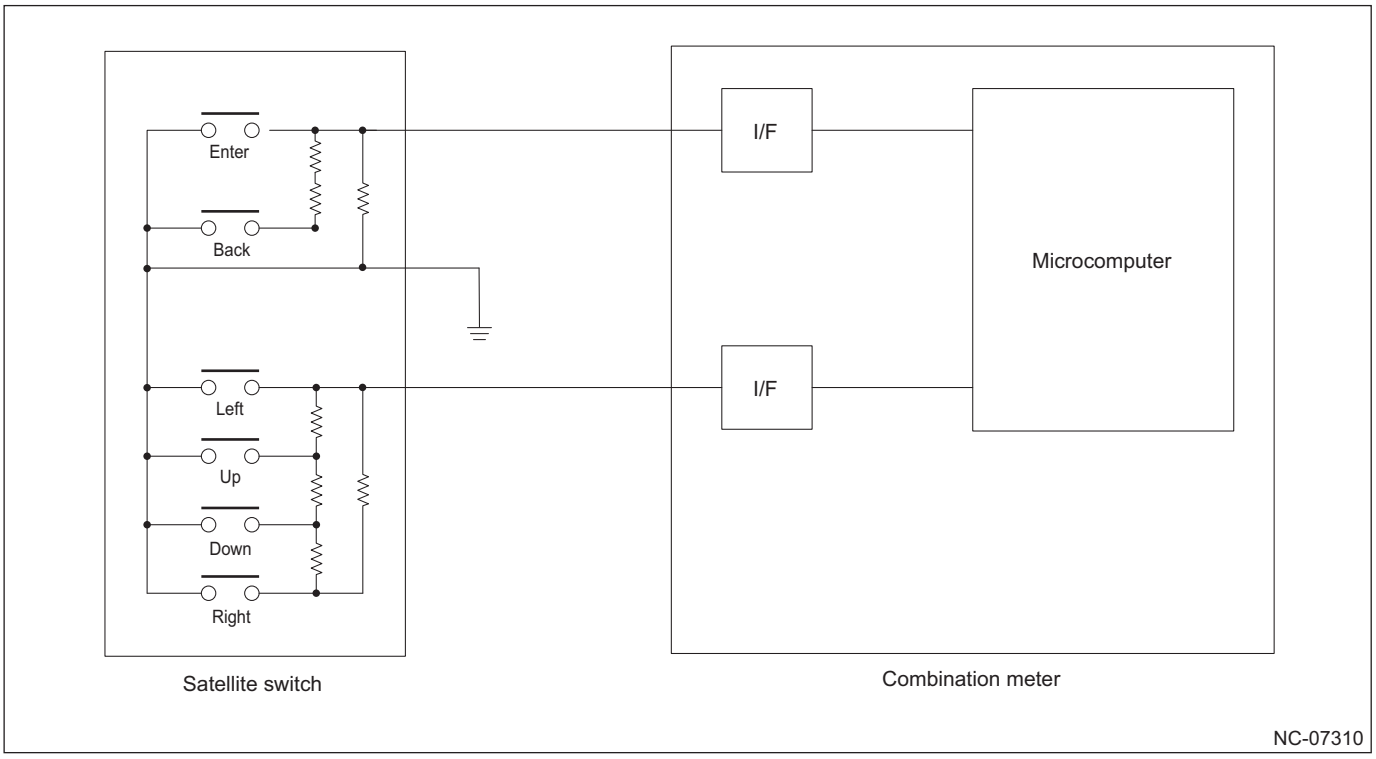
Odometer/trip meter operation

- The combination meter microcomputer displays the odometer/trip meter based on the drive wheel shaft average vehicle speed signal and cumulative vehicle speed pulse value sent from the VDC CM & H/M via CAN communication.
- The combination meter microcomputer switches between odometer, trip A, and trip B based on the TRIP RESET switch operation signal.



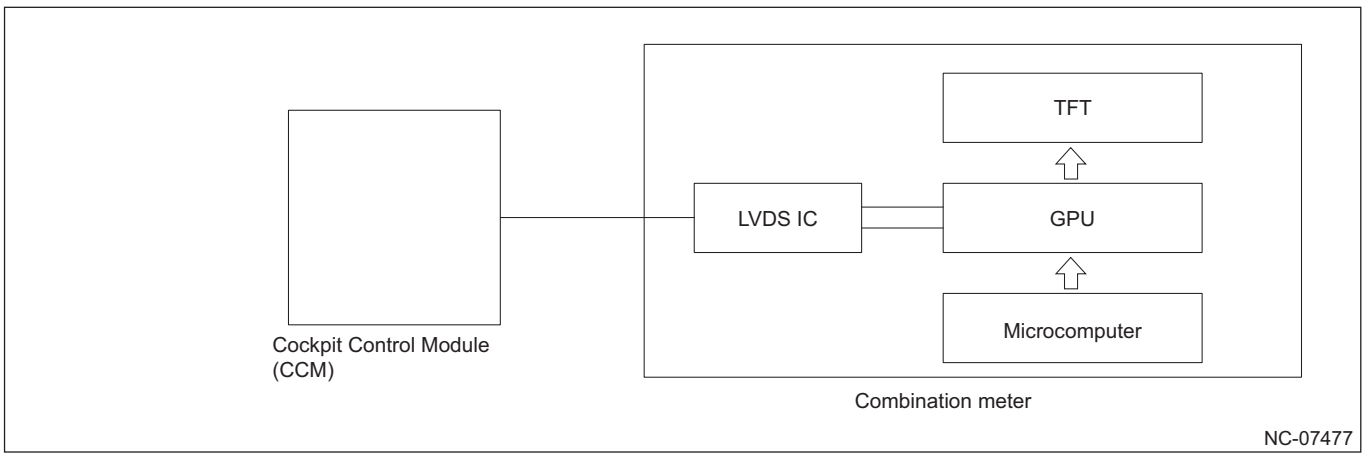
Satellite switch operation

The combination meter microcomputer changes the combination meter display based on the satellite switch operation signal.



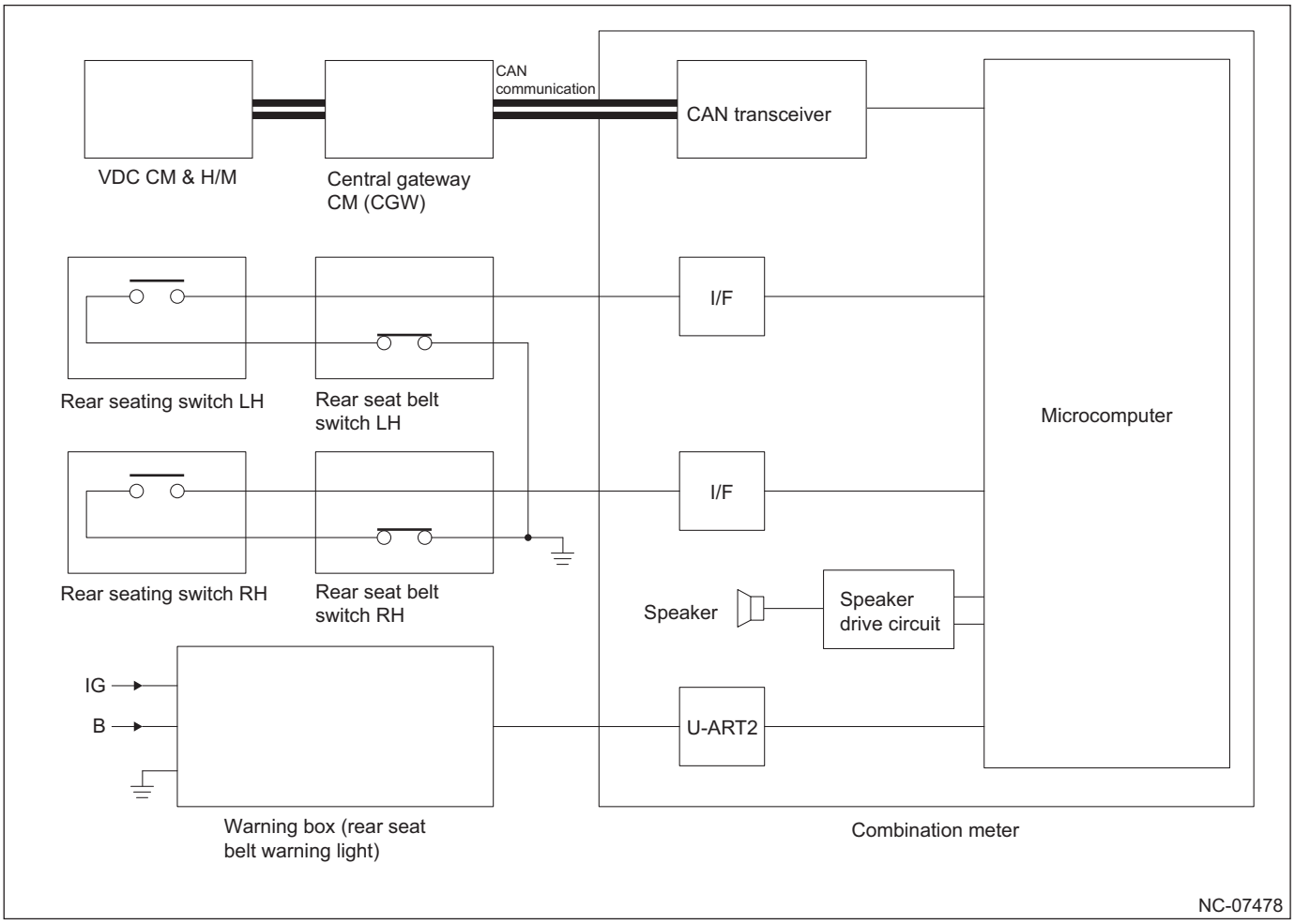
Cockpit Control Module (CCM) cooperative operation

The combination meter microcomputer displays the screen linked with the display of the Center Information Display (CID) based on the display link signal that is exchanged with the Cockpit Control Module (CCM).



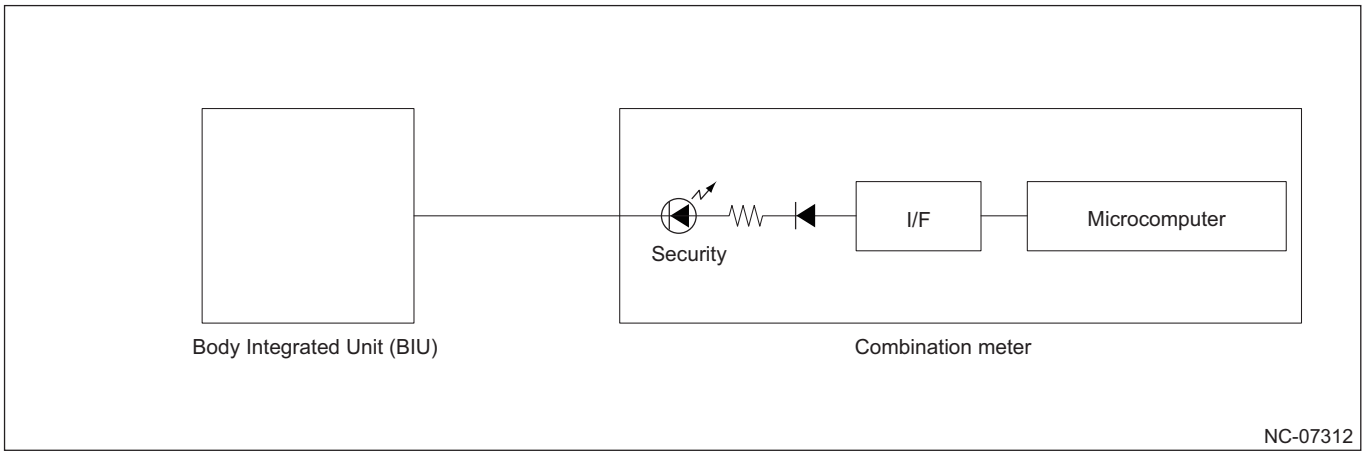
Rear seat belt reminder operation

- 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.



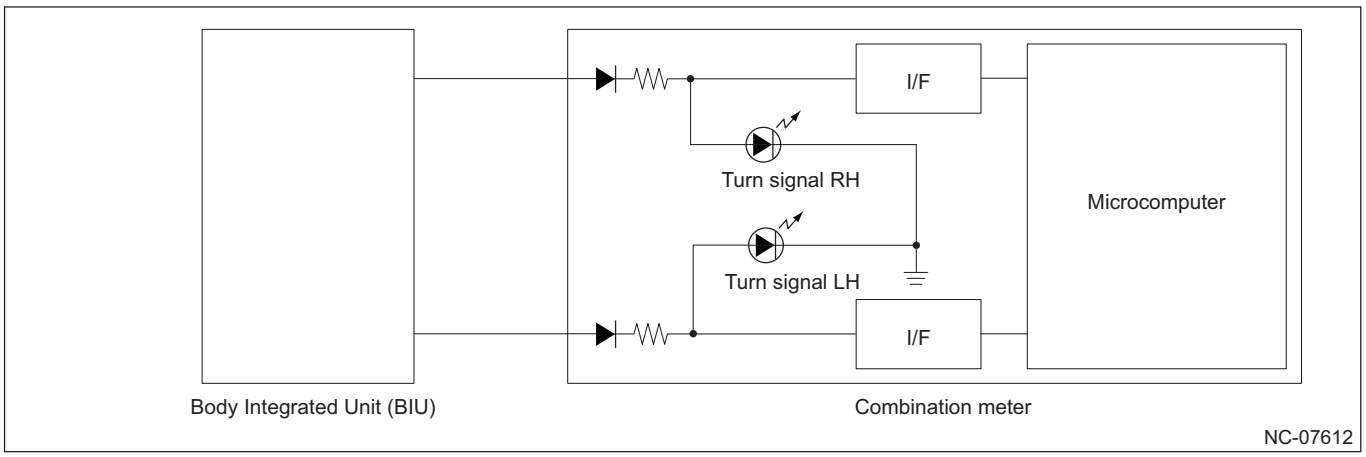
Immobilizer/security operation

The combination meter microcomputer flashes the security indicator light based on the security signal sent from the Body Integrated Unit (BIU).



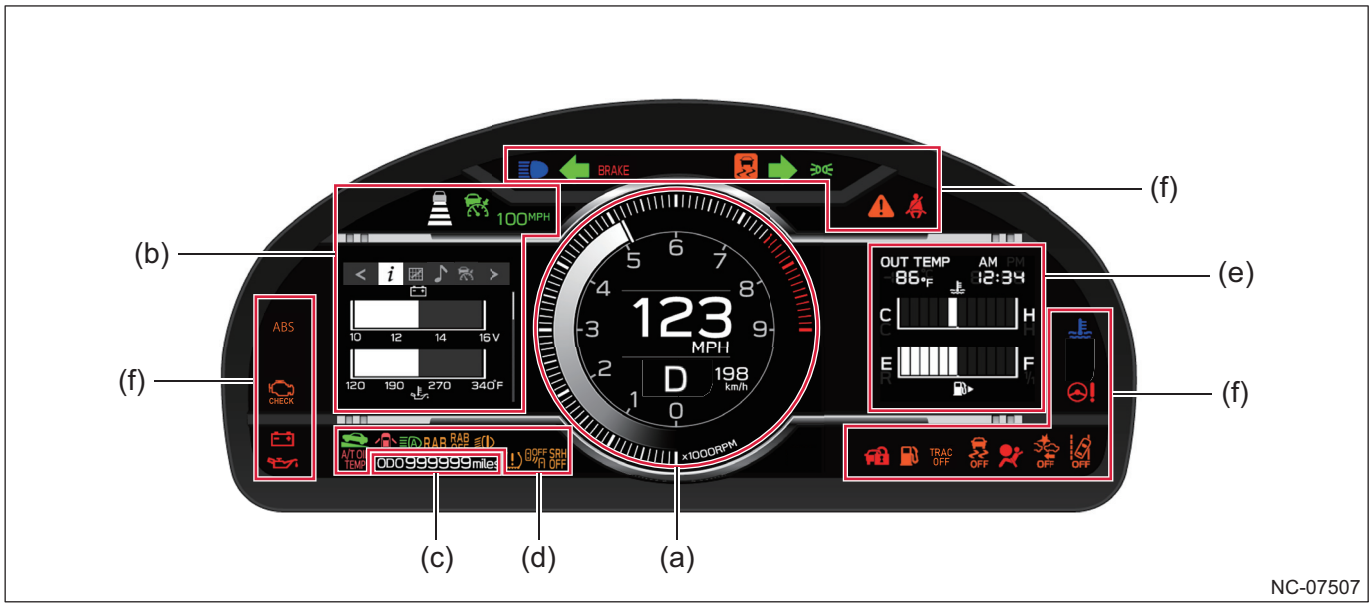
Turn signal operation

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

Display area



**The illustration shows a typical example that may differ from the actual display.*

Reference
The display contents vary depending on the grade and options.

Display area		Display contents
(a)	7-inch TFT color LCD	Tachometer/speedometer • Tachometer • Digital speedometer • Shift indicator
(b)		Multi Information Display (MID) • Drive information • Exclusive SUBARU BRZ contents • Audio information • Driving support function information • Driving support function settings • Setting • Warning messages (interrupt display)
(c)		Basic content • Odometer/trip meter
(d)		• Warning/indicator lights
(e)	LCD segment display	Basic content • Ambient temperature gauge • Clock • Coolant temperature gauge • Fuel gauge
(f)	LED warning/indicator lights	• Warning/indicator lights (LED) • Turn signal lights

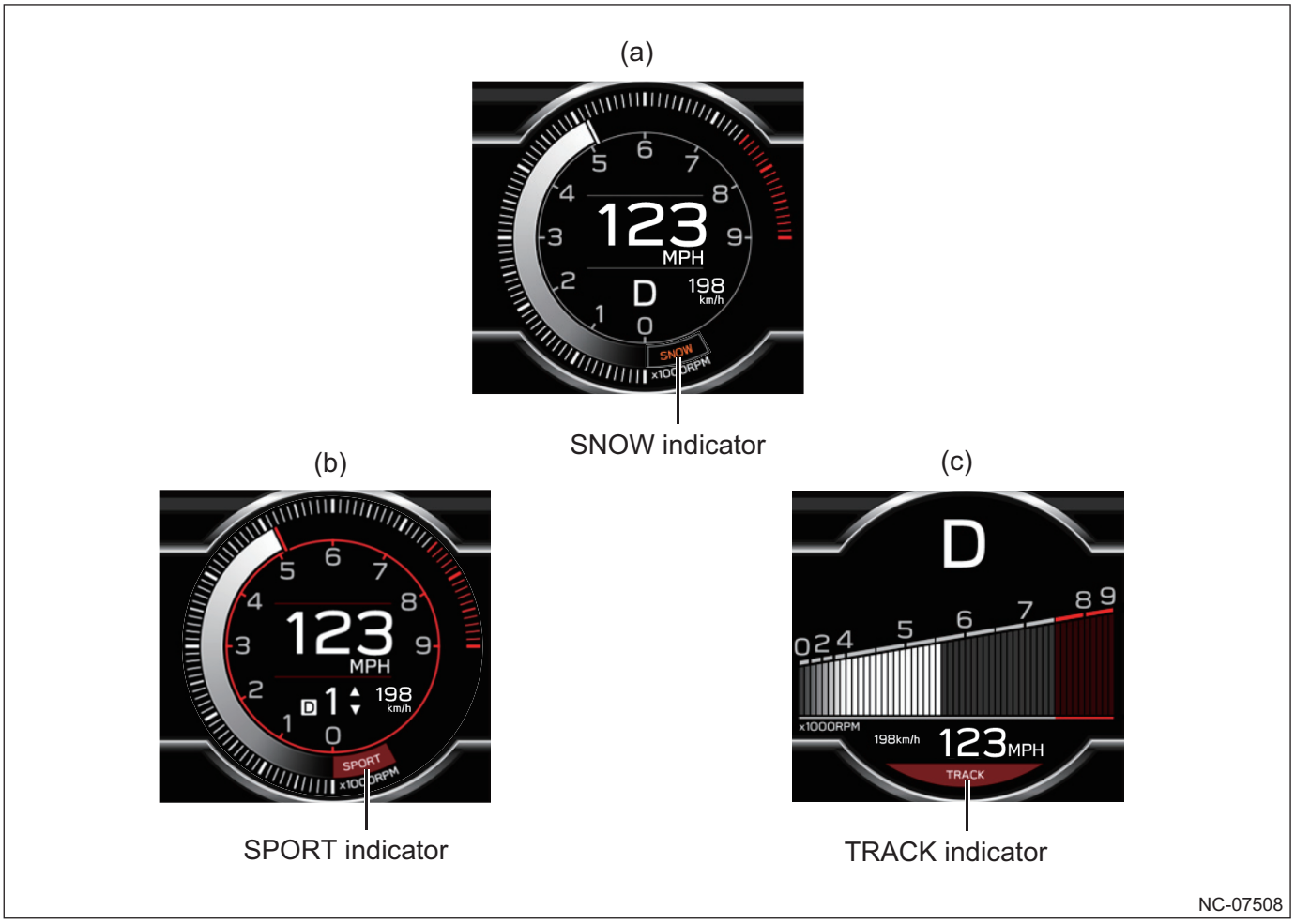
■ Tachometer/speedometer

The 7-inch TFT color LCD contains the digital speedometer and shift indicator, as well as a tachometer with an advanced gradation display.

- Five driving modes are used and can be selected according to driver preferences and the situation. The display contents also change according to the mode.
- A REV indicator has been adopted, and the indicator display can be changed according to the selected driving mode.

Driving modes

5 driving modes are available: Normal mode, SNOW mode, SPORT mode, TRACK mode, and VDC OFF mode.



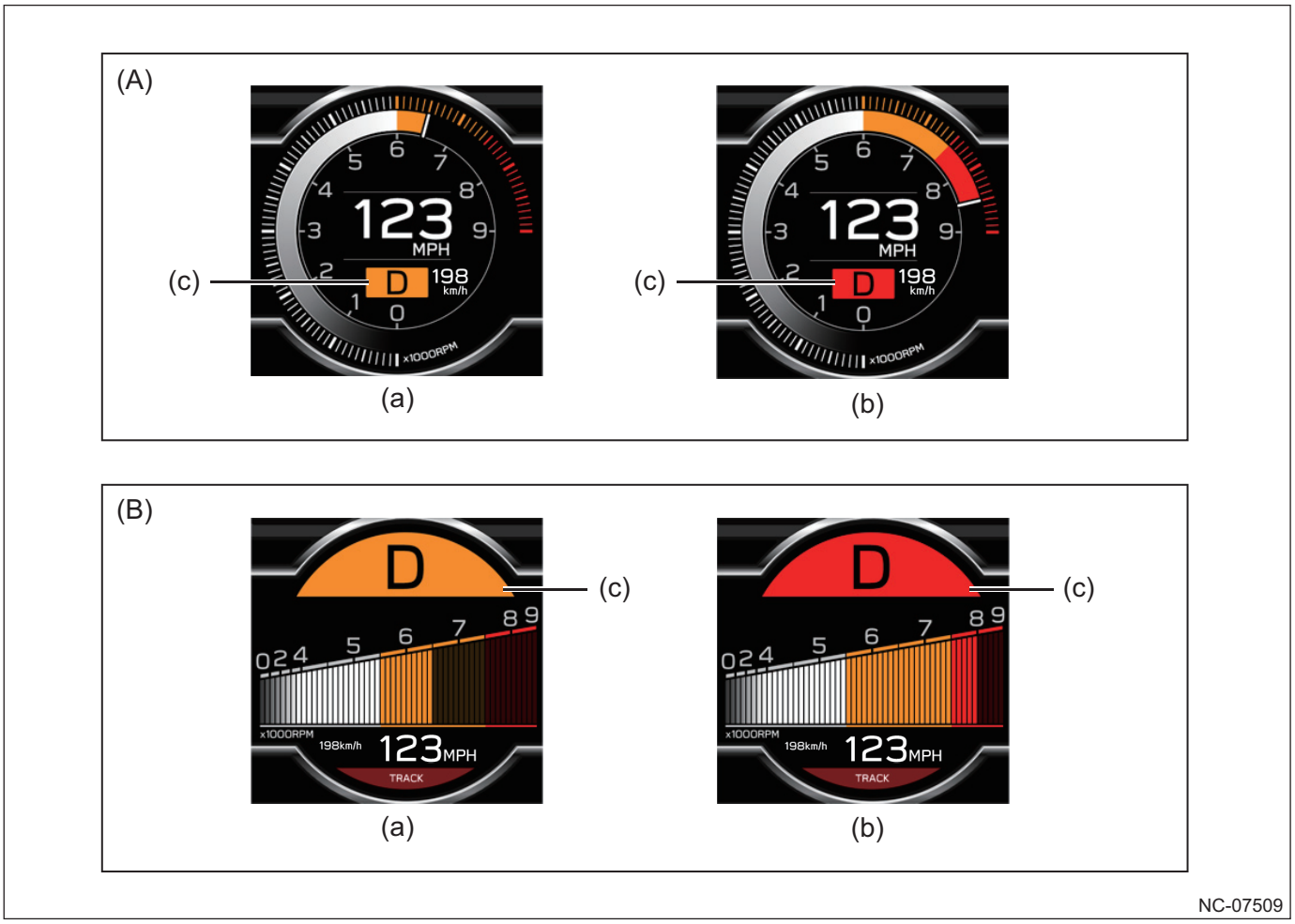
**The illustration shows a typical example that may differ from the actual display.*

Driving modes		Details	Application
(a)	Normal mode	This is the normal screen display, with the digital speedometer and shift indicator displayed in the center and the gauge display tachometer displayed around them.	All models
	SNOW mode	In addition to the normal screen display from normal mode, a SNOW indicator is displayed at the bottom.	AT only
(b)	SPORT mode	• Based on normal mode, the end of the tachometer and ring are displayed in red. • A SPORT indicator is displayed at the bottom.	AT only
(c)	TRACK mode	• The shift indicator is displayed large at the top. • The tachometer speed display type is changed to a bar display, which indicates the engine speed in 500 rpm increments from 0 to 4000 rpm, and in 100 rpm increments from 4000 to 7500 rpm. • A TRACK indicator is displayed at the bottom.	All models
	VDC OFF mode	• In the same way as TRACK mode, the shift indicator is displayed large at the top, and the tachometer is changed to a bar display. • The TRACK indicator is not displayed at the bottom.	All models

REV indicator

A REV indicator has been adopted that illuminates the shift position display in orange and sounds the buzzer when the set engine speed is reached.

- When TRACK mode or VDC OFF mode is selected, the REV indicator is displayed large, both for reasons of visibility during sports driving and to produce an effect similar to a race car.
- When the engine is cold, the red zone is displayed lower than usual.



**The illustration shows a typical example that may differ from the actual display.*

(A) Normal display

(B) TRACK mode/VDC OFF mode

(a) Display when the set engine speed is reached

(b) Display when red zone is reached

(c) REV indicator

■ Multi Information Display (MID)

The Multi Information Display (MID) is placed on the 7-inch TFT color LCD.

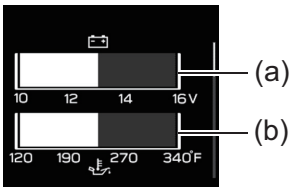
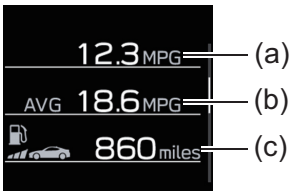
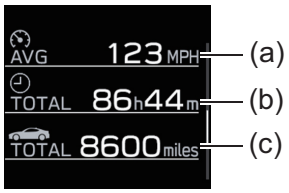
- A multi information display area which allows the display contents to be selected according to driver preferences and the situation has been adopted.
- An interrupt display is set in the multi information display area for the Reverse Automatic Braking.
- A full-time EyeSight display area was adopted so that the EyeSight operating status can be checked at any time.

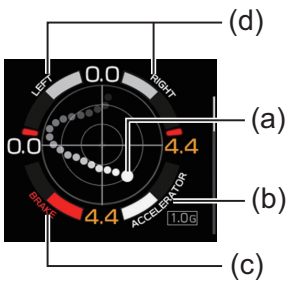
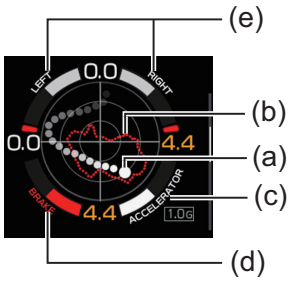
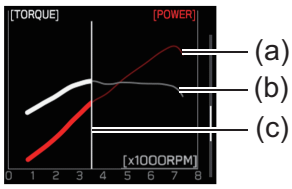
▮ Multi information display area

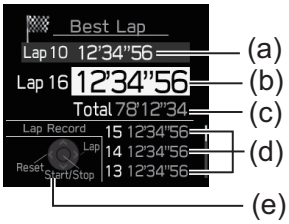
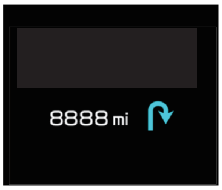
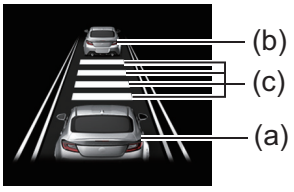
Display contents

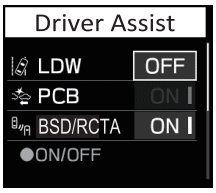
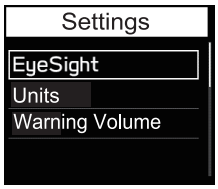
6 content menus are provided: drive information, exclusive SUBARU BRZ contents, driving support function information, driving support function settings, settings, and warning messages.

> **Reference**
> The content menus and display items vary depending on the grade and options.

Content menu	Screen	Display item
Drive information  NC-07192	 NC-07510	Drive information 1 (a) Voltage meter (b) Oil temperature gauge
	 NC-07511	Drive information 2 (a) Momentary fuel consumption (b) Average fuel consumption (c) Remaining fuel cruising distance
	 NC-07512	Drive information 3 (a) Average speed (b) Driving time (c) Driving distance
	 NC-07627	Drive information 4 (tire air pressure display)

Content menu	Screen	Display item
Exclusive SUBARU BRZ contents  NC-07193	 NC-07102	G monitor (track display) (a) Current G value (value resolved into front, back, left, and right) (b) Acceleration opening angle (c) Brake fluid pressure (d) Steering wheel operation amount
	 NC-07103	G monitor (peak hold display) (a) Current G value (value resolved into front, back, left, and right) (b) Maximum G track (c) Acceleration opening angle (d) Brake fluid pressure (e) Steering wheel operation amount
	 NC-07513	Power torque curve (a) Output curve (b) Torque curve (c) Current engine speed
	 NC-07105	Stopwatch (top screen) (a) Fastest lap time

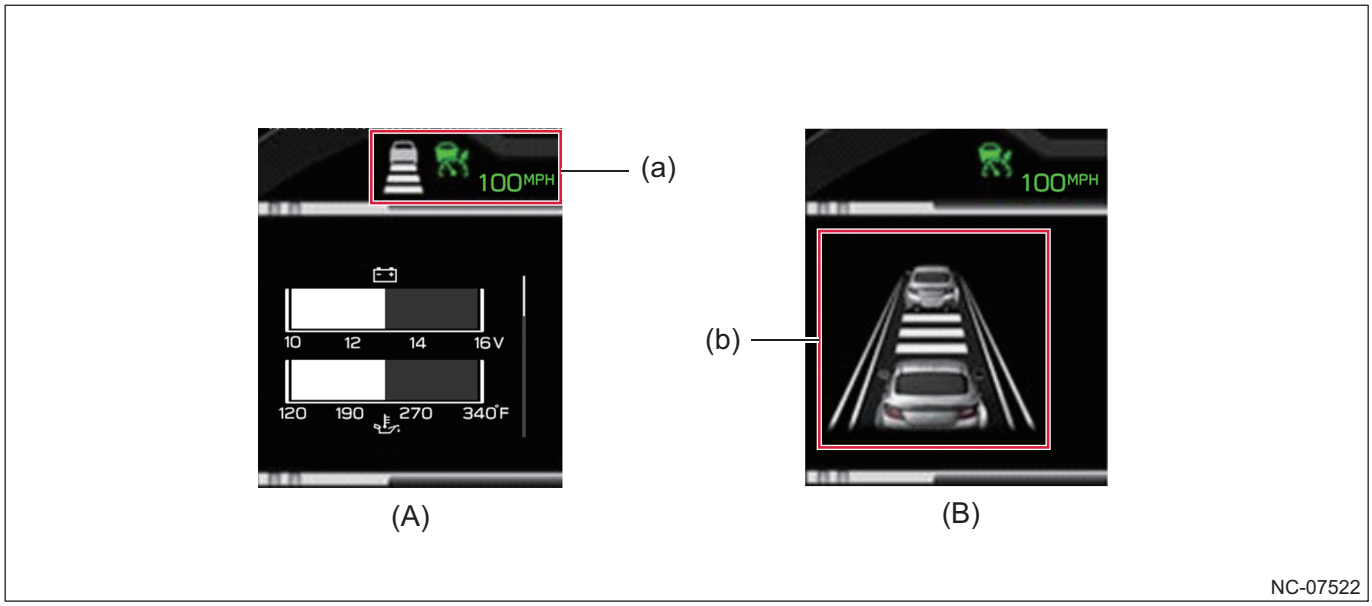
Content menu	Screen	Display item
	 NC-07106	Stopwatch (measurement screen) (a) Fastest lap time (b) Current lap time (c) Total time since measurement start (d) Past lap times (Records up to 50 laps.) (e) Steering Switch operation guide
Navigation information  NC-07514 (Displayed only when Android Auto or Apple CarPlay is connected.)	 NC-08671	Turn-by-Turn
Audio information  NC-07515	 NC-07518	Information about currently playing audio
Driving support function information  NC-07194	 NC-07107	(a) Own vehicle indicator light (b) Preceding vehicle indicator light (c) Set distance between vehicles indicator light

Content menu	Screen	Display item
Driving support function settings  NC-07195	 NC-07628	• LDW (Lane Departure Warning) • PCB (Pre-Collision Braking) • BSD/RCTA (Blind Spot Detection / Rear Cross Traffic Alert) • RAB (Reverse Automatic Braking) • Sonar interruption screen, warning buzzer • SRH (Steering Responsive Headlight)
Setting  NC-07196	 NC-07629	• EyeSight • Units • Warning buzzer volume • Screen setting • Vehicle settings
Warning messages  NC-07197	 NC-07521	Various interrupt displays

**The illustration shows a typical example that may differ from the actual display.*

EyeSight full-time display area (models equipped with EyeSight)

The EyeSight full-time display area continues to display a simplified indication of the EyeSight operating status even when the display on the multi information display area is changed to content other than driving support function information, allowing the distance between vehicles and the operating status to be identified at any time.



**The illustration shows a typical example that may differ from the actual display.*

(A) When content other than driving support function information is displayed on the multi information display area

(B) When driving support function information is displayed on the multi information display area

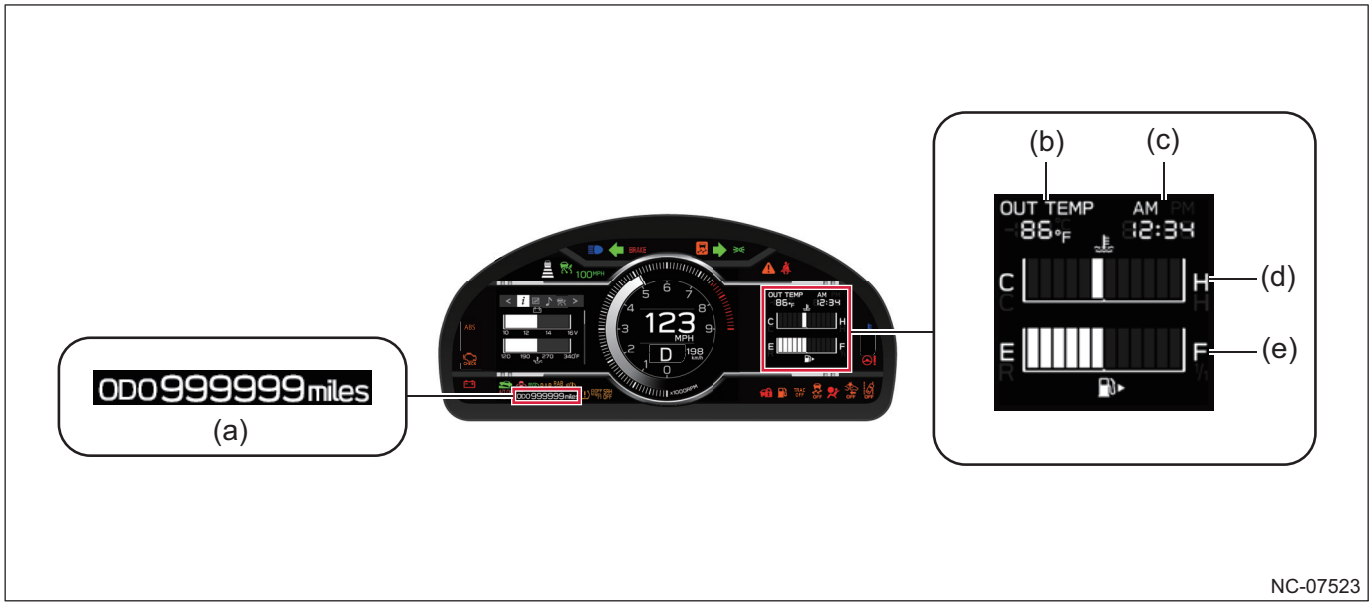
(a) Simplified display of EyeSight status together with other information

(b) More detailed display of EyeSight status

■ Basic content

Basic contents are placed on the 7-inch TFT color LCD and LCD segment display.

- Information which the driver may want to check at any time (odometer/trip meter, ambient temperature gauge, clock, coolant temperature gauge, fuel gauge) is displayed at all times.
- The odometer/trip meter is displayed on the TFT color LCD for improved instantaneous readability and visibility.
- The size of the characters for the ambient temperature gauge and clock has been increased for improved visibility.
- The coolant temperature gauge is displayed with one-point segments, and the fuel gauge is displayed with stacking segments for improved instantaneous readability and visibility.



**The illustration shows a typical example that may differ from the actual display.*

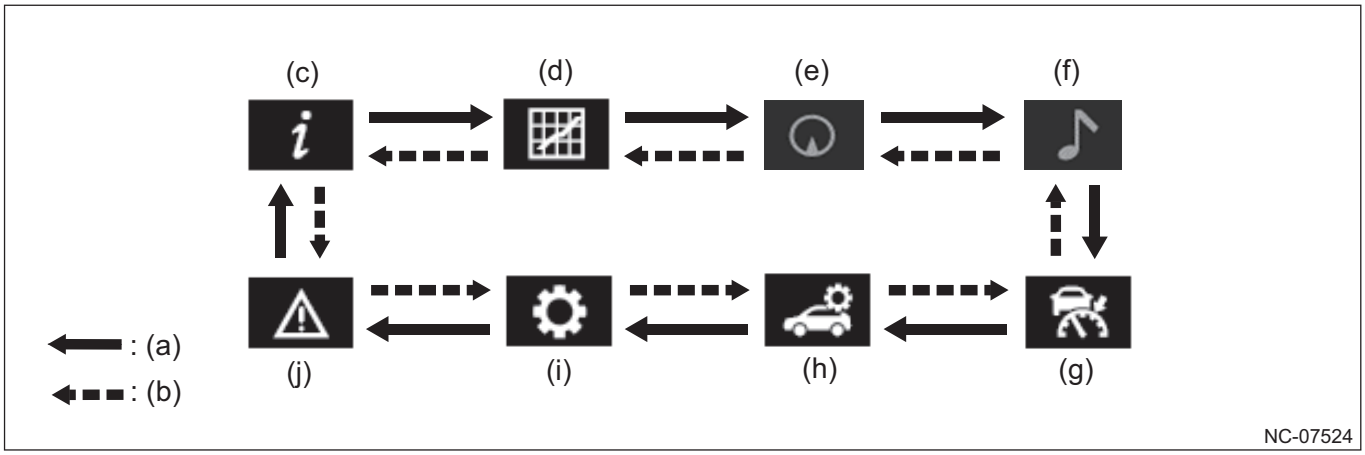
(a) Odometer/trip meter
(b) Ambient temperature gauge
(c) Clock
(d) Coolant temperature gauge
(e) Fuel gauge

Screen transitions

■ Display contents

▮ Changing the content menu

The content menu is changed by operating the left/right buttons located in the satellite switches.



**The illustration shows a typical example that may differ from the actual display.*

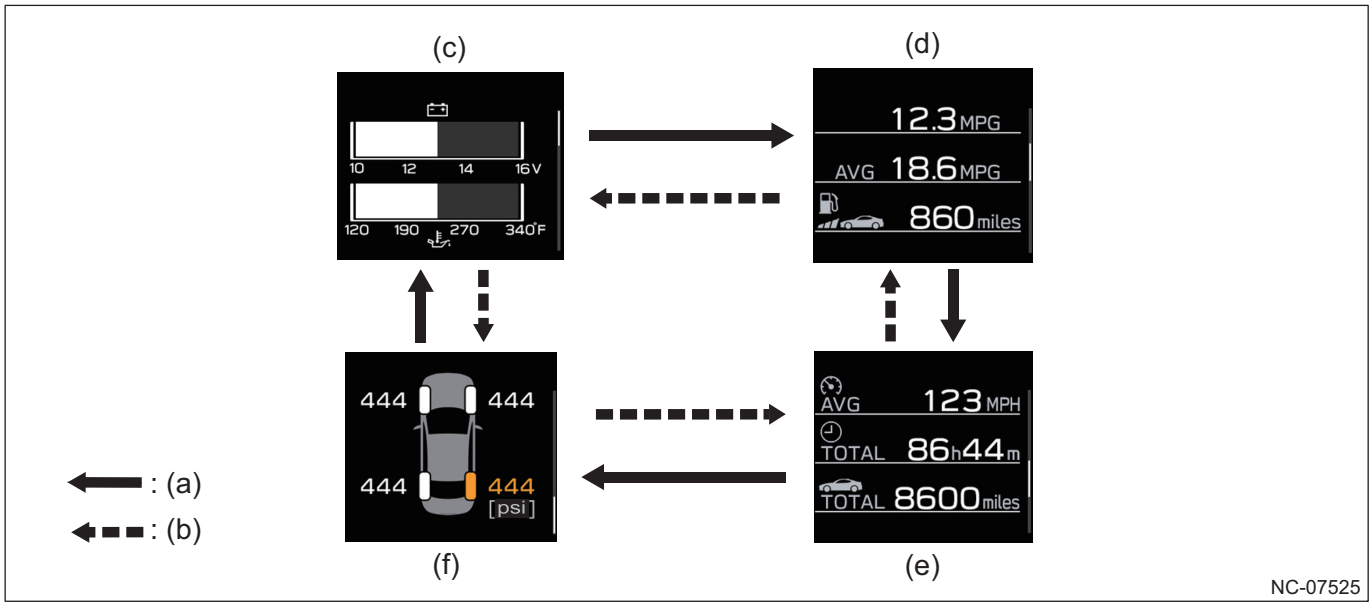
(a) Right button operated
(b) Left button operated
(c) Drive information
(d) Exclusive SUBARU BRZ contents
(e) Navigation information (Displayed only when Android Auto or Apple CarPlay is connected.)
(f) Audio information
(g) Driving support function information
(h) Driving support function settings
(i) Settings
(j) Warning messages

▮ Changing the displayed items

The displayed items are changed by operating the up/down buttons located in the satellite switches.

Reference

- The illustration shows the displayed items for drive information as a typical example.
- The operation for changing the displayed items is the same on other content menus as well.



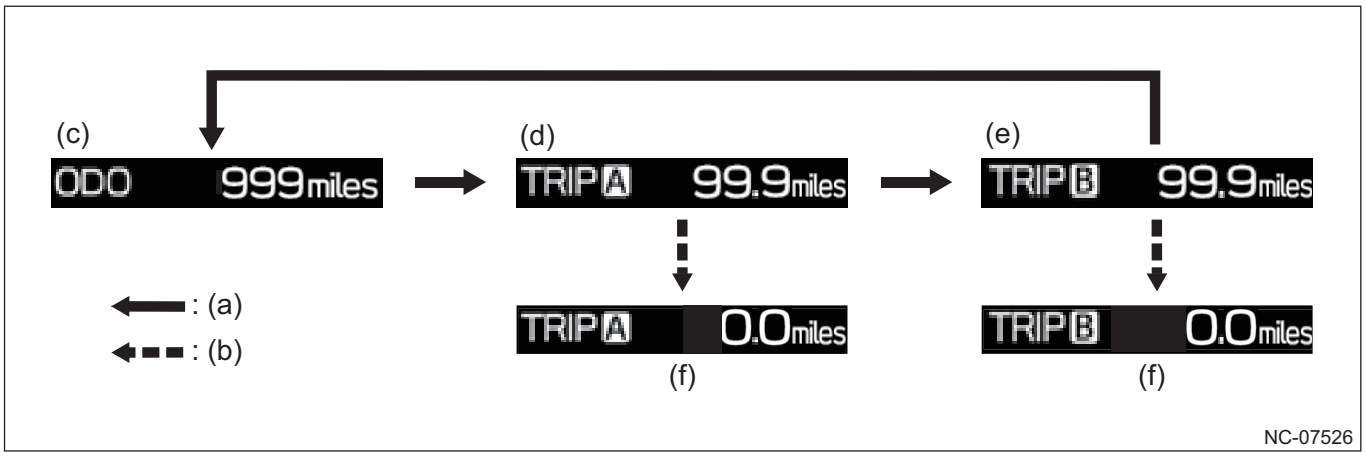
**The illustration shows a typical example that may differ from the actual display.*

(a) Down button operated
(b) Up button operated
(c) Drive information 1
(d) Drive information 2
(e) Drive information 3
(f) Drive information 4

■ Odometer/trip meter

The odometer/trip meter is changed by operating the TRIP/RESET switch.

- A short press of the TRIP/RESET switch changes among ODO, TRIP A, and TRIP B.
- Pressing and holding the TRIP/RESET switch resets the trip.



**The illustration shows a typical example that may differ from the actual display.*

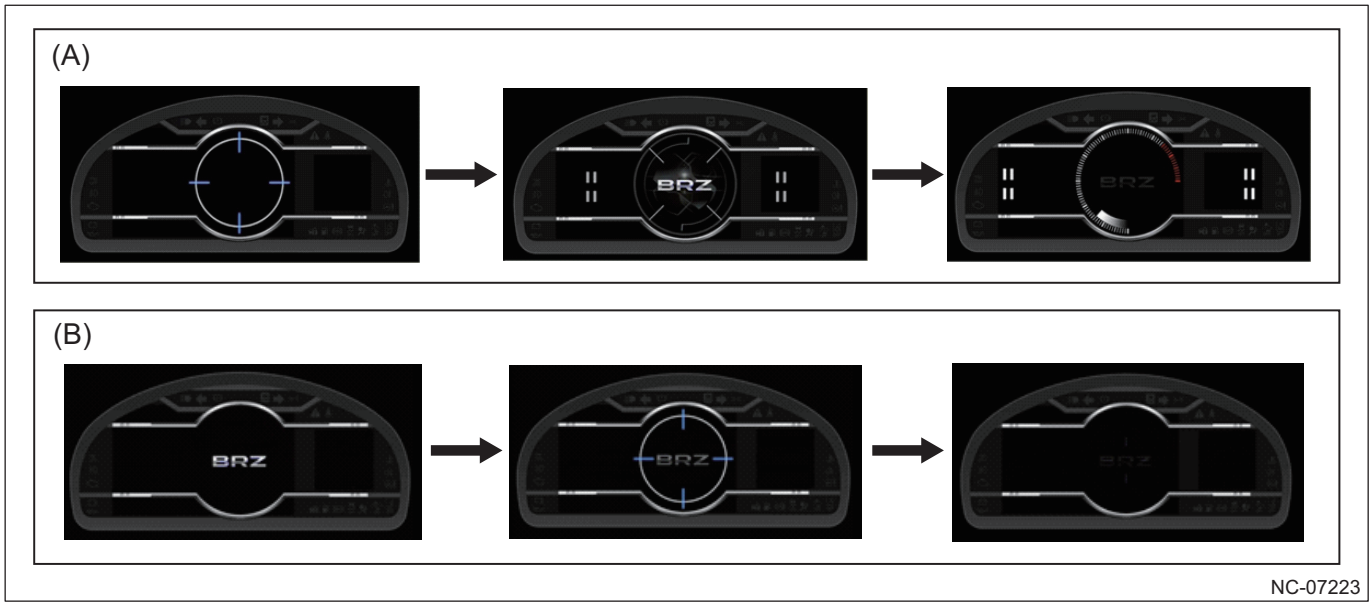
(a) TRIP/RESET switch operation (short press)
(b) TRIP/RESET switch operation (press and hold)
(c) Odometer
(d) TRIP A meter
(e) TRIP B meter
(f) Reset

Function

Opening screen / Ending screen

An animation is displayed to produce a feeling of hospitality when the engine is turned ON/OFF.

Function	Opening screen	When the engine switch is turned ON, the SUBARU BRZ emblem is displayed in the screen center and pistons are displayed on the left and right moving coordinated with the crankshaft in the background, creating an animation that suggests an engine starting.
	Ending screen	When the engine switch is turned OFF, an animation is displayed with the SUBARU BRZ emblem displayed in the screen center and gradually fading out.



(A) Opening screen (B) Ending screen

Speedometer

Displays the own vehicle speed.

Display range	0 to 186 MPH (0 to 300 km/h)

Tachometer

Displays the engine speed.

Display range	0 to 9000 RPM (r/min) • Red zone: 7500 to 9000 RPM (r/min) (when warm), 4500 to 9000 RPM (r/min) (when cold)

Odometer/trip meter

Displays the total mileage driven.

The displayed item is changed by operating the TRIP/RESET switch.

Odometer	Display range	0 to 999999 miles (km)
	Function	When the display reaches the upper limit, it maintains 999999 miles (km).
Trip meter A/B	Display range	0.0 to 9999.9 miles (km)
	Function	When the display reaches the upper limit, it returns from 9999.9 miles (km) to 0.0 miles (km) and continues counting.

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 gauge

Displays the remaining fuel level.

Display details	• E: Approx. 5.2 L or less • Midpoint: Approx. 21.9 to 25.9 L • F: Approx. 44.4 L or more

Coolant temperature gauge

Displays the engine coolant temperature.

Display details	• C: Approx. 108°F (42°C) or less • Mid stable point: Approx. 225°F (107°C) to 230°F (110°C) • H: Approx. 248°F (120°C) or more

Oil temperature gauge

Displays the engine oil temperature.

Display range	120 to 340°F (50 ～ 170 ℃)

Voltage meter

Displays the battery voltage.

Display range	10 to 16 V

Clock

Displays the current time.

Display details	The following 2 patterns can be selected for the display format. • 12 H display • 24 H display

Shift position/shift range indicator light

Indicates the currently selected shift position or shift range.

AT models

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 (shift lever M position/shift lever D position and when paddle shift operated)
	Shift range	• 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 models

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

Driving time

Displays the elapsed time since the engine switch was turned ON.

Display range	00' to 99 h 59 (00 minutes to 99 hours 59 minutes)

Driving distance

Displays the distance driven since the engine switch was turned ON.

Display range	0 to 9999 miles (km)

Average fuel consumption

Displays the average fuel consumption at each trip meter reset.

Display range	0 to 76.2 MPG (0 to 32.4 km/L)

Momentary fuel consumption

Displays the momentary fuel consumption during driving.

Display range	0 to 127 MPG (0 to 54 km/L)

Remaining fuel cruising distance

Displays the distance that can be driven with remaining amount of fuel.

Display range	10 to 9999 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.

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 switch on the instrument panel on the driver's seat side.

Telltale

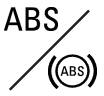
Warning lights that notify the user of various system trouble, and indicator lights that notify the user of the headlight status and the ON/OFF status of various functions have been adopted.

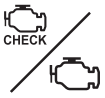
LED are used for the warning lights and indicator lights, reducing power consumption and extending the lifetime.

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 warning light	Red	Turns on when the engine switch is turned ON, and then turns off after a certain length of time if there are no abnormalities. 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.
	Parking brake negative pressure warning light	Red	• Turns on when the engine switch is turned ON, and then turns off after a certain length of time if there are no abnormalities. • Turns on when there is trouble in the system.
	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.
	ABS warning light	Yellow	• Turns on when the engine switch is turned ON, and then turns off after a certain length of time if there are no abnormalities. • Turns on when there is trouble in the ABS (Anti-lock Brake System) or brake assist.
	SRS airbag system warning light	Red	• Turns on when the engine switch is turned ON, and then turns off after a certain length of time if there are no abnormalities. • Turns on when there is trouble in the SRS airbag system or in the seat belt system equipped with pretensioner.
	Engine oil pressure warning light	Red	• Turns on when the engine switch is turned ON, and then turns off after a certain length of time if there are no abnormalities. • 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
	AT oil temperature warning light	Red	Turns on when the AT transmission fluid temperature is high.
	Charge warning light	Red	• Turns on when the engine switch is turned ON, and then turns off after a certain length of time if there are no abnormalities. • 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, and then turns off after a certain length of time if there are no abnormalities. • Turns on when there is trouble in the engine electronic control system, electronic control throttle, or AT electronic control system while the engine is running.
	Low fuel warning light	Yellow	• Turns on when the engine switch is turned ON, and then turns off after a certain length of time if there are no abnormalities. • Turns on when the amount of remaining fuel is approximately 7 L or less.
	VSC (VDC) warning light	Yellow	• Turns on when the engine switch is turned ON, and then turns off after a certain length of time if there are no abnormalities. • Turns on when there is trouble in the VSC (VDC) system, TRC system, or Hill Start Assist 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 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.
	Coolant temperature warning light	Red	Turns on when the engine switch is turned ON, and then turns off after a certain length of time. Turns on or flashes according to the coolant temperature. • Flashes when the coolant temperature is approaching overheating and turns on when overheating occurs.
	Steering control warning light	Red	• Turns on when the engine switch is turned ON, and then turns off after a certain length of time if there are no abnormalities. • Turns on when there is trouble with the power steering while the engine is running.

Warning light	Name	Indication color	Details
	SRH warning light	Yellow	• Turns on when the engine switch is turned ON, and then turns off after a certain length of time if there are no abnormalities in the system. • Turns on when there is trouble in the SRH.
	RAB warning light	Yellow	Turns on when there is trouble in the RAB.
	Master warning	Yellow	• Turns on when the engine switch is turned ON, and then turns off after a certain length of time if there are no abnormalities. • Turns on or flashes together with a buzzer sound when there is system trouble, and a warning message is displayed on the multi information display.
	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.
	Conventional Cruise Control warning light	Yellow	Turns on when there is trouble with the Conventional Cruise Control.
	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
	Parking brake operation light	Red	• Turns on when the engine switch is turned ON, and turns off when the parking brake is fully released. • Turns on during operation.
	Turn signal switch indicator lights	Green	Flashes when the turn signal or hazard lights are operating.

Indicator lights	Name	Indication color	Details
	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.
	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.
	VSC (VDC) operation indicator light	Yellow	• Turns on when the engine switch is turned ON, and then turns off after a certain length of time if there are no abnormalities. • Flashes when the TRC function activates or when the VSC (VDC) function activates.
	VSC (VDC) OFF indicator light	Yellow	• Turns on when activation of the VSC (VDC) function is turned OFF. • Turns on when TRACK mode is selected.
	BSD/RCTA OFF indicator light	Yellow	Turns on when BSD/RCTA is temporarily stopped or when BSD/RCTA is turned OFF.
	SRH OFF indicator light	Yellow	Turns on when SRH is turned OFF.
	Adaptive Cruise Control indicator light	White/ green	• Turns on when Adaptive Cruise Control is ON. • 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 Adaptive Cruise Control is ON and the distance between vehicles setting switch is pressed and held. (AT) • Turns on when the Cruise Control switch is pressed. (MT) • Changes from white to green when Conventional Cruise Control is set.

Indicator lights	Name	Indication color	Details
 NC-05938	READY indicator light	-	Turns on when Cruise Control can be set.
 NC-07119	Preceding vehicle indicator light	-	• Turns on when Adaptive Cruise Control is set and a preceding vehicle is recognized. • An icon is displayed when content other than driving support function information is displayed on the Multi Information Display (MID).
 NC-07120	Preceding vehicle indicator light (icon display)		
 NC-07191	Own vehicle indicator light	-	The brake lights on the display illuminate red when the driver depress the brake pedal or brake control activates.
 NC-06312	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. • An icon is displayed when content other than driving support function information is displayed on the Multi Information Display (MID).
 NC-07121	Set distance between vehicles indicator light (icon display)		
 NC-07122	Set vehicle speed display	-	Displays the set vehicle speed.
 NC-07123	EyeSight temporary stop indicator light	White	• Turns on if the Cruise Control switch or distance between vehicles setting switch is pressed within approximately 7 seconds after engine start, and turns off approximately 7 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. (Reverse Automatic Braking may be used in some cases.)
 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 7 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-07723	Pre-collision brake OFF indicator light	Yellow	• Turns on when the engine switch is turned ON, then turns off approximately 7 seconds after engine start. • Turns on when Pre-Collision Braking and Pre-Collision Throttle Management are OFF.

Indicator lights	Name	Indication color	Details
	Low temperature indicator light	Yellow	• Turns on when the ambient temperature is 37°F (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 41°F (5°C) or higher.
	RAB OFF indicator light / Temporary stop indicator light	Yellow	Turns on when the vehicle stops as a result of automatic (damage reduction) brake activation, and turns off when the shift lever is moved to any position other than R. Turns on when RAB is temporarily stopped or when automatic (damage reduction) brake is turned OFF.
	Hill Start Assist activation indicator light	Green	Turns on when Hill Start Assist is set. Also turns on when Hill Start Assist is activated.
	TRAC OFF	Yellow	Turns on when TRAC is turned OFF.
	Coolant temperature indicator	Blue	Turns on when the coolant temperature is low, and turns off when the coolant temperature rises to the normal value.
	SNOW mode	-	Turns on when SNOW mode is selected.
	SPORT mode	-	Turns on when SPORT mode is selected.
	TRACK mode	-	Turns on when TRACK mode is selected.

Customization function

A customization function has been adopted which allows the various combination meter displays, function ON/OFF, and displayed items to be changed.

The customization settings are operated using the satellite switch meter operation buttons.

Reference

Whether or not a particular customization item is present depends on the destination, grade and options.

Driving support function settings

Customization item	Details
LDW	Lane Departure Warning can be turned ON/OFF. • ON: Lane Departure Warning is performed. • OFF: Lane Departure Warning is not performed.
PCB	Pre-Collision Braking can be turned ON/OFF. • ON: Pre-Collision Braking is performed. • OFF: Pre-Collision Braking is not performed.
BSD/RCTA	Blind Spot Detection / Rear Cross Traffic Alert can be turned ON/OFF. • ON: Blind Spot Detection / Rear Cross Traffic Alert operates. • OFF: Blind Spot Detection / Rear Cross Traffic Alert does not operate.
RAB	Reverse Automatic Braking can be turned ON/OFF. • ON: Reverse Automatic Braking is performed. • OFF: Reverse Automatic Braking is not performed.
 NC-07257	The sonar interrupt displays and warning buzzer can be turned ON/OFF. • ON: Interrupt displays and buzzer sounding are performed. • OFF: Interrupt displays and buzzer sounding are not performed.
SRH	Steering responsive headlight can be turned ON/OFF. • ON: Steering responsive headlight operates. • OFF: Steering responsive headlight does not operate.

Setting

Customization item			Details
EyeSight	Acquisition Sound		The preceding vehicle recognition sound can be turned ON/OFF. • ON: The detection sound occurs. • OFF: The detection sound does not occur.
	Start Alert		Lead Vehicle Start Alert can be turned ON/OFF. • ON: Lead Vehicle Start Alert is performed. • OFF: Lead Vehicle Start Alert is not performed.
	Accel Lv.		The Cruise Control acceleration level can be selected from 4 patterns. • Lv.1 (eco): Acceleration is focused on reducing fuel consumption. • Lv.2 (comfort): Acceleration is slower than standard. • Lv.3 (standard): Acceleration is the standard level. • Lv.4 (dynamic): Acceleration is faster than standard.
	Select Drive Lane		The traffic category can be changed between right-hand traffic and left-hand traffic. • Right Lane: Control for right-hand traffic is performed. • Left Lane: Control for left-hand traffic is performed.
Units			The display units can be selected from 2 patterns. • miles, MPH, MPG • km, km/h, L/100 km
Warning Volume			The warning buzzer volume can be selected from 3 patterns. • Max: Large warning sounds occur. • Mid: Medium warning sounds occur. • Min: Small warning sounds occur.
Screen Settings	Startup Scrn		The opening screen can be turned ON/OFF. • ON: The opening screen is displayed. • OFF: The opening screen is not displayed.
	GSI		The gear shift indicators (shift position and upshift/downshift possible indicator light) can be turned ON/OFF. • ON: The gear shift indicators are displayed. • OFF: The gear shift indicators are not displayed.
	REV.	Indicator	The REV indicator can be turned ON/OFF. • ON: The REV indicator is displayed. • OFF: The REV indicator is not displayed.
		RPM	The engine speed at which the REV indicator is displayed can be set. • It can be set in the range of 2000 to 7400 rpm.
		Buzzer	The buzzer can be turned ON/OFF. • ON: The buzzer sounds. • OFF: The buzzer does not sound.

Customization item			Details
Car Settings	Keyless Entry	Buzzer	The buzzer can be turned ON/OFF. • ON: The buzzer sounds. • OFF: The buzzer does not sound.
		Hazard Flasher	Turn the hazard lights ON/OFF. • ON: The hazard lights flash. • OFF: The hazard lights do not flash.
		Driver Door Unlock	Driver's door unlock operation can be selected from 2 patterns. • Driver Door Only: Only the driver's door is unlocked. • All: All doors are unlocked.
	Defogger		Select the activation time for the rear window defogger and heated door mirror. • 15 minutes: The functions turn OFF automatically after approximately 15 minutes. • Continuous: The functions operate until the rear window defogger and heated door mirror switch is turned OFF.
	Interior Light		The time between when the engine switch is turned OFF and when the interior illumination automatically turns off can be selected from 3 patterns. • 7.5 seconds: The interior illumination turns off after approximately 7.5 seconds. • 15 seconds: The interior illumination turns off after approximately 15 seconds. • 30 seconds: The interior illumination turns off after approximately 30 seconds.
	Auto Light Sensor	Light Sensitivity	The sensitivity of auto light activation can be selected from 5 patterns. • Min: The time before auto light reacts is slower than standard. • Low: The time before auto light reacts is slightly slower than standard. • Mid: Standard time before auto light reacts. • High: The time before auto light reacts is slightly faster than standard. • Max: The time before auto light reacts is faster than standard.
		Wiper Link	The function which turns on the auto light linked with wiper operation can be turned ON/OFF. • ON: Auto light turns on linked with wiper operation. • OFF: Not linked with wiper operation.

Customization item			Details
Car Settings	Welcome Lighting	Approaching Time Set	The welcome light activation time when boarding can be selected from 4 patterns. • 30 seconds: Welcome light turns on for approximately 30 seconds. • 60 seconds: Welcome light turns on for approximately 60 seconds. • 90 seconds: Welcome light turns on for approximately 90 seconds. • OFF: Welcome light does not turn on.
		Leaving Time Set	The welcome light activation time when exiting can be selected from 4 patterns. • 30 seconds: Welcome light turns on for approximately 30 seconds. • 60 seconds: Welcome light turns on for approximately 60 seconds. • 90 seconds: Welcome light turns on for approximately 90 seconds. • OFF: Welcome light does not turn on.
	1-Touch LN CHGR		The function which flashes the turn signal lights 3 times when one-touch operation of the turn signal switch is performed can be turned ON/OFF. • ON: Turn signal light flashes 3 times when one-touch operation is performed. • OFF: Turn signal light does not flash 3 times when one-touch operation is performed.

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.

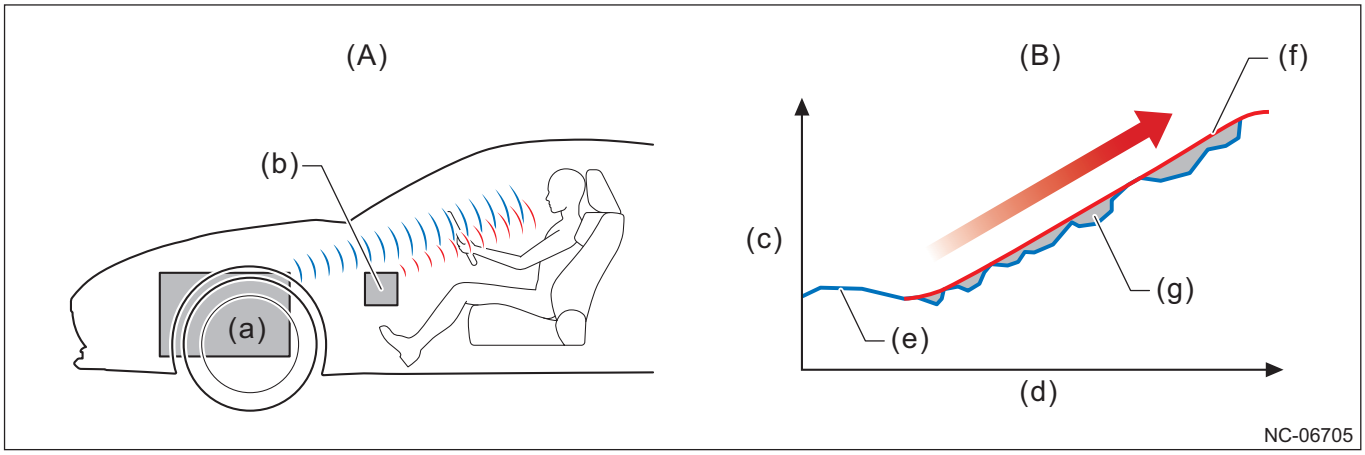
11.4 Active Sound Control

11.4.1 Overview

Overview

- The electrical engine sound is output from a special speaker installed inside the instrument panel, providing active sound control that reproduces a natural sound similar to that produced by an engine.
- The sound varies according to the engine speed, acceleration opening angle, transmission information (AT models), and other factors, and is output from a special speaker, complementing the actual engine sound.
- It creates an energetic sound that increases in pitch at higher engine speeds, producing an engine sound with a good revving feel.

Operation image of active sound control



(A)	Image of engine sound reaching occupants	(B)	Image of complementary engine sound
(a)	Engine	(e)	Actual engine sound
(b)	Active sound control speaker	(f)	Engine sound heard by the occupants
(c)	Engine sound	(g)	Area that is complemented by active sound control
(d)	Engine speed		

Specifications

Active sound control speaker

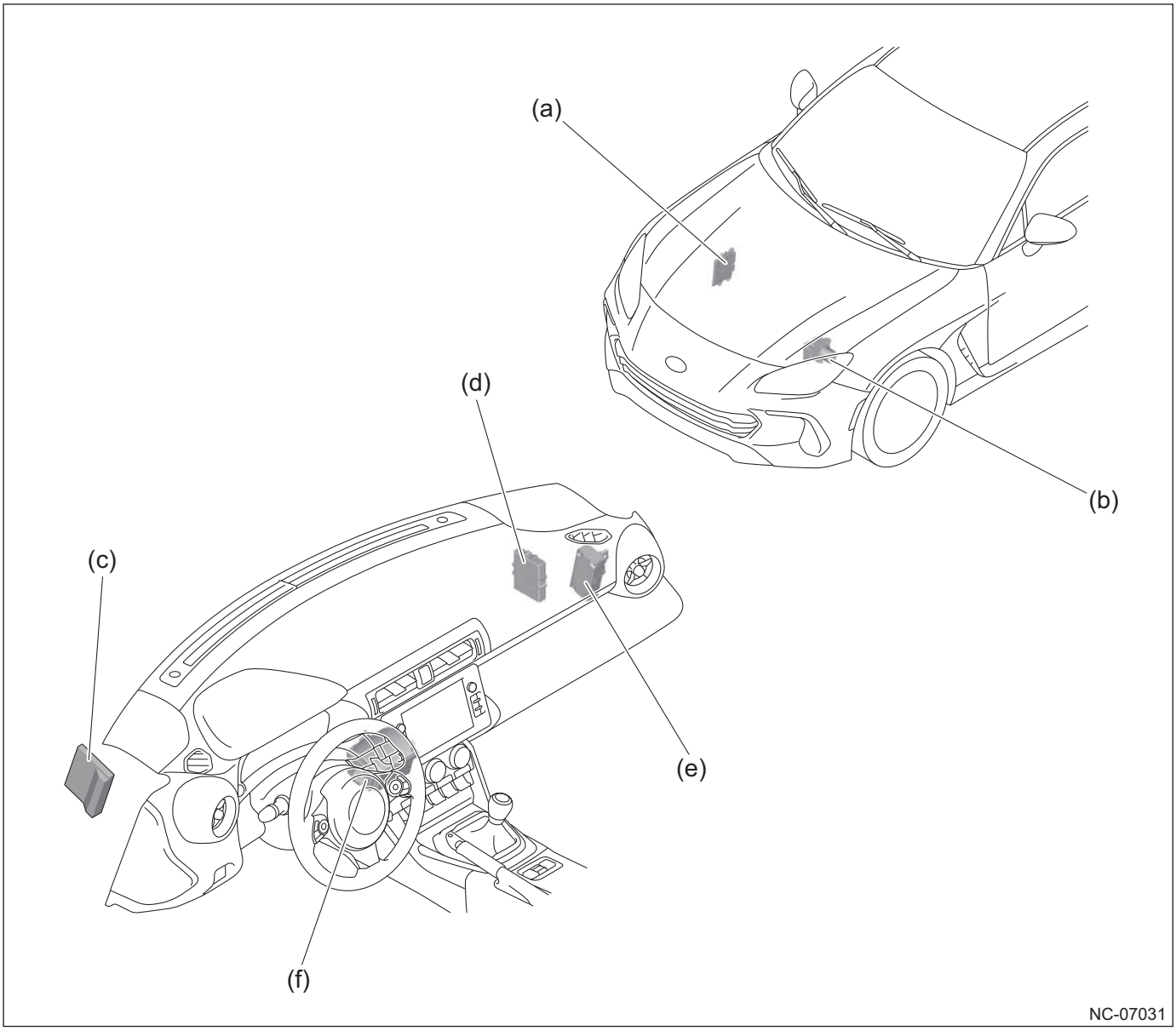
Diameter [mm]	Rated input (maximum input) [W]	Usage	Playback frequency range
80	5 (10)	Medium-bass to medium-treble	180 Hz to 5 kHz

Characteristics

- Active sound control outputs a relatively restrained sound during city driving and other everyday driving, producing an engine sound that does not produce feelings of stress. During sports driving, it produces a powerful sound output with a good revving feel, for a sound that is suitable for both everyday driving and sports driving.
- This function supports the SUBARU Select Monitor (SSM), and active sound control can be turned ON/OFF. For details, refer to the customization settings. {11-98}

11.4.2 Component

Component layout drawing



(a)	Engine Control Module (ECM)	(d)	Central gateway CM (CGW)
(b)	VDC control module and hydraulic control module (VDC CM & H/M)	(e)	Active sound control module
(c)	Transmission Control Module (TCM)	(f)	Active sound control speaker

Component details

Active sound control module

This is installed inside the instrument panel, and contains a microcontroller that calculates the optimal engine sound complement range frequency according to the vehicle control conditions, a sound source ROM for electronic sound, a sound synthesizing processor that synthesizes the electronic sound, and a power amplifier that amplifies the electronic sound.

It receives signals via CAN communication from the modules installed at various parts of the vehicle, and operates active sound control.

It supports the SUBARU Select Monitor (SSM), and active sound control can be customized, the operation conditions can be inspected, and diagnosis can be performed.

Active sound control speaker

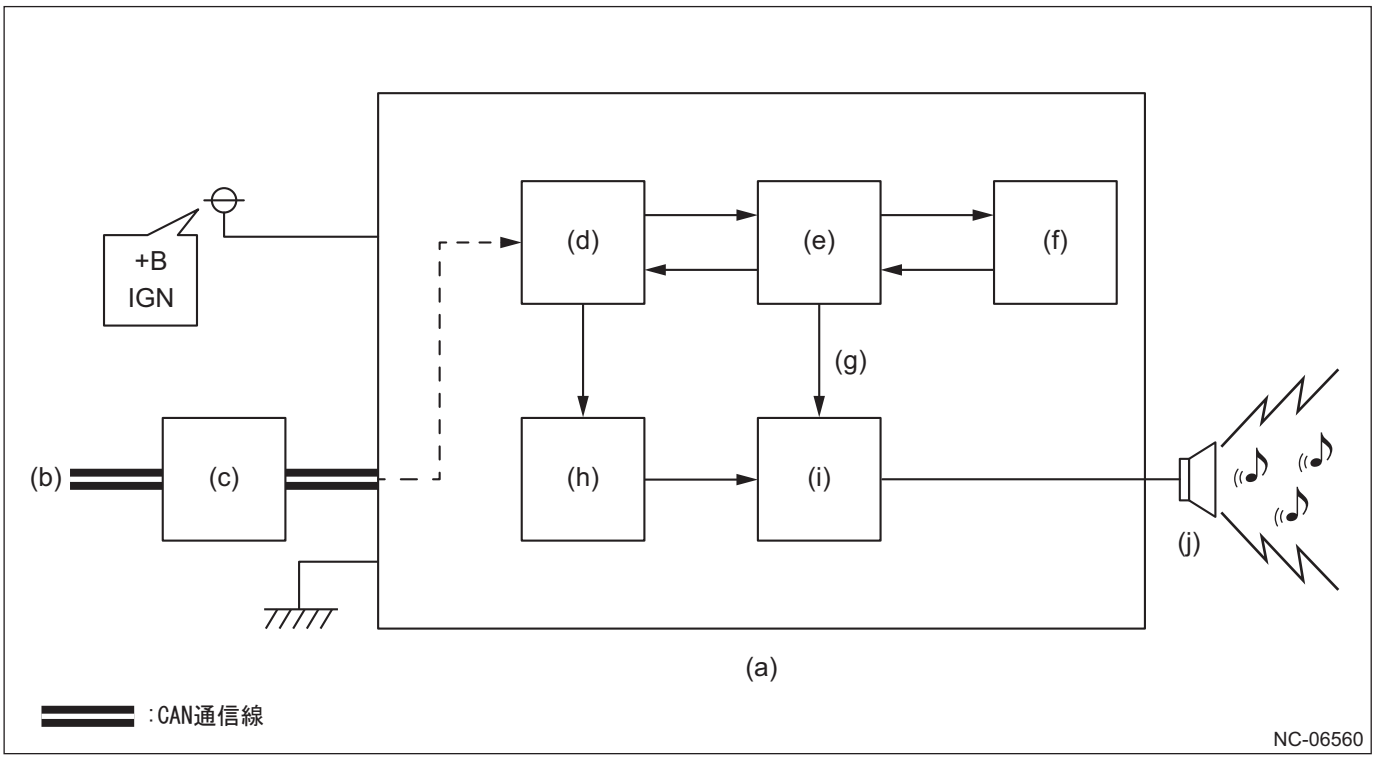
In order to prevent diminished audio performance caused by sound wraparound, an enclosure-type speaker is used, and is installed in a box with sufficient capacity to deliver full speaker performance.

The speaker is installed inside the center of the instrument panel, aiming to produce reflection and dispersion effects for the output sound.

11.4.3 Construction and Operation

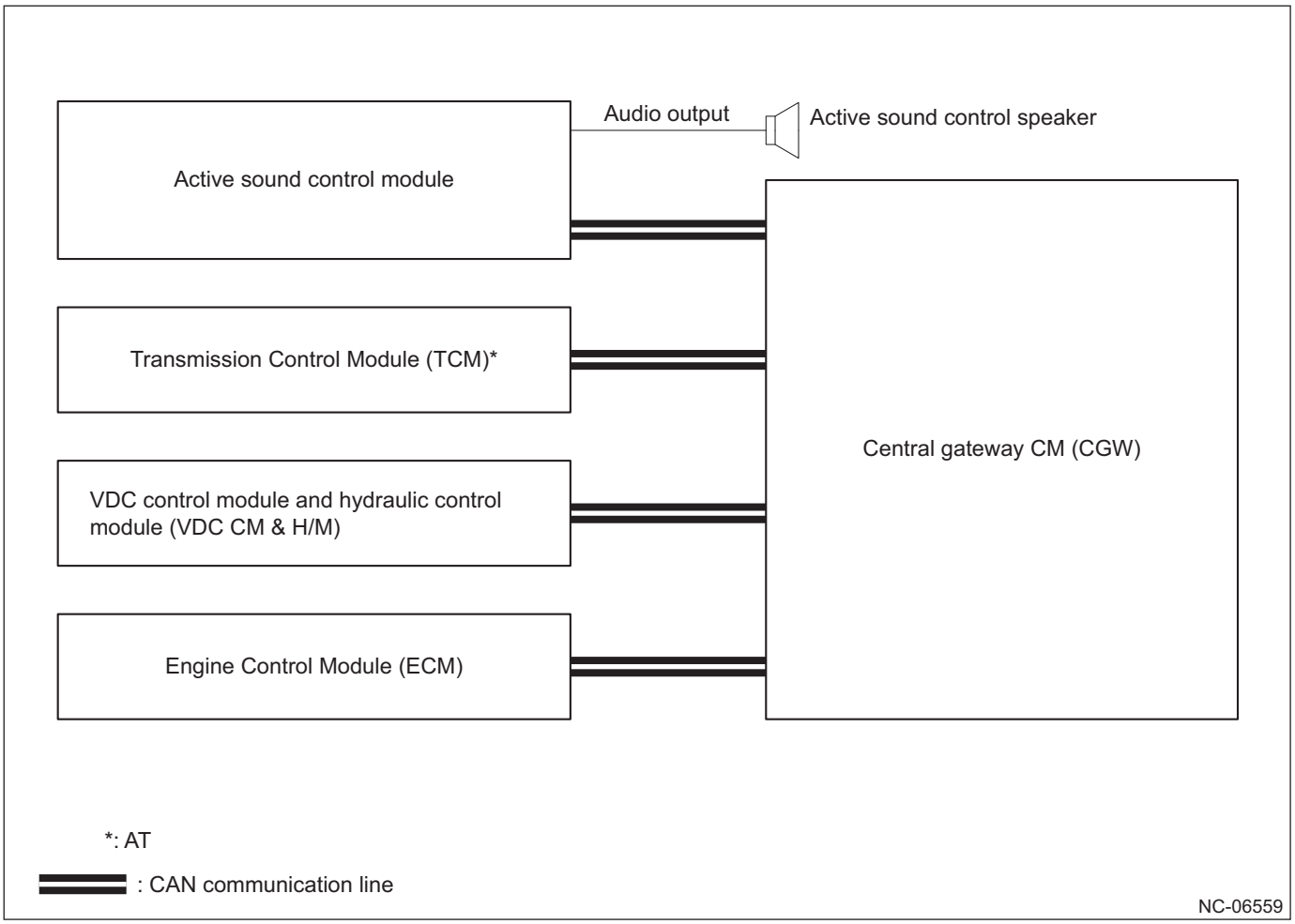
System diagram

System configuration diagram



(a)	Active sound control module	(f)	Sound source ROM
(b)	CAN communication	(g)	Sound signal
(c)	Central gateway CM (CGW)	(h)	Sound ON/OFF
(d)	Micro controller	(i)	Power Amplifier
(e)	Sound synthesizing processor	(j)	Active sound control speaker

System block diagram



Main component functions

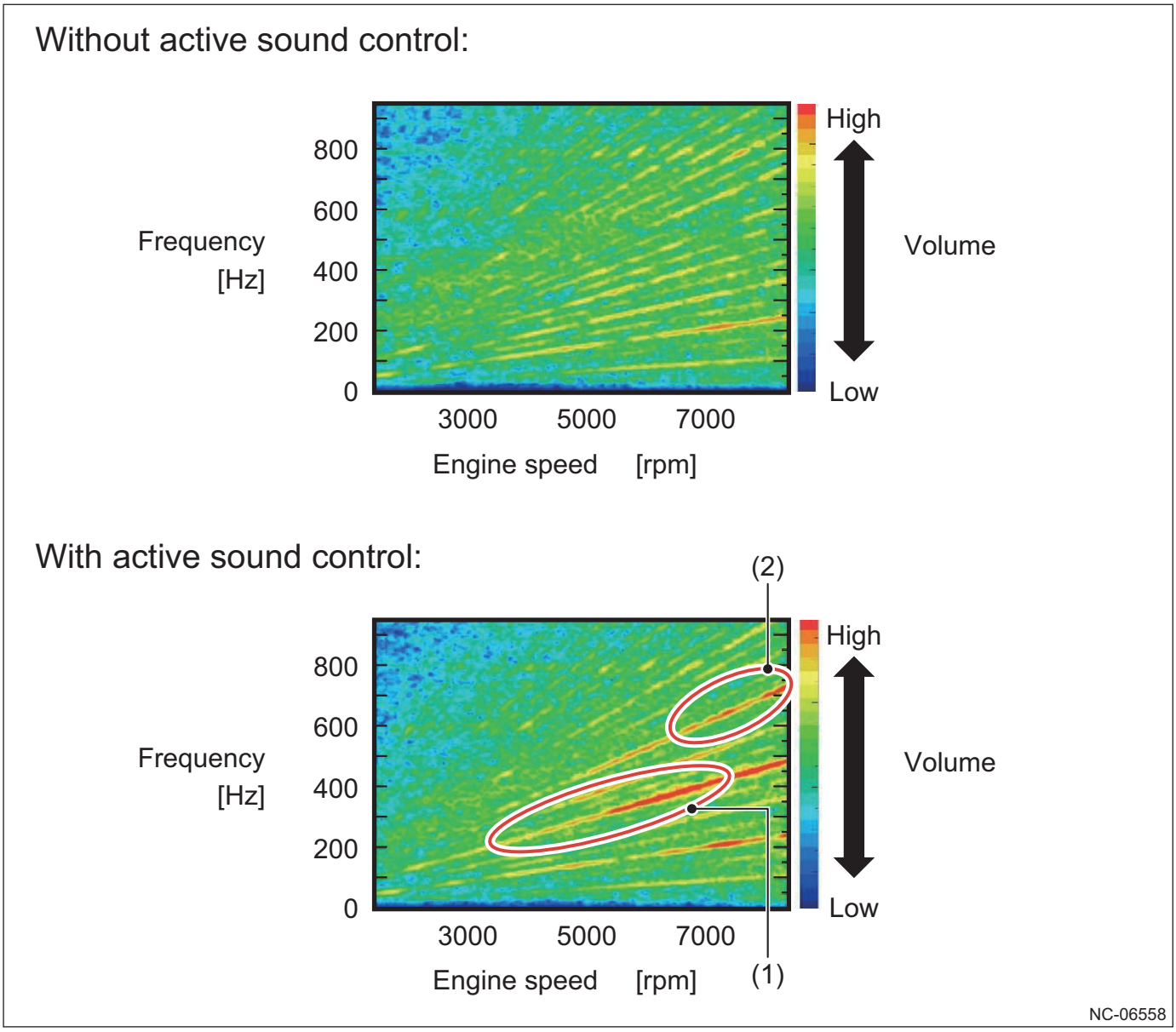
Part name	Function
Active sound control module	• Receives the signals from the control computer that is installed in the vehicle and turns operation ON/OFF and calculates the optimal engine sound complement range frequency according to the vehicle control conditions. • Engine sound produced at the calculated frequency is amplified by an internal power amplifier, and is output to the active sound control speaker.
Active sound control speaker	Outputs the engine sound that is input from the active sound control module.
Central gateway CM (CGW)	Relays CAN communication between the control computers for the various devices installed in the vehicle.
Engine Control Module (ECM)	Sends the transmission information, engine speed, acceleration opening angle, and other information via CAN communication to the active sound control module.
Transmission Control Module (TCM)*	Sends transmission driving mode information and other information via CAN communication to the active sound control module.
VDC control module and hydraulic control module (VDC CM & H/M)	Sends wheel speed information and other information via CAN communication to the active sound control module.

**: AT*

Function

- Active sound control calculates and outputs sound which complements the engine sound in the vehicle interior according to the vehicle behavior (accelerator pedal work, vehicle speed, engine speed) in real time. This control produces a revving sound according to the engine output, and produces a linear engine sound that allows the driver to easily identify the engine speed.

Engine sound areas complemented by active sound control



No.	Control description
(1)	Reinforcing the 200 to 400 Hz range produces a feeling of power in medium speed ranges.
(2)	Reinforcing the 600+ Hz range produces a good feeling of revving at high speed ranges.

- The volume of the sound produced by active sound control is fixed in MT models, and varies automatically according to the engine mode in AT models.

Reference
When the driving mode is changed, active sound control stops for 1 second in order to change the sound volume.

Active sound control volume

Transmission	Driving modes	Volume
MT	-	High
AT	NORMAL	Low
	SNOW	Low
	SPORT	High

Customization function

Active sound control can be turned ON/OFF by using the SUBARU Select Monitor (SSM).

Reference

The default value is ON.

Diagnosis

The active sound control module supports the SUBARU Select Monitor (SSM), and the following work can be performed using it. For details, refer to the service manual.

Item	Description
DTC	If an error occurred in the active sound control module, the active sound control module reads the Diagnostic Trouble Code (DTC) that was saved in memory.
Data monitor	This can display the active sound control operation status and the vehicle information and other information that is input into the active sound control module.
Freeze frame data	This displays the operation status, vehicle information, and other information that was stored at the time when an active sound control module detected an error.
Active test	This forcibly drives the active sound control speaker and produces sound.

11.5 Telematics System

11.5.1 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.

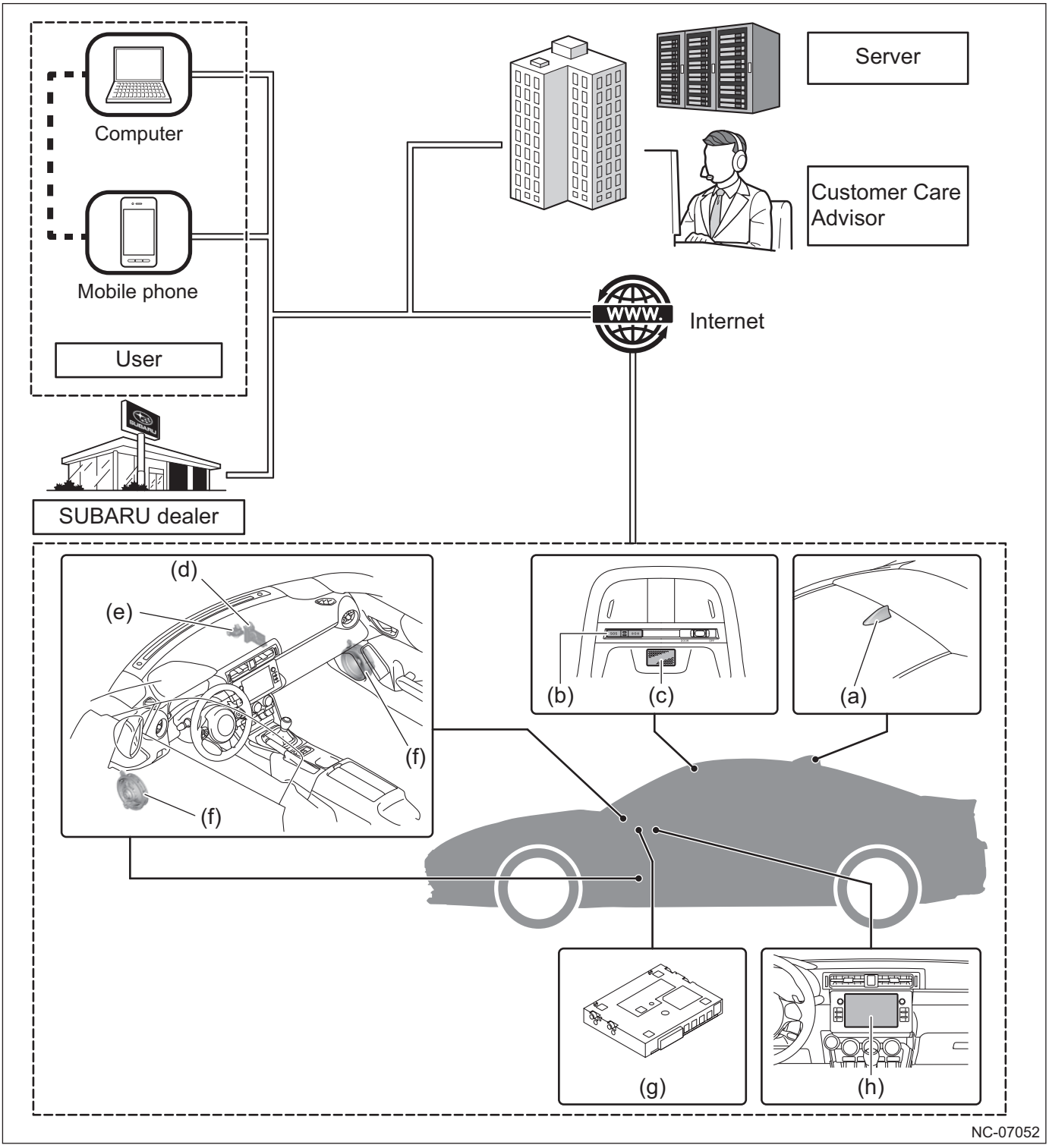
Wi-Fi Hotspot

- 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)	Roof antenna • Telematics antenna		Communication with the SUBARU STARLINK networks is performed via an Internet connection.
(b)	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.
(d)	Telematics sub antenna		Communication with the SUBARU STARLINK networks is performed via an Internet connection.
(e)	GPS antenna		Receives signals from GPS satellites.
(g)	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.

Communication user interface incorporated in the vehicle

Symbol	Display	Description
(c)	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).
(f)	Door speaker	Outputs the speech of the Customer Care Advisor at the SUBARU STARLINK Call Center or other call party.
(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.
Wi-Fi Hotspot*2			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: AT only*
**2: 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 (BackUp 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

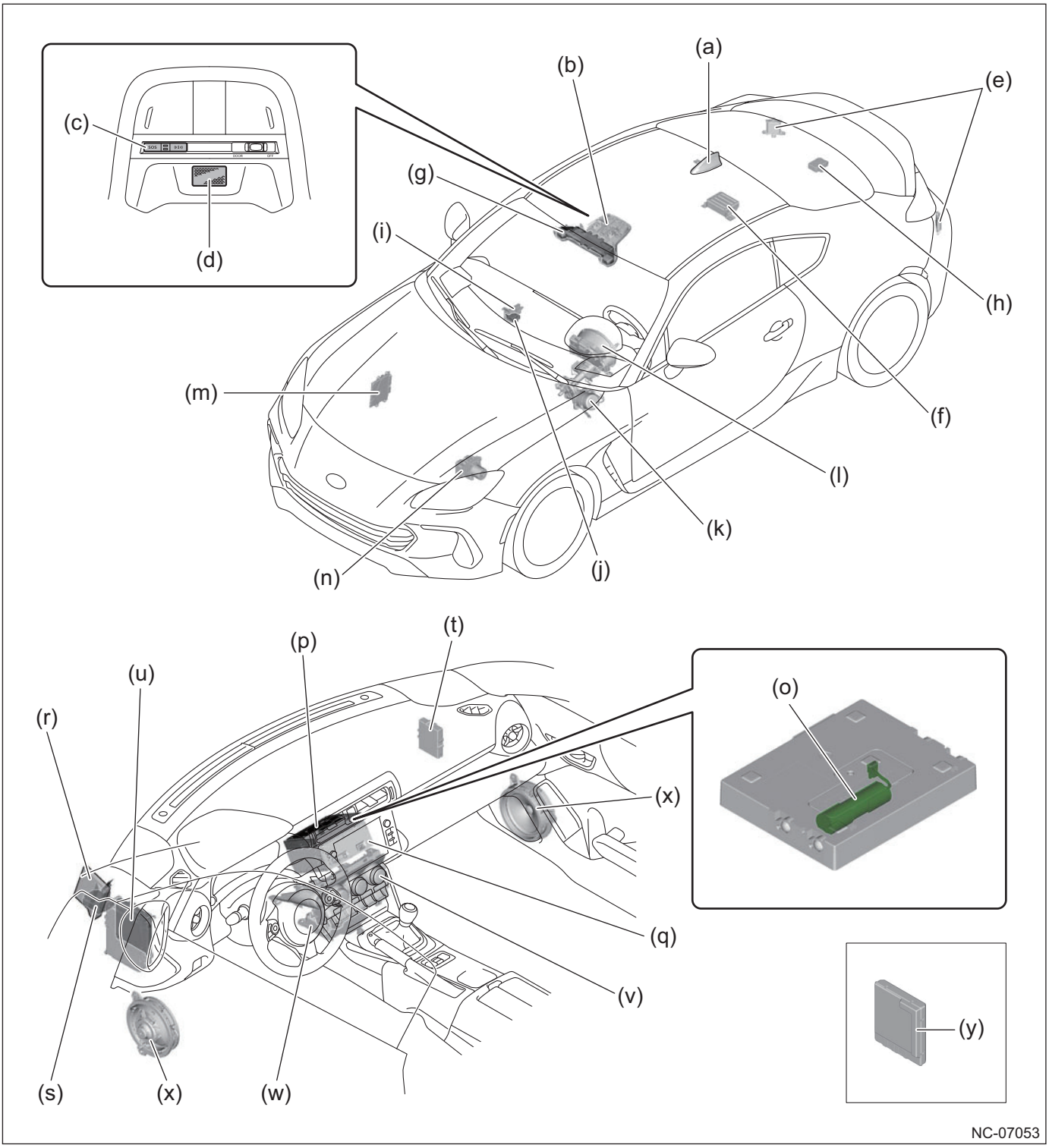
- If the signal environment is poor while driving or in the location where the vehicle is stopped, this will affect the communications of the Data Communication Module (DCM) and may prevent SUBARU STARLINK services from being used or reduce the quality of those services.
- In order to protect the vehicle battery, if the 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 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 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.

11.5.2 Component

Component layout drawing



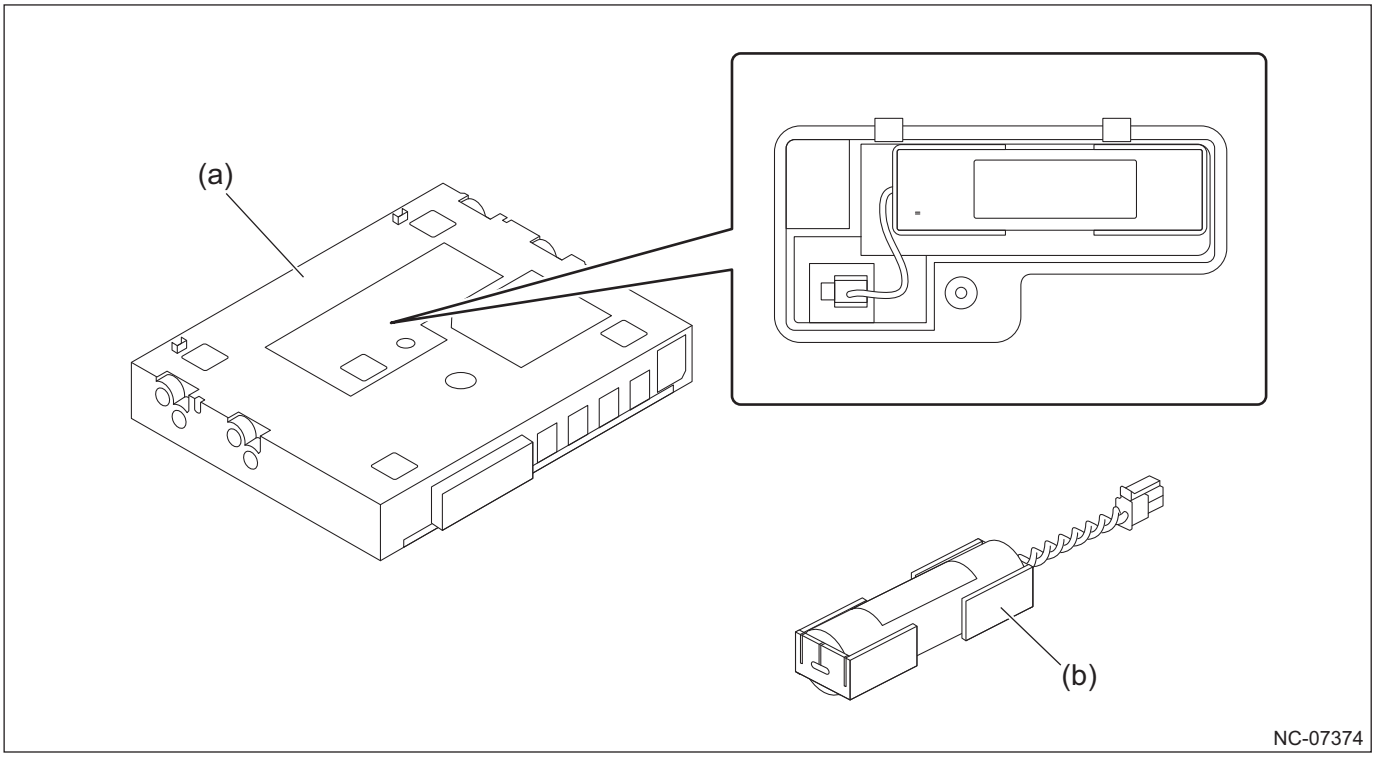
(a)	Roof antenna • Telematics antenna	(n)	VDC control module and hydraulic control module (VDC CM & H/M)
(b)	Spot map light	(o)	Backup battery (BUB)
(c)	Telematics button • LED status light • SOS button • i-button	(p)	Data Communication Module (DCM)
(d)	Microphone	(q)	Cockpit Control Module (CCM)
(e)	Radar sensor	(r)	Transmission Control Module (TCM)
(f)	Audio amplifier	(s)	Auto headlight beam leveler CM
(g)	Stereo camera	(t)	Central gateway CM (CGW)
(h)	TPMS CM	(u)	Body integrated unit
(i)	Telematics sub antenna	(v)	A/C control panel (A/C CM integrated type)
(j)	GPS antenna	(w)	Airbag control module
(k)	Power steering CM	(x)	Door speaker
(l)	Combination meter	(y)	Keyless access CM
(m)	Engine Control Module (ECM)		

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 backup battery (BUB). This battery is charged from the vehicle battery while the 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)

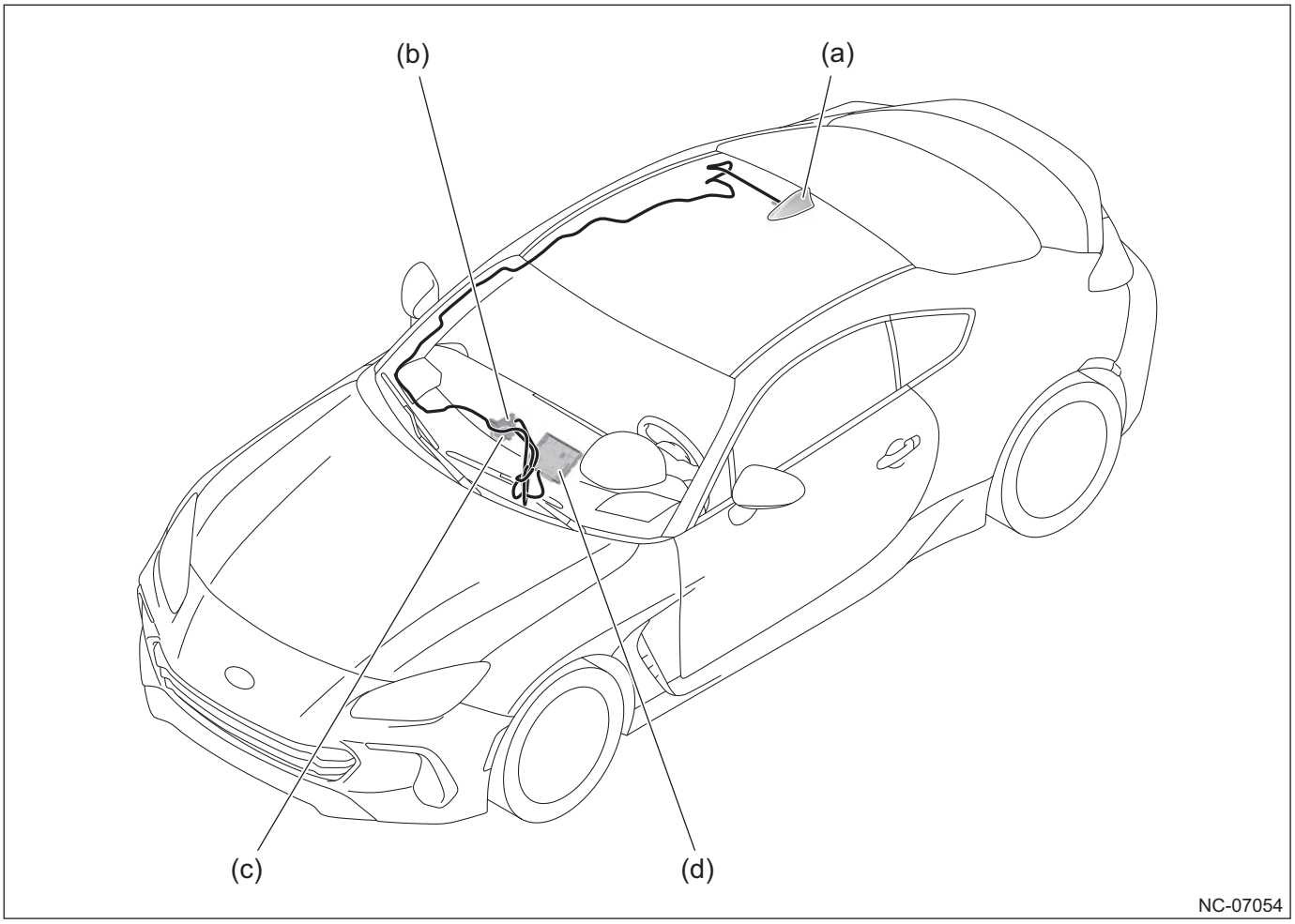
(b) Backup battery (BUB)

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.



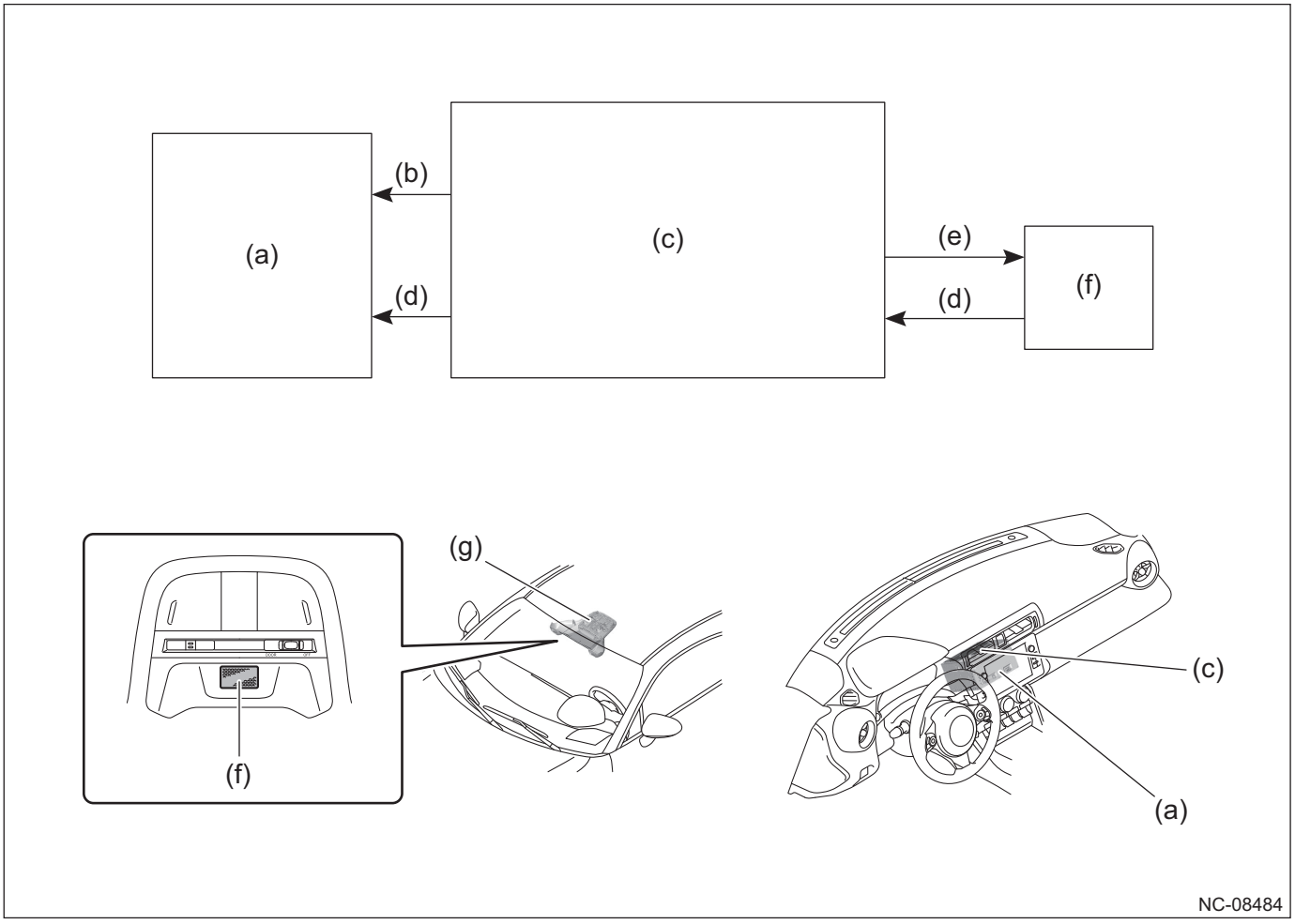
(a)	Roof antenna • Telematics antenna	(c)	GPS antenna
(b)	Telematics sub antenna	(d)	Data Communication Module (DCM)

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.

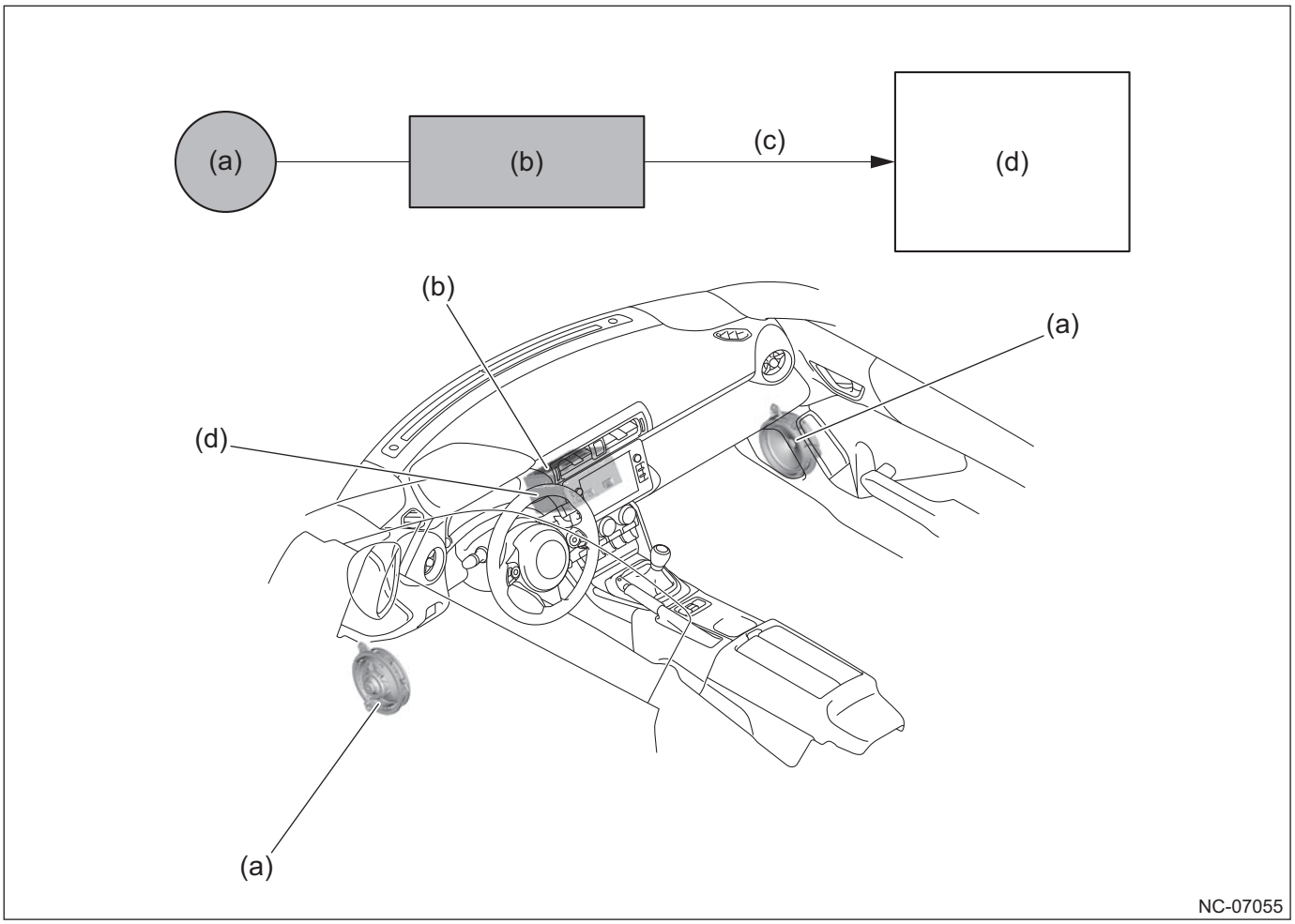


(a) Cockpit Control Module (CCM)
(b) Mute signal
(c) Data Communication Module (DCM)
(d) Microphone signal
(e) Microphone power supply
(f) Microphone
(g) Spot map light

■ Speaker connection diagram

The structure uses door speakers on the left and right sides 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.

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.

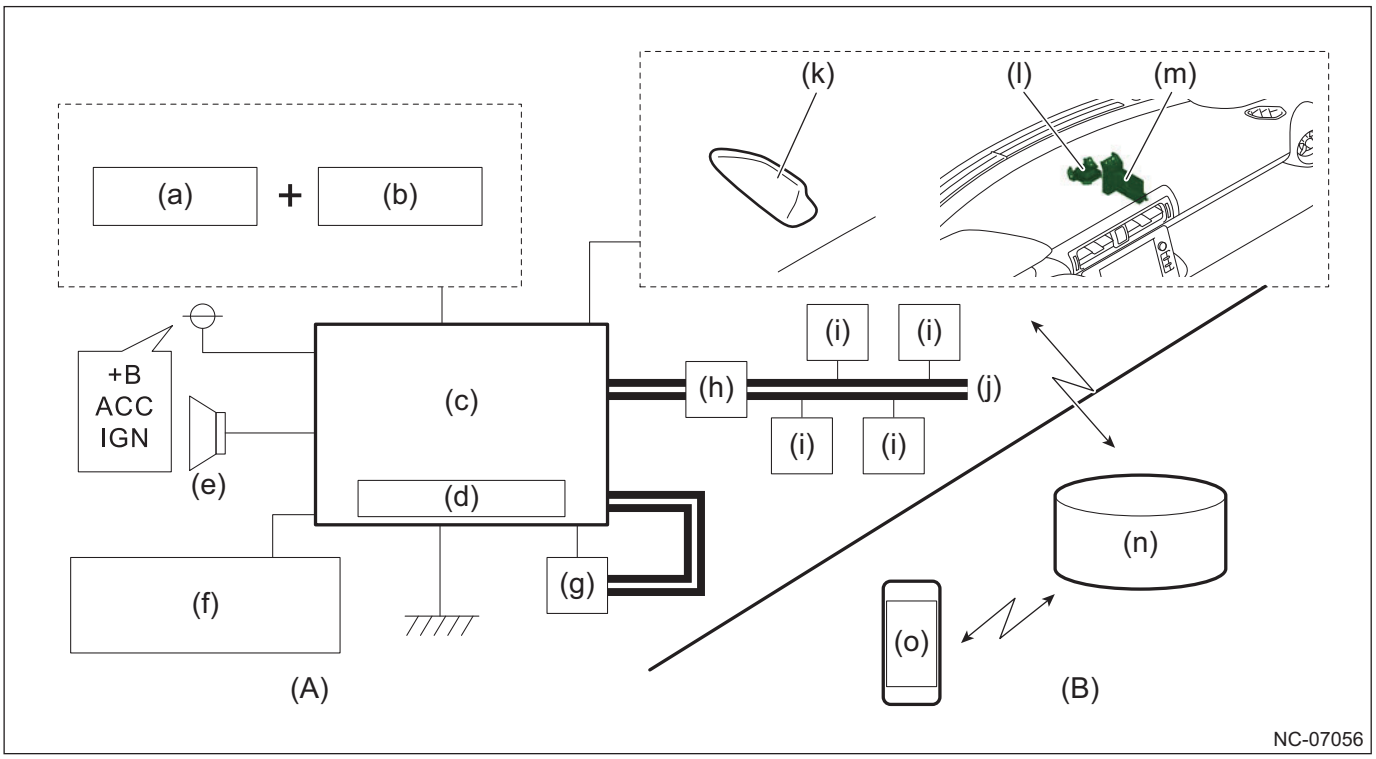


(a)	Door speaker	(c)	Mute signal
(b)	Data Communication Module (DCM)	(d)	Cockpit Control Module (CCM)

11.5.3 Construction and Operation

System diagram

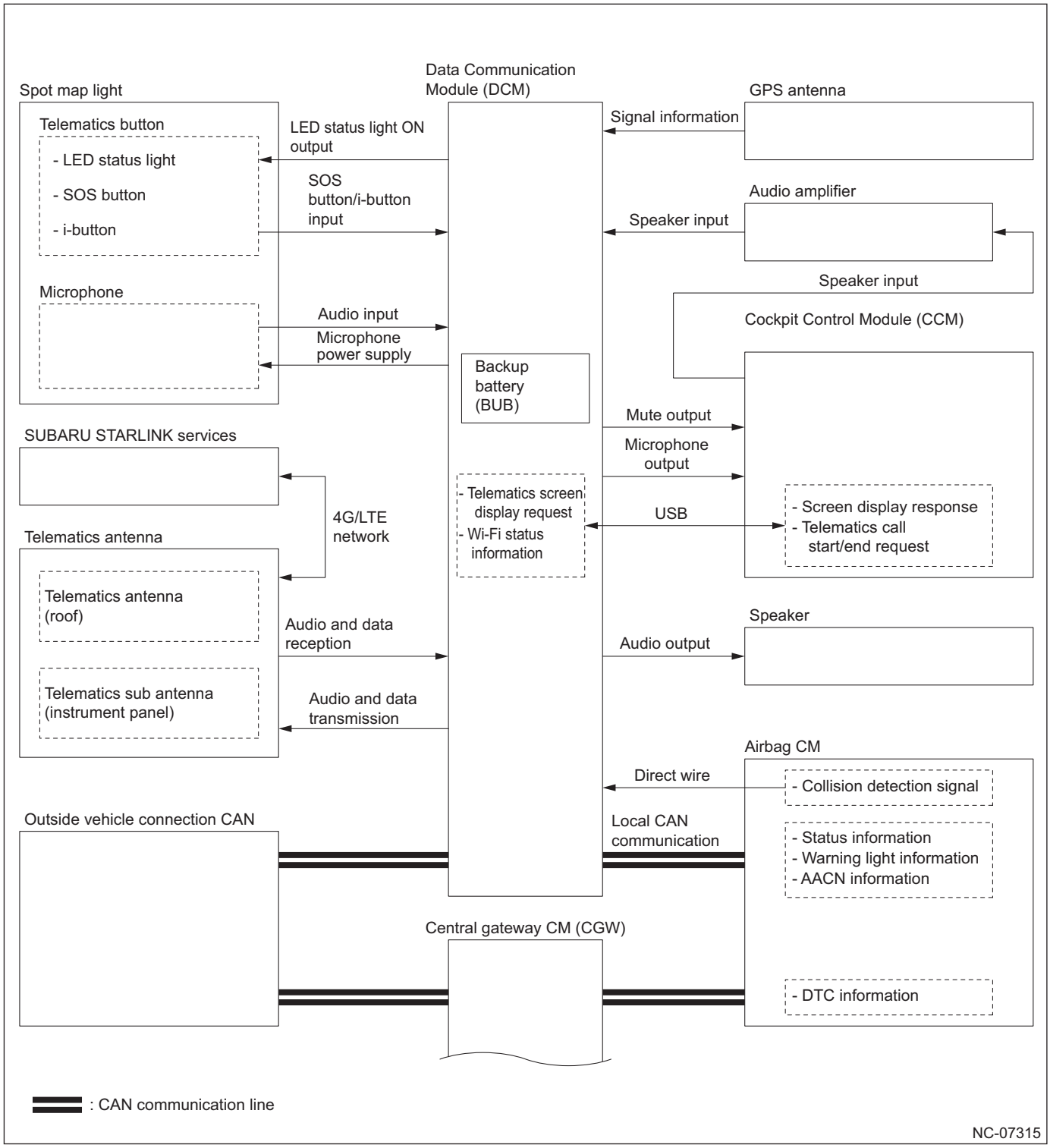
System configuration diagram

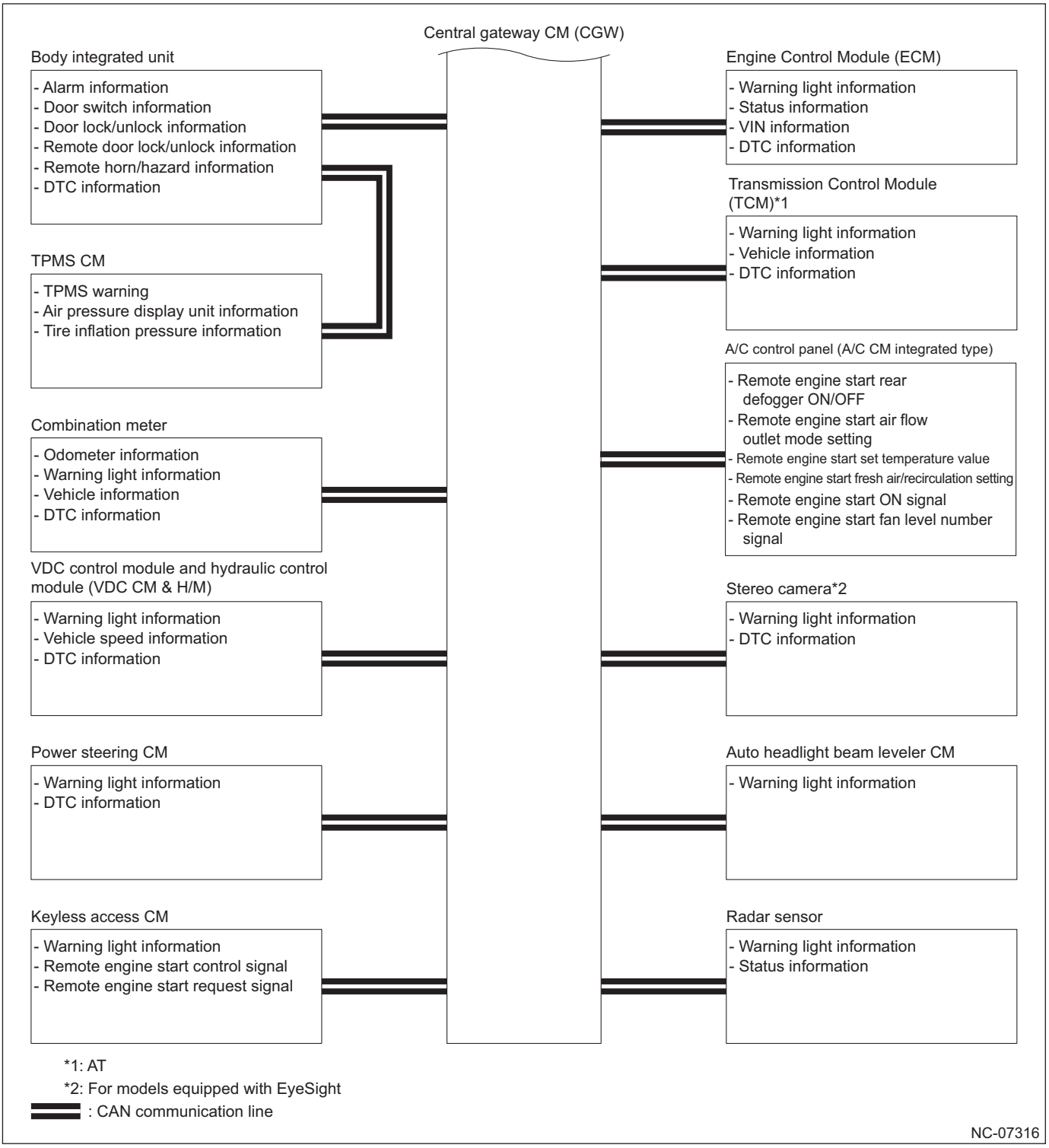


(A)	Vehicle	(B)	SUBARU Of America (SOA) side
(a)	Microphone	(i)	Control computer of each device installed in vehicle
(b)	Telematics button	(j)	CAN communication
(c)	Data Communication Module (DCM)	(k)	Roof antenna (telematics antenna)
(d)	Backup battery (BUB)	(l)	GPS antenna
(e)	Door speaker	(m)	Telematics sub antenna
(f)	Cockpit Control Module (CCM)	(n)	External server
(g)	Airbag control module	(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
TPMS CM
- TPMS warning
- Air pressure display unit information
- Tire inflation pressure information
Combination meter
- Odometer information
- Warning light information
- Vehicle information
- DTC information
VDC control module and hydraulic control module (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
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 control panel (A/C CM integrated type)
- 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
Radar sensor
- Warning light information
- Status information
*1: AT
*2: For models equipped with EyeSight
: CAN communication line
NC-07316

Main component functions

Part name			Function
Spot 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 control module, 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.
Backup 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.

Part name	Function
Roof antenna • Telematics antenna	Communicates with the SUBARU STARLINK Call Center or server for SUBARU STARLINK services.
Telematics sub antenna	
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).
Audio amplifier	Amplifies the audio signal from the Cockpit Control Module (CCM), and outputs signals to the Data Communication Module (DCM).
Door 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 control module	• 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 control module and hydraulic control module (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).
Radar sensor	Sends radar sensor 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).
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).

Part name	Function
TPMS CM	Sends TPMS warnings, air pressure display unit information, and tire inflation pressure information via CAN communication to the Data Communication Module (DCM) through the body integrated unit.
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 door lock system warning light information and the remote engine start control signal via CAN communication to the Data Communication Module (DCM).
A/C control panel (A/C CM integrated type)	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: AT*
**2: For models equipped with EyeSight*

Function

STARLINK Safety and Security

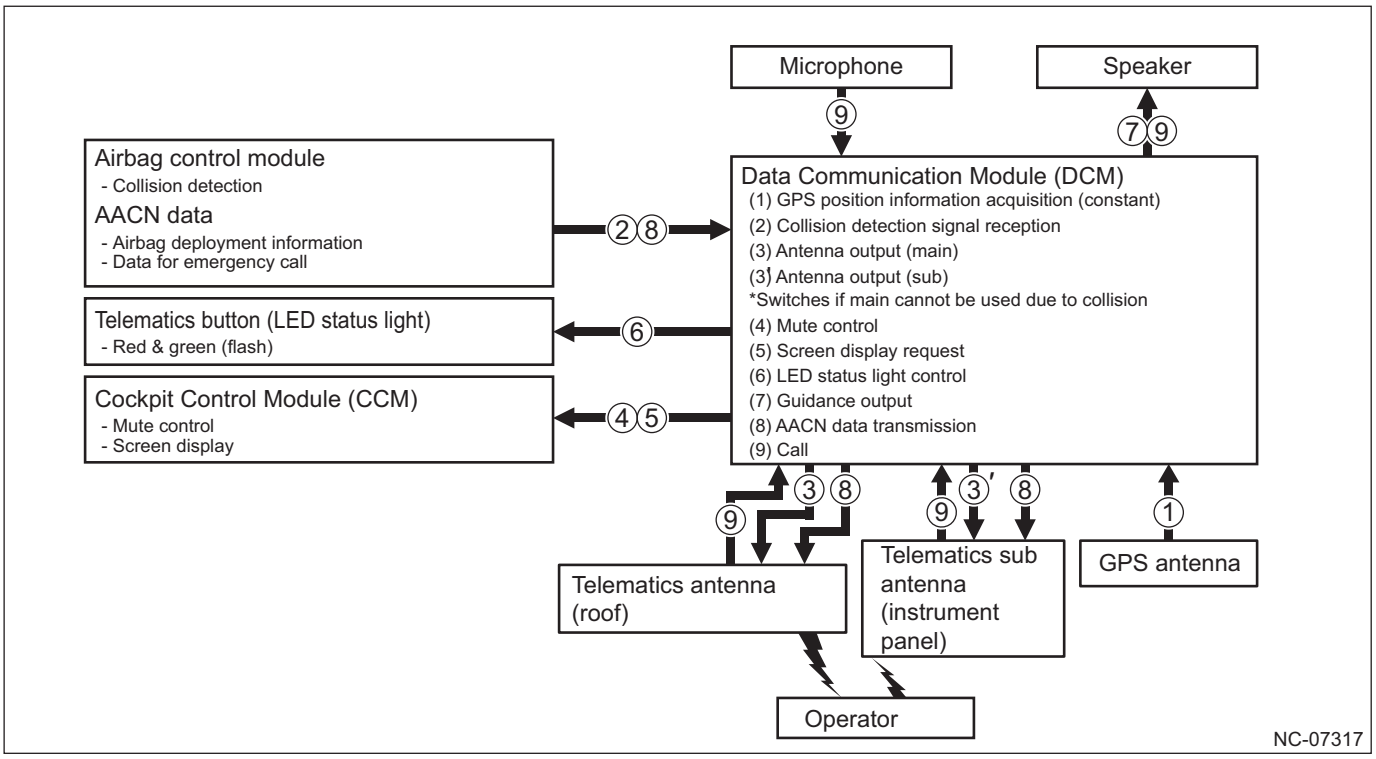
■ Advanced Automatic Collision Notification

- 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 control module.
- 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 backup 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

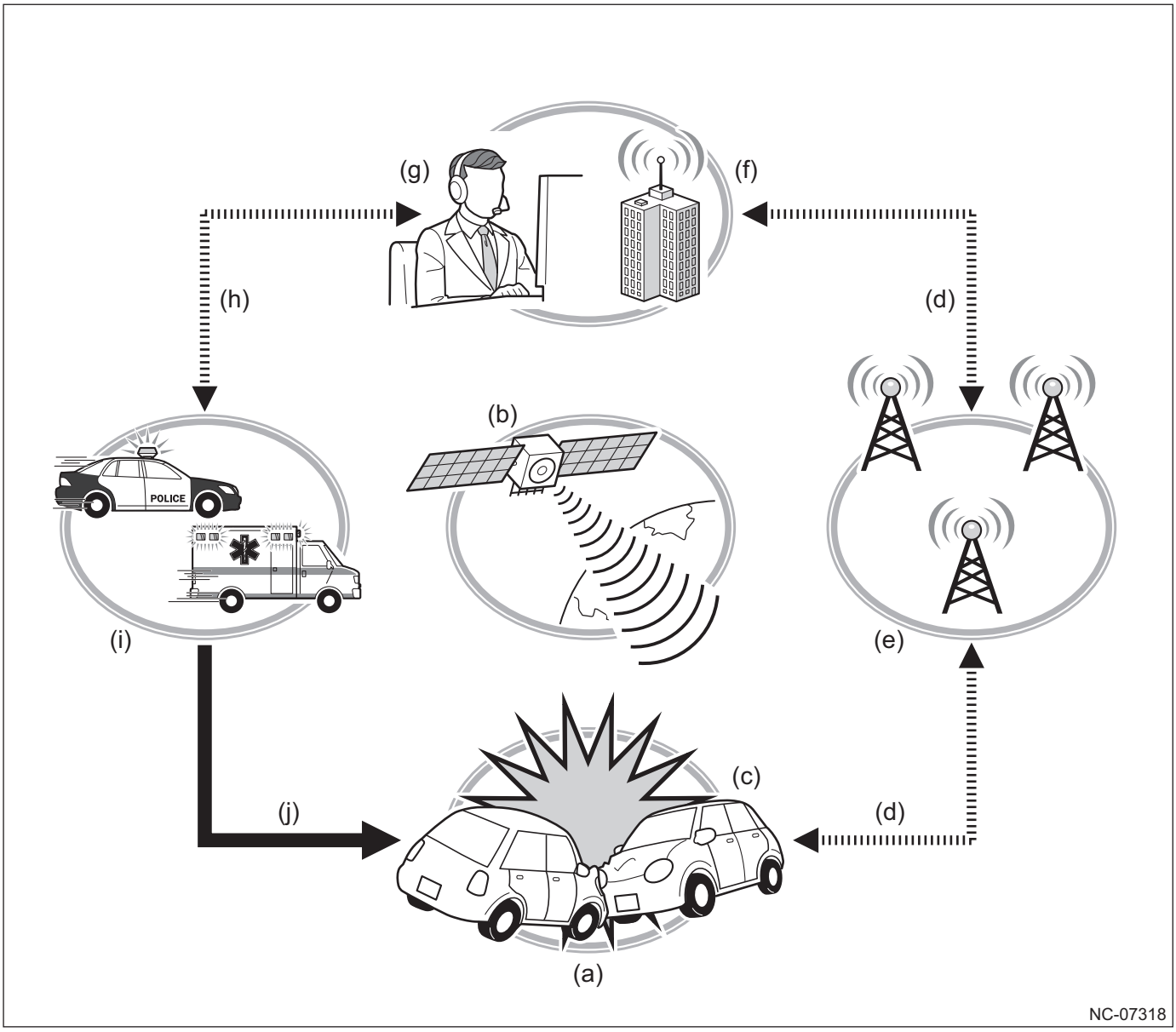
- Automatic notification cannot be canceled from the user side.
- The sound volume of the call with the Customer Care Advisor can be adjusted by means of the audio system volume knob.

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 control module • 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 (used when the telematics antenna is damaged)
(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 control module • Data Communication Module (DCM) • Telematics antenna • Telematics sub antenna (used when the telematics antenna is damaged)
(9)	Communicates with the Customer Care Advisor using the microphone and speakers.	• Telematics antenna • Telematics sub antenna • Data Communication Module (DCM) • Speaker • Microphone

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

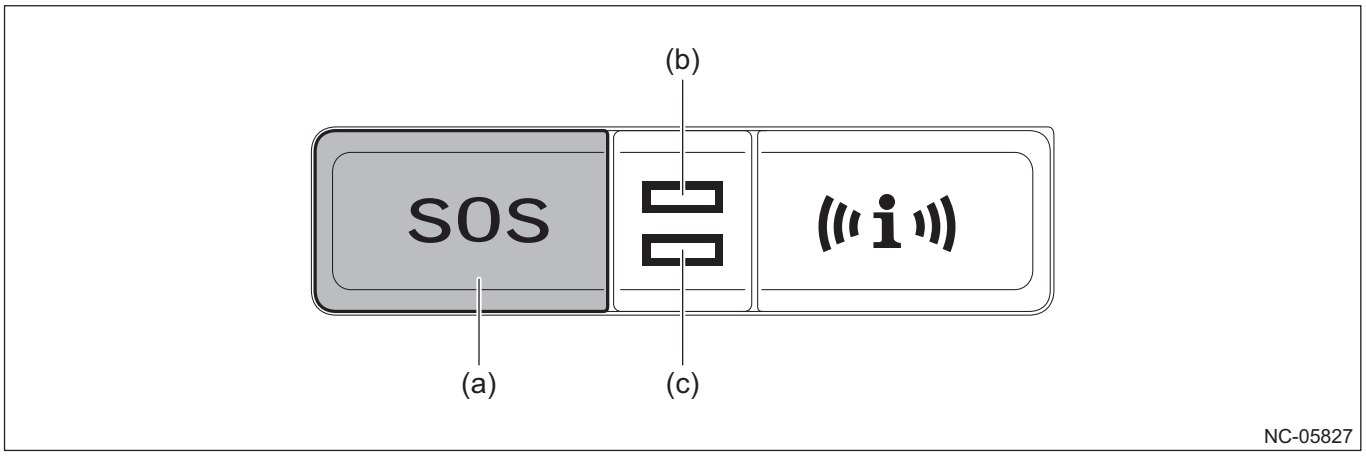
■ SOS Emergency Assistance

- 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

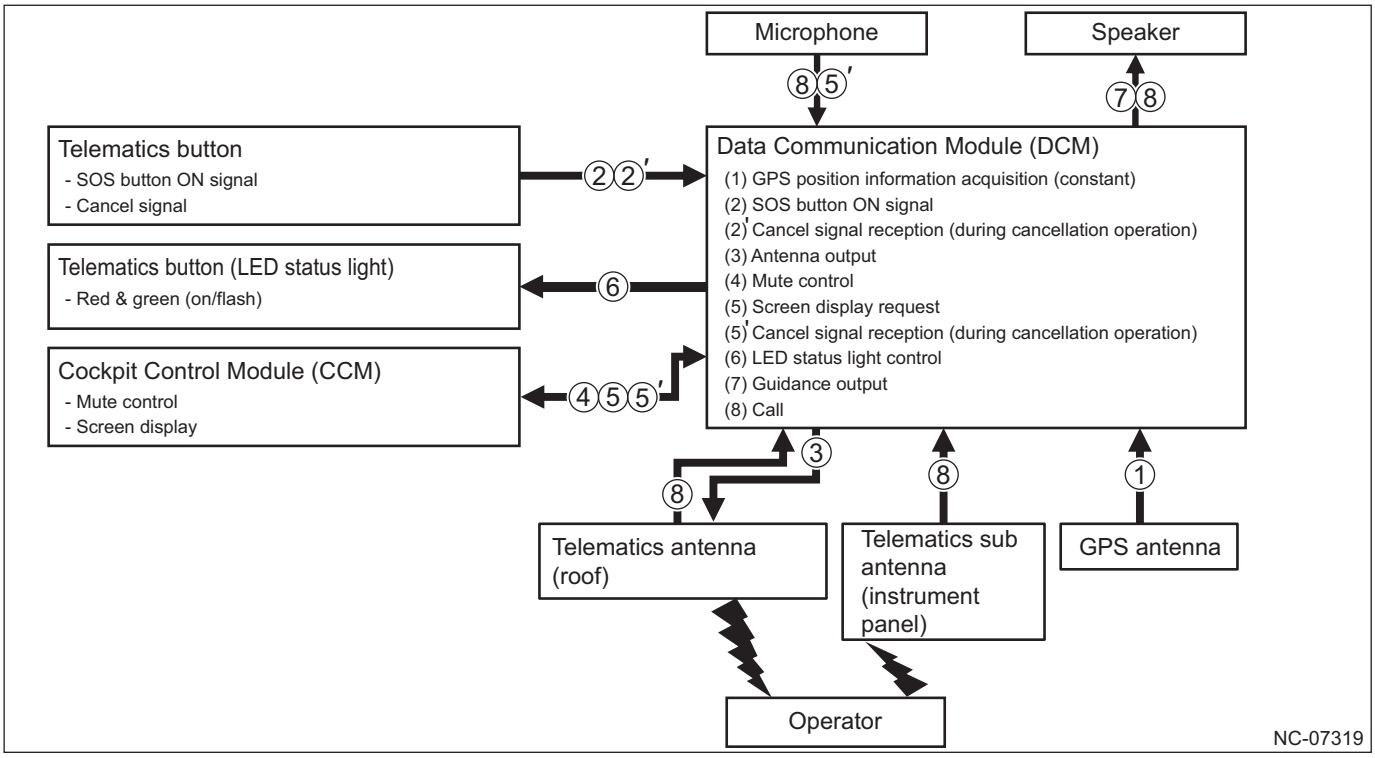
- If the user accidentally pressed the SOS button, the emergency call can be canceled by pressing and holding the SOS button again for 2 seconds or longer or by performing the operation displayed on the calling screen. The emergency call can also be canceled by an operation using voice recognition.
- 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)

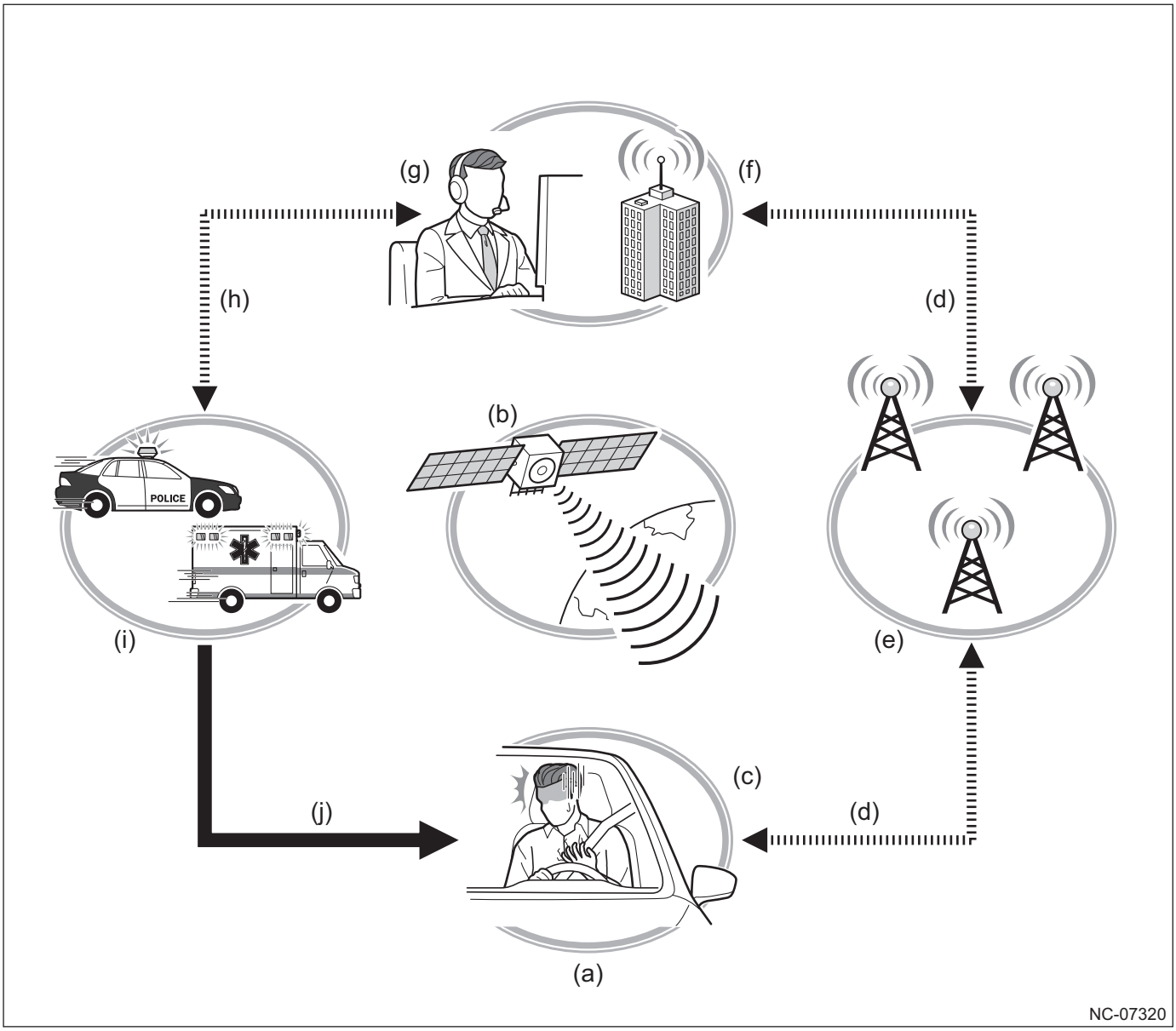
Vehicle side control flow



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
(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. *	• Data Communication Module (DCM) • Telematics antenna
(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 • Data Communication Module (DCM) • Speaker • Microphone

**: Flashes while emergency notification is in progress, and returns to on when 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

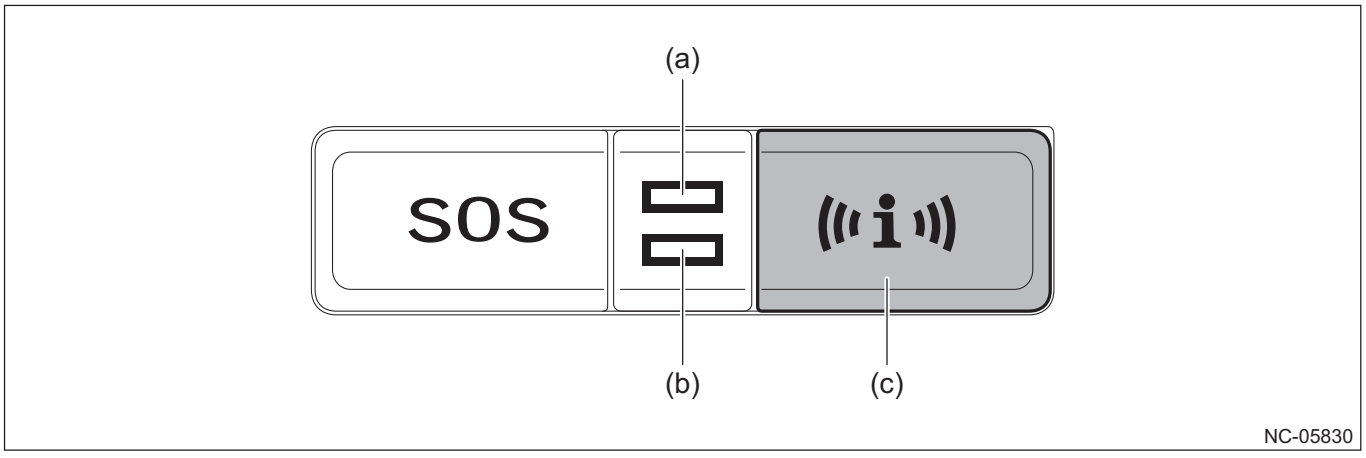
■ Enhanced Roadside Assistance

- 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

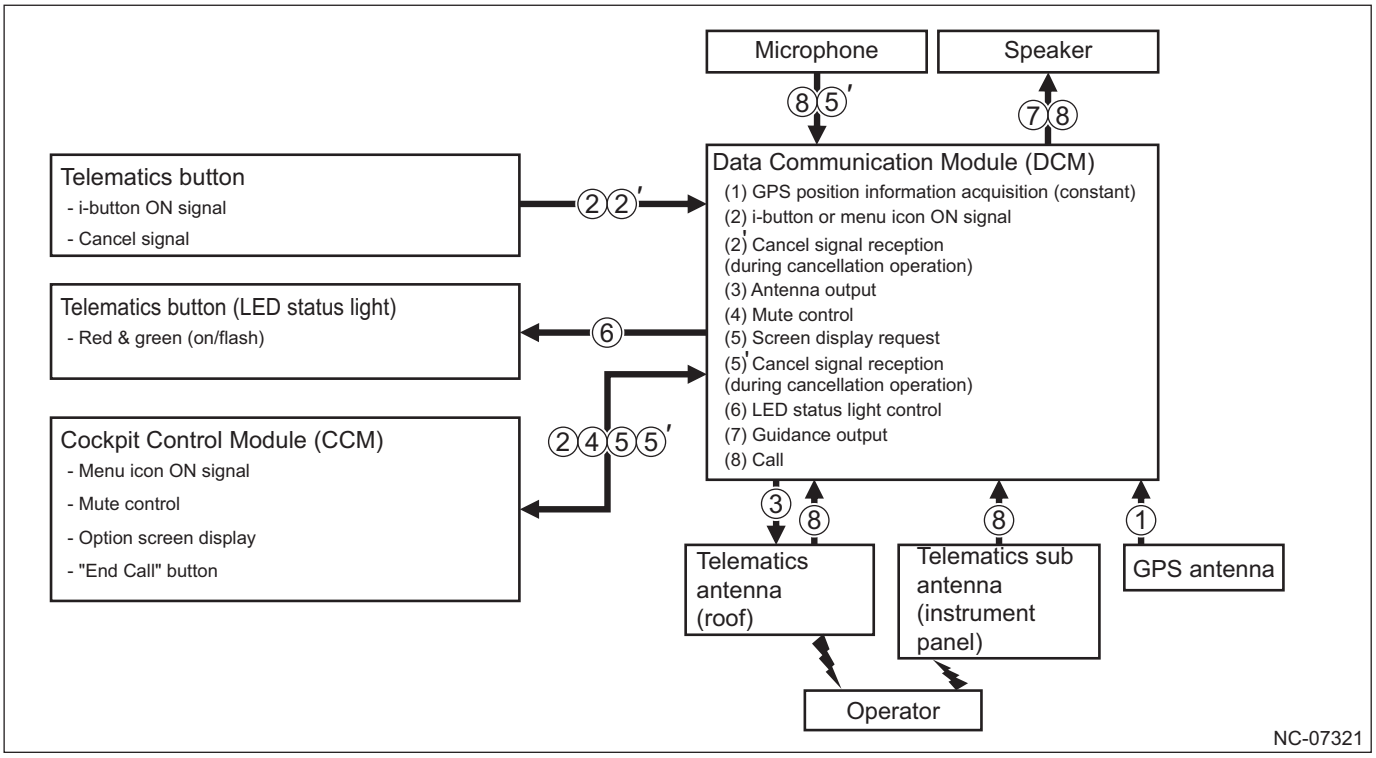
- If the user has registered for use of STARLINK Concierge, then he or she can display the options screen by pressing the i-button and can select either Enhanced Roadside Assistance or STARLINK Concierge. If no operation is performed for 10 seconds, Enhanced Roadside Assistance is automatically selected.
- 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

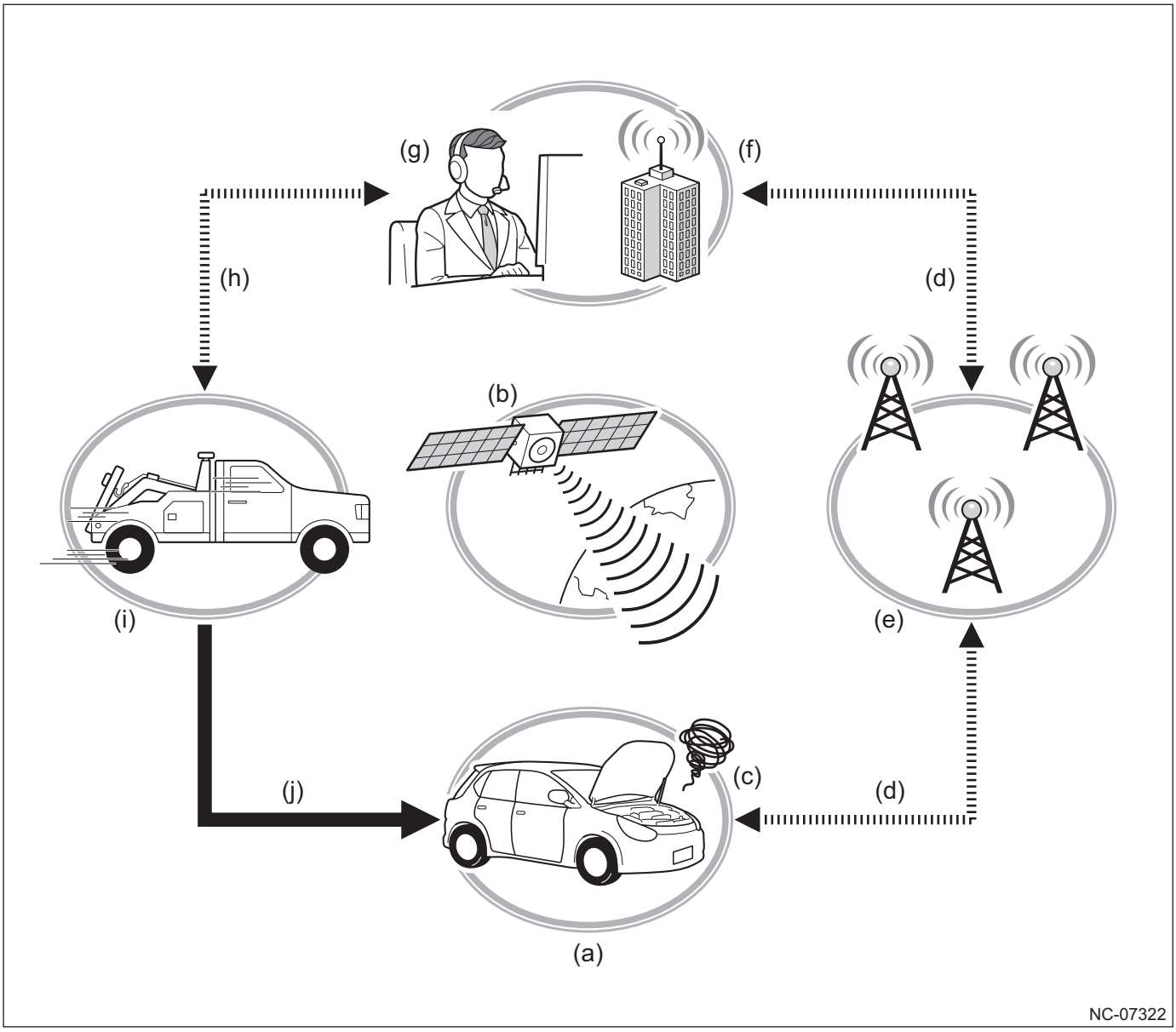
Vehicle side control flow



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
(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. *	• 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 • Data Communication Module (DCM) • Speaker • Microphone

**: Flashes while connecting to the SUBARU STARLINK Call Center, and returns to on when 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

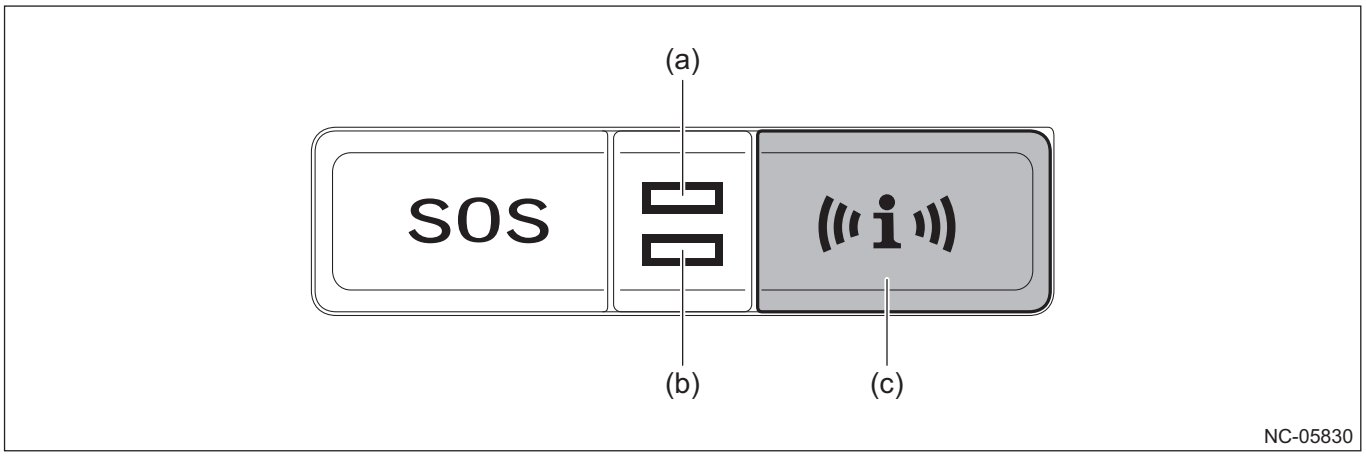
■ STARLINK Concierge

- 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.
- 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

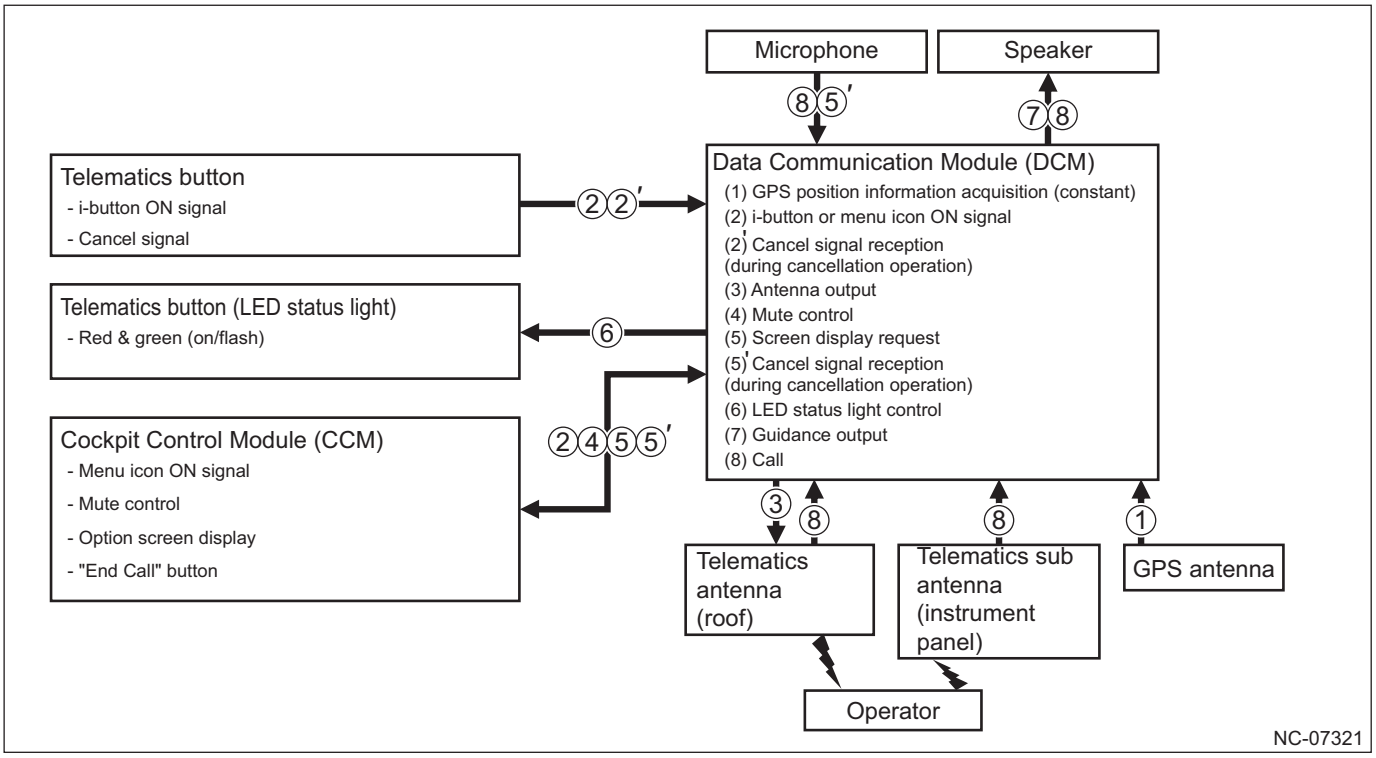
- In addition to STARLINK Concierge, Enhanced Roadside Assistance can also be selected from the option screen. If no operation is performed for 10 seconds, Enhanced Roadside Assistance is automatically selected.
- If the user accidentally pressed the i-button, the connection to the SUBARU STARLINK Call 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

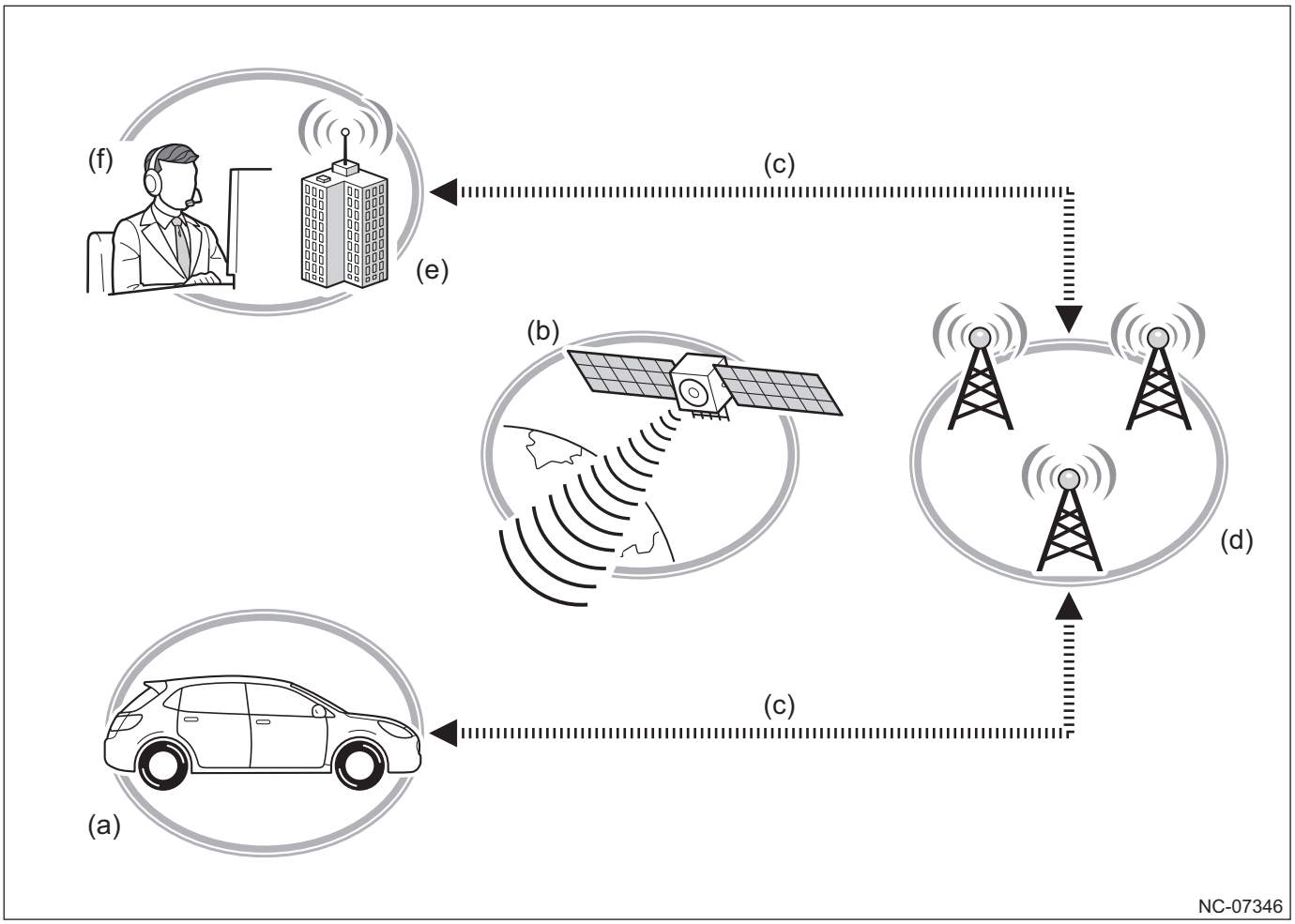
Vehicle side control flow



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
(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. *	• 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 • Data Communication Module (DCM) • Speaker • Microphone

**: Flashes while connecting to the SUBARU STARLINK Call Center, and returns to on when the cancel operation is performed.*

STARLINK Concierge service flow



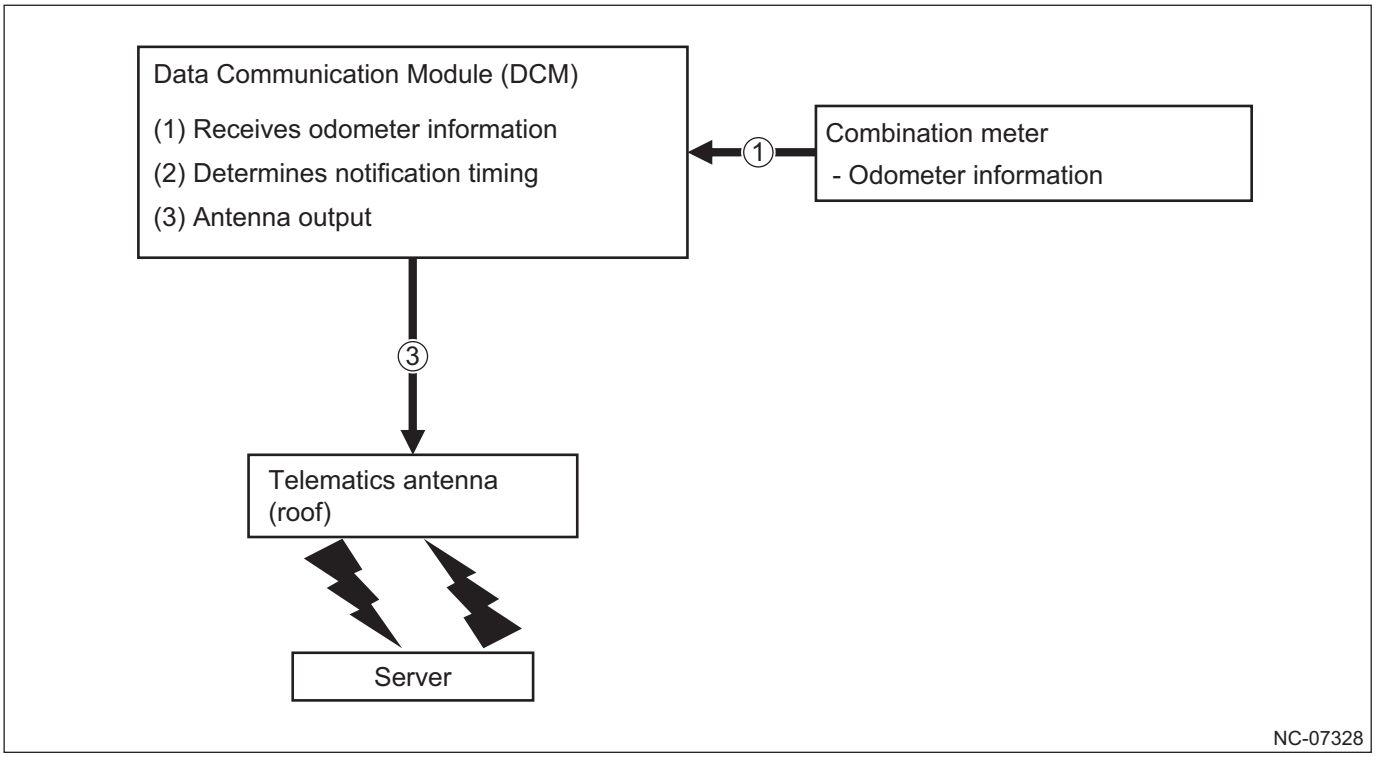
** The illustration shows an example of the service flow that may differ from the actual service.*

(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

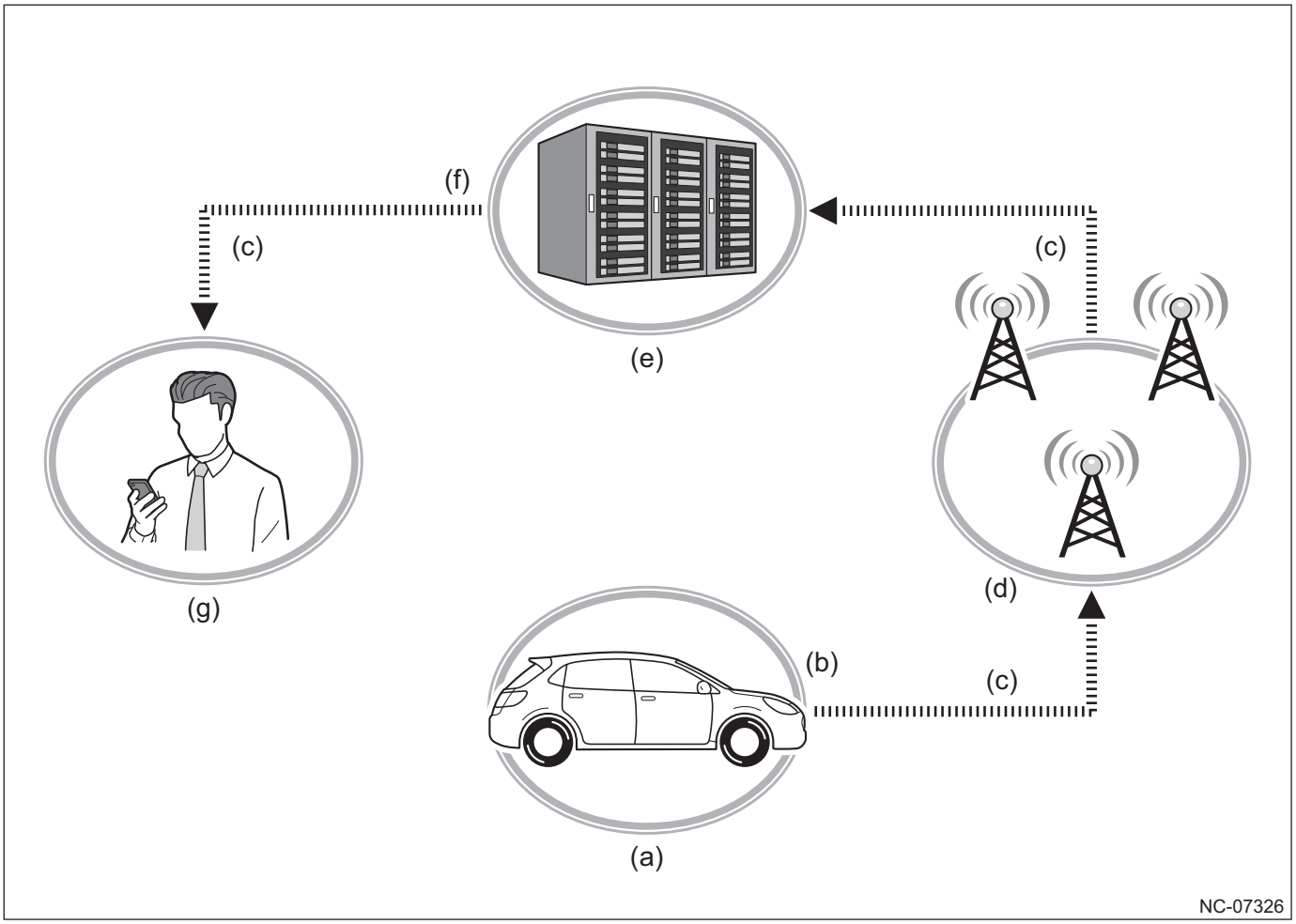
- This function acquires vehicle driving mileage information and can provide the user with engine oil change, regular inspections, and other maintenance notifications.
- The user can receive notifications by email or other means that were set from MySubaru, so that vehicle maintenance can be carried 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

Maintenance Notifications service flow



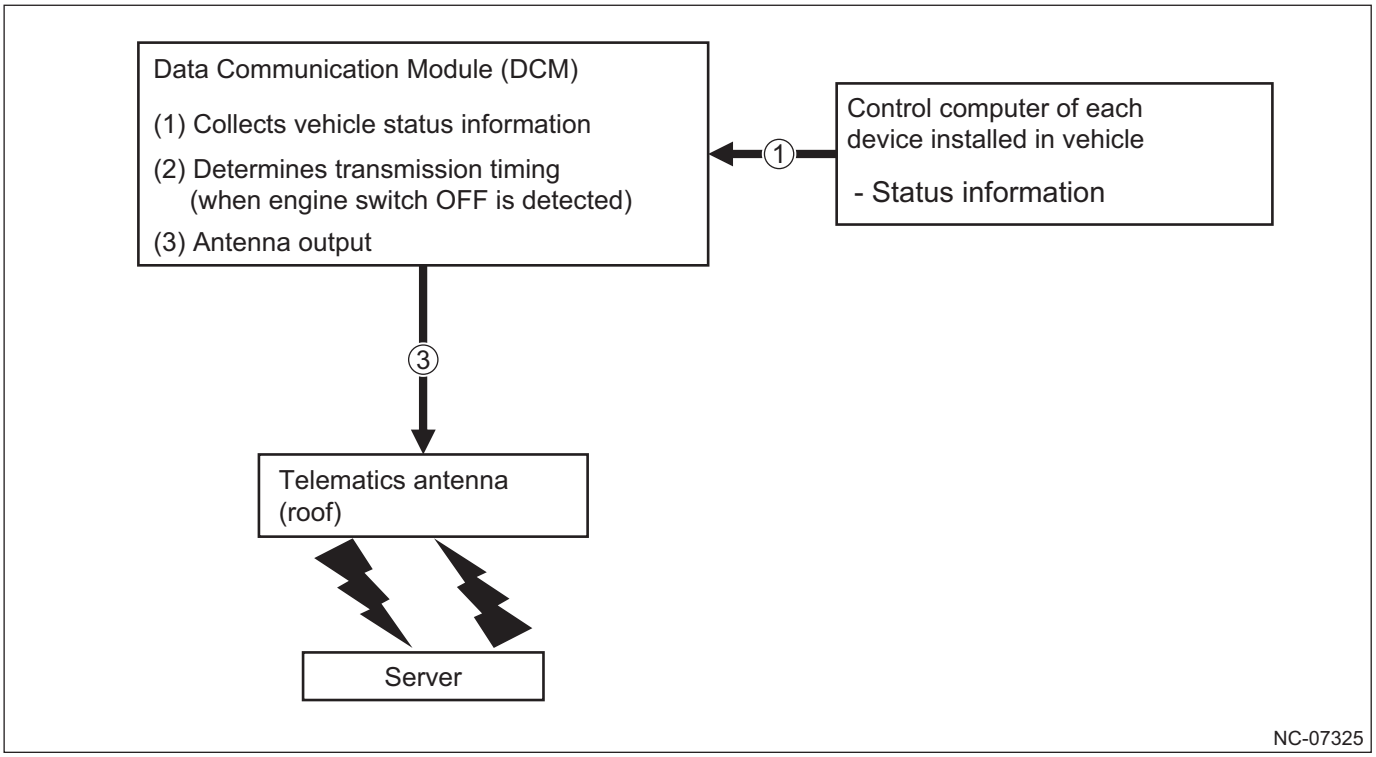
** The illustration shows an example of the service flow that may differ from the actual service.*

(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

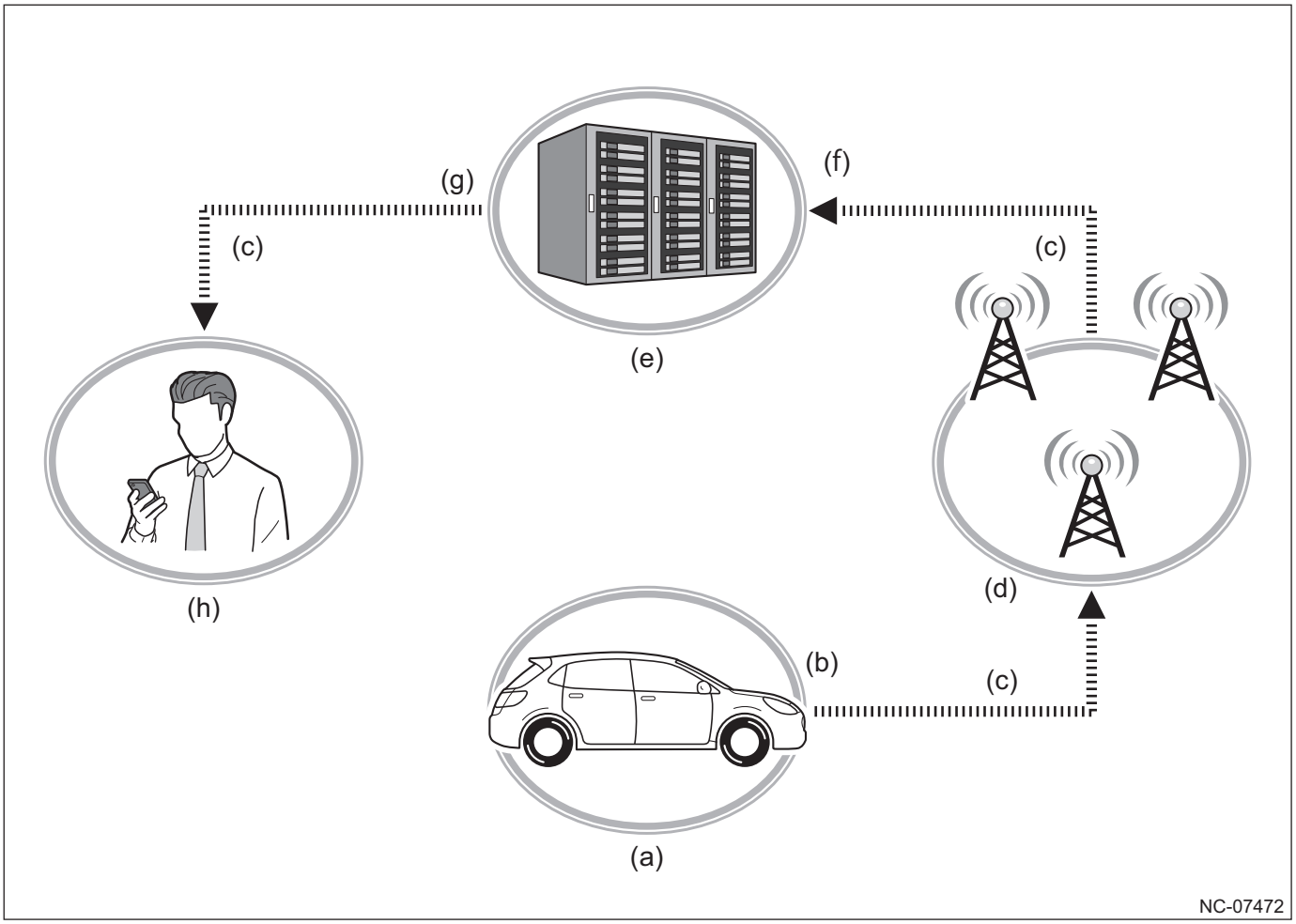
- This function collects status information from the control computer of each device installed in the vehicle, and organizes it to create an overall diagnosis report that is easy to view.
- An email containing a link to the site where the user can view the overall diagnosis report is sent each month 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 engine switch OFF is detected)	Data Communication Module (DCM)
(3)	Sends the collected status information to the server.	• Data Communication Module (DCM) • Telematics antenna

Vehicle Health Report service flow



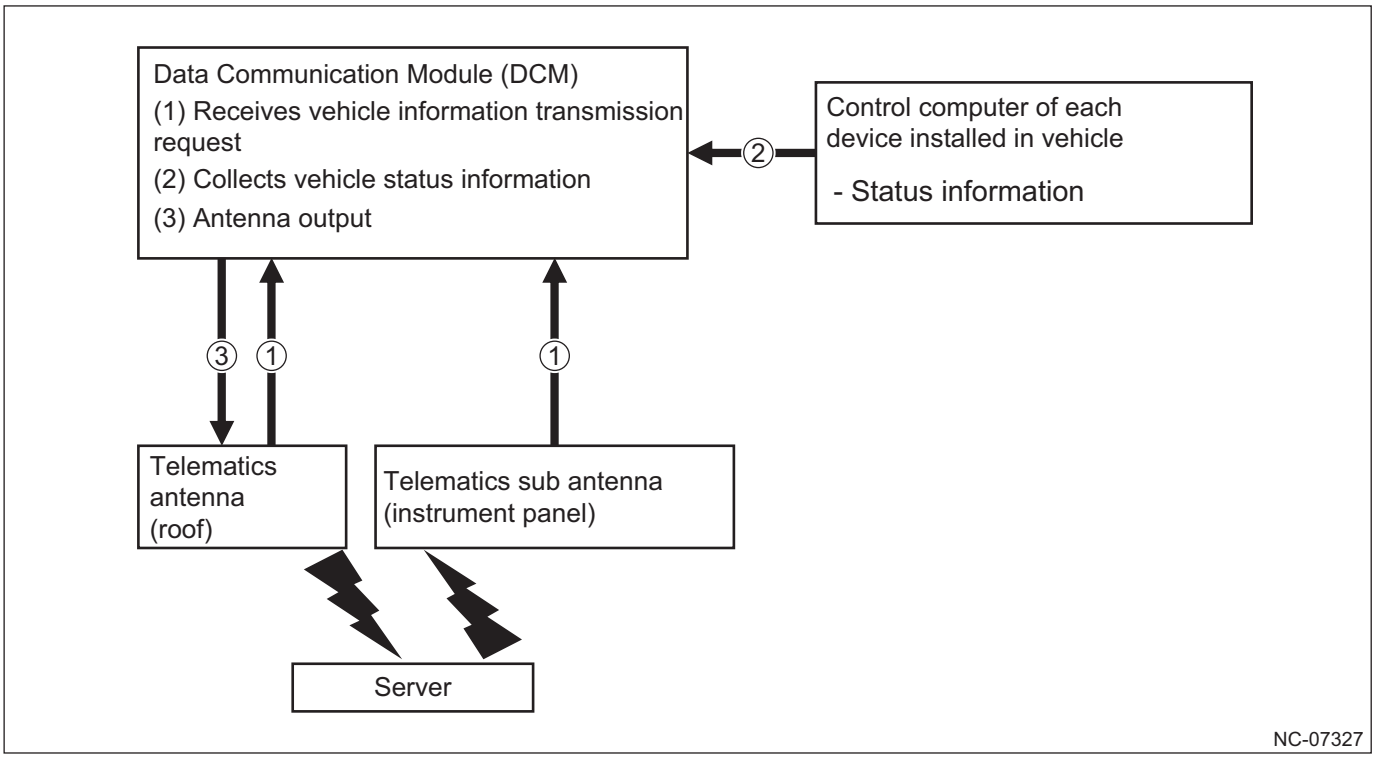
** The illustration shows an example of the service flow that may differ from the actual service.*

(a)	Collects vehicle status information.	(e)	Server
(b)	Sends the information when the 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

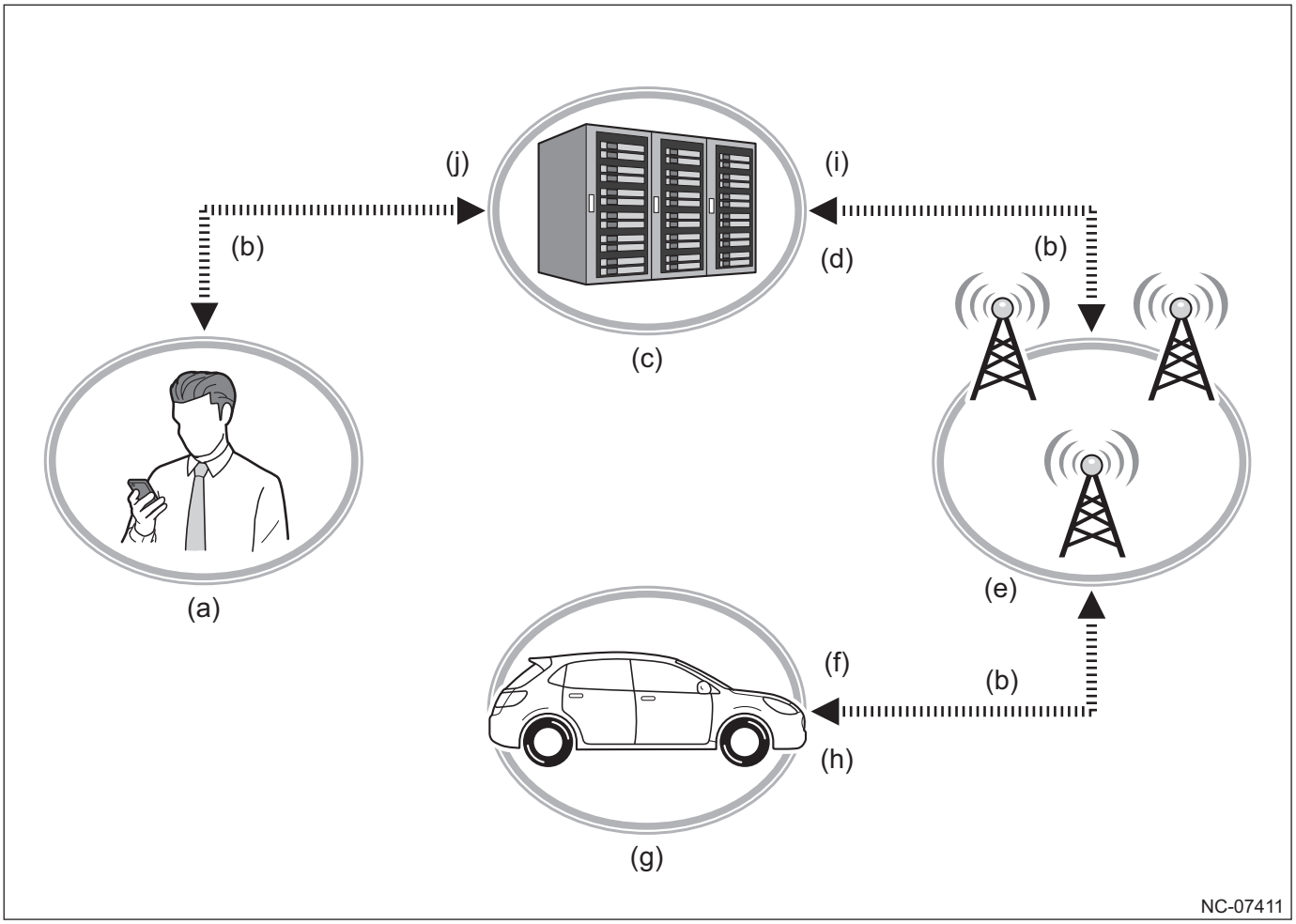
- This function allows the user to acquire odometer, driving mileage, tire air pressure, and other vehicle diagnosis information by an operation from MySubaru.

Vehicle side control flow



No.	Control description	Supported unit
(1)	Receives a vehicle information request signal from the server.	• Telematics antenna • Telematics sub antenna • Data Communication Module (DCM)
(2)	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)
(3)	Sends the collected status information to the server.	• Data Communication Module (DCM) • Telematics antenna

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	(f)	Receives the vehicle information request signal and collects vehicle status information.
(b)	Mobile phone line	(g)	User vehicle
(c)	Server	(h)	Sends the collected status information.
(d)	Sends the vehicle information request signal to the user vehicle.	(i)	Performs vehicle diagnosis based on the collected status information.
(e)	Mobile phone base station	(j)	Displays vehicle diagnosis results on the user's MySubaru.

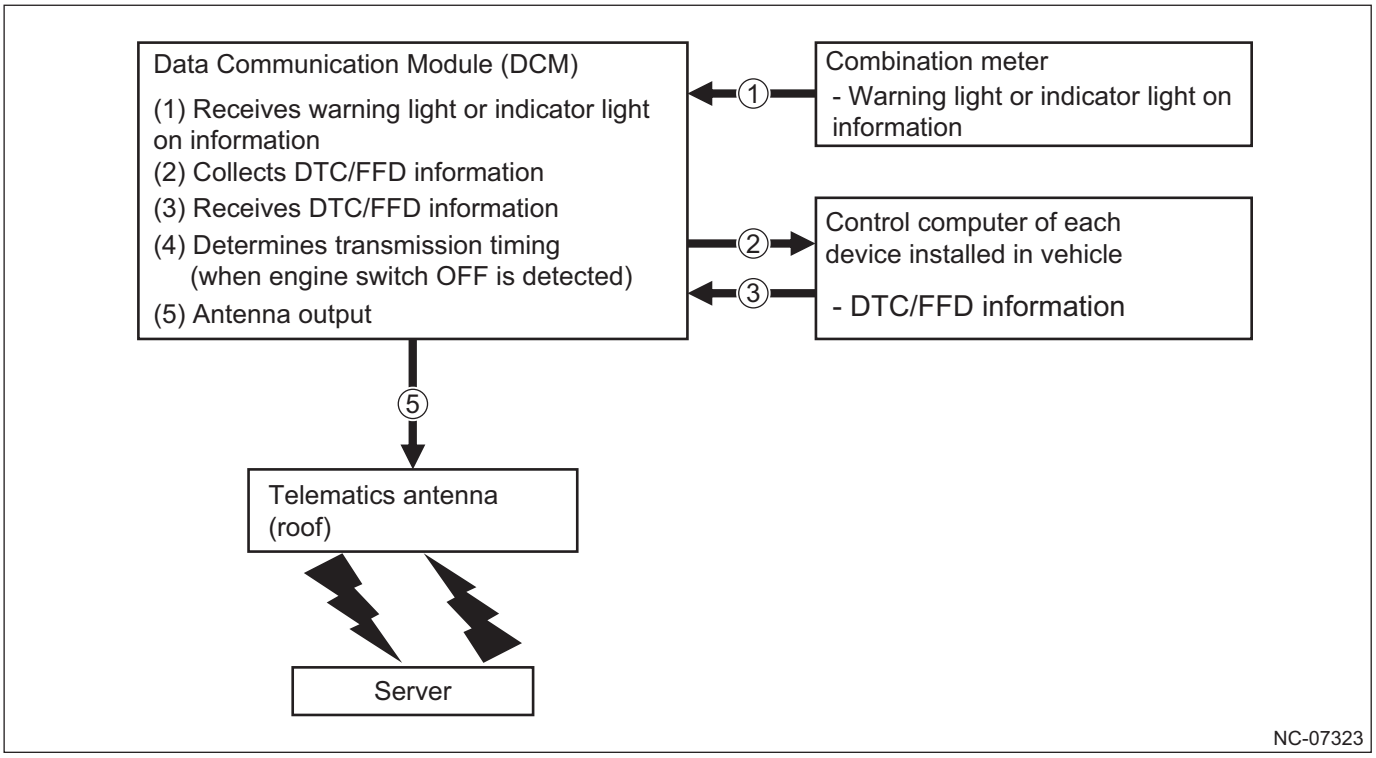
■ Diagnostic Alerts

- 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) receives 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 engine switch is ON, it continually collects DTC 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



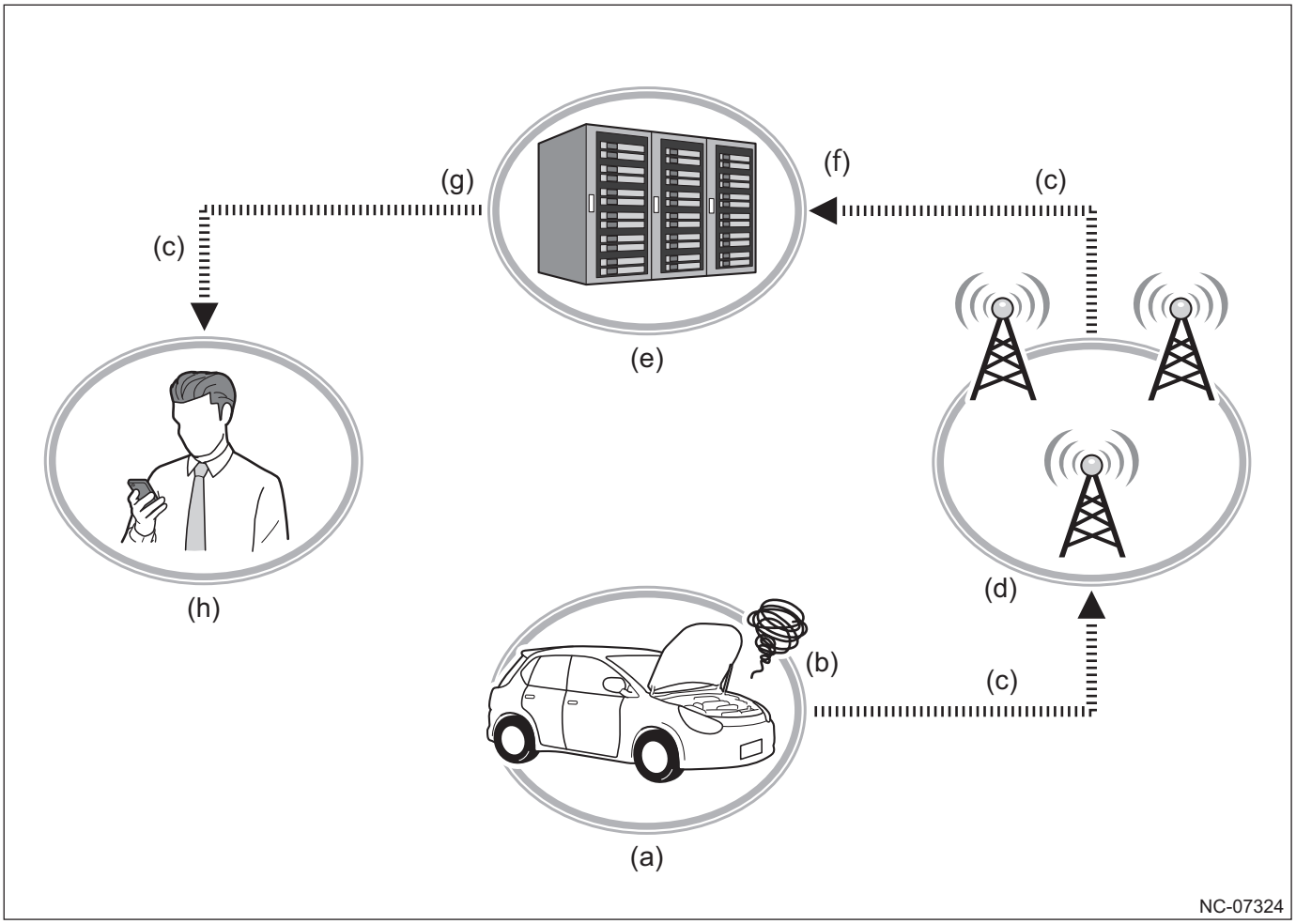
No.	Control description	Supported unit
(1)	Receives warning light or indicator light on information. (Received by regular communication of status information.)	• Combination meter • Data Communication Module (DCM)
(2)	Sends an inquiry for whether DTC/FFD information exists to the control computer of each device installed in the vehicle. (Continual)	• Data Communication Module (DCM) • Control computer of each device installed in vehicle
(3)	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)
(4)	Decides the timing for sending to the server. (When engine switch OFF is detected)	Data Communication Module (DCM)
(5)	Sends the collected DTC/FFD information to the server.	• Data Communication Module (DCM) • Telematics antenna

Control computers where DTC information is collected from

Engine Control Module (ECM)
Transmission Control Module (TCM)*1
VDC control module and hydraulic control module (VDC CM & H/M)
Combination meter
Stereo camera*2
Airbag control module
Body integrated unit
Data Communication Module (DCM)
Central gateway CM (CGW)

**1: AT*
**2: For models equipped 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.	(e)	Server
(b)	Sends DTC/FFD information.	(f)	Analyzes the received DTC/FFD information.
(c)	Mobile phone line	(g)	Sends the problem which occurred and way of correcting it to the user.
(d)	Mobile phone base station	(h)	Receives notifications by email or other means that were set from MySubaru.

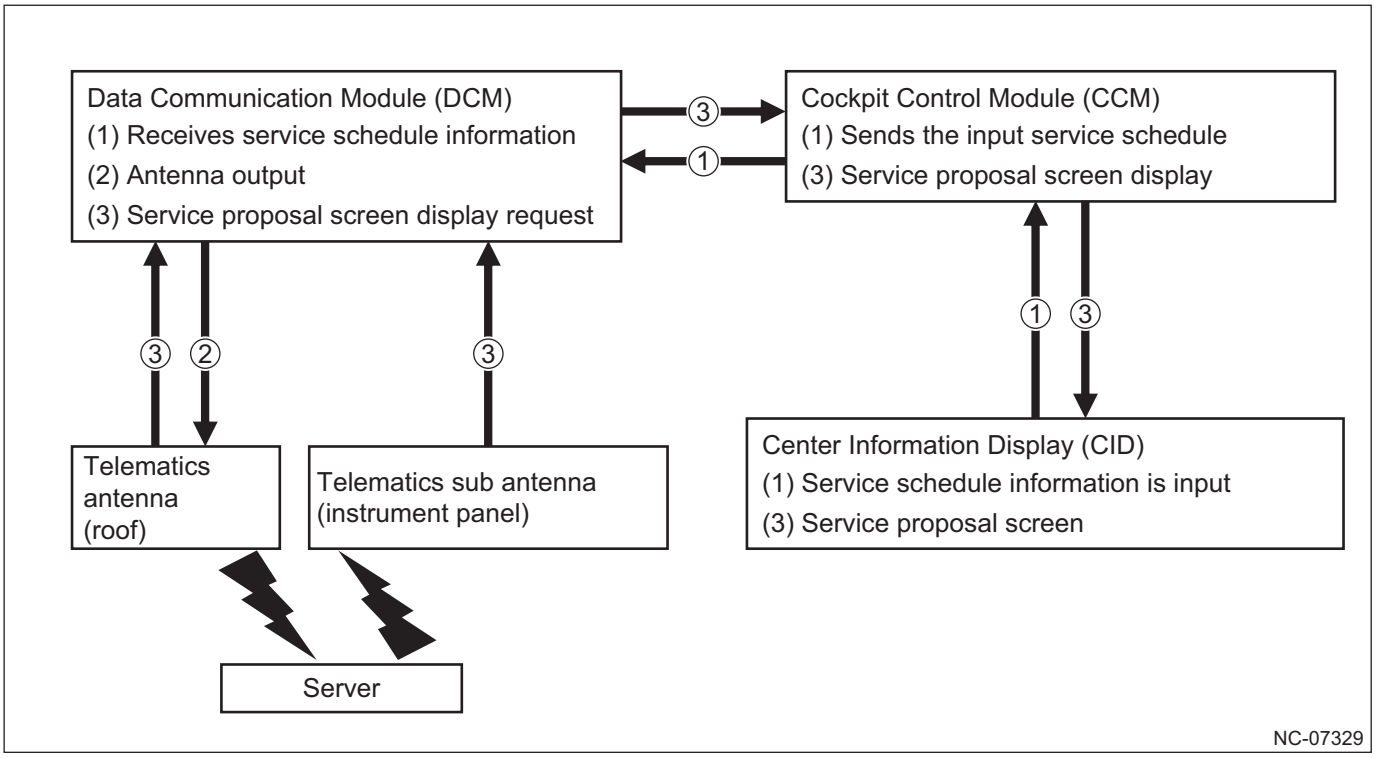
■ Service Appointment Scheduler

- 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

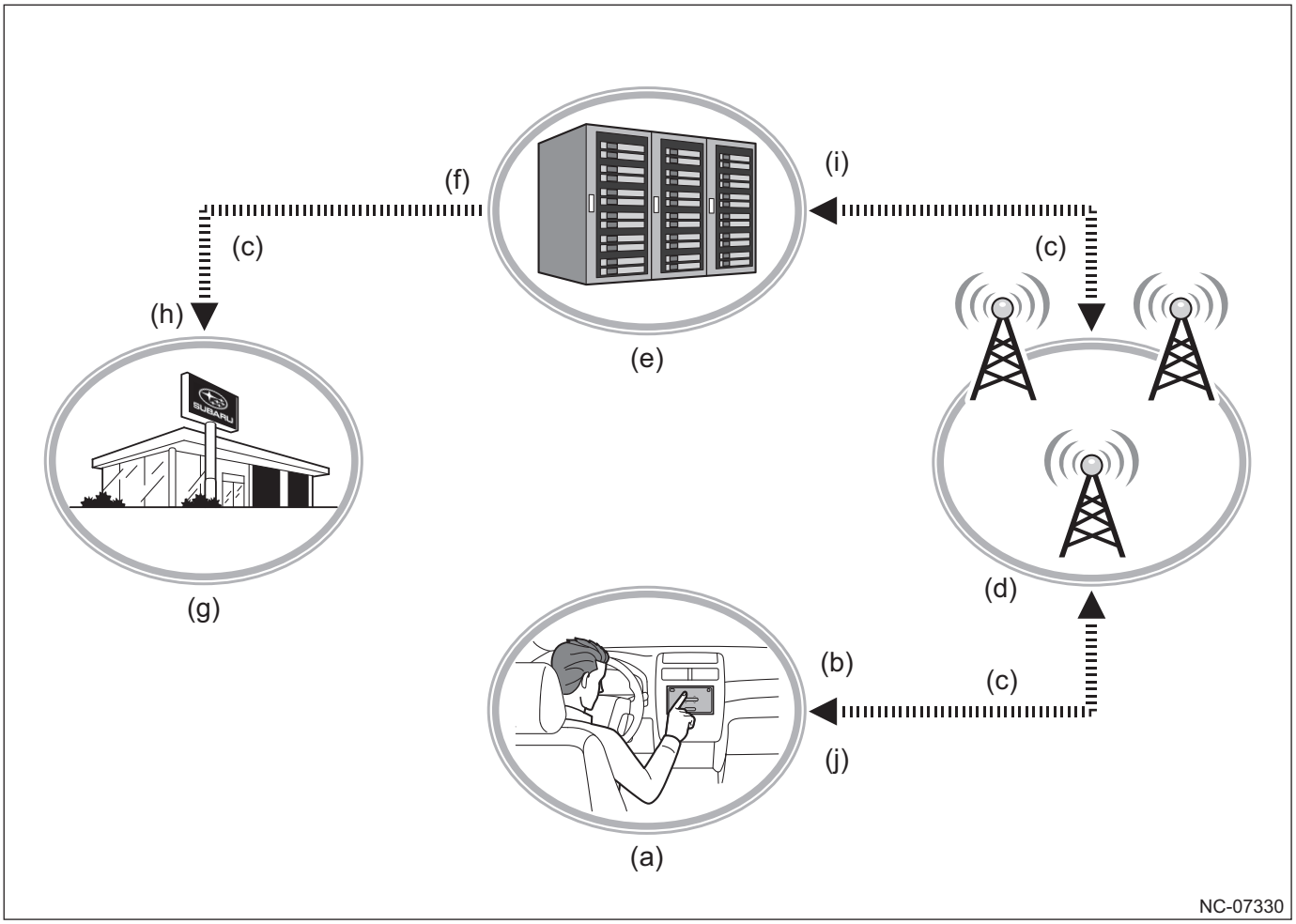
- In order to call the SUBARU dealer, the user's mobile phone must be configured to allow hands-free calling using the in-vehicle device.
- Depending on the SUBARU dealer where the user wants to have the car serviced, it may not be possible to access the dealer from the Service Appointment Scheduler.
- 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
(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)

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 (AT 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.

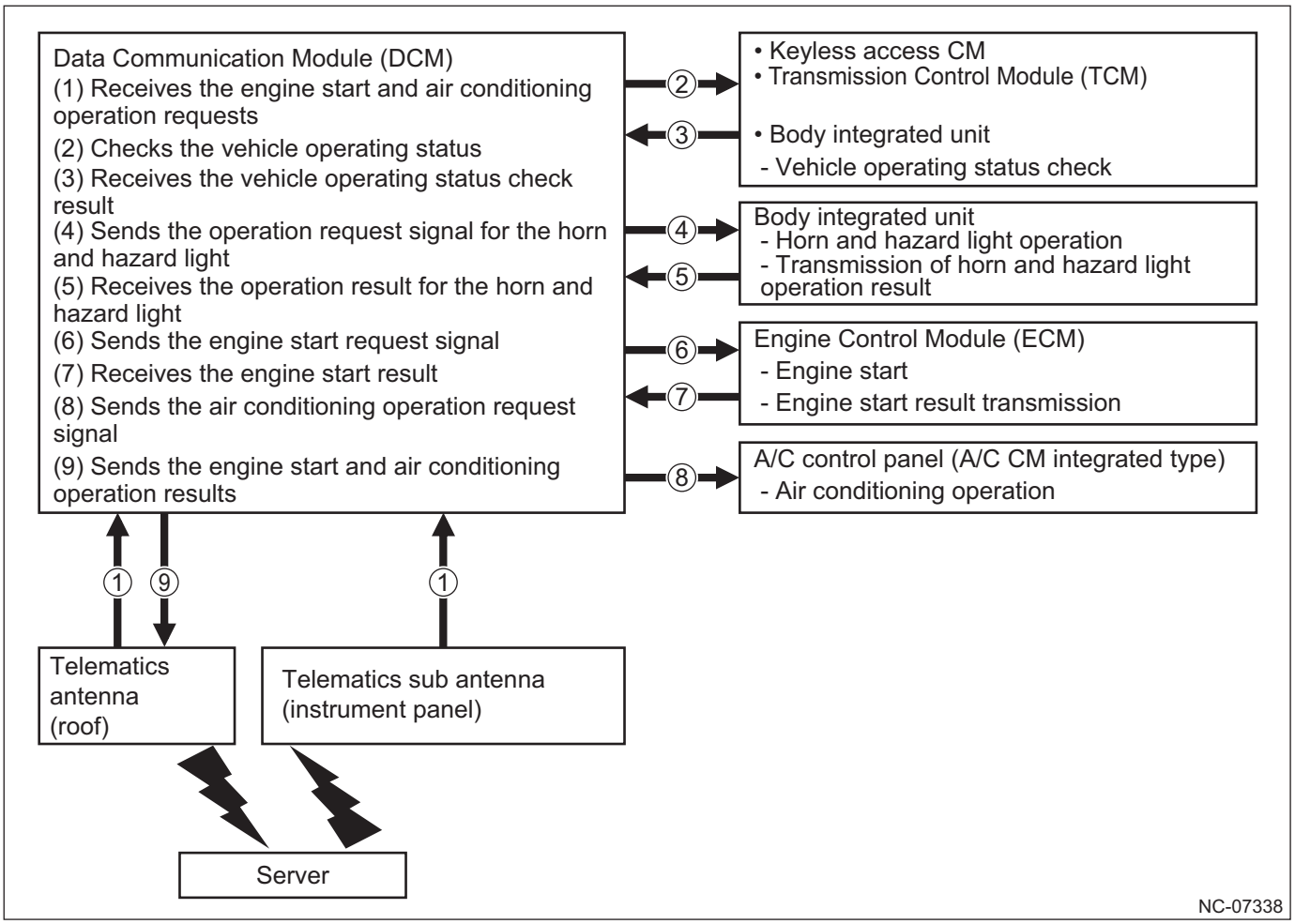
Warning

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 control panel (A/C CM integrated type)
(9)	Sends the engine start result to the server.	• Data Communication Module (DCM) • Telematics antenna

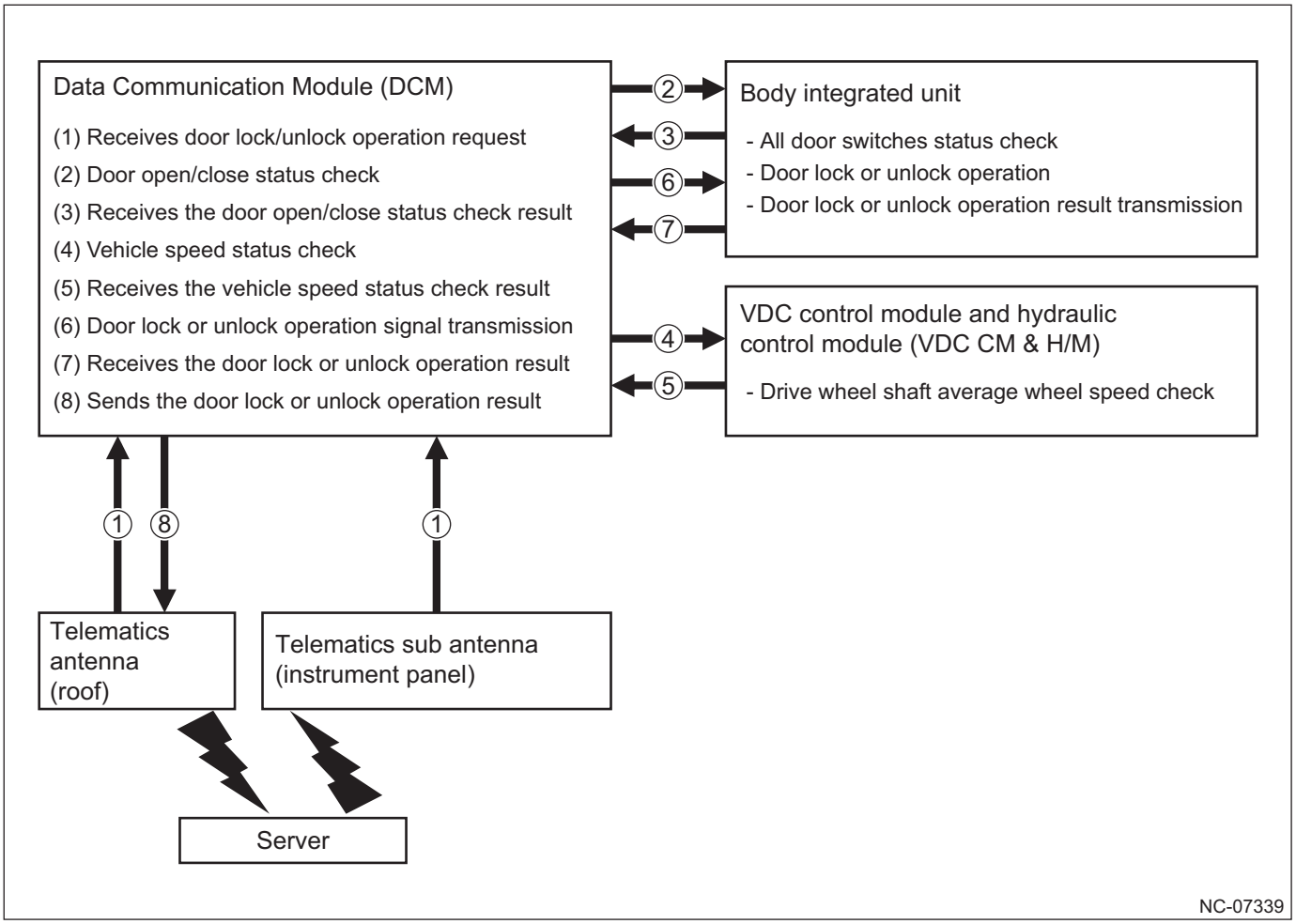
▮ Remote Door Lock & Unlock

- 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 control module and hydraulic control module (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 control module and hydraulic control module (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

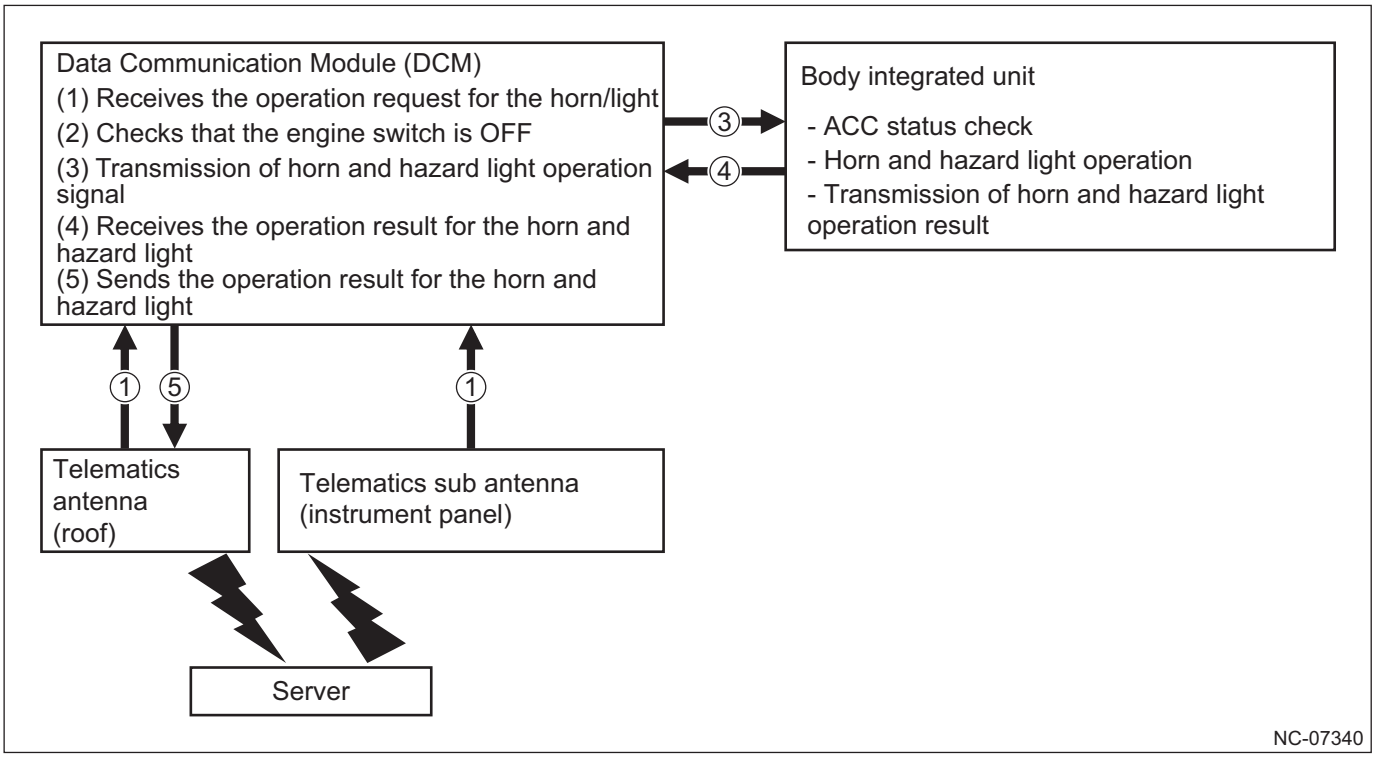
■ Remote Horn & Lights

- 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 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 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 CommunicationModule (DCM)
(5)	Sends the operation result for the horn and hazard lights to the server.	• Data Communication Module (DCM) • Telematics antenna

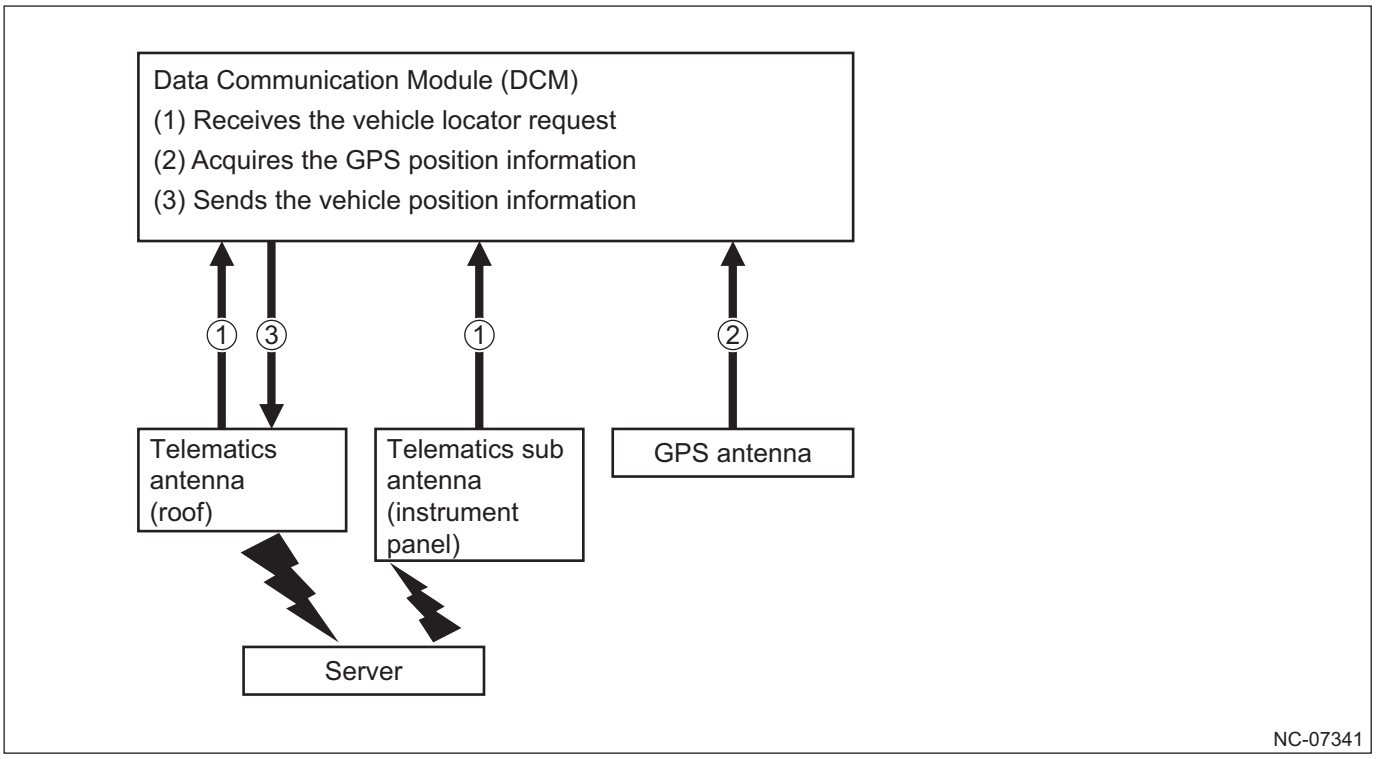
▮ Remote Vehicle Locator

- 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

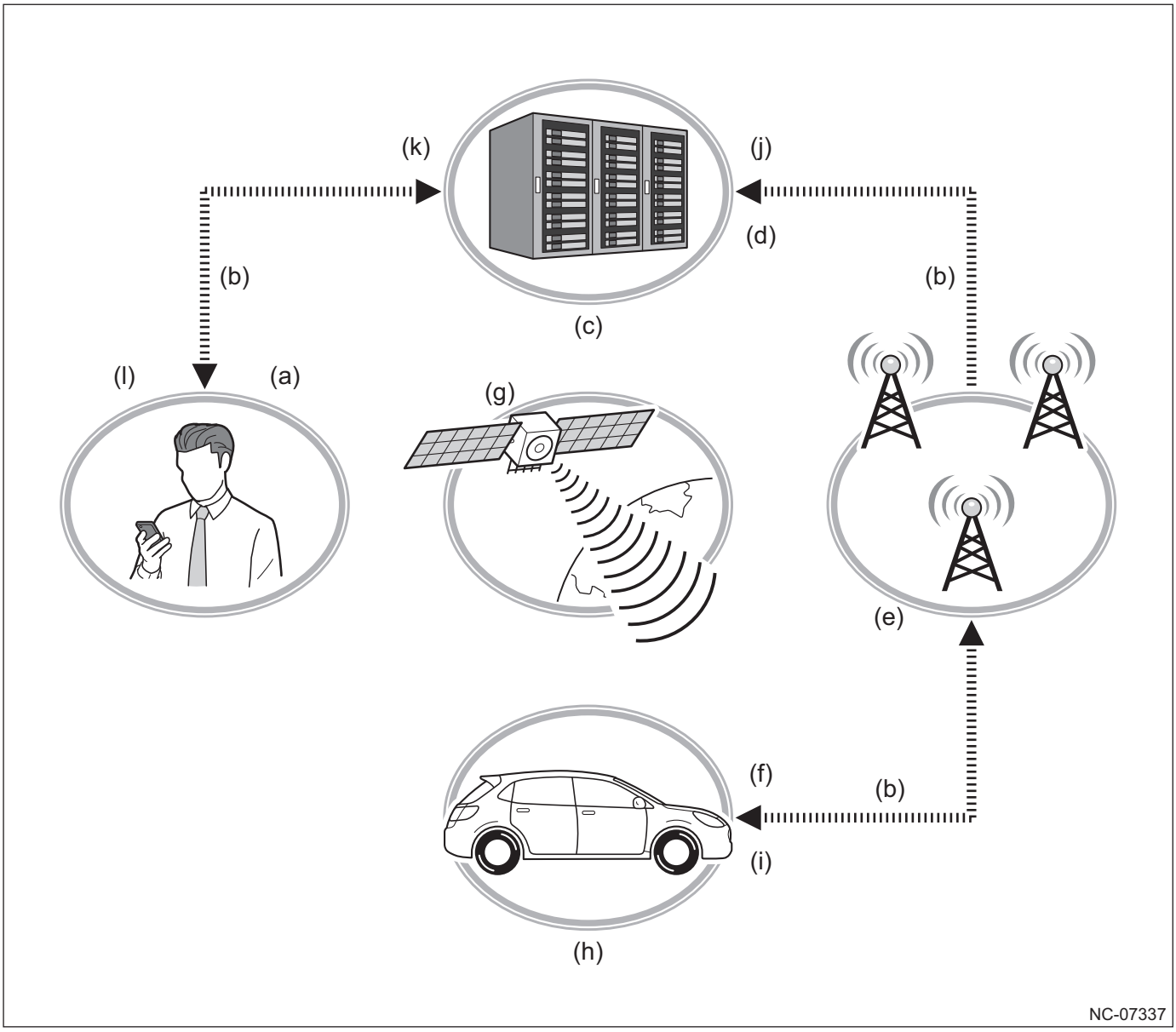
- Acquiring vehicle position information by remote operation can also be used by contacting STARLINK Customer Care (1-855-753-2495).
- Depending on the signal conditions, it may not be possible to use Remote Vehicle Locator.

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

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.

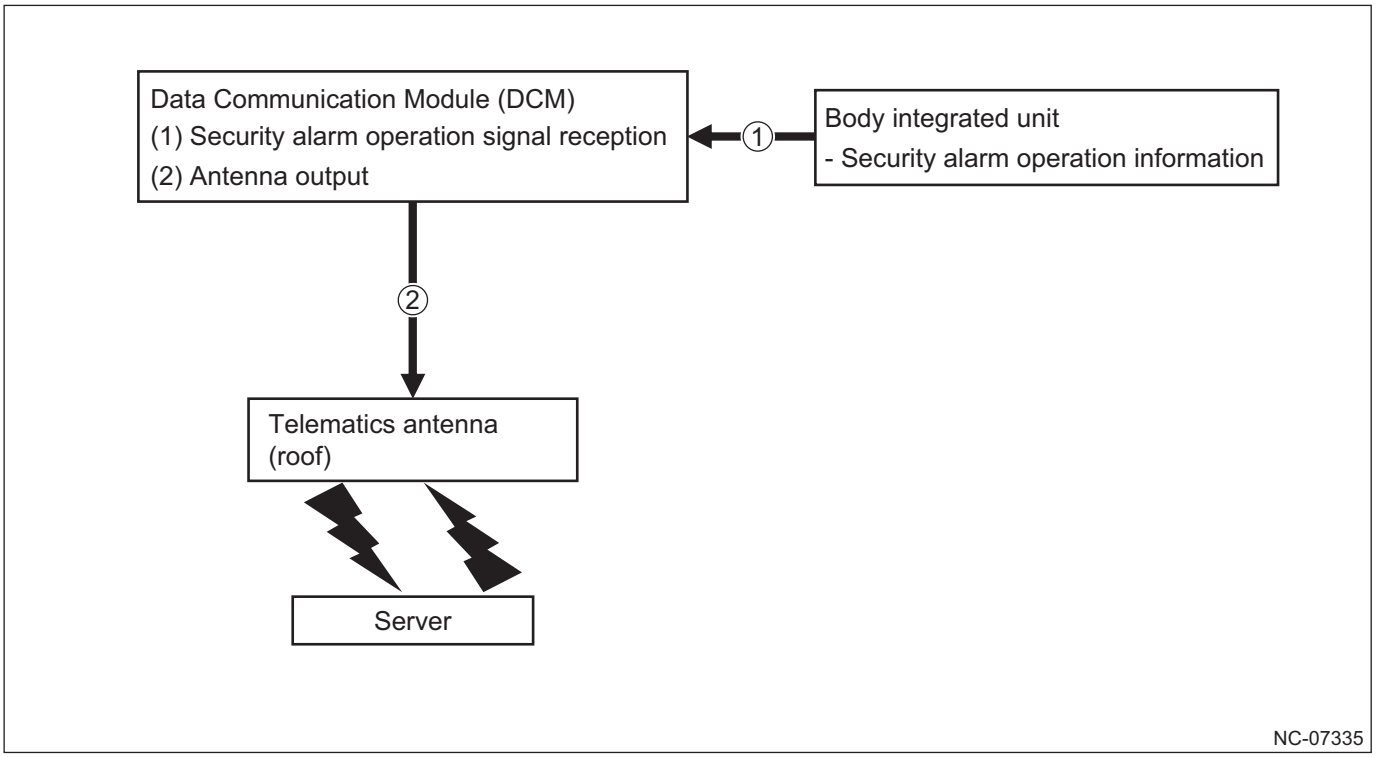
■ Vehicle Security Alarm Notification

- 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

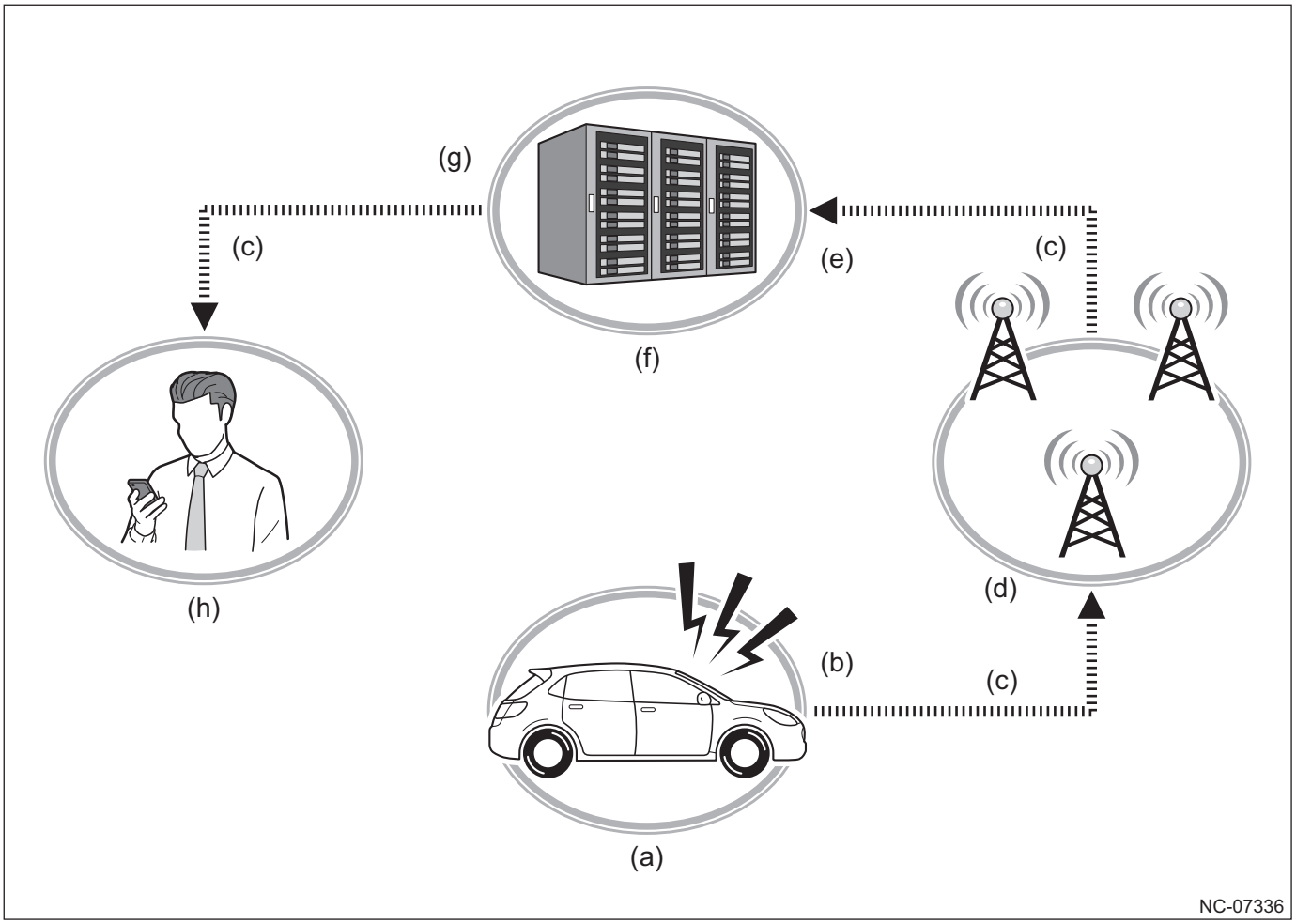
- The notification address can be registered or changed from MySubaru.
- Depending on the signal conditions, it may not be possible to use Vehicle Security Alarm Notification.
- If the engine switch is not turned ON for 14 days or longer after it was turned OFF, the Data Communication Module (DCM) enters shutdown mode and Vehicle Security Alarm Notification will not be sent. For details, refer to the handling precautions. {11-106}

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

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.

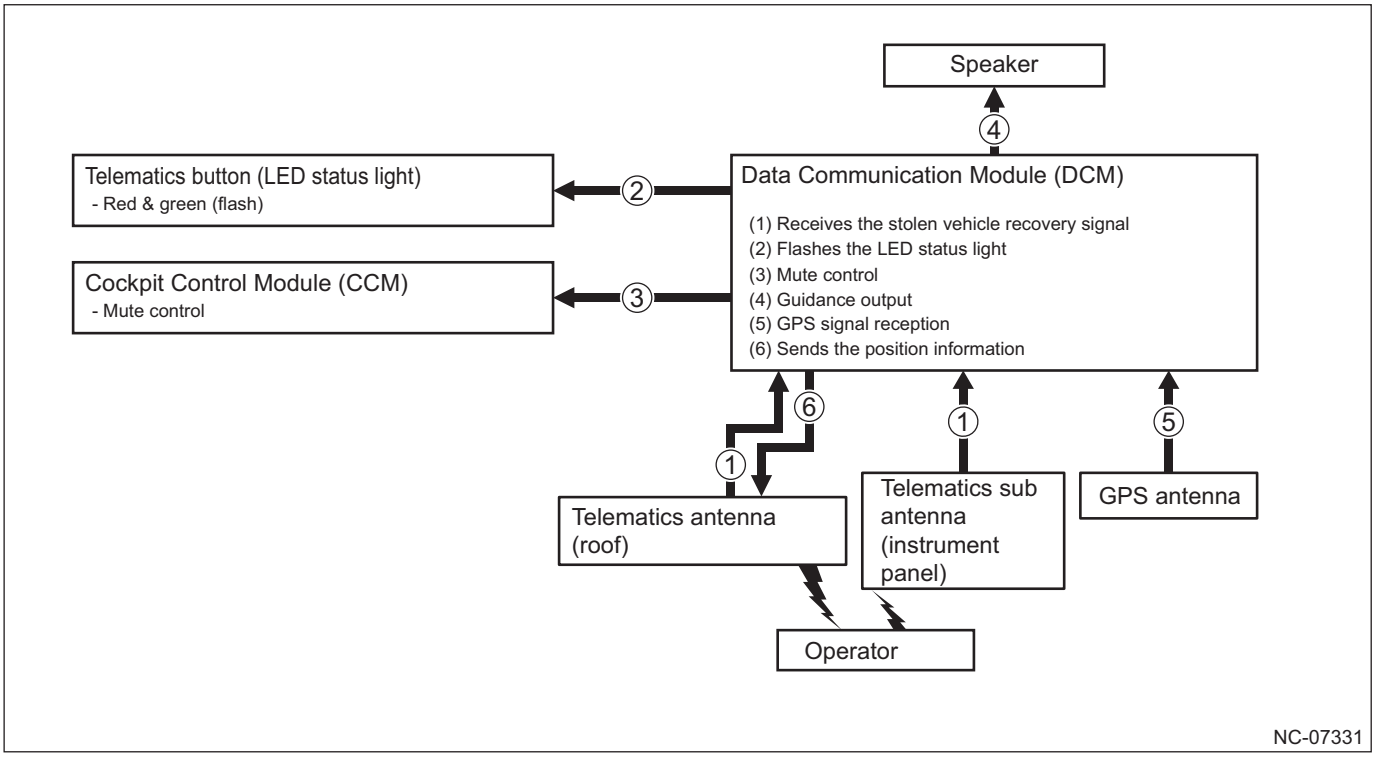
▮ Stolen Vehicle Recovery

- 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 engine switch is OFF.

Vehicle side control flow

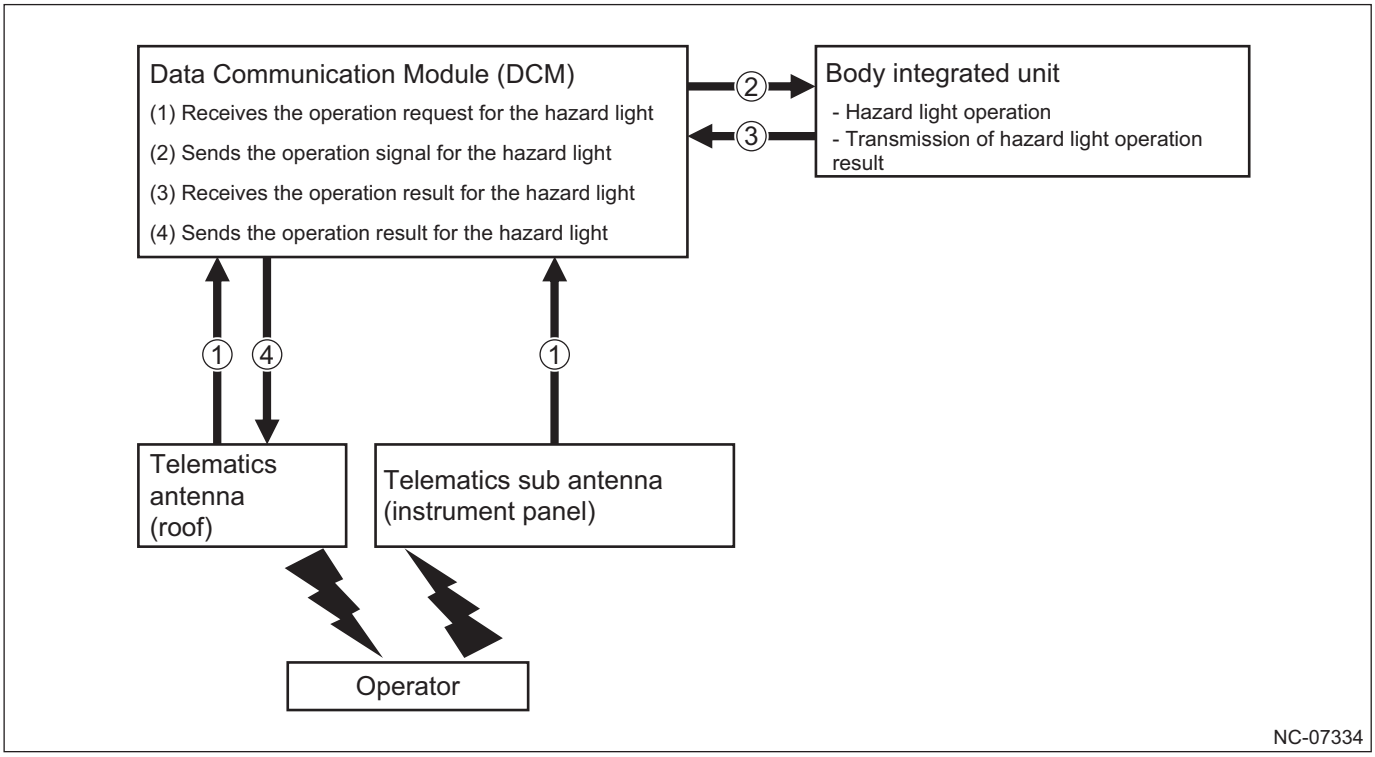


No.	Control description	Supported unit
(1)	Receives a stolen vehicle recovery request signal from the server.	• Telematics antenna • Telematics sub antenna • Data Communication Module (DCM)
(2)	Flashes the LED status light.	• Data Communication Module (DCM) • Telematics button
(3)	Mutes the currently 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

▮ 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

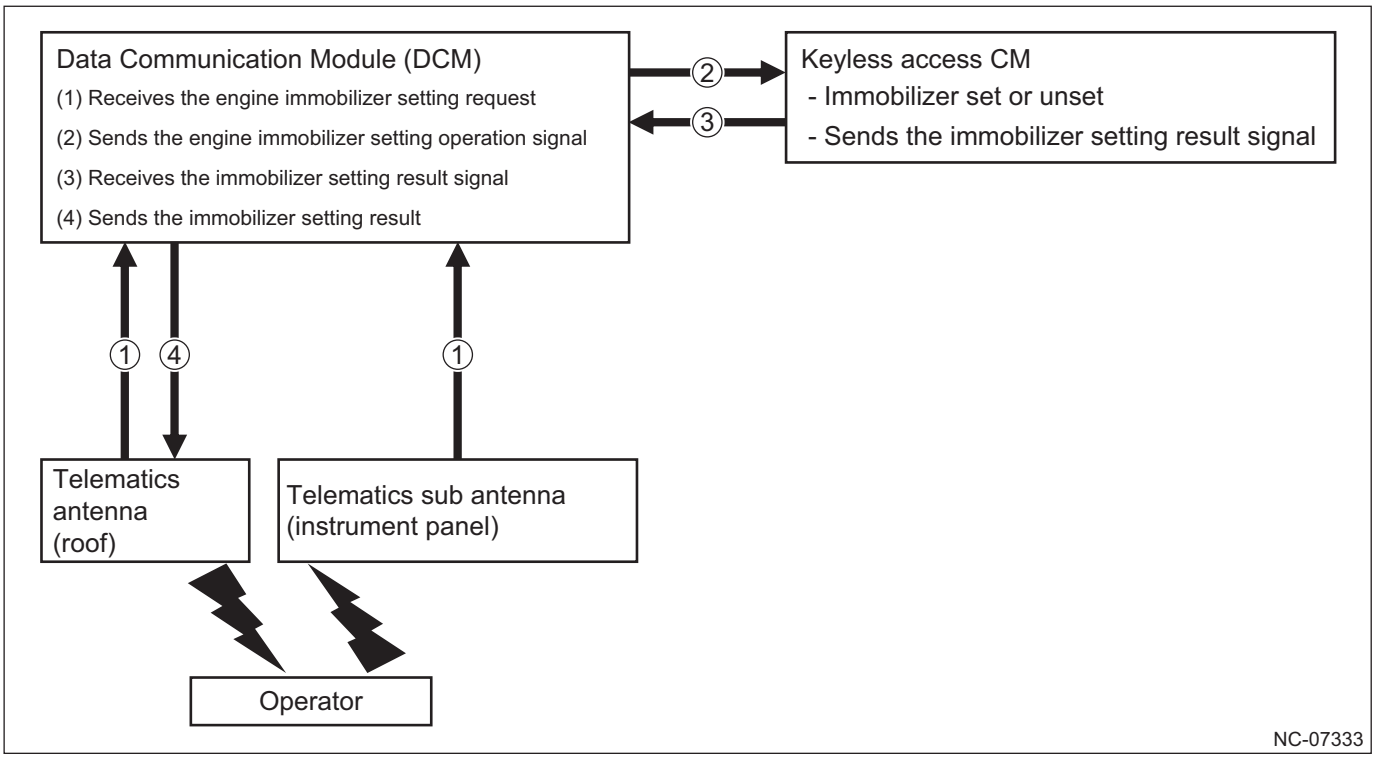


No.	Control description	Supported unit
(1)	Receives the hazard light activation request signal from the server.	• Telematics antenna • Telematics sub antenna • Data Communication Module (DCM)
(2)	Sends the hazard light activation signal.	• Data Communication Module (DCM) • Body integrated unit
(3)	Receives 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

■ Stolen Vehicle Immobilizer

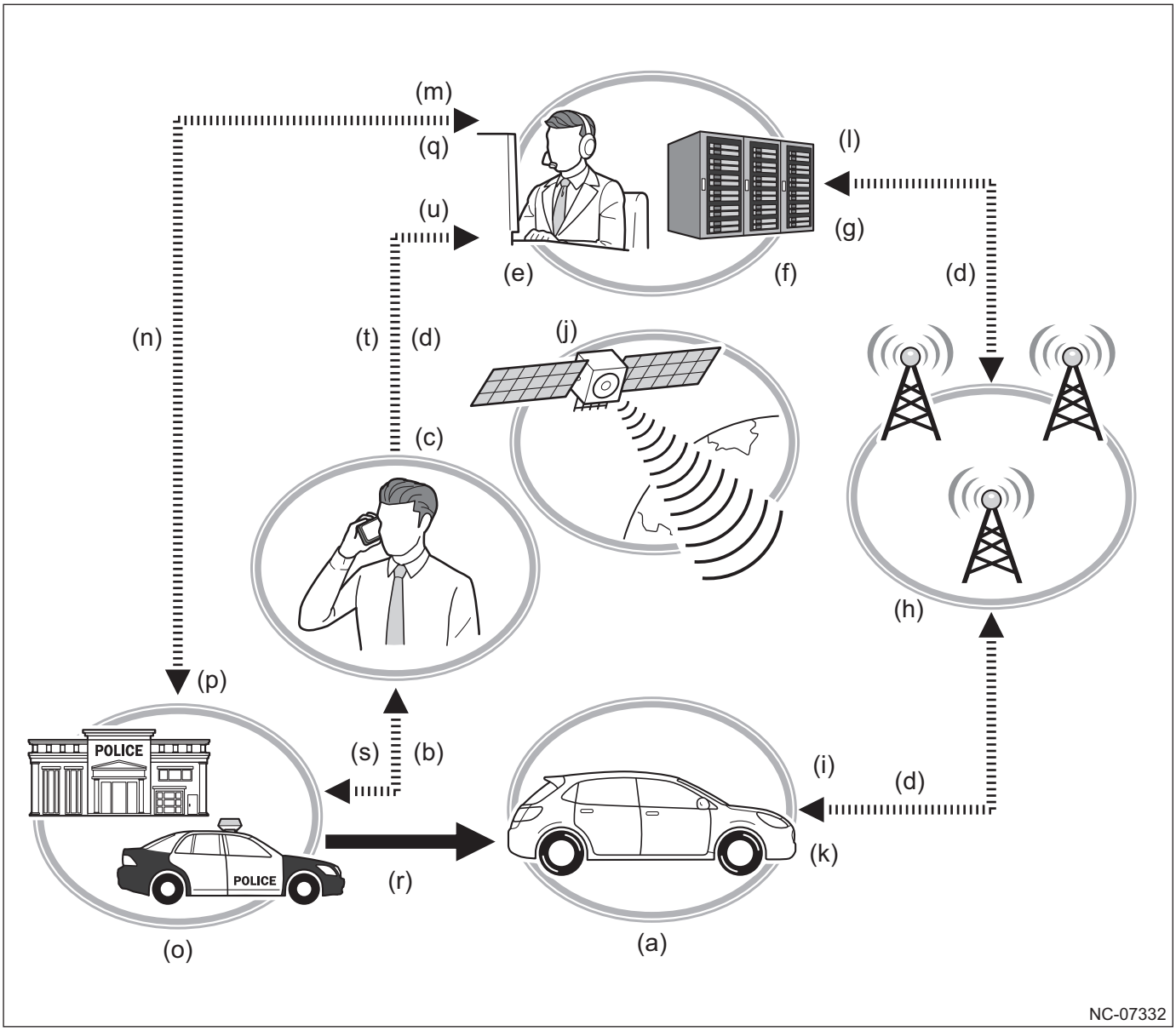
- Upon request from the police, this function allows a Customer Care Advisor to perform a remote operation that prevents the engine of a stolen vehicle from being started.
- Setting the activation restriction on the vehicle engine immobilizer by remote operation prevents the engine from being started. 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

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

(b) The user notices the vehicle theft and reports it to the police.

(c) Reports the case number received from the police to the Customer Care Advisor at the SUBARU STARLINK Call Center.

(d) Mobile phone line

(e) Customer Care Advisor

(f) Server

(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.

(l) Receives position information and remote operation results from the vehicle.

(m) Notify the police of the vehicle position information or the operation result when there is a remote operation request of the stolen vehicle.

(n) Fixed line

(o) Police department

(p) Requests operation to support recovery of the stolen vehicle.

(q) Receives request from the police for remote operation of the stolen vehicle.

(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

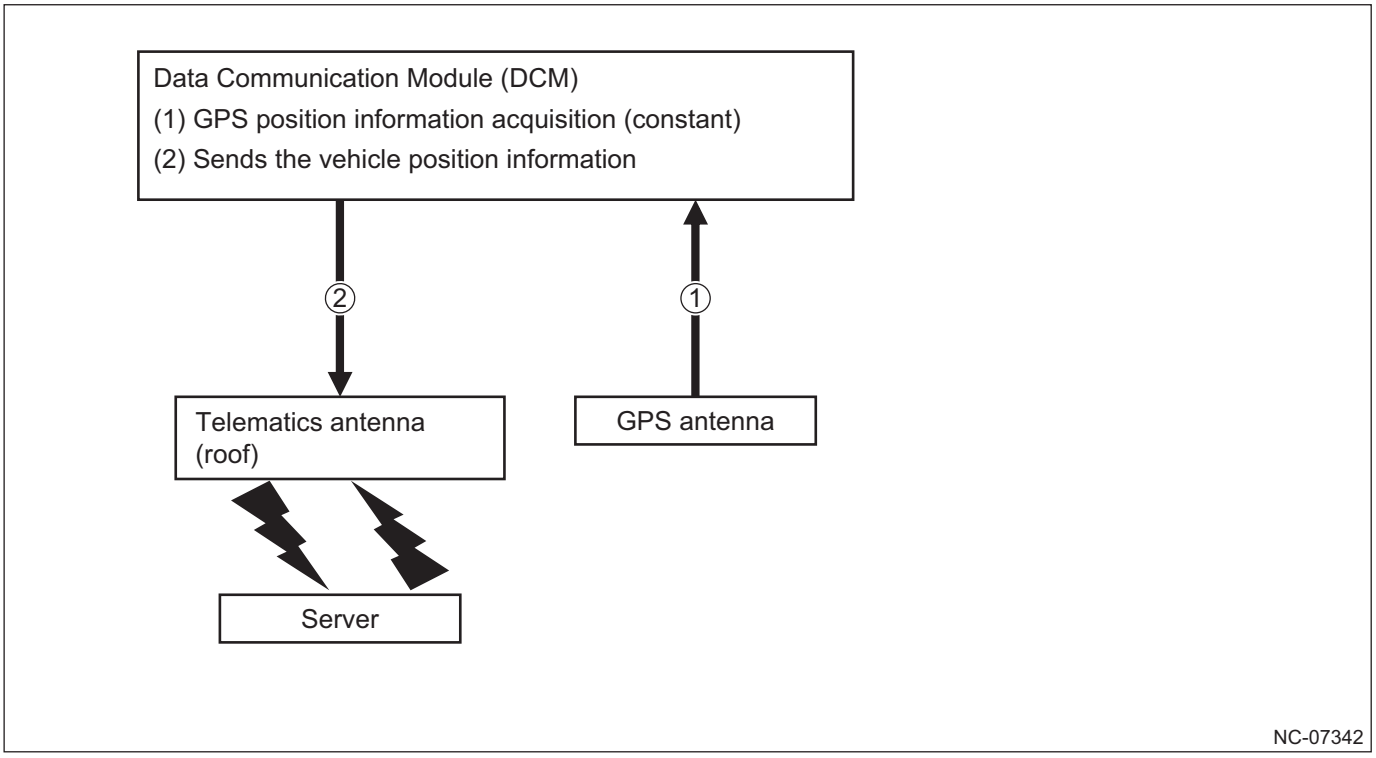
- This service allows limits to be set from MySubaru when the vehicle was loaned to someone, and allows the driver using the vehicle to be managed.

▮ 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

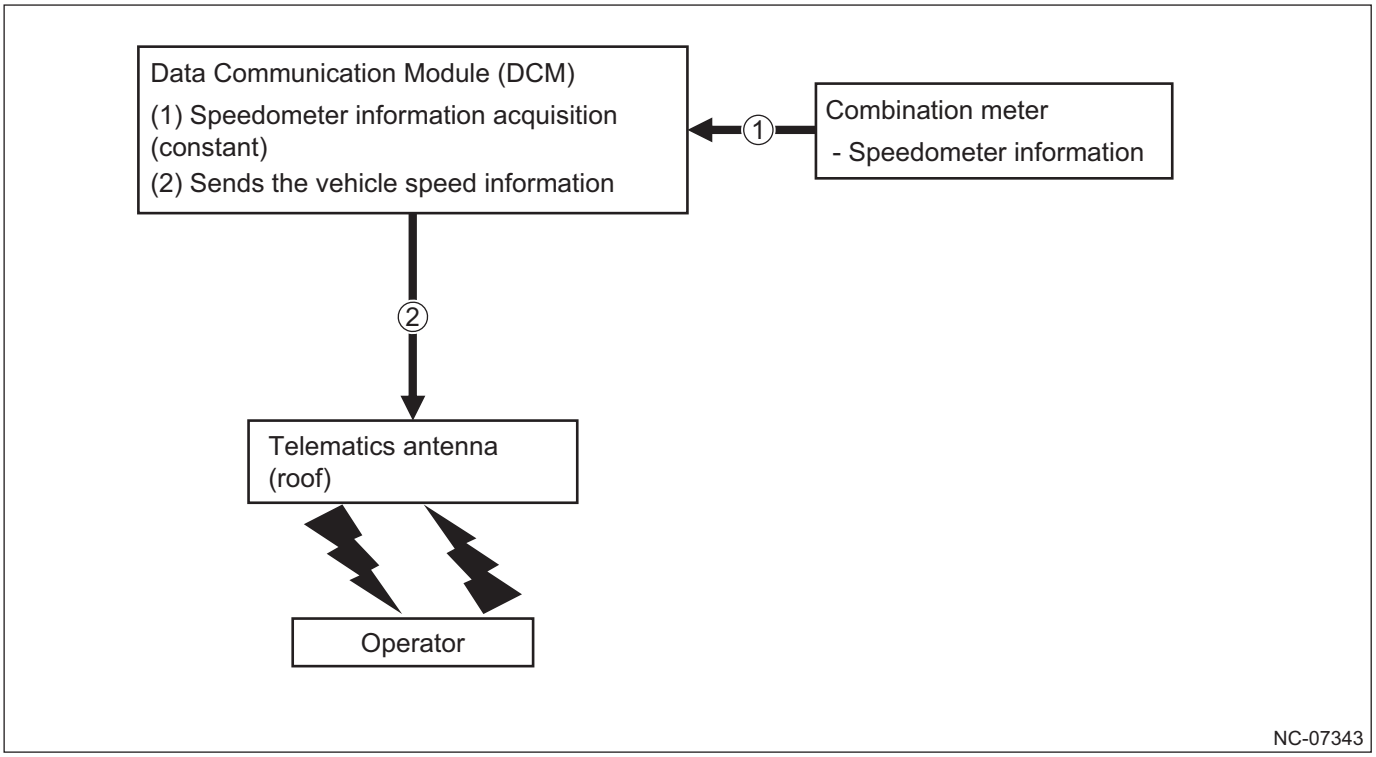
■ Speed Alert

- 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

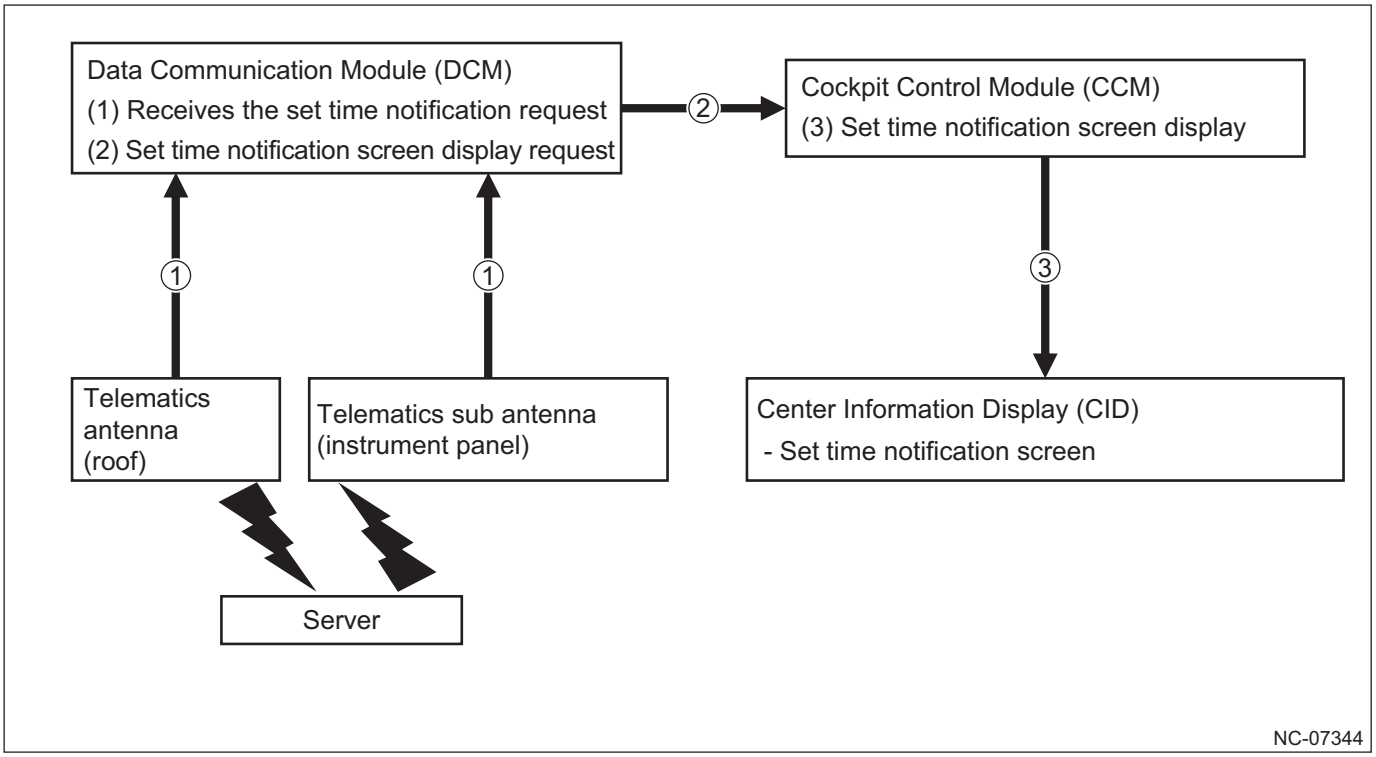
▮ Curfew Alert

- 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

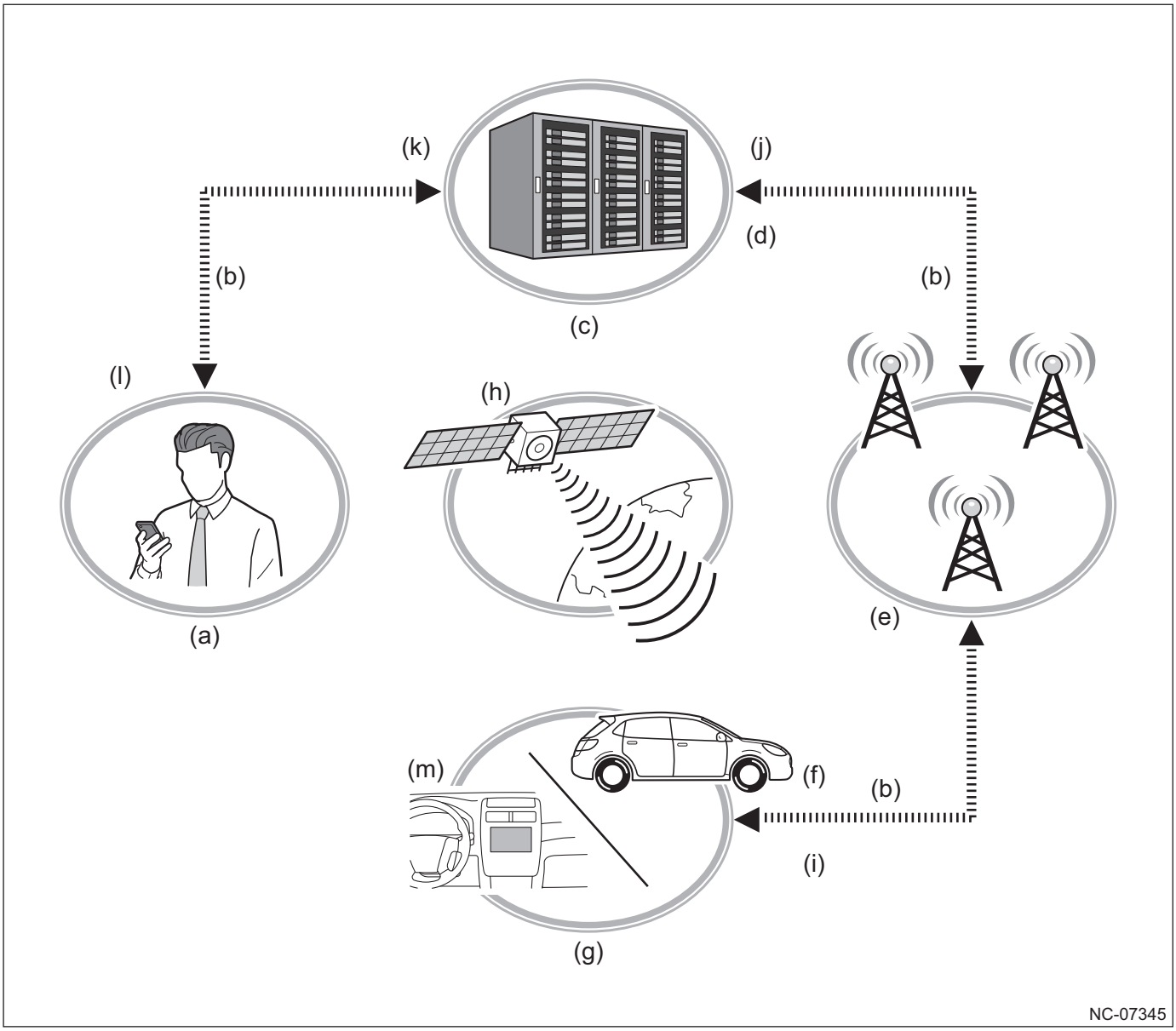
Depending on the signal conditions, it may not be possible to use Curfew Alert.

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)

Vehicle Alerts service flow



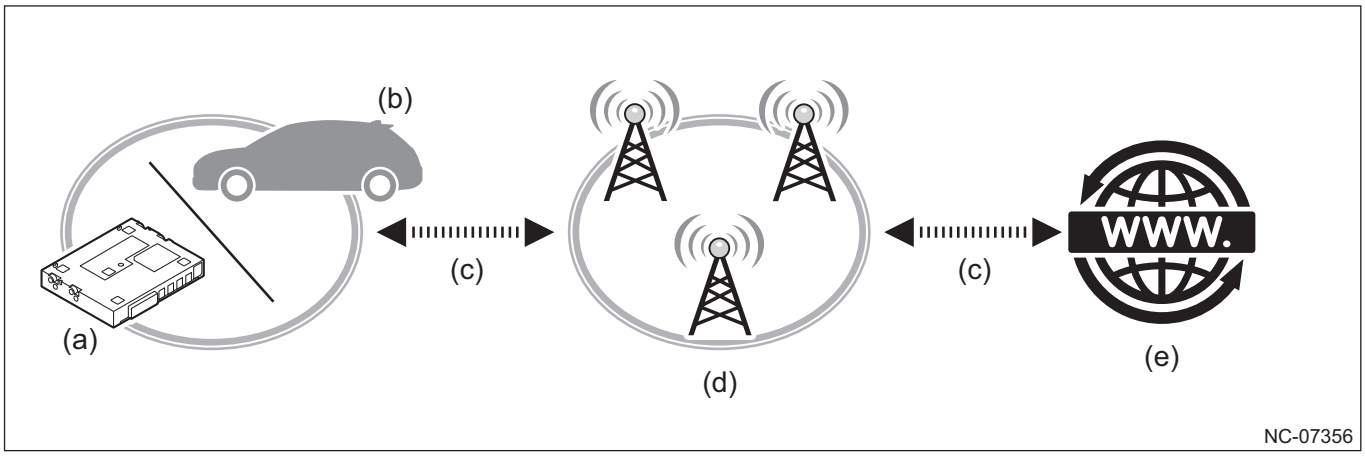
** The illustration shows an example of the service flow that may differ from the actual service.*

(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		

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". {11-22}

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.

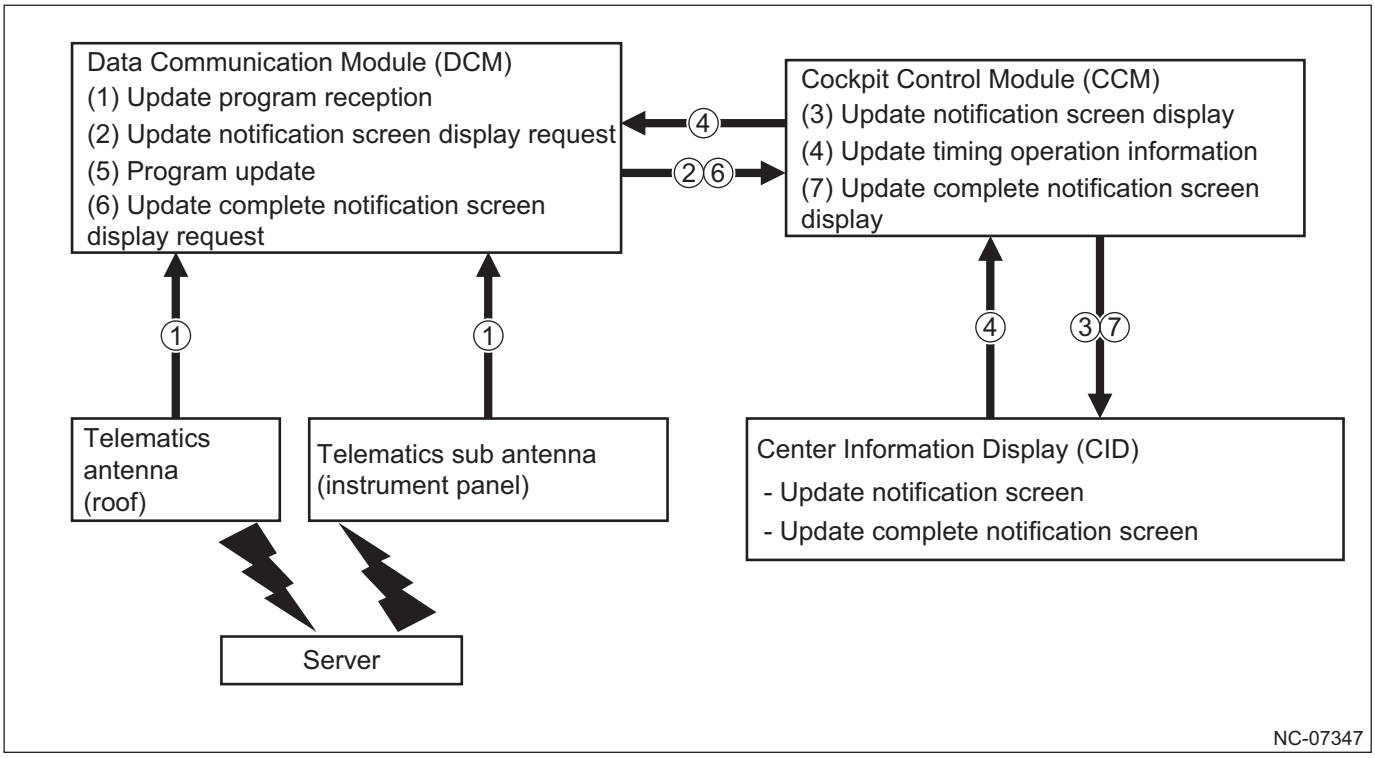
■ SUBARU STARLINK System Update

- 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 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

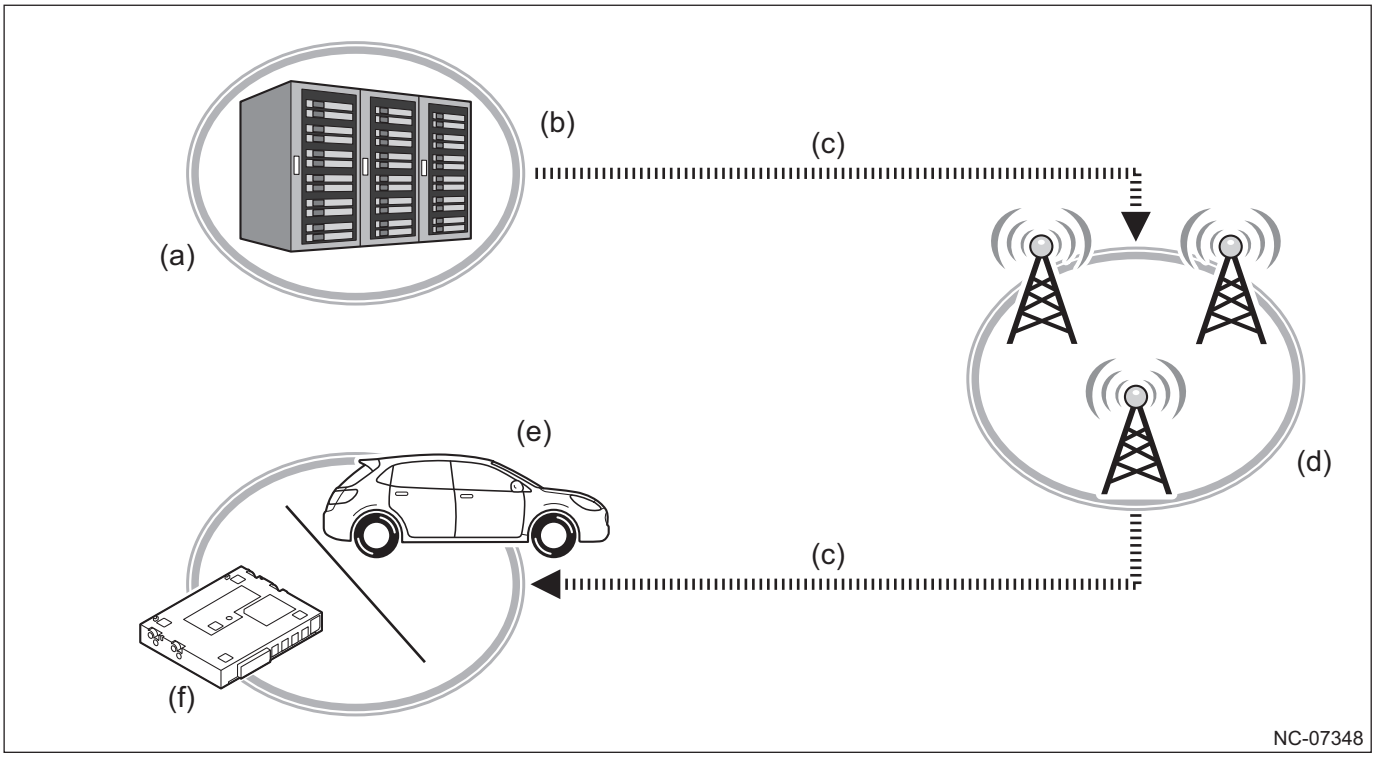
- While update is in progress, all SUBARU STARLINK services that utilize the Data Communication Module (DCM) are unavailable.
- When update is completed, the completion screen appears on the display.
- The update timing can be delayed a maximum of 2 times. However update is started automatically the third time the 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)

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.

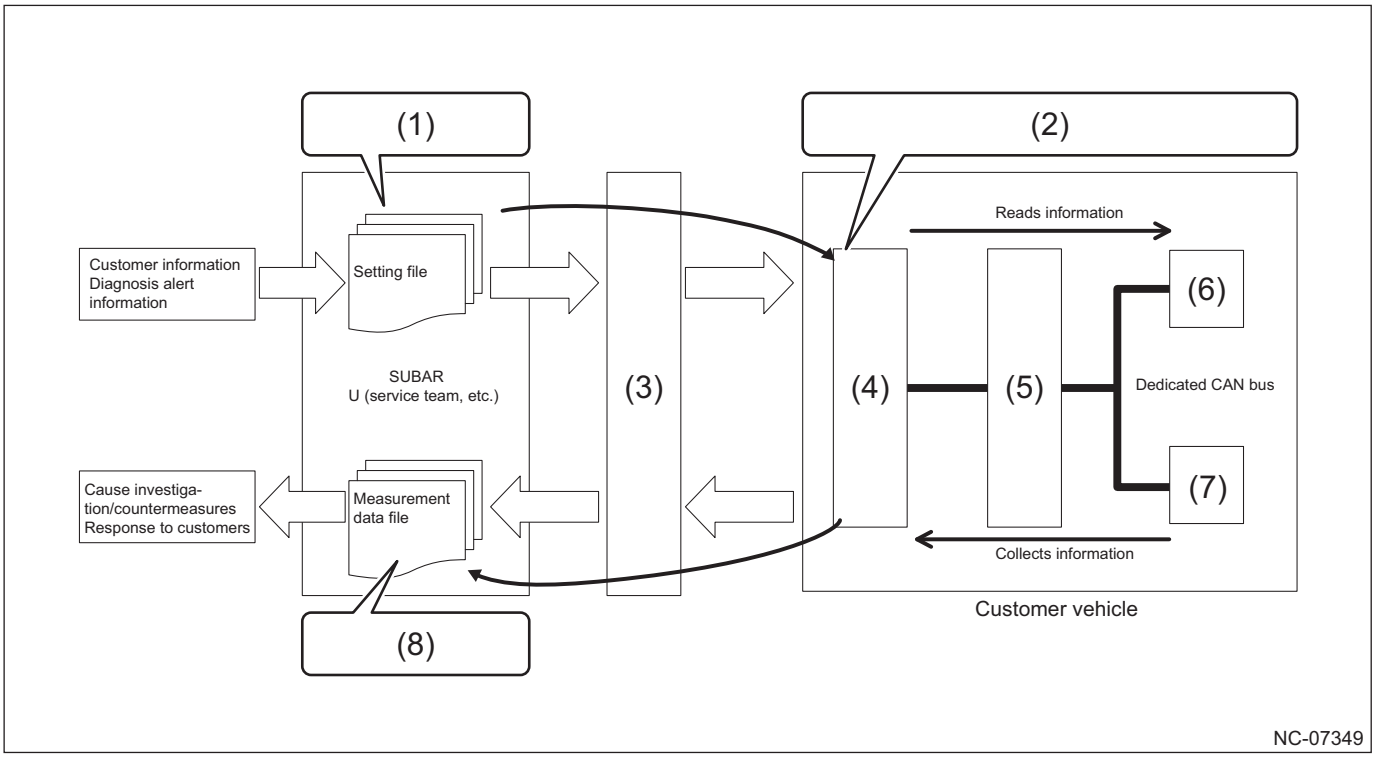
■ Driving Recorder Data Feed

- 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) (AT 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) (AT only)
(8)	Analyzes the measurement data file that was sent from the vehicle, identifies the cause, and considers a correction.

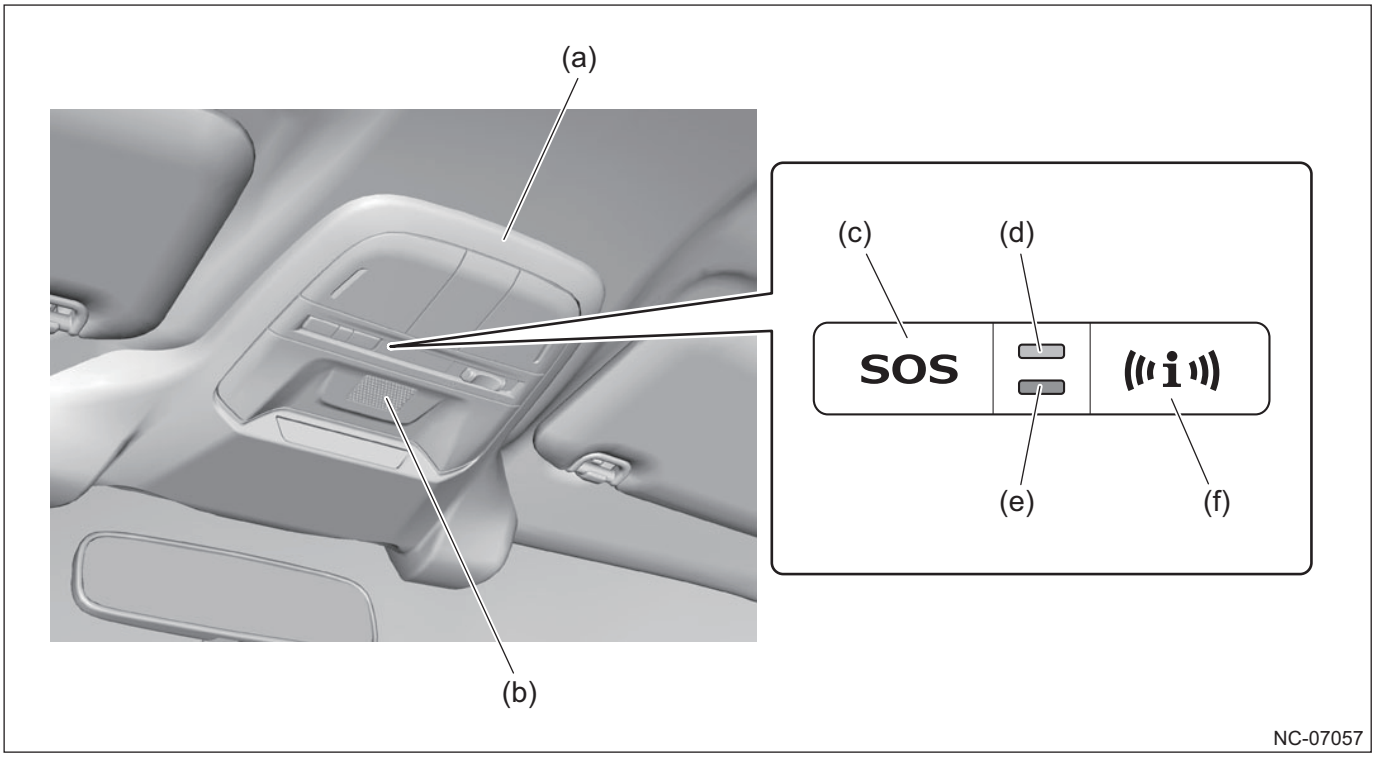
User interface

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 for operability in an emergency, the buttons are positioned inside the spot 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)	Spot 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.) • Replacement of the backup battery (BUB)
Flashing	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."

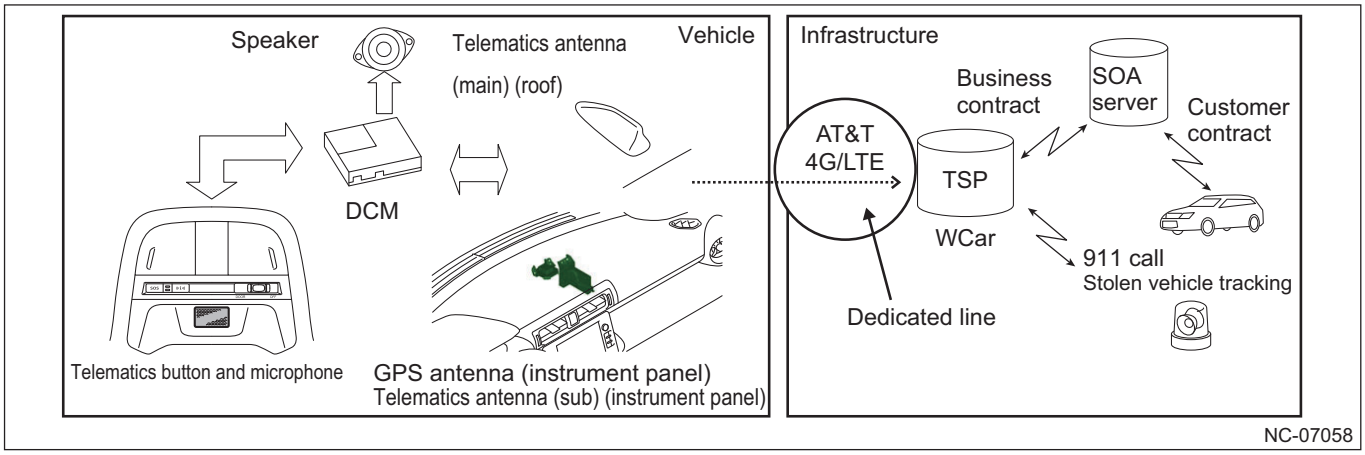
■ French guidance (C0 only)

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).

11.6 Information

11.6.1 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.

Specifications

Hardware

Display	Specifications	Color LCD
	Size/resolution	8.0-inch/WVGA (800x480)
	Touch panel	Electrostatic
	Display language	English (USA), French (Canadian), Spanish (Mexican)
CPU	Name	Intel Apollo Lake
	Spec.	37,944 MIPS 4-Core 1.8 GHz
Main memory	Main	16 GB
	RAM	3 GB
USB terminal		USB2.0x2 (maximum 2.1 A each)

Software

Time setting	Smartphone link*1/Automatic (GPS link)*2/Manual
Display language	English (USA), French (Canadian), Spanish (Mexican)

**1: Supported except for models equipped with Data Communication Module (DCM)*
**2: Supported only for models equipped with Data Communication Module (DCM)*

Characteristics

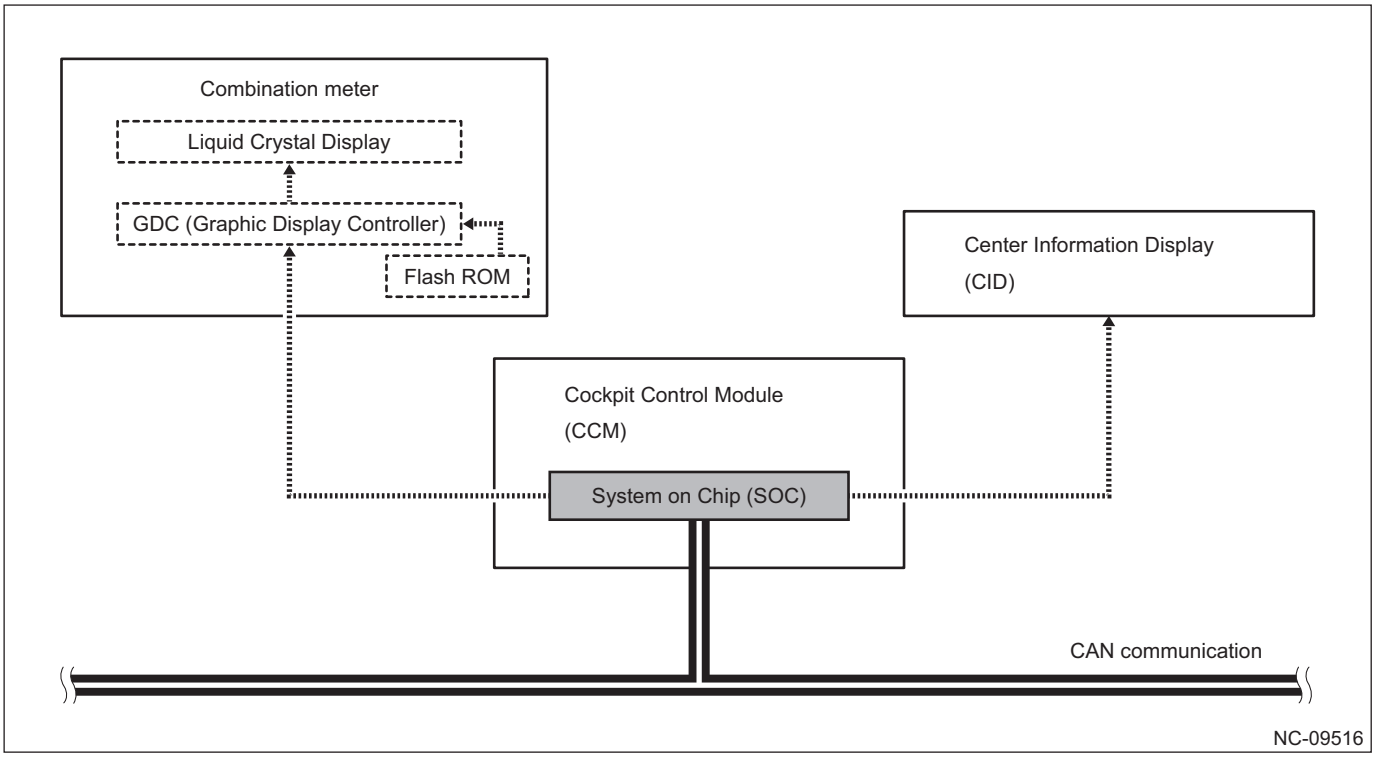
Information display link

- 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) is designed to enable display linked between the Center Information Display (CID) and LCD display (built into the combination meter).
- Because control is performed that links the Center Information Display (CID) and LCD display (built into the combination meter), it provides seamless information display and displays without delay.
- The Flash ROM that stores the data generated on the LCD display and the Graphic Display Controller (GDC) that instructs data generation are built into the combination meter to control the displayed contents of the LCD display.

Reference

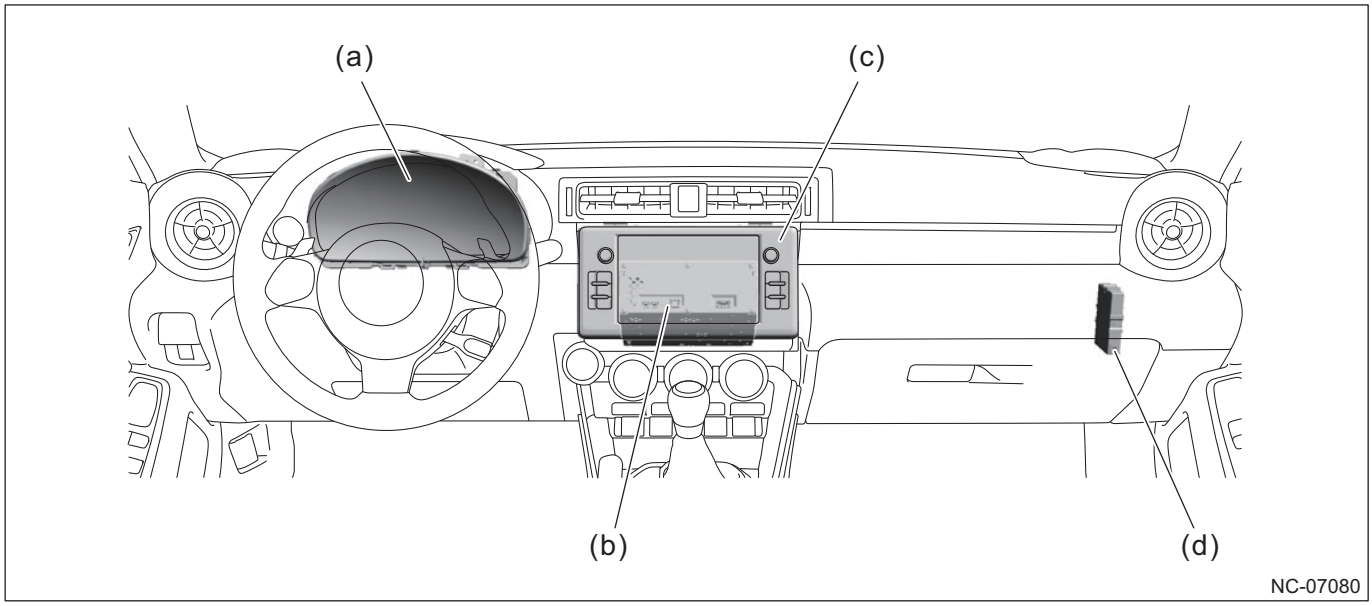
The generation of displays linked to the Center Information Display (CID), such as displaying the audio source on the LCD display, and displays on the Center Information Display (CID), is controlled by the Cockpit Control Module (CCM).

Infotainment system control mechanism



11.6.2 Component

Component layout drawing

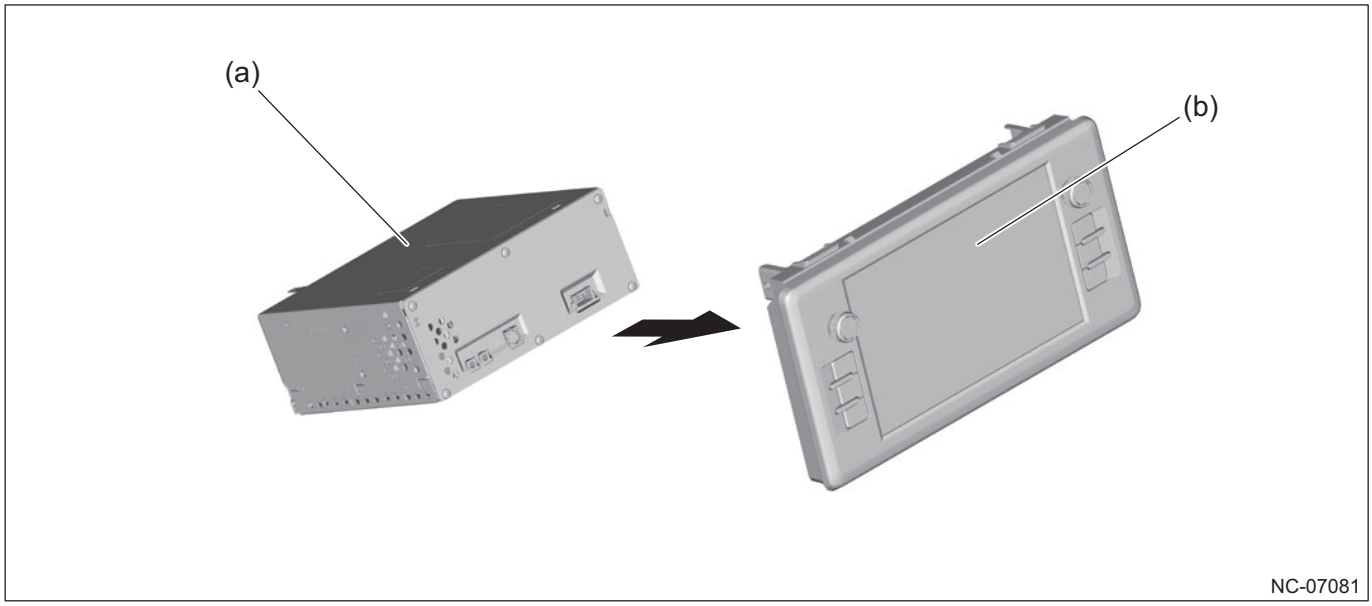


(a)	Combination meter • Liquid Crystal Display	(c)	Center Information Display (CID)
(b)	Cockpit Control Module (CCM)	(d)	Central gateway CM (CGW)

Component details

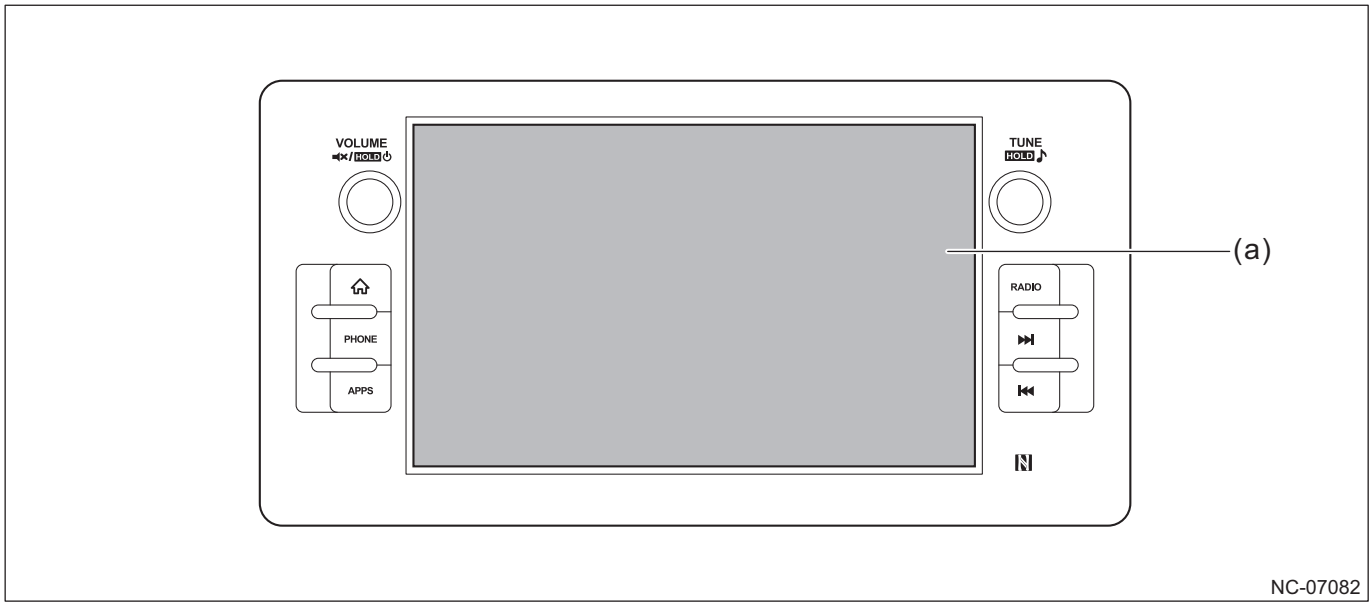
Infotainment system hardware

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.



Symbol	Part name	Function
(a)	Cockpit Control Module (CCM)	Adopts a System on Chip (SOC) method, and its hypervisor system links the Center Information Display (CID) and multi information display (built into combination meter) to control display.
(b)	Center Information Display (CID)	• Equipped with an 8-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 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).

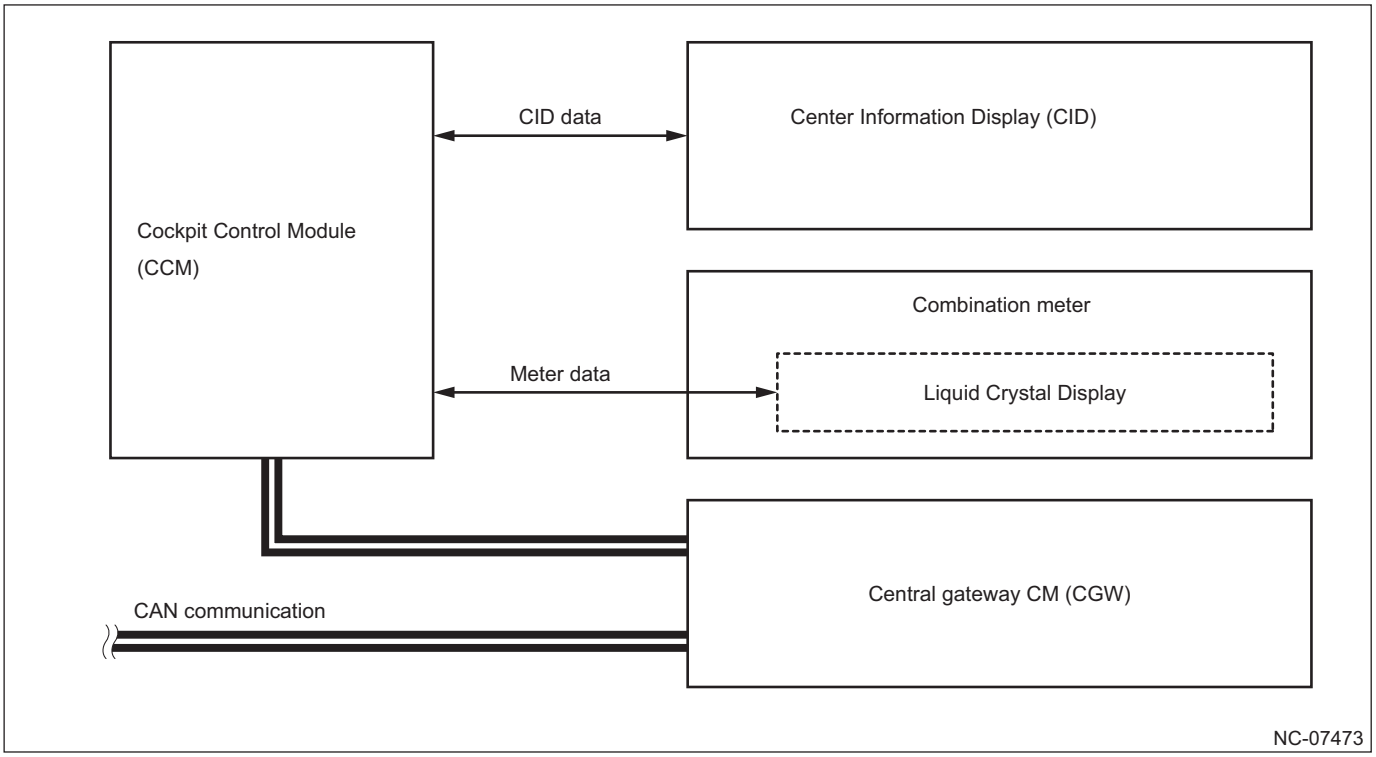
Center Information Display (CID)



(a) Display

11.6.3 Construction and Operation

System diagram



Main component functions

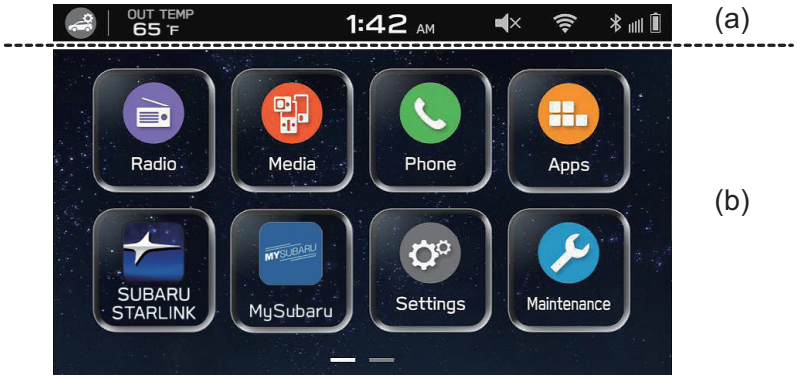
Part name	Function
Cockpit Control Module (CCM) (Product of DENSO Corporation)	• Adopts a System on Chip (SOC) method, and its hypervisor system links the Center Information Display (CID) and multi information display (built into combination meter) to control display. • Receives various types of vehicle information, such as the control status and operation status of various in-vehicle systems, via CAN communication from the control computer of each device installed in the vehicle. • Generates the information screen or reminder screen according to the user operation.
Center Information Display (CID) (Product of DENSO Corporation)	• 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 • Liquid Crystal Display	• Displays certain information screens generated by the Cockpit Control Module (CCM). • See "Combination Meter / MID" for details on the LCD display {11-59}
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.

- 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.
- Touch operations such as drag and swipe can be used.
- 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.
- 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. Refer to "Audio and Speaker System" for details on the display hierarchy {11-20}.



**The illustration shows a typical example that may differ from the actual display.*

Symbol	Area name	Display contents
(a)	Status bar area	• Displays vehicle setting shortcut buttons, ambient temperature, clock, 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)	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. • Refer to "Audio and Speaker System" for details on the category area {11-20}.

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.

Refer to "Audio and Speaker System" for details on the icons displayed on the Home Screen {11-22}.

Infotainment system settings

By touching the <Settings> button on the Home Screen, the setting items for the Infotainment System are displayed.

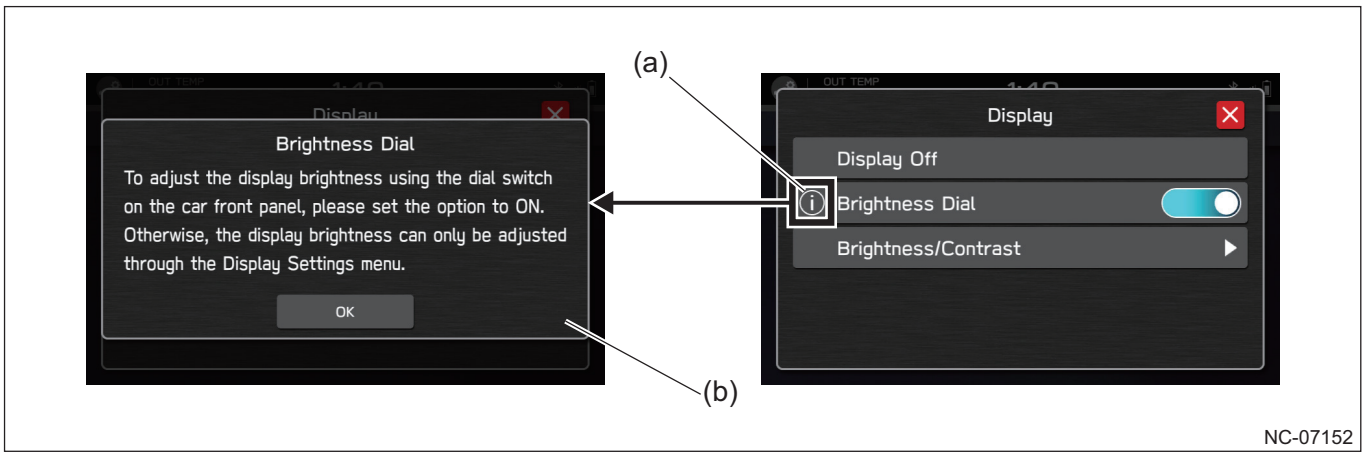
Refer to "Audio and Speaker System" for details related to the setting items {11-22}.

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 display



**The illustration shows a typical example that may differ from the actual display.*

(a) Information mark

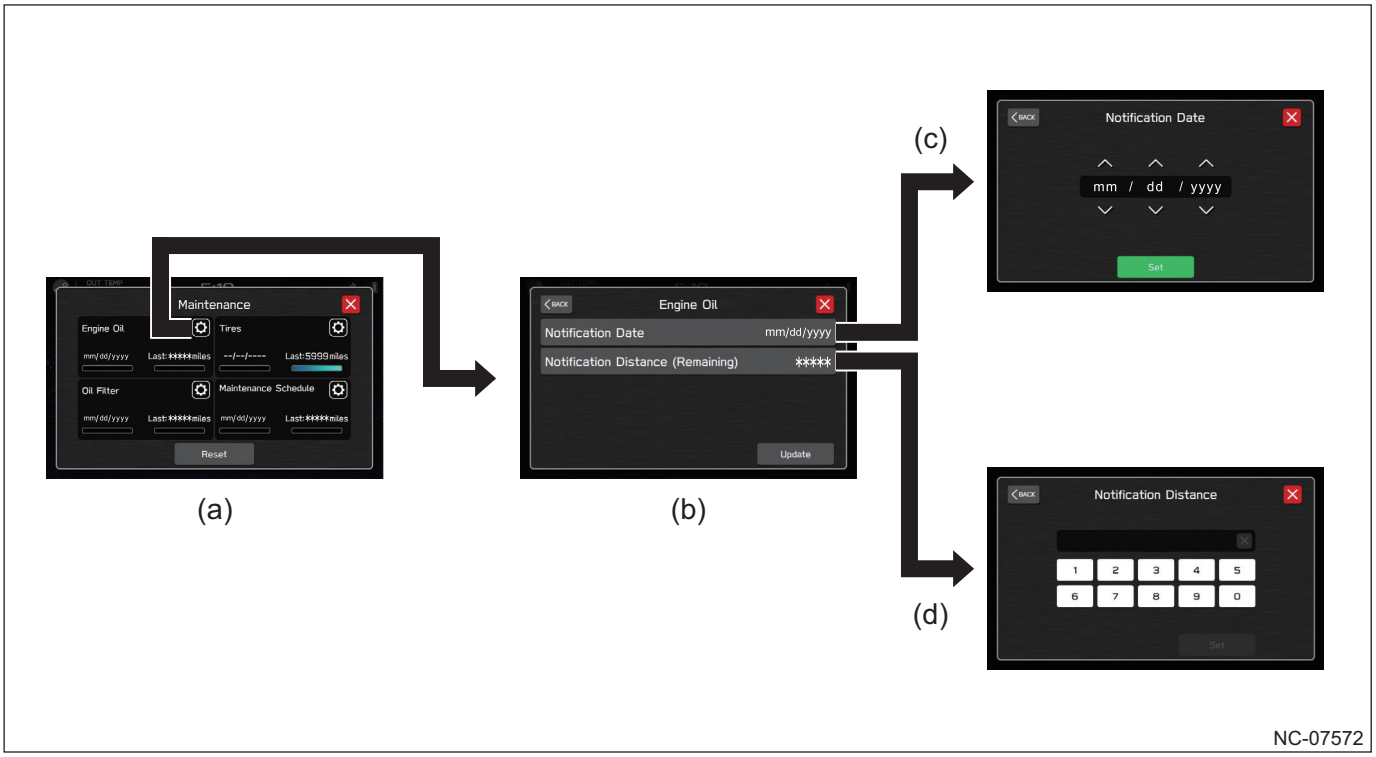
(b) Operation guidance display

Maintenance contents

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 mileage are displayed on the maintenance contents top screen, and a notification is provided when the set date or distance approaches.

All reminders can be reset by touching the <Reset> button.



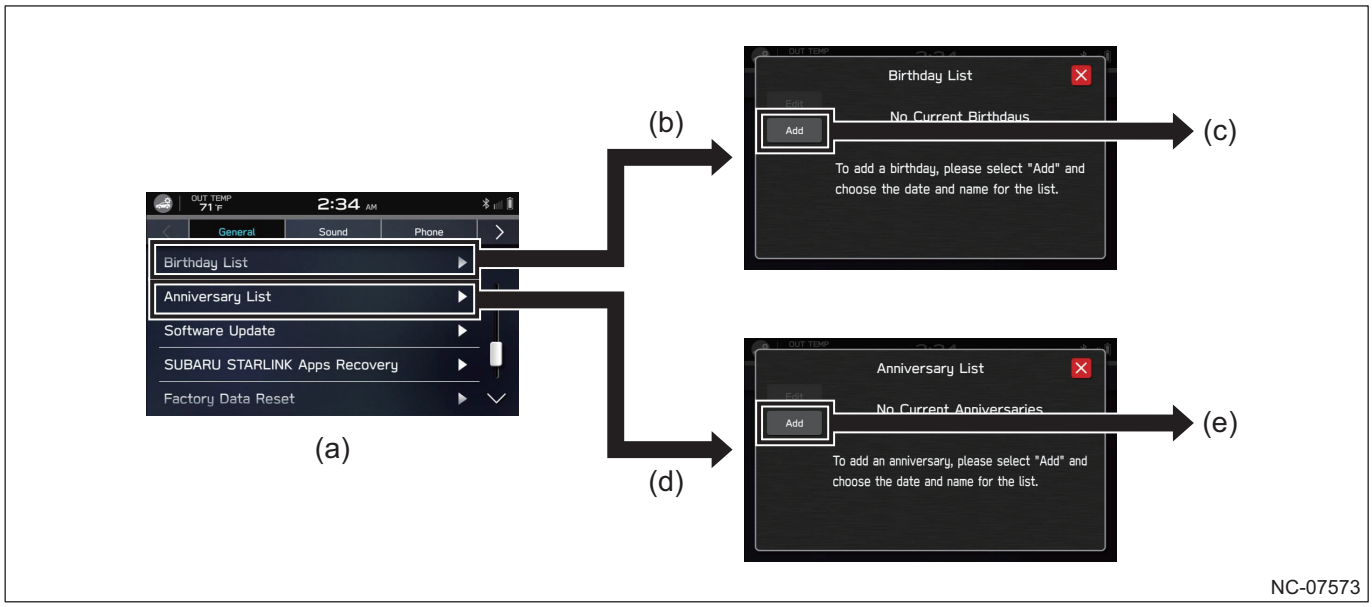
**The illustration shows a typical example that may differ from the actual display.*

(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 birthdays and anniversaries 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.



**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 new birthday
(d) Anniversary list screen
(e) Add new anniversary

Information settings

Used to set the information functions from the Infotainment System setting items.

When <Settings> is touched in the category area, the Infotainment System setting items are displayed, and the following information functions can be set. (Refer to "Audio and Speaker System" for details {11-22}.)

Tab	Setting item	Set item
General	Reminder screen	The maintenance, birthday, and anniversary notification functions can be turned ON/OFF.
	Meter screen	The behavior when starting the combination meter, gear shift indicator display*, and REV indicator display can be set.
	Birthday	A birthday can be set. (See "Event reminder contents")
	Anniversary	An anniversary can be set. (See "Event reminder contents")

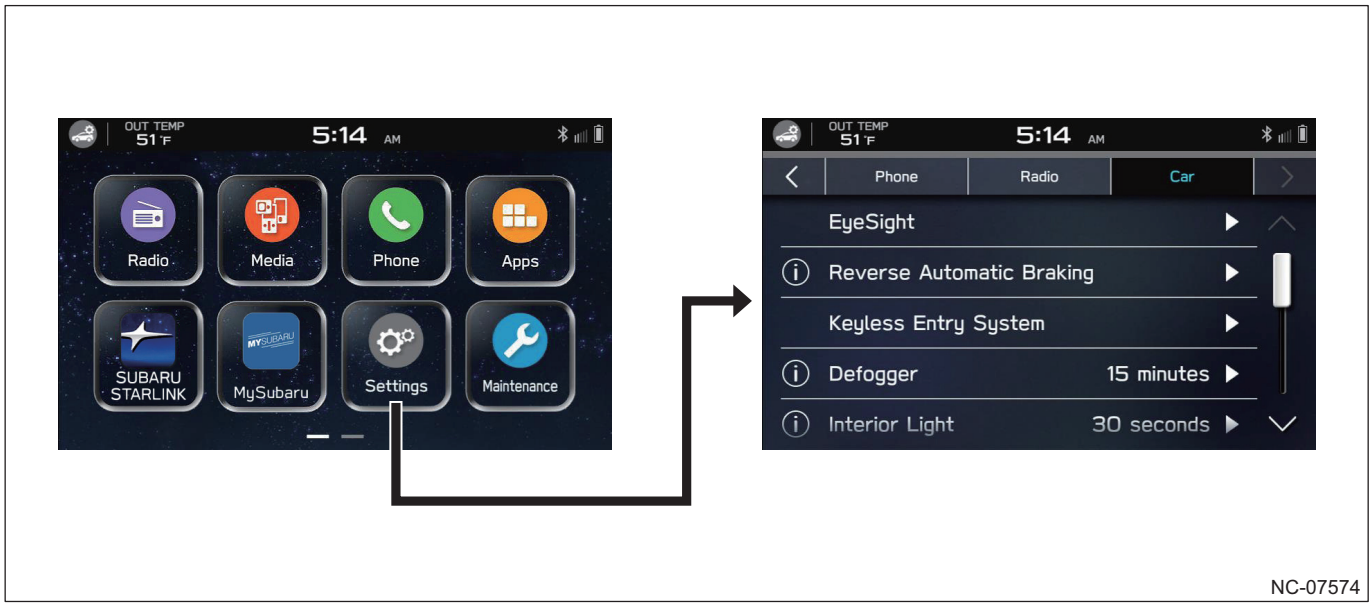
**: MT*

Customization function

Vehicle settings

The infotainment system is equipped with a customization function for the vehicle settings that can be operated on the 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.*

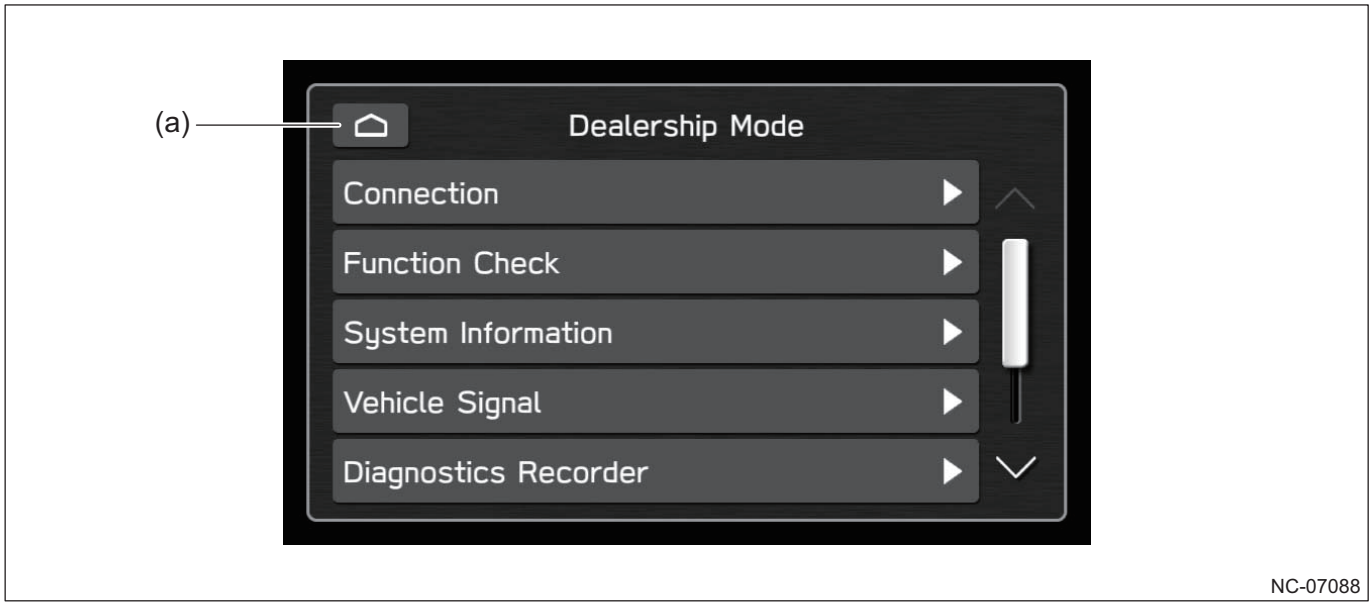
Diagnosis

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 (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.

<Dealership Mode>	Operation
Start	Press the TUNE knob 6 times while pressing and holding both the SEEK forward and back switches at the same time.
End	Touch the Home button on the screen.



**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 and antennas connected to the Cockpit Control Module (CCM), and the CAN communication status. • AUX, USB1, and USB2 indicate the device connection status at each port.
<Function Check>	<Panel and Steering Switch>		Displays the operation condition of switches and knobs on the Center Information Display (CID), and the operation condition of the audio operation switches on the steering wheel.
	<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 spot 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 <Connectivity ID> for SUBARU STARLINK connection and <Product Information> on 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.

11.7 Rearview Camera

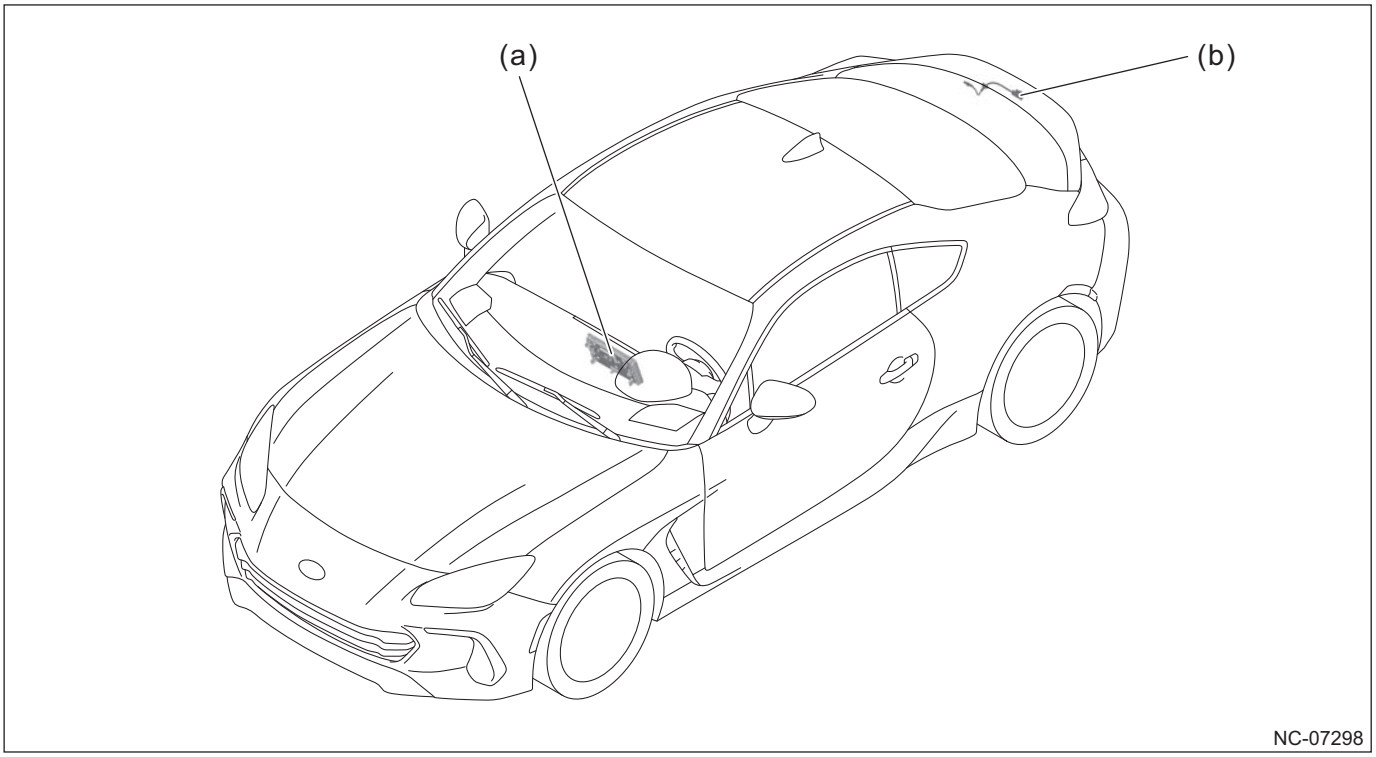
11.7.1 Overview

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.

11.7.2 Component

Component layout drawing



(a) Center Information Display (CID)

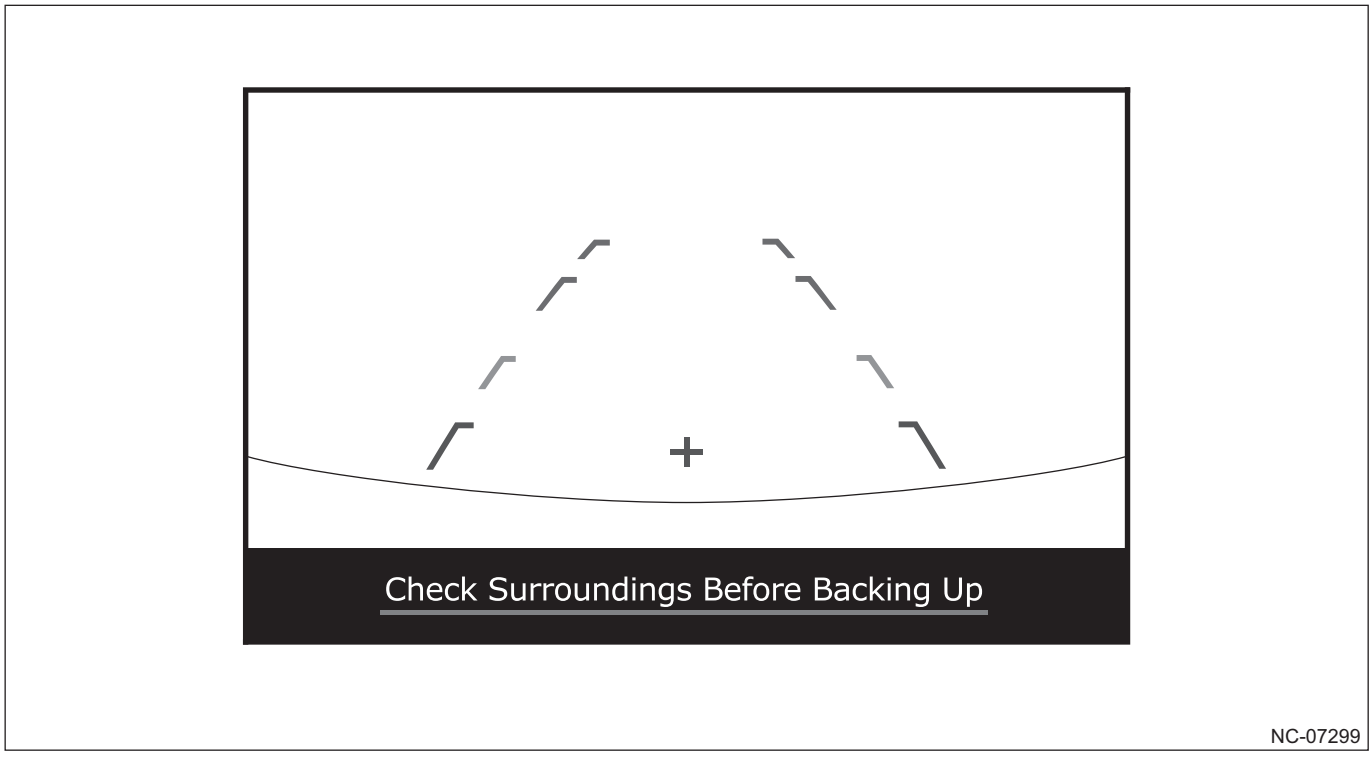
(b) Rearview camera

Component details

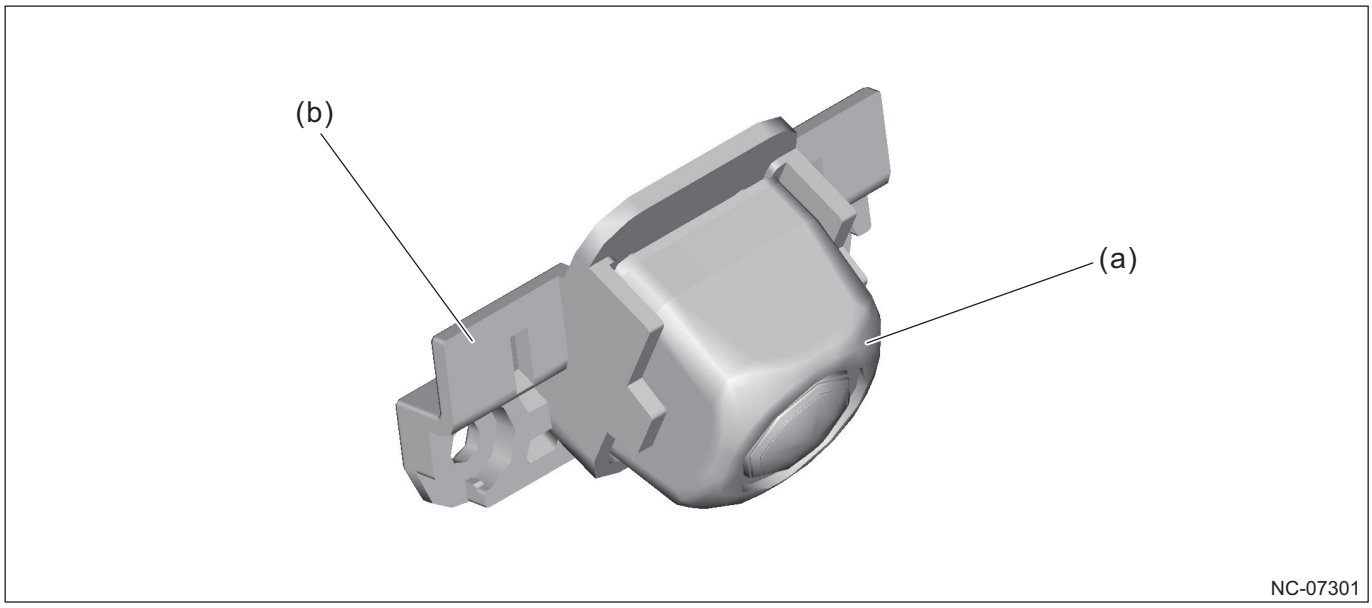
Rear view monitor

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

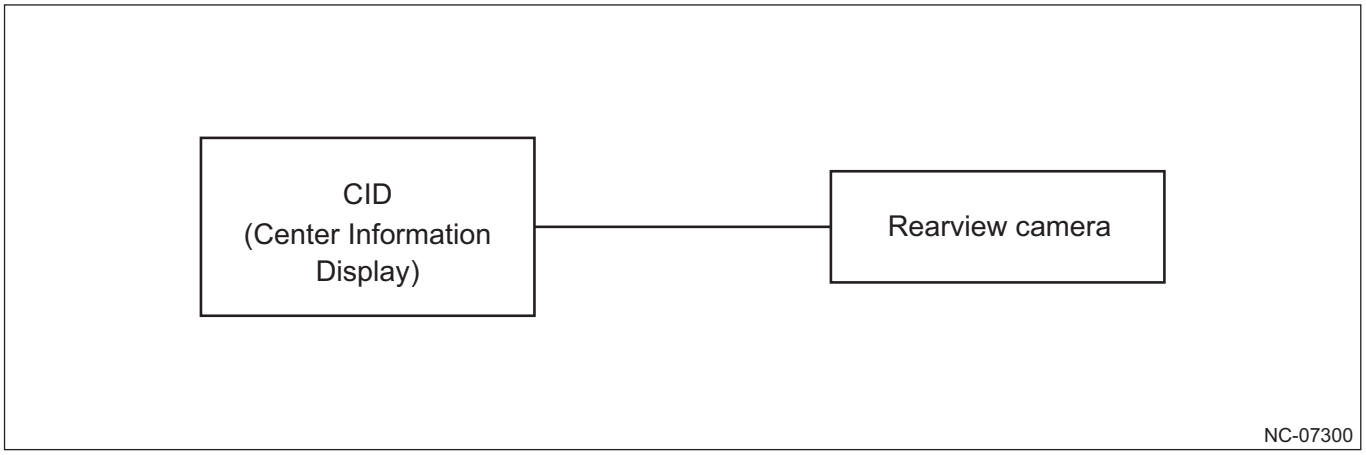


(a) Rearview camera

(b) Camera bracket

11.7.3 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 to the rear of the vehicle to the CID.
CID	Displays a screen based on the video signal that was input from the rearview camera.

11.8 Antenna

11.8.1 Overview

Overview

The antennas used by the infotainment system and telematics system are positioned in different locations of the vehicle.

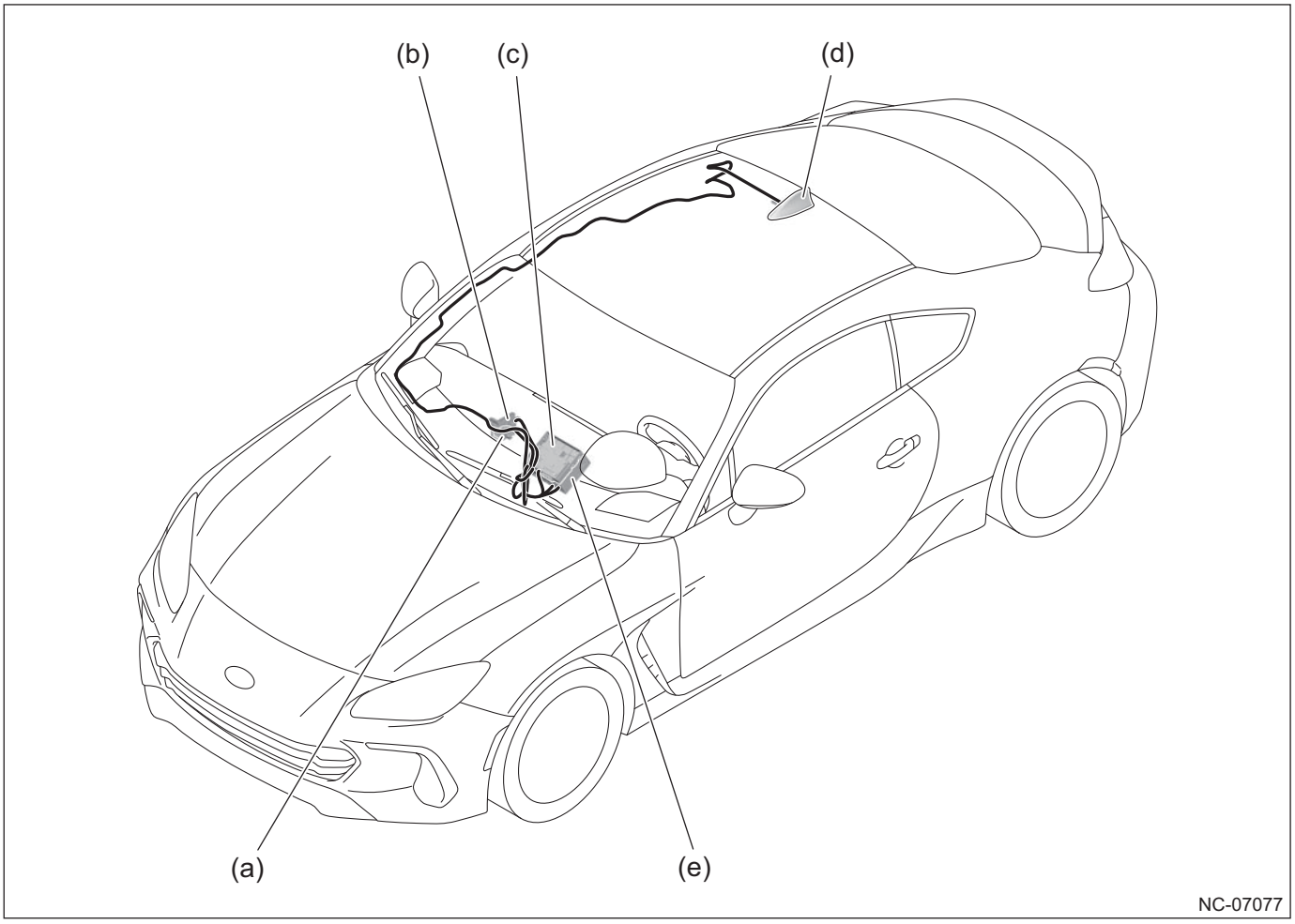
Antenna layout

Position	Type
Roof antenna	AM/FM/SXM
	Telematics antenna*
Instrument panel antenna	Telematics sub antenna*
	GPS antenna*

**: For models equipped with Data Communication Module (DCM)*

11.8.2 Component

Component layout drawing



(a)	GPS antenna	(d)	Roof antenna • AM • FM • SXM • Radio antenna amplifier • Telematics antenna
(b)	Telematics sub antenna	(e)	Cockpit Control Module (CCM)
(c)	Data Communication Module (DCM)		

Component details

Roof antenna

A shark fin type roof antenna is provided.

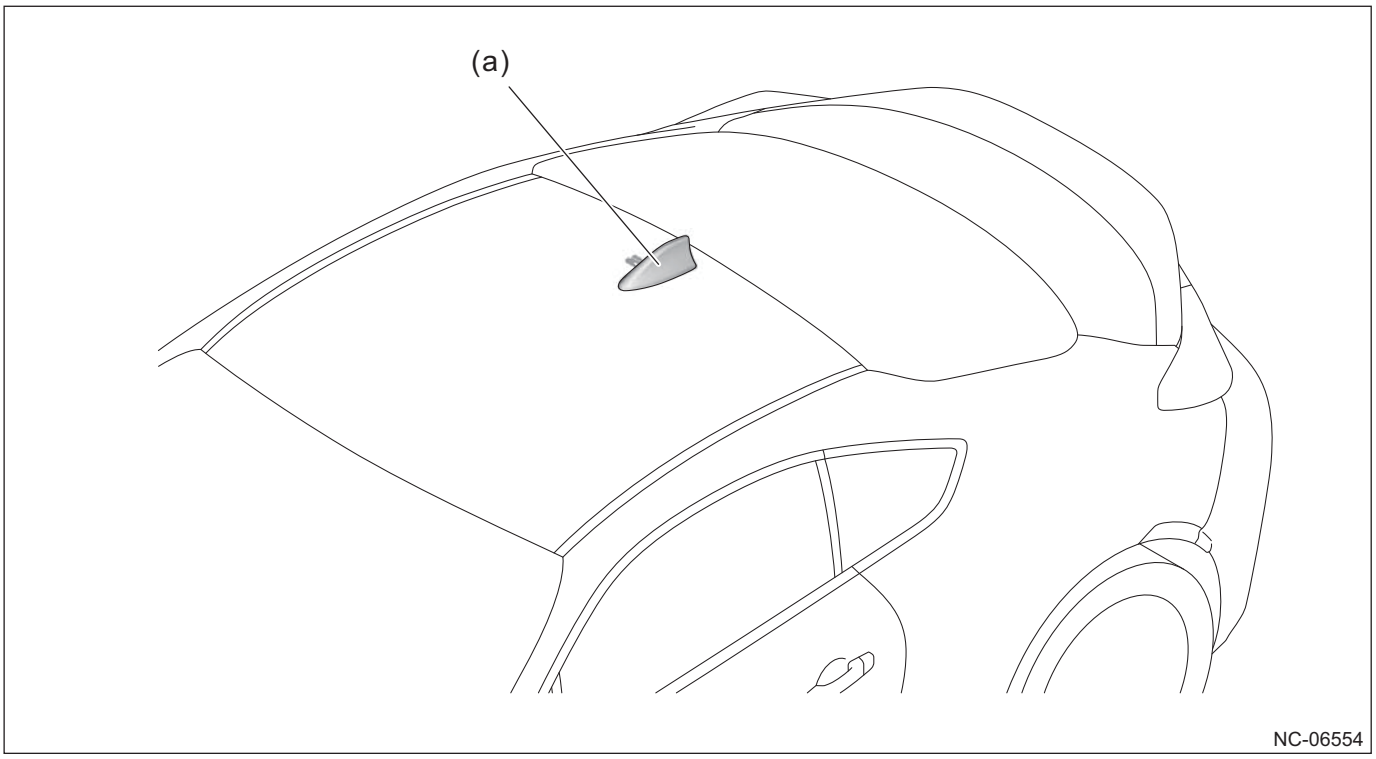
This design avoids wind noise while driving and eliminates the need for antenna removal or folding.

■ 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 equipped 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

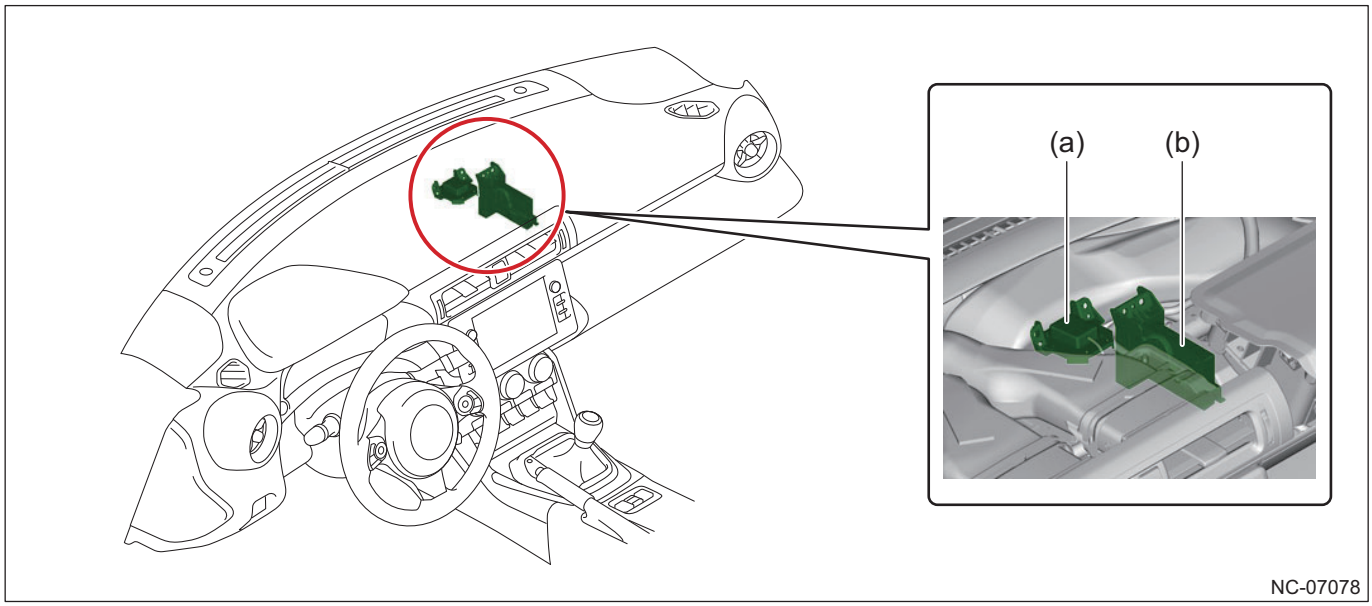
The Telematics sub antenna and GPS antenna are provided inside the instrument panel according to the specifications.

■ Telematics sub antenna

In models equipped with a Data Communication Module (DCM), a telematics sub antenna is installed inside the instrument panel on the passenger'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 equipped with a Data Communication Module (DCM).



(a) GPS antenna

(b) Telematics sub antenna

12 ADVANCED SAFETY SYSTEM

CONTENTS

12.1 General Overview 12-2
12.1.1 Overview 12-2
12.2 EyeSight 12-3
12.2.1 Overview 12-3
12.2.2 Component 12-4
12.2.3 Construction and Operation 12-9
12.3 Blind Spot Detection/Rear Cross Traffic Alert (BSD/RCTA) 12-29
12.3.1 Overview 12-29
12.3.2 Component 12-30
12.3.3 Construction and Operation 12-34
12.4 Reverse Automatic Braking 12-44
12.4.1 Overview 12-44
12.4.2 Component 12-45
12.4.3 Construction and Operation 12-48
12.5 Conventional Cruise Control 12-59
12.5.1 Overview 12-59
12.5.2 Component 12-60
12.5.3 Construction and Operation 12-63

12.1 General Overview

12.1.1 Overview

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. Ensures driving safety under a wide range of weather and road conditions with systems that allow stable driving in the same way as under normal conditions. (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

Overview

EyeSight is a driving assistant system that recognizes vehicles, persons, obstacles, lanes, and other objects by processing images from the stereo camera, and cooperatively controls the vehicle dynamics control, engine, transmission, and other systems according to the conditions.

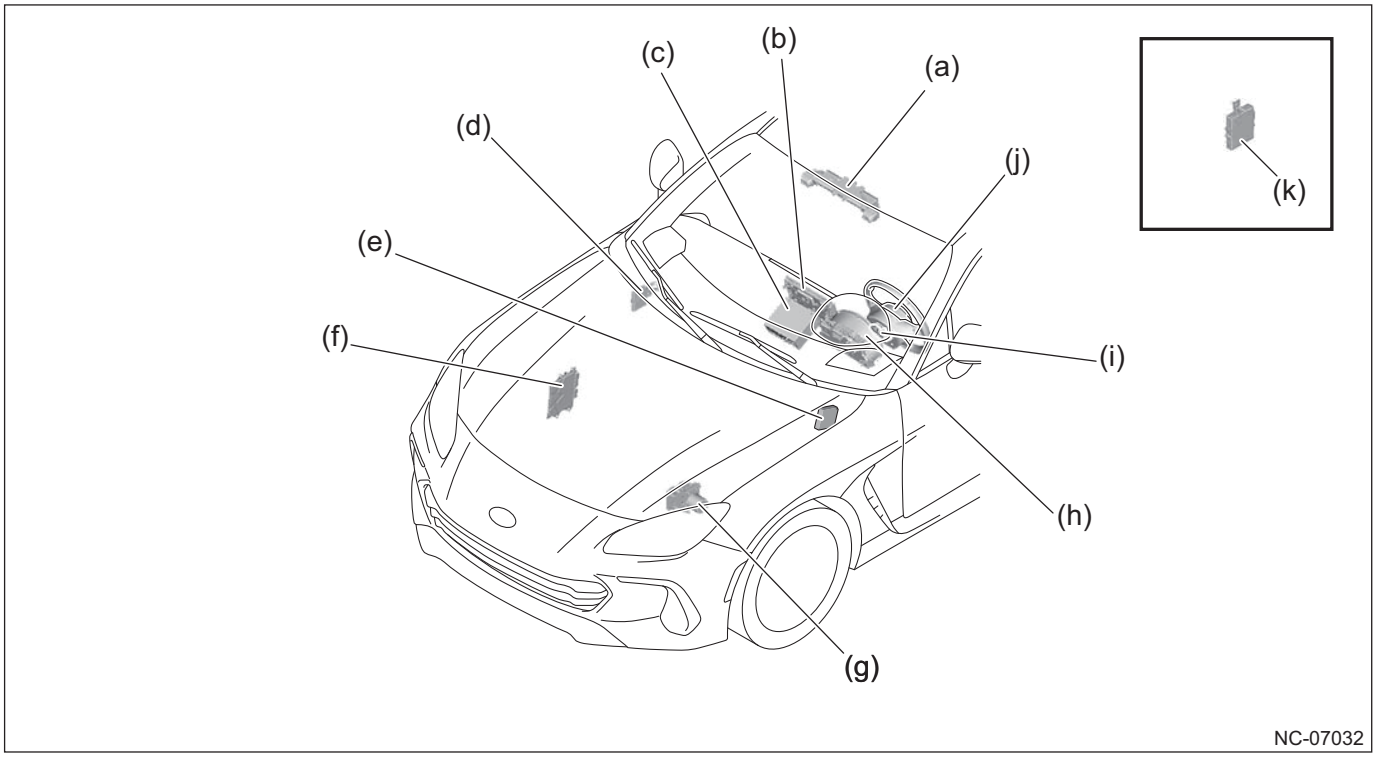
The operating status of the system and warnings are displayed on the combination meter.

EyeSight is equipped with the following functions.

Pre-Collision Braking	Vehicle Distance Alarm
	Pre-Collision Braking Assist
	Pre-Collision Braking
Adaptive Cruise Control	
Conventional Cruise Control (For details, refer to "Conventional Cruise Control".)	
Lane Departure Warning	
Lane Sway Warning	
Lead Vehicle Start Alert	
Pre-Collision Throttle Management	

12.2.2 Component

Component layout drawing



(a) Stereo camera
(b) Center Information Display (CID)
(c) Cockpit Control Module (CCM)
(d) Central gateway CM (CGW)
(e) Transmission Control Module (TCM)
(f) Engine Control Module (ECM)
(g) VDC CM & H/M
(h) Combination meter
(i) Cruise Control switch
(j) Distance between vehicles setting switch
(k) EyeSight security gateway CM

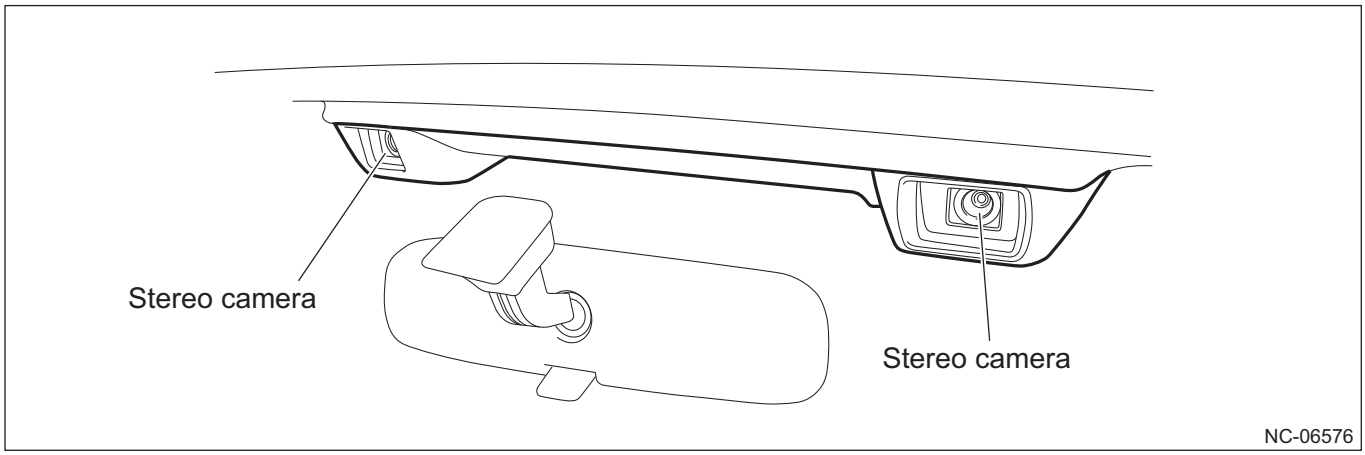
Component details

Main component functions

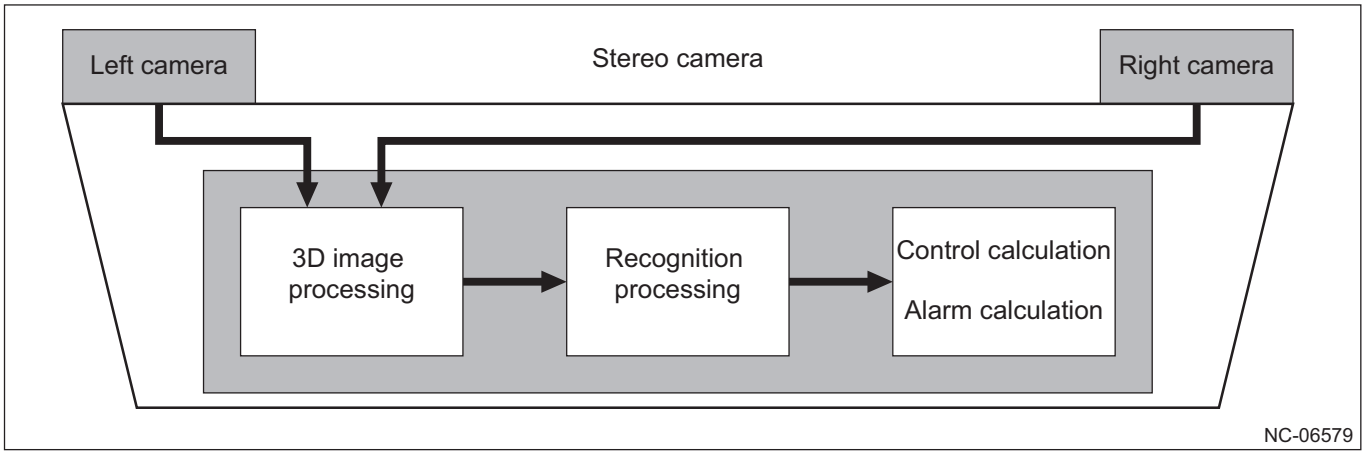
Component	Function
Stereo camera	3D image processing and recognition processing are performed using the camera image, and control calculation and alarm calculation are performed based on the processing results and the signals from each computer. After calculation, it sends signals for control, alarms, 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 security gateway CM	Connects the stereo camera and power unit bus (CAN) and exchanges signals between computers.
Cruise Control switch	Turns Adaptive Cruise Control (ACC) and Conventional Cruise Control ON/OFF, and sets the vehicle speed. Sends the set conditions to the computers.
Distance between vehicles setting switch	Sets the distance between vehicles for Adaptive Cruise Control (ACC). Sends the switch operation signal 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 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, lateral G recognition, vehicle speed, VDC operating status, etc.) to the stereo camera. Receives brake control and brake light on signals from the stereo camera and controls each of them.
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 via the combination meter.
Center Information Display (CID)	Sends the function ON/OFF status to the Cockpit Control Module (CCM).

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.

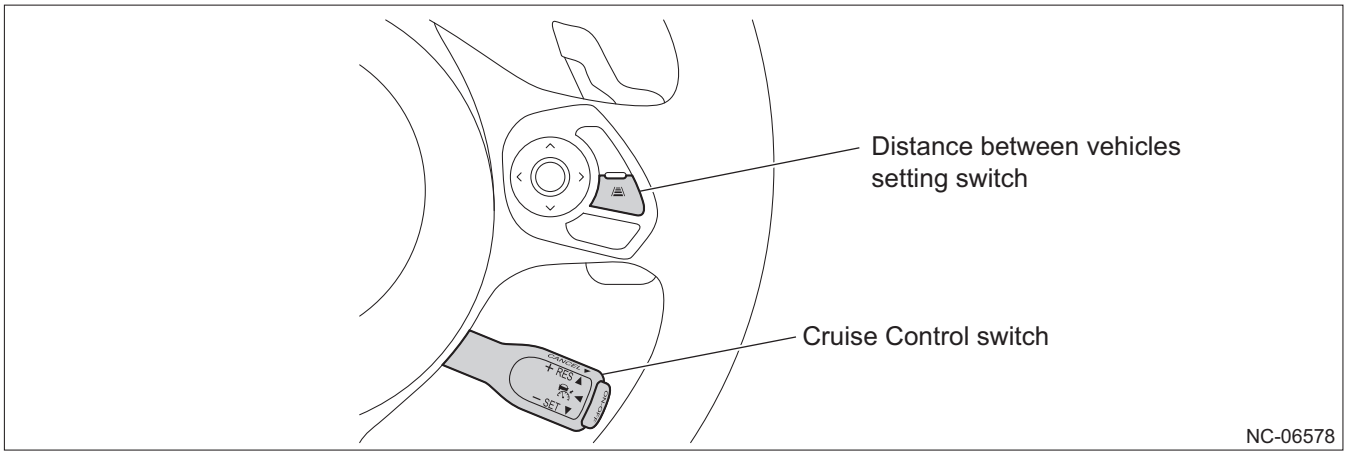


■ Construction / Operation



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.

Steering Switch

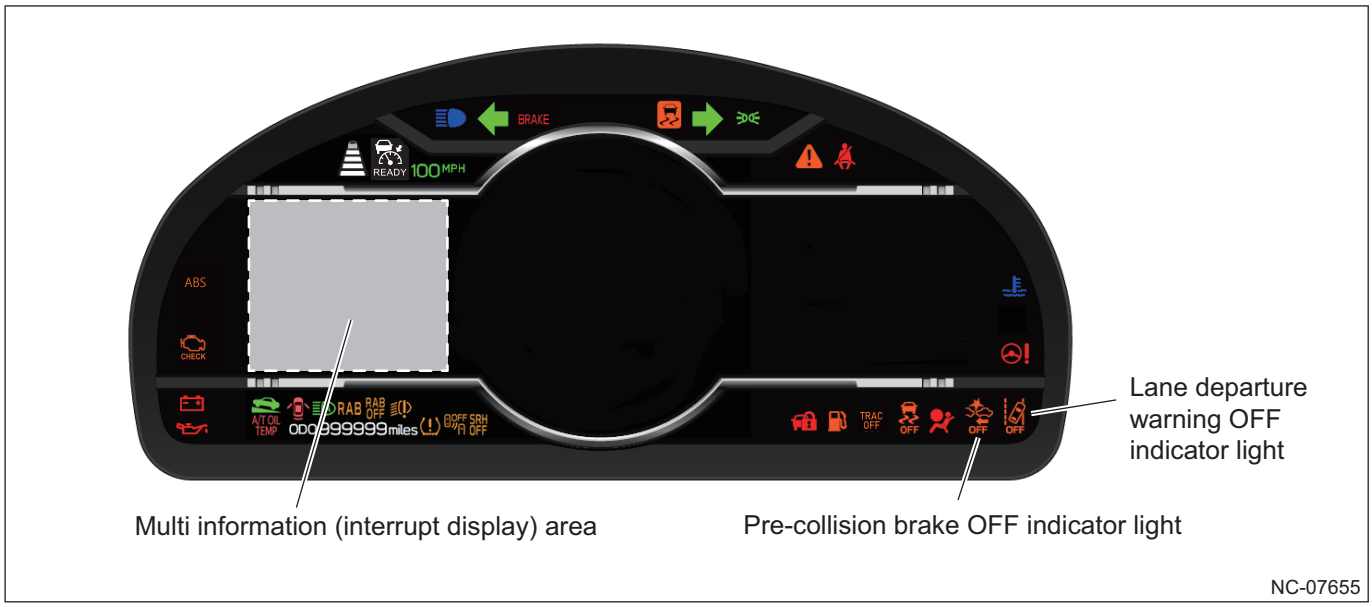


Name		Operation	Function
Distance between vehicles setting switch		Press	Switches distance between vehicles in four levels during setting for Adaptive Cruise Control (ACC). Used for switching from Conventional Cruise Control to Adaptive Cruise Control (ACC).
		Press and hold for approximately 2 seconds or longer.	Used for switching from Adaptive Cruise Control (ACC) to Conventional Cruise Control.
Cruise Control switch	ON-OFF switch	Press	Turning on and off the Cruise Control
	+RES	Press up	Sets the Cruise Control. (If pressed after Cruise Control was canceled, it will set again to the speed that was set for Cruise Control before it was canceled.) Raises the set vehicle speed (when the Cruise Control is set).
	-SET	Press down	Sets the Cruise Control. Lowers the set vehicle speed (when the Cruise Control is set).
	CANCEL	Pull toward the driver	Temporarily cancels the Cruise Control.

Indicator lights

The Pre-collision brake OFF indicator light and lane departure warning OFF indicator light are arranged in the combination meter.

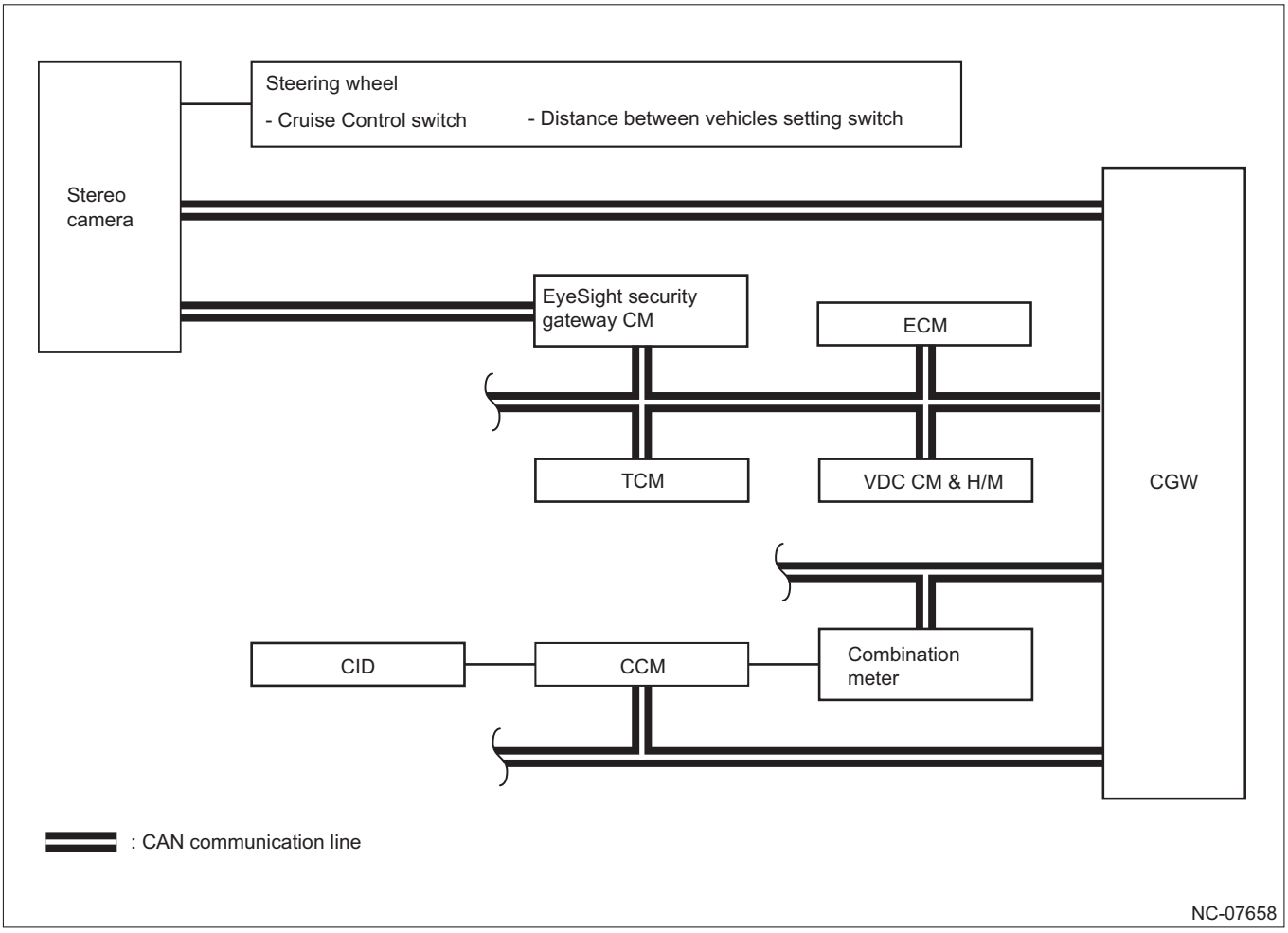
Information such as the EyeSight operating status, alarms, and system errors is displayed on the Multi Information Display (MID).



**The illustration shows a typical example that may differ from the actual display.*
For details about the combination meter, refer to "ENTERTAINMENT - Combination meter".

12.2.3 Construction and Operation

System diagram

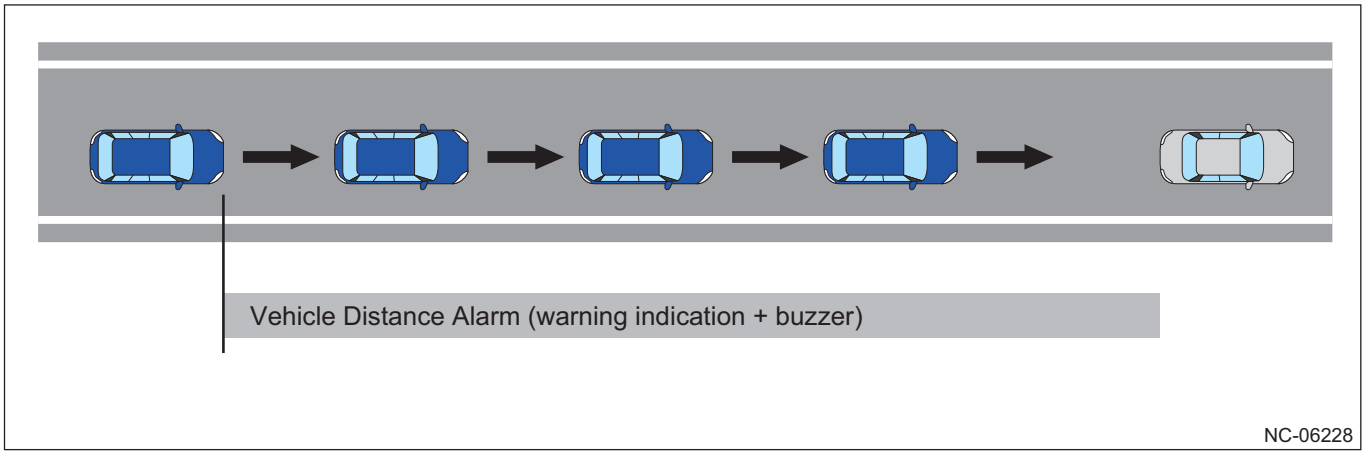


Pre-Collision Braking

Overview

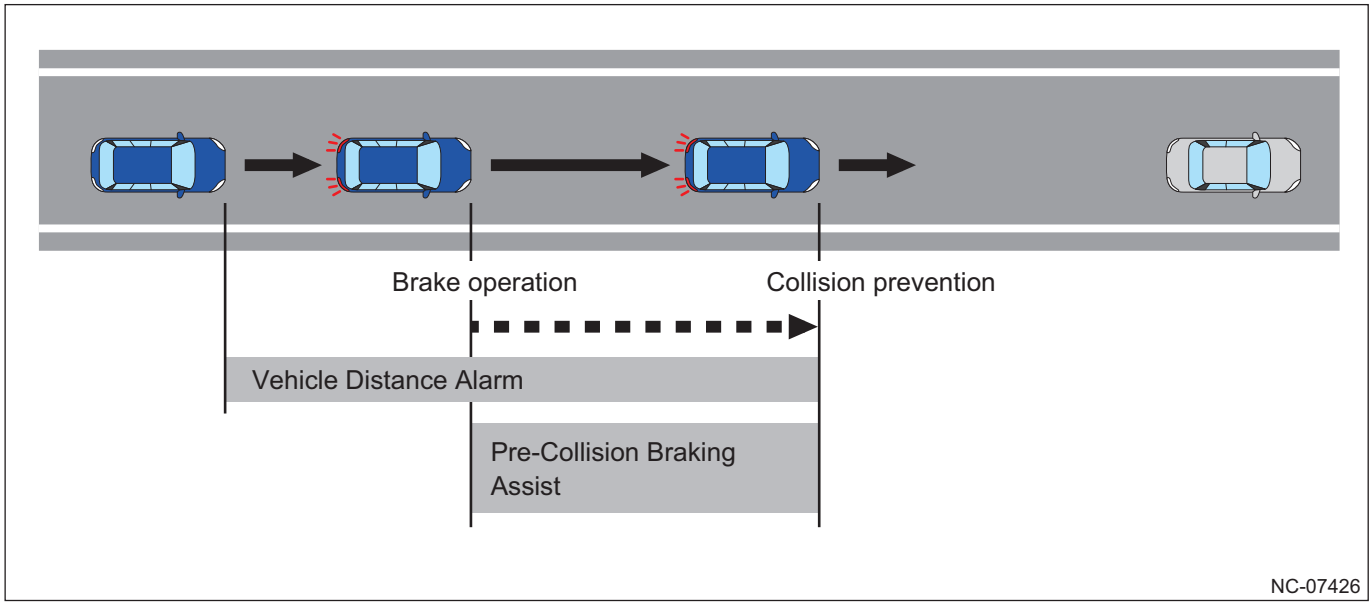
■ Vehicle Distance Alarm

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

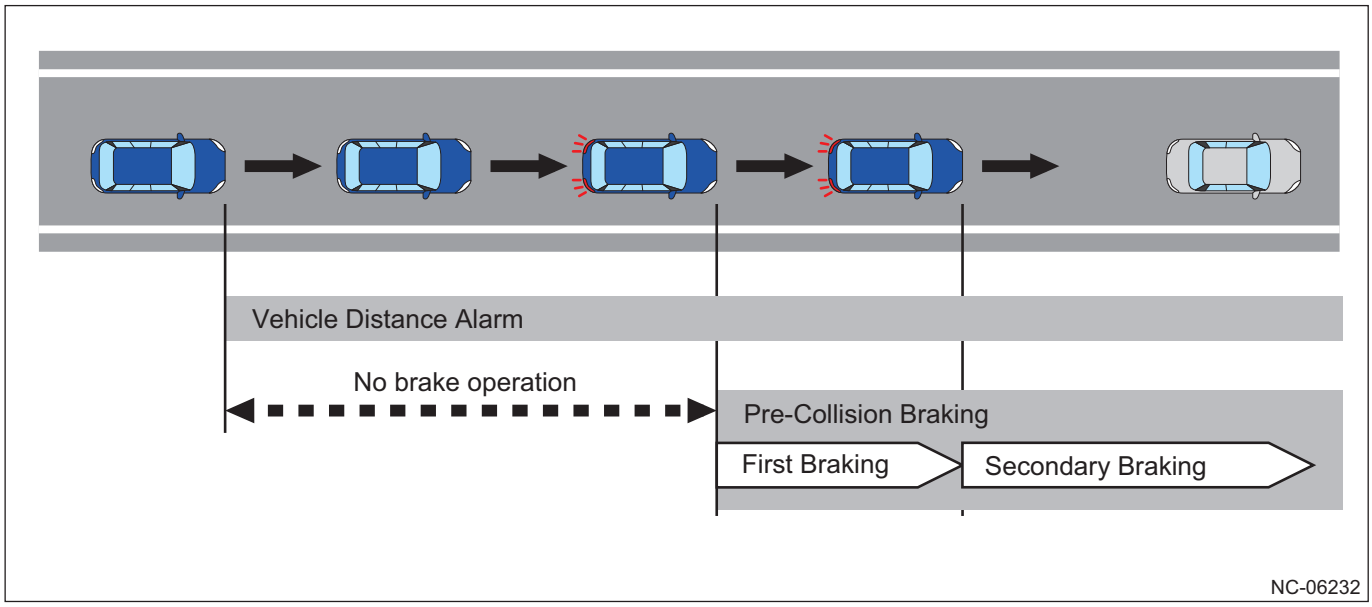
When there is a possibility of colliding with the preceding vehicle and the driver is warned, and then the driver performs an avoiding action, the system assists the driver to prevent collision by performing brake control.



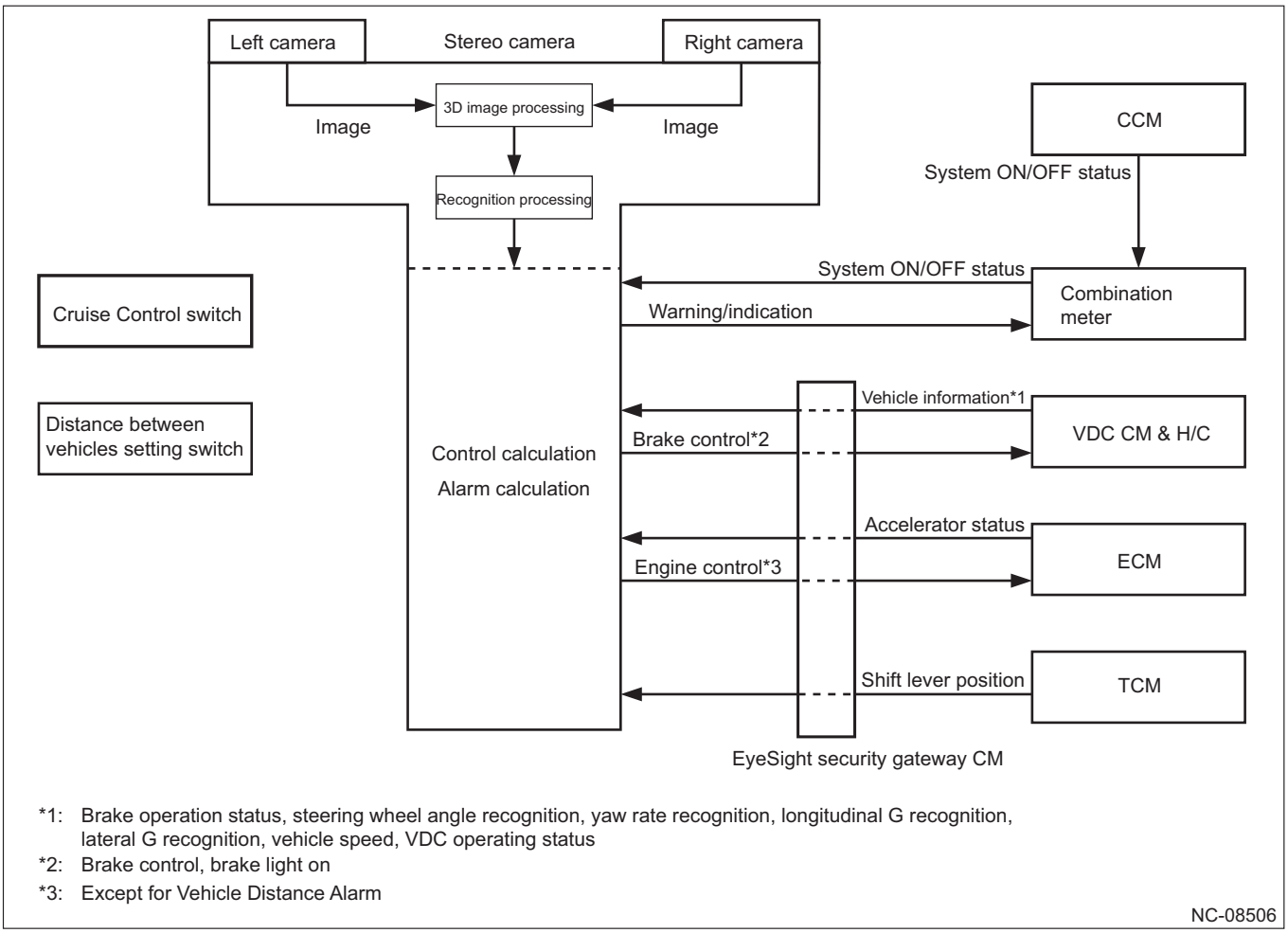
■ Pre-Collision Braking

When there is a possibility of colliding with the preceding vehicle 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.

After the vehicle is stopped by Pre-Collision Braking, the system slowly releases the brakes and the vehicle begins driving at creeping speed.

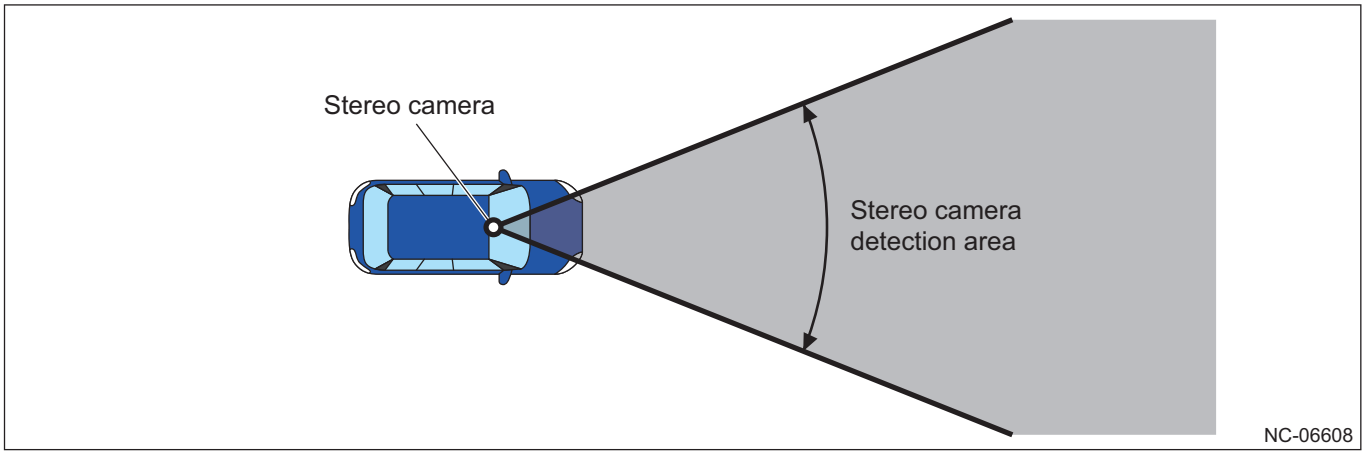


Block diagram



Operation

■ Detection area



■ 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 display.

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.

Vehicle speed condition

Own vehicle speed is approximately 7 to 100 MPH (approximately 10 to 160 km/h).

■ Pre-Collision Braking (primary brake)

When the system judges that there is a high possibility of collision with a preceding vehicle or forward obstacle while driving, it warns the driver with a buzzer sound and display, and performs brake control.

When the system judges that the possibility of collision has decreased based on the operation amount of the driver's avoiding action (operating the brake pedal, steering wheel, etc.), it cancels the operation.

Vehicle speed condition

Own vehicle speed is approximately 1 to 100 MPH (approximately 1 to 160 km/h).

■ Pre-Collision Braking (secondary brake)

When the system further judges that the possibility of collision is extremely high based on Pre-Collision Braking (primary brake), it performs stronger brake control.

When the system judges that the collision cannot be prevented, it continues brake control.

Vehicle speed condition

Own vehicle speed is approximately 1 to 100 MPH (approximately 1 to 160 km/h).

Display

**The illustration shows a typical example that may differ from the actual display.*

■ Indicator

Display	Description	Display	Description
 NC-07664	Pre-collision brake OFF indicator light	-	-

■ Alarm / warning / operating status

▮ Multi Information Display (MID)

Display	Description
 NC-07427	Vehicle Distance Alarm, Pre-Collision Braking Primary Brake Alarm, Pre-Collision Braking Secondary Brake Alarm: Red frame • When there is a possibility of collision with a forward vehicle
 NC-07429	Notification • After activation of Pre-Collision Braking

Adaptive Cruise Control

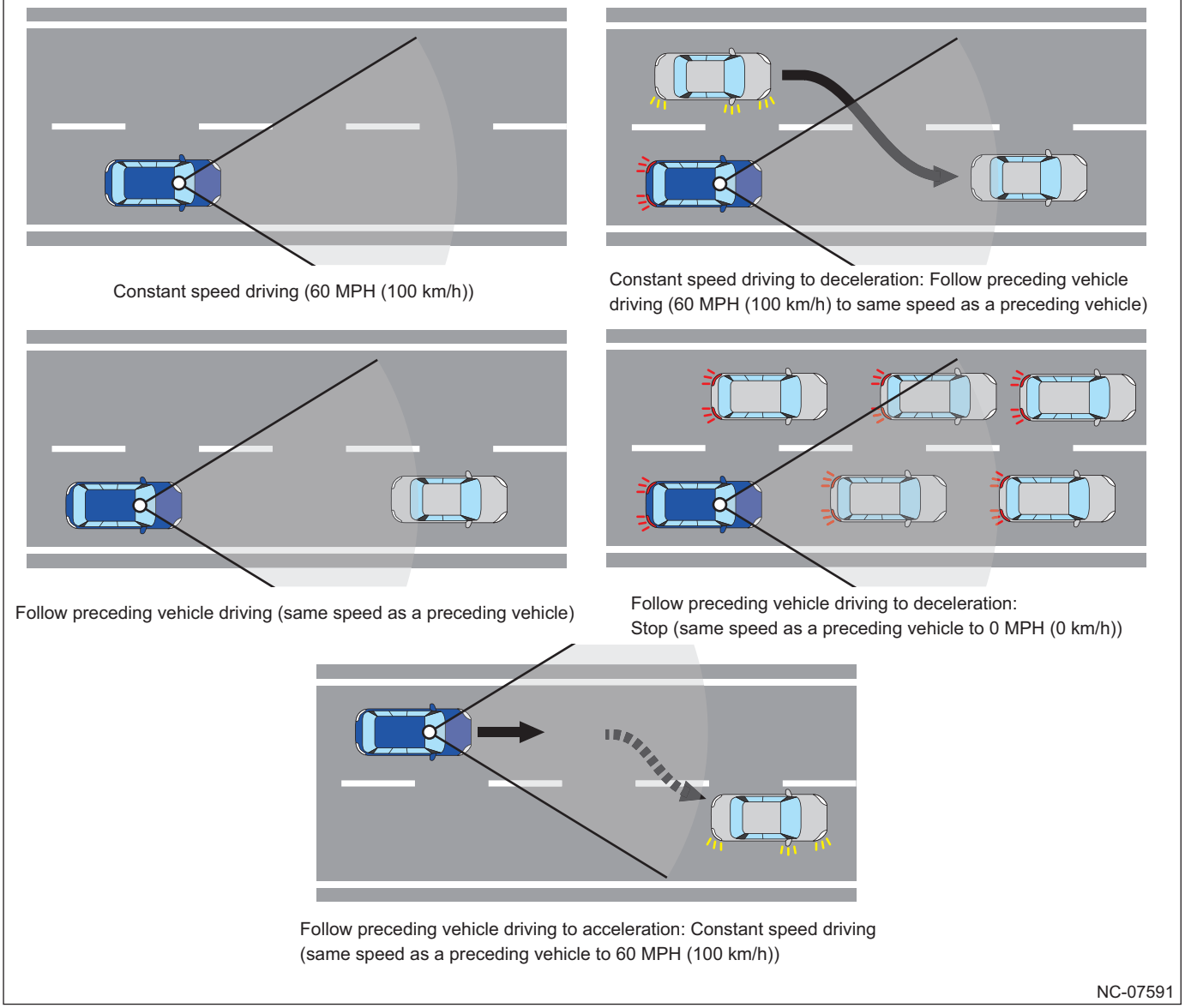
Overview

When the stereo camera recognizes a preceding vehicle in its own vehicle lane in front, the system follows the vehicle while automatically maintaining a vehicle distance which is appropriate for the vehicle speed, with the upper speed limit being the speed that was set by the driver.

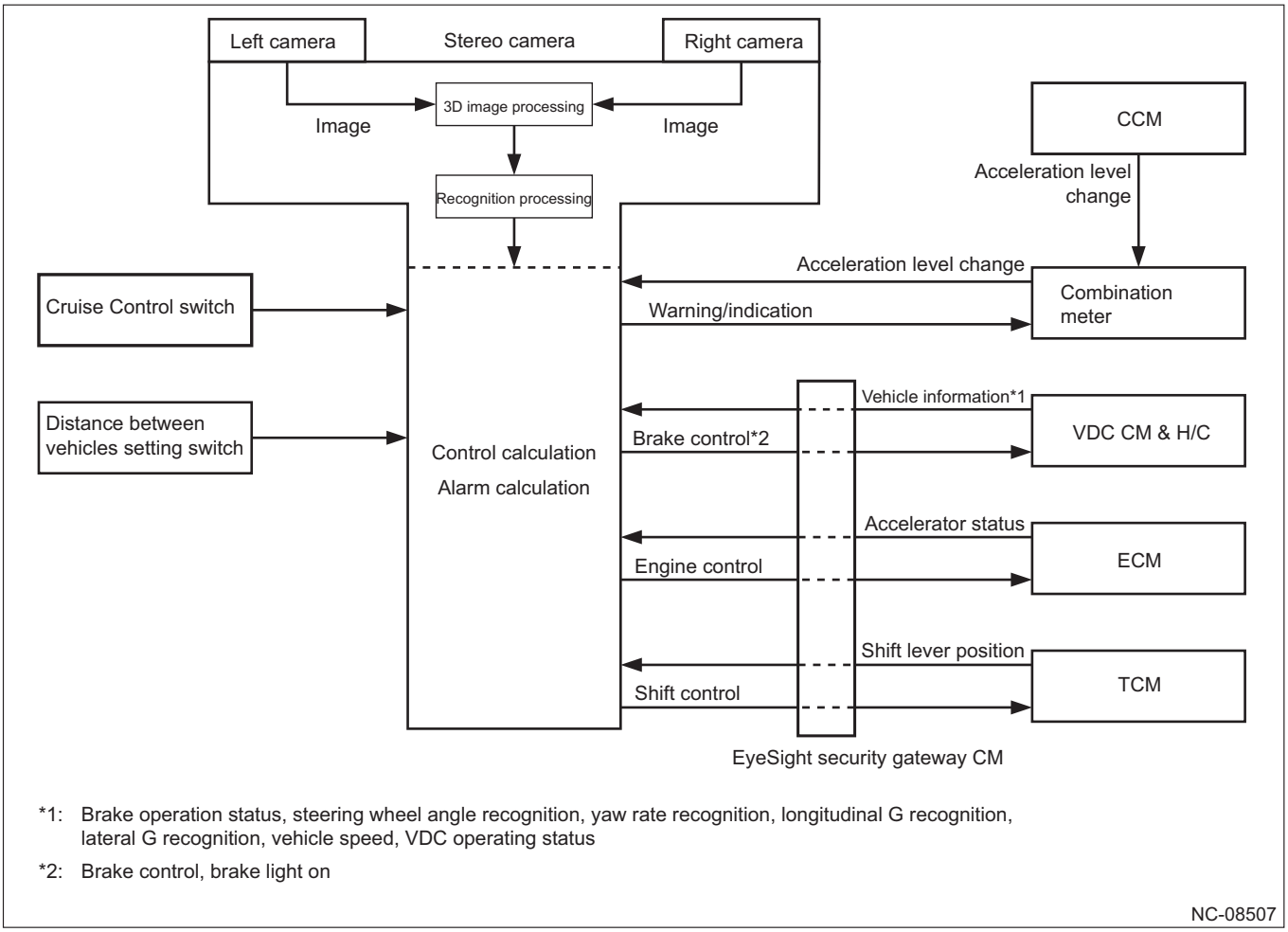
After the preceding vehicle stopped and the own vehicle also stopped, the system slowly releases the brakes and the vehicle begins driving at creeping speed.

When the Cruise Control ON-OFF switch is turned ON, Adaptive Cruise Control (ACC) starts, and the driver can switch between Adaptive Cruise Control (ACC) and Conventional Cruise Control.

Image of operation when vehicle speed is set to 60 MPH (100 km/h)



Block diagram



Operation

Constant speed driving	If there is no preceding vehicle in its own vehicle lane in front, the vehicle drives at 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.
Main status ON (settable status)	When the ON-OFF switch of the Cruise Control switch is pressed, the Adaptive Cruise Control (ACC) enters the settable status.
Set (control start)	While driving under the settable status, operating the Cruise Control switch to the +RES or -SET side sets Adaptive Cruise Control and starts control. • The vehicle speed when the Cruise Control switch was operated becomes the set vehicle speed. • When the previous set vehicle speed is displayed and the switch is operated to the +RES side, the previous set vehicle speed becomes the set vehicle speed.

Cancel	While driving with Cruise Control set, the set status is canceled when the Cruise Control switch is pulled toward the driver (CANCEL) or when the brake pedal is operated. If the system judges that normal control is not possible, control is automatically canceled.	
Restart	While control is canceled (settable status) and the Cruise Control switch is operated to the -SET side, control is restarted. • The vehicle speed when the Cruise Control switch was operated becomes the set vehicle speed.	
Recovery	When driving under the settable status, operating the Cruise Control switch to the +RES side resumes constant speed driving at the speed set in the memory.	
Main status OFF	Press the ON-OFF switch of the Cruise Control switch.	
Increase set vehicle speed	Operate the Cruise Control switch once to the +RES side	The set vehicle speed increases in 1 MPH (1 km/h) increments each time the switch is operated.
	Continually operate the Cruise Control switch to the +RES side	The set vehicle speed increases in 5 MPH (5 km/h) increments while the switch is held in the operating position.
	Depress the accelerator pedal	Depress the accelerator pedal and increase the vehicle speed to the speed you want to set, then operate the Cruise Control switch to the -SET side. • The vehicle speed when the Cruise Control switch was operated becomes the new set vehicle speed.
Decrease set vehicle speed	Operate the Cruise Control switch once to the -SET side	The set vehicle speed decreases in 1 MPH (1 km/h) increments each time the switch is operated.
	Continually operate the Cruise Control switch to the -SET side	The set vehicle speed decreases in 5 MPH (5 km/h) increments while the switch is held in the operating position.
	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, control by Adaptive Cruise Control (ACC) is temporarily canceled. Operate the Cruise Control switch to the -SET side. • The vehicle speed when the Cruise Control switch was operated becomes the set vehicle speed.
Accelerate temporarily	When the Cruise Control is set and the accelerator pedal is depressed, the vehicle accelerates to above the set vehicle speed. When the accelerator pedal is released, the vehicle speed returns to the set vehicle speed.	
Decelerate temporarily	When the Cruise Control is set and the brake pedal is depressed, the vehicle decelerates. • When the brake pedal is depressed, control by Adaptive Cruise Control (ACC) is temporarily canceled. When the brake pedal is released and the Cruise Control switch is operated to the +RES side, the set vehicle speed before cancellation is set again 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 in 4 stages during follow preceding vehicle driving by operating the distance between vehicles setting switch.	
Status notification	The driver is notified of the Adaptive Cruise Control (ACC) status and the set vehicle speed by the combination meter.	

■ Settable conditions

The shift lever is in the D or M range.	All doors are closed.
The driver's seat belt is fastened.	The parking brake is not engaged.
The brake pedal is not 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.

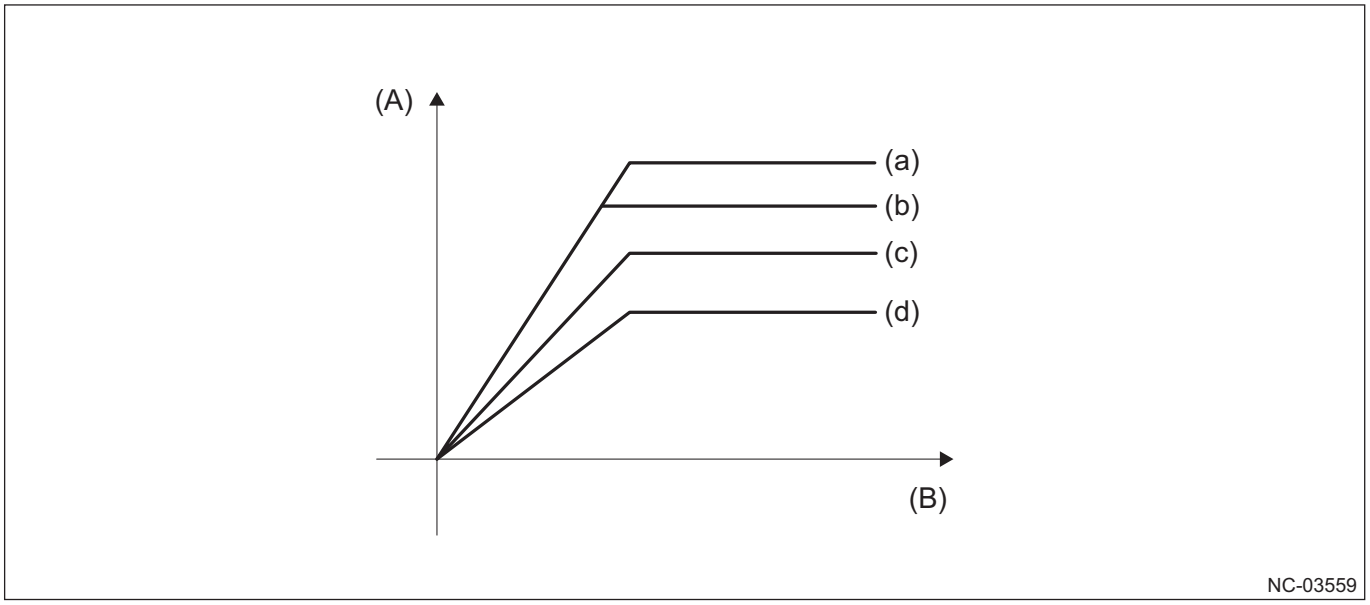
■ Acceleration characteristics setting

The acceleration characteristics of the Cruise Control can now be switched in four levels by changing the setting using the customization function of the Multi Information Display (MID). 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



(A) Acceleration

(B) Time

(a) 100 to 120% dynamic

(b) 100% standard

(c) 80% comfort

(d) 60% eco

Display

**The illustration shows a typical example that may differ from the actual display.*

■ Indicator

Display	Description	Display	Description
 NC-06137	Adaptive Cruise Control indicator light • Green: Control in progress • White: Control not in progress	 NC-06364	READY indicator light • White: Settable status
 NC-07715	Distance between vehicles indicator light	 NC-07670	Preceding vehicle indicator light

■ Alarm / warning / operating status

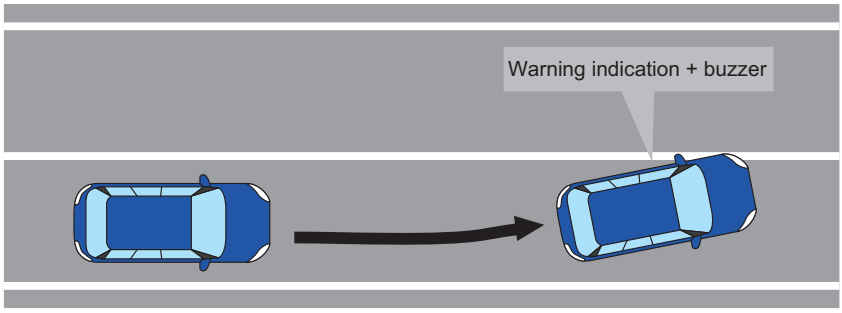
▮ Multi Information Display (MID)

Display	Description
 NC-06716	Vehicle distance setting
 NC-07427	Requiring more brake pedal force warning: Red frame
 NC-06615	Adaptive Cruise Control (ACC) cancel notification

Lane Departure Warning

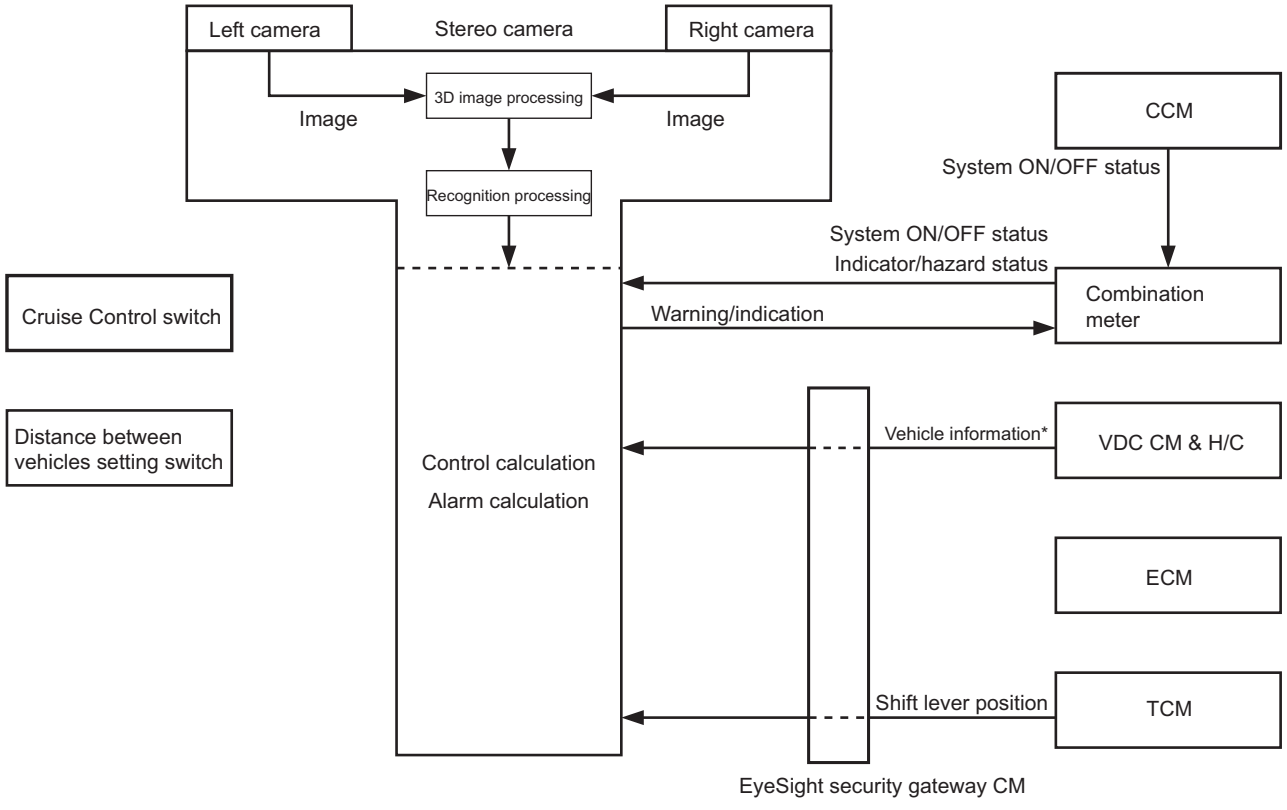
Overview

The white lines in front of its own vehicle are recognized by the stereo camera, the system judges the possibility of departure from the vehicle lane based on the positions of the white lines, and the driver is warned by means of a display on the combination meter and a buzzer.



NC-07261

Block diagram



*: Brake operation status, steering wheel angle recognition, yaw rate recognition, longitudinal G recognition, lateral G recognition, vehicle speed, VDC operating status

NC-08508

Operation

■ Operating conditions

Operation is started when the following is satisfied.

Driving at approximately 30 MPH (50 km/h) or higher	Driving straight or on a mild curve
In Customize, "LDW (Lane Departure Warning)" is set to "ON".	-

Display

**The illustration shows a typical example that may differ from the actual display.*

■ Indicator

Display	Description	Display	Description
 NC-05478	Lane departure warning OFF indicator light	-	-

■ Alarm / warning / operating status

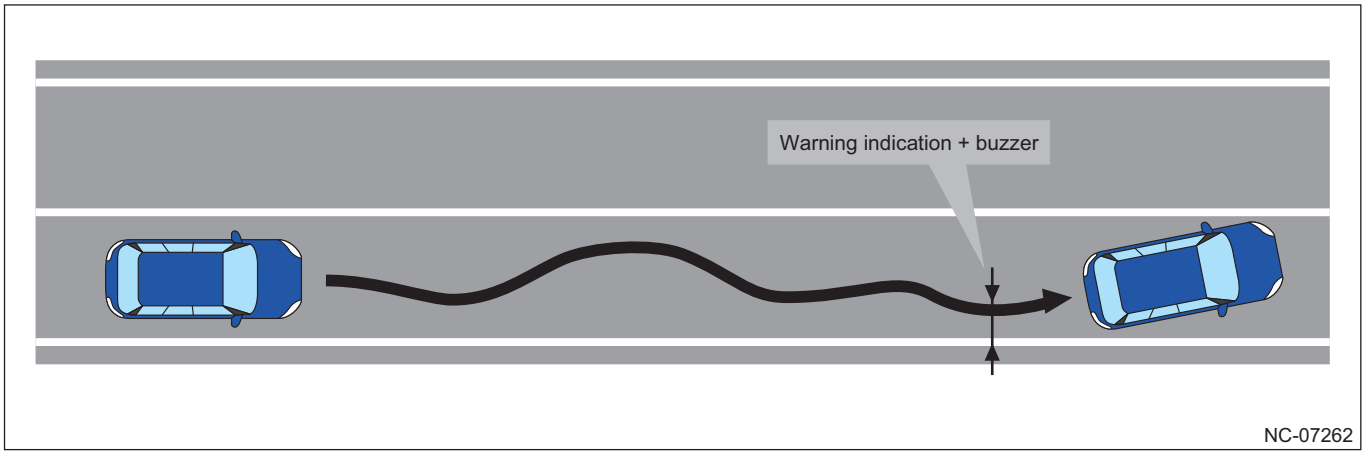
▮ Multi Information Display (MID)

Display	Description
 NC-07431	Lane Departure Warning: Yellow frame • Lane line: Yellow (flashing) (on departing side)

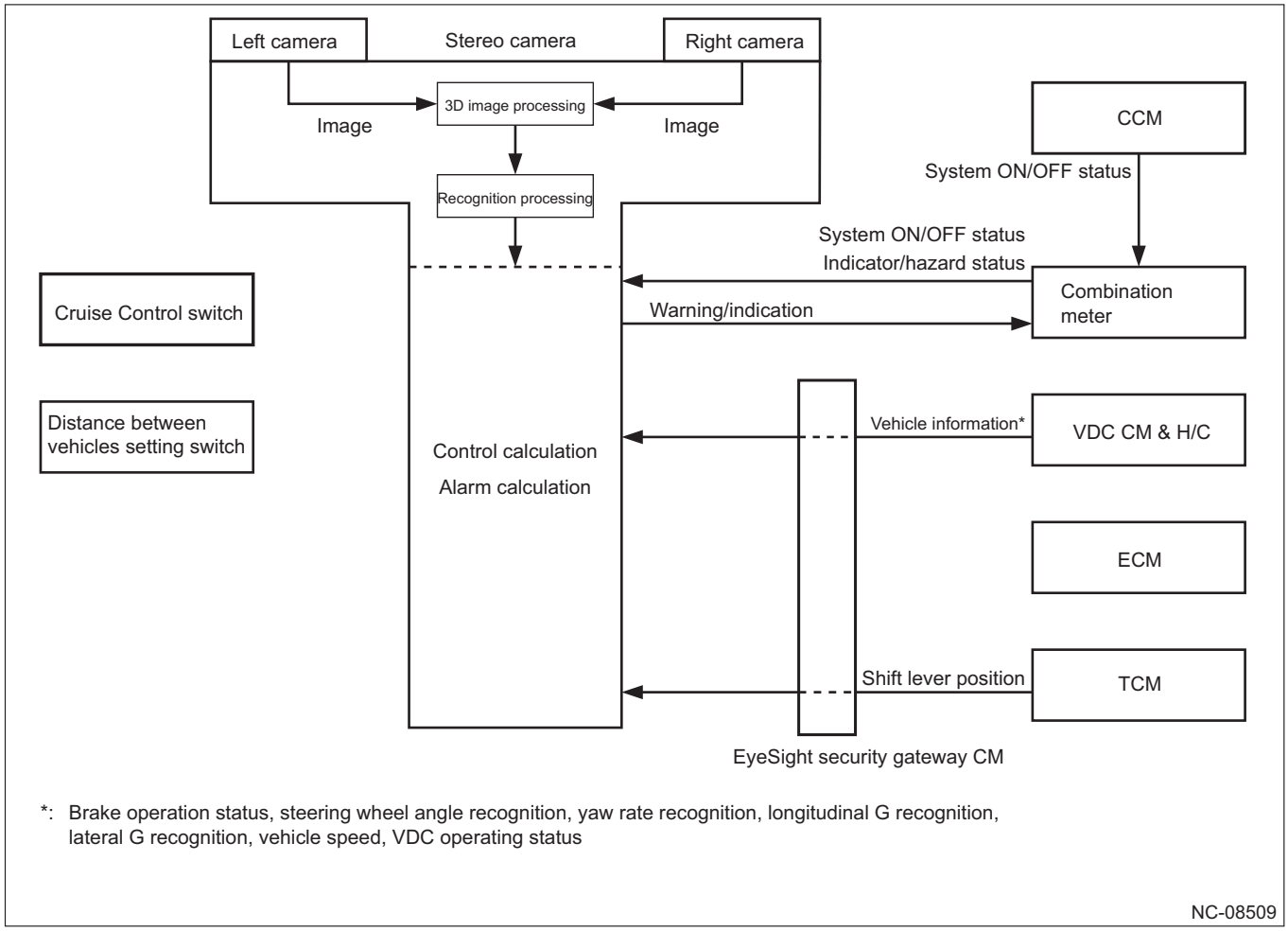
Lane Sway Warning

Overview

The white lines in front of its own vehicle are recognized by the stereo camera, the system judges swaying due to driver drowsiness or distraction based on the amount of deviation of the white line position, and the driver is warned by means of a display on the combination meter and a buzzer.



Block diagram



*: Brake operation status, steering wheel angle recognition, yaw rate recognition, longitudinal G recognition, lateral G recognition, vehicle speed, VDC operating status

Operation

■ Operating conditions

Operation is started when the following is satisfied.

Driving at approximately 37 MPH (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, "LDW (Lane Departure Warning)" is set to "ON".	-

Display

**The illustration shows a typical example that may differ from the actual display.*

■ Alarm / warning / operating status

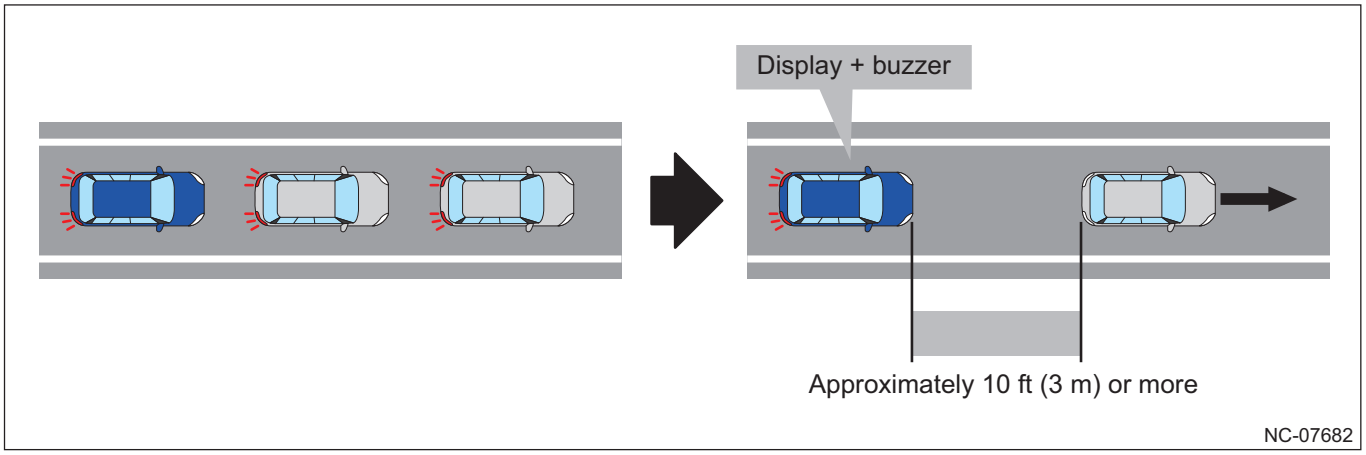
▮ Multi Information Display (MID)

Display	Description
 NC-07432	Lane Sway Warning: Yellow frame • Lane lines: Yellow (Left and right flash alternately.)

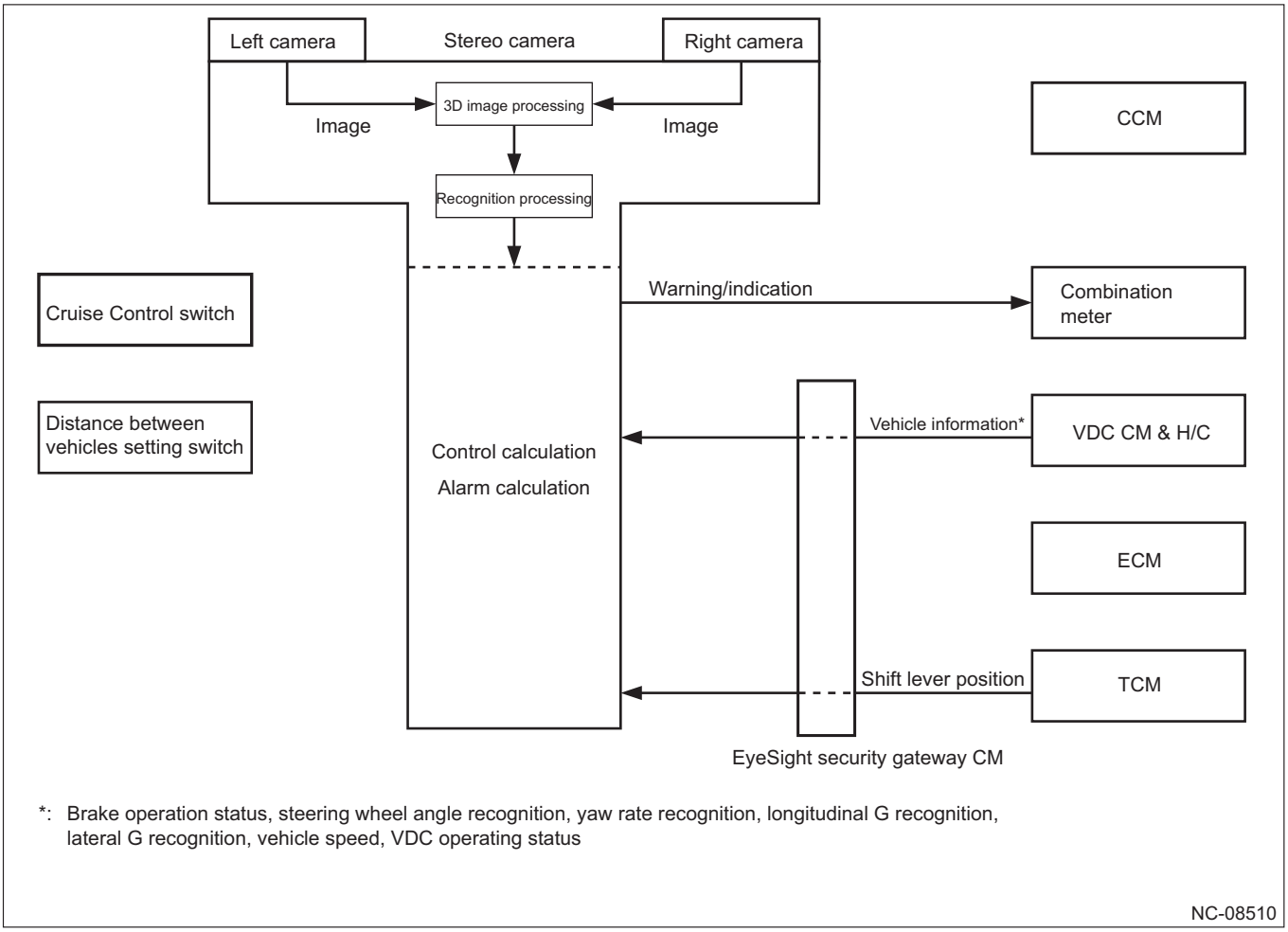
Lead Vehicle Start Alert

Overview

When a preceding vehicle is recognized by the stereo camera and the system's own vehicle does not start driving even after the preceding vehicle started off, the driver is notified that the preceding vehicle has started driving by means of a display on the combination meter and a buzzer sound.



Block diagram



Operation

■ Operating conditions

Operation is started when the following is satisfied.

Shift lever position is D, M, or N.	The stereo camera has recognized a preceding vehicle.
The vehicle stopped when the preceding vehicle stopped. (The own vehicle remains stopped for a while within a vehicle distance of approximately 32 ft (approximately 10 m) or less.)	The preceding vehicle accelerated and moved approximately 10 ft (approximately 3 m) or more however the own vehicle remains stopped.
In Customize, "Lead Vehicle Start Alert" is set to "ON".	-

Display

**The illustration shows a typical example that may differ from the actual display.*

■ Alarm / warning / operating status

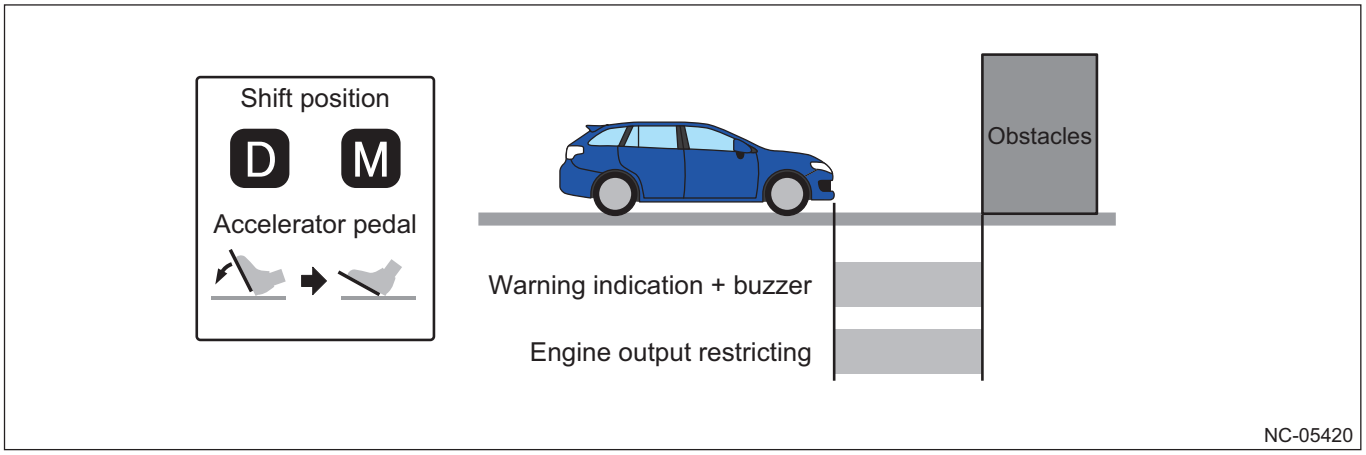
▮ Multi Information Display (MID)

Display	Description
 NC-07433	Lead Vehicle Start Alert • When preceding vehicle has started

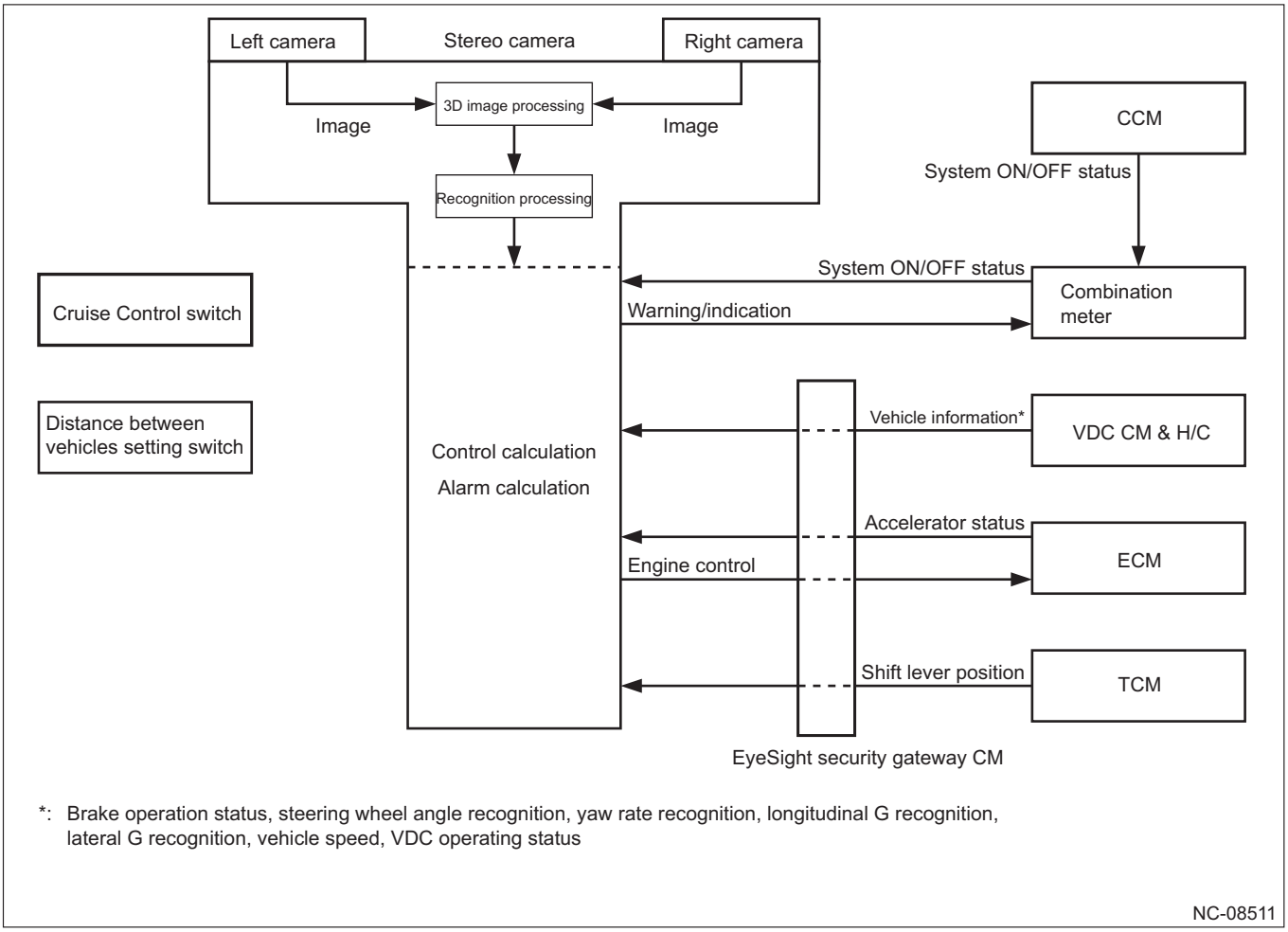
Pre-Collision Throttle Management

Overview

If the accelerator pedal is depressed more than necessary due to accidental pedal operation or other reason while a forward obstacle is present, the engine output is limited to slow the acceleration and the driver is warned by means of a warning display and warning sound.



Block diagram



*: Brake operation status, steering wheel angle recognition, yaw rate recognition, longitudinal G recognition, lateral G recognition, vehicle speed, VDC operating status

Operation

■ Operating conditions

Operation is started when the following is satisfied.

Shift lever position is D or M.	The stereo camera has recognized an obstacle in front of the vehicle.
The system judged that the accelerator pedal was depressed more than necessary.	-

Display

**The illustration shows a typical example that may differ from the actual display.*

■ Alarm / warning / operating status

▮ Multi Information Display (MID)

Display	Description
 NC-07427	Pre-Collision Throttle Management (Alarm): Red frame

Customization function

Selecting an item on the Multi Information Display (MID) or Center Information Display (CID) allows the driver to turn the functions ON/OFF and configure them.

Multi Information Display (MID)

Item			Setting
Driver Assist	LDW (Lane Departure Warning)		ON/OFF
	PCB (Pre-Collision Braking System)		ON/OFF
Settings	EyeSight	Acquisition Sound (Lead Vehicle Acquisition Sound)	ON/OFF
		Start Alert (Lead Vehicle Moving Monitor Function)	ON/OFF
		Accel Lv. (Cruise Control Acceleration Characteristics)	Lv. 1 (Eco)/ Lv. 2 (Comfort)/ Lv. 3 (Standard)/ Lv. 4 (Dynamic)
		Select Drive Lane (Select Drive on Left/Drive on Right)	Right Lane/Left Lane
	Warning Volume		Min/Mid/Max

Center Information Display (CID)

Item		Setting
EyeSight	Pre-Collision Braking	Setting ON/Setting OFF
	Lane Departure Warning	ON/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 Function	ON/OFF
	Select Drive on Left/Drive on Right	Right Lane/Left Lane
Warning Volume		Min/Mid/Max

12.3 Blind Spot Detection/Rear Cross Traffic Alert (BSD/RCTA)

12.3.1 Overview

Overview

To expand the preventive safety idea, the Blind Spot Detection / Rear Cross Traffic Alert is adopted to aim at full surrounding preventive safety.

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.

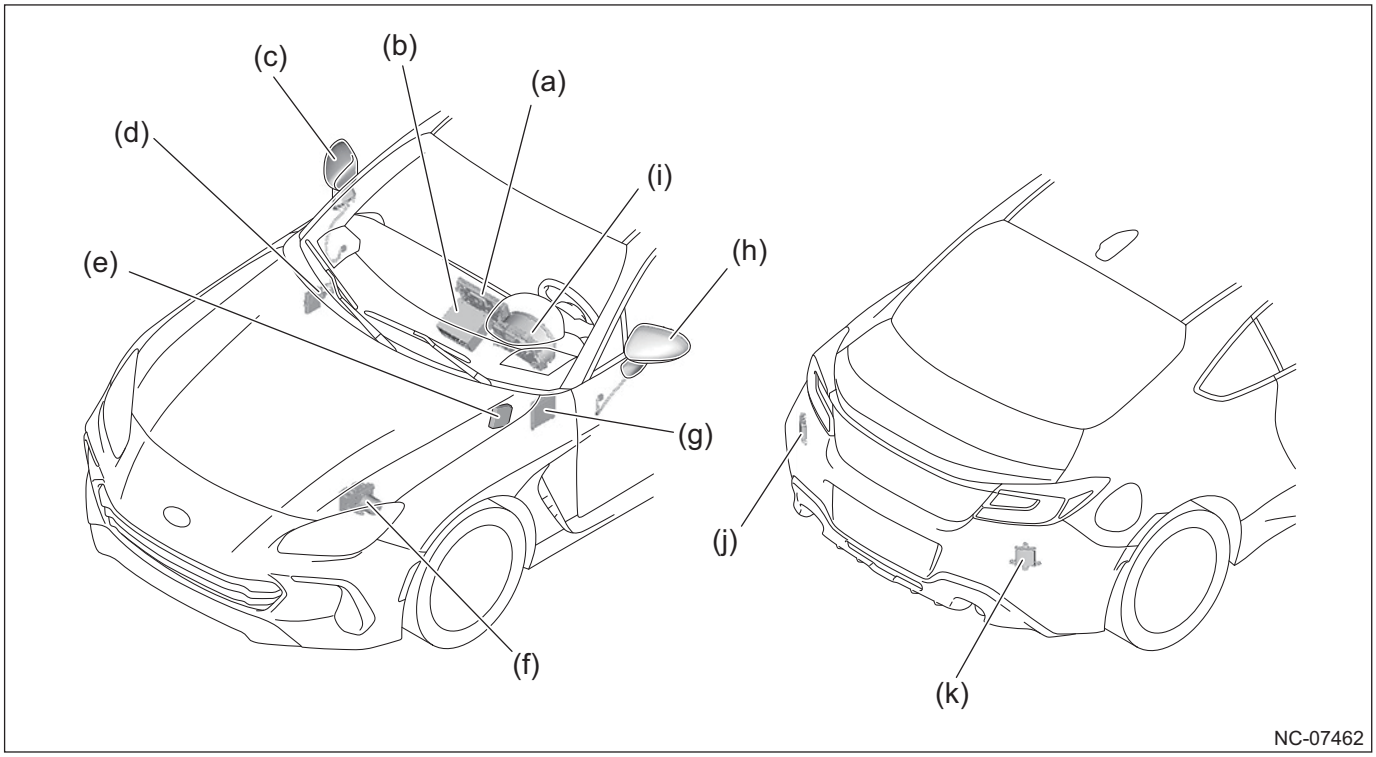
The system warns the driver with the BSD/RCTA approach indicator light (LED) on the door mirror or the warning buzzer from the combination meter.

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.

12.3.2 Component

Component layout drawing



(a) Center Information Display (CID)
(b) Cockpit Control Module (CCM)
(c) BSD/RCTA approach indicator light (outer mirror RH)
(d) Central gateway CM (CGW)
(e) Transmission Control Module (TCM)
(f) VDC CM & H/M
(g) Body integrated unit
(h) BSD/RCTA approach indicator light (outer mirror LH)
(i) Combination meter
(j) Rear radar (LH) (master)
(k) Rear radar (RH) (slave)

Component details

Main component functions

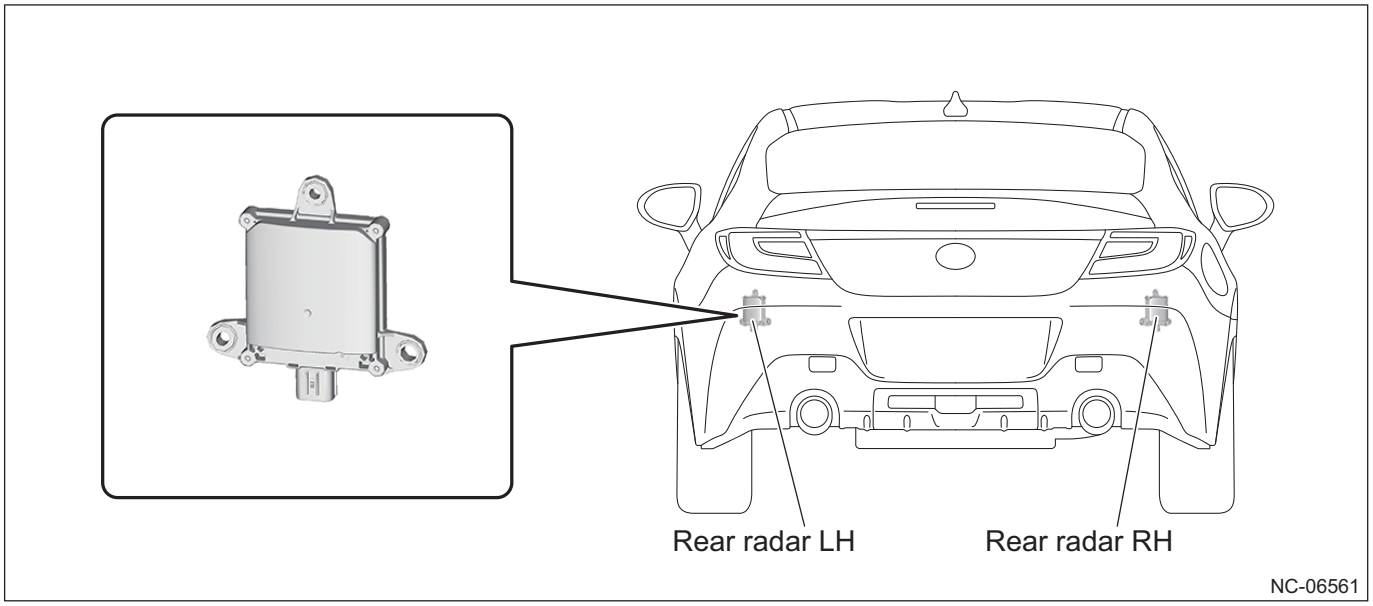
Component	Function
Central gateway CM (CGW)	Relays CAN communication between the control computers for the various devices installed in the vehicle.
Rear radar (LH) (master) / (RH) (slave)	Recognizes vehicles in the rear direction and performs warning determination control. • The rear radar (LH) (master) acquires the information required for control via CAN communication. • The rear radar (LH) (master) and rear radar (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 rear radar (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 rear radar (LH) (master) / (RH) (slave).
VDC CM & H/M	Sends the vehicle speed, yaw rate, and steering angle information to the rear radar (LH) (master).
Combination meter	Sends the turn signal and lighting information to the rear radar (LH) (master). Receives the RCTA alarm from the rear radar (LH) (master) and sounds the warning buzzer. Sends the system ON/OFF status to the rear radar (LH) (master).
Cockpit Control Module (CCM)	Sends the signals from the Center Information Display (CID) to the combination meter.
Center Information Display (CID)	Sends the function ON/OFF status to the Cockpit Control Module (CCM).
Body integrated unit (BIU)	Sends the lighting information and MT reverse information (MT models) to the rear radar (LH) (master).

Rear radar

The rear radars are attached to the vehicle body under the rear combination light via brackets, and one is installed on each side.

Each radar sensor detects vehicles on its installed side.

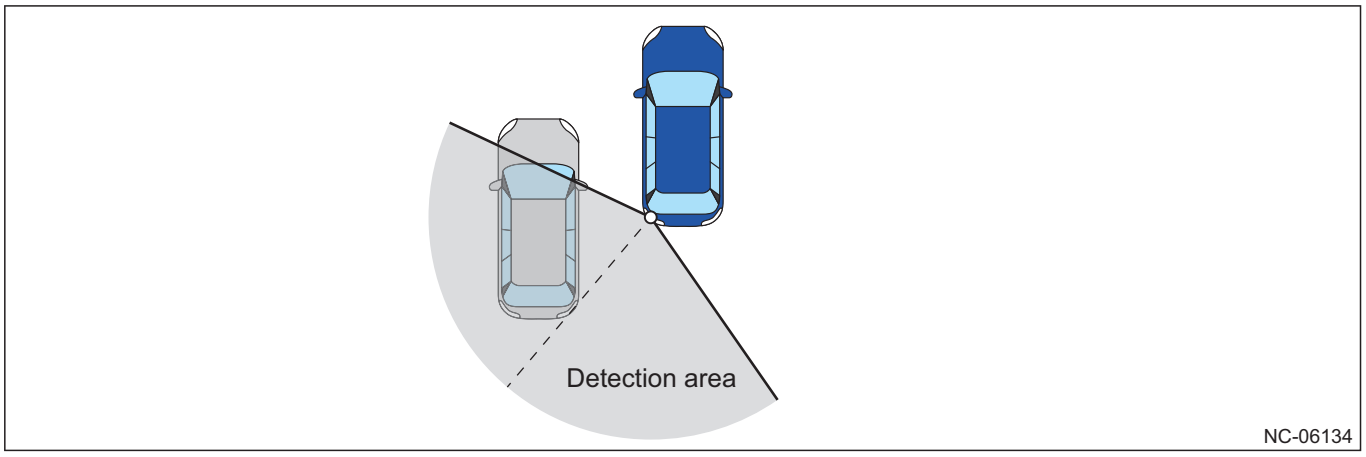
The rear radars cannot be seen from the outside since they are covered by the rear bumper face.



Rear radar specifications

Detection distance	Approximately 230 ft (70 m)
Azimuth direction detection angle	±75°

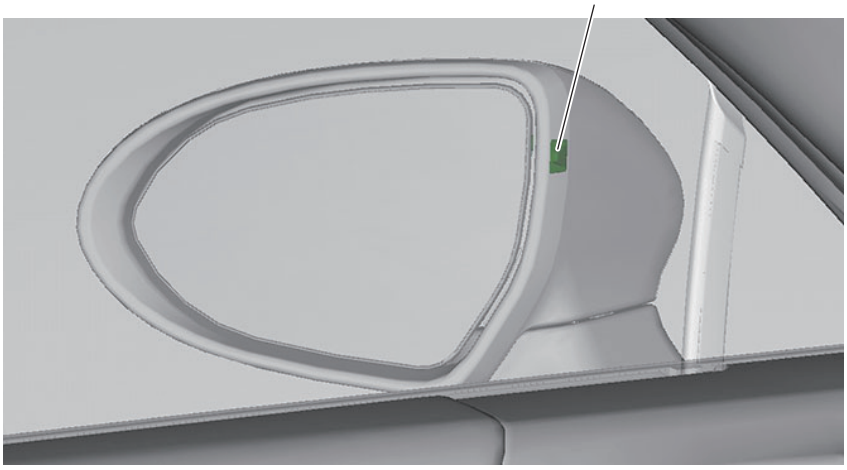
Rear radar detection area (radar irradiation image)



**The illustration shows one side only.*

BSD/RCTA approach indicator light

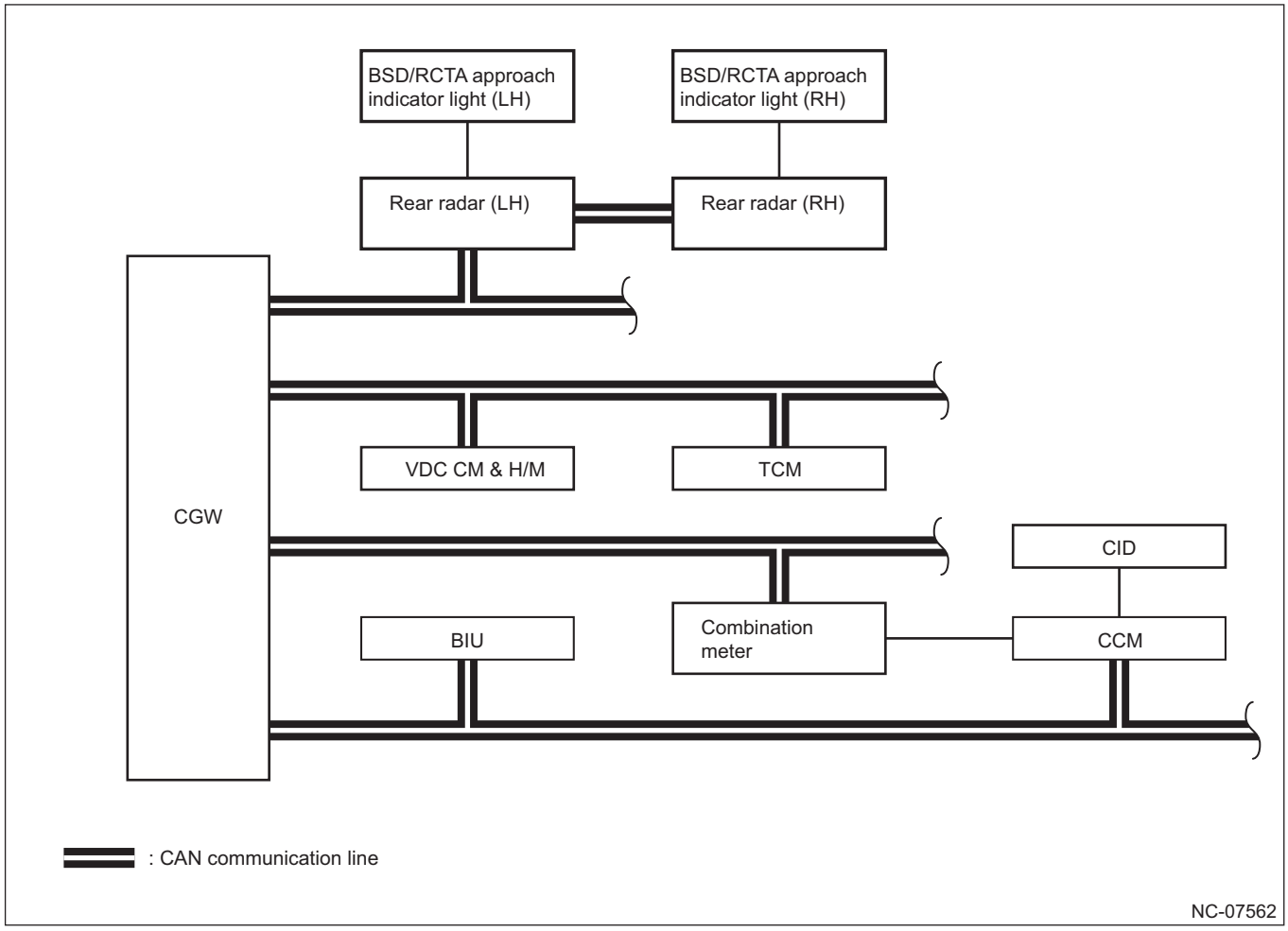
Warning is issued without disrupting the movement of view when checking the rear side by illuminating/flashing the LED indicator set inside the outer mirror when there is a vehicle in the blind spot of the rear side.



NC-07561

12.3.3 Construction and Operation

System diagram



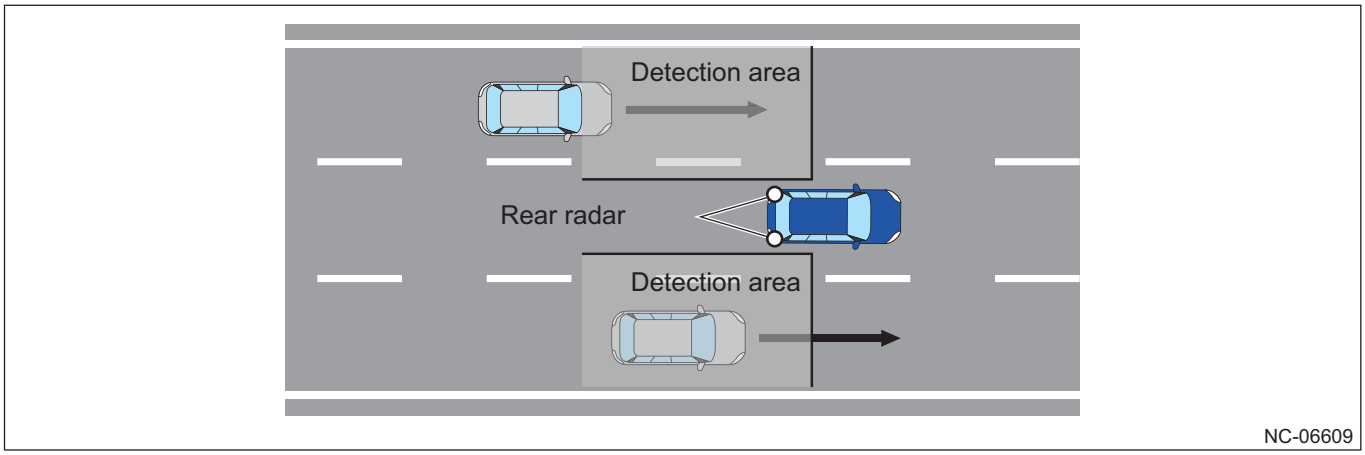
Blind spot vehicle detection (BSD)

Overview

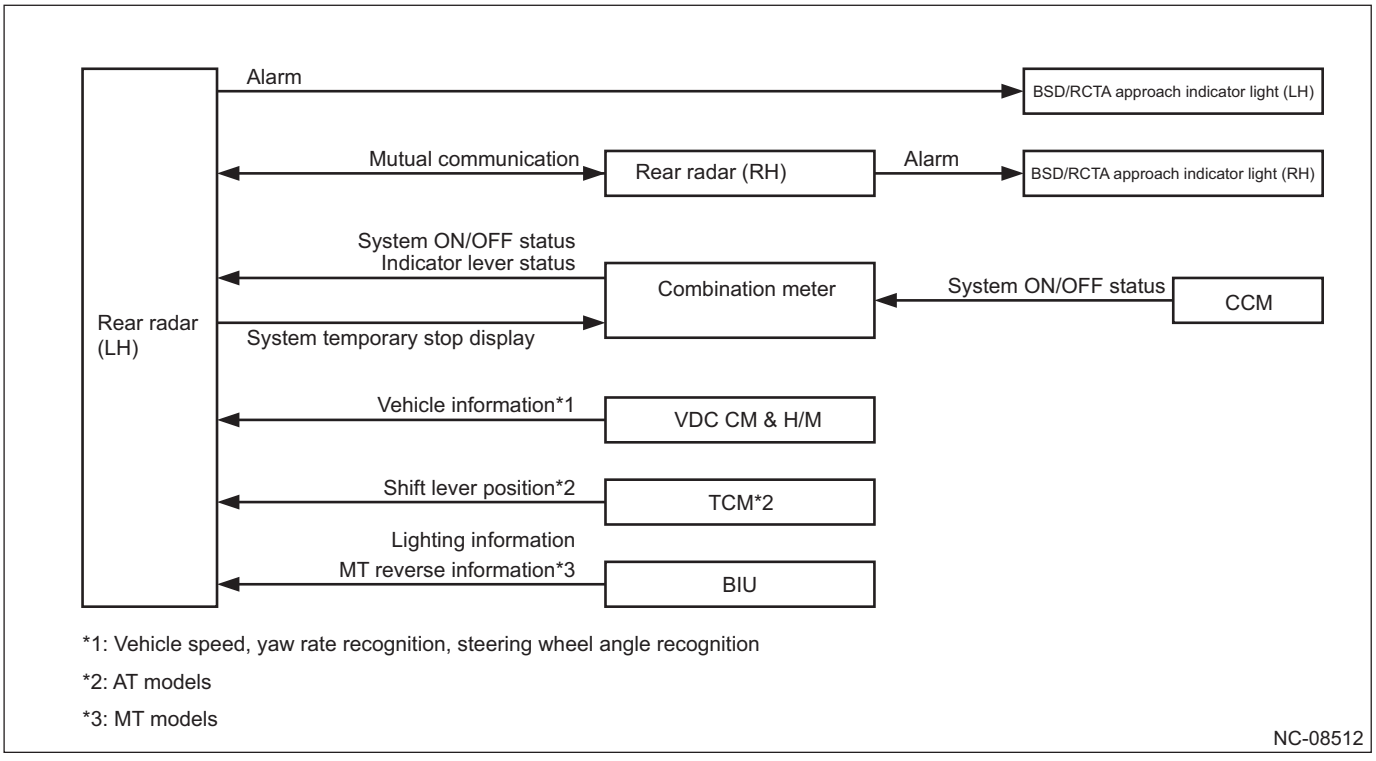
This function warns the driver by turning on the BSD/RCTA approach indicator light when it detects a (rear) vehicle in the blind spot created by the rear quarter pillar.

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.

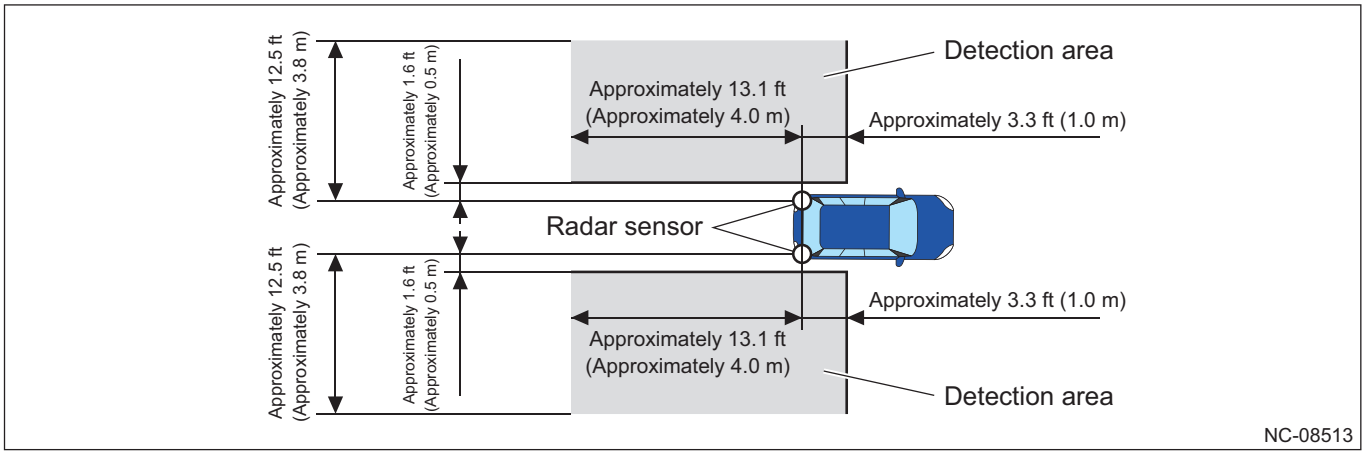


Block diagram



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

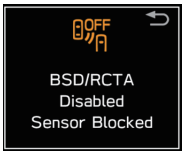
**The illustration shows a typical example that may differ from the actual display.*

■ Indicator

Display	Description	Display	Description
 NC-05482	BSD/RCTA OFF indicator light	 NC-05483	BSD/RCTA warning light • Turns on when a system error occurs.

■ Alarm / warning / operating status

▮ Multi Information Display (MID)

Display	Description
 NC-07564	BSD/RCTA temporary stop
 NC-09049	Temporary stop: Radar detection not functioning

Lane change assistance (LCA)

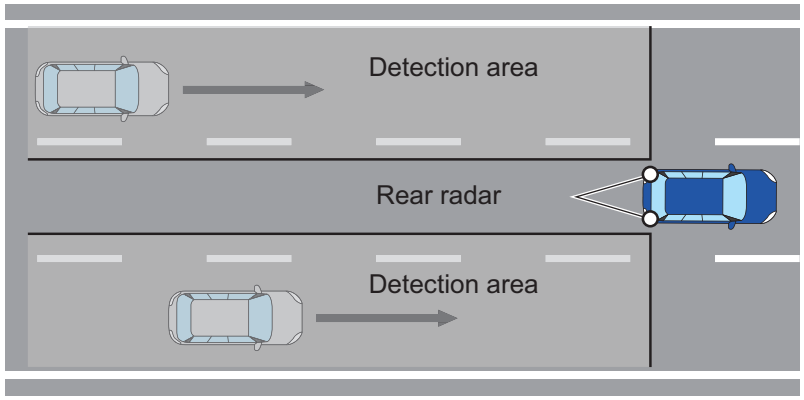
Overview

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.

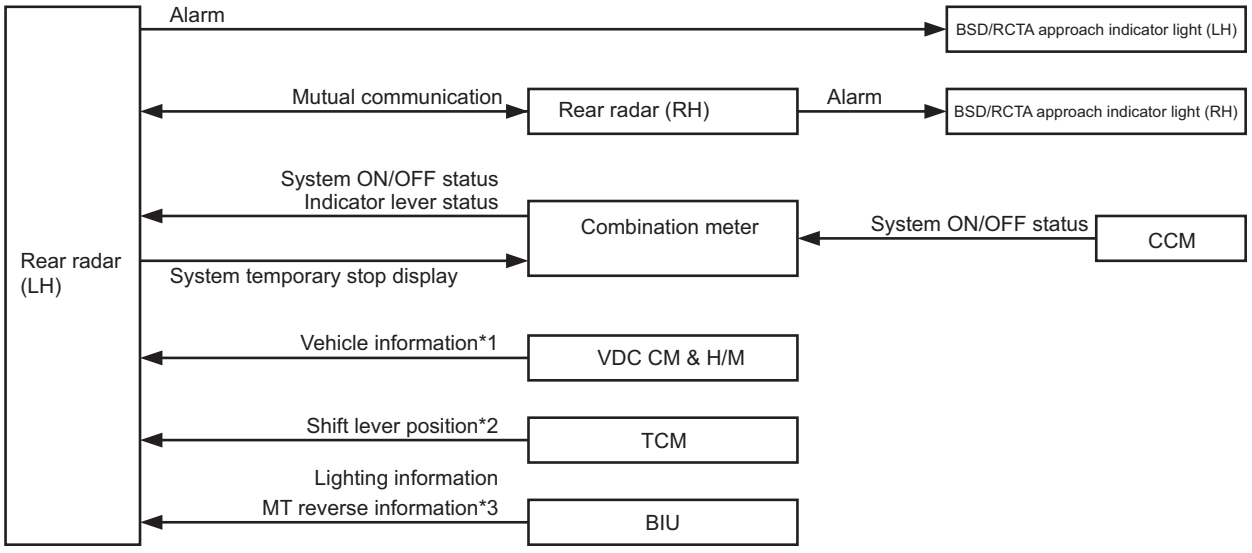
Control starts when the vehicle speed is approximately 6 MPH (10 km/h) or higher.

- Vehicles in the neighboring lanes approximately 230 ft (70 m) to the rear are detected.
- The vehicles with the predicted collision time of 4.0 seconds or less will be the target of warning.



NC-06610

Block diagram



*1: Vehicle speed, yaw rate recognition, steering wheel angle recognition

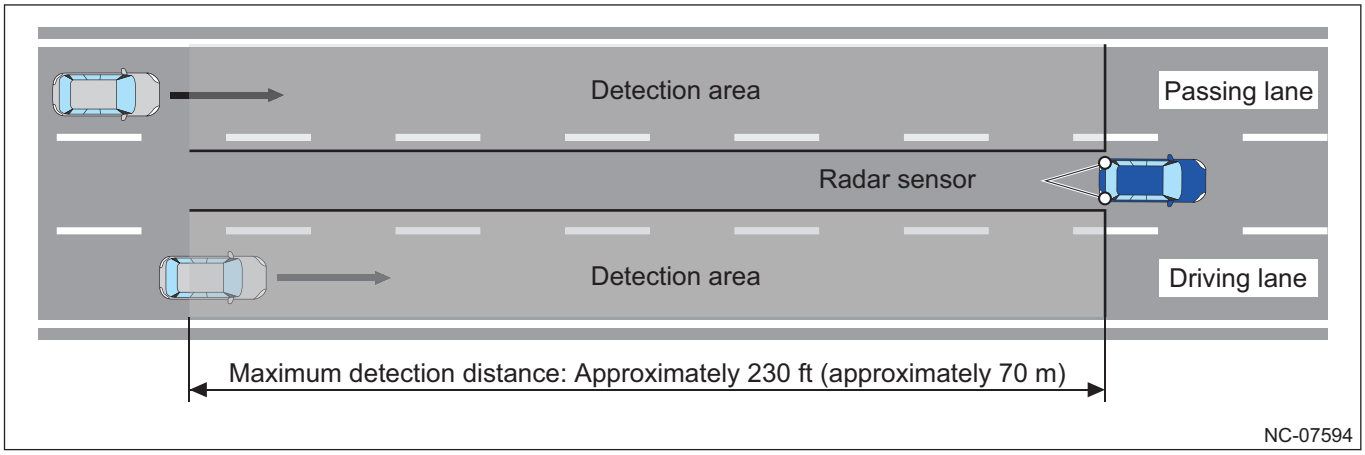
*2: AT models

*3: MT models

NC-08514

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

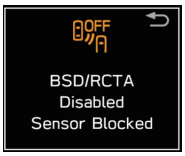
**The illustration shows a typical example that may differ from the actual display.*

■ Indicator

Display	Description	Display	Description
 NC-05482	BSD/RCTA OFF indicator light	 NC-05483	BSD/RCTA warning light • Turns on when a system error occurs.

■ Alarm / warning / operating status

▮ Multi Information Display (MID)

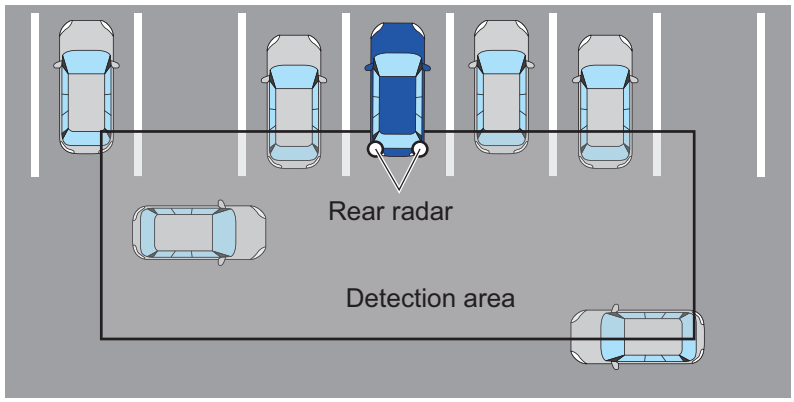
Display	Description
 NC-07564	BSD/RCTA temporary stop
 NC-09049	Temporary stop: Radar detection not functioning

Rear Cross Traffic Alert (RCTA)

Overview

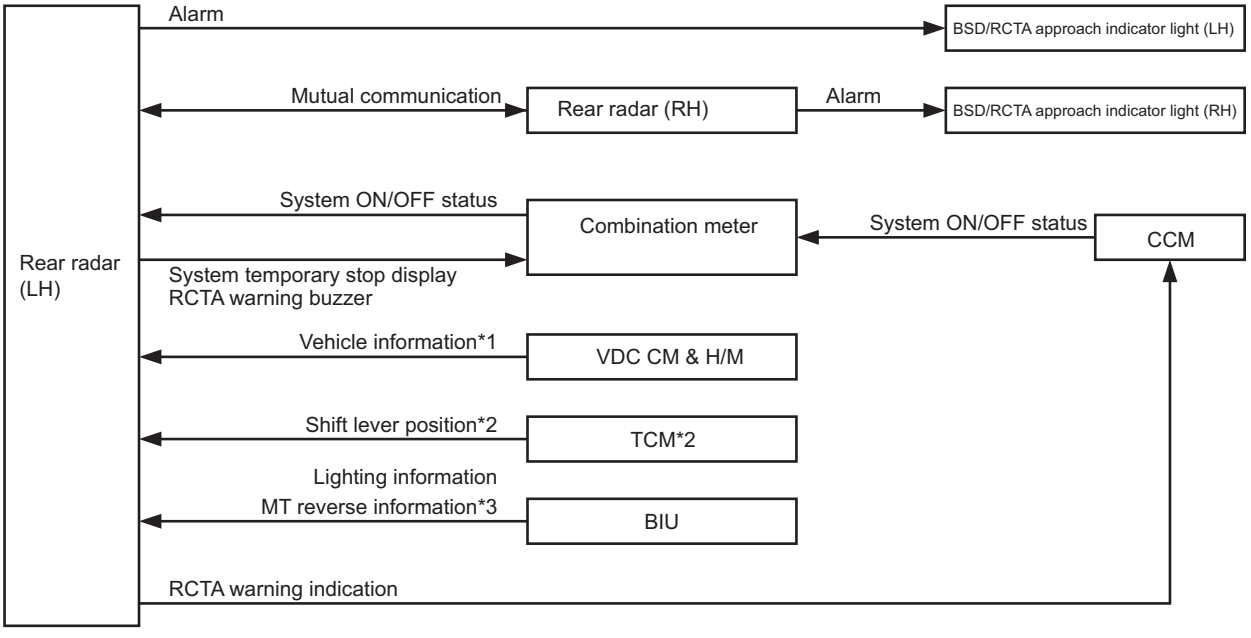
This function warns the driver by flashing the BSD/RCTA approach indicator light and sounding the warning buzzer when there is cross-traffic approaching from the left or right when the vehicle is reversing and the system determines that there is the danger of collision.

The vehicle that may collide within 3.5 seconds will be the target of warning.



NC-06611

Block diagram



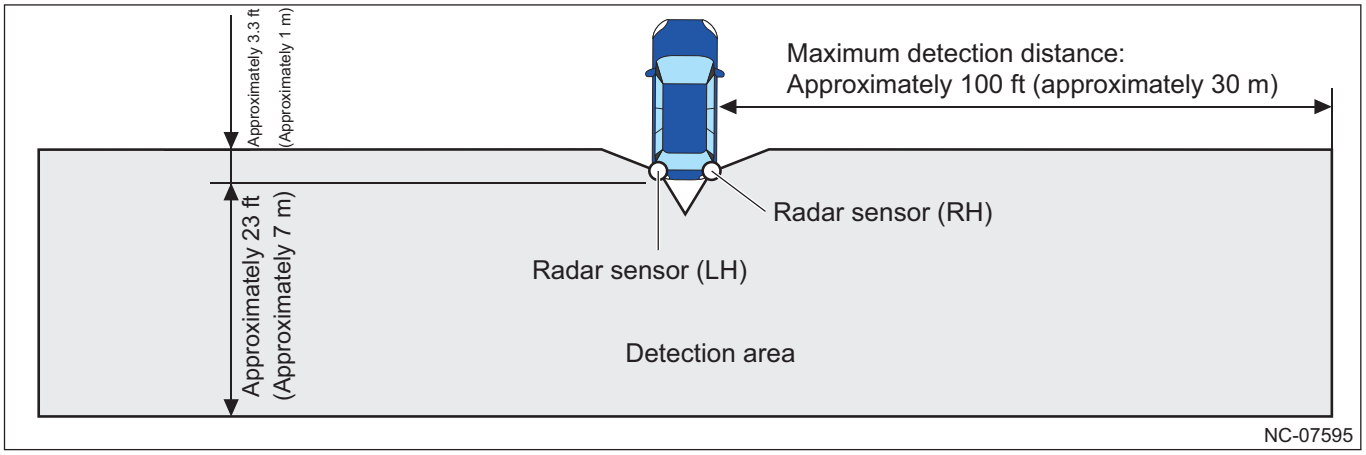
*1: Vehicle speed, yaw rate recognition, steering wheel angle recognition

*2: AT models *3: MT models

NC-08515

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

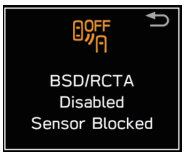
**The illustration shows a typical example that may differ from the actual display.*

■ Indicator

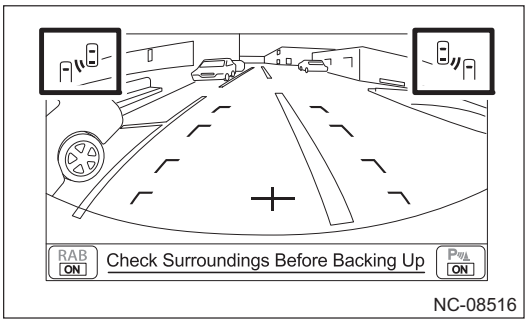
Display	Description	Display	Description
 NC-05482	BSD/RCTA OFF indicator light	 NC-05483	BSD/RCTA warning light • Turns on when a system error occurs.

■ Alarm / warning / operating status

▮ Multi Information Display (MID)

Display	Description
 NC-07564	BSD/RCTA temporary stop
 NC-09049	Temporary stop: Radar detection not functioning

▮ Center Information Display (CID)

Display	Description
 NC-08516	RCTA alarm in progress

Customization function

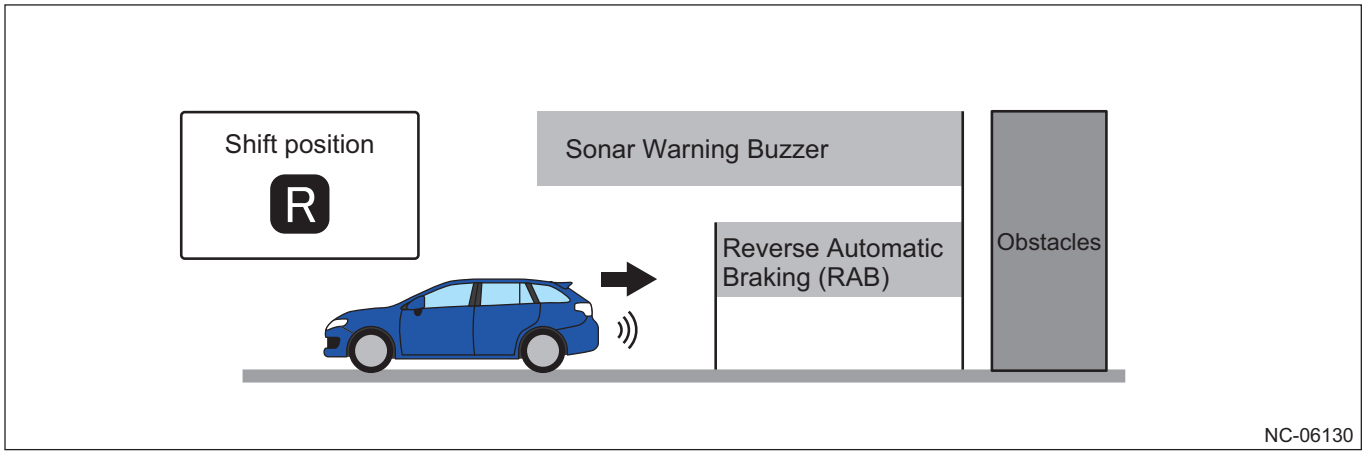
Selecting an item on the Multi Information Display (MID) or Center Information Display (CID) allows the driver to turn the functions ON/OFF and configure them.

Item	Setting
BSD/RCTA	ON/OFF

12.4 Reverse Automatic Braking

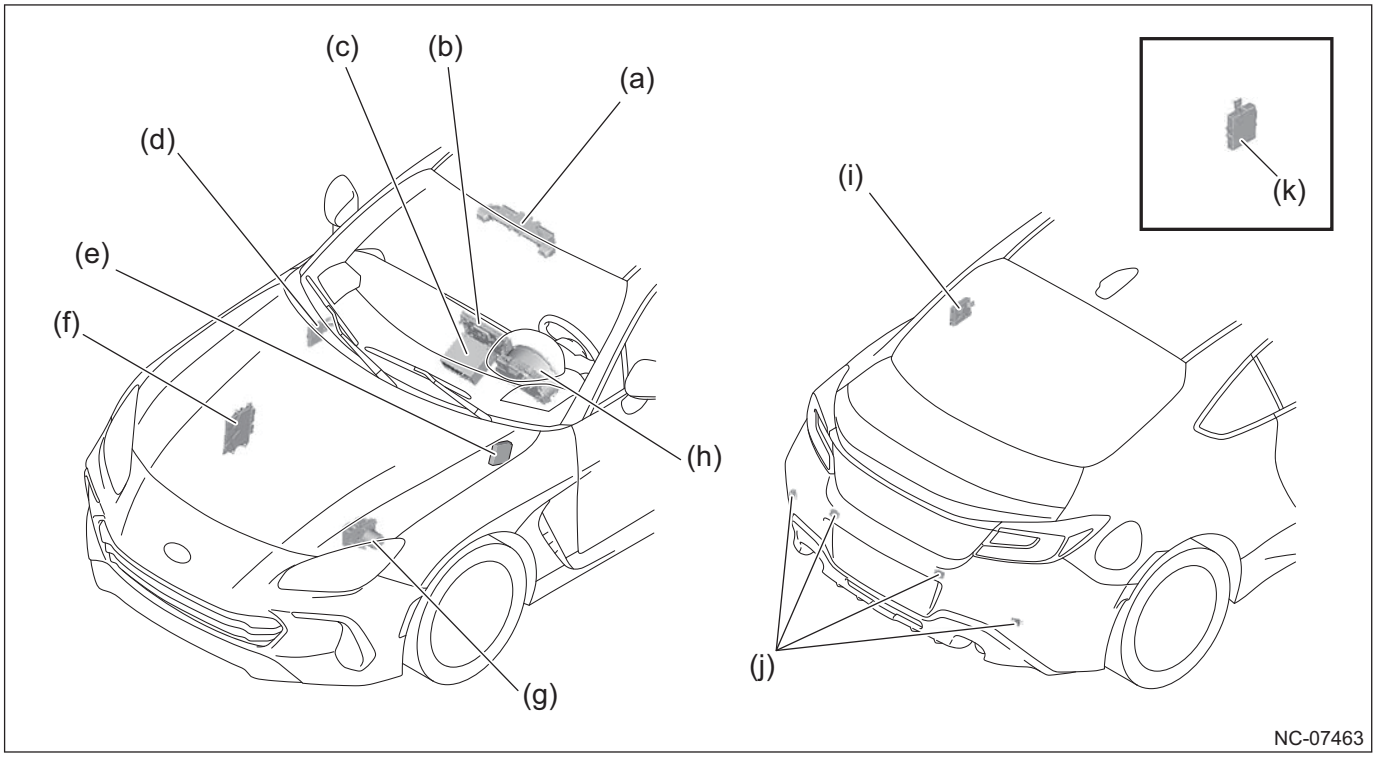
12.4.1 Overview

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. (for some grades)



12.4.2 Component

Component layout drawing



(a) Stereo camera
(b) Center Information Display (CID)
(c) Cockpit Control Module (CCM)
(d) Central gateway CM (CGW)
(e) Transmission Control Module (TCM)
(f) Engine Control Module (ECM)
(g) VDC CM & H/M
(h) Combination meter
(i) Sonar CM
(j) Sonar sensor
(k) EyeSight security gateway CM

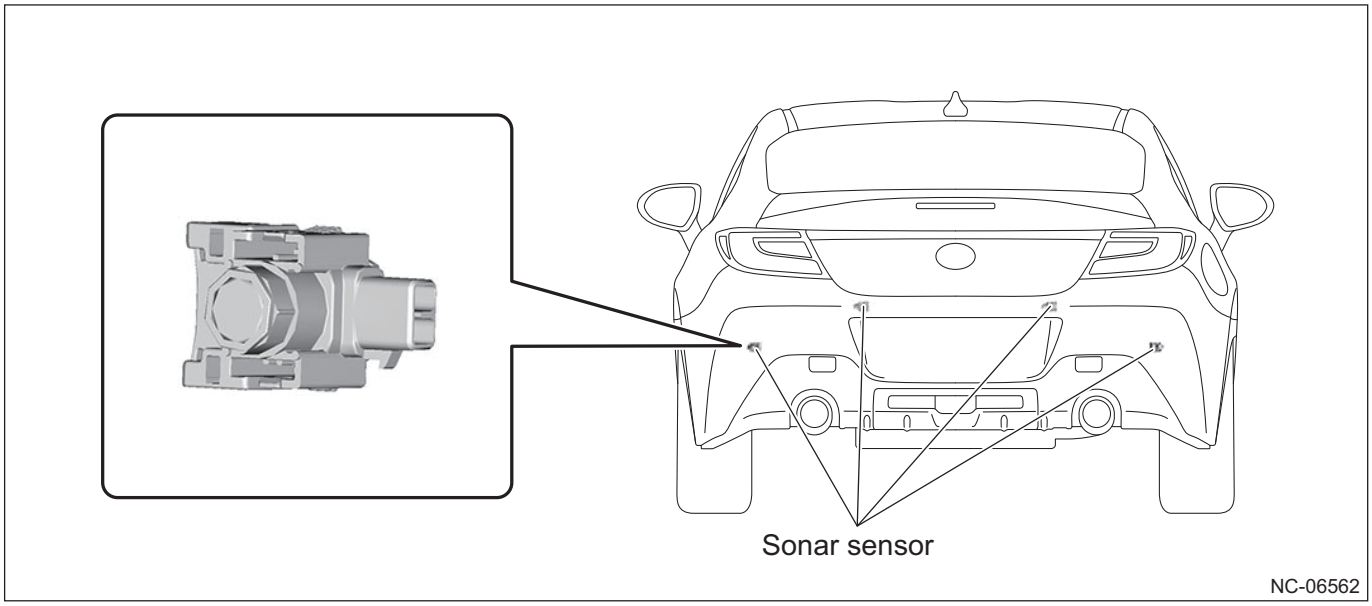
Component details

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.
EyeSight security gateway CM	Connects the stereo camera and power unit bus (CAN) and exchanges signals between computers.
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.

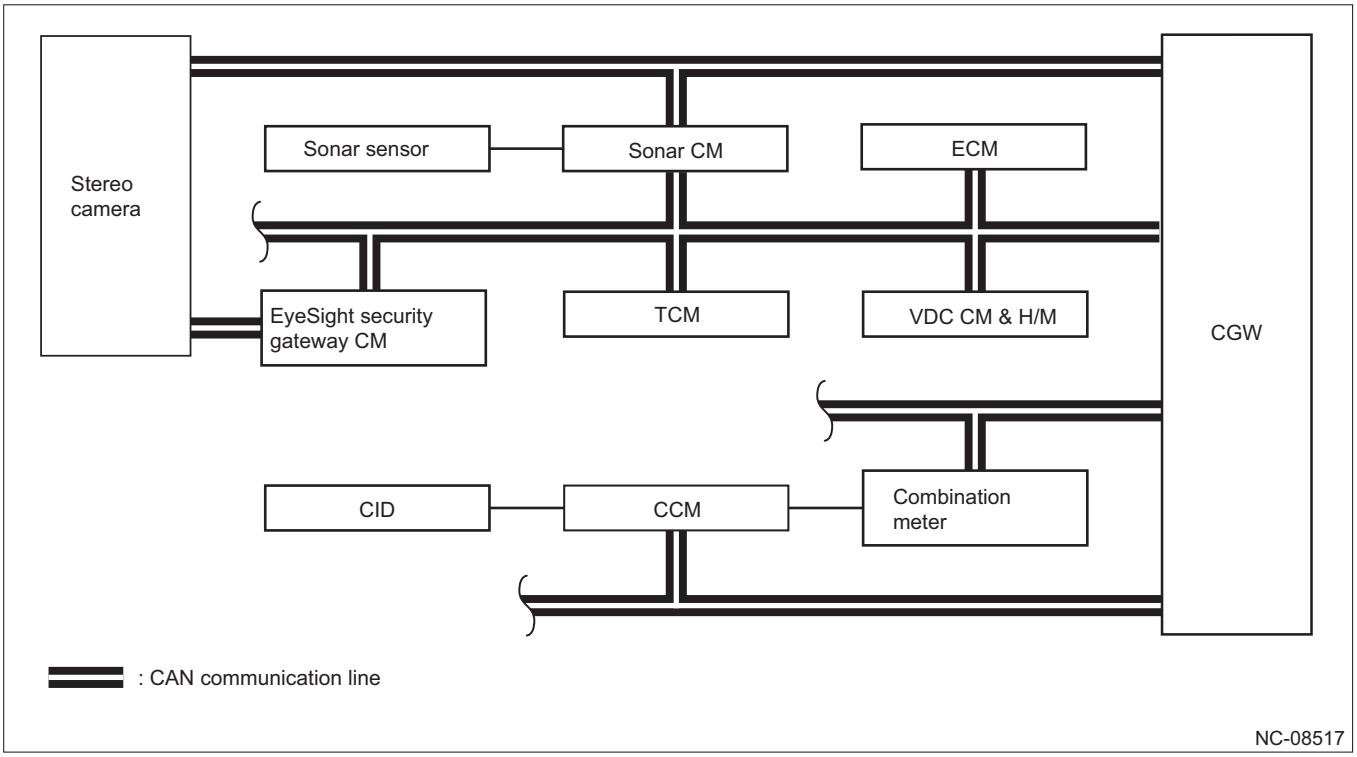
Sonar sensor

The sonar sensor measures the distance to objects to the rear of the vehicle.



12.4.3 Construction and Operation

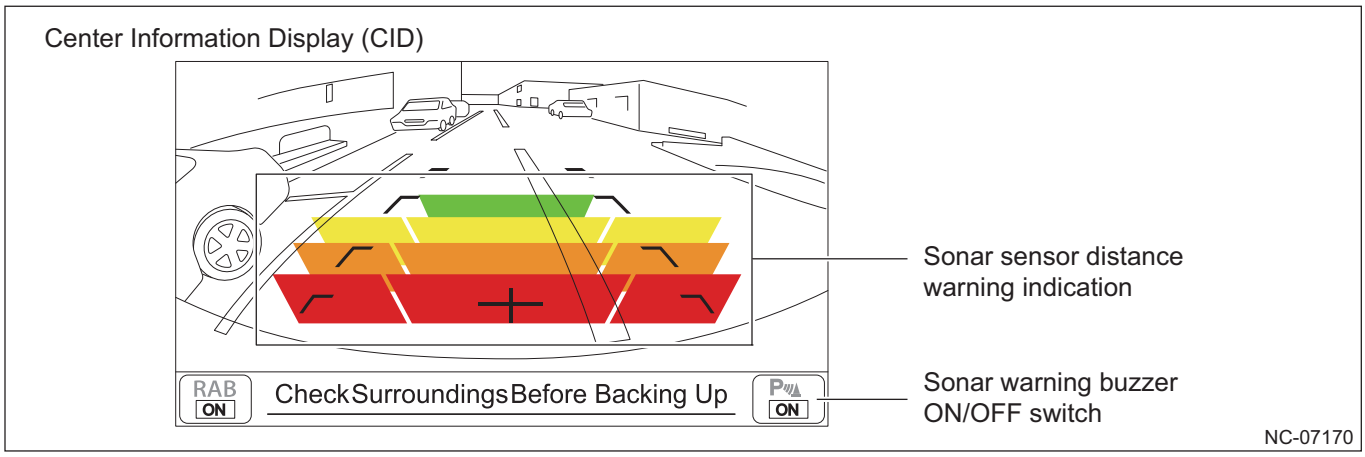
System diagram



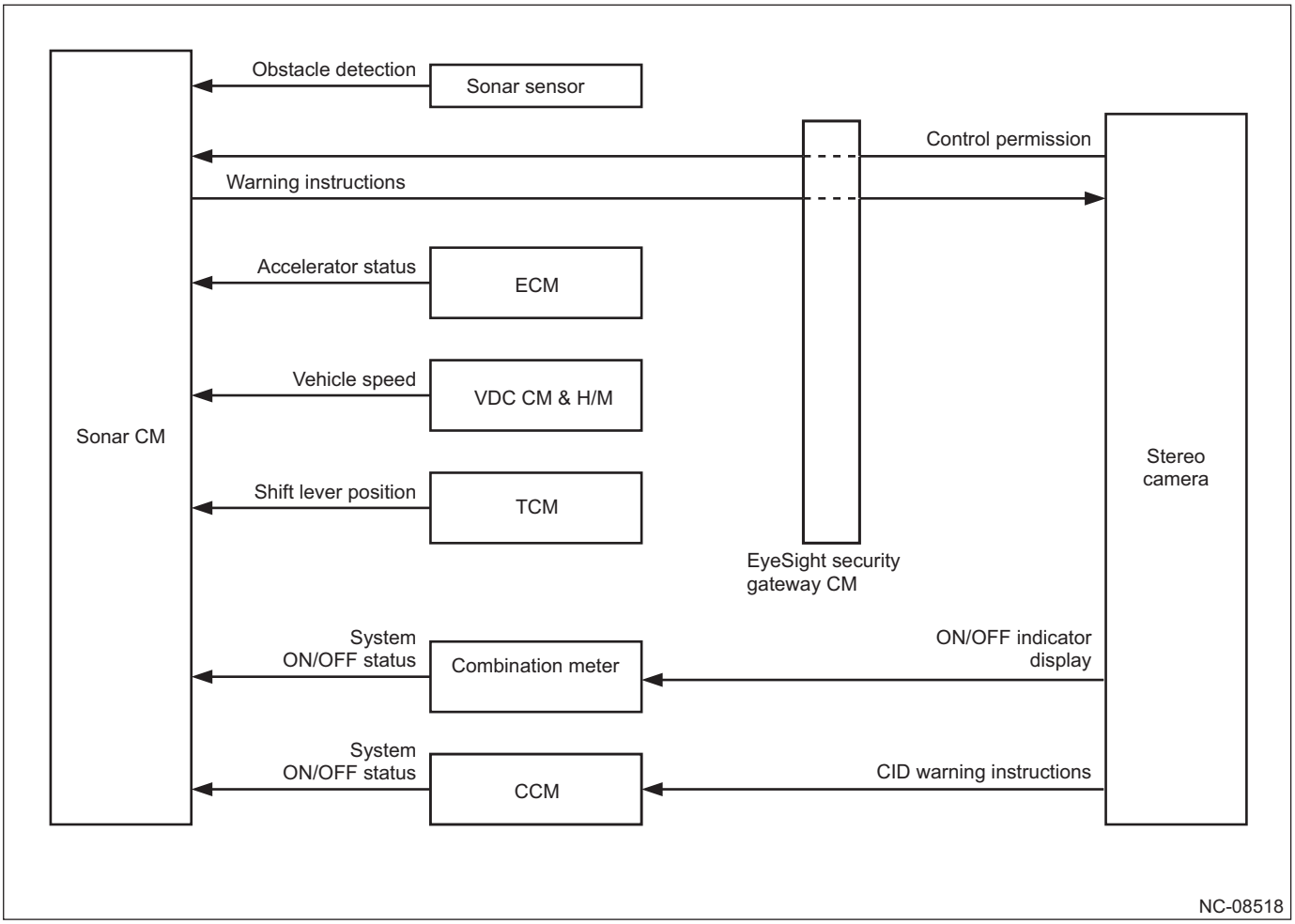
Sonar warning buzzer

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.



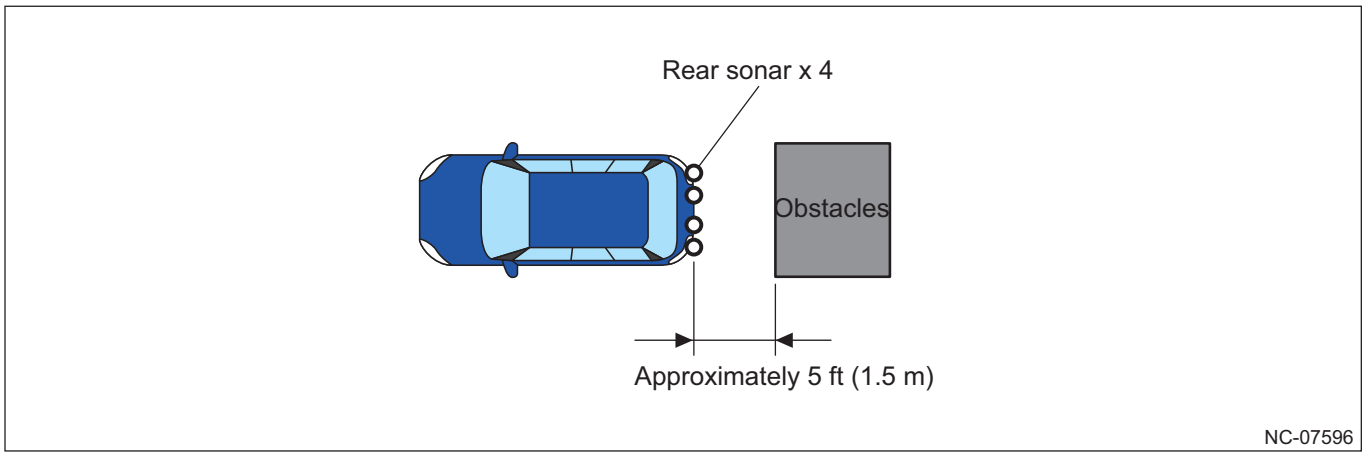
Block diagram



Operation

■ Detection area

An obstacle in the detection range of approximately 1.5 m (approximately 5 ft) to the rear from the bumper 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)	-

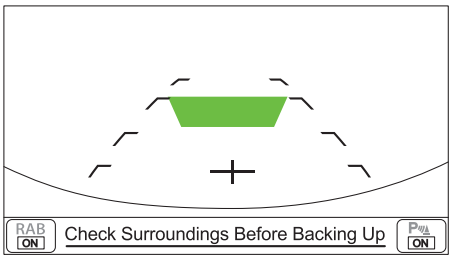
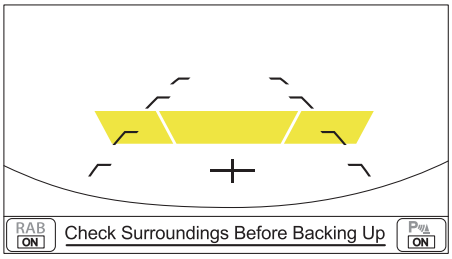
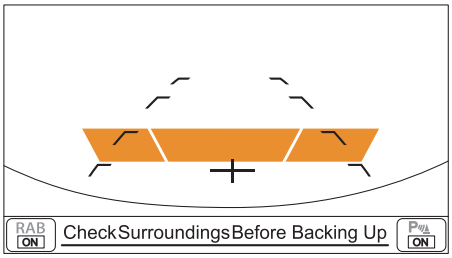
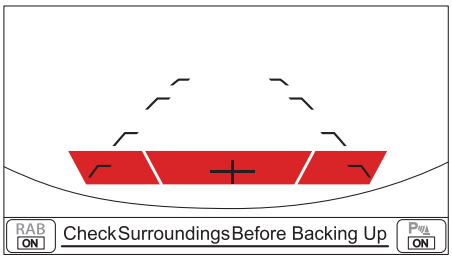
Display

**The illustration shows a typical example that may differ from the actual display.*

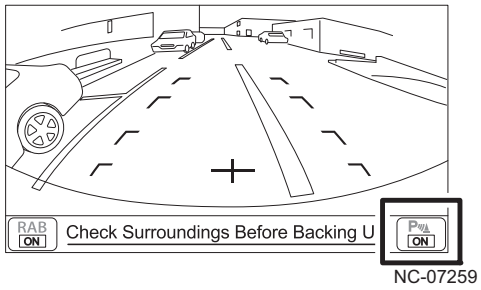
■ Alarm / warning / operating status

▮ 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.

Alarm Pattern	Distance to obstacle ###	Sonar sensor distance warning indication	Indication color	Warning buzzer
Long distance warning	3.0 ft (0.9 m) or more	 NC-07166	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-07167	Yellow	Repeating intermittent beeps
Proximity warning	1.6 ft (0.5 m) or more 2.3 ft (0.7 m) or less	 NC-07168	Orange	Repeating rapid beeps
Close proximity warning	1.6 ft (0.5 m) or less	 NC-07169	Red	Continuous beep sound

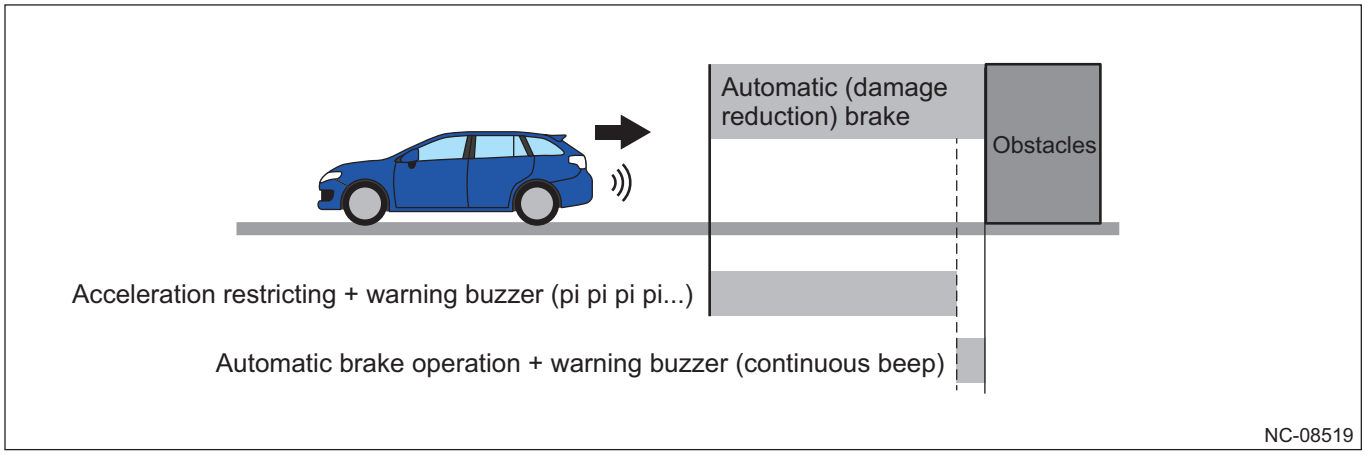
▮ Center Information Display (CID)

Display	Description
 NC-07259	Sonar warning buzzer ON/OFF switch

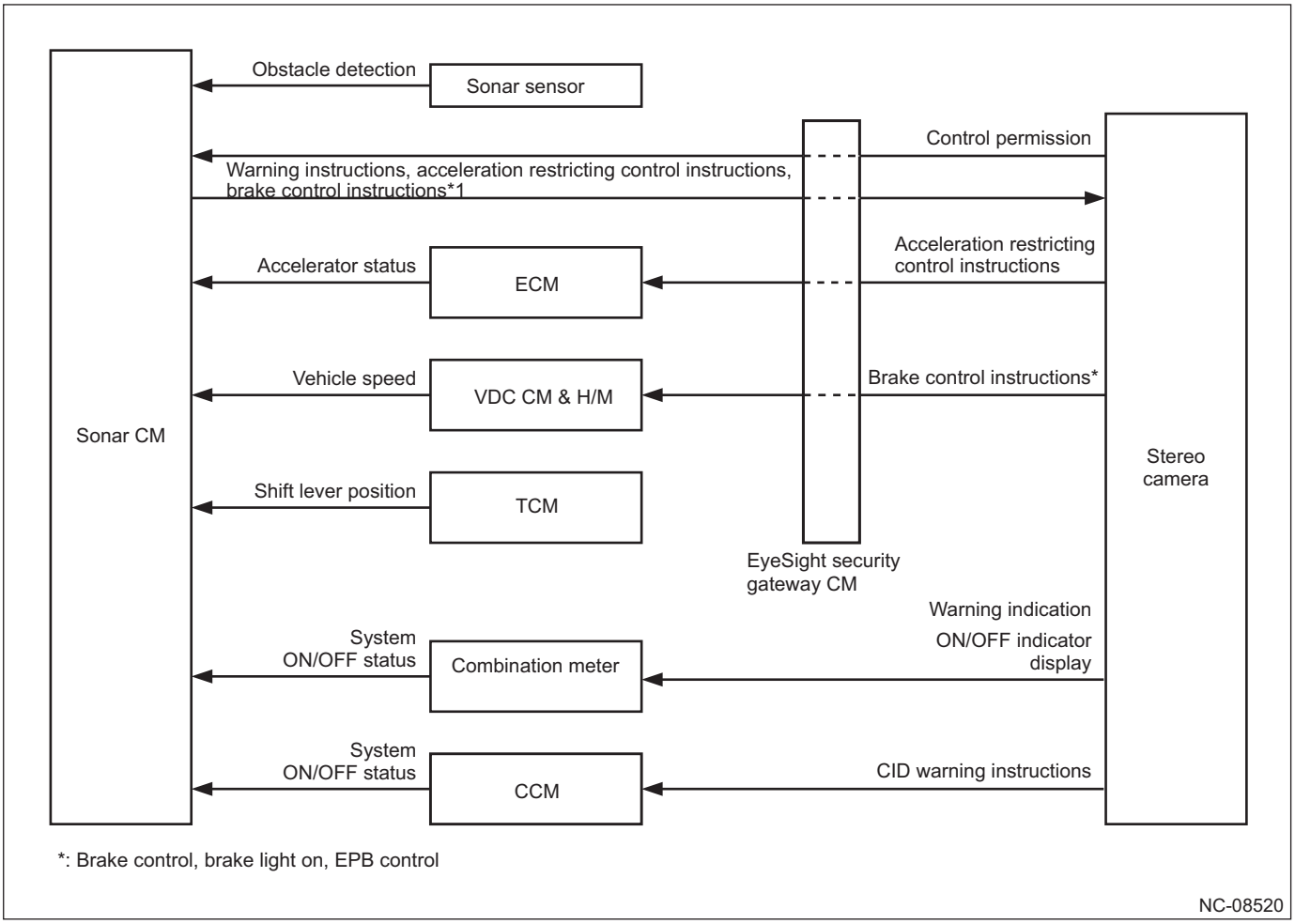
Automatic (Damage Reduction) Brake

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 a speed of 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 (damage reduction) brake was activated	When the driver presses the accelerator pedal after the automatic (damage reduction) brake was 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 3 seconds have elapsed without any operation after the vehicle stopped
When a door is opened after the vehicle stopped	-

■ 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
	Obstacles already close to the vehicle when the shift lever was shifted to "R"
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
	Obstacles located at a height higher than the vehicle, or at a low height close to the ground
	Obstacles smaller than a 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	The sonar sensor or the bumper near the sonar sensor is extremely hot or cold.
		A sticker is affixed to, or paint or chemical is applied to, the sonar sensor or the bumper near the sonar sensor.
		Ice, snow, or dirt is adhering to the sonar sensor or the bumper near the sonar sensor.
		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 sonar sensor has shifted as a result of strong impact to the bumper, bumper deformation, or other reason.
	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
	Parts attached close to the sonar sensor	When a commercially available electrical part (fog light, fender pole, radio antenna, etc.), accessory (trailer hitch, bicycle carrier, etc.), or license plate with illuminated numbers is attached close to the rear bumper sonar sensor

In the following cases, the system may not fully stop even if it operates correctly	When the road surface is slippery
	When driving over a manhole cover or similar object
	When the tires are not appropriate (air pressure, tread, size, brand, etc.)
	When tire chains are attached
	When emergency repairs were made using the puncture repair kit
	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

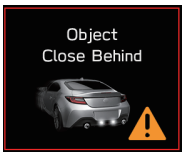
**The illustration shows a typical example that may differ from the actual display.*

■ Indicator

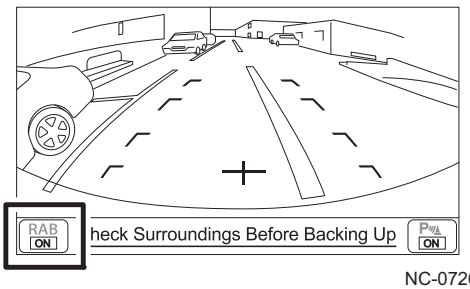
Display	Description	Display	Description
 NC-05485	RAB OFF indicator light	 NC-05486	RAB warning light

■ Alarm / warning / operating status

▮ Multi Information Display (MID)

Display	Description
 NC-07435	Brake request warning: Red frame • Acceleration restriction is active • Automatic (damage reduction) brake is operating
 NC-07428	Brake request warning: Yellow frame • After automatic (damage reduction) brake operation
 NC-07436	RAB temporary stop

▮ Center Information Display (CID)

Display	Description
 NC-07260	Automatic (damage reduction) brake ON/OFF switch

Customization function

Selecting an item on the Multi Information Display (MID) or Center Information Display (CID) allows the driver to turn the functions ON/OFF and configure them.

Multi Information Display (MID)

Item		Setting
RAB (Reverse Automatic Braking)		ON/OFF
 NC-09051	Sonar Audible Alarm	ON/OFF

Center Information Display (CID)

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.

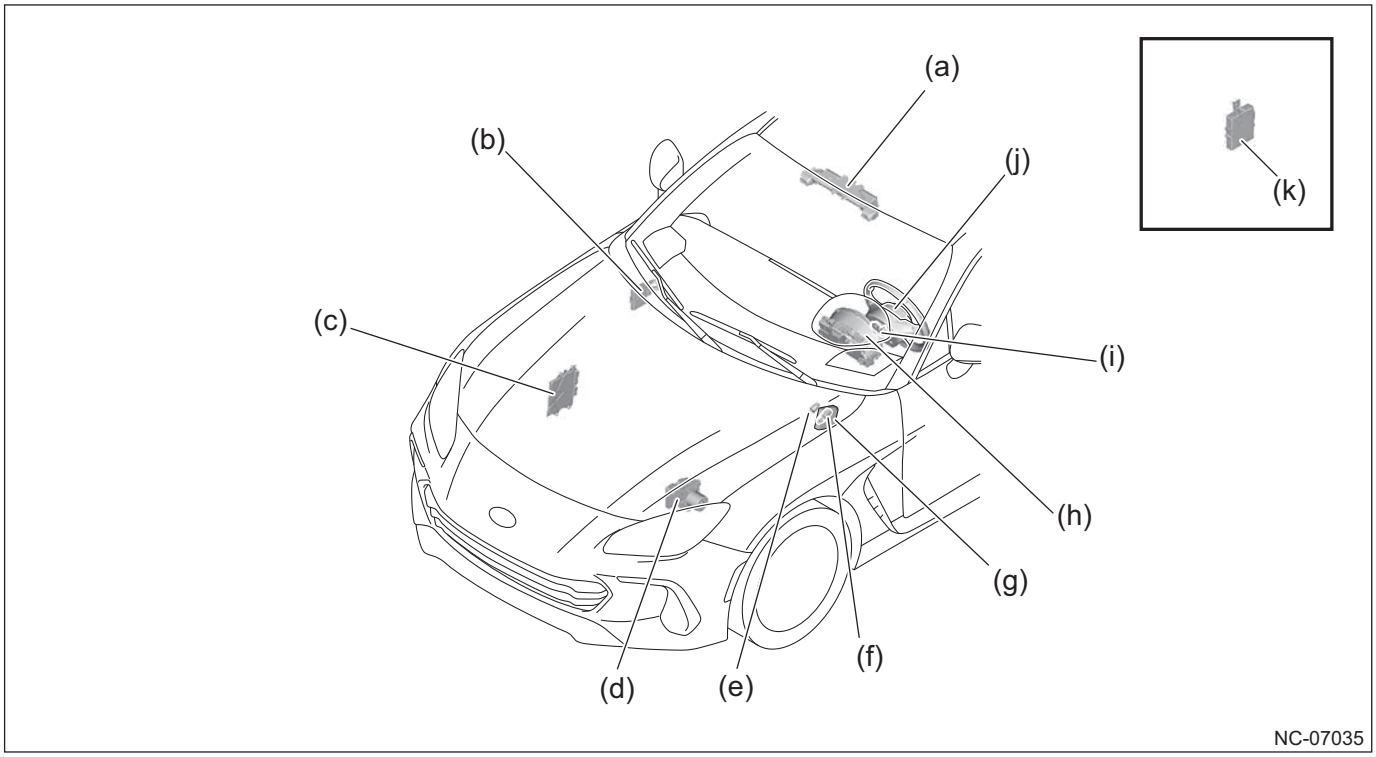
This is a driving assistant system that makes driving on a motorway or vehicle-only road more comfortable.

While the Cruise Control is set in a model equipped 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. If the model is not equipped with EyeSight, engine braking is performed to decelerate in these circumstances.

*In vehicles equipped 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) Engine Control Module (ECM)
(d) VDC CM & H/M
(e) Stop light switch
(f) Clutch switch*2
(g) Transmission Control Module (TCM)*1
(h) Combination meter
(i) Cruise Control switch
(j) Distance between vehicles setting switch*1
(k) EyeSight security gateway CM*1

**1: AT models*
**2: MT models*

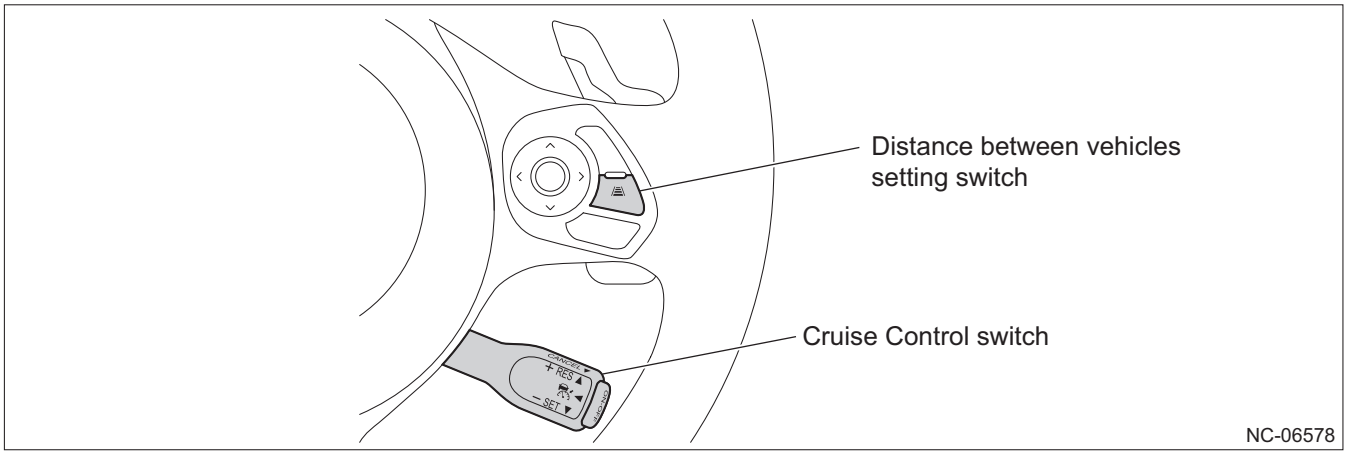
Component details

Main component functions

Component	Function	
Engine Control Module (ECM)	AT models	Sends the engine status (accelerator status) to the stereo camera. Receives engine control signals from the stereo camera and controls the engine.
	MT models	Controls the main functions of the Cruise Control system based on signals from the switches and computers.
VDC CM & H/M	AT models	Sends vehicle information (brake operation status, steering wheel angle recognition, yaw rate recognition, longitudinal G recognition, lateral G recognition, vehicle speed, VDC operating status, etc.) to the stereo camera. Receives brake control and brake light on signals from the stereo camera and controls each of them.
	MT models	Sends the vehicle speed signals to the Engine Control Module (ECM).
Transmission Control Module (TCM)	AT models	Sends the shift lever position status to the stereo camera. Receives transmission control signals from the stereo camera and controls the transmission.
Stereo camera	AT models	Performs control calculation based on 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)	AT/MT models	Relays CAN communication between the control computers for the various devices installed in the vehicle.
EyeSight security gateway CM	AT models	Connects the stereo camera and power unit bus (CAN) and exchanges signals between computers.
Combination meter	AT models	Receives the vehicle speed setting and system ON/OFF status from the stereo camera and displays each of these.
	MT models	Receives the vehicle speed setting and system ON/OFF status from the Engine Control Module (ECM) and displays each of these.
Stop light switch	AT/MT models	Detects depression of the brake pedal and outputs the signal to the Engine Control Module (ECM).
Clutch switch	MT models	Detects depression of the clutch and outputs the signal to the Engine Control Module (ECM).
Cruise Control switch	AT models	Turns Conventional Cruise Control ON/OFF, and sets the vehicle speed. Sends the set conditions to the computers.
	MT models	Sends the vehicle speed setting from the Cruise Control switch and system ON/OFF status to the Engine Control Module (ECM).
Distance between vehicles setting switch	AT models	Press and hold for approximately 2 seconds or longer to send the command for switching between Adaptive Cruise Control (ACC) and Conventional Cruise Control to the stereo camera.

Steering Switch

Turns on and off the Conventional Cruise Control, and switches the set vehicle speed.

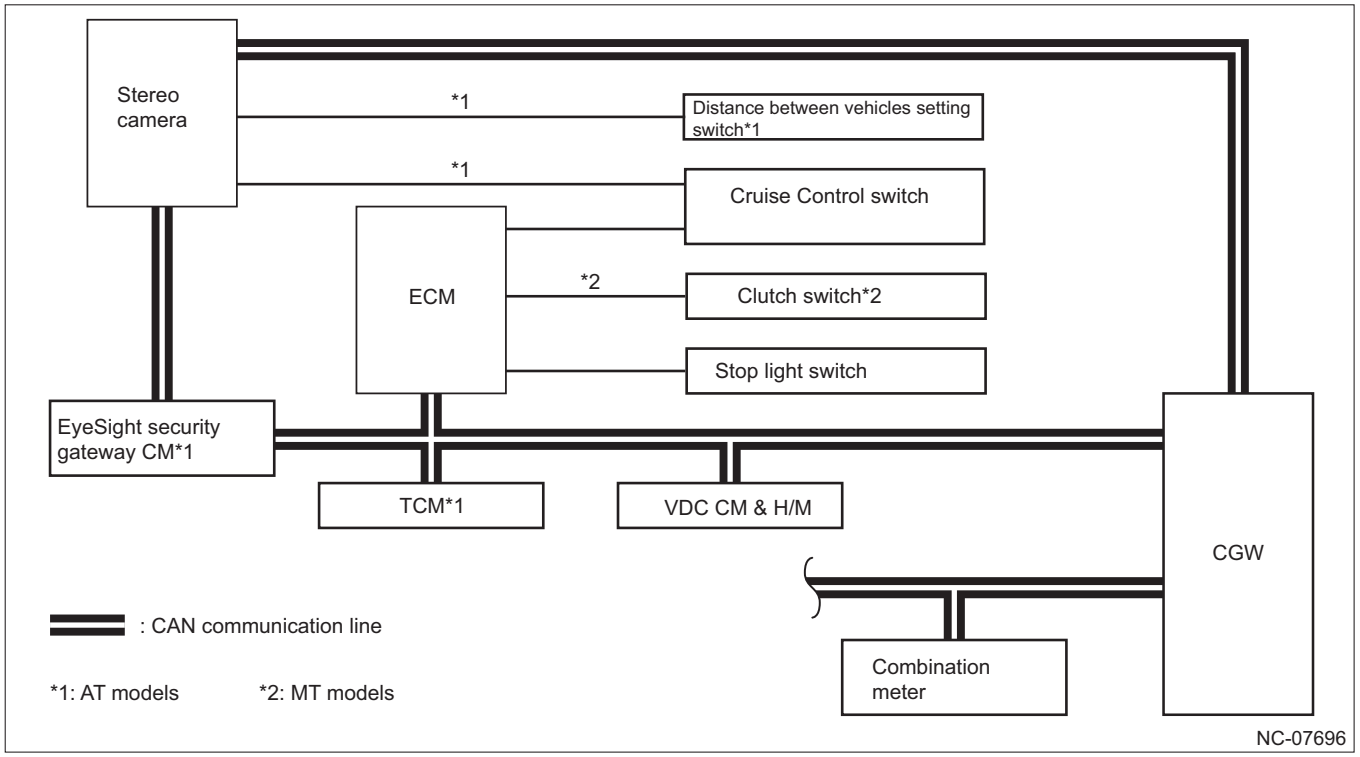


Name		Operation	Function
Cruise Control switch	ON-OFF switch	Press	Cruise Control ON/OFF*1
	+RES	Press up	Sets the Cruise Control. (If pressed after Cruise Control was canceled, it will set again to the speed that was set for Cruise Control before it was canceled.) Raises the set vehicle speed (when the Cruise Control is set).
	-SET	Press down	Sets the Cruise Control. Lowers the set vehicle speed (when the Cruise Control is set).
	CANCEL	Pull toward the driver	Temporarily cancels the Cruise Control.
Distance between vehicles setting switch*2		Press and hold for approximately 2 seconds or longer.	Used for switching between Adaptive Cruise Control (ACC) and Conventional Cruise Control.

**1: In models equipped with EyeSight, this turns Adaptive Cruise Control (ACC) ON.*
**2: For models equipped with EyeSight*

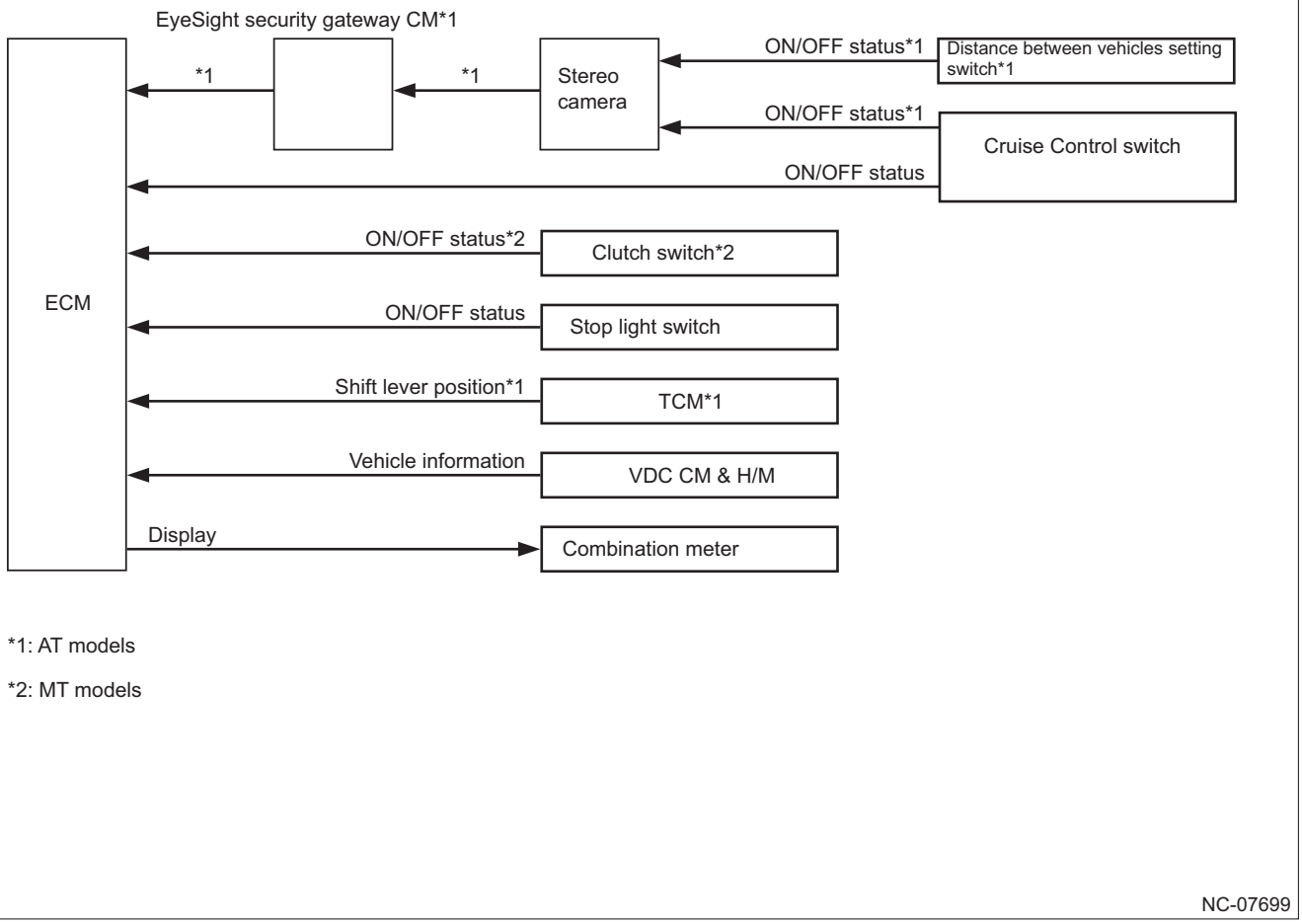
12.5.3 Construction and Operation

System diagram



System details

Block diagram



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

Main status ON (settable status)	For models equipped with EyeSight	When the ON-OFF switch of the Cruise Control 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.
	For models not equipped with EyeSight	After the ON-OFF switch of the Cruise Control switch is pressed, Conventional Cruise Control enters the settable status.
Set (control start)	While driving under the settable status, operating the Cruise Control switch to the +RES or -SET side sets Conventional Cruise Control and starts control. • The vehicle speed when the Cruise Control switch was operated becomes the set vehicle speed. • When the previous set vehicle speed is displayed and the switch is operated to the +RES side, the previous set vehicle speed becomes the set vehicle speed.	
Cancel	While driving with Cruise Control set, the set status is canceled when any of the following operations is performed: the Cruise Control switch is pulled toward the driver (CANCEL), the brake pedal is operated, or the clutch is operated (MT models). If the system judges that normal control is not possible, control is automatically canceled.	
Restart	While control is canceled (settable status) and the Cruise Control switch is operated to the -SET side, control is restarted. • The vehicle speed when the Cruise Control switch was operated becomes the set vehicle speed.	
Recovery	When driving under the settable status, operating the Cruise Control switch to the +RES side resumes constant speed driving at the speed set in the memory.	
Main status OFF	Press the ON-OFF switch of the Cruise Control switch.	

Increase set vehicle speed	Operate the Cruise Control switch once to the +RES side	For models equipped with EyeSight	The set vehicle speed increases in 1 MPH (1 km/h) increments each time the switch is operated.
		For models not equipped with EyeSight	The set vehicle speed increases in 1 MPH (1 km/h) increments each time the switch is operated.
	Continually operate the Cruise Control switch to the +RES side	For models equipped with EyeSight	The set vehicle speed increases in 5 MPH (5 km/h) increments while the switch is held in the operating position.
		For models not equipped with EyeSight	Continues to accelerate while the switch is operated, and the vehicle speed at the time when the switch is released becomes the set vehicle speed.
	Depress the accelerator pedal	Depress the accelerator pedal and increase the vehicle speed to the speed you want to set, then operate the Cruise Control switch to the -SET side. • The vehicle speed when the Cruise Control switch was operated becomes the new set vehicle speed.	

<table>
<tr><td rowspan="5">Decrease set vehicle speed</td><td rowspan="2">Operate the Cruise Control switch once to the -SET side</td><td>For models equipped with EyeSight</td><td>The set vehicle speed decreases in 1 MPH (1 km/h) increments each time the switch is operated.</td></tr>
<tr><td>For models not equipped with EyeSight</td><td>The set vehicle speed decreases in 1 MPH (1 km/h) increments each time the switch is operated.</td></tr>
<tr><td rowspan="2">Continually operate the Cruise Control switch to the -SET side</td><td>For models equipped with EyeSight</td><td>The set vehicle speed decreases in 5 MPH (5 km/h) increments while the switch is held in the operating position.</td></tr>
<tr><td>For models not equipped with EyeSight</td><td>Continues to decelerate while the switch is operated, and the vehicle speed at the time when the switch is released becomes the set vehicle speed.</td></tr>
<tr><td>Depress the brake pedal</td><td colspan="2">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, control by Conventional Cruise Control is temporarily canceled.

Operate the Cruise Control switch to the -SET side.
• The vehicle speed when the Cruise Control switch was operated becomes the set vehicle speed.</td></tr>
<tr><td>Accelerate temporarily</td><td colspan="3">When the Cruise Control is set and the accelerator pedal is depressed, the vehicle accelerates to above the set vehicle speed.
When the accelerator pedal is released, the vehicle speed returns to the set vehicle speed.</td></tr>
<tr><td>Decelerate temporarily</td><td colspan="3">When the Cruise Control is set and the brake pedal is depressed, the vehicle decelerates.
• When the brake pedal is depressed, the set vehicle speed of Conventional Cruise Control is canceled temporarily.

When the brake pedal is released and the Cruise Control switch is operated to the +RES side, the set vehicle speed before cancellation is set again and the vehicle speed returns to the set vehicle speed.</td></tr>
<tr><td>Status notification</td><td colspan="3">The driver is notified of the Conventional Cruise Control status and the set vehicle speed by the combination meter.</td></tr>
</table>

Display

**The illustration shows a typical example that may differ from the actual display.*

■ Indicator

Display	Description	Display	Description
 NC-07702	Conventional Cruise Control indicator light • Green: Control in progress • White: Control not in progress Conventional Cruise Control warning light* • Yellow: Conventional Cruise Control error	-	-

**: For models not equipped with EyeSight*

■ Alarm / warning / operating status

▮ Multi Information Display (MID) (For models equipped with EyeSight)

Display	Description
 NC-06623	Cruise Control cancel notification

13 LAN SYSTEM

CONTENTS

13.1 General Overview 13-2
13.1.1 Overview 13-2
13.2 CAN Communication System. 13-3
13.2.1 Overview 13-3
13.2.2 Component. 13-4
13.2.3 Construction and Operation. 13-7

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

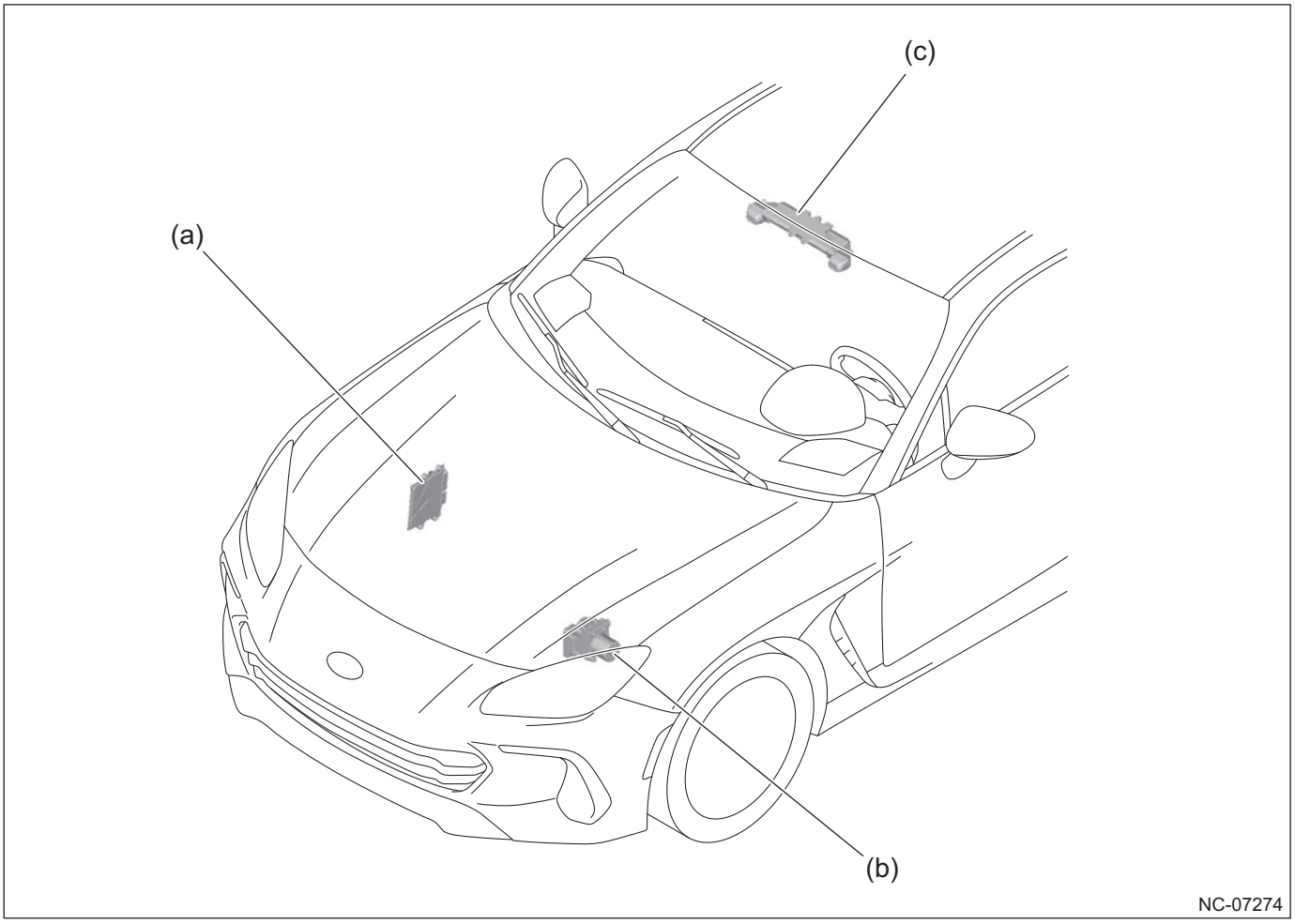
A CAN (Controller Area Network) communication system has been adopted and uses pairs of communication lines (twisted pair cables, shielded twisted pair cables) to transmit multiple sources of information and data that were converted to digital signals by the communication circuit. This makes it possible 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)

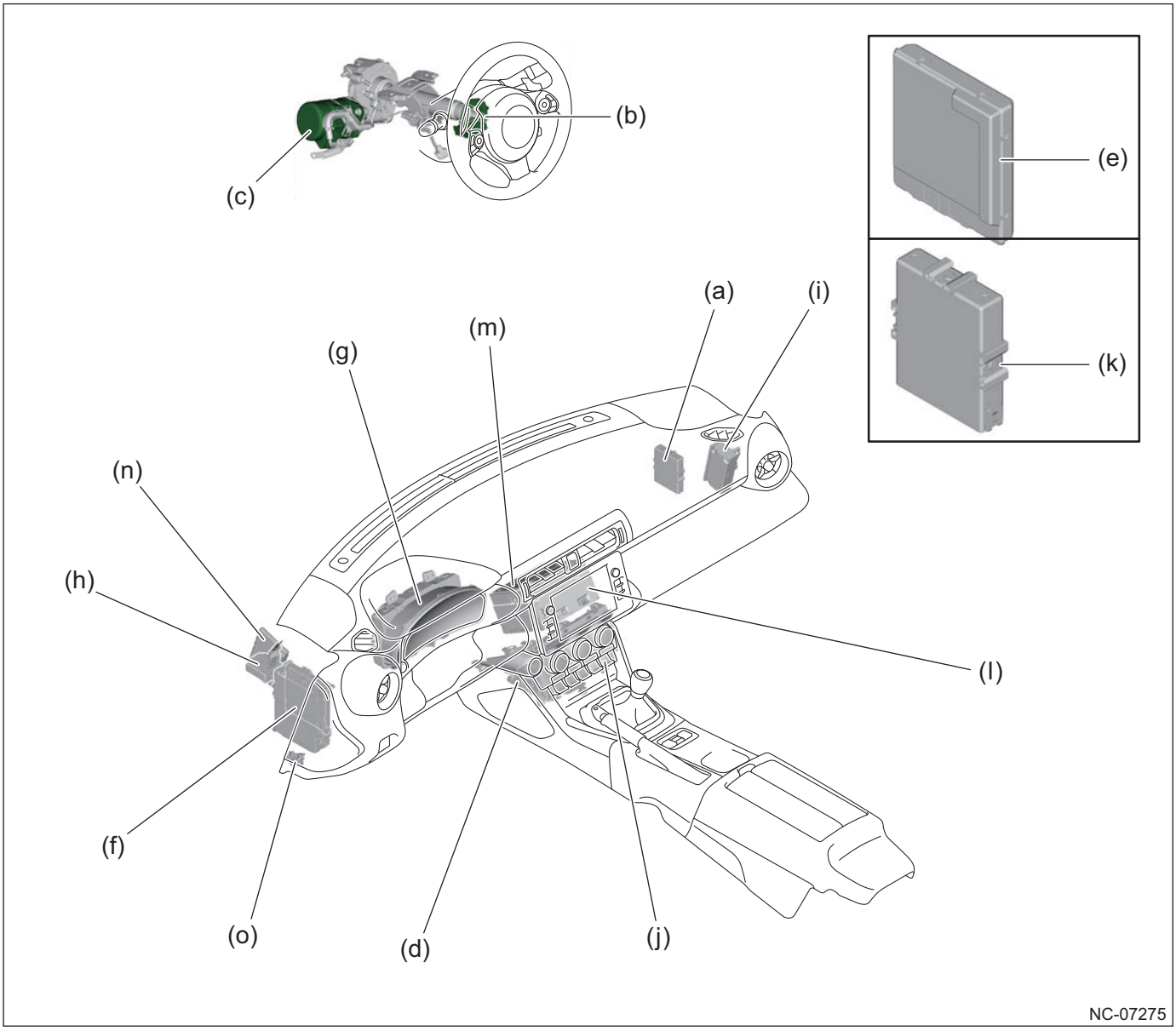
13.2.2 Component

Component layout drawing



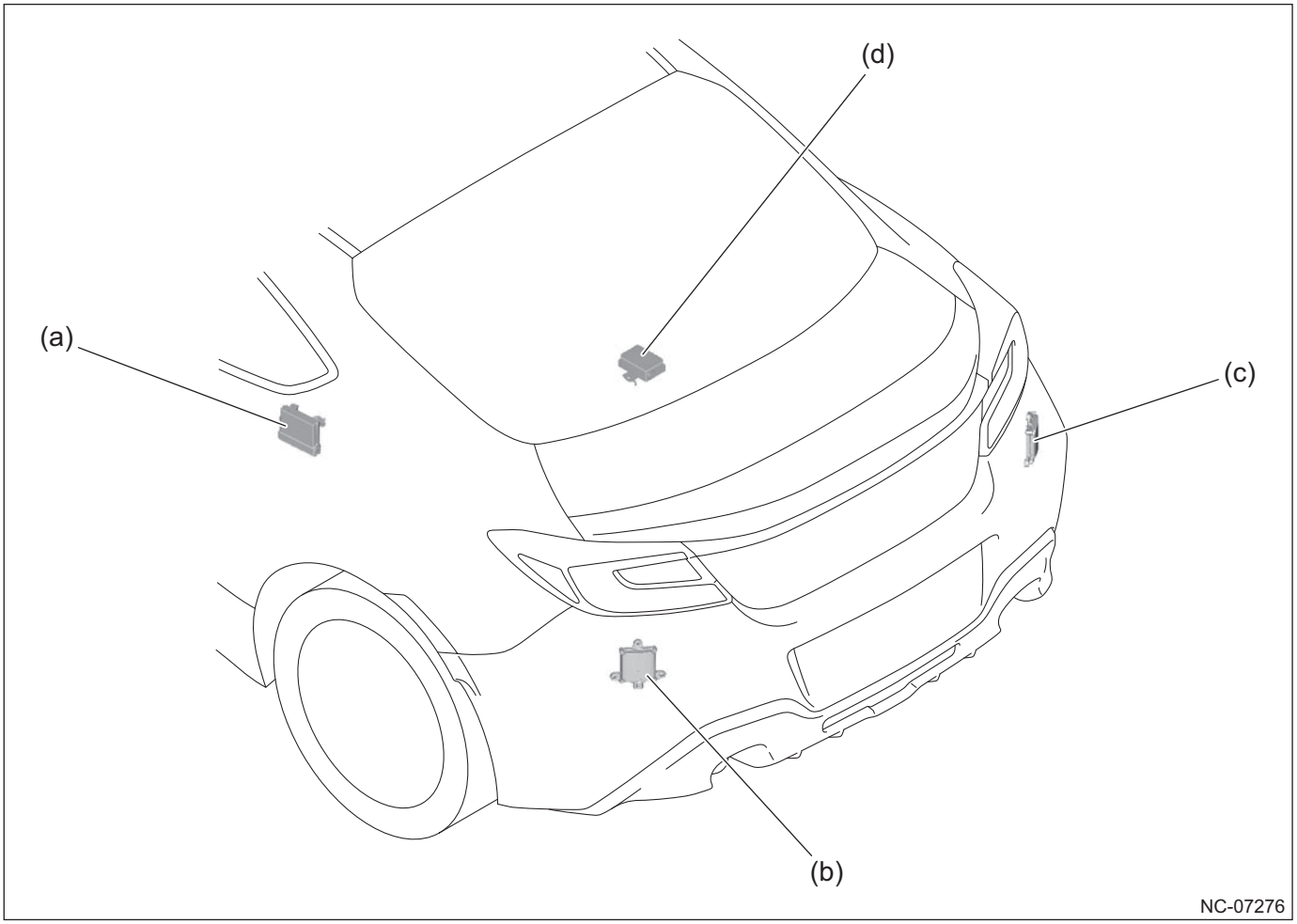
(a) Engine Control Module (ECM)
(b) VDC CM & H/M
(c) Stereo camera*1

**1: Models equipped with EyeSight*



(a) Central gateway CM (CGW)
(b) Steering angle sensor
(c) Power steering CM
(d) Airbag CM
(e) Keyless access CM
(f) Body integrated unit
(g) Combination meter
(h) Auto headlight beam leveler CM
(i) Active sound control module
(j) A/C CM (with integrated panel)
(k) EyeSight security gateway CM*1
(l) Cockpit Control Module (CCM)
(m) Data Communication Module (DCM)*2
(n) Transmission Control Module (TCM)*3
(o) Data link connector

*1: Models equipped with EyeSight
*2: Models equipped with telematics system
*3: AT



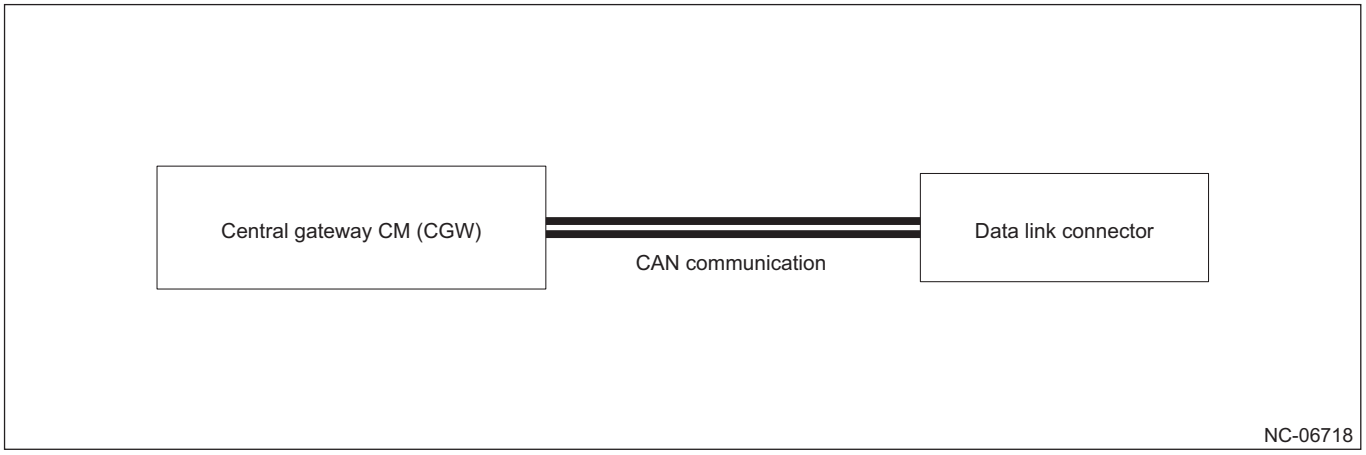
(a) Sonar CM*1
(b) Rear radar LH*2
(c) Rear radar RH*2
(d) TPMS control module*3

**1: Models equipped with Reverse Automatic Braking (RAB)*
**2: Models equipped with Blind Spot Detection/Rear Cross Traffic Alert (BSD/RCTA)*
**3: Models equipped with TPMS (Tire Pressure Monitoring System)*

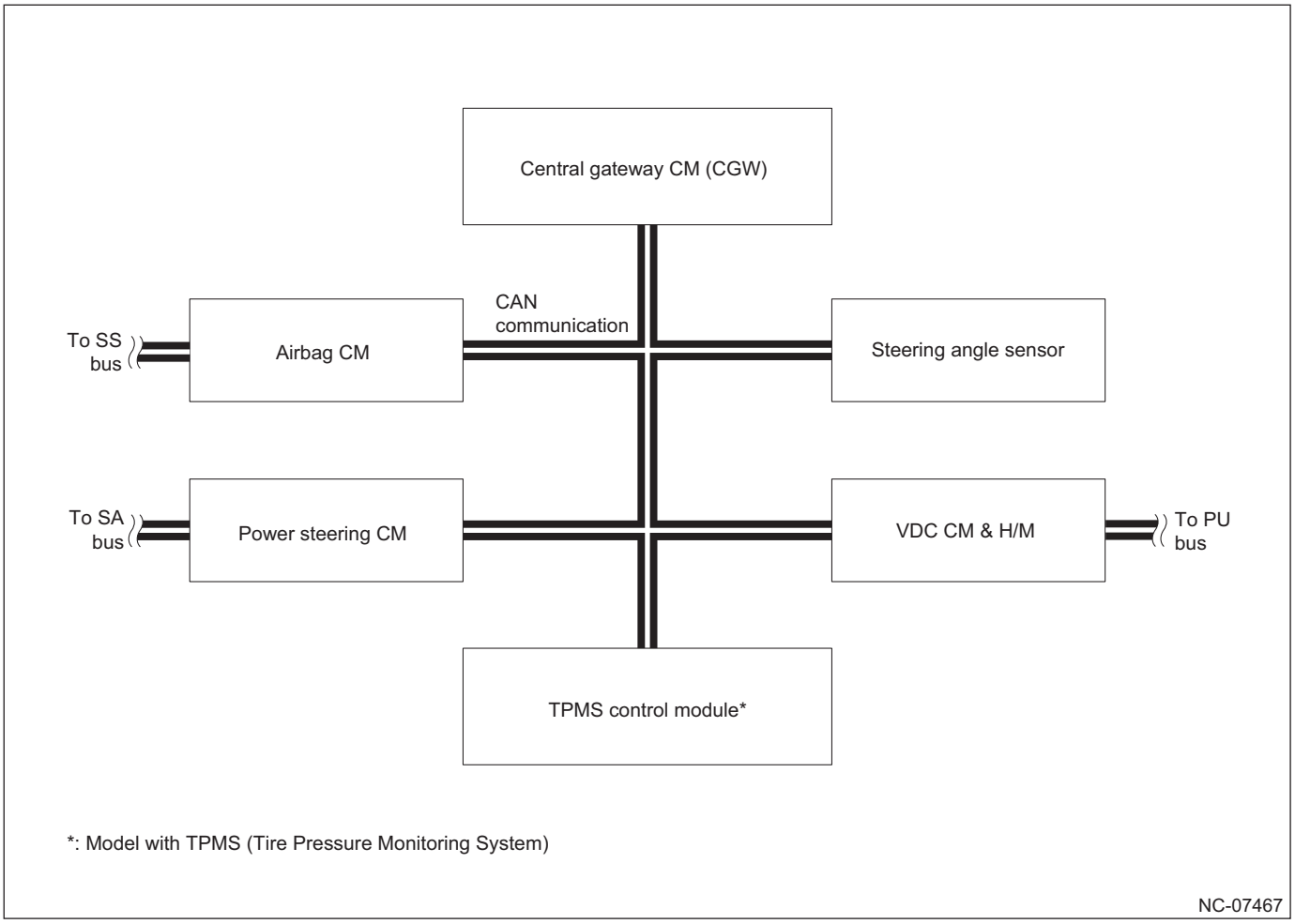
13.2.3 Construction and Operation

System diagram

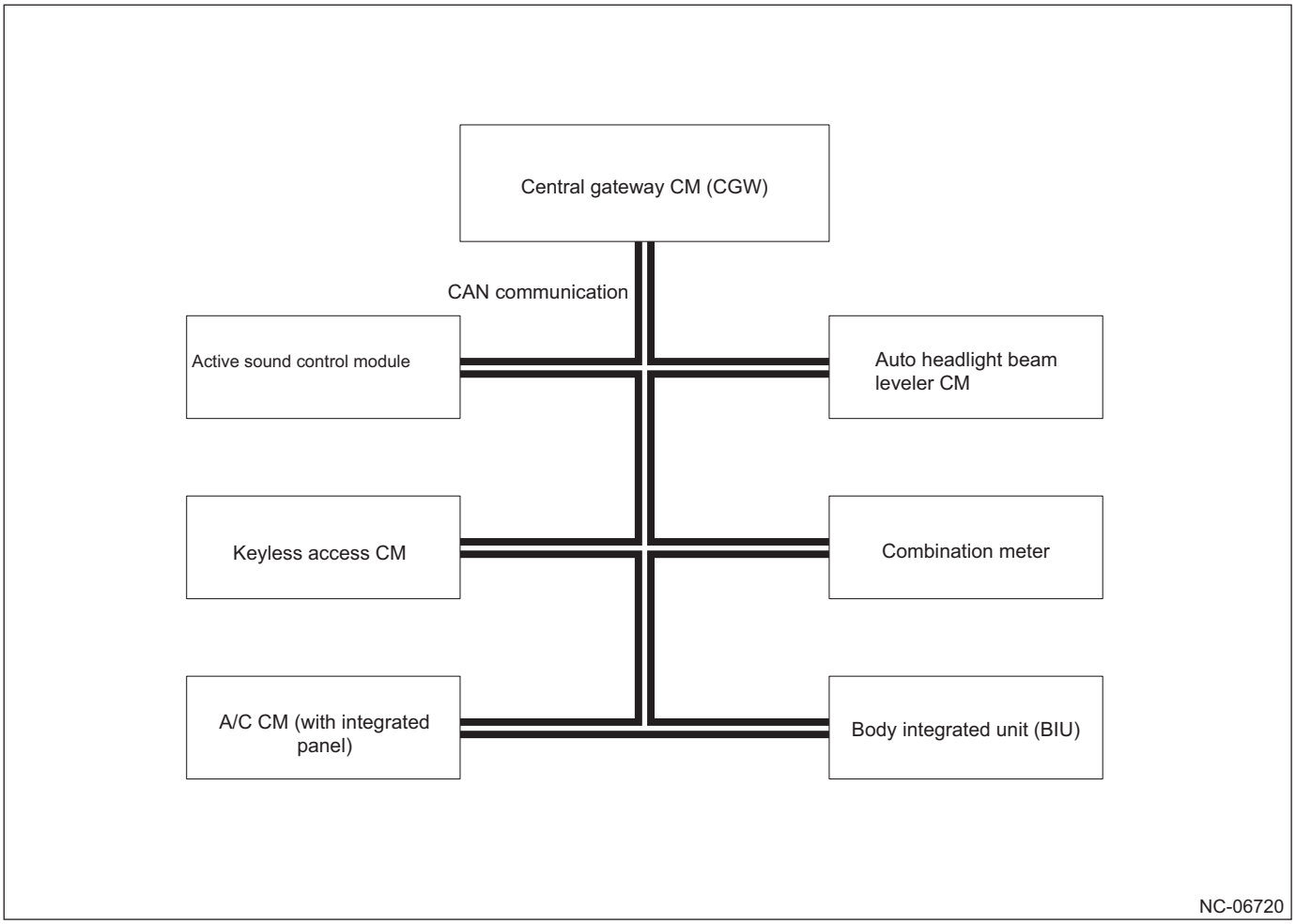
DIAG (failure diagnosis) bus



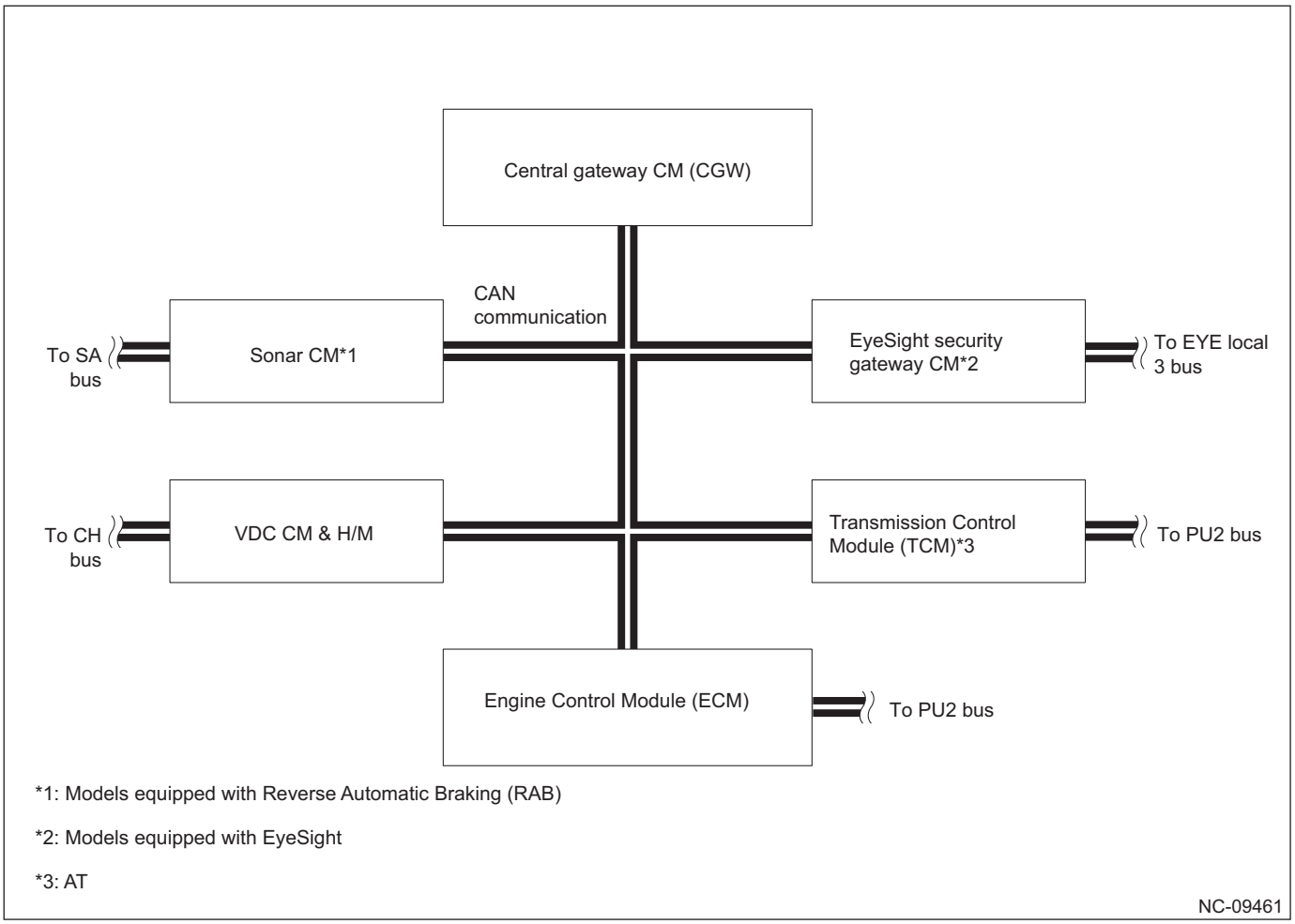
CH (chassis) bus



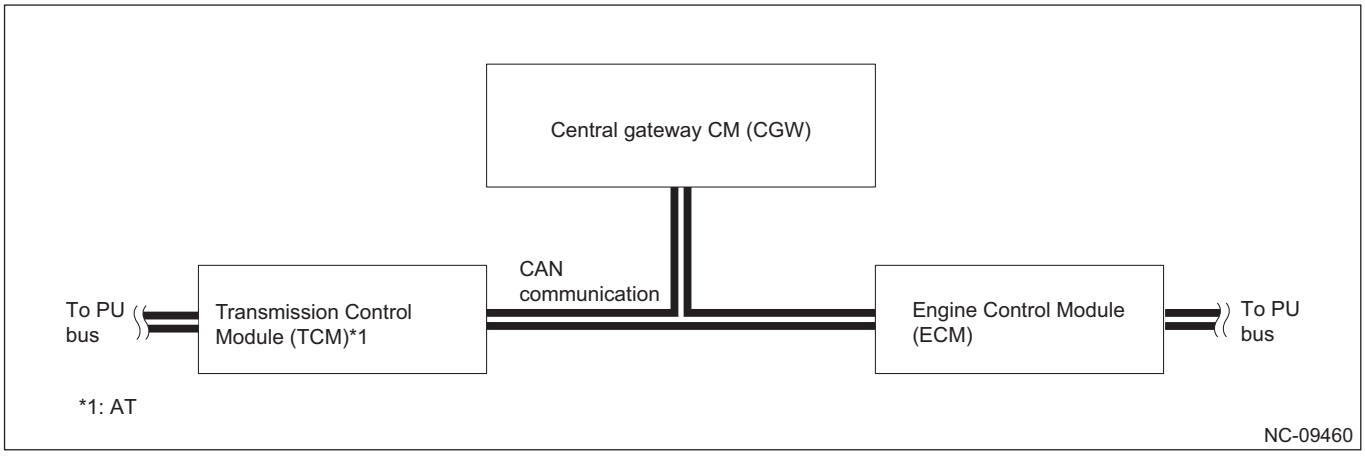
B (body) bus


Central gateway CM (CGW)
CAN communication
Active sound control module
Auto headlight beam leveler CM
Keyless access CM
Combination meter
A/C CM (with integrated panel)
Body integrated unit (BIU)
NC-06720

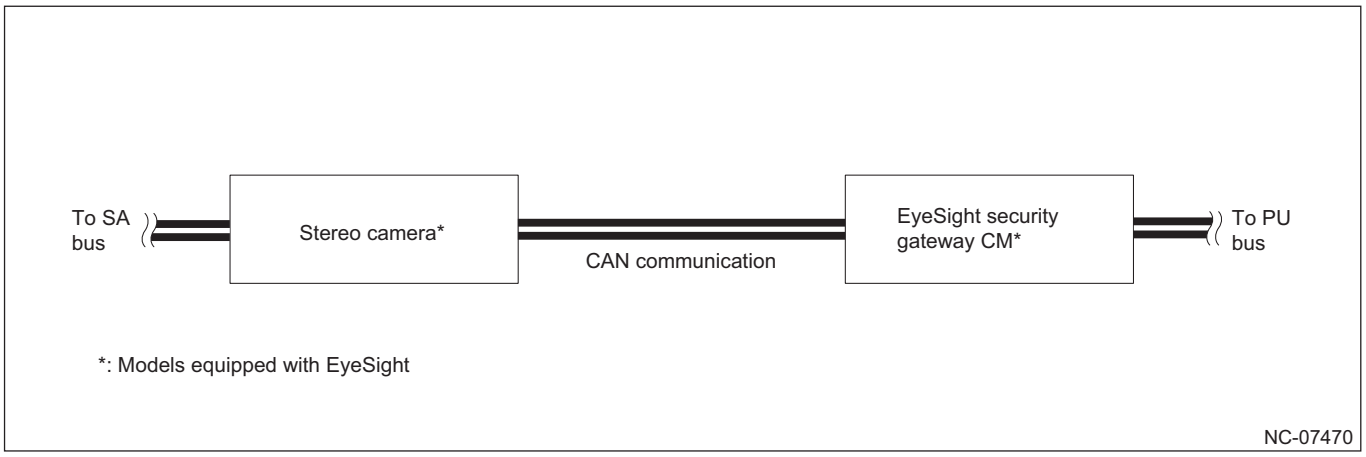
PU (power unit) bus



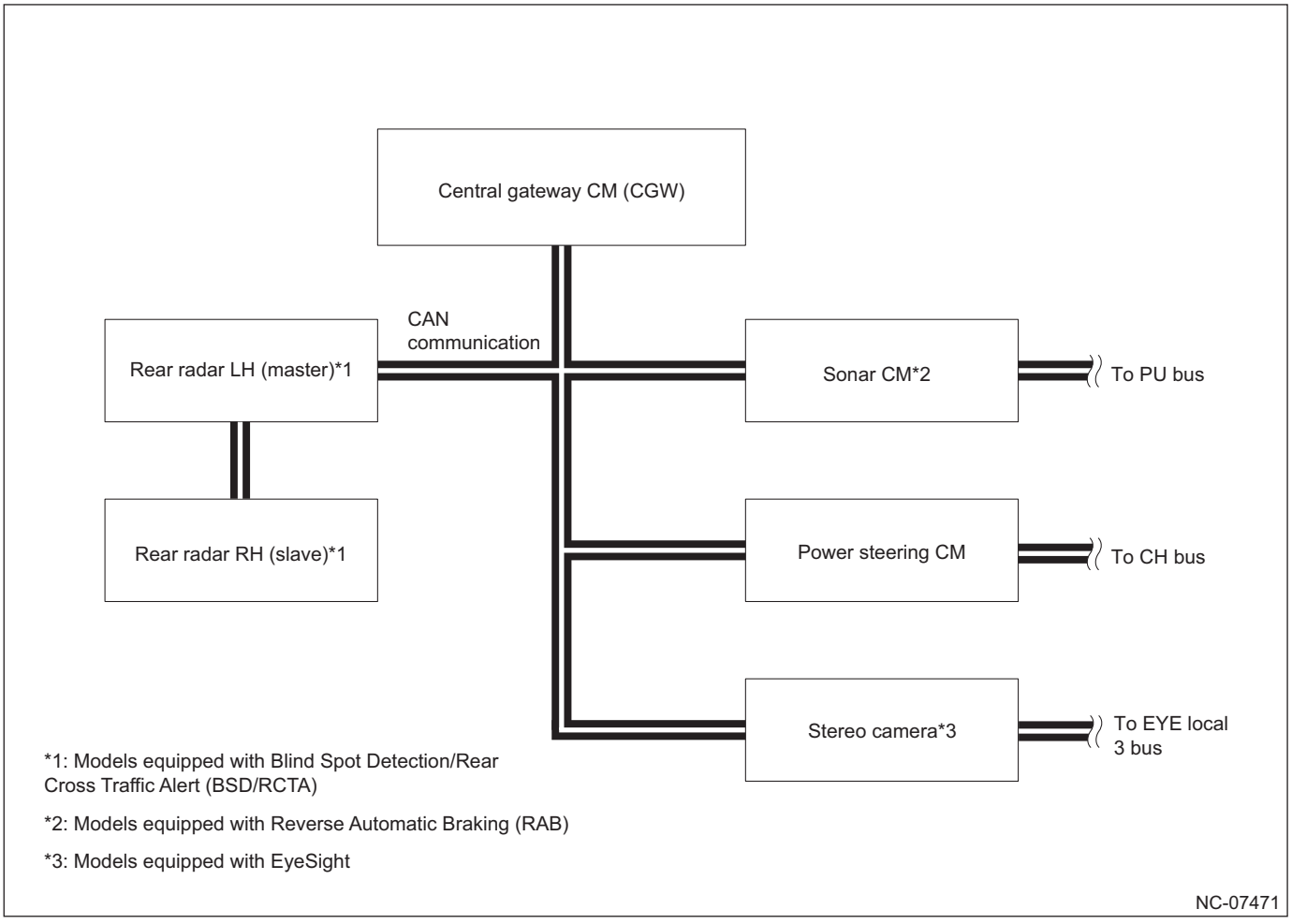
PU2 (power unit 2) bus



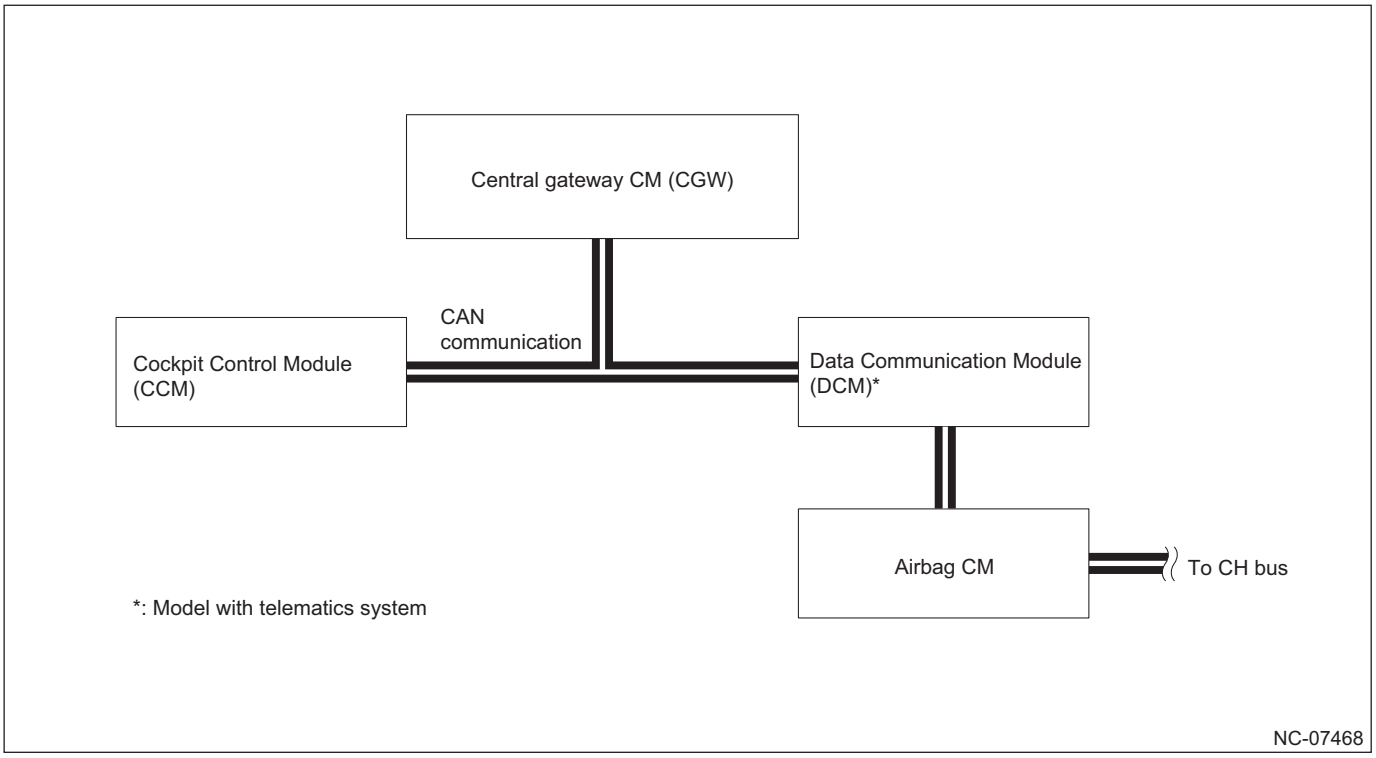
EYE local 3 bus



SA (advanced safety) bus



SS (vehicle external connection) 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.
Data link connector	Outputs the failure diagnosis information signals and other signals sent from each CM connected to the CAN communication system to the Subaru Select Monitor.
EyeSight security gateway CM*1	Controls the EyeSight security functions.
Engine Control Module (ECM)	Controls the engine control system.
Transmission Control Module (TCM)*2	Controls the transmission control system.
VDC CM & H/M	• Controls the brake system. • Controls the electronic parking brake 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	Controls the keyless access & push button start system.
Rear radar*4	• Controls BSD/RCTA. • Detects other vehicles to the rear of the vehicle.
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. • Controls the High Beam Assist (HBA) system.
A/C CM (with integrated panel)	Controls the air conditioning system.
Active sound control module	Controls active sound control.
Cockpit Control Module (CCM)	Controls the infotainment system.
Data Communication Module (DCM)*5	Controls the telematics system.
TPMS control module*6	Controls the TPMS (Tire Pressure Monitoring System).

**1: Models equipped with EyeSight*
**2: AT*
**3: Models equipped with Reverse Automatic Braking (RAB)*
**4: Models equipped with Blind Spot Detection/Rear Cross Traffic Alert (BSD/RCTA)*
**5: Models equipped with telematics system*
**6: Models equipped with TPMS (Tire Pressure Monitoring System)*

System details

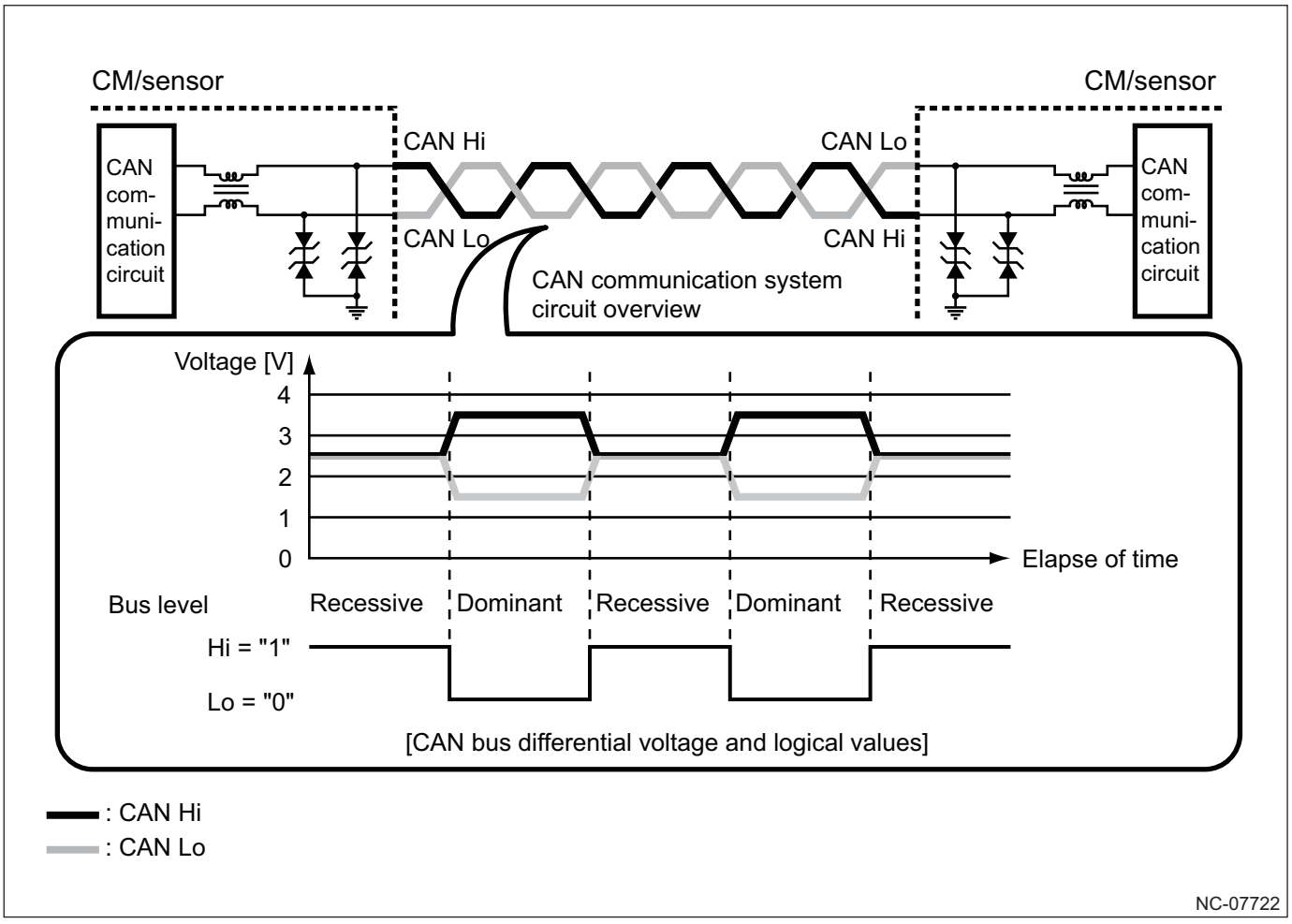
General

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, EYE local 3 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.

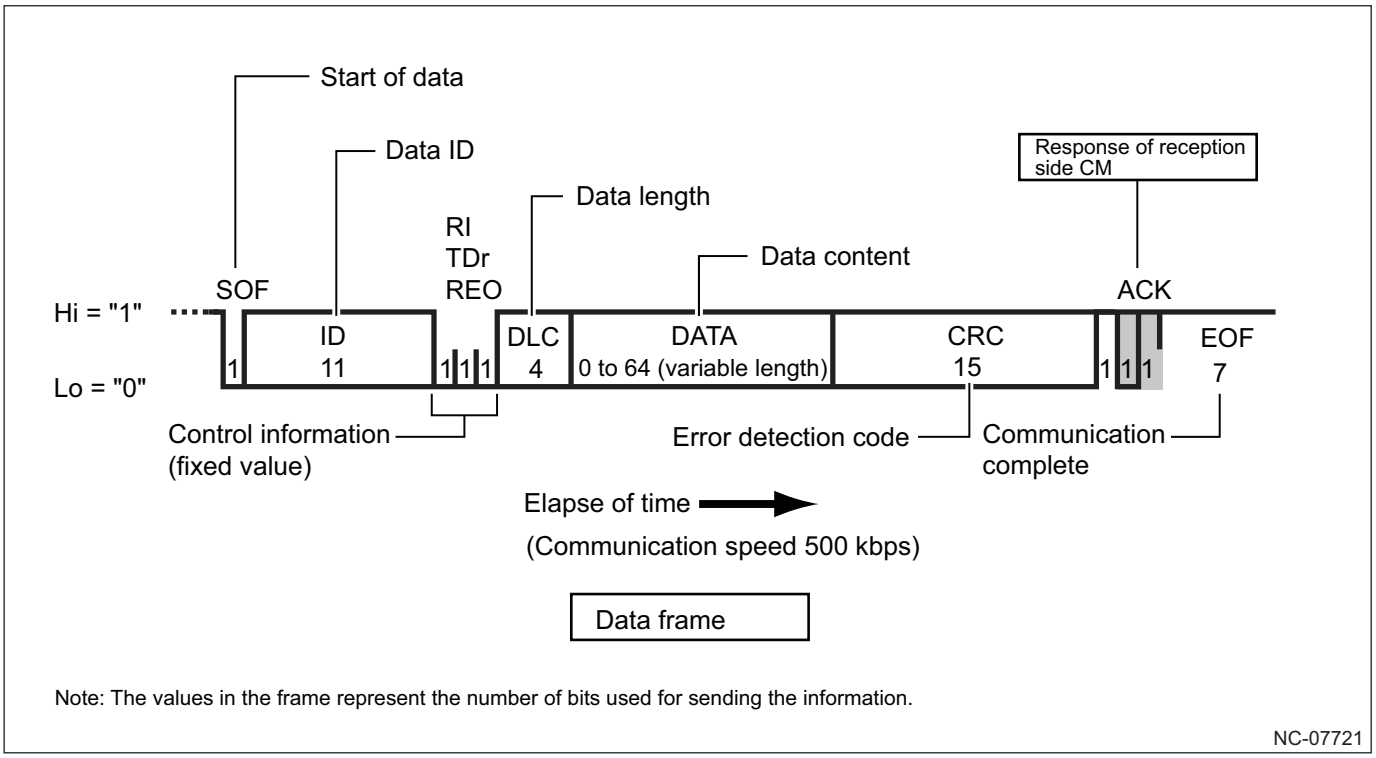
The CAN communication protocol uses a CSMA/CD (Carrier Sense Multiple Access with Collision Detection) type* that gives all control modules (CM) and sensors the authority to initiate data transmission, while restricting data transmission to the communication lines so that it is possible to share pairs 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.