

CONTENTS

BASIC INSPECTION	2	STARTING SYSTEM	18
DIAGNOSIS AND REPAIR WORKFLOW	2	Symptom Table	18
K9K MODELS	2	PRECAUTION	19
K9K MODELS : Work Flow	2	PRECAUTIONS	19
HR16DE/MR20DE MODELS	4	Supplemental Restraint System (SRS) "AIR BAG" and "SEAT BELT PRE-TENSIONER"	19
HR16DE/MR20DE MODELS : Work Flow	4	ON-VEHICLE REPAIR	20
FUNCTION DIAGNOSIS	8	STARTER MOTOR	20
STARTING SYSTEM	8	K9K MODELS	20
System Diagram	8	K9K MODELS : Exploded View	20
System Description	8	K9K MODELS : Removal and Installation	20
Component Parts Location	8	HR16DE MODELS	20
Component Description	9	HR16DE MODELS : Exploded View	20
COMPONENT DIAGNOSIS	10	HR16DE MODELS : Removal and Installation	22
B TERMINAL CIRCUIT	10	HR16DE MODELS : Disassembly and Assembly....	22
Description	10	HR16DE MODELS : Inspection	22
Diagnosis Procedure	10	MR20DE MODELS	25
S TERMINAL CIRCUIT	11	MR20DE MODELS : Exploded View	25
Description	11	MR20DE MODELS : Removal and Installation	27
Diagnosis Procedure	11	MR20DE MODELS : Disassembly and Assembly....	27
STARTING SYSTEM	12	MR20DE MODELS : Inspection	27
Wiring Diagram - STARTING SYSTEM (M/T MODELS) -	12	SERVICE DATA AND SPECIFICATIONS (SDS)	31
Wiring Diagram - STARTING SYSTEM (CVT MODELS) -	15	SERVICE DATA AND SPECIFICATIONS (SDS)	31
SYMPTOM DIAGNOSIS	18	Starter Motor	31

DIAGNOSIS AND REPAIR WORKFLOW

< BASIC INSPECTION >

BASIC INSPECTION

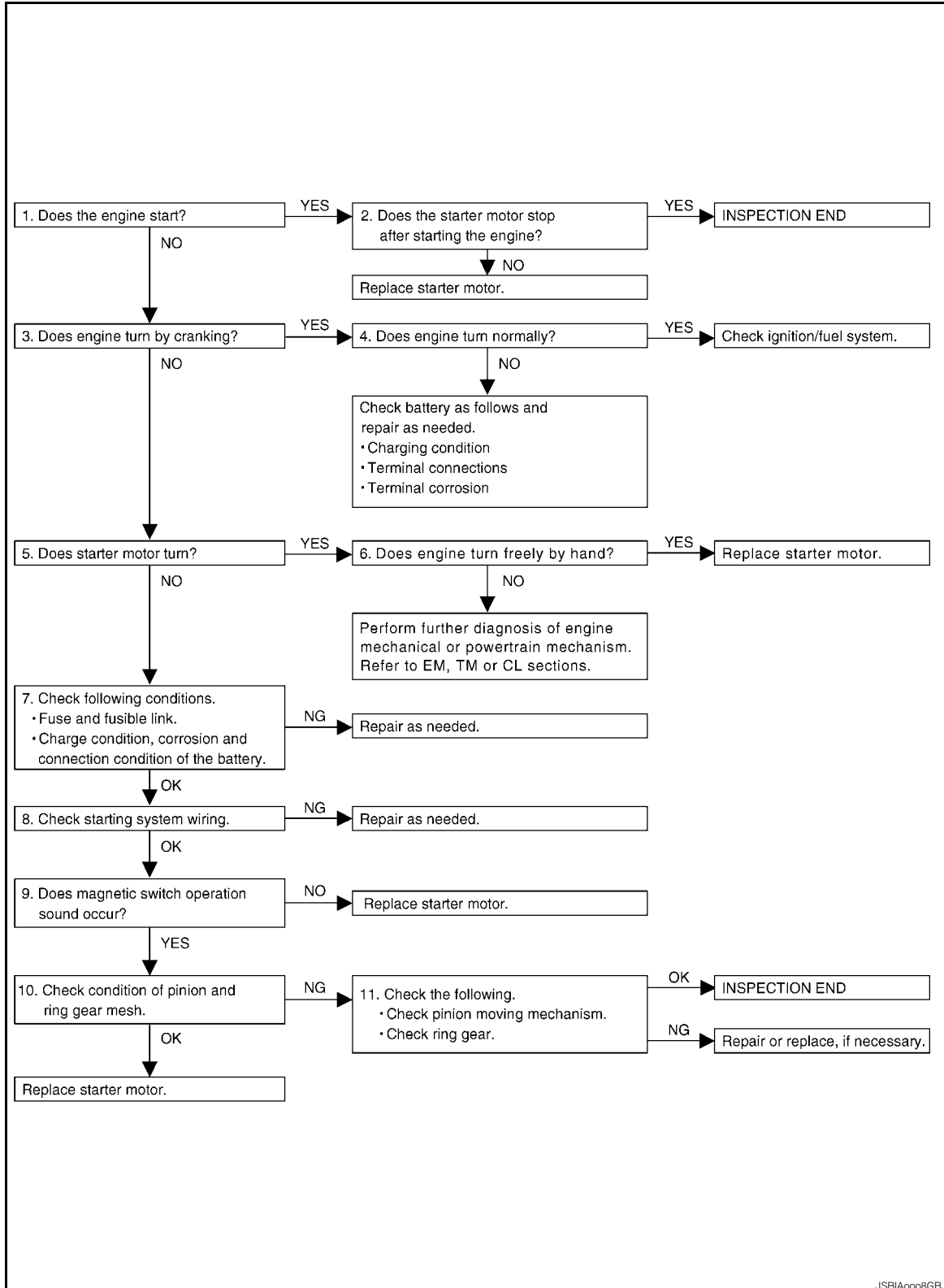
DIAGNOSIS AND REPAIR WORKFLOW

K9K MODELS

K9K MODELS : Work Flow

INFOID:000000001116764

OVERALL SEQUENCE



JSBIA0008GB

DIAGNOSIS AND REPAIR WORKFLOW

< BASIC INSPECTION >

DETAILED FLOW

NOTE:

If any malfunction is found, immediately disconnect the battery cable from the negative terminal.

1.CHECK ENGINE START

Crank the engine and check that the engine starts.

Does the engine start?

YES >> GO TO 2.

NO >> GO TO 3.

2.CHECK THAT THE STARTER MOTOR STOPS

Check that the starter motor stops after starting the engine.

Does the starter motor stop?

YES >> INSPECTION END

NO >> Replace starter motor.

3.CHECK THE ENGINE SPEED WITH CRANKING

Check that the engine runs at cranking.

Does engine turn by cranking?

YES >> GO TO 4.

NO >> GO TO 5.

4.CHECK THE ENGINE SPEED WITH CRANKING

Check that the engine speed is not low at cranking.

Does engine turn normally?

YES >> Check ignition/fuel system.

NO >> Check charge condition, corrosion and connection condition of the battery. Refer to [PG-4, "Work Flow"](#).

5.CHECK STARTER MOTOR ACTIVATION

Check that the starter motor runs at cranking.

Does starter motor turn?

YES >> GO TO 6.

NO >> GO TO 7.

6.ENGINE ROTATION STATUS

Check that the engine can be rotated by hand.

Does engine turn freely by hand?

YES >> Replace starter motor.

NO >> Perform further diagnosis of engine mechanical or powertrain mechanism. Refer to EM, TM or CL sections.

7.CHECK POWER SUPPLY CIRCUIT

Check the following conditions.

- Fuse and fusible link
- Charge condition, corrosion and connection condition of the battery. Refer to [PG-4, "Work Flow"](#).

Are these inspection results normal?

YES >> GO TO 8.

NO >> Repair as needed.

8.CHECK STARTING SYSTEM WIRING

Check the following.

- "B" terminal circuit. Refer to [STR-10, "Diagnosis Procedure"](#)
- "S" terminal circuit. Refer to [STR-11, "Diagnosis Procedure"](#)

Are these inspection results normal?

YES >> GO TO 9.

NO >> Repair as needed.

DIAGNOSIS AND REPAIR WORKFLOW

< BASIC INSPECTION >

9. CHECK MAGNETIC SWITCH OPERATION SOUND

Check that a magnetic switch operation sound can be heard when the ignition switch is set at the starting position.

Does magnetic switch operation sound occur?

YES >> GO TO 10.

NO >> Replace starter motor.

10. PINION AND RING GEAR ENGAGEMENT CHECK

Check condition of pinion and ring gear mesh.

Is the inspection result normal?

YES >> Replace starter motor.

NO >> GO TO 11.

11. CHECK STARTER MOTOR UNIT

Check the following.

- Check pinion moving mechanism.
- Check ring gear.

Are these inspection results normal?

YES >> INSPECTION END

NO >> Repair or replace, if necessary.

HR16DE/MR20DE MODELS

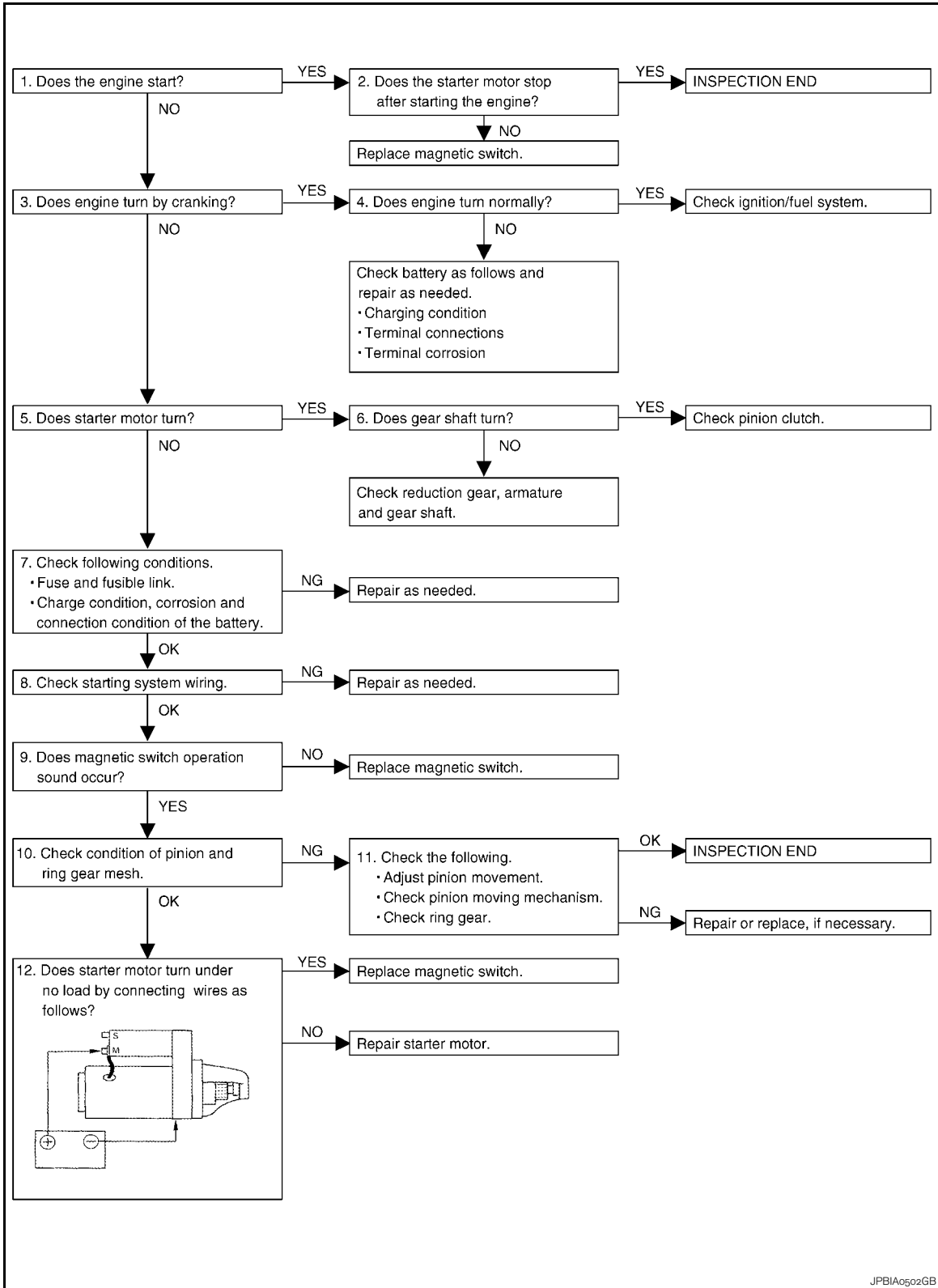
HR16DE/MR20DE MODELS : Work Flow

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DIAGNOSIS AND REPAIR WORKFLOW

< BASIC INSPECTION >

OVERALL SEQUENCE



DETAILED FLOW

NOTE:

If any malfunction is found, immediately disconnect the battery cable from the negative terminal.

1.CHECK ENGINE START

Crank the engine and check that the engine starts.

Does the engine start?

DIAGNOSIS AND REPAIR WORKFLOW

< BASIC INSPECTION >

YES >> GO TO 2.
NO >> GO TO 3.

2.CHECK THAT THE STARTER MOTOR STOPS

Check that the starter motor stops after starting the engine.

Does the starter motor stop?

YES >> INSPECTION END
NO >> Replace magnetic switch.

3.CHECK THE ENGINE SPEED WITH CRANKING

Check that the engine runs at cranking.

Does engine turn by cranking?

YES >> GO TO 4.
NO >> GO TO 5.

4.CHECK THE ENGINE SPEED WITH CRANKING

Check that the engine speed is not low at cranking.

Does engine turn normally?

YES >> Check ignition/fuel system.
NO >> Check charge condition, corrosion and connection condition of the battery. Refer to [PG-4, "Work Flow"](#).

5.CHECK STARTER MOTOR ACTIVATION

Check that the starter motor runs at cranking.

Does starter motor turn?

YES >> GO TO 6.
NO >> GO TO 7.

6.CHECK STARTER MOTOR UNIT

1. Remove starter motor.
2. Check that the gear shaft of starter motor rotates.

Does gear shaft turn?

YES >> • Check pinion clutch. Refer to the following.
- HR16DE models: [STR-22, "HR16DE MODELS : Inspection"](#).
- MR20DE models: [STR-27, "MR20DE MODELS : Inspection"](#).
NO >> Check reduction gear, armature and gear shaft.

7.CHECK POWER SUPPLY CIRCUIT

Check the following conditions.

- Fuse and fusible link
- Charge condition, corrosion and connection condition of the battery. Refer to [PG-4, "Work Flow"](#).

Are these inspection results normal?

YES >> GO TO 8.
NO >> Repair as needed.

8.CHECK STARTING SYSTEM WIRING

Check the following.

- "B" terminal circuit. Refer to [STR-10, "Diagnosis Procedure"](#)
- "S" terminal circuit. Refer to [STR-11, "Diagnosis Procedure"](#)

Are these inspection results normal?

YES >> GO TO 9.
NO >> Repair as needed.

9.CHECK MAGNETIC SWITCH OPERATION SOUND

Check that a magnetic switch operation sound can be heard when the ignition switch is set at the starting position.

Does magnetic switch operation sound occur?

DIAGNOSIS AND REPAIR WORKFLOW

< BASIC INSPECTION >

- YES >> GO TO 10.
NO >> Replace magnetic switch.

10. PINION AND RING GEAR ENGAGEMENT CHECK

Check condition of pinion and ring gear mesh.

Is the inspection result normal?

- YES >> GO TO 12.
NO >> GO TO 11.

11. CHECK STARTER MOTOR UNIT

Check the following.

- Adjust pinion movement. Refer to the following.
- HR16DE models: [STR-22. "HR16DE MODELS : Inspection"](#)
- MR20DE engine models: [STR-27. "MR20DE MODELS : Inspection"](#)
- Check pinion moving mechanism.
- Check ring gear.

Are these inspection results normal?

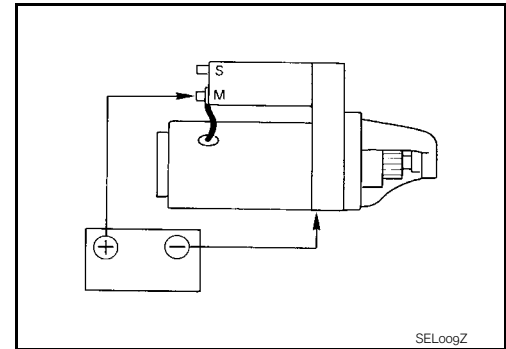
- YES >> INSPECTION END
NO >> Repair or replace, if necessary.

12. CHECK STARTER MOTOR UNIT

Check that the starter motor runs when connecting the positive terminal (12 V) to starter motor terminal M and the negative terminal (ground) to starter motor body.

Does the starter motor run?

- YES >> Replace magnetic switch.
NO >> Repair starter motor.



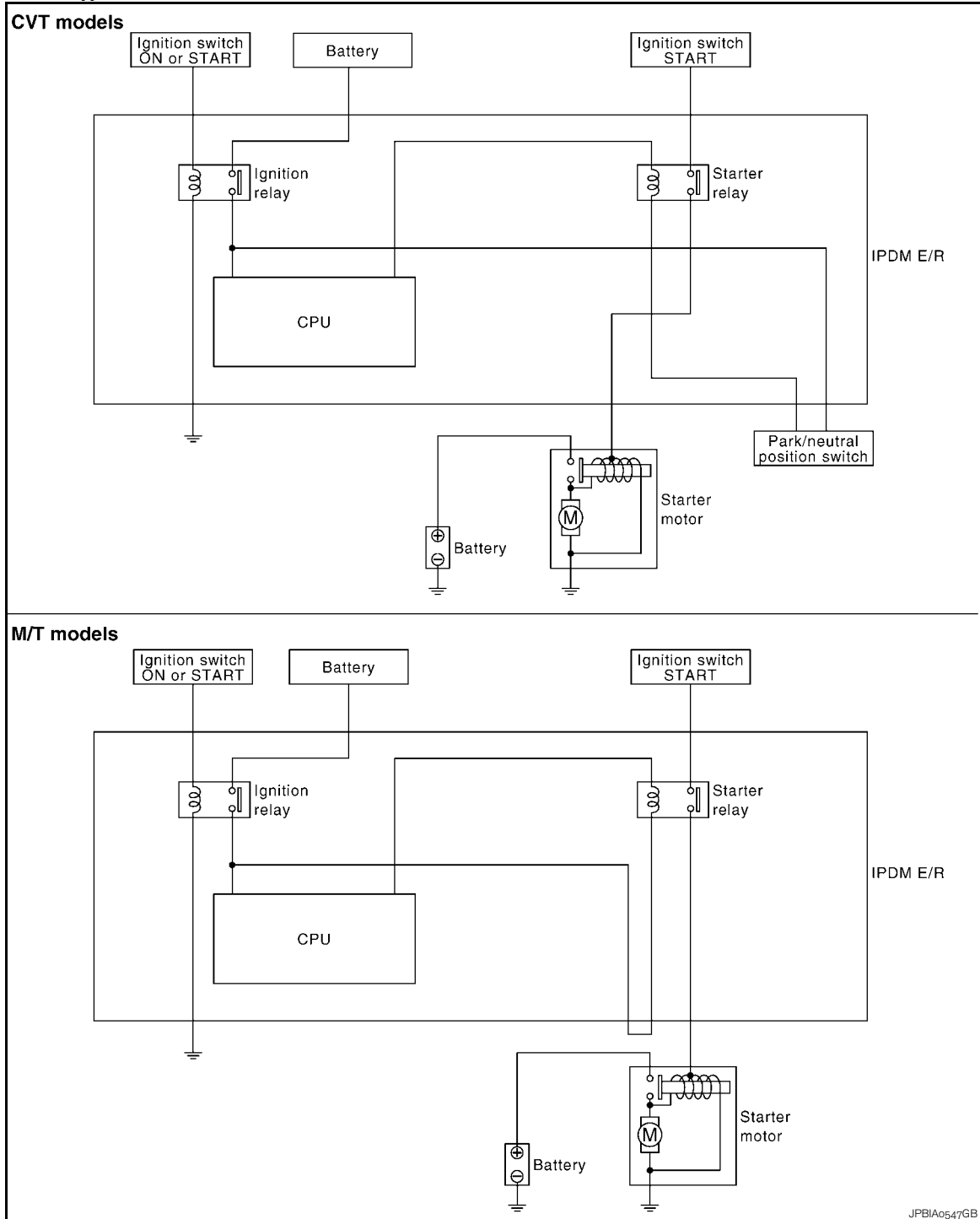
STARTING SYSTEM

< FUNCTION DIAGNOSIS >

FUNCTION DIAGNOSIS

STARTING SYSTEM

System Diagram



System Description

INFOID:000000000955265

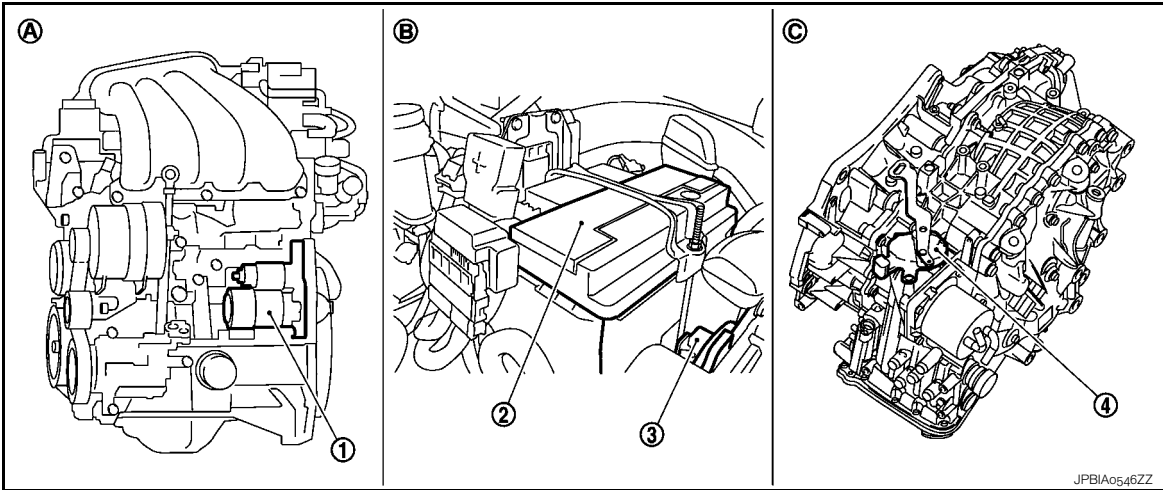
The starter motor plunger closes and provides a closed circuit between the battery and starter motor. The starter motor is grounded to the engine block. With power and ground supplied, cranking occurs and the engine starts.

Component Parts Location

INFOID:000000000955266

STARTING SYSTEM

< FUNCTION DIAGNOSIS >



1. Starter motor

4. Park/neutral position switch
(CVT models only)

A. Engine
2. Battery

3. IPDM E/R

B. Engine room (left side)
3. IPDM E/R

4. Park/neutral position switch
(CVT models only)

C. CVT assembly

Component Description

INFOID:0000000000955267

Component part	Description
Park/neutral position switch (CVT models only)	Park/neutral position switch supplies power to the starter relay inside IPDM E/R when the selector lever is shifted to the P or N position.
IPDM E/R	CPU inside IPDM E/R controls the starter relay. Ignition relay inside IPDM E/R supplies power to the Park/neutral position switch when ignition switch is ON or START.
Starter motor	The starter motor plunger closes and the motor is supplied with battery power, which in turn cranks the engine, when the "S" terminal is supplied with electric power.

B TERMINAL CIRCUIT

< COMPONENT DIAGNOSIS >

COMPONENT DIAGNOSIS

B TERMINAL CIRCUIT

Description

INFOID:000000000955268

The "B" terminal is constantly supplied with battery power.

Diagnosis Procedure

INFOID:000000000955269

CAUTION:

Perform diagnosis under the condition that engine cannot start by the following procedure.

1. Remove fuel pump fuse.
2. Crank or start the engine (where possible) until the fuel pressure is released.

1.CHECK "B" TERMINAL CIRCUIT

1. Turn ignition switch OFF.
2. Check that starter motor "B" terminal connection is clean and tight.
3. Check voltage between starter motor "B" terminal and ground.

Terminals		Voltage (Approx.)
(+)	(-)	
Starter motor "B" terminal	Terminal	Battery voltage
F49 (K9K) F52 (HR16DE) F10 (MR20DE)	2	

Is the inspection result normal?

YES >> GO TO 2.

NO >> Check harness between battery and starter motor for open circuit.

2.CHECK BATTERY CABLE CONNECTION STATUS (VOLTAGE DROP TEST)

1. Shift CVT selector lever to "P" or "N" position. (CVT models)
2. Check voltage between battery positive terminal and starter motor "B" terminal.

Terminals		Condition	Voltage (Approx.)
(+)	(-)		
	Starter motor "B" terminal		
	Terminal		
Battery positive terminal	F49 (K9K) F52 (HR16DE) F10 (MR20DE)	2	When the ignition switch is in START position
			Less than 0.5 V

Is the inspection result normal?

YES >> GO TO 3.

NO >> Check harness between the battery and the starter motor for poor continuity.

3.CHECK GROUND CIRCUIT STATUS (VOLTAGE DROP TEST)

1. Shift CVT selector lever to "P" or "N" position. (CVT models)
2. Check voltage between starter motor case and battery negative terminal.

Terminals		Condition	Voltage (Approx.)
(+)	(-)		
Starter motor case	Battery negative terminal	When the ignition switch is in START position	Less than 0.2 V

Is the inspection result normal?

YES >> "B" terminal circuit is OK. Further inspection is necessary. Refer to [STR-4, "HR16DE/MR20DE MODELS : Work Flow"](#).

NO >> Check the starter motor case and ground for poor continuity.

S TERMINAL CIRCUIT

< COMPONENT DIAGNOSIS >

S TERMINAL CIRCUIT

Description

INFOID:000000000955270

The starter motor magnetic switch is supplied with power when the ignition switch is turned to START with the selector lever P or N for CVT models.

STR

Diagnosis Procedure

INFOID:000000000955271

CAUTION:

Perform diagnosis under the condition that engine cannot start by the following procedure.

1. Remove fuel pump fuse.
2. Crank or start the engine (where possible) until the fuel pressure is released.

1.CHECK "S" CONNECTOR CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect "S" terminal.
3. Shift CVT selector lever to "P" or "N" position. (CVT models)
4. Check voltage between starter motor harness connector and ground.

Terminals		Condition	Voltage (Approx.)
(+)	(-)		
Starter motor harness connector	Terminal		
F50 (K9K) F53 (HR16DE) F11 (MR20DE)	1	Ground	When the ignition switch is in START position Battery voltage

Is the inspection result normal?

YES >> "S" terminal circuit is OK. Further inspection is necessary. Refer to [STR-2, "K9K MODELS : Work Flow"](#) (K9K models) or [STR-4, "HR16DE/MR20DE MODELS : Work Flow"](#) (HR16DE/MR20DE models).

NO >> GO TO 2.

2.CHECK CONNECTOR

1. Turn ignition switch OFF.
2. Check the following terminals and connectors for damage, bend and loose connection.
 - Harness connector E8 (M/T models)
 - Harness connector F122 (M/T models)
 - Harness connector E6 (CVT models)
 - Harness connector F123 (CVT models)

Is the inspection result normal?

YES >> GO TO 3.

NO >> Repair the terminal and connector.

3.CHECK HARNESS CONTINUITY (OPEN CIRCUIT)

1. Disconnect IPDM E/R connector.
2. Check continuity between starter motor "S" terminal and IPDM E/R harness connector.

Starter motor "S" terminal		IPDM E/R harness connector		Continuity
Connector No.	Terminal No.	Connector No.	Terminal No.	
F50 (K9K) F53 (HR16DE) F11 (MR20DE)	1	E14	50	Existed

Is the inspection result normal?

YES >> Inspect IPDM E/R and power supply circuit. Refer to [SEC-5, "Work Flow"](#).

NO >> Repair the harness.

STARTING SYSTEM

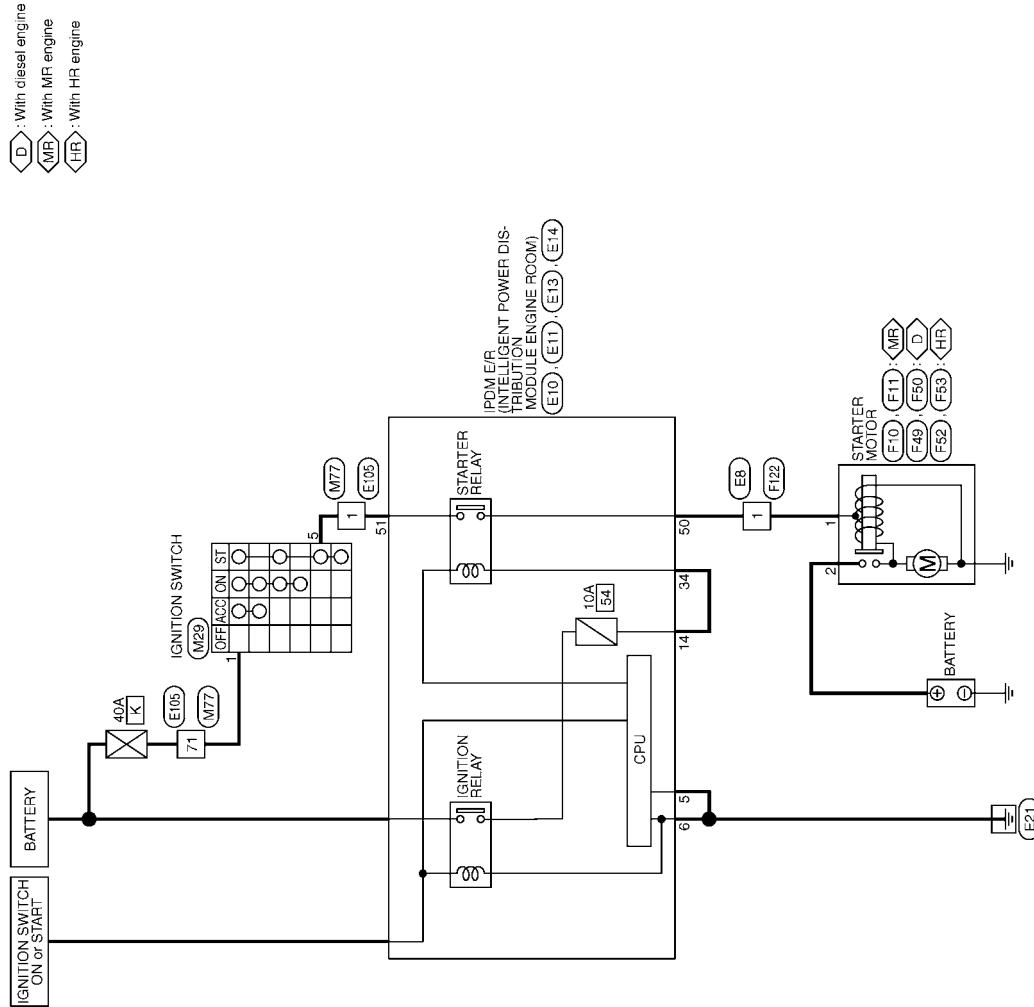
< COMPONENT DIAGNOSIS >

STARTING SYSTEM

Wiring Diagram - STARTING SYSTEM (M/T MODELS) -

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STARTING SYSTEM (WITH M/T)



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STARTING SYSTEM

< COMPONENT DIAGNOSIS >

STARTING SYSTEM (WITH M/T)

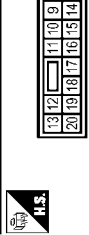
Connector No.	E8
Connector Name	WIRE TO WIRE
Connector Type	MC2MW-LC



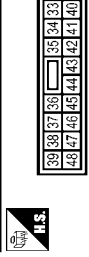
Connector No.	E10
Connector Name	IPDM E/R INTELLIGENT POWER DISTRIBUTION MODULE ENGINE ROOM)
Connector Type	M08FB-LC



Connector No.	E11
Connector Name	IPDM E/R INTELLIGENT POWER DISTRIBUTION MODULE ENGINE ROOM)
Connector Type	NS12FBR-CS



Connector No.	E13
Connector Name	IPDM E/R INTELLIGENT POWER DISTRIBUTION MODULE ENGINE ROOM)
Connector Type	NS18FW-CS



Terminal No.	1
Color of Wire	B/R
Signal Name [Specification]	-

Terminal No.	5
Color of Wire	B
Signal Name [Specification]	-
Terminal No.	6
Color of Wire	B
Signal Name [Specification]	-

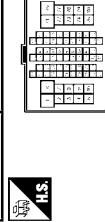
Terminal No.	14
Color of Wire	R/B
Signal Name [Specification]	-

Terminal No.	34
Color of Wire	R/B
Signal Name [Specification]	-

Connector No.	E14
Connector Name	IPDM E/R INTELLIGENT POWER DISTRIBUTION MODULE ENGINE ROOM)
Connector Type	YZK 7283-5591-40-F



Connector No.	E105
Connector Name	WIRE TO WIRE
Connector Type	TH80MW-NS16-TM4



Connector No.	F10
Connector Name	STARTER MOTOR
Connector Type	-



Connector No.	F11
Connector Name	STARTER MOTOR
Connector Type	-



Terminal No.	51
Color of Wire	P
Signal Name [Specification]	-
Terminal No.	50
Color of Wire	B/R
Signal Name [Specification]	-

Terminal No.	1
Color of Wire	P
Signal Name [Specification]	-
Terminal No.	71
Color of Wire	L
Signal Name [Specification]	-

Terminal No.	2
Color of Wire	B/Y
Signal Name [Specification]	-

Terminal No.	1
Color of Wire	B/R
Signal Name [Specification]	-

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STARTING SYSTEM

< COMPONENT DIAGNOSIS >

STARTING SYSTEM (WITH M/T)

Connector No.	F49
Connector Name	STARTER MOTOR
Connector Type	-



Terminal No.	2
Color of Wire	B/Y
Signal Name [Specification]	-

Connector No.	F50
Connector Name	STARTER MOTOR
Connector Type	-



Terminal No.	1
Color of Wire	B/R
Signal Name [Specification]	-

Connector No.	F52
Connector Name	STARTER MOTOR
Connector Type	-



Terminal No.	2
Color of Wire	B/Y
Signal Name [Specification]	-

Connector No.	F53
Connector Name	STARTER MOTOR
Connector Type	-



Terminal No.	1
Color of Wire	B/R
Signal Name [Specification]	-

Connector No.	F122
Connector Name	WIRE TO WIRE
Connector Type	M02FW-LC



Terminal No.	1
Color of Wire	B/R
Signal Name [Specification]	-

Connector No.	M29
Connector Name	IGNITION SWITCH
Connector Type	M08FW-LC



Terminal No.	5
Color of Wire	R
Signal Name [Specification]	-

Connector No.	M77
Connector Name	WIRE TO WIRE
Connector Type	TH00FW-NS13-TM4



Terminal No.	1
Color of Wire	R
Signal Name [Specification]	-

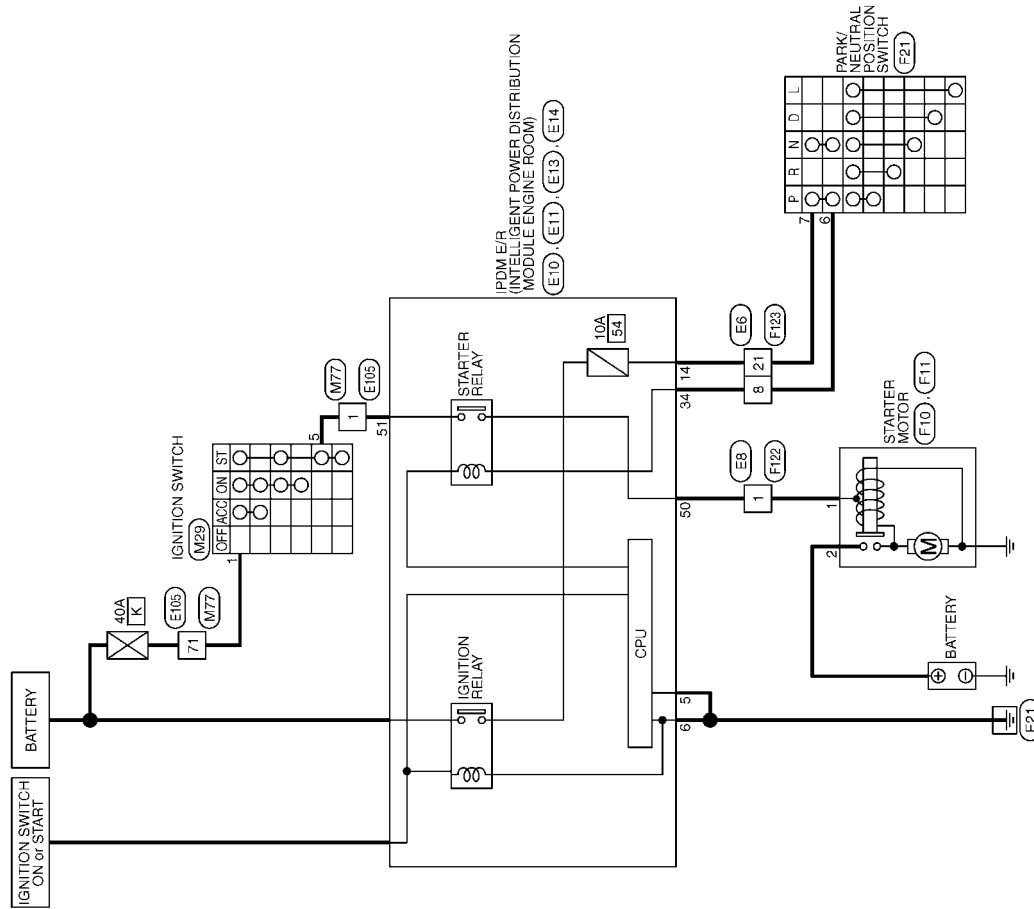
STARTING SYSTEM

< COMPONENT DIAGNOSIS >

Wiring Diagram - STARTING SYSTEM (CVT MODELS) -

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STARTING SYSTEM (WITH CVT)



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STARTING SYSTEM

< COMPONENT DIAGNOSIS >

STARTING SYSTEM (WITH CVT)

Connector No.	E6
Connector Name	WIRE TO WIRE
Connector Type	TK24MW-1V



1	2	3	4	5	6	7	8	9	10	11		
12	13	14	15	16	17	18	19	20	21	22	23	24

Terminal No.	8
Color of Wire	W/B
Terminal No.	21
Color of Wire	R/B
Signal Name [Specification]	—

Connector No.	E3
Connector Name	WIRE TO WIRE
Connector Type	MD2MW-LC



1

Terminal No.	1
Color of Wire	B/R
Signal Name [Specification]	—

Connector No.	E10
Connector Name	IPDM E/R (INTELLIGENT POWER DISTRIBUTION MODULE ENGINE ROOM)
Connector Type	MD2FB-LC



5	4	3
8	7	6

Terminal No.	5
Color of Wire	B
Terminal No.	6
Color of Wire	B
Signal Name [Specification]	—

Connector No.	E11
Connector Name	IPDM E/R (INTELLIGENT POWER DISTRIBUTION MODULE ENGINE ROOM)
Connector Type	NS12FB-CS



13	12		11	10	9	
20	19	18	17	16	15	14

Terminal No.	14
Color of Wire	R/B
Signal Name [Specification]	—

Connector No.	E13
Connector Name	IPDM E/R (INTELLIGENT POWER DISTRIBUTION MODULE ENGINE ROOM)
Connector Type	NS10FW-CS



39	38	37	36		35	34	33	
48	47	46	45	44	43	42	41	40

Terminal No.	34
Color of Wire	R/B
Signal Name [Specification]	—

Connector No.	E14
Connector Name	IPDM E/R (INTELLIGENT POWER DISTRIBUTION MODULE ENGINE ROOM)
Connector Type	YZR 72S-5591-40-F



51	50	49
54	53	52

Terminal No.	50
Color of Wire	B/R
Terminal No.	51
Color of Wire	P
Signal Name [Specification]	—

Connector No.	E105
Connector Name	WIRE TO WIRE
Connector Type	TH60MF-NS16-7M4



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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Terminal No.	1
Color of Wire	P
Terminal No.	71
Color of Wire	L
Signal Name [Specification]	—

Connector No.	F10
Connector Name	STARTER MOTOR
Connector Type	—



2

Terminal No.	2
Color of Wire	B/Y
Signal Name [Specification]	—

STARTING SYSTEM

< COMPONENT DIAGNOSIS >

STARTING SYSTEM (WITH CVT)

Connector No.	F11
Connector Name	STARTER MOTOR
Connector Type	-



Terminal No.	Color of Wire	Signal Name [Specification]
1	B/R	-

Connector No.	F21
Connector Name	PARK/NEUTRAL POSITION SWITCH
Connector Type	PK08FG



Terminal No.	Color of Wire	Signal Name [Specification]
6	W/B	-
7	R/B	-

Connector No.	F122
Connector Name	WIRE TO WIRE
Connector Type	M02FW-LC



Terminal No.	Color of Wire	Signal Name [Specification]
1	B/R	-

Connector No.	F123
Connector Name	WIRE TO WIRE
Connector Type	TK24FW-IV



Terminal No.	Color of Wire	Signal Name [Specification]
8	W/B	-
21	R/B	-

Connector No.	M29
Connector Name	IGNITION SWITCH
Connector Type	M06FW-LC



Terminal No.	Color of Wire	Signal Name [Specification]
1	L	-
5	R	-

Connector No.	M77
Connector Name	WIRE TO WIRE
Connector Type	TH40FW-NS16-TM4



Terminal No.	Color of Wire	Signal Name [Specification]
1	R	-
71	L	-

STARTING SYSTEM

< SYMPTOM DIAGNOSIS >

SYMPTOM DIAGNOSIS

STARTING SYSTEM

Symptom Table

INFOID:000000000955272

Symptom	Reference
No normal cranking	Refer to STR-2, "K9K MODELS : Work Flow" (K9K models) or STR-4, "HR16DE/MR20DE MODELS : Work Flow" (HR16DE/MR20DE models).
Starter motor does not rotate	

PRECAUTIONS

< PRECAUTION >

PRECAUTION

PRECAUTIONS

Supplemental Restraint System (SRS) "AIR BAG" and "SEAT BELT PRE-TENSIONER"

INFOID:000000000955273

The Supplemental Restraint System such as "AIR BAG" and "SEAT BELT PRE-TENSIONER", used along with a front seat belt, helps to reduce the risk or severity of injury to the driver and front passenger for certain types of collision. This system includes seat belt switch inputs and dual stage front air bag modules. The SRS system uses the seat belt switches to determine the front air bag deployment, and may only deploy one front air bag, depending on the severity of a collision and whether the front occupants are belted or unbelted. Information necessary to service the system safely is included in the SRS and SB section of this Service Manual.

WARNING:

- To avoid rendering the SRS inoperative, which could increase the risk of personal injury or death in the event of a collision that would result in air bag inflation, all maintenance must be performed by an authorized NISSAN/INFINITI dealer.
- Improper maintenance, including incorrect removal and installation of the SRS, can lead to personal injury caused by unintentional activation of the system. For removal of Spiral Cable and Air Bag Module, see the SRS section.
- Do not use electrical test equipment on any circuit related to the SRS unless instructed to in this Service Manual. SRS wiring harnesses can be identified by yellow and/or orange harnesses or harness connectors.

STARTER MOTOR

< ON-VEHICLE REPAIR >

ON-VEHICLE REPAIR

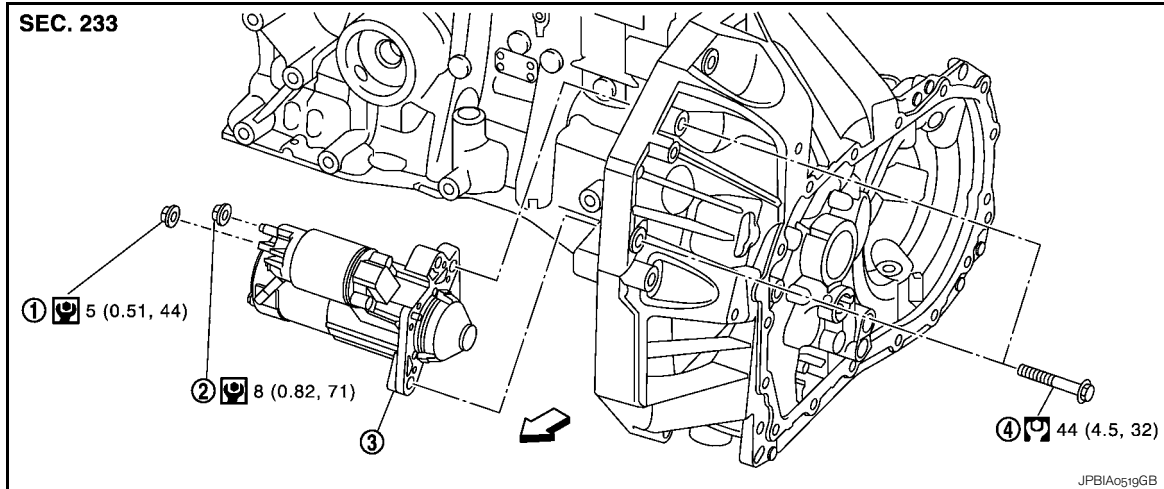
STARTER MOTOR

K9K MODELS

K9K MODELS : Exploded View

INFOID:000000000955275

REMOVAL



1. "S" terminal nut
2. "B" terminal nut
3. Starter motor
4. Starter motor mounting bolt

↙ : Engine front

Refer to [GI-4, "Components"](#) for symbols in the figure.

K9K MODELS : Removal and Installation

INFOID:000000000955276

REMOVAL

1. Disconnect the battery cable from the negative terminal.
2. Remove "S" terminal nut and "S" terminal harness.
3. Remove "B" terminal nut and "B" terminal harness.
4. Remove starter motor mounting bolts.
5. Remove starter motor upward from the vehicle.

INSTALLATION

Install in the reverse order of removal.

CAUTION:

Be sure to tighten "B" terminal nut carefully.

HR16DE MODELS

HR16DE MODELS : Exploded View

INFOID:000000000955718

REMOVAL

< ON-VEHICLE REPAIR >



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P

- Refer to GI-4, "Components" for symbols in the figure.

Type: M000T32171



- STR-21

STARTER MOTOR

< ON-VEHICLE REPAIR >

- | | | |
|--------------------|---------------------|-------------|
| 13. Planetary gear | 14. Gear shaft | 15. Packing |
| 16. Internal gear | 17. Pinion assembly | 18. Stopper |
| 19. Stopper ring | | |

 (H): High-temperature grease point

Refer to [GI-4, "Components"](#) for symbols not described on the above.

HR16DE MODELS : Removal and Installation

INFOID:00000000095719

REMOVAL

1. Disconnect the battery cable from the negative terminal.
2. Remove "B" terminal nut and "B" terminal harness.
3. Remove "S" terminal nut and "S" terminal harness.
4. Remove starter motor mounting bolts.
5. Remove starter motor upward from the vehicle.

INSTALLATION

Install in the reverse order of removal.

CAUTION:

Be sure to tighten "B" terminal nut carefully.

HR16DE MODELS : Disassembly and Assembly

INFOID:00000000096766

ASSEMBLY

Apply high-temperature grease to lubricate the bearing, gears and frictional surface when assembling the starter.

Carefully observe the following instructions.

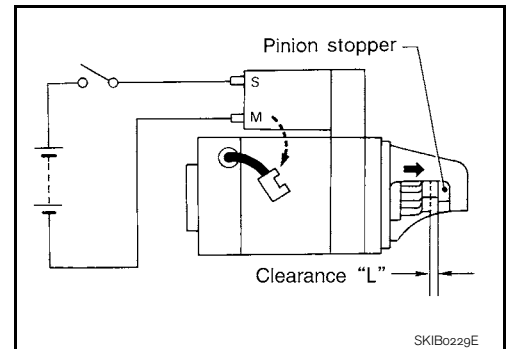
Pinion Protrusion Length Adjustment

CLEARANCE

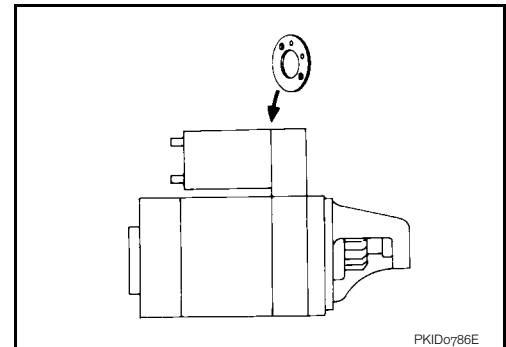
- With pinion driven out by magnetic switch, push pinion back to remove slack and measure clearance "L" between the front edge of the pinion and the pinion stopper.

Clearance "L"

: Refer to SDS [STR-31, "Starter Motor"](#).



- Adjust with the adjusting plate if the measurement value is not in the specified area.



HR16DE MODELS : Inspection

INFOID:00000000096767

INSPECTION

Magnetic Switch Check

STARTER MOTOR

< ON-VEHICLE REPAIR >

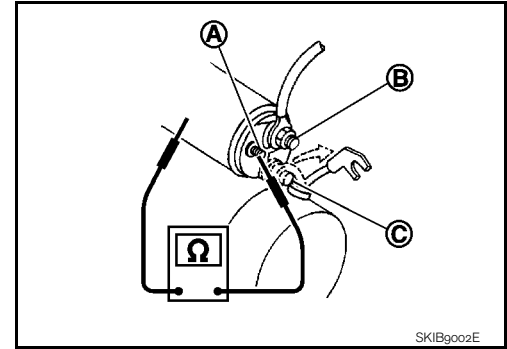
- Before starting to check, disconnect the battery cable from the negative terminal.
- Disconnect "M" terminal of starter motor.

1. Continuity test [between "S" terminal (A) and switch body]

B : "B" terminal

C : "M" terminal

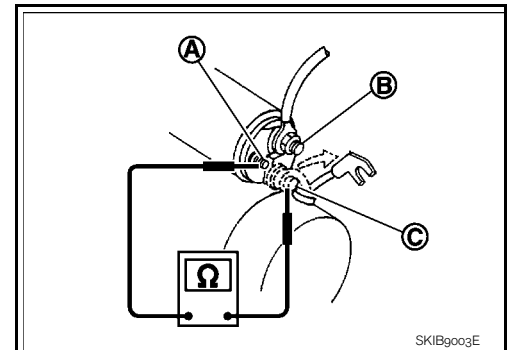
- Replace magnetic switch if continuity does not exist.



2. Continuity test [between "S" terminal (A) and "M" terminal (C)]

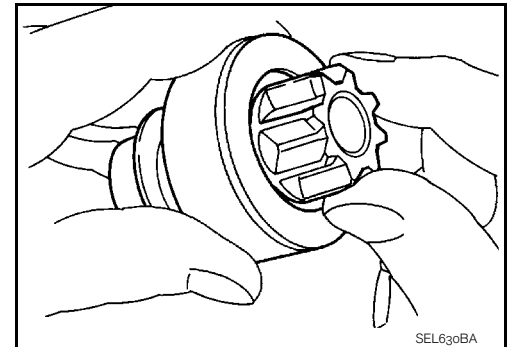
B : "B" terminal

- Replace magnetic switch if continuity does not exist.



Pinion/Clutch Check

1. Inspect pinion teeth.
 - Replace pinion if teeth are worn or damaged. (Also check condition of ring gear teeth.)
2. Inspect reduction gear teeth (If equipped).
 - Replace reduction gear if teeth are worn or damaged. (Also check condition of armature shaft gear teeth.)
3. Check to see if pinion locks in one direction and rotates smoothly in the opposite direction.
 - Replace pinion assembly if it is locked or rotated in both directions or unusual resistance is evident.

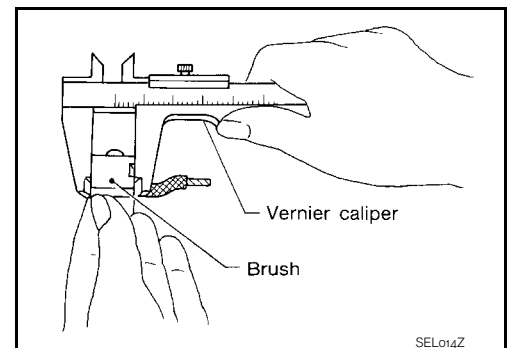


Brush Check

- Check wear of brush.

Minimum length of brush : Refer to SDS [STR-31](#),
["Starter Motor"](#).

- Replace brush if the measurement value is less than the specified value.



Brush Spring Check

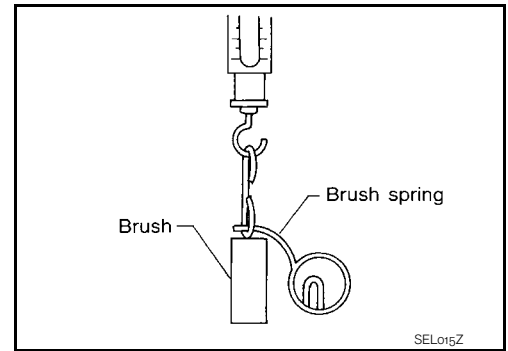
STARTER MOTOR

< ON-VEHICLE REPAIR >

- Check brush spring tension with brush spring detached from brush.

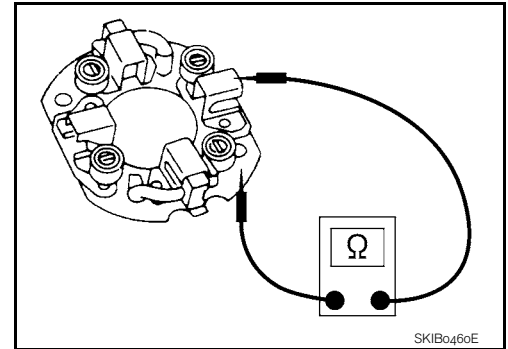
Spring tension (with new brush) : Refer to SDS [STR-31](#), "[Starter Motor](#)".

- Replace brush spring if the measurement value is less than the specified value.



Brush Holder Check

1. Perform insulation test between brush holder (positive side) and its base (negative side).
 - Replace brush holder assembly if continuity does not exist.
2. Check brush to see if it moves smoothly.
 - If brush holder is bent, replace it; if sliding surface is dirty, clean.

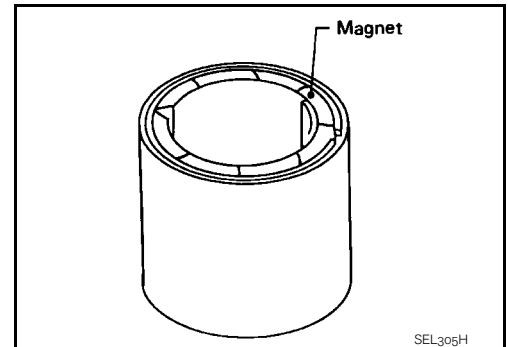


Yoke Check

Magnet is secured to yoke by bonding agent. Check magnet to see that it is secured to yoke and for any cracks. Replace malfunctioning parts as an assembly.

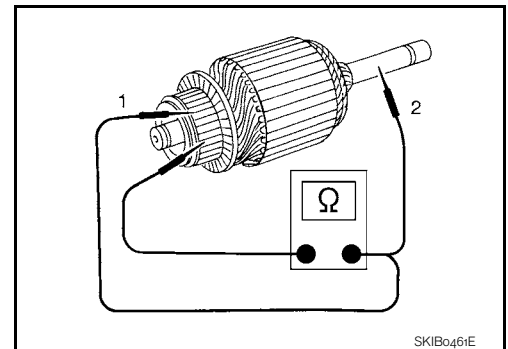
CAUTION:

Never clamp yoke in a vise or strike it with a hammer.



Armature Check

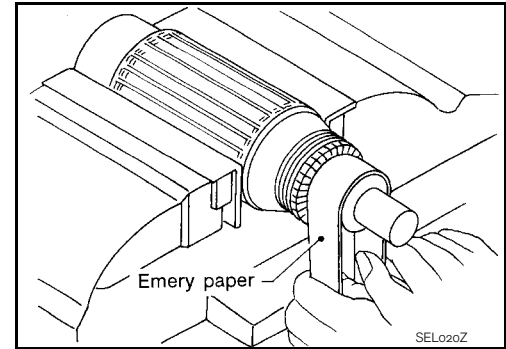
1. Continuity test (between two segments side by side)
 - Replace armature assembly if continuity does not exist.
2. Insulation test (between each commutator bar and shaft)
 - Replace armature assembly if continuity exists.



STARTER MOTOR

< ON-VEHICLE REPAIR >

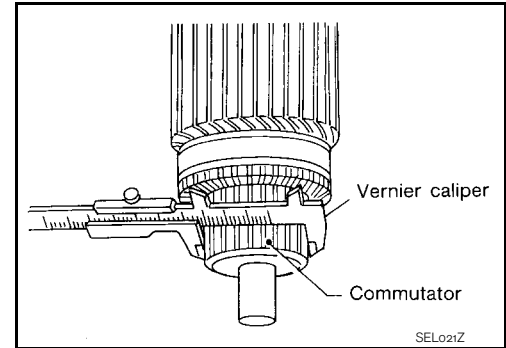
3. Check commutator surface.
 - Grind with No. 500 - 600 emery paper if it has a rough surface.



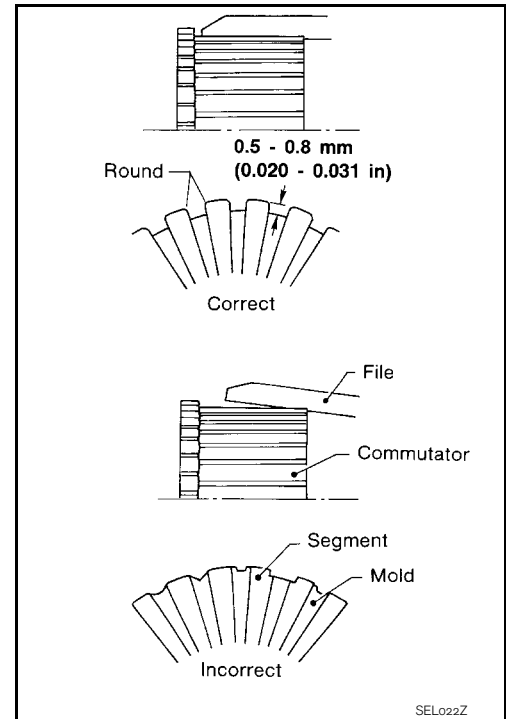
4. Check diameter of commutator.

Commutator minimum diameter : Refer to SDS [STR-31](#), "[Starter Motor](#)".

- Replace armature assembly if the measurement value is less than the specified value.



5. Check depth of insulating mold from commutator surface.
 - Undercut to 0.5 to 0.8 mm (0.020 to 0.031 in) if the depth is 0.2 mm (0.008 in) or less.



MR20DE MODELS

MR20DE MODELS : Exploded View

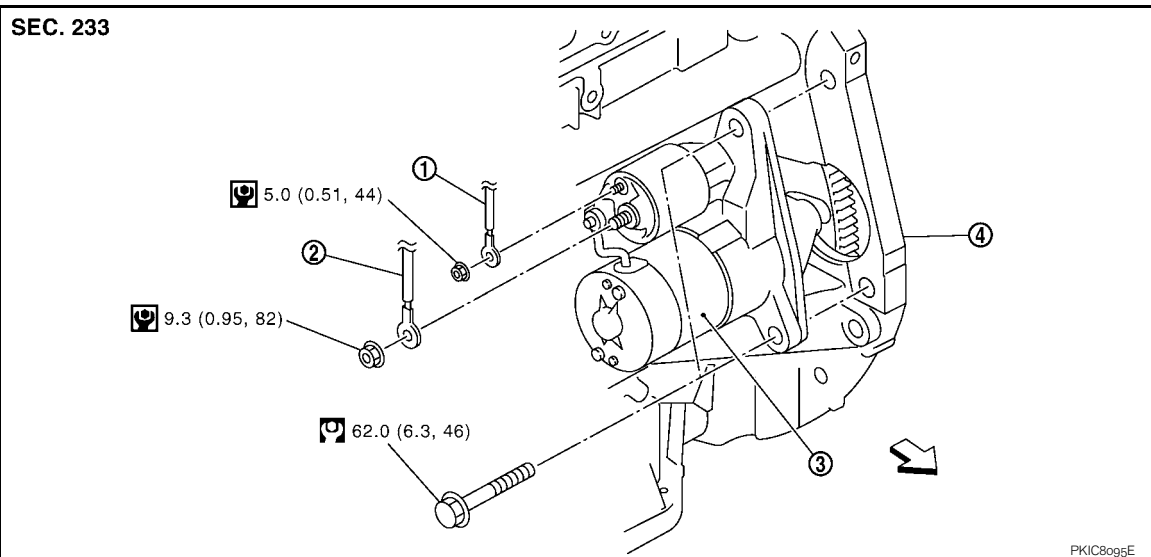
REMOVAL

INFOID:000000000955722

STARTER MOTOR

< ON-VEHICLE REPAIR >

SEC. 233



1. "S" terminal harness
2. "B" terminal harness
3. Starter motor
4. Cylinder block

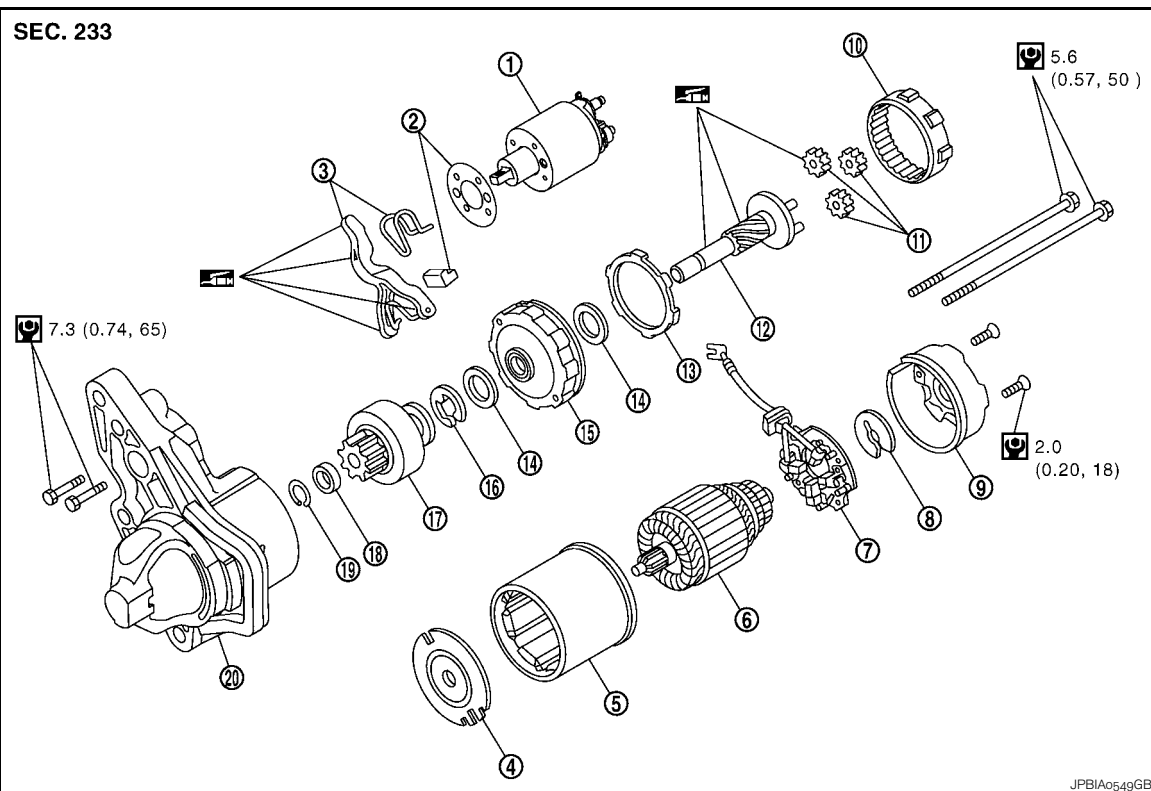
↩ : Engine front

Refer to [GI-4, "Components"](#) for symbols in the figure.

DISASSEMBLY

Type: S114-902A

SEC. 233



1. Magnetic switch assembly
2. Dust cover kit
3. Shift lever set
4. Center bracket (A)
5. Yoke assembly
6. Armature assembly
7. Brush holder assembly
8. Thrust washer
9. Rear cover assembly
10. Internal gear
11. Planetary gear
12. Pinion shaft

STARTER MOTOR

< ON-VEHICLE REPAIR >

- | | | |
|-------------------------|------------------------|------------------------|
| 13. Packing | 14. Thrust washer | 15. Center bracket (P) |
| 16. E-ring | 17. Pinion assembly | 18. Pinion stopper |
| 19. Pinion stopper clip | 20. Gear case assembly | |

 : High-temperature grease point

Refer to [GI-4, "Components"](#) for symbols not described on the above.

MR20DE MODELS : Removal and Installation

INFOID:000000000955723

REMOVAL

1. Disconnect the battery cable from the negative terminal.
2. Disconnect the oil pressure switch connector.
3. Remove "B" terminal nut and "B" terminal harness.
4. Remove "S" terminal nut and "S" terminal harness.
5. Remove starter motor mounting bolts.
6. Remove starter motor upward from the vehicle.

CAUTION:

Never damage oil pressure switch when removing starter motor.

INSTALLATION

Install in the reverse order of removal.

CAUTION:

Be sure to tighten "B" terminal nut carefully.

MR20DE MODELS : Disassembly and Assembly

INFOID:000000000955724

ASSEMBLY

Apply high-temperature grease to lubricate the bearing, gears and frictional surface when assembling the starter.

Carefully observe the following instructions.

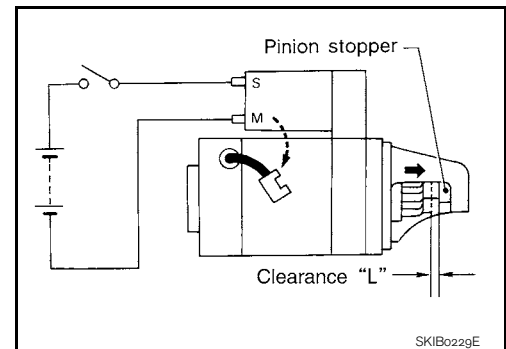
Pinion Protrusion Length Adjustment

CLEARANCE

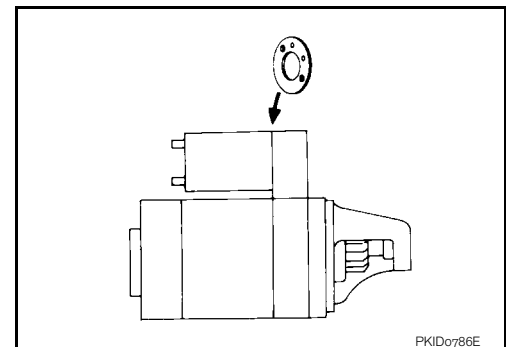
- With pinion driven out by magnetic switch, push pinion back to remove slack and measure clearance "L" between the front edge of the pinion and the pinion stopper.

Clearance "L"

: Refer to SDS [STR-31, "Starter Motor"](#).



- Adjust with the adjusting plate if the measurement value is not in the specified area.



MR20DE MODELS : Inspection

INFOID:000000000955725

STARTER MOTOR

< ON-VEHICLE REPAIR >

INSPECTION

Magnetic Switch Check

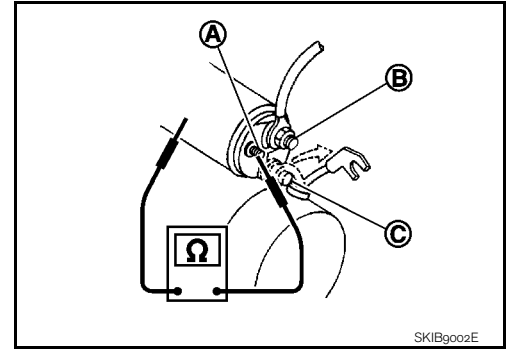
- Before starting to check, disconnect the battery cable from the negative terminal.
- Disconnect "M" terminal of starter motor.

1. Continuity test [between "S" terminal (A) and switch body]

B : "B" terminal

C : "M" terminal

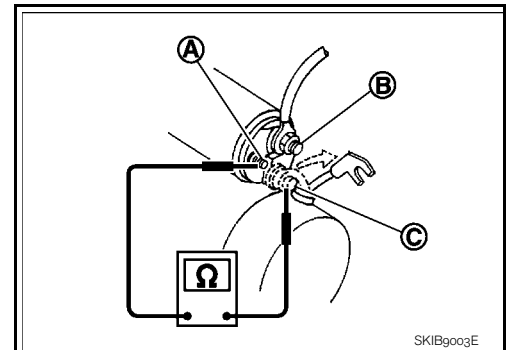
- Replace magnetic switch if continuity does not exist.



2. Continuity test [between "S" terminal (A) and "M" terminal (C)]

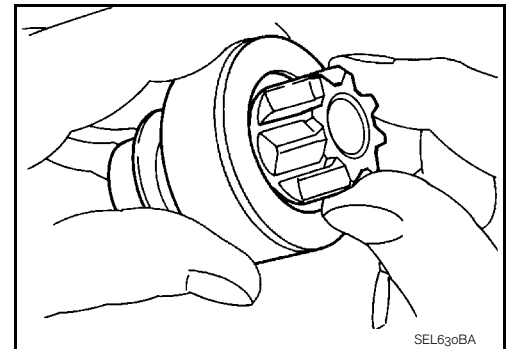
B : "B" terminal

- Replace magnetic switch if continuity does not exist.



Pinion/Clutch Check

1. Inspect pinion teeth.
 - Replace pinion if teeth are worn or damaged. (Also check condition of ring gear teeth.)
2. Inspect reduction gear teeth (If equipped).
 - Replace reduction gear if teeth are worn or damaged. (Also check condition of armature shaft gear teeth.)
3. Check to see if pinion locks in one direction and rotates smoothly in the opposite direction.
 - Replace pinion assembly if it is locked or rotated in both directions or unusual resistance is evident.

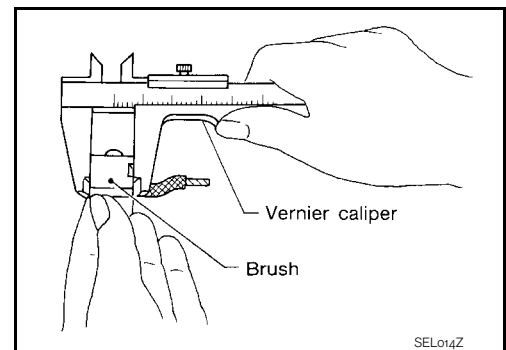


Brush Check

- Check wear of brush.

Minimum length of brush : Refer to SDS [STR-31](#),
["Starter Motor"](#).

- Replace brush if the measurement value is less than the specified value.



Brush Spring Check

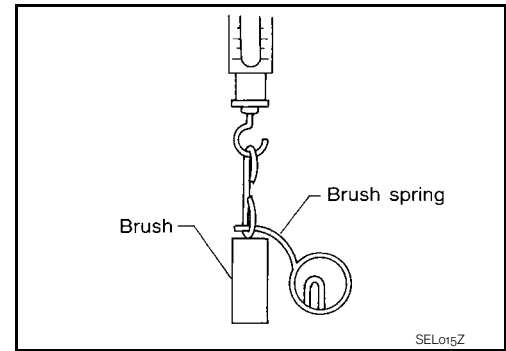
STARTER MOTOR

< ON-VEHICLE REPAIR >

- Check brush spring tension with brush spring detached from brush.

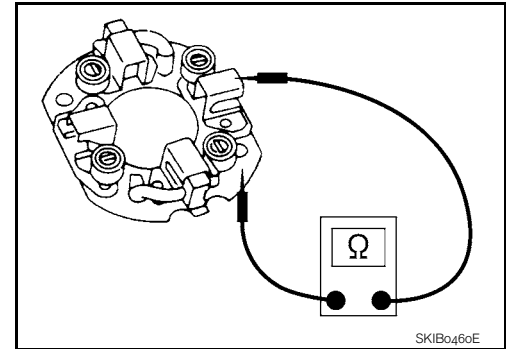
Spring tension (with new brush) : Refer to SDS [STR-31](#), "[Starter Motor](#)".

- Replace brush spring if the measurement value is less than the specified value.



Brush Holder Check

1. Perform insulation test between brush holder (positive side) and its base (negative side).
 - Replace brush holder assembly if continuity does not exist.
2. Check brush to see if it moves smoothly.
 - If brush holder is bent, replace it; if sliding surface is dirty, clean.

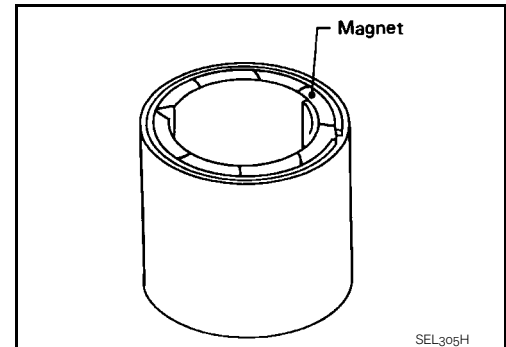


Yoke Check

Magnet is secured to yoke by bonding agent. Check magnet to see that it is secured to yoke and for any cracks. Replace malfunctioning parts as an assembly.

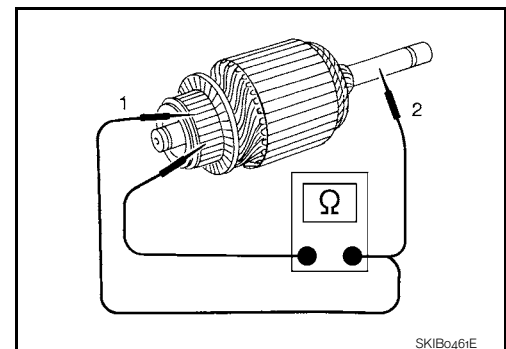
CAUTION:

Never clamp yoke in a vise or strike it with a hammer.



Armature Check

1. Continuity test (between two segments side by side)
 - Replace armature assembly if continuity does not exist.
2. Insulation test (between each commutator bar and shaft)
 - Replace armature assembly if continuity exists.

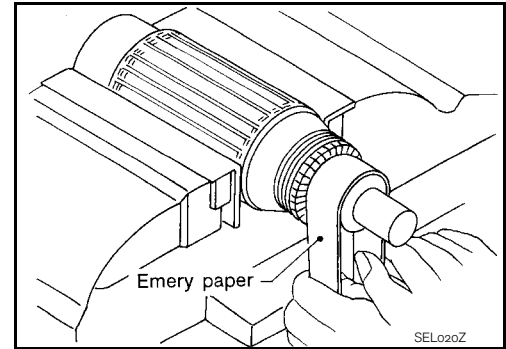


STARTER MOTOR

< ON-VEHICLE REPAIR >

3. Check commutator surface.

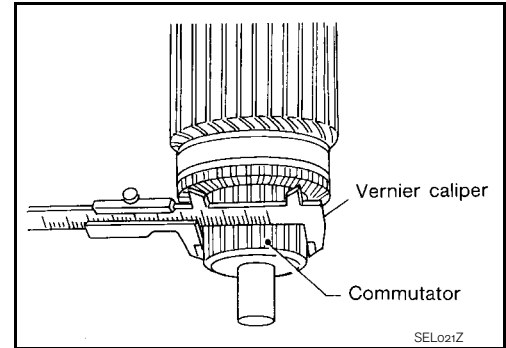
- Grind with No. 500 - 600 emery paper if it has a rough surface.



4. Check diameter of commutator.

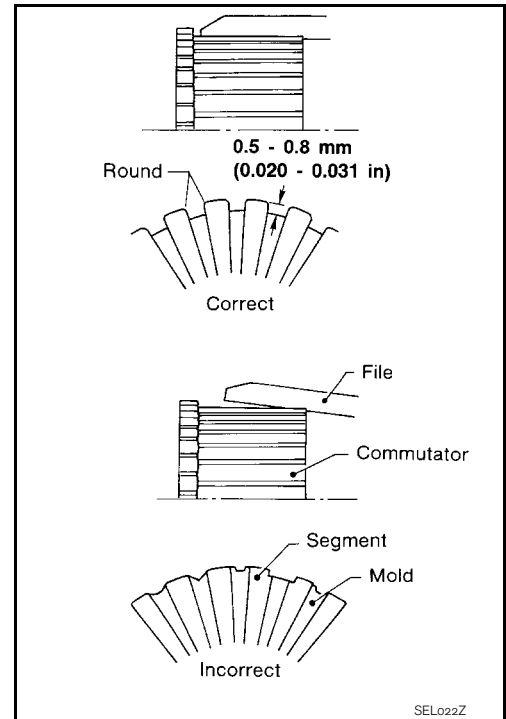
Commutator minimum diameter : Refer to SDS [STR-31](#), ["Starter Motor"](#).

- Replace armature assembly if the measurement value is less than the specified value.



5. Check depth of insulating mold from commutator surface.

- Undercut to 0.5 to 0.8 mm (0.020 to 0.031 in) if the depth is 0.2 mm (0.008 in) or less.



SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

SERVICE DATA AND SPECIFICATIONS (SDS)

SERVICE DATA AND SPECIFICATIONS (SDS)

Starter Motor

INFOID:000000000955279

A

STR

Applied model		K9K	HR16DE	MR20DE
Type		M000T87881	M000T32171	S114-902A
		MITSUBISHI make	MITSUBISHI make	HITACHI make
		Reduction gear type	Reduction gear type	Reduction gear type
System voltage [V]		—	12	12
No-load	Terminal voltage [V]	—	11	11
	Current [A]	—	Less than 95	Less than 110
	Revolution [rpm]	—	More than 3,000	More than 3,000
Minimum diameter of commutator [mm (in)]		—	28.8 (1.134)	28.0 (1.102)
Minimum length of brush [mm (in)]		—	5.5 (0.217)	10.5 (0.413)
Brush spring tension [N (kg, lb)]		—	17.7 (1.81, 3.98)	16.2 (1.65, 3.64)
Clearance between bearing metal and armature shaft [mm (in)]		—	Less than 0.2 (0.008)	Less than 0.2 (0.008)
Clearance "L" between pinion front edge and pinion stopper [mm (in)]		—	0.3 - 2.0 (0.012 - 0.079)	0.3 - 2.5 (0.012 - 0.098)

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