STARTING & CHARGING SYSTEM

SECTION SC

CONTENTS

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

NESC0001

The Supplemental Restraint System such as “AIR BAG” and “SEAT BELT PRE-TENSIONER” used along with a seat belt, help to reduce the risk or severity of injury to the driver and front passenger in a frontal collision. The Supplemental Restraint System consists of air bag modules (located in the center of the steering wheel and in the instrument panel on the passenger side), seat belt pre-tensioners, a diagnosis sensor unit, warning lamp, wiring harness, and spiral cable.

The vehicle (except Crew Cab model) is equipped with a passenger air bag deactivation switch. Because no rear seat exists where a rear-facing child restraint can be placed, the switch is designed to turn off the passenger air bag so that a rear-facing child restraint can be used in the front passenger seat. The switch is located in the center of the instrument panel, near the ashtray. When the switch is turned to the ON position, the passenger air bag is enabled and could inflate in a frontal collision. When the switch is turned to the OFF position, the passenger air bag is disabled and will not inflate in a frontal collision. A passenger air bag OFF indicator on the instrument panel lights up when the passenger air bag is switched OFF. The driver air bag always remains enabled and is not affected by the passenger air bag deactivation switch.

Information necessary to service the system safely is included in the **RS 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 which would result in air bag inflation, all maintenance should be performed by an authorized NISSAN 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 RS 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 harness connectors.**
- **The vehicle (except Crew Cab model) is equipped with a passenger air bag deactivation switch which can be operated by the customer. When the passenger air bag is switched OFF, the passenger air bag is disabled and will not inflate in a frontal collision. When the passenger air bag is switched ON, the passenger air bag is enabled and could inflate in a frontal collision. After SRS maintenance or repair, make sure the passenger air bag deactivation switch is in the same position (ON or OFF) as when the vehicle arrived for service.**

Wiring Diagrams and Trouble Diagnosis

NESC0002

When you read wiring diagrams, refer to the following:

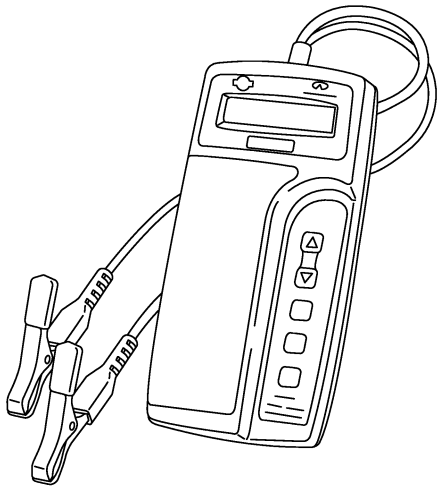
- ***GI-11***, “HOW TO READ WIRING DIAGRAMS”
- ***EL-10***, “POWER SUPPLY ROUTING” for power distribution circuit

When you perform trouble diagnosis, refer to the following:

- ***GI-34***, “How to Follow Test Groups in Trouble Diagnoses”
- ***GI-23***, “HOW TO PERFORM EFFICIENT DIAGNOSIS FOR AN ELECTRICAL INCIDENT”

Special Service Tool

NESC0022

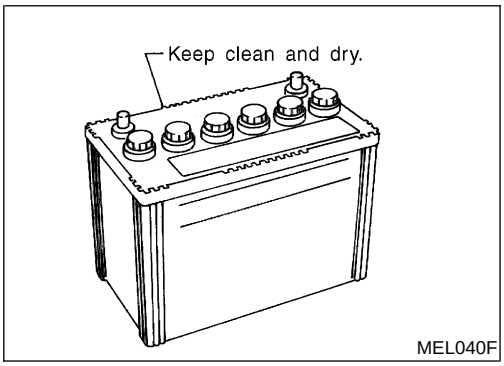
Tool number Tool name	Description
J-44373 Model 620 Battery/Starting/Charging system tester	 SEL403X

How to Handle Battery

NESC0003

CAUTION:

- **If it becomes necessary to start the engine with a booster battery and jumper cables, use a 12-volt booster battery.**
- **After connecting battery cables, ensure that they are tightly clamped to battery terminals for good contact.**
- **Never add distilled water through the hole used to check specific gravity.**

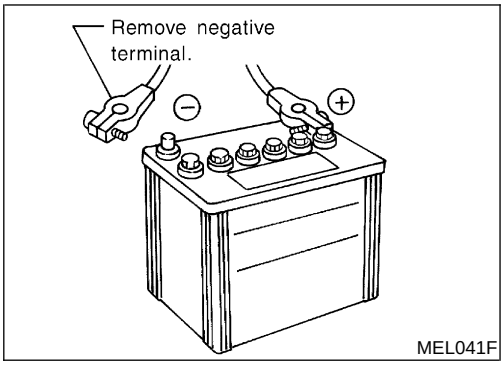


METHODS OF PREVENTING OVER-DISCHARGE

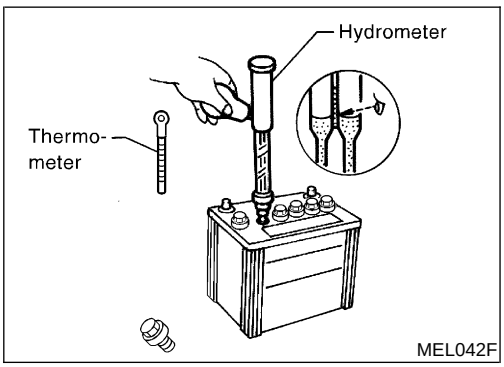
NESC0003S01

The following precautions must be taken to prevent over-discharging a battery.

- The battery surface (particularly its top) should always be kept clean and dry.
- The terminal connections should be clean and tight.
- At every routine maintenance, check the electrolyte level. This also applies to batteries designated as “low maintenance” and “maintenance-free”.



- When the vehicle is not going to be used over a long period of time, disconnect the negative battery terminal. (If the vehicle has an extended storage switch, turn it off.)



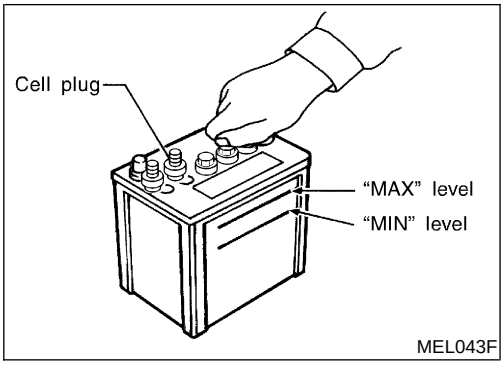
- Check the charge condition of the battery. Periodically check the specific gravity of the electrolyte. Keep a close check on charge condition to prevent over-discharge.

CHECKING ELECTROLYTE LEVEL

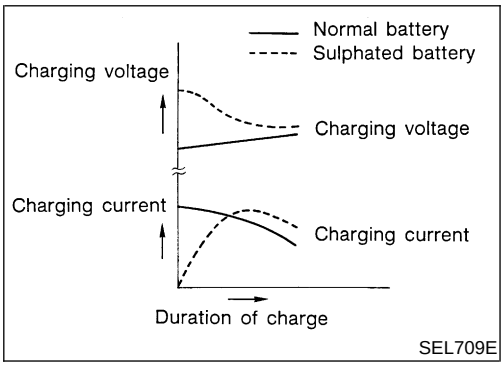
NESC0003S02

WARNING:

Do not allow battery fluid to come in contact with skin, eyes, fabrics, or painted surfaces. After touching a battery, do not touch or rub your eyes until you have thoroughly washed your hands. If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.



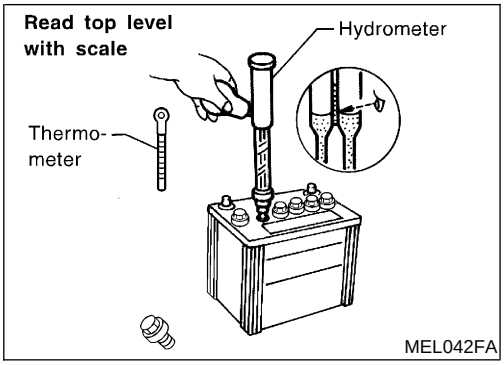
- Remove the cell plug using a suitable tool.
- Add distilled water up to the MAX level.



Sulphation

NESC0003S0201

A battery will be completely discharged if it is left unattended for a long time and the specific gravity will become less than 1.100. This may result in sulphation on the cell plates.
To determine if a battery has been "sulphated", note its voltage and current when charging it. As shown in the figure, less current and higher voltage are observed in the initial stage of charging sulphated batteries.
A sulphated battery may sometimes be brought back into service by means of a long, slow charge, 12 hours or more, followed by a battery capacity test.



SPECIFIC GRAVITY CHECK

=NESC0003S03

1. Read hydrometer and thermometer indications at eye level.

2. Use the chart below to correct your hydrometer reading according to electrolyte temperature.

Hydrometer Temperature Correction

NESC0003S0301

Battery electrolyte temperature °C (°F)	Add to specific gravity reading
71 (160)	0.032
66 (150)	0.028
60 (140)	0.024
54 (129)	0.020
49 (120)	0.016
43 (110)	0.012
38 (100)	0.008
32 (90)	0.004
27 (80)	0
21 (70)	−0.004
16 (60)	−0.008
10 (50)	−0.012
4 (39)	−0.016
−1 (30)	−0.020
−7 (20)	−0.024
−12 (10)	−0.028
−18 (0)	−0.032

Corrected specific gravity	Approximate charge condition
1.260 - 1.280	Fully charged
1.230 - 1.250	3/4 charged
1.200 - 1.220	1/2 charged
1.170 - 1.190	1/4 charged
1.140 - 1.160	Almost discharged
1.110 - 1.130	Completely discharged

CHARGING THE BATTERY

=NESC0003S04

CAUTION:

- **Do not "quick charge" a fully discharged battery.**
- **Keep the battery away from open flame while it is being charged.**
- **When connecting the charger, connect the leads first, then turn on the charger. Do not turn on the charger first, as this may cause a spark.**
- **If battery electrolyte temperature rises above 60°C (140°F), stop charging. Always charge battery at a temperature below 60°C (140°F).**

Charging Rates

NESC0003S0401

Amps	Time
50	1 hour
25	2 hours
10	5 hours
5	10 hours

Do not charge at more than 50 ampere rate.

NOTE:

The ammeter reading on your battery charger will automatically decrease as the battery charges. This indicates that the voltage of the battery is increasing normally as the state of charge improves. The charging amps indicated above refer to initial charge rate.

- If, after charging, the specific gravity of any two cells varies more than .050, the battery should be replaced.

Trouble Diagnoses with Battery/Starting/Charging System Tester

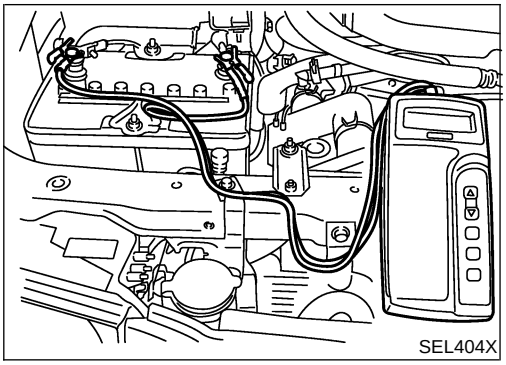
NESC0019

CAUTION:

When working with batteries, always wear appropriate eye protection.

NOTE:

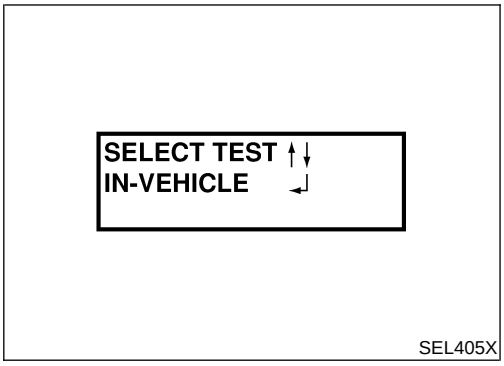
- To ensure a complete and thorough diagnosis, the battery, starter and generator test segments must be done as a set from start to finish.
- If battery surface charge is detected while testing, the tester will prompt you to turn on the headlights to remove the surface charge.
- If necessary, the tester will prompt you to determine if the battery temperature is above or below 0°C (32°F). Choose the appropriate selection by pressing the up or down arrow button, then press "ENTER" to make the selection.


SEL404X

1. Turn off all loads on the vehicle electrical system. Clean or repair as necessary.
2. Visually inspect the battery, battery terminals and cable ends with ignition switch in "OFF" position.

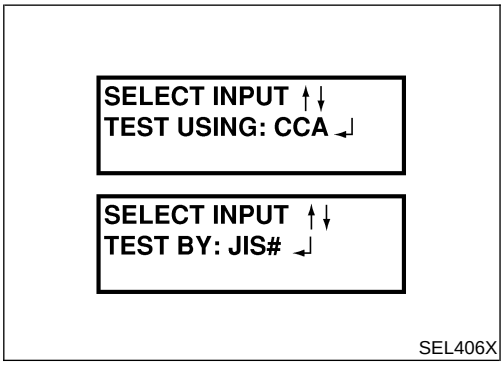
NOTE:
The contact surface between the battery terminals, cable ends and tester leads must be clean for a valid test. A poor connection will prevent testing and a "CHECK CONNECTION" message will appear during the test procedures. If this occurs, clean the battery post and terminals, reconnect them and restart the test.

3. Connect the red tester lead clamp to the positive battery terminal, and the black to the negative terminal.



SEL405X

4. The tester will turn on automatically. Using the arrow keys, select "IN-VEHICLE" on the tester and then press the "ENTER" key.



SEL406X

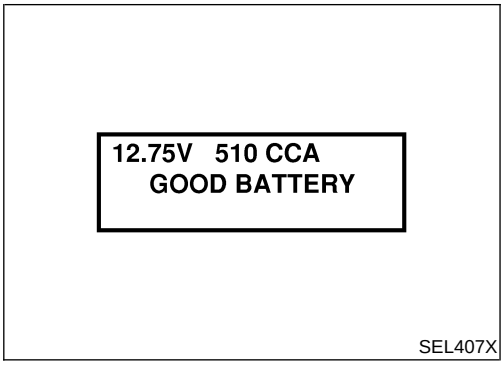
5. Locate the battery type and rating stamped or written on the top case of the battery to be tested.

NOTE:
The battery type and rating will have either of the following.

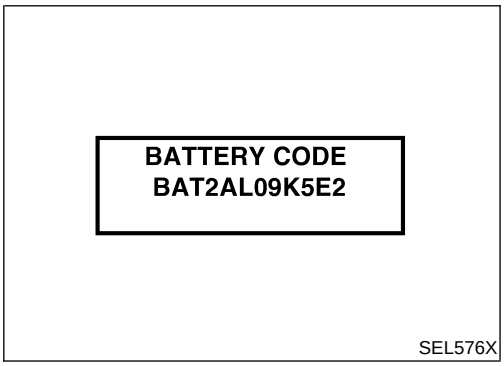
CCA: Cold Cranking Amps (490 CCA, 550 CCA, etc.)
JIS: Japanese Industrial Standard.
Battery is stamped with a number such as:
80D26L: 80 (rank of output), D (physical size-depth), 26 (width in cm). The last character L (post configuration) is not input into the tester.
The tester requires the rating for the battery be entered exactly as it is written or stamped on the battery. Do not attempt a CCA conversion for JIS stamped batteries. JIS must be input directly.

6. Using the arrow and "ENTER" keys alternately, select the battery type and rating.

NOTE:
The tester lists five choices; CCA, JIS, IEC, DIN, and EN. Only use CCA or JIS.



7. Press "ENTER" to begin the test. Diagnosis results are displayed on the tester. Refer to "DIAGNOSTIC RESULT ITEM CHART", SC-9.



8. Press "ENTER", then test output code is displayed. Record the test output code on the repair order.
9. Toggle back to the "DIAGNOSTIC SCREEN" for test results.

NOTE:

- If necessary, the tester will ask the user to determine if the battery has just been charged. Choose the appropriate selection by pressing the up or down arrow button and then press the "ENTER" button to make the selection.
- When testing a battery installed in a vehicle that has recently been driven, select "BEFORE CHARGE".
- If the battery has just been slow charged due to a "CHARGE & RETEST" decision by the tester, and the tester asks the user "BEFORE CHARGE/AFTER CHARGE", select "AFTER CHARGE".

DIAGNOSTIC RESULT ITEM CHART

NESC0019S01

Diagnostic item	Service procedure
GOOD BATTERY	Battery is OK. Refer to "Trouble Diagnoses", SC-18.
REPLACE BATTERY	Replace battery. Before replacing battery, clean the battery cable clamps and battery posts. Perform battery test again with Battery/Starting/Charging system tester. If second test result is "Replace Battery", then do so. Perform battery test again to confirm repair.
BAD CELL-REPLACE	Replace the battery. Perform battery test again with Battery/Starting/Charging system tester to confirm repair.
GOOD-RECHARGE	Perform the slow battery charging procedure. (Initial rate of charge is 10A for 12 hours.) Perform battery test again with Battery/Starting/Charging system tester.
CHARGE & RETEST	Perform the slow battery charging. (Initial rate of charge is 10A for 12 hours.) Perform battery test again with Battery/Starting/Charging system tester to confirm repair. **NOTE:** **If the tester asks the user "BEFORE CHARGE/AFTER CHARGE", select "AFTER CHARGE".**

System Description

NESC0004

NESC0004S07

KA24DE M/T MODELS

Power is supplied at all times

- through 40A fusible link (letter **e**, located in the fuse and fusible link box)
- to ignition switch terminal B.

With the ignition switch in the START position, power is supplied

- through ignition switch terminal ST
- to clutch interlock relay terminal 5.

With the ignition switch in the ON or START position, power is supplied

- through 10A fuse [No. 11, located in the fuse block (J/B)]
- to clutch interlock relay terminal 2.

Ground is supplied

- to clutch interlock relay terminal 1
- through clutch interlock switch terminal 1
- through clutch interlock switch terminal 2
- through body grounds M14 and M68.

The clutch interlock relay is energized and power is supplied

- through clutch interlock relay terminal 3
- to starter motor windings terminal S.

The starter motor plunger closes and provides a closed circuit between the battery and the starter motor. The starter motor is grounded to the cylinder block. With power and ground supplied, the starter motor operates.

KA24DE A/T MODELS

=NESC0004S06

Power is supplied at all times

- through 40A fusible link (letter **e**, located in the fuse and fusible link box)
- to ignition switch terminal B.

With the ignition switch in the START position, power is supplied

- through ignition switch terminal ST
- to park/neutral position (PNP) relay terminal 5.

With the ignition switch in the ON or START position, power is supplied

- through 10A fuse [No. 11, located in the fuse block (J/B)]
- to PNP switch terminal 1.

With the selector lever in the P or N position, power is supplied

- through PNP switch terminal 2
- to PNP relay terminal 2.

Ground is supplied

- to PNP relay terminal 1
- through body grounds E12 and E54.

The PNP relay is energized and power is supplied

- through PNP relay terminal 3
- to starter motor windings terminal S.

The starter motor plunger closes and provides a closed circuit between the battery and the starter motor. The starter motor is grounded to the cylinder block. With power and ground supplied, the starter motor operates.

VG33E AND VG33ER M/T MODELS

=NESC0004S02

Power is supplied at all times

- through 40A fusible link (letter **e**, located in the fuse and fusible link box)
- to ignition switch terminal B.

With the ignition switch in the START position, power is supplied

- through ignition switch terminal ST
- to clutch interlock relay terminal 5.

With the ignition switch in the ON or START position, power is supplied

- through 10A fuse [No. 11, located in the fuse block (J/B)]
- to clutch interlock relay terminal 2 and
- through 10A fuse [No. 5, located in the fuse block (J/B)] (4-door models), or
- through 7.5A fuse [No. 5, located in the fuse block (J/B)] (2-door models)
- to vehicle security relay terminal 2 (models with vehicle security system).

If the vehicle security system is not activated (models with vehicle security system) and clutch pedal is depressed, ground is supplied

- to clutch interlock relay terminal 1
- through vehicle security relay terminals 3, 4 (models with vehicle security system) and
- through clutch interlock switch terminal 1
- through clutch interlock switch terminal 2
- through body grounds M14 and M68.

The clutch interlock relay is energized and power is supplied

- through clutch interlock relay terminal 3
- to starter motor windings terminal S.

The starter motor plunger closes and provides a closed circuit between the battery and the starter motor. The starter motor is grounded to the cylinder block. With power and ground supplied, the starter motor operates. If the vehicle security system is activated (models with vehicle security system), ground is supplied to vehicle security relay terminal 1 through smart entrance control unit terminal 40, disengaging the clutch interlock relay and preventing starter motor operation.

VG33E AND VG33ER A/T MODELS

=NESC0004S03

Power is supplied at all times

- through 40A fusible link (letter **e**, located in the fuse and fusible link box)
- to ignition switch terminal B.

With the ignition switch in the START position, power is supplied

- through ignition switch terminal ST
- to park/neutral position (PNP) relay terminal 5.

With the ignition switch in the ON or START position, power is supplied

- through 7.5A fuse [No. 12, located in the fuse block (J/B)]
- to PNP switch terminal 1 and
- through 10A fuse [No. 5, located in the fuse block (J/B)] (4-door models), or
- through 7.5A fuse [No. 5, located in the fuse block (J/B)] (2-door models)
- to vehicle security relay terminal 2 (models with vehicle security system).

With the selector lever in the P or N position, power is supplied

- through PNP switch terminal 2
- to PNP relay terminal 2.

If the vehicle security system is not activated (models with vehicle security system), ground is supplied

- to PNP relay terminal 1
- through body grounds E12 and E54 (VG33E models without vehicle security system) or
- through body grounds M14 and M68 (VG33ER models without vehicle security system) or
- through vehicle security relay terminals 3, 4 (models with vehicle security system) and
- through body grounds M14 and M68.

The PNP relay is energized and power is supplied

- through PNP relay terminal 3
- to starter motor windings terminal S.

The starter motor plunger closes and provides a closed circuit between the battery and the starter motor. The starter motor is grounded to the cylinder block. With power and ground supplied, the starter motor operates. If the vehicle security system is activated (models with vehicle security system), ground is supplied to vehicle security relay terminal 1 through smart entrance control unit terminal 40, disengaging the PNP relay and preventing starter motor operation.

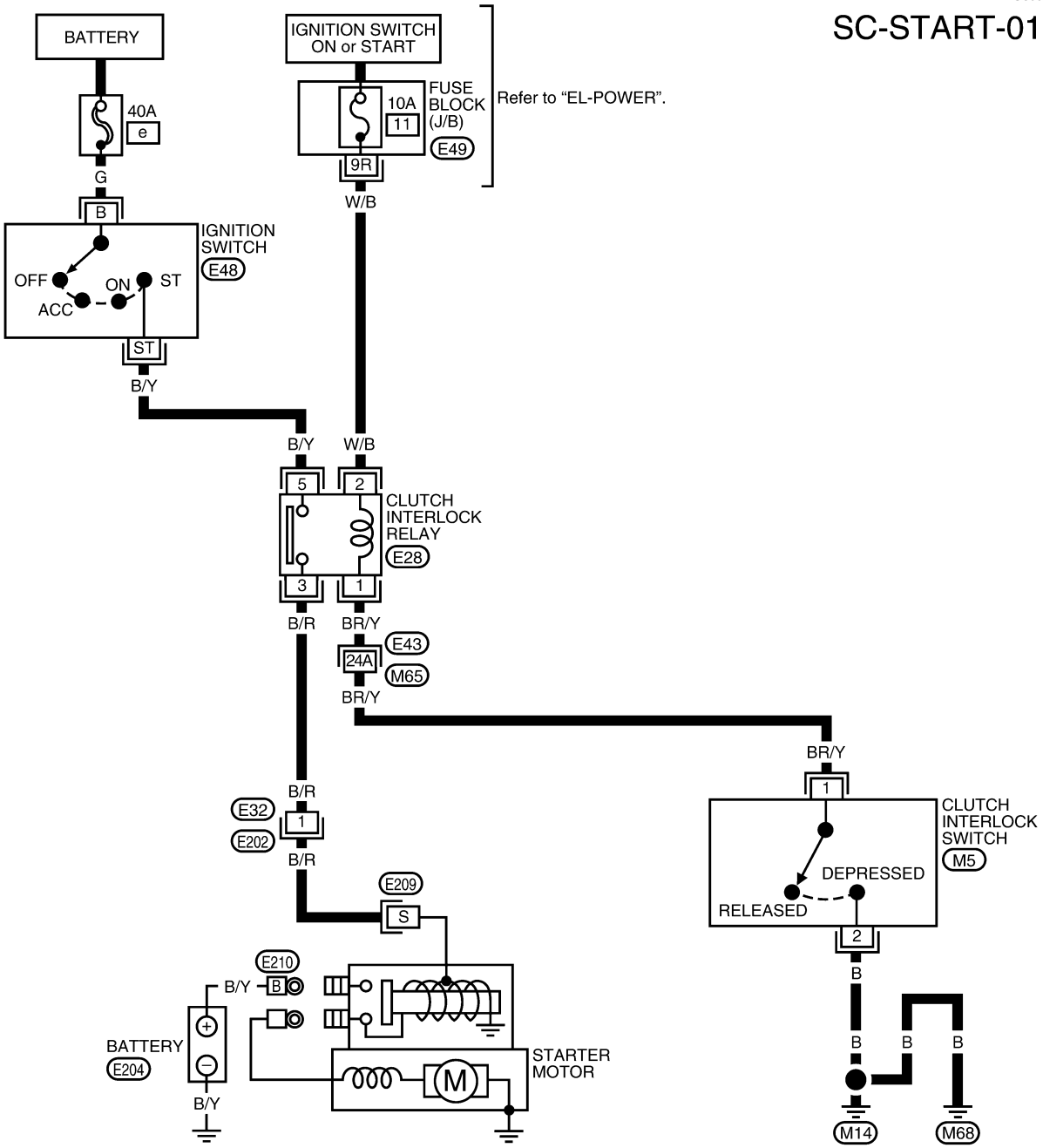
Wiring Diagram — START —

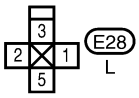
NESC0005

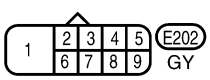
KA24DE M/T MODELS

NESC0005S05

SC-START-01







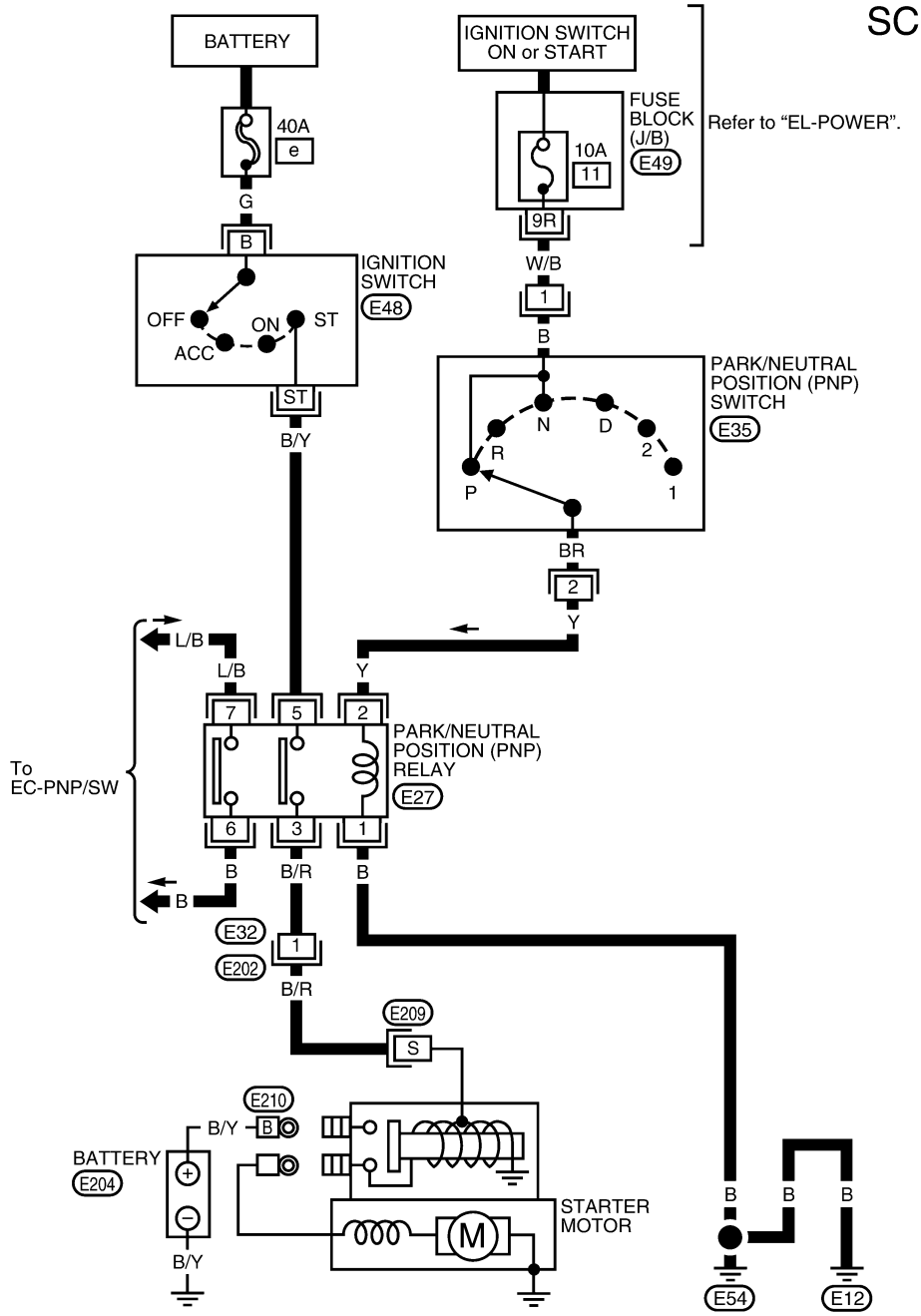
Refer to the following.
M65 , E43 -SUPER MULTIPLE JUNCTION (SMJ)

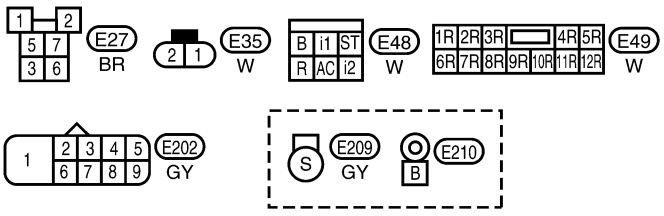
WSC058

KA24DE A/T MODELS

NESC0005S06

SC-START-02



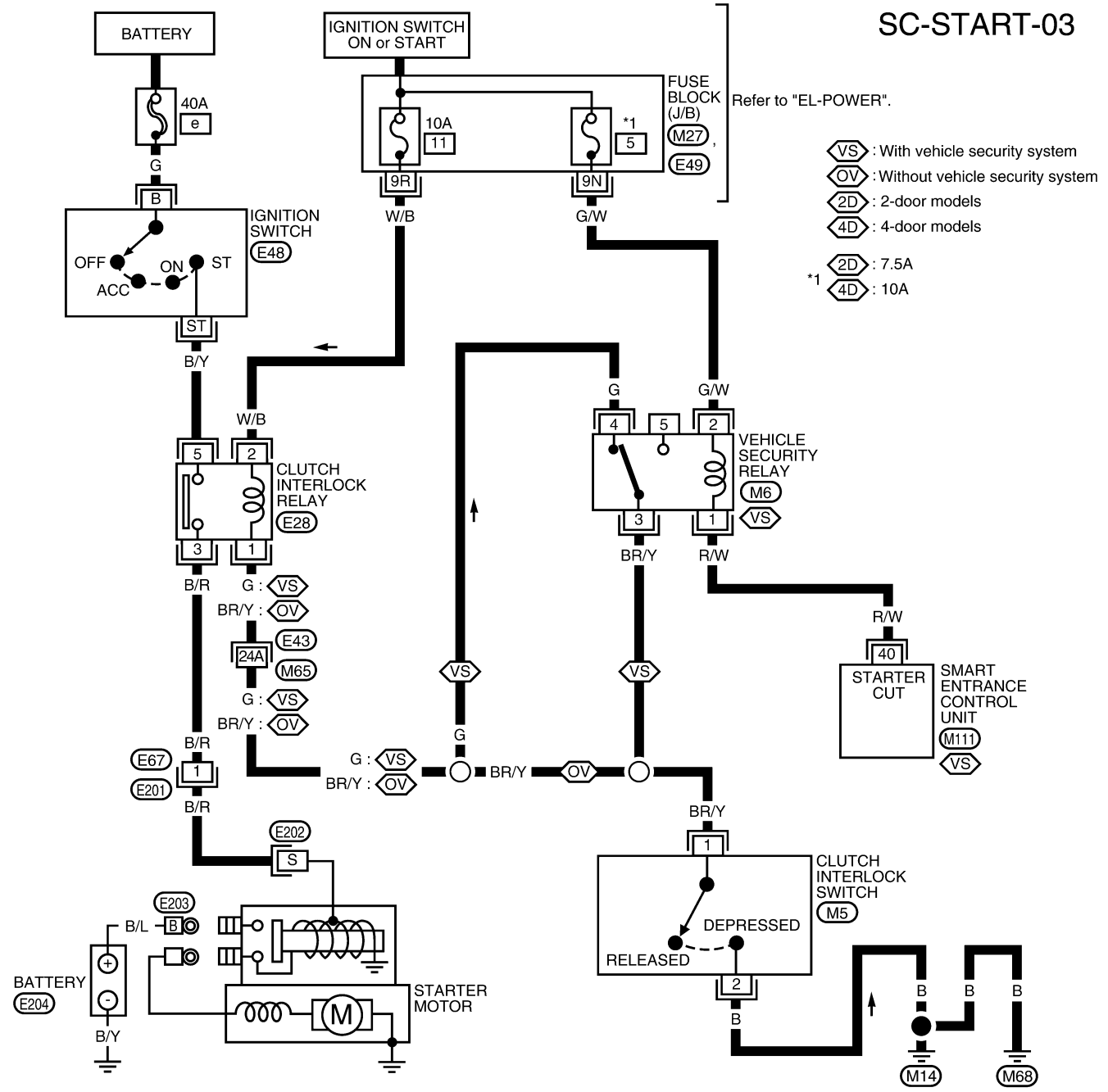


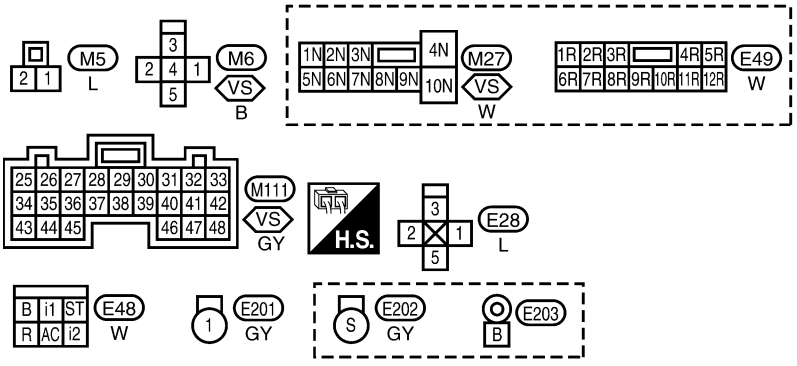
WSC064

Wiring Diagram — START — (Cont'd)

VG33E AND VG33ER M/T MODELS

NESC0005S03



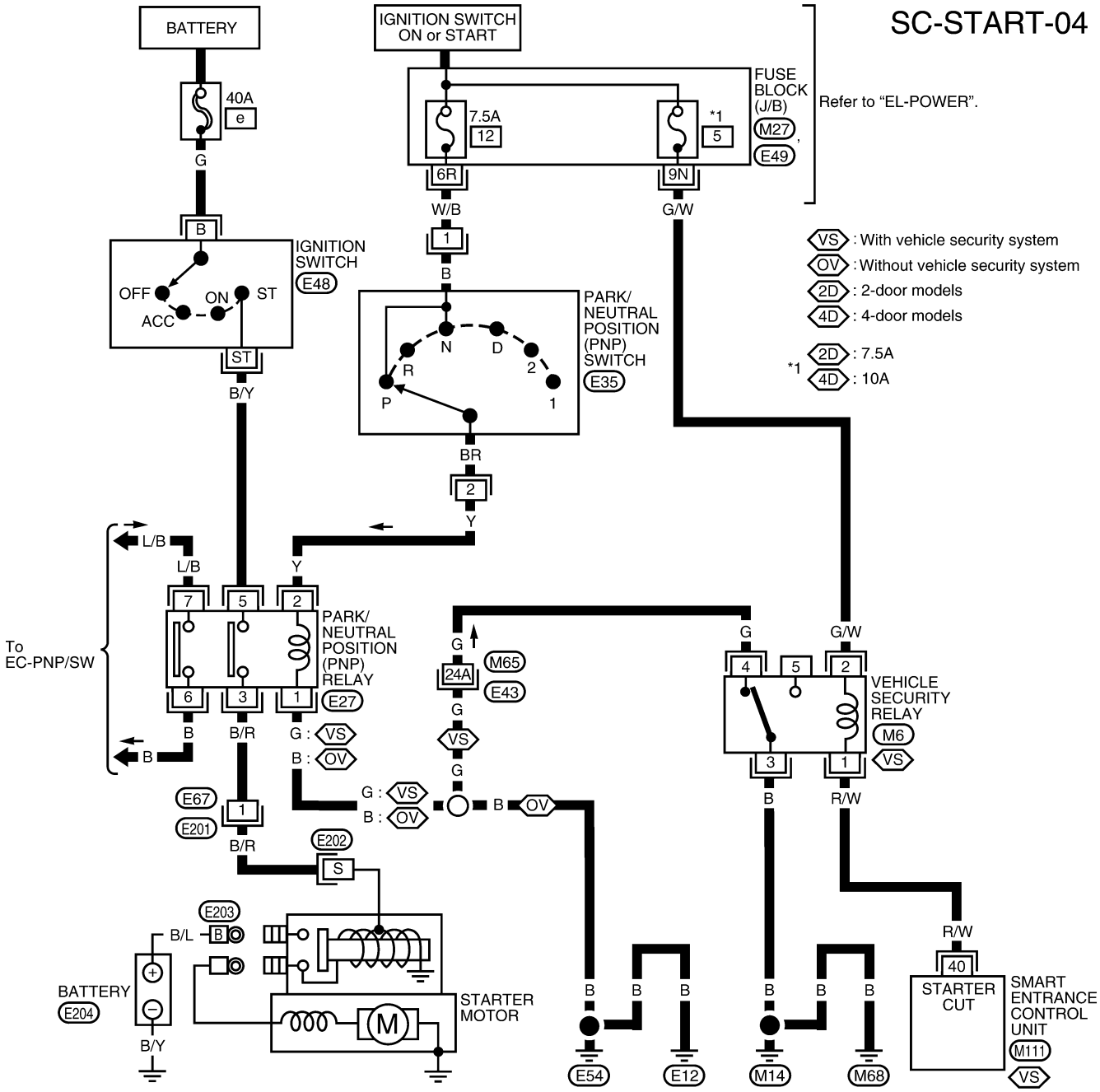


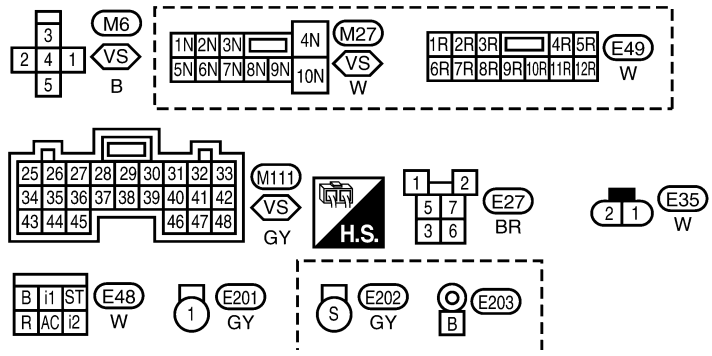
Refer to the following.
M65 , E43 -SUPER MULTIPLE JUNCTION (SMJ)

WSC061

VG33E AND VG33ER A/T MODELS

NESC0005S04





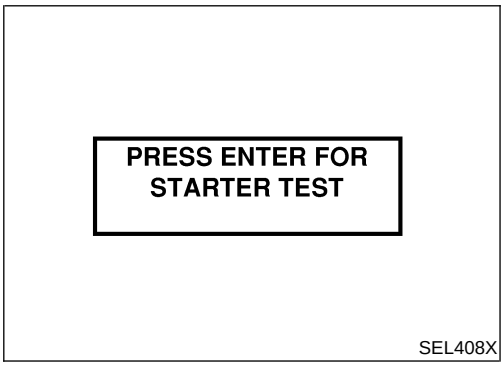
Refer to the following.
M65 , E43 - SUPER MULTIPLE JUNCTION (SMJ)

WSC062

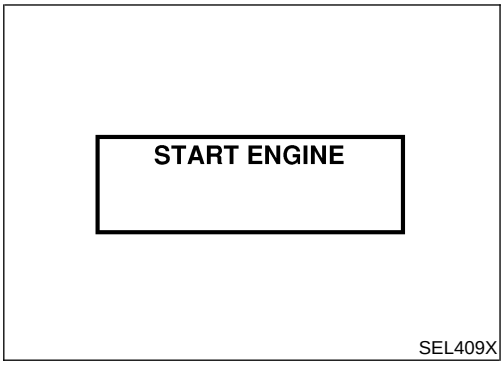
Trouble Diagnoses with Battery/Starting/Charging System Tester

NESC0020

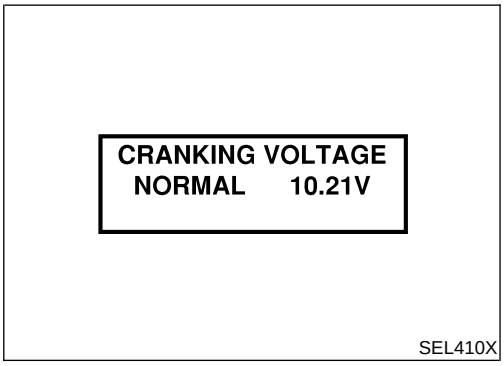
NOTE:
To ensure a complete and thorough diagnosis, the battery, starter and generator test segments must be done as a set from start to finish.



1. Turn off all loads on the vehicle electrical system.
2. Perform battery test with Battery/Starting/Charging system tester. Refer to “Trouble Diagnoses with Battery/Starting/Charging System Tester”, SC-7.
3. Press “ENTER” to begin the starting system test.



4. Start the engine.



5. Diagnosis result is displayed on the tester. Refer to “DIAGNOSTIC RESULT ITEM CHART”, SC-19.

NOTE:
- If the starter performs normally but the engine does not start, perform engine diagnosis.
- For intermittent “NO CRANK” or “NO STARTER OPERATION” incidents, refer to “DIAGNOSTIC PROCEDURE 2”, SC-23.

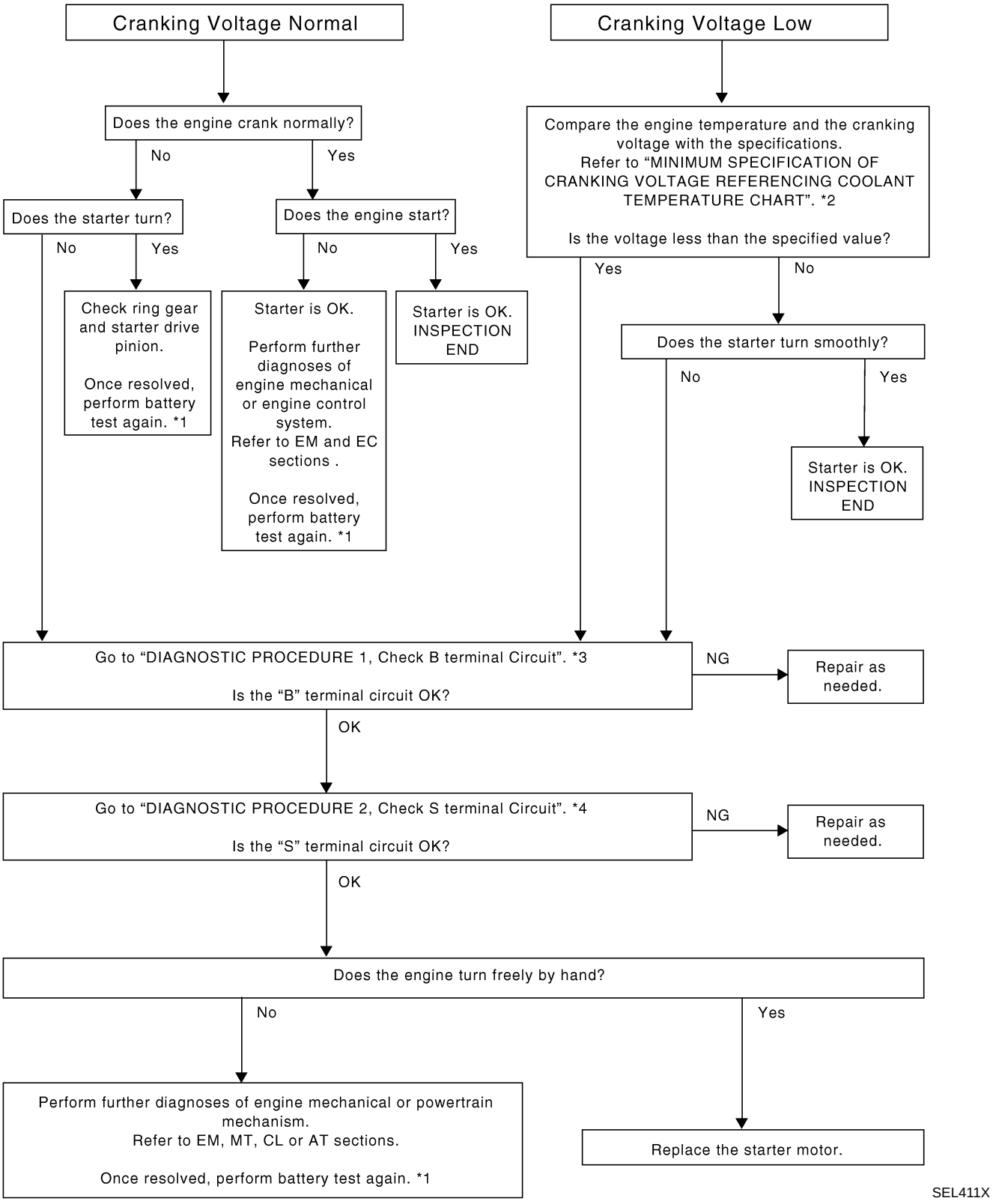
DIAGNOSTIC RESULT ITEM CHART

NESC0020S01

Diagnostic item	Service procedure
CRANKING VOLTAGE NORMAL	Go to "WORK FLOW", SC-20.
CRANKING VOLTAGE LOW	Go to "WORK FLOW", SC-20.
CHARGE BATTERY	Perform the slow battery charging procedure. (Initial rate of charge is 10A for 12 hours.) Perform battery test again with Battery/Starting/Charging system tester. Refer to "Trouble Diagnoses with Battery/Starting/Charging System Tester", SC-7.
REPLACE BATTERY	Before replacing battery, clean the battery cable clamps and battery posts. Perform battery test again with Battery/Starting/Charging system tester. Refer to "Trouble Diagnoses with Battery/Starting/Charging System Tester", SC-7. If second test result is "REPLACE BATTERY", then do so. Perform battery test again to confirm repair.

WORK FLOW

NESC0020S02



SEL411X

*1 SC-7 *3 SC-21 *4 SC-23
*2 SC-24

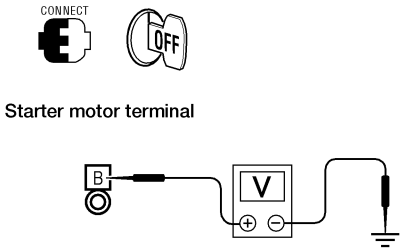
DIAGNOSTIC PROCEDURE 1
Check "B" Terminal Circuit

NESC0020S03

NESC0020S0301

1	CHECK POWER SUPPLY FOR STARTER MOTOR "B" TERMINAL

1. Remove the fuel pump fuse.
2. Crank or start the engine (where possible) until the fuel pressure is released.
3. Turn the ignition switch OFF.
4. Check that the starter motor terminal "B" [E210, (B/Y) for KA24DE models or E203, (B/L) for VG33E and VG33ER models] connection is clean and tight.
5. Check voltage between starter motor terminal "B" [E210, (B/Y) for KA24DE models or E203, (B/L) for VG33E and VG33ER models] and ground using a digital circuit tester.



Battery voltage should exist.

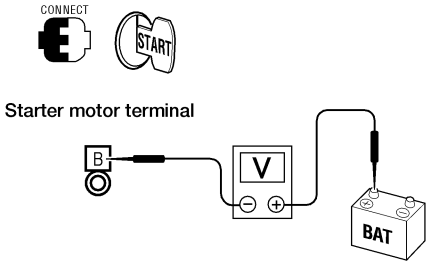
LSC037

OK or NG

OK	▶	GO TO 2.
NG	▶	Check harness between the battery and the starter motor for open circuit.

2	CHECK BATTERY CABLE CONNECTION QUALITY (VOLTAGE DROP TEST)

1. Check voltage between starter motor terminal "B" [E210, (B/Y) for KA24DE models or E203, (B/L) for VG33E and VG33ER models] and battery positive terminal using a digital circuit tester.



When the ignition switch is in START position,
Voltage: Less than 0.5V

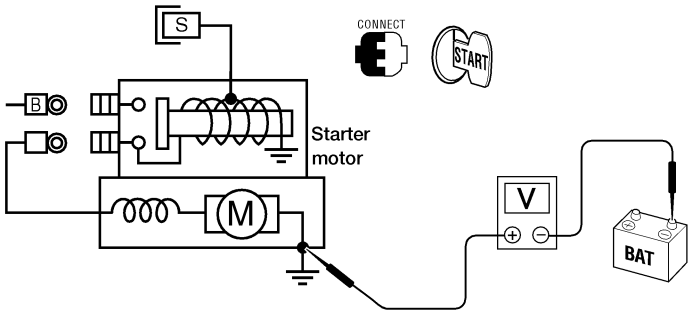
LSC038

OK or NG

OK	▶	GO TO 3.
NG	▶	Check harness between the battery and the starter motor for poor continuity.

3	CHECK STARTER MOTOR GROUND CIRCUIT (VOLTAGE DROP TEST)

1. Check voltage between starter motor case and battery negative terminal using a digital circuit tester.



When the ignition switch is in START position,
Voltage: Less than 0.2V

LSC039

OK or NG

OK	▶	Starter motor "B" terminal circuit is OK. Further inspection necessary. Refer to "WORK FLOW", SC-20.
NG	▶	Check the starter motor case and ground for poor continuity.

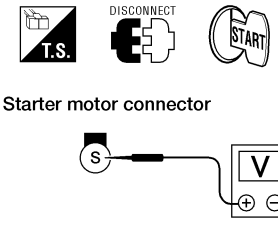
DIAGNOSTIC PROCEDURE 2
Check "S" Terminal Circuit

=NESC0020S04

NESC0020S0401

1	CHECK POWER SUPPLY FOR STARTER MOTOR "S" TERMINAL

1. Remove the fuel pump fuse.
2. Crank or start the engine (where possible) until the fuel pressure is released.
3. Turn the ignition OFF.
4. Disconnect starter motor terminal "S" [E209 (B/R) for KA24DE models or E202 (B/R) for VG33E and VG33ER models] connector.
5. Check voltage between starter motor terminal "S" [E209, (B/R) for KA24DE models or E202, (B/R) for VG33E and VG33ER models] and ground using a digital circuit tester.



When the ignition switch is in START position,
Battery voltage should exist.

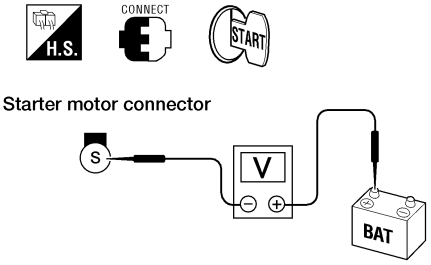
LSC040

OK or NG

OK	▶	GO TO 2.
NG	▶	**Check the following.** ● 40A fusible link (letter **e**, located in fuse and fusible link box) ● Clutch interlock relay (MT models) ● Park/neutral position relay (AT models) ● Harness for open or short

2	CHECK "S" TERMINAL CONNECTION QUALITY (VOLTAGE DROP TEST)

1. Connect starter motor terminal "S" [E209, (B/R) for KA24DE models or E202, (B/R) for VG33E and VG33ER models] connector.
2. Check voltage between starter motor terminal "S" [E209, (B/R) for KA24DE models or E202, (B/R) for VG33E and VG33ER models] and battery positive terminal using a digital tester.



When the ignition switch is in START position,
Voltage: Less than 1V

LSC041

OK or NG

OK	▶	Starter motor "S" terminal circuit is OK. Further inspection necessary. Refer to "WORK FLOW", SC-20.
NG	▶	Check harness between the battery and the starter motor "S" terminal for poor continuity.

MINIMUM SPECIFICATION OF CRANKING VOLTAGE REFERENCING COOLANT TEMPERATURE

NESC0020S05

Engine coolant temperature	Voltage V	
	KA24DE	VG33E and VG33ER
−30°C to −20°C (−22°F to −4°F)	8.0	8.6
−19°C to −10°C (−2°F to 14°F)	9.0	9.3
−9°C to 0°C (16°F to 32°F)	9.9	9.5
More than 1°C (More than 34°F)	10.2	10.2

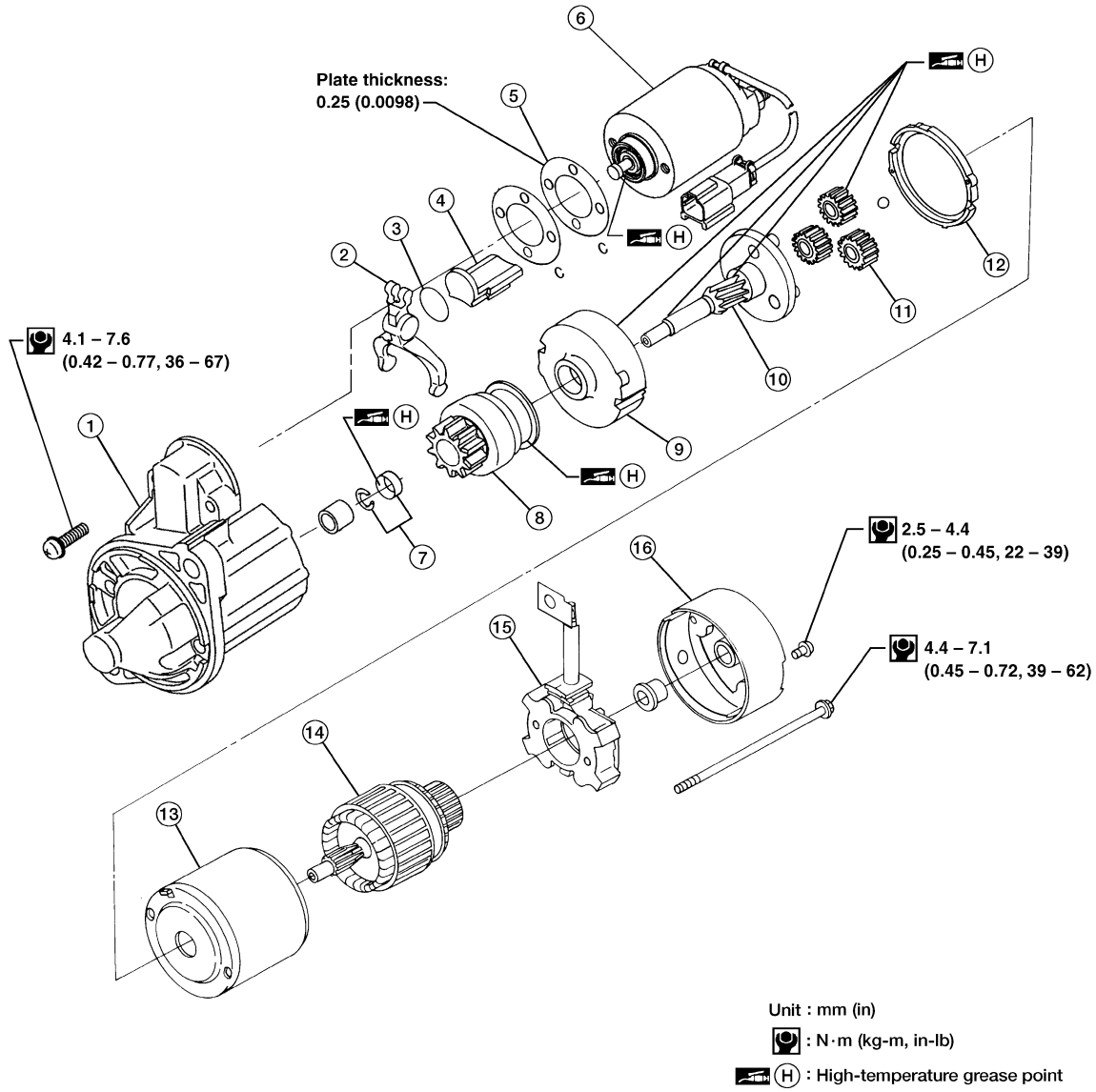
Construction

=NESC0006

KA24DE MODELS

NESC0006S03

SEC. 233
M000T87381ZC



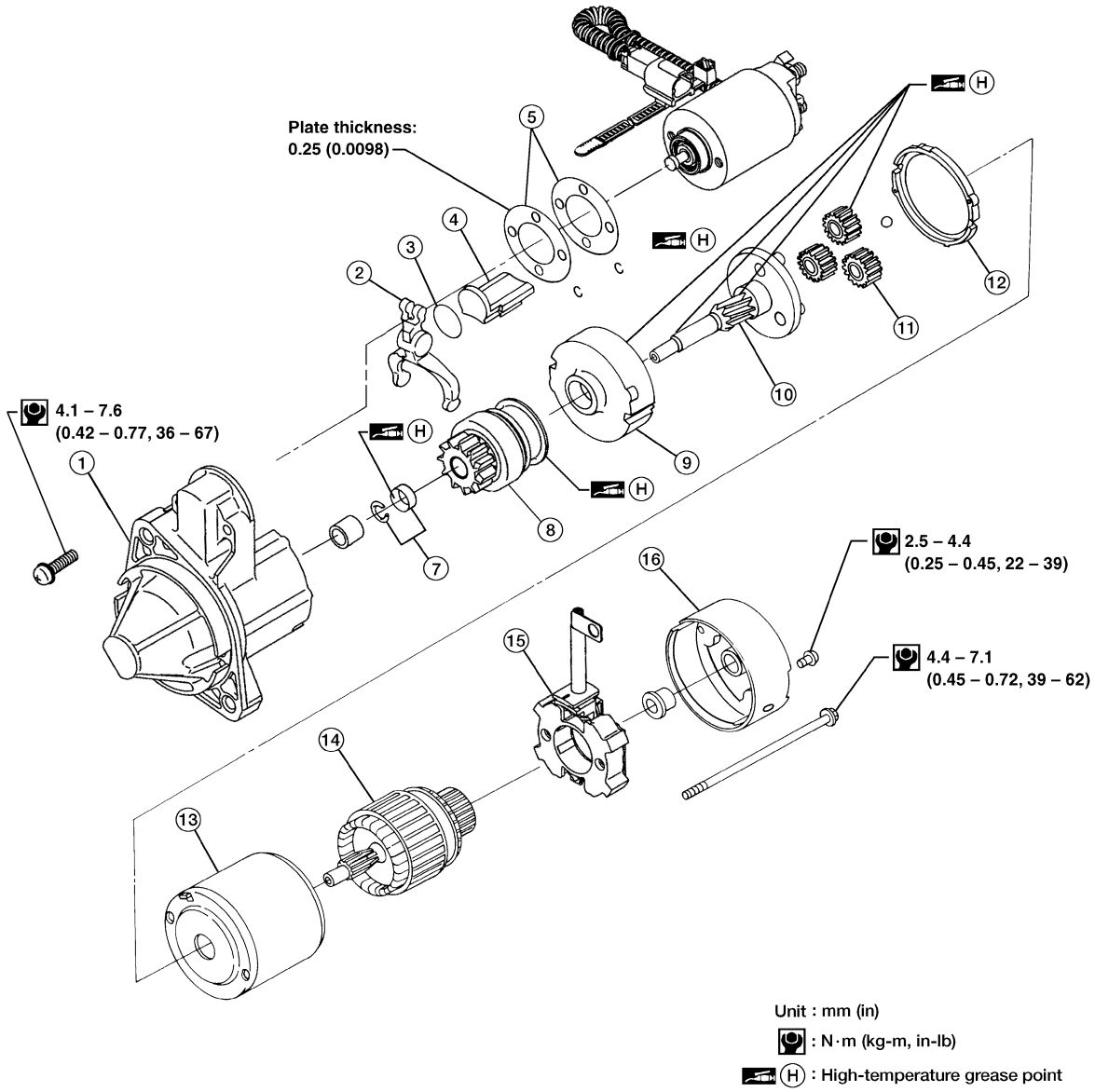
1. Gear case
2. Shift lever
3. Plate
4. Packing
5. Adjusting plate
6. Magnetic switch assembly
7. Pinion stopper set
8. Pinion assembly
9. Internal gear
10. Pinion shaft
11. Planetary gear
12. Packing
13. Yoke
14. Armature
15. Brush holder assembly
16. Rear cover

Construction (Cont'd)

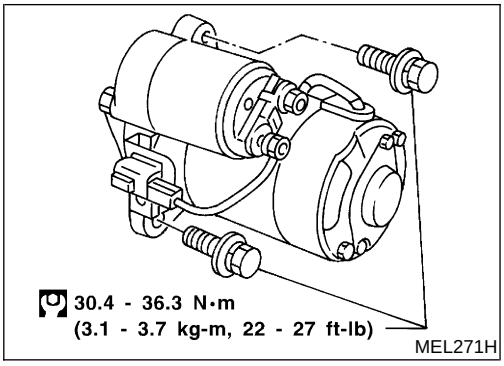
VG33E AND VG33ER MODELS

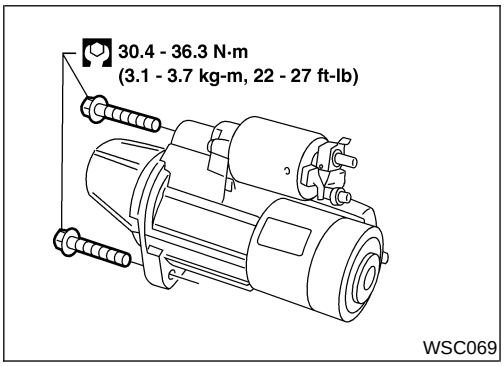
=NESC0006S02

SEC. 233
M000T87481ZC



1. Gear case
2. Shift lever
3. Plate
4. Packing
5. Adjusting plate
6. Magnetic switch assembly
7. Pinion stopper set
8. Pinion assembly
9. Internal gear
10. Pinion shaft
11. Planetary gear
12. Packing
13. Yoke
14. Armature
15. Brush holder assembly
16. Rear cover





Removal and Installation

NESC0007

KA24DE MODELS

NESC0007S03

Removal

NESC0007S0301

1. Remove engine under cover.
2. Remove two bolts and starter.

Installation

NESC0007S0302

To install, reverse the removal procedure.

VG33E AND VG33ER MODELS

NESC0007S02

Removal

NESC0007S0201

1. Remove engine under cover.
2. Remove two bolts and starter.

Installation

NESC0007S0202

To install, reverse the removal procedure.

Pinion/Clutch Check

NESC0008

1. Inspect pinion teeth.

- Replace pinion if teeth are worn or damaged. (Also check condition of ring gear teeth.)

2. Inspect reduction gear teeth.

- 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.

- If it locks or rotates in both directions, or unusual resistance is evident, replace.

System Description

NESC0009

The generator provides DC voltage to operate the vehicle's electrical system and to keep the battery charged. The voltage output is controlled by the IC regulator.
Power is supplied at all times to generator terminal S through:

- 80A fusible link [letter **a**, located in the fuse and fusible link box (with KA24DE engine)] or
- 100A fusible link [letter **a**, located in the fuse and fusible link box (with VG33E and VG33ER engine)] and
- 7.5A fuse (No. 36, located in the fuse and fusible link box).

Generator terminal B supplies power to charge the battery and operate the vehicle's electrical system. Output voltage is controlled by the IC regulator at generator terminal S detecting the input voltage. The charging circuit is protected by the 80A fusible link (with KA24DE engine) or the 100A fusible link (with VG33E and VG33ER engine).
Ground is supplied to generator terminal E through body ground E203 (with KA24DE engine) or body ground A1 (with VG33E and VG33ER engine).
With the ignition switch in the ON or START position, power is supplied

- through 10A fuse [No. 11, located in the fuse block (J/B)]
- to combination meter terminal 17 for the charge warning lamp.

Ground is supplied to combination meter terminal 43 through generator terminal L. With power and ground supplied, the charge warning lamp will illuminate. When the generator is providing sufficient voltage with the engine running, the ground is opened and the charge warning lamp will go off.
If the charge warning lamp illuminates with the engine running, a fault is indicated.

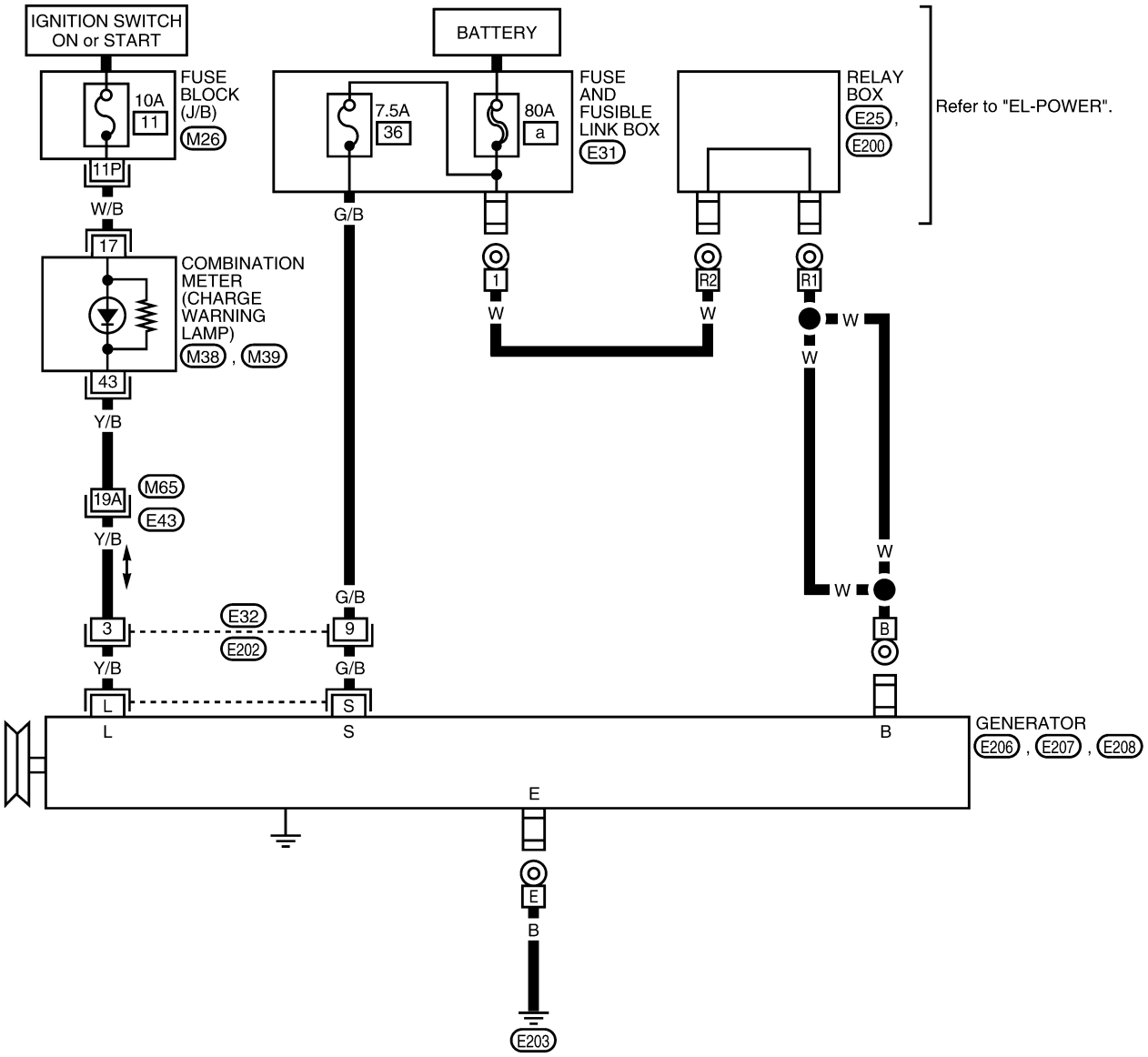
Wiring Diagram — CHARGE —

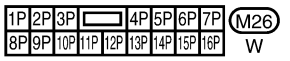
NESC0010

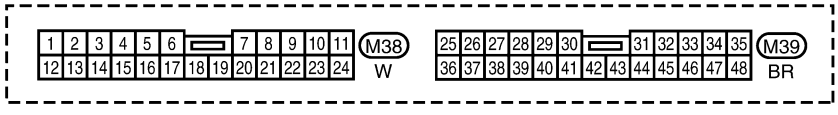
KA24DE MODELS

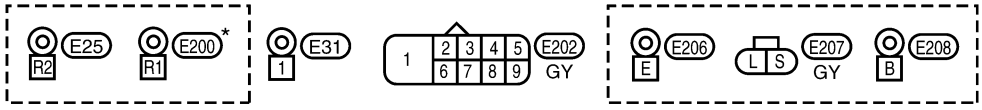
NESC0010S03

SC-CHARGE-01









★: This connector is not shown in "HARNESS LAYOUT" of EL section.

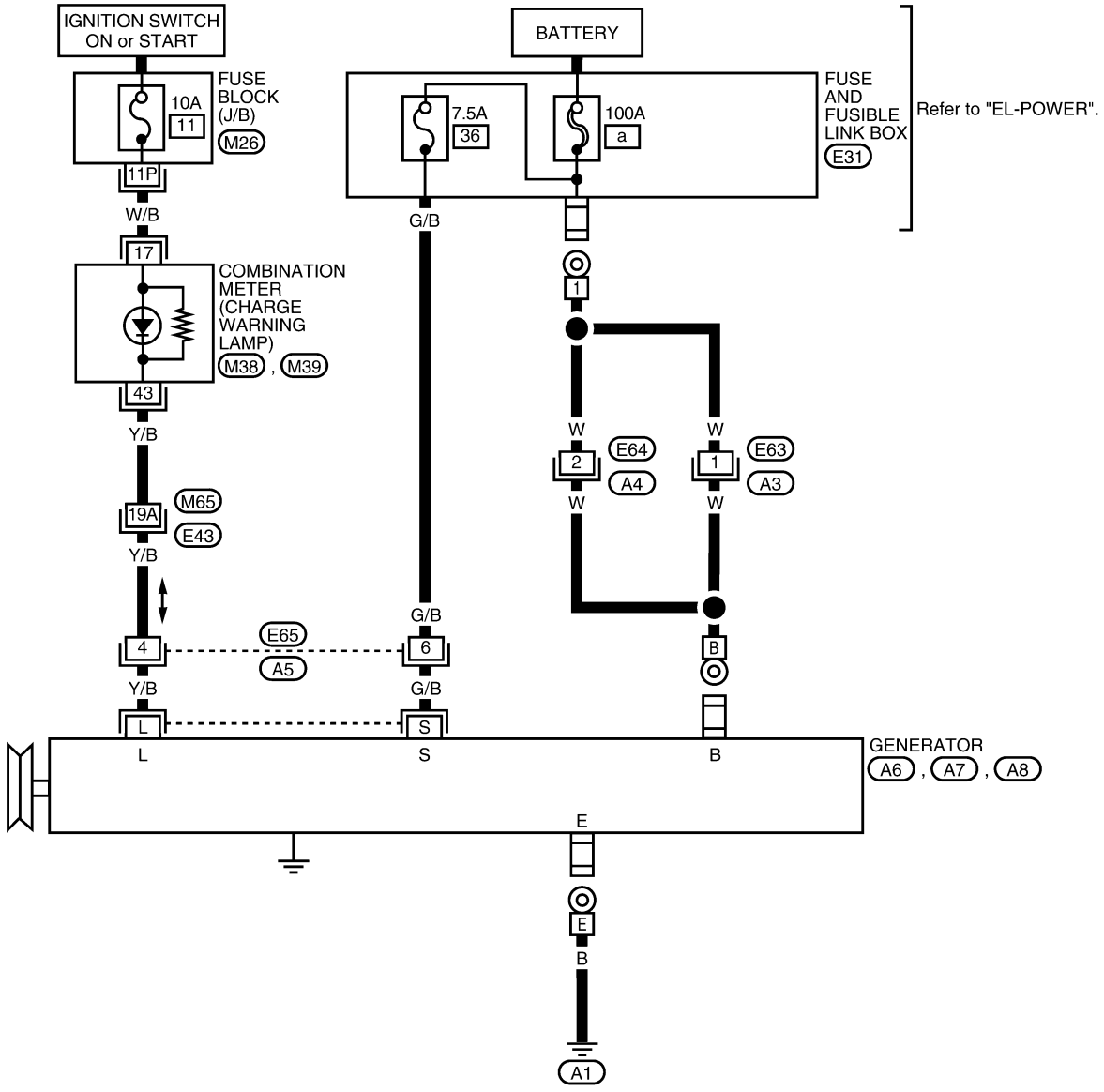
Refer to the following.
M65 , E43 - SUPER MULTIPLE JUNCTION (SMJ)

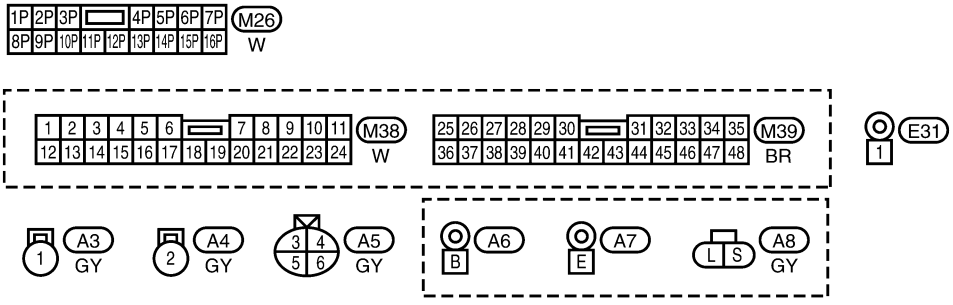
WSC056

VG33E AND VG33ER MODELS

NESC0010S02

SC-CHARGE-02





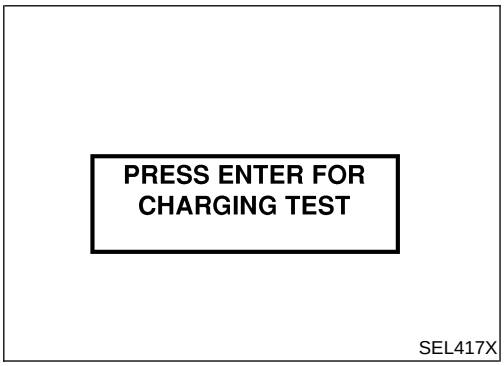
Refer to the following.
M65 , E43 - SUPER MULTIPLE JUNCTION (SMJ)

WSC057

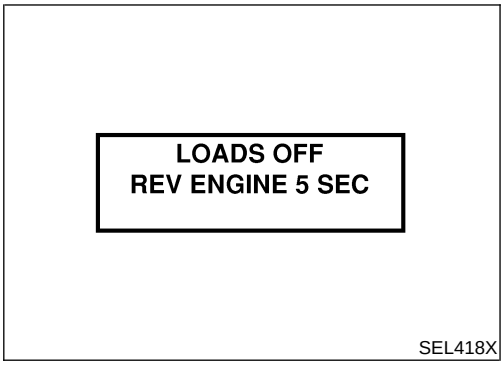
Trouble Diagnoses with Battery/Starting/Charging System Tester

NESC0021

NOTE:
To ensure a complete and thorough diagnosis, the battery, starter and generator test segments must be done as a set from start to finish.

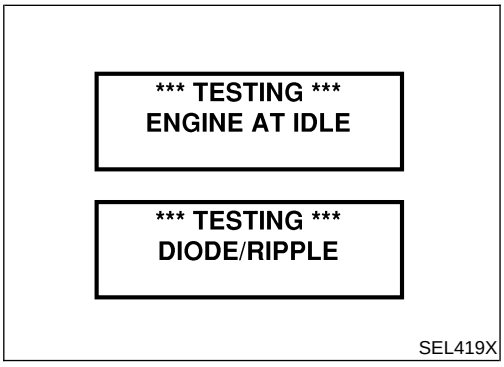


1. Turn off all loads on the vehicle electrical system.
2. Perform battery and starting system test with Battery/Starting/Charging system tester.
3. Press “ENTER” to begin the charging system test.
4. Start engine.



5. Press “ENTER” until “LOADS OFF REV ENGINE 5 SEC” is displayed.
6. Raise and hold the engine speed at 1,500 to 2,000 rpm for about 5 seconds, then return the engine to idle.
   Once the increase in engine rpm is detected, press “ENTER” to continue.

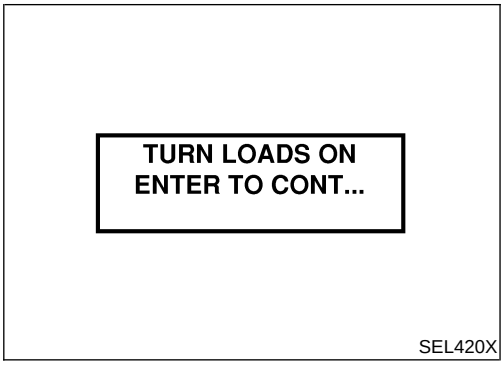
NOTE:
- If after 30 seconds an increase in engine idle speed is not detected, “RPM NOT DETECTED” will display.
- Some engines may have a higher idle initially after starting, particularly when the engine is cold. The tester may detect this without any other action being taken. If this occurs, continue on with the testing process. The final results will not be affected.



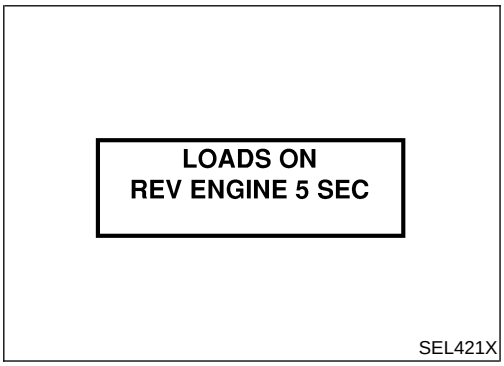
7. The tester now checks the engine at idle and performs the DIODE/RIPPLE check.
8. When complete, the tester will prompt you to turn on the following electrical loads.

- Heater fan set to highest speed. Do not run the A/C or windshield defroster.
- Headlamp high beam
- Rear window defogger

NOTE:
Do not run the windshield wipers or any other cyclical loads.

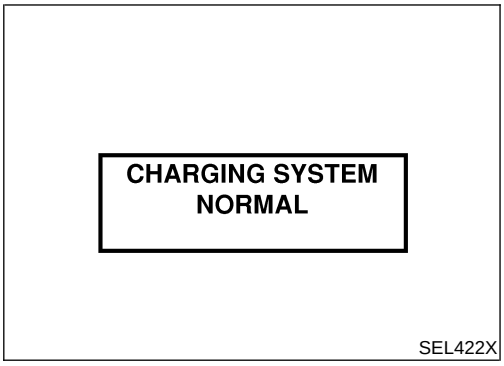


9. Press "ENTER" to continue.

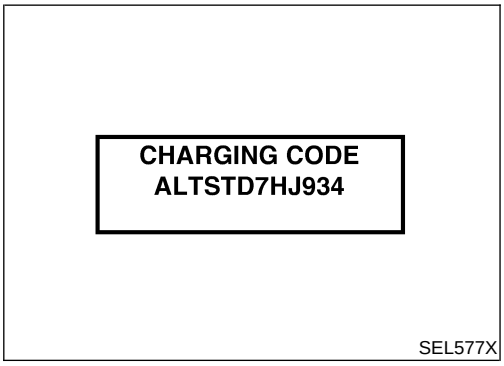


10. Raise and hold the engine speed at 1,500 to 2,000 rpm for about 5 seconds, then return the engine to idle. Once the increase in engine rpm is detected, press "ENTER" to continue.

NOTE:
If after 30 seconds an increase in engine idle speed is not detected, "RPM NOT DETECTED" will be displayed. Press "ENTER" to restart the test.



11. Diagnostic result is displayed on the tester. Refer to "DIAGNOSTIC RESULT ITEM CHART", SC-33.



12. Press "ENTER" then test output code is displayed. Record the test output code on the repair order.
13. Toggle back to the "DIAGNOSTIC SCREEN" for test results.

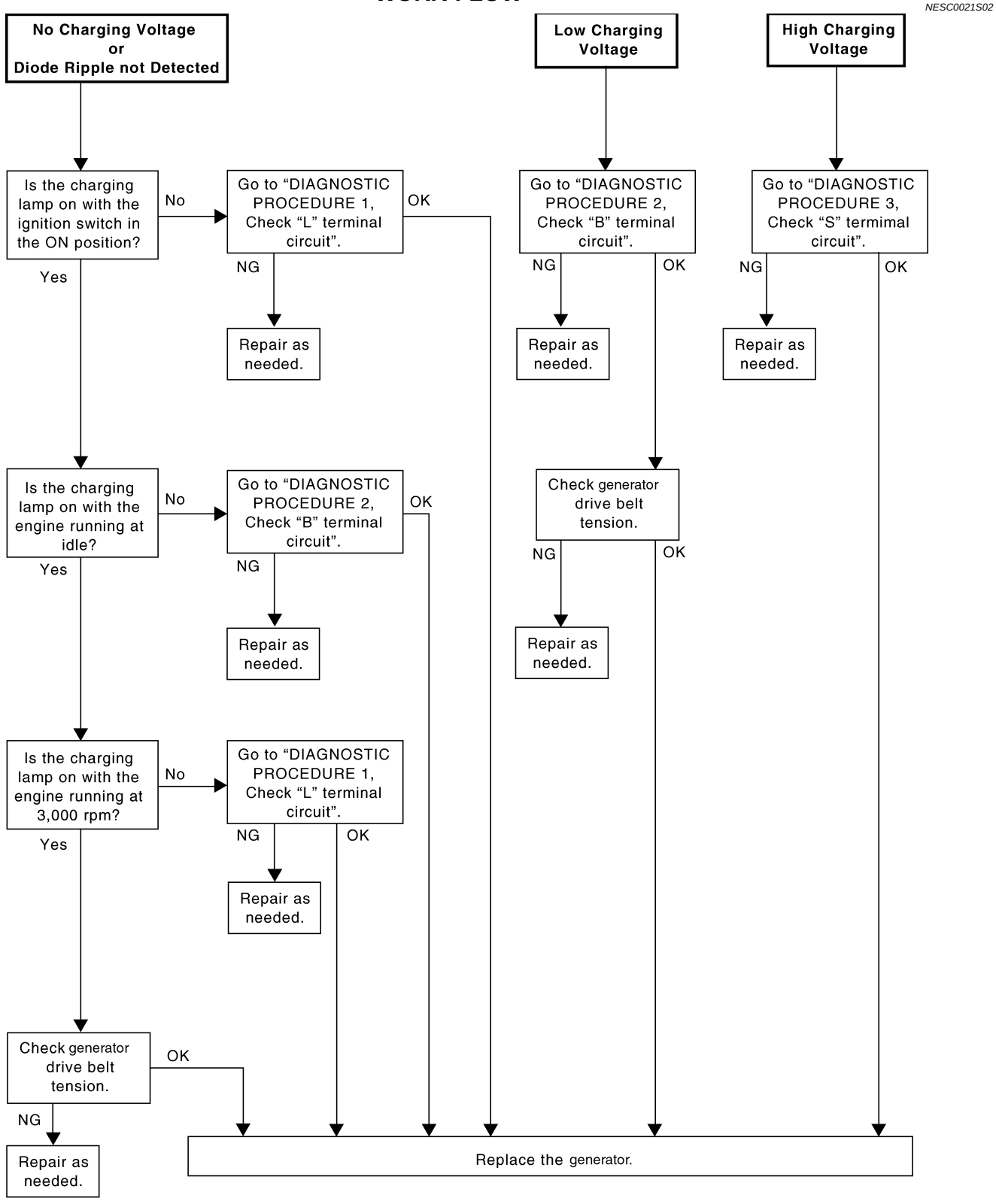
DIAGNOSTIC RESULT ITEM CHART

NESC0021S01

Diagnostic item	Service procedure
CHARGING SYSTEM NORMAL	Charging system is normal and will also show DIODE RIPPLE test result.
NO CHARGING VOLTAGE	Go to "WORK FLOW", SC-34.
LOW CHARGING VOLTAGE	Go to "WORK FLOW", SC-34.
HIGH CHARGING VOLTAGE	Go to "WORK FLOW", SC-34.
DIODE RIPPLE NORMAL	Diode ripple is OK and will also show CHARGING VOLTAGE test result.
EXCESS RIPPLE DETECTED	Replace the generator. Perform "DIODE RIPPLE" test again using Battery/Starting/ Charging system tester to confirm repair.
DIODE RIPPLE NOT DETECTED	Go to "WORK FLOW", SC-34.

WORK FLOW

NESC0021S02



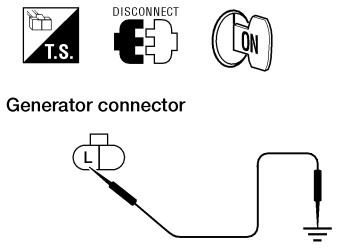
LSC047

DIAGNOSTIC PROCEDURE 1
Check "L" Terminal Circuit

NESC0021S03

NESC0021S0301

1	CHECK "L" TERMINAL CONNECTION	
Check to see if "L" terminal is clean and tight. **OK or NG**		
OK	▶	GO TO 2.
NG	▶	Repair "L" terminal connection. Confirm repair by performing complete Battery/Starting/Charging system test.

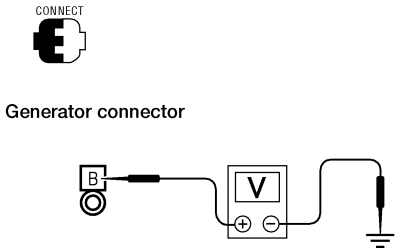
2	CHECK "L" TERMINAL CIRCUIT	
1. Disconnect E207 for KA24DE models or A8 for VG33E and VG33ER models connector from generator. 2. Apply ground to terminal "L" [E207, (Y/B) for KA24DE models or A8, (Y/B) for VG33E and VG33ER models] with the ignition switch in the ON position.  **CHARGE lamp should light up.** LSC042 **OK or NG**		
OK	▶	Replace the generator. Confirm repair by performing complete Battery/Starting/Charging system test.
NG	▶	**Check the following.** ● 10A fuse [No. 11, located in fuse block (J/B)] ● CHARGE lamp ● Harness for open or short between combination meter and fuse ● Harness for open or short between combination meter and generator

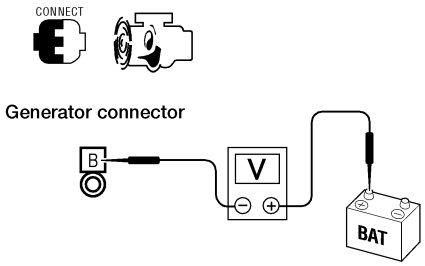
DIAGNOSTIC PROCEDURE 2
Check "B" Terminal Circuit

=NESC0021S04

NESC0021S0401

1	CHECK "B" TERMINAL CONNECTION	
Check to see if "B" terminal is clean and tight.		
OK or NG		
OK	▶	GO TO 2. Confirm repair by performing complete Battery/Starting/Charging system test.
NG	▶	Repair "B" terminal connection.

2	CHECK GENERATOR "B" TERMINAL CIRCUIT	
Check voltage between generator terminal "B" [E208, (W) for the KA24DE models or A6, (W) for VG33E and VG33ER models] and ground using a digital circuit tester.		
 LSC043		**Battery voltage should exist.**
OK or NG		
OK	▶	GO TO 3.
NG	▶	**Check the following.** ● 80A fusible link (letter **a**, located in fuse and fusible link box) for KA24DE models ● 100A fusible link (letter **a**, located in fuse and fusible link box) for VG33E and VG33ER models ● Harness for open or short between generator and fusible link

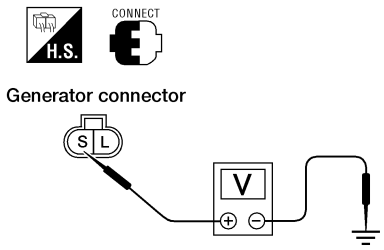
3	CHECK "B" TERMINAL CONNECTION QUALITY (VOLTAGE DROP TEST)	
Check voltage between generator terminal "B" [E208, (W) for the KA24DE models or A6, (W) for VG33E and VG33ER models] and battery positive terminal using a digital tester.		
 LSC044		With the engine running at idle and warm, **Voltage: Less than 0.2V**
OK or NG		
OK	▶	Replace the generator. Confirm repair by performing complete Battery/Starting/Charging system test.
NG	▶	Check harness between the battery and the generator for poor continuity.

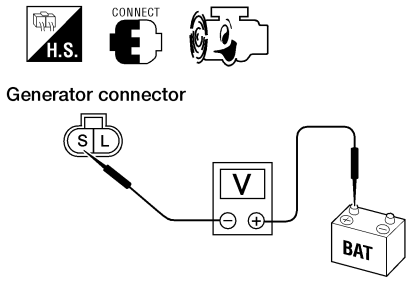
DIAGNOSTIC PROCEDURE 3
Check "S" Terminal Circuit

=NESC0021S05

NESC0021S0501

1	CHECK "S" TERMINAL CONNECTION	
Check to see if "S" terminal is clean and tight.		
OK or NG		
OK	▶	GO TO 2.
NG	▶	Repair "S" terminal connection. Confirm repair by performing complete Battery/Starting/Charging system test.

2	CHECK GENERATOR "S" TERMINAL CIRCUIT	
Check voltage between generator terminal "S" [E207, (G/B) for KA24DE models or A8, (G/B) for VG33E and VG33ER models] and ground using a digital circuit tester.		
 LSC045		**Battery voltage should exist.**
OK or NG		
OK	▶	GO TO 3.
NG	▶	**Check the following.** ● 7.5A fuse (No. 36, located in fuse and fusible link box) ● Harness for open or short between generator and fuse

3	CHECK "S" TERMINAL CONNECTION QUALITY (VOLTAGE DROP TEST)	
Check voltage between generator terminal "S" [E207, (G/B) for KA24DE models or A8, (G/B) for VG33E and VG33ER models] and battery positive terminal using a digital tester.		
 LSC046		With the engine running at idle and warm, **Voltage: Less than 0.2V**
OK or NG		
OK	▶	Replace the generator. Confirm repair by performing complete Battery/Starting/Charging system test.
NG	▶	Check harness between the battery and the generator for poor continuity.

MALFUNCTION INDICATOR

=NESC0021S06

The IC regulator warning function activates to illuminate "CHARGE" warning lamp, if any of the following symptoms occur while generator is operating:

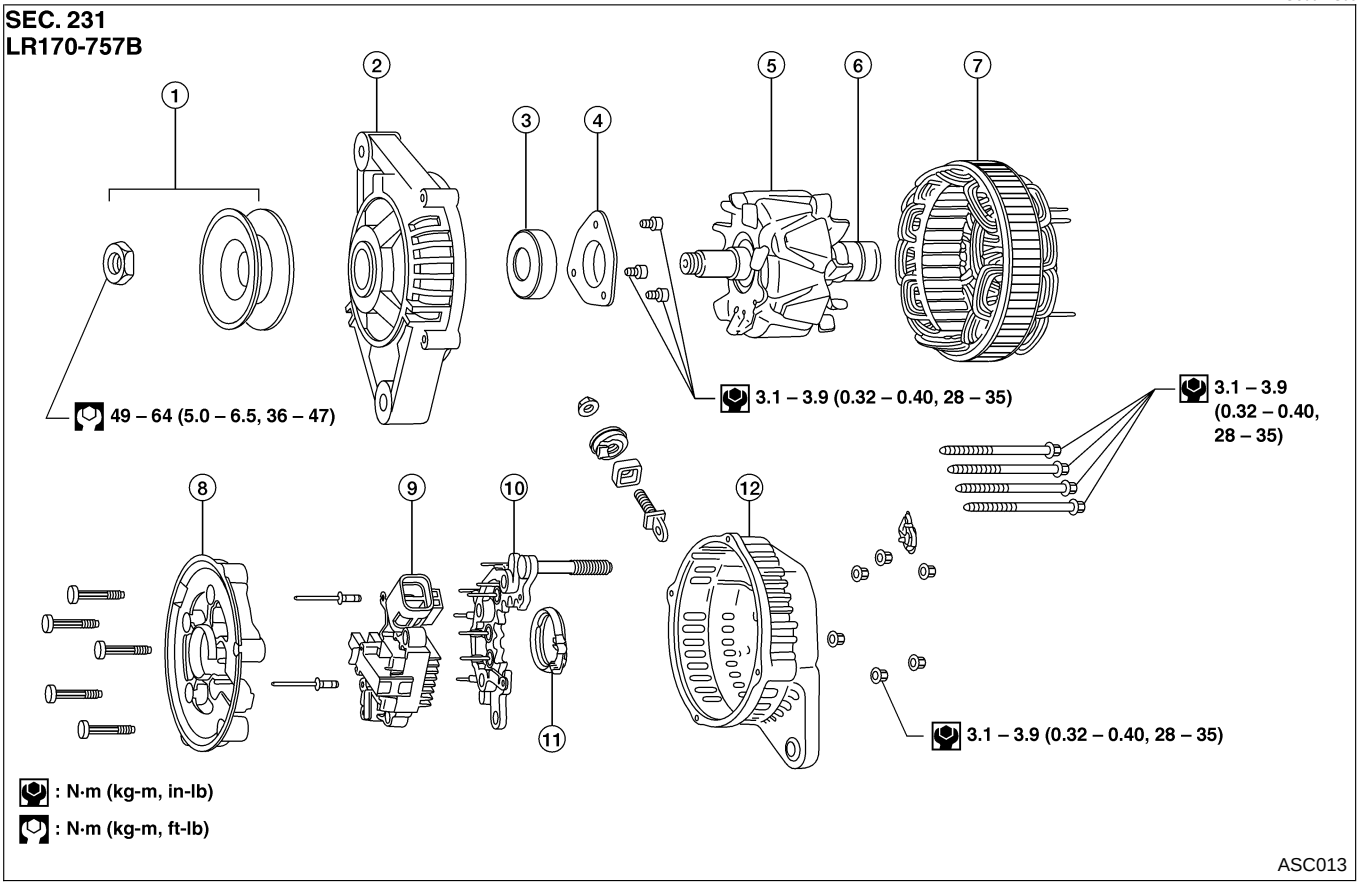
- Excessive voltage is produced.
- No voltage is produced.

Construction

NESC0012

KA24DE MODELS

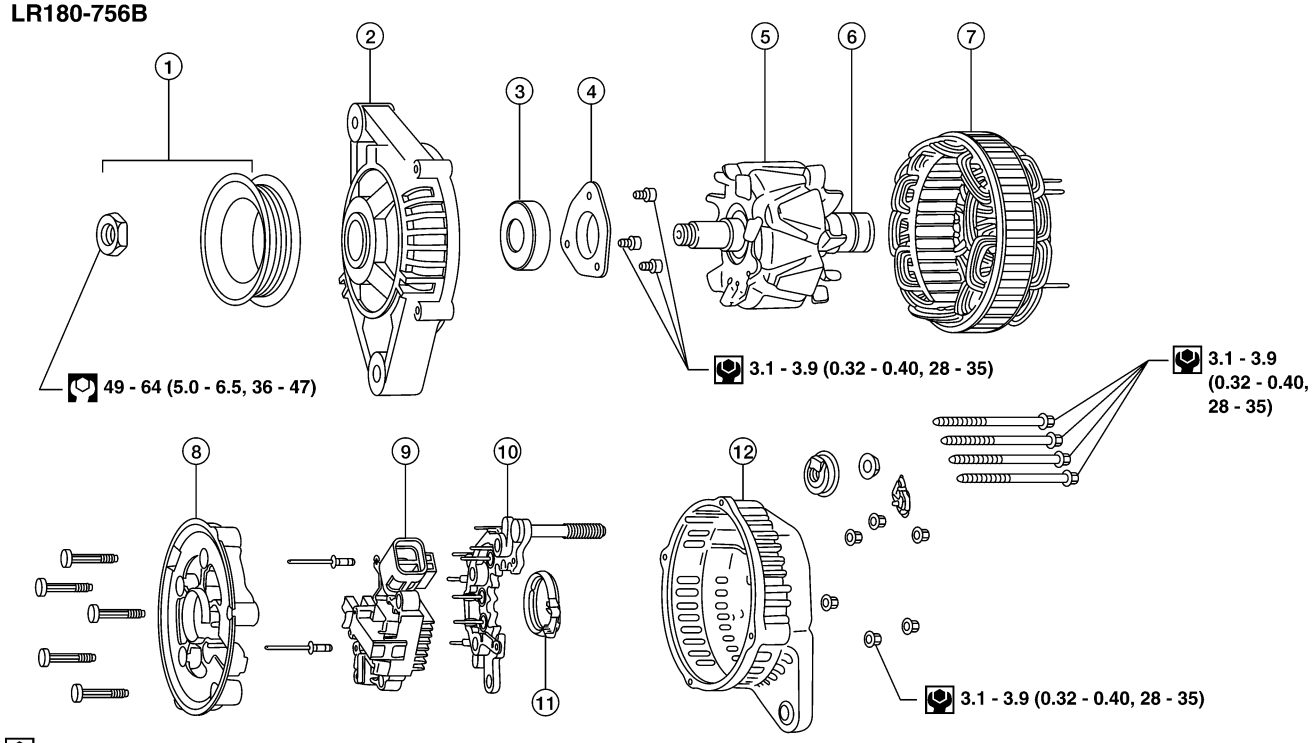
NESC0012S03



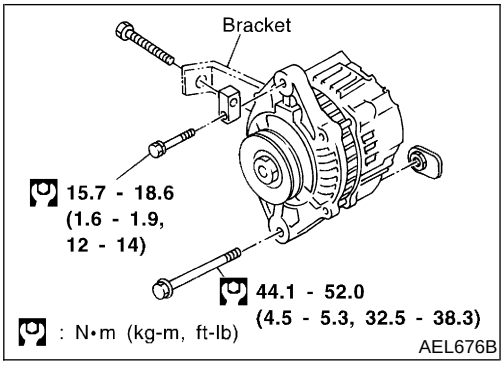
1. Pulley assembly
2. Front cover
3. Front bearing
4. Retainer
5. Rotor
6. Slip ring
7. Stator
8. Fan guide
9. IC regulator assembly
10. Diode assembly
11. Packing
12. Rear cover

VG33E AND VG33ER MODELS

NESC0012S02



1. Pulley assembly
2. Front cover
3. Front bearing
4. Retainer
5. Rotor
6. Slip ring
7. Stator
8. Fan guide
9. IC regulator assembly
10. Diode assembly
11. Packing
12. Rear cover



Removal and Installation

=NESC0013

KA24DE MODELS

NESC0013S03

Removal

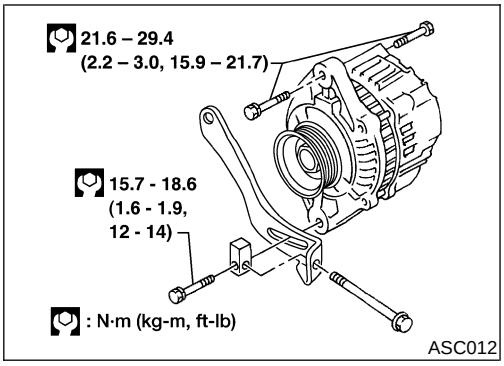
NESC0013S0301

1. Remove engine undercover.
2. Remove RH side splash shield.
3. Disconnect harness connectors.
4. Loosen adjustment bolt, remove belt.
5. Remove two generator bolts and generator.

Installation

NESC0013S0302

To install, reverse the removal procedure.



VG33E AND VG33ER MODELS

NESC0013S02

Removal

NESC0013S0201

1. Disconnect harness connectors.
2. Remove engine undercover.
3. Loosen adjustment bolt, remove belt.
4. Remove 3 generator bolts and generator.

Installation

NESC0013S0202

To install, reverse the removal procedure.

Battery

NESC0014

Applied area	USA	Canada
Type	55D23R	65D26R
Capacity V-AH	12-60	12-65
Cold cranking current A (For reference value)	356	413

Starter

NESC0015

Engine		KA24DE	VG33E and VG33ER
Type		M000T87381ZC	M000T87481ZC
		MITSUBISHI make	
		Reduction gear type	
System voltage		12 V	
No-load	Terminal voltage	11.0 V	
	Current	Less than 90 A	
	Revolution	More than 2,500 rpm	
Minimum diameter of commutator		28.8 mm (1.134 in)	
Minimum length of brush		7.0 mm (0.276 in)	
Brush spring tension		5.8 - 21.6 N (0.59 - 2.20 kg, 1.30 - 4.86 lb)	
Clearance of bearing metal and armature shaft		Less than 0.2 mm (0.008 in)	
Clearance between pinion front edge and pinion stopper		0.5 - 2.0 mm (0.02 - 0.079 in)	

Generator

NESC0016

Engine	KA24DE	VG33E and VG33ER
Type	LR170-757B	LR180-756B
	HITACHI make	
Nominal rating	12 V-70 A	12 V-80 A
Ground polarity	Negative	
Minimum revolution under no-load (When 13.5 volts are applied)	Less than 1,000 rpm	
Hot output current (When 13.5 volts are applied)	More than 17 A/1,300 rpm More than 54 A/2,500 rpm More than 72 A/5,000 rpm	More than 23 A/1,300 rpm More than 65 A/2,500 rpm More than 77 A/5,000 rpm
Regulated output voltage	14.1 - 14.7 V	
Minimum length of brush	6.0 mm (0.236 in)	
Brush spring pressure	1.000 - 2.452 N (102 - 250 g, 3.60 - 8.82 oz)	
Slip ring minimum outer diameter	26.0 mm (1.024 in)	
Rotor (Field coil) resistance	2.6 Ω	2.7 Ω

NOTES