SECTION SC
STARTING & CHARGING SYSTEM

CONTENTS

PRECAUTIONS

PFP:00001

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

EKS00FTC

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 which 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.**

Precautions for Power Generation Variable Voltage Control System

EKS00FTD

CAUTION:

For this model, the battery current sensor that is installed to the negative battery cable measures the charging/discharging current of the battery and performs various engine controls. If an electrical component is connected directly to the negative battery terminal, the current flowing through that component will not be measured by the battery current sensor. This condition may cause a malfunction of the engine control system and battery discharge may occur. Do not connect an electrical component or ground wire directly to the battery terminal.

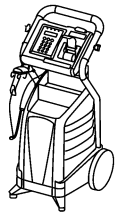
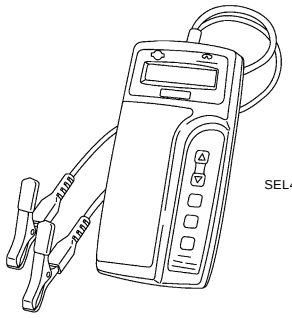
PREPARATION

PFP:00002

Special Service Tools

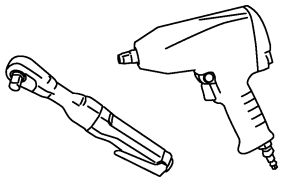
EKS00FTF

The actual shapes of Kent-Moore tools may differ from those of special service tools illustrated here.

Tool number (Kent-Moore No.) Tool name	Description
(J-48087) Battery Service Center  WKIA5280E	Tests battery. For operating instructions, refer to Technical Service Bulletin and Battery Service Center User Guide.
(J-44373) Model 620 Starting/Charging System Tester  SEL403X	Tests starting and charging systems. For operating instructions, refer to Technical Service Bulletin.

Commercial Service Tools

EKS00FTG

Tool number Tool name	Description
Power tool  PBIC0190E	Loosening bolts and nuts

BATTERY

PFP:AYBGL

How to Handle Battery

EKS00FTH

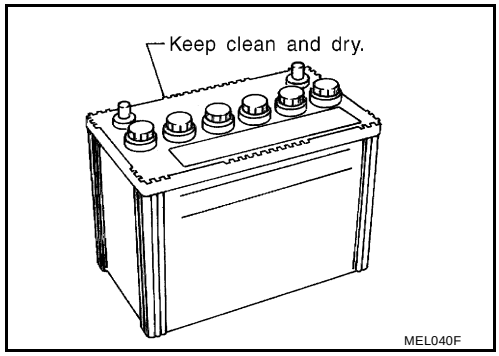
CAUTION:

- **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.**

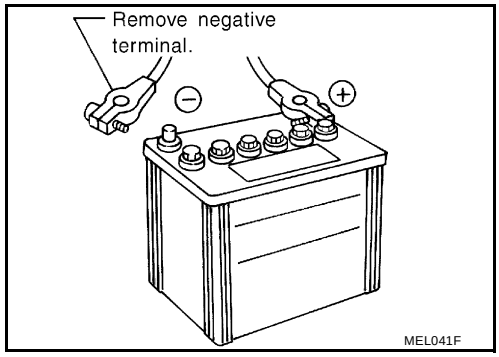
METHODS OF PREVENTING OVER-DISCHARGE

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

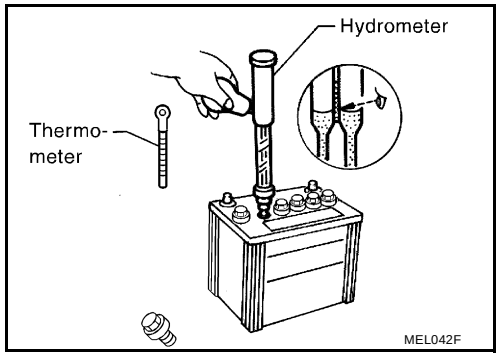
- The battery surface (particularly its top) should always be kept clean and dry.
- The terminal connections should be clean and tight.
- At every routine maintenance, check the electrolyte level.
  This also applies to batteries designated as “low maintenance” and “maintenance-free”.



- When the vehicle is not going to be used over a long period of time, disconnect the negative battery terminal.



- 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.

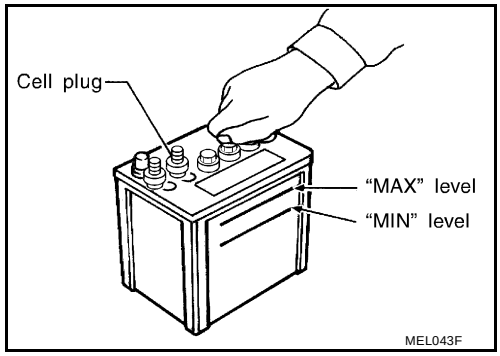


CHECKING ELECTROLYTE LEVEL

WARNING:

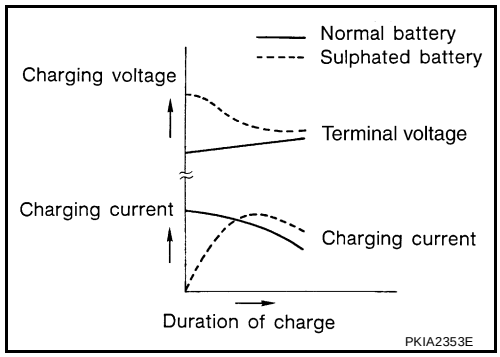
Do not allow battery fluid to come in contact with skin, eyes, fabrics, or painted surfaces. After touching a battery, do not touch or rub your eyes until you have thoroughly washed your hands. If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.

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



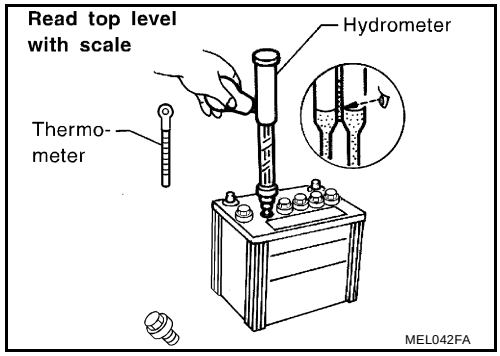
Sulfation

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 sulfation of the cell plates.
To determine if a battery has been sulfated, 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 sulfated batteries.
A sulfated 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

1. Read hydrometer and thermometer indications at eye level.
2. Use the following chart to correct your hydrometer reading according to electrolyte temperature.



Hydrometer Temperature Correction

Battery electrolyte temperature °C (°F)	Add to specific gravity reading
71 (160)	0.032
66 (150)	0.028
60 (140)	0.024
54 (130)	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 (40)	–0.016
–1 (30)	–0.020
–7 (20)	–0.024

Battery electrolyte temperature °C (°F)	Add to specific gravity reading
–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

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 55°C (131°F), stop charging. Always charge battery at a temperature below 55°C (131°F).**

Charging Rates

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 0.050, the battery should be replaced.

Trouble Diagnoses with Battery Service Center

EKS00FTI

For battery testing, use Battery Service Center (J-48087). For details and operating instructions, refer to Technical Service Bulletin and/or Battery Service Center User Guide.

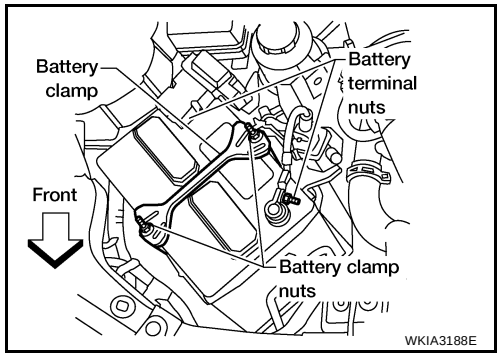
Removal and Installation

EKS00FTJ

REMOVAL

1. Disconnect both negative and positive battery terminal.

   CAUTION:
   Remove negative battery terminal first.
2. Remove battery clamp nuts and battery clamp.
3. Remove battery.



INSTALLATION

Installation is in the reverse order of removal.

CAUTION:
Install positive battery terminal first.

Battery clamp bolt	**: 3.4 N·m (0.35 kg-m, 30 in-lb)**
Battery terminal nut	**: 3.4 N·m (0.35 kg-m, 30 in-lb)**

STARTING SYSTEM

PFP:23300

System Description

EKS00FTK

Power is supplied at all times:

- to starter motor terminal 2 and
- through 40A fusible link (letter **j** , located in the fuse and fusible link box)
- to ignition switch terminal B.

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

- from ignition switch terminal ST
- to IPDM E/R terminal 21.

With the ignition switch in the ON or START position, power is supplied to IPDM E/R (intelligent power distribution module engine room) CPU.
With the selector lever in the P or N position, power is supplied:

- through A/T assembly terminal 9
- to IPDM E/R terminal 48.

Ground is supplied at all times:

- to IPDM E/R terminals 38 and 59
- from body grounds E9, E15 and E24.

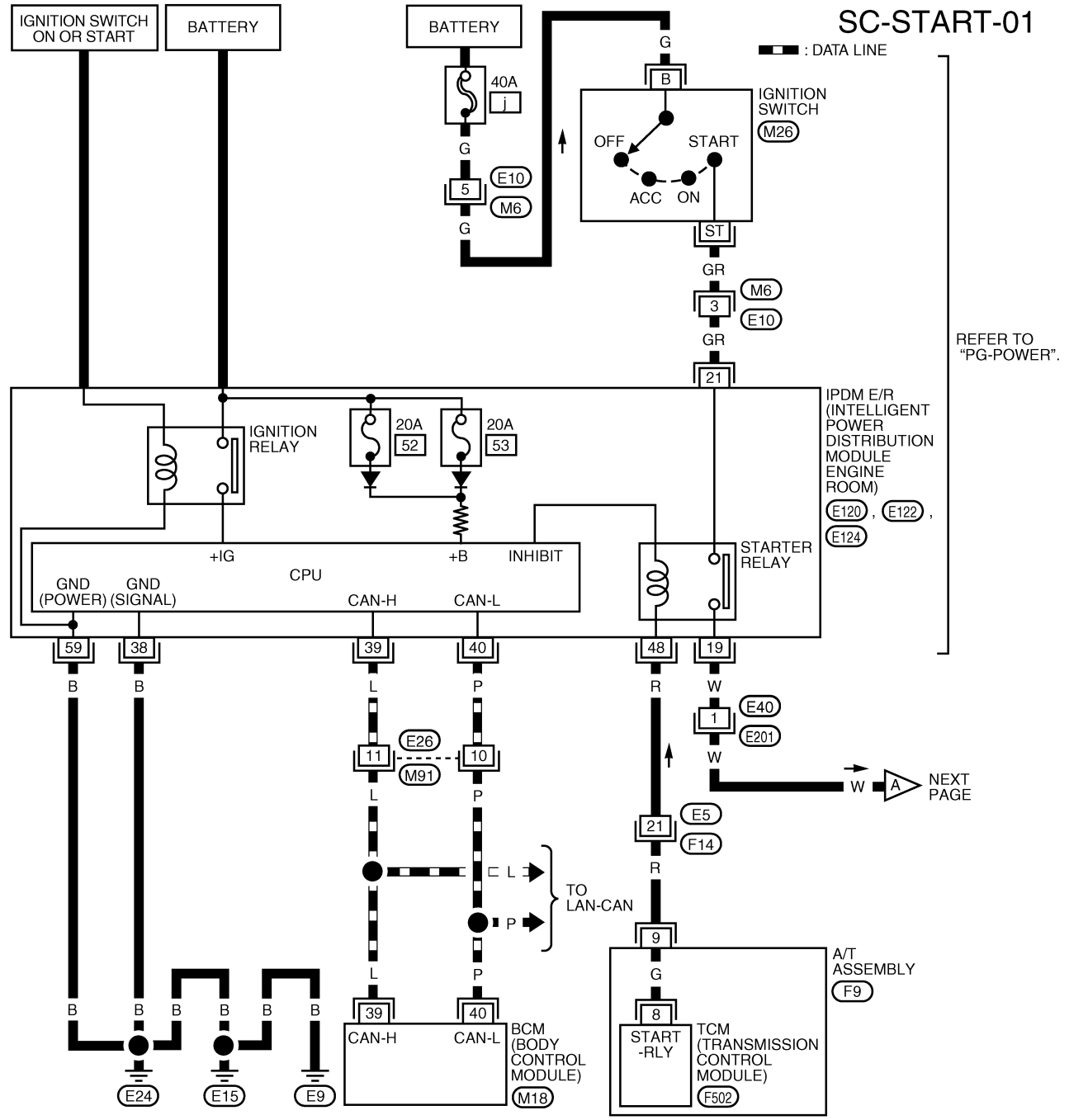
Provided that the IPDM E/R receives a starter relay request ON signal from the BCM over the CAN lines, the IPDM E/R grounds the starter relay and power is supplied:

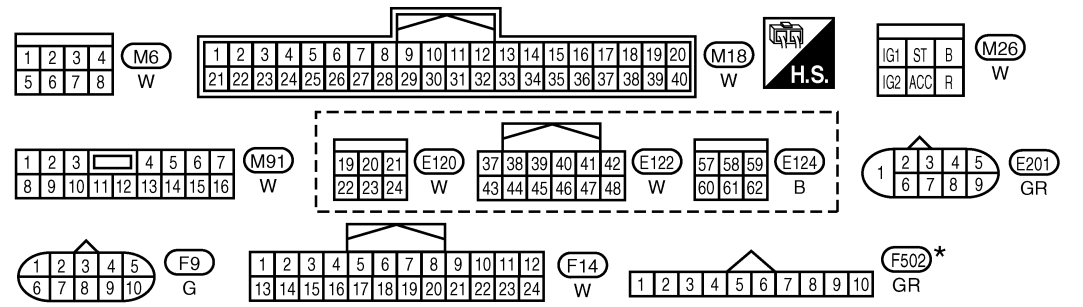
- from terminal 19 of the IPDM E/R
- to terminal 1 of the starter motor.

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.

Wiring Diagram — START —

EKS00FTL

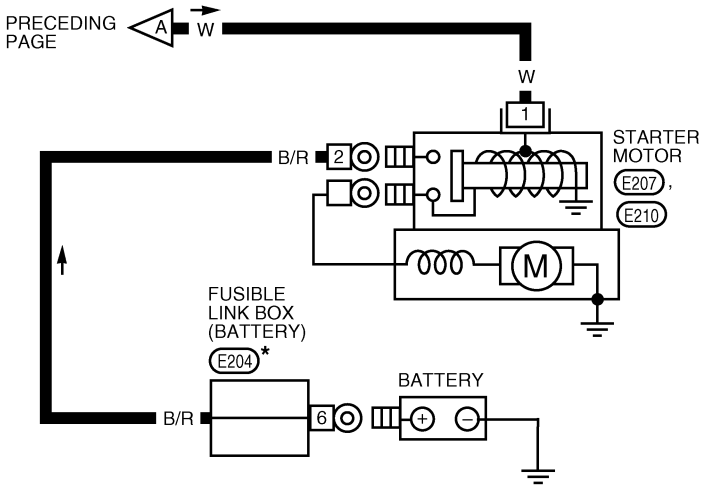


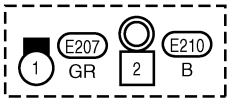


*: THIS CONNECTOR IS NOT SHOWN IN "HARNESS LAYOUT" OF PG SECTION.

WKWA4635E

SC-START-02





*: E204 IS AN INTEGRAL PART OF FUSIBLE LINK BOX (BATTERY) ASSEMBLY.

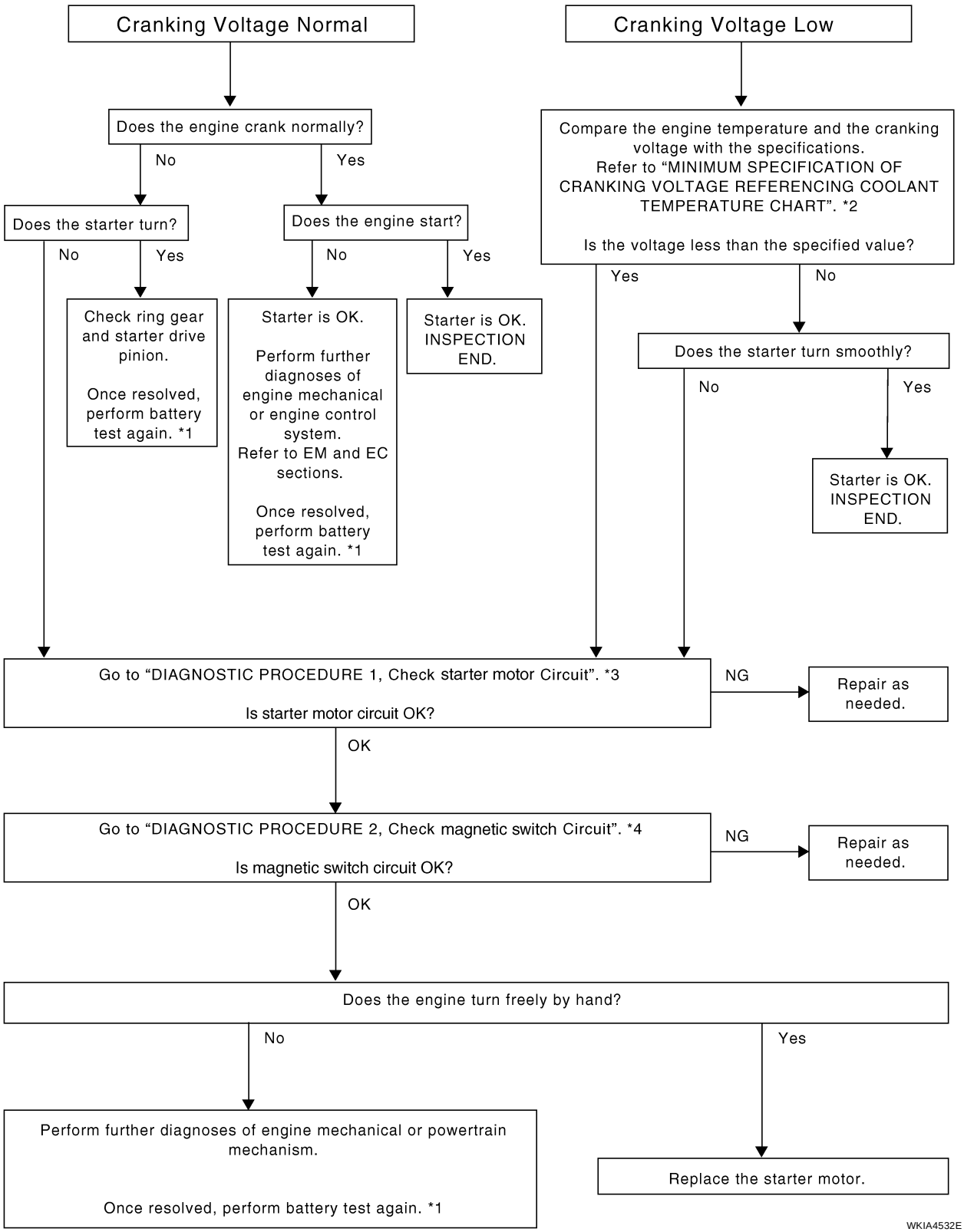
WKWA4588E

Trouble Diagnoses with Starting/Charging System Tester (Starting)

EKS00FTM

For starting system testing, use Starting/Charging System Tester (J-44373). For details and operating instructions, refer to Technical Service Bulletin.

WORK FLOW



*1 For battery testing, use Battery Service Center (J-48087).
For details and operating instructions, refer to Technical Service Bulletin and/or Battery Service Center User Guide.

*2 SC-13, "Check Starter Motor Circuit"

*3 SC-14, "DIAGNOSTIC PROCEDURE 2"

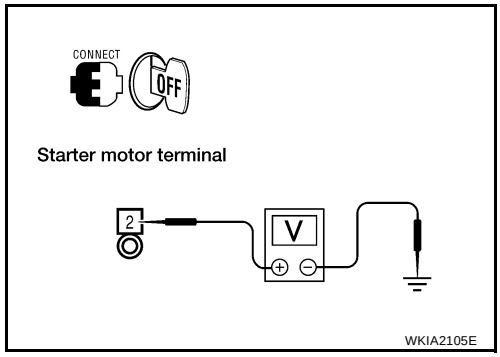
*4 SC-14, "Check Magnetic Switch Circuit"

DIAGNOSTIC PROCEDURE 1
Check Starter Motor Circuit

1. CHECK POWER SUPPLY TO STARTER MOTOR

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 connector F27 connection is clean and tight.
5. Check voltage between starter motor connector F27 terminal 2 and ground using a digital circuit tester.

Battery voltage should exist.



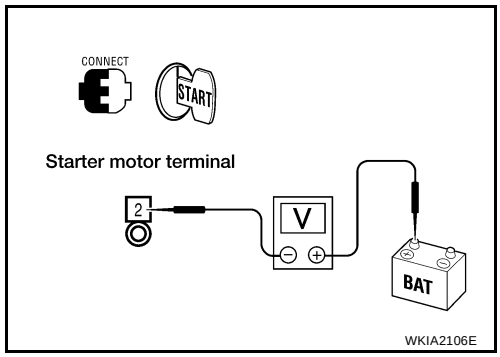
OK or NG

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

2. CHECK VOLTAGE DROP ON STARTER MOTOR CIRCUIT

Check voltage between starter motor connector F27 terminal 2 and battery positive terminal using a digital circuit tester.

Ignition switch in START. : Less than 0.5V



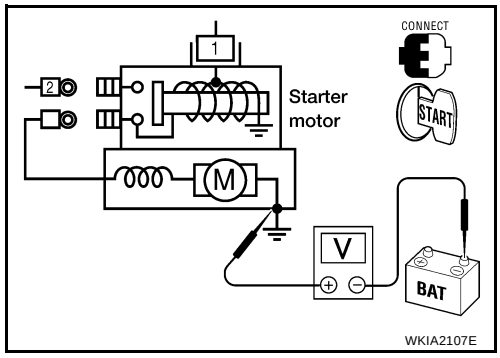
OK or NG

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

3. CHECK VOLTAGE DROP ON STARTER MOTOR GROUND CIRCUIT

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

Ignition switch in START. : Less than 0.2V



OK or NG

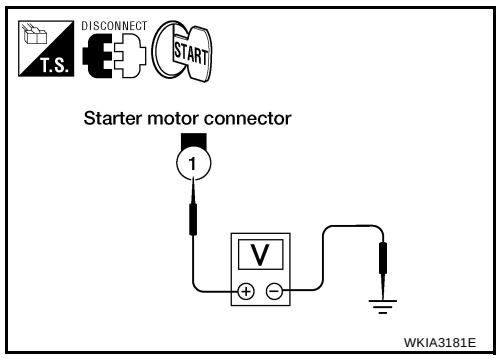
OK >> Starter motor ground circuit is OK. Further inspection is necessary. Refer to SC-11, "WORK FLOW" .
NG >> Check harness between the starter motor case and ground for poor continuity.

DIAGNOSTIC PROCEDURE 2
Check Magnetic Switch Circuit

1. CHECK POWER SUPPLY TO MAGNETIC SWITCH

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. Disconnect starter motor connector E207.
5. Check voltage between starter motor connector E207 terminal 1 and ground using a digital circuit tester.

Ignition switch in START. : Battery voltage



OK or NG

OK >> GO TO 2.

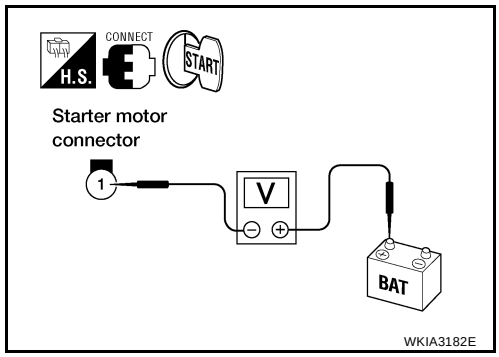
NG >> Check the following.

- 40A fusible link (letter **j** , located in fuse and fusible link box)
- Ignition switch
- Starter relay [within the intelligent power distribution module engine room (IPDM E/R)]
- Starter relay request ON signal
- Harness for open or short

2. CHECK VOLTAGE DROP ON MAGNETIC SWITCH CIRCUIT

1. Turn the ignition switch OFF.
2. Connect starter motor connector E207.
3. Check voltage between starter motor connector E207 terminal 1 and battery positive terminal using a digital circuit tester.

Ignition switch in START. : Less than 1V



OK or NG

OK >> Magnetic switch circuit is OK. Further inspection is necessary. Refer to SC-11, "WORK FLOW" .

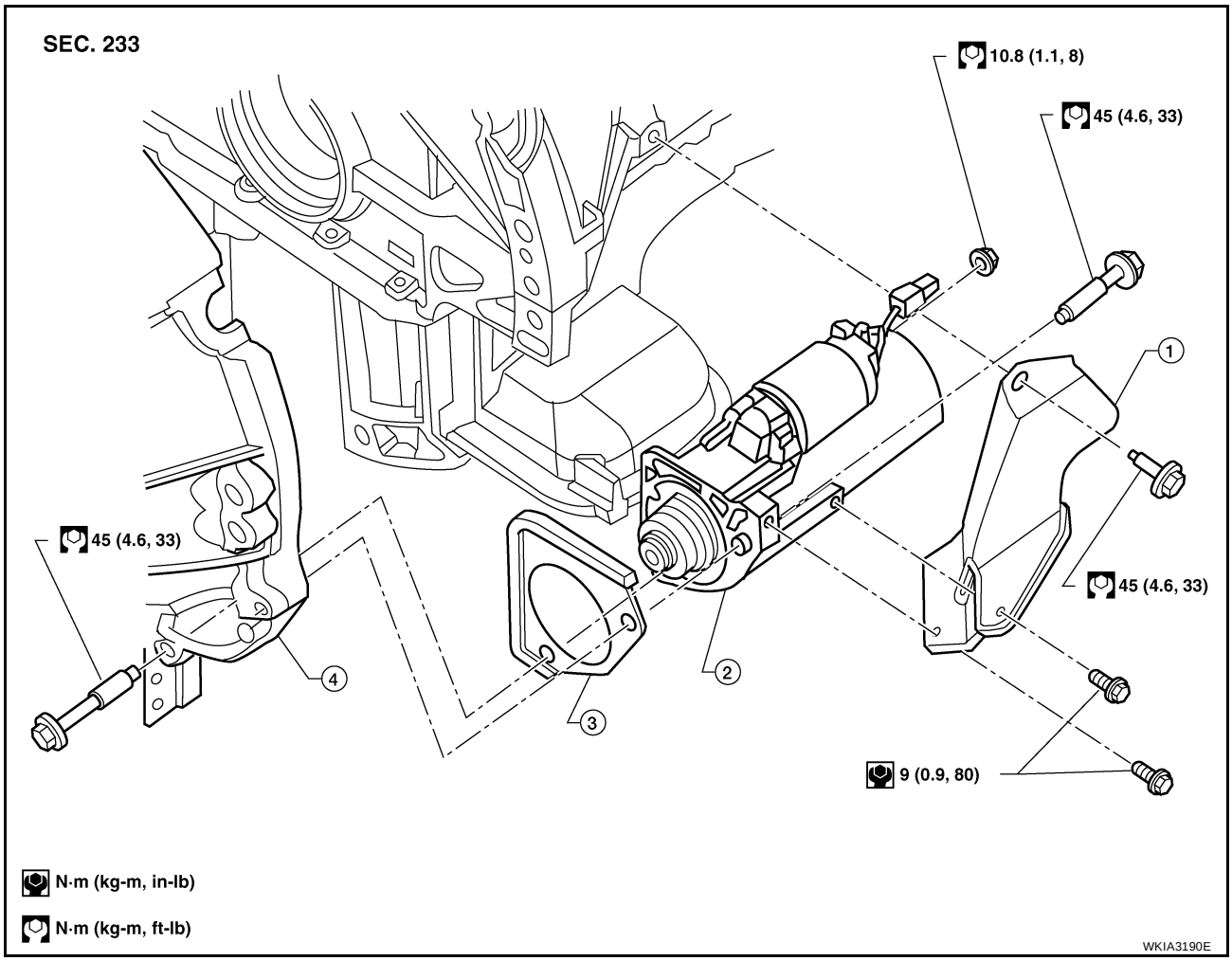
NG >> Check harness between the battery and the magnetic switch for poor continuity.

MINIMUM SPECIFICATION OF CRANKING VOLTAGE REFERENCING COOLANT TEMPERATURE

Engine coolant temperature	Voltage V
–30°C to –20°C (–22°F to –4°F)	8.4
–19°C to –10°C (–2°F to 14°F)	8.9
–9°C to 0°C (16°F to 32°F)	9.3
More than 1°C (More than 34°F)	9.7

Removal and Installation

EKS00FTN

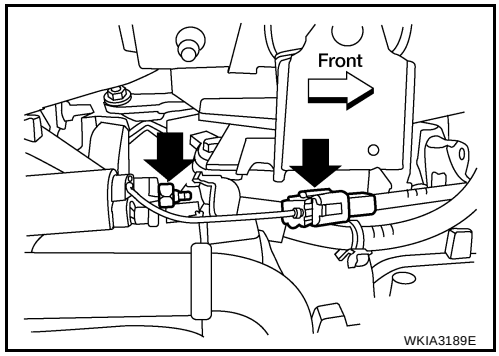


1. Starter cover
2. Starter motor assembly
3. Starter cover plate (rear)
4. Transmission housing

REMOVAL

1. Disconnect the negative battery terminal.
2. Remove engine undercover, using power tools.
3. Remove exhaust manifold cover from exhaust manifold (right bank) to gain access to starter cover bolts. Refer to EX-4, "REMOVAL" .
4. Remove starter cover bolts and starter cover.

5. Disconnect terminal "1" connector and terminal "2" nut.
6. Remove the two starter bolts, using power tools.
7. Remove the starter.



INSTALLATION

To installation is in the reverse order of removal.

Terminal "2" nut : 10.8 N·m (1.1 kg-m, 8 ft-lb)

CAUTION:
Be sure to tighten terminal "2" nut carefully.

CHARGING SYSTEM

PFP:23100

System Description

EKS00FTO

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 3 through:

- 15A fuse (No. 30, located in the fuse and fusible link box).

Terminal 1 supplies power to charge the battery and operate the vehicle's electrical system. Output voltage is controlled by the IC regulator at terminal 3 detecting the input voltage. A pulse width modulated (PWM) signal is sent from terminal 37 of the IPDM E/R to terminal 4 of the generator. The ECM determines the duty cycle of the power generation variable voltage control system. The charging circuit is protected by the 140A fusible link [letter **a** , located in the fusible link box (battery)].
The generator ground is supplied

- to terminal 5
- through ground E203, and
- through the generator case to the cylinder block.

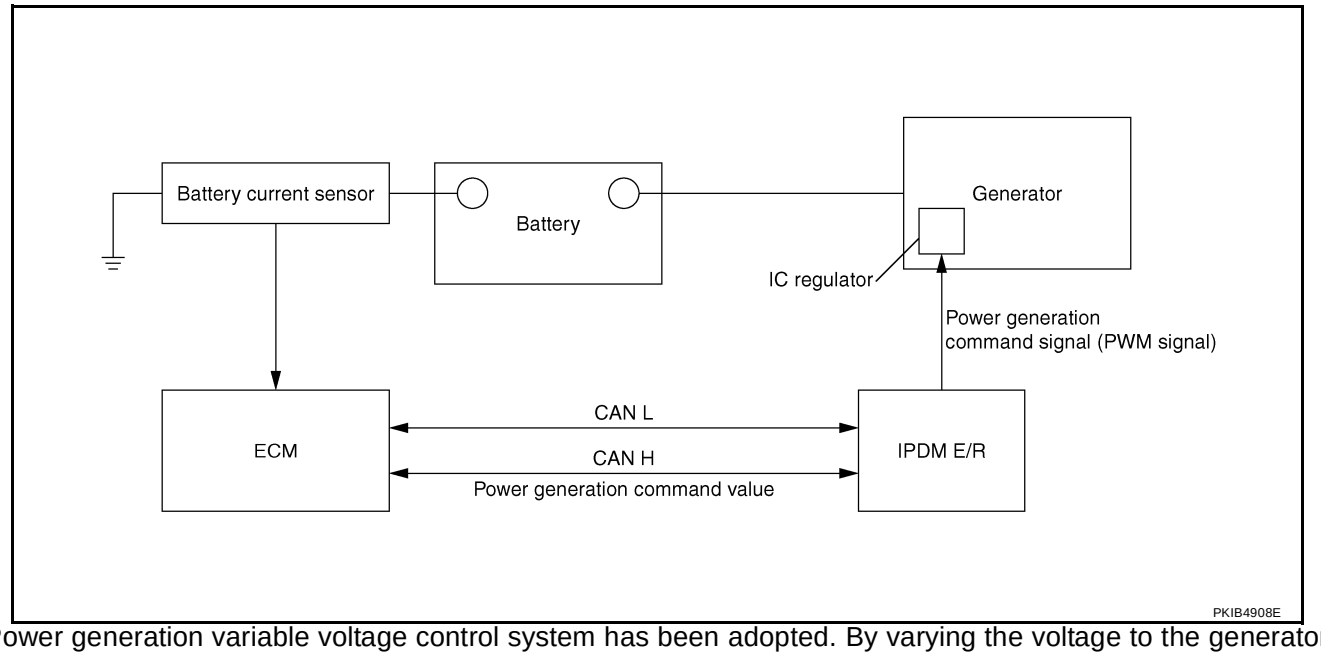
With the ignition switch in the ON or START position, power is supplied:

- through 10A fuse [No. 14, located in the fuse block (J/B)]
- to combination meter terminal 16 for the charge warning lamp.

Ground is supplied to terminal 2 of the combination meter through terminal 2 of the generator. 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. 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.

POWER GENERATION VARIABLE VOLTAGE CONTROL SYSTEM



Power generation variable voltage control system has been adopted. By varying the voltage to the generator, engine load due to power generation of the generator is reduced and fuel consumption is decreased.

Operation

- The battery current sensor detects the charging/discharging current of the battery. ECM judges the battery condition based on this signal.
- ECM judges whether to control voltage according to the battery condition.
- ECM calculates the target power generation voltage according to the battery condition and sends the calculated value, through CAN lines, as the power generation command value to IPDM E/R.

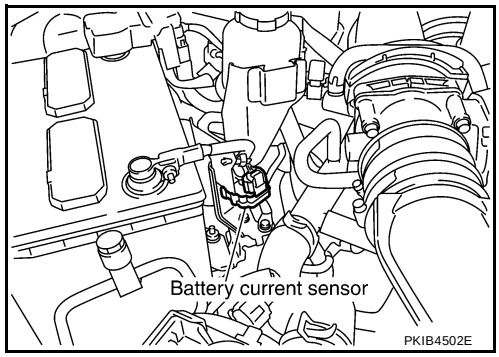
- IPDM E/R converts the received power generation command value into the power generation command signal (PWM signal) and sends it to the IC regulator.
- The IC regulator performs final control over the power generation voltage.
- When there is no power generation command signal, the generator performs the normal power generation according to the characteristic of the IC regulator.

NOTE:
When any malfunction is detected in the power generation variable voltage control system, power generation is performed according to the characteristic of the IC regulator in the generator.

Component

BATTERY CURRENT SENSOR

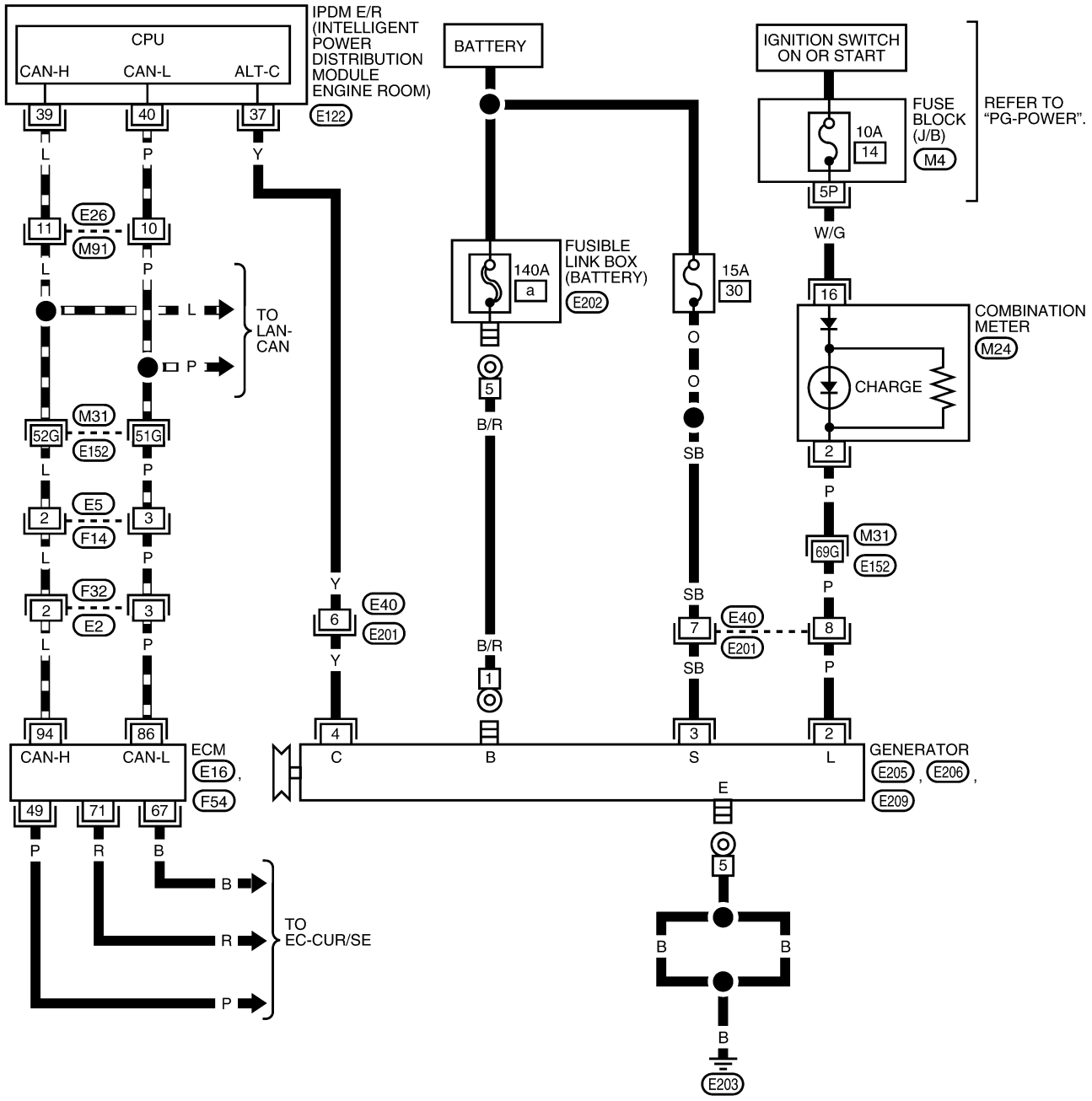
- Battery current sensor is installed to the negative battery cable and it detects the charging/discharging current of the battery and sends the voltage signal to ECM according to the current value.

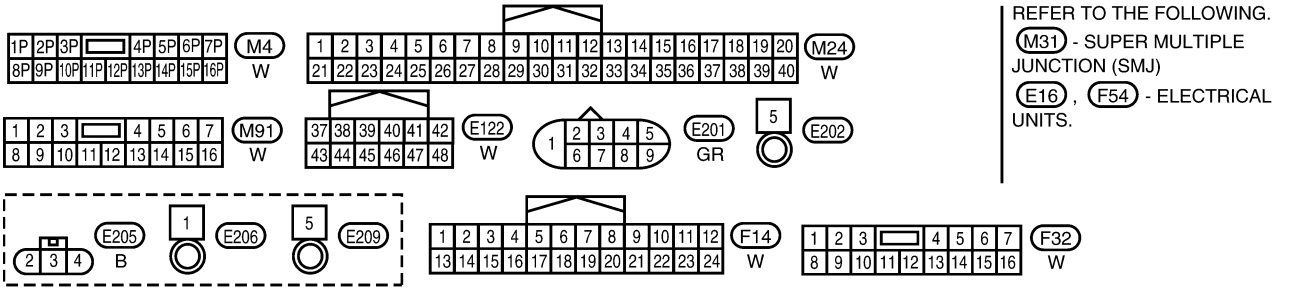


Wiring Diagram — CHARGE —

EKS00FTP

SC-CHARGE-01





REFER TO THE FOLLOWING.
M31 - SUPER MULTIPLE JUNCTION (SMJ)
E16, F54 - ELECTRICAL UNITS.

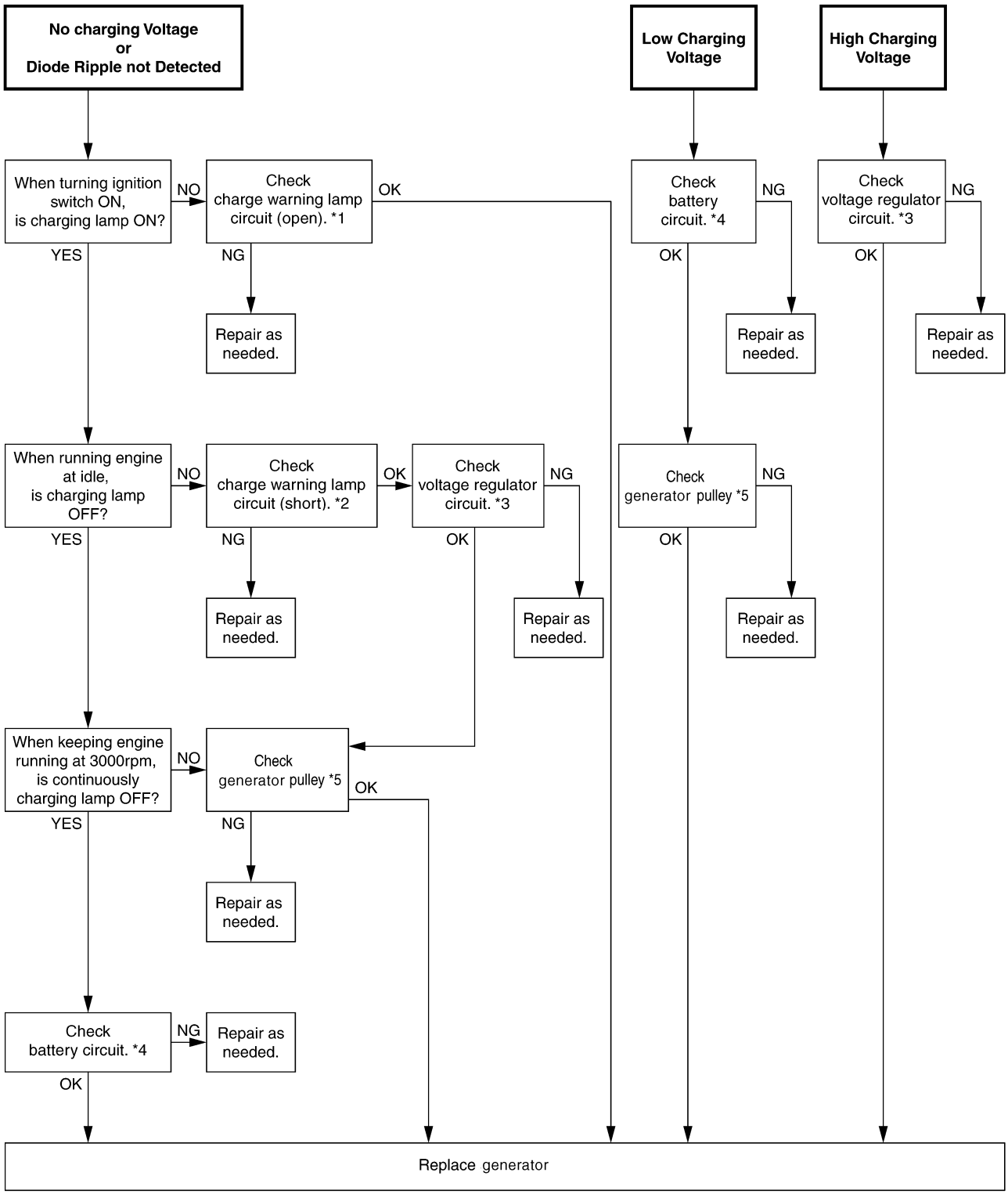
WKWA5790E

Trouble Diagnoses with Starting/Charging System Tester (Charging)

EKS00FTQ

For charging system testing, use Starting/Charging System Tester (J-44373). For details and operating instructions, refer to Technical Service Bulletin.

WORK FLOW



WKIA3717E

*1	SC-21, "DIAGNOSTIC PROCEDURE 1"	*2	SC-24, "DIAGNOSTIC PROCEDURE 4"	*3	SC-22, "DIAGNOSTIC PROCEDURE 2"
*4	SC-24, "DIAGNOSTIC PROCEDURE 4"	*5	SC-27, "GENERATOR PULLEY INSPECTION"		

PRELIMINARY INSPECTION

1. CHECK BATTERY TERMINALS CONNECTION

Check if battery terminals are clean and tight.

OK or NG

OK >> GO TO 2.
NG >> Repair battery terminal connections.

2. CHECK FUSE AND FUSIBLE LINK

Check for blown fuses and fusible link. Refer to PG-86, "FUSE AND FUSIBLE LINK BOX" .

Unit	Power source (Power supply terminals)	Fuse or fusible link
Generator	Battery (“1” terminal)	a
	Battery (“3” terminal)	30
Combination meter	Ignition switch ON (“2” terminal)	14

OK or NG

OK >> GO TO 3.
NG >> If fuse is blown, be sure to eliminate cause of malfunction before installing new fuse.

3. CHECK GENERATOR DRIVE BELT TENSION

Check generator drive belt tension. Refer to EM-14, "Checking Drive Belts" .

OK or NG

OK >> Inspection End.
NG >> Repair as needed.

DIAGNOSTIC PROCEDURE 1

Check Charge Warning Lamp Circuit (Open)

1. CHECK CHARGE WARNING LAMP CIRCUIT CONNECTION

1. Turn the ignition switch OFF.
2. Check terminal "2" harness connector.

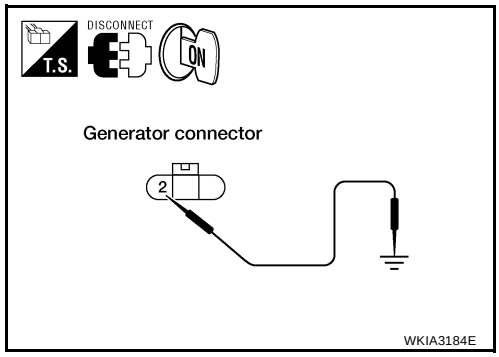
OK or NG

OK >> GO TO 2.
NG >> Repair terminal "2" connection. Confirm repair by performing complete Starting/Charging system test. Refer to SC-20, "Trouble Diagnoses with Starting/Charging System Tester (Charging)" .

2. CHECK CHARGE WARNING LAMP CIRCUIT (OPEN)

1. Disconnect E205 connector from generator.
2. Apply ground to connector E205 terminal 2 with the ignition switch in the ON position.

CHARGE lamp should light up.



OK or NG

OK >> GO TO SC-20, "Trouble Diagnoses with Starting/Charging System Tester (Charging)" .

NG >> Check the following.

- Charge warning lamp (Combination meter)
- Harness for open or short between combination meter and fuse
- Harness for open between combination meter and generator

DIAGNOSTIC PROCEDURE 2

Check Charge Warning Lamp Circuit (Short)

1. CHECK CHARGE WARNING LAMP CIRCUIT (SHORT)

1. Turn the ignition switch OFF.
2. Disconnect generator connector E205.
3. Turn ignition switch ON.

Does charge warning lamp light up?

YES >> Check the following.

- Harness for short between combination meter and generator
- Charge warning lamp (Combination meter)

NO >> GO TO SC-20, "WORK FLOW" .

DIAGNOSTIC PROCEDURE 3

Check Voltage Regulator Circuit

1. CHECK VOLTAGE REGULATOR CIRCUIT CONNECTION

1. Turn the ignition switch OFF.
2. Check terminal "3" harness connector.

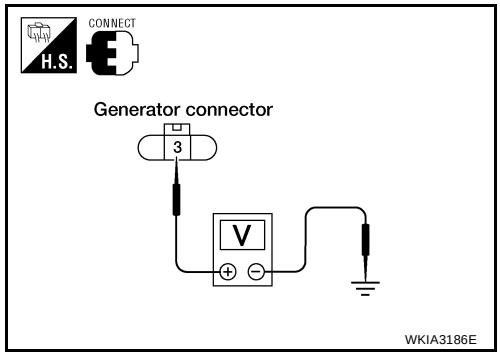
OK or NG

OK >> GO TO 2.
NG >> Repair terminal "3" connection. Confirm repair by performing complete Starting/Charging system test. Refer to SC-20, "Trouble Diagnoses with Starting/Charging System Tester (Charging)" .

2. CHECK GENERATOR VOLTAGE REGULATOR CIRCUIT

Check voltage between generator connector E205 terminal 3 and ground using a digital circuit tester.

Battery voltage should exist.



OK or NG

OK >> GO TO SC-20, "WORK FLOW" .
NG >> Check harness for open between generator and fuse.

DIAGNOSTIC PROCEDURE 4

Check Battery Circuit

1. CHECK BATTERY CIRCUIT CONNECTION

1. Turn the ignition switch OFF.
2. Check to see if terminal "1" is clean and tight.

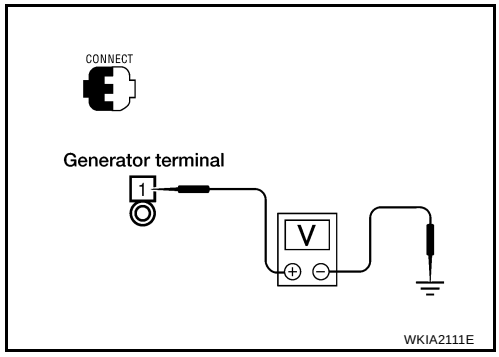
OK or NG

OK >> GO TO 2.
NG >> Repair terminal "1" connection. Confirm repair by performing complete Starting/Charging system test. Refer to SC-20, "Trouble Diagnoses with Starting/Charging System Tester (Charging)" .

2. CHECK BATTERY CIRCUIT

Check voltage between generator connector E206 terminal 1 and ground using a digital circuit tester.

Battery voltage should exist.



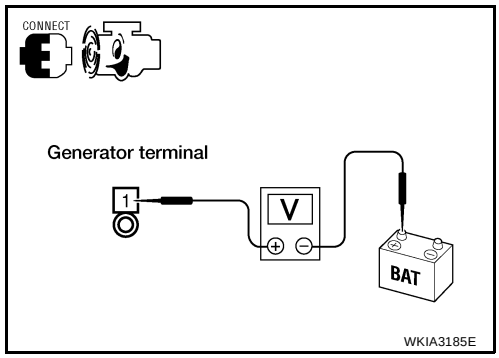
OK or NG

OK >> GO TO 3.
NG >> Check harness for open between generator and fusible link.

3. CHECK VOLTAGE DROP ON BATTERY CIRCUIT

1. Start engine.
2. While engine is running at idle and warm, check voltage between generator connector E206 terminal 1 and battery positive terminal using a digital circuit tester.

With engine running at idle and warm. : Less than 0.2V



OK or NG

OK >> GO TO SC-20, "WORK FLOW" .
NG >> Check harness between the battery and the generator for poor continuity.

Power Generation Variable Voltage Control System Inspection

EKS00FTR

CAUTION:

- **For this model, the battery current sensor that is installed to the negative battery cable measures the charging/discharging current of the battery and performs various engine controls. If an electrical component is connected directly to the negative battery terminal, the current flowing through that component will not be measured by the battery current sensor. This condition may cause a malfunction of the engine control system and battery discharge may occur. Do not connect an electrical component or ground wire directly to the battery terminal.**
- **When performing this inspection, always use the charged battery that completed the battery inspection. When the charging rate of the battery is low, the response speed of the voltage change will become slow. This is a cause of an incorrect inspection.**

INSPECTION PROCEDURE

1. CHECK SELF-DIAGNOSIS OF ECM

CAUTION:

If CONSULT-II is used with no connection of CONSULT-II CONVERTER, malfunction might be detected in self-diagnosis depending on control unit which carries out CAN communication.

Perform ECM self-diagnosis with CONSULT-II.

Self-diagnostic results content

No malfunction detected>>GO TO 2.
Malfunction detected>>Check applicable parts, and repair or replace corresponding parts.

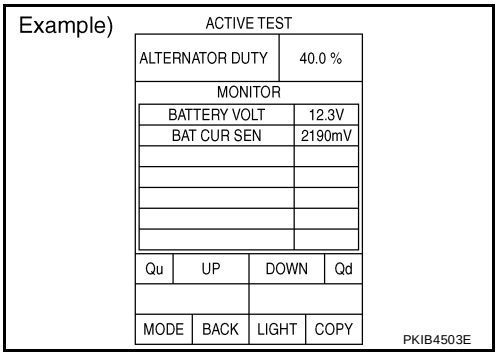
2. CHECK POWER GENERATION VARIABLE VOLTAGE CONTROL SYSTEM OPERATION

1. Connect CONSULT-II and CONSULT-II CONVERTER and start the engine.
2. Put selector lever in “P” or “N” position and turn all electric loads including A/C OFF.
3. Select “ALT DUTY” at “ACTIVE TEST” of “ENGINE”, and then check the value of “BATTERY VOLT” monitor when “ALTERNATOR DUTY” is set to 40 %.

“BATTERY VOLT”

seconds after setting “ALTERNATOR DUTY” to 40%	**12.0 V - 13.6 V**

Example)

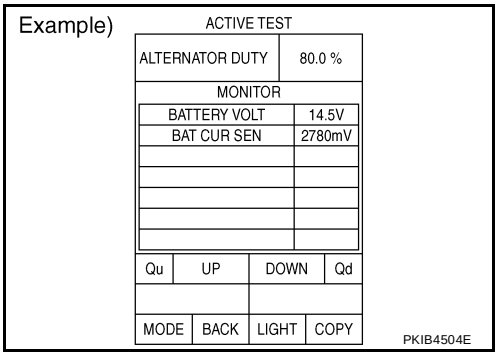


4. Check the value of “BATTERY VOLT” when “ALTERNATOR DUTY” is set to 80%.

“BATTERY VOLT”

20 seconds after setting “ALTERNATOR DUTY” to 80%	**0.5 V or more than the value of “BATTERY VOLT” when "ALTERNATOR DUTY" was 40%**

Example)



OK or NG

OK >> Inspection End.
NG >> GO TO 3. (The charging condition of the battery should be normal.)

3. CHECK SELF-DIAGNOSIS OF IPDM E/R

Perform IPDM E/R self-diagnosis with CONSULT-II.

Self-diagnostic results content

No malfunction detected>>GO TO 4.
Malfunction detected>>Check applicable parts, and repair or replace corresponding parts.

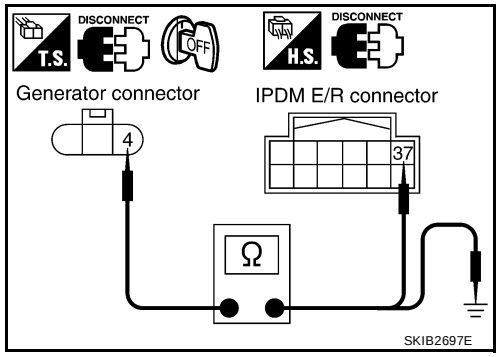
4. CHECK HARNESS BETWEEN IPDM AND GENERATOR

1. Disconnect generator connector E205 and IPDM E/R connector E122.
2. Check continuity between generator harness connector E205 terminal 4 and IPDM E/R harness connector E122 terminal 37.

4 – 37	**Continuity should exist.**

3. Check continuity between generator harness connector E205 terminal 4 and ground.

4 – Ground	**Continuity should not exist.**

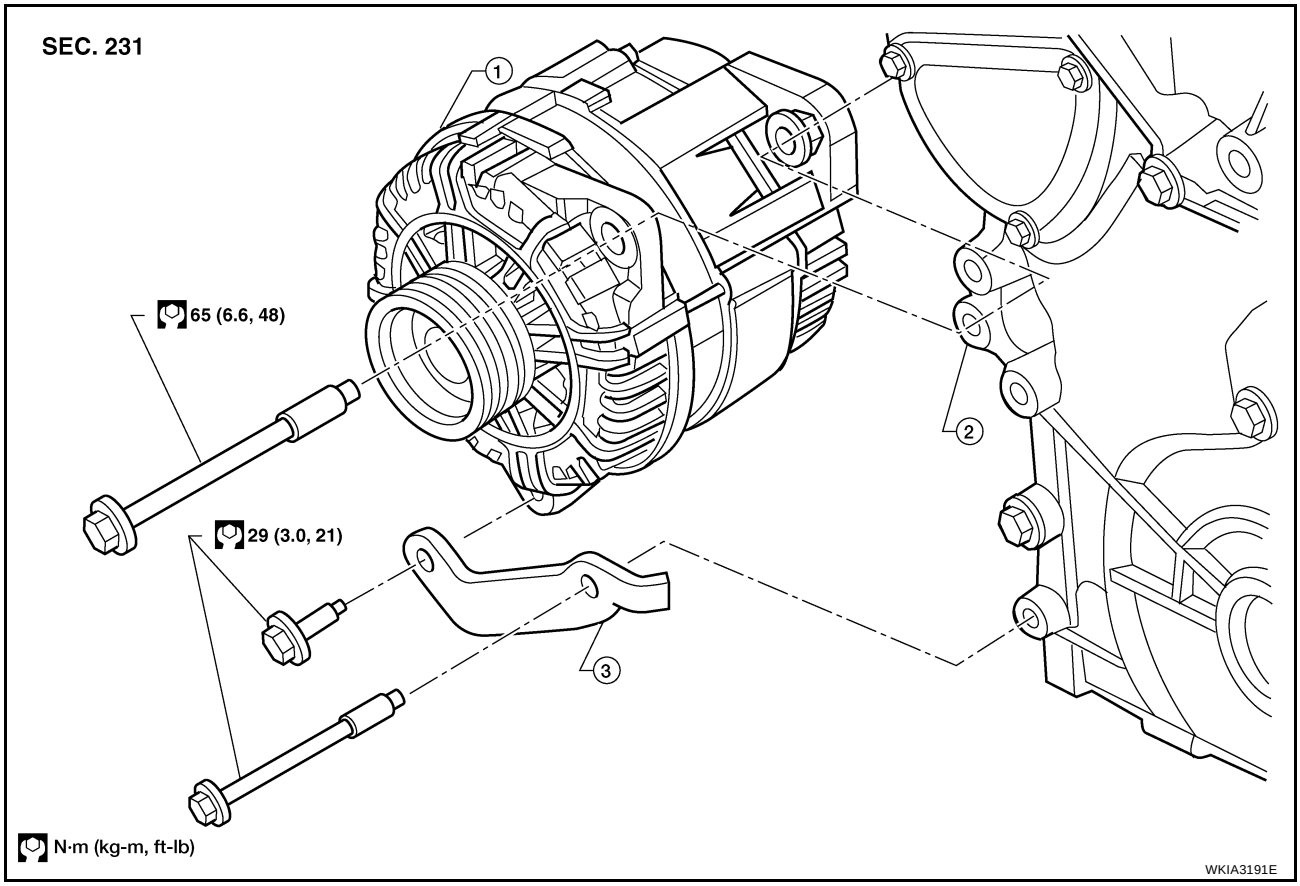


OK or NG

OK >> Replace IPDM E/R. Refer to PG-34, "Removal and Installation of IPDM E/R" .
NG >> Repair harness or connector between IPDM E/R and generator.

Removal and Installation

EKS00FTS



1. Generator
2. Engine block
3. Generator stay

REMOVAL

1. Disconnect the negative battery terminal.
2. Remove the fan shroud. Refer to CO-14, "Removal and Installation" .

3. Remove the drive belt. Refer to EM-14, "Removal and Installation" .
4. Remove generator stay, using power tools.
5. Remove the generator upper bolt, using power tools.
6. Disconnect the generator harness connectors.
7. Remove the generator.

GENERATOR PULLEY INSPECTION

Perform the following.

- Make sure that the generator pulley does not rattle.
- Make sure that the generator pulley nut is properly tightened.

Generator pulley nut : 118 N·m (12.0 kg-m, 87 ft-lb)

INSTALLATION

Installation is in the reverse order of removal.

- Install the generator and check tension of drive belt. Refer to EM-14, "Tension Adjustment" .

Terminal "1" nut : 10.8 N·m (1.1 kg-m, 8 ft-lb)

CAUTION:
Be sure to tighten terminal "1" nut carefully.

- For this model, the power generation variable voltage control system that controls the power generation voltage of the generator has been adopted. Therefore, the power generation variable voltage control system inspection should be performed after replacing the generator in order to ensure that the system operates normally. Refer to SC-25, "Power Generation Variable Voltage Control System Inspection" .

SERVICE DATA AND SPECIFICATIONS (SDS)

PFP:00030

Battery

EKS00FTT

	Standard battery
Type	Gr. 24
Capacity (20 HR) minimum V-AH	63
Cold cranking current A (For reference value)	550

Starter

EKS00FTU

Application		All models
Manufacturer		Mitsubishi M002T85571ZCKD
Type		Reduction gear type
System voltage		12V
No-load	Terminal voltage	11V
	Current	Less than 120A
	Revolution	More than 3,100 rpm
Minimum diameter of commutator		31.4 mm (1.236 in)
Minimum length of brush		11.0 mm (0.433 in)
Brush spring tension		26.7-36.1 N (2.72 - 3.68 kg, 5.93 - 8.02 lb)
Clearance between pinion front edge and pinion stopper		0.5 - 2.0 mm (0.020 - 0.079 in)

Generator

EKS00FTV

Type	LR1130-701	LR1110-725
	Hitachi	
Nominal rating	12V-130A	12V-110A
Ground polarity	Negative	
Minimum revolution under no-load (When 13.5 volts is applied)	1,200 rpm	1.100 rpm
Hot output current (When 13.5 volts is applied)	More than 78A/1,800 rpm More than 108A/2,500 rpm More than 130A/5,000 rpm	More than 70A/1,800rpm More than 91A/2,500rpm More than 110A/5,000rpm
Regulated output voltage	14.1 - 14.7V @ 20°C	
Minimum length of brush	6 mm (0.24 in)	
Brush spring pressure	1.0 - 3.432 N (0.102 - 0.3501 kg, 0.22 - 0.7715 lbs)	
Slip ring minimum outer diameter	26 mm (1.02 in)	
Rotor (Field coil) resistance	2.1 ohms	
Adjustment range of power generation variable voltage control	11.4-15.6V	