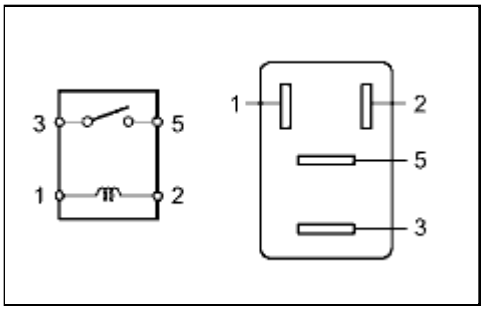
Last Modified: 5-10-2010	6.4 G	**From:** 200908
Model Year: 2010	**Model:** 4Runner	**Doc ID:** RM0000046ON000X
Title: 1GR-FE STARTING: RELAY: ON-VEHICLE INSPECTION (2010 4Runner)		

ON-VEHICLE INSPECTION

1. INSPECT STARTER RELAY (ST)

(a) Measure the resistance according to the value(s) in the table below.

Standard Resistance:



TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
3 - 5	Battery voltage not applied to terminals 1 and 2	10 kΩ or higher
	Battery voltage applied to terminals 1 and 2	Below 1 Ω

If the result is not as specified, replace the starter relay.

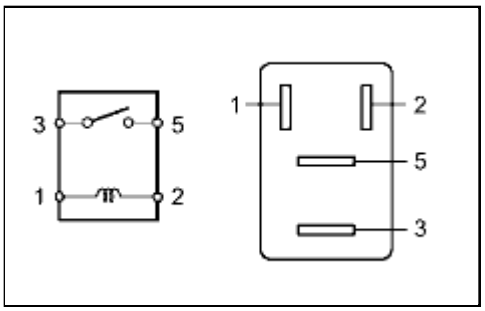
Last Modified: 5-10-2010	6.4 G	**From:** 200908
Model Year: 2010	**Model:** 4Runner	**Doc ID:** RM0000046ON001X
Title: 2TR-FE STARTING: RELAY: ON-VEHICLE INSPECTION (2010 4Runner)		

ON-VEHICLE INSPECTION

1. INSPECT STARTER RELAY (ST)

(a) Measure the resistance according to the value(s) in the table below.

Standard Resistance:



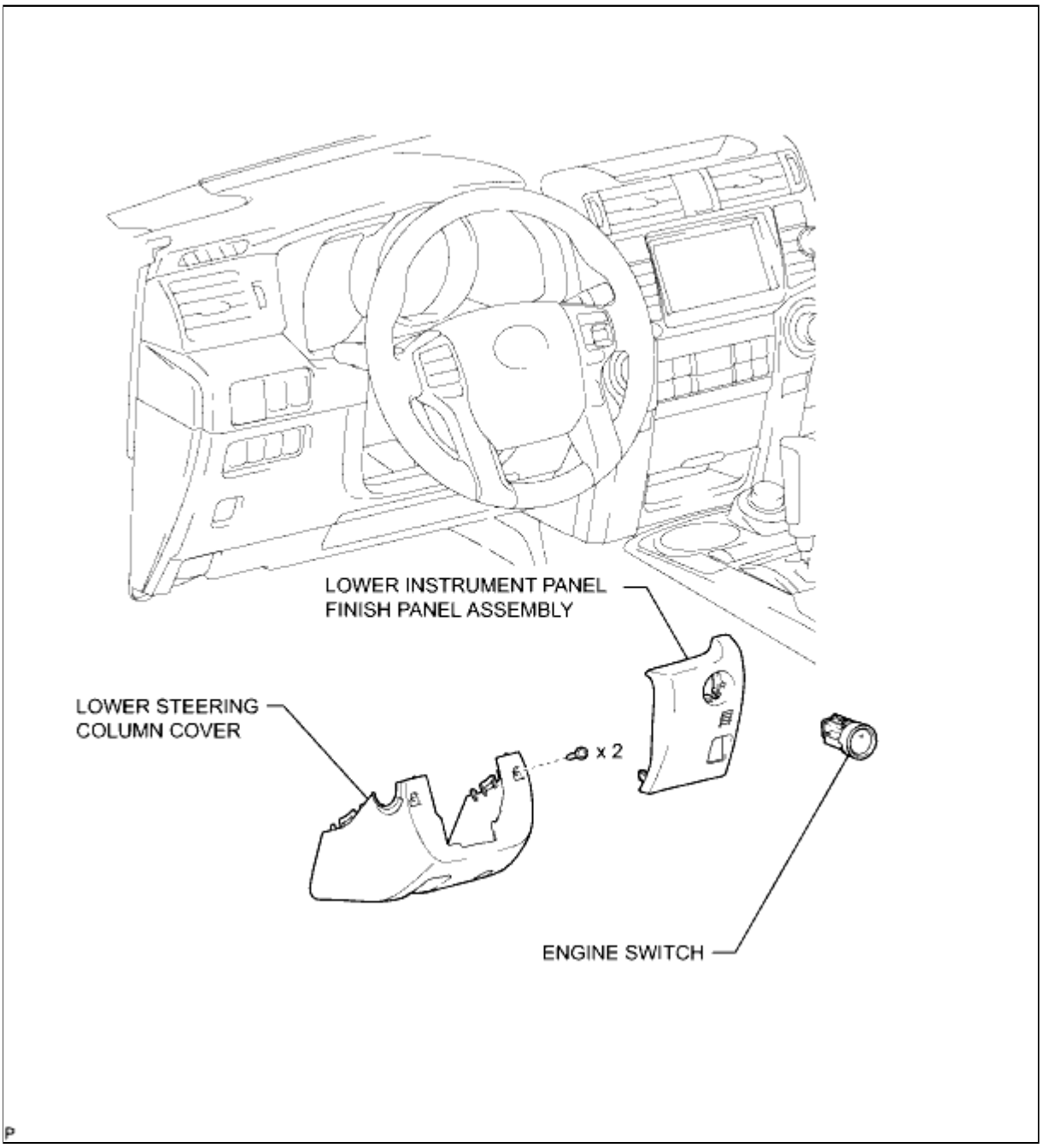
TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
3 - 5	Battery voltage not applied to terminals 1 and 2	10 kΩ or higher
	Battery voltage applied to terminals 1 and 2	Below 1 Ω

If the result is not as specified, replace the starter relay.

Last Modified: 5-10-2010	6.4 K	**From:** 200908
Model Year: 2010	**Model:** 4Runner	**Doc ID:** RM0000046P2000X
Title: 1GR-FE STARTING: ENGINE SWITCH: COMPONENTS (2010 4Runner)		

COMPONENTS

ILLUSTRATION



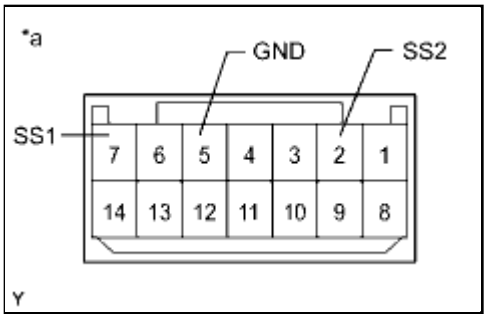
Last Modified: 5-10-2010	6.4 G	**From:** 200908
Model Year: 2010	**Model:** 4Runner	**Doc ID:** RM0000046P1000X
Title: 1GR-FE STARTING: ENGINE SWITCH: INSPECTION (2010 4Runner)		

INSPECTION

1. INSPECT ENGINE SWITCH

(a) Measure the resistance according to the value(s) in the table below.

Standard Resistance:



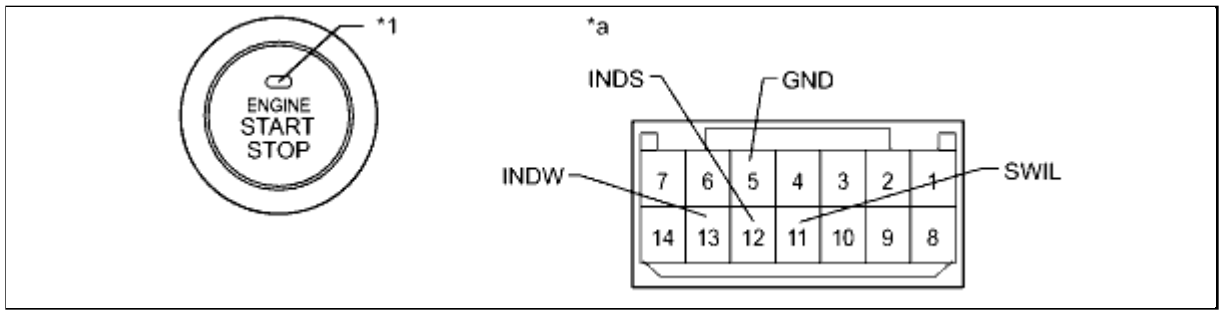
TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
7 (SS1) - 5 (GND)	Pushed	Below 1 Ω
	Not pushed	10 kΩ or higher
2 (SS2) - 5 (GND)	Pushed	Below 1 Ω
	Not pushed	10 kΩ or higher

Text in Illustration

*a	Component without harness connected (Engine Switch)

If the result is not as specified, replace the engine switch.

(b) Apply battery voltage to the terminals of the switch and check the illumination condition of the switch.



Text in Illustration

*1	Indicator Light	-	-

*a	Component without harness connected (Engine Switch)	-	-

OK:

MEASUREMENT CONDITION	SPECIFIED CONDITION
Battery positive (+) → terminal 11 (SWIL) Battery negative (-) → terminal 5 (GND)	Illuminates (illumination of lettering)
Battery positive (+) → terminal 12 (INDS) Battery negative (-) → terminal 5 (GND)	Illuminates (green)
Battery positive (+) → terminal 13 (INDW) Battery negative (-) → terminal 5 (GND)	Illuminates (amber)

NOTICE:

- If the positive (+) lead and negative (-) lead are incorrectly connected, the engine switch indicator will not illuminate.
- If the voltage is too low, the indicator will not illuminate.

If the result is not as specified, replace the engine switch.

Last Modified: 5-10-2010	6.4 A	**From:** 200908
Model Year: 2010	**Model:** 4Runner	**Doc ID:** RM0000046P3000X
Title: 1GR-FE STARTING: ENGINE SWITCH: REMOVAL (2010 4Runner)		

REMOVAL

1. REMOVE LOWER STEERING COLUMN COVER

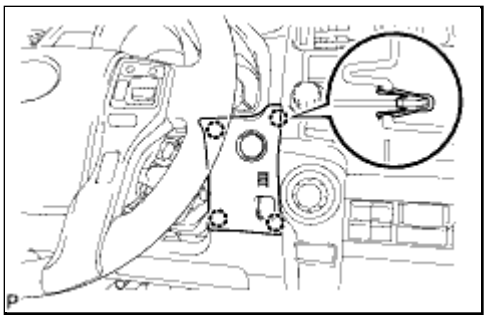
(a) Remove the 2 screws.

HINT:

Turn the steering wheel to the right and left as necessary to remove the 2 screws.

(b) Detach the 2 claws to remove the lower steering column cover.

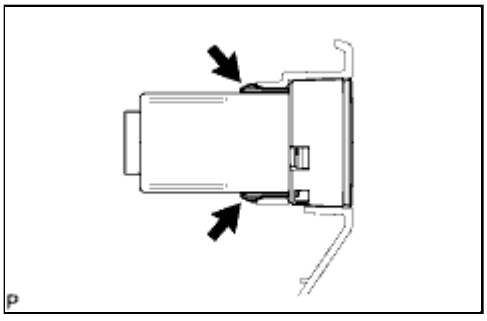
2. REMOVE LOWER INSTRUMENT PANEL FINISH PANEL ASSEMBLY



(a) Detach the 4 clips.

(b) Disconnect the engine switch connector and remove the lower instrument panel finish panel.

3. REMOVE ENGINE SWITCH



(a) Detach the 2 claws and remove the engine switch from the lower instrument panel finish panel.

Last Modified: 5-10-2010	6.4 A	**From:** 200908
Model Year: 2010	**Model:** 4Runner	**Doc ID:** RM0000046P0000X
Title: 1GR-FE STARTING: ENGINE SWITCH: INSTALLATION (2010 4Runner)		

INSTALLATION

1. INSTALL ENGINE SWITCH

(a) Attach the 2 claws to install the engine switch.

2. INSTALL LOWER INSTRUMENT PANEL FINISH PANEL ASSEMBLY

(a) Connect the engine switch connector.

(b) Attach the 4 clips to install the lower instrument panel finish panel assembly.

3. INSTALL LOWER STEERING COLUMN COVER

(a) Attach the 2 claws to install the lower steering column cover.

(b) Install the 2 screws.

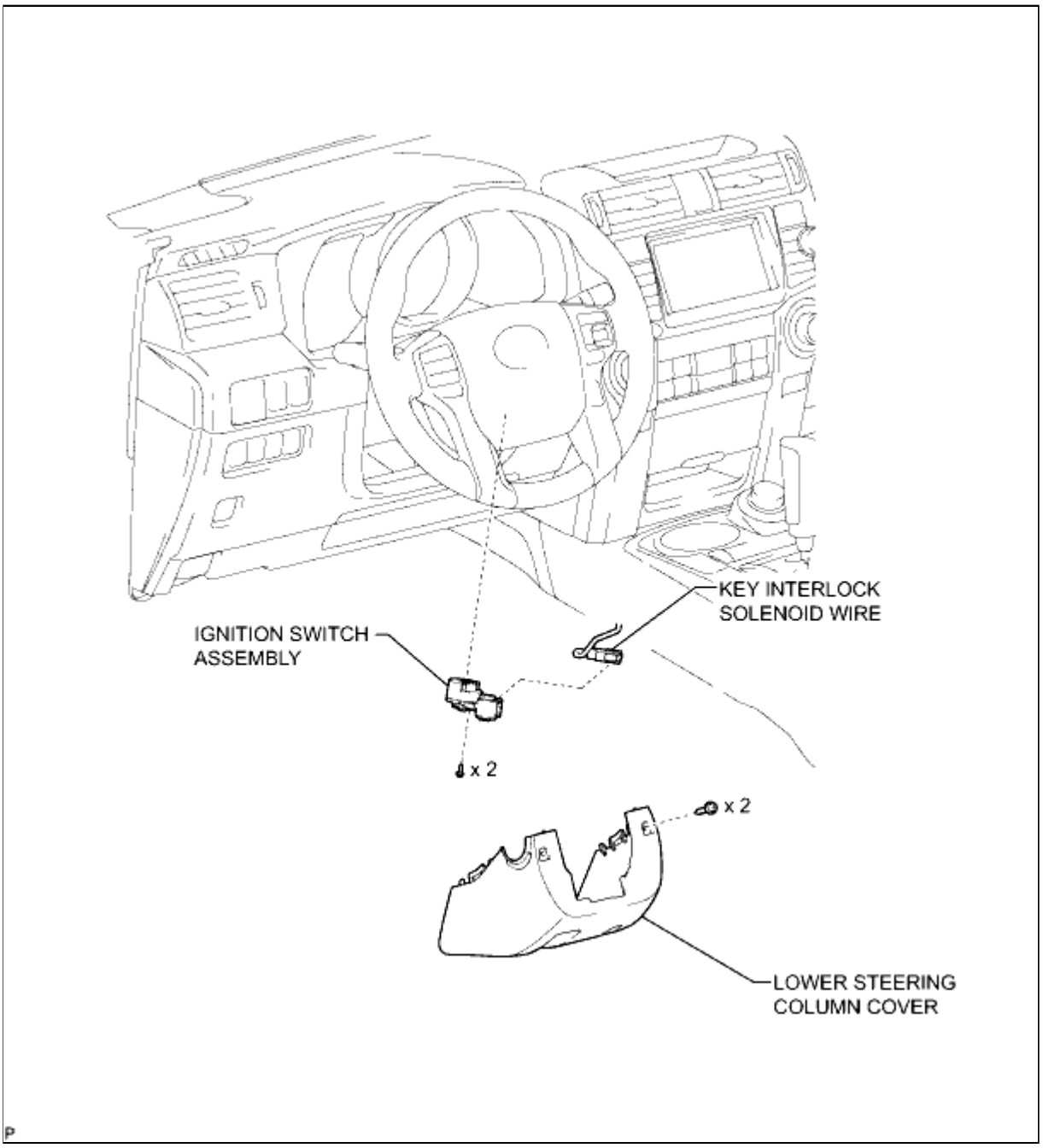
HINT:

Turn the steering wheel to the right and left as necessary to install the 2 screws.

Last Modified: 5-10-2010	6.4 K	**From:** 200908
Model Year: 2010	**Model:** 4Runner	**Doc ID:** RM0000046P4000X
Title: 1GR-FE STARTING: IGNITION SWITCH: COMPONENTS (2010 4Runner)		

COMPONENTS

ILLUSTRATION

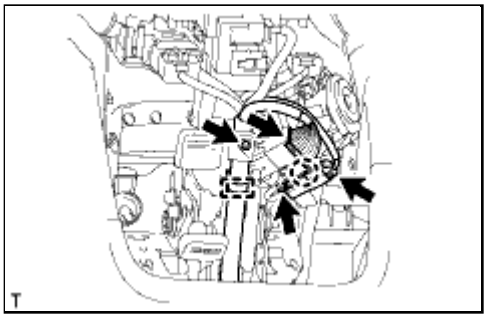


Last Modified: 5-10-2010	6.4 A	**From:** 200908
Model Year: 2010	**Model:** 4Runner	**Doc ID:** RM000000YK101BX
Title: 1GR-FE STARTING: IGNITION SWITCH: REMOVAL (2010 4Runner)		

REMOVAL

1. REMOVE LOWER STEERING COLUMN COVER INFO

2. REMOVE IGNITION SWITCH ASSEMBLY



(a) Disconnect the ignition switch connector and key interlock solenoid connector and detach wire harness clamp.

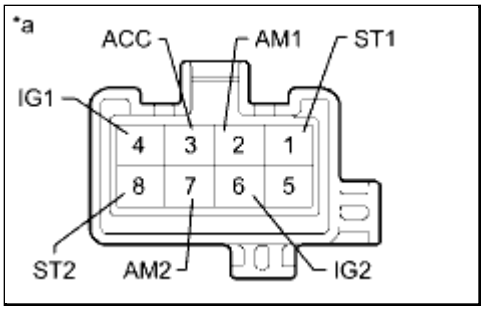
(b) Remove the 2 screws and ignition switch.

(c) Detach the claw and disconnect the key interlock solenoid wire harness from the ignition switch.

Last Modified: 5-10-2010	6.4 G	**From:** 200908
Model Year: 2010	**Model:** 4Runner	**Doc ID:** RM000000YK002NX
Title: 1GR-FE STARTING: IGNITION SWITCH: INSPECTION (2010 4Runner)		

INSPECTION

1. INSPECT IGNITION SWITCH ASSEMBLY



(a) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
-	LOCK	10 kΩ or higher
2 (AM1) - 3 (ACC)	ACC	Below 1 Ω
2 (AM1) - 3 (ACC) 2 (AM1) - 4 (IG1) 6 (IG2) - 7 (AM2)	ON	Below 1 Ω
1 (ST1) - 2 (AM1) 1 (ST1) - 4 (IG1) 6 (IG2) - 7 (AM2) 6 (IG2) - 8 (ST2)	START	Below 1 Ω

Text in Illustration

*a	Component without harness connected (Ignition Switch)

If the result is not as specified, replace the ignition switch assembly.

Last Modified: 5-10-2010	6.4 A	**From:** 200908
Model Year: 2010	**Model:** 4Runner	**Doc ID:** RM000000YJZ01CX
Title: 1GR-FE STARTING: IGNITION SWITCH: INSTALLATION (2010 4Runner)		

INSTALLATION

1. INSTALL IGNITION SWITCH ASSEMBLY

(a) Attach the claw to connect the key interlock solenoid wire harness to the ignition switch.

(b) Install the ignition switch with the 2 screws.

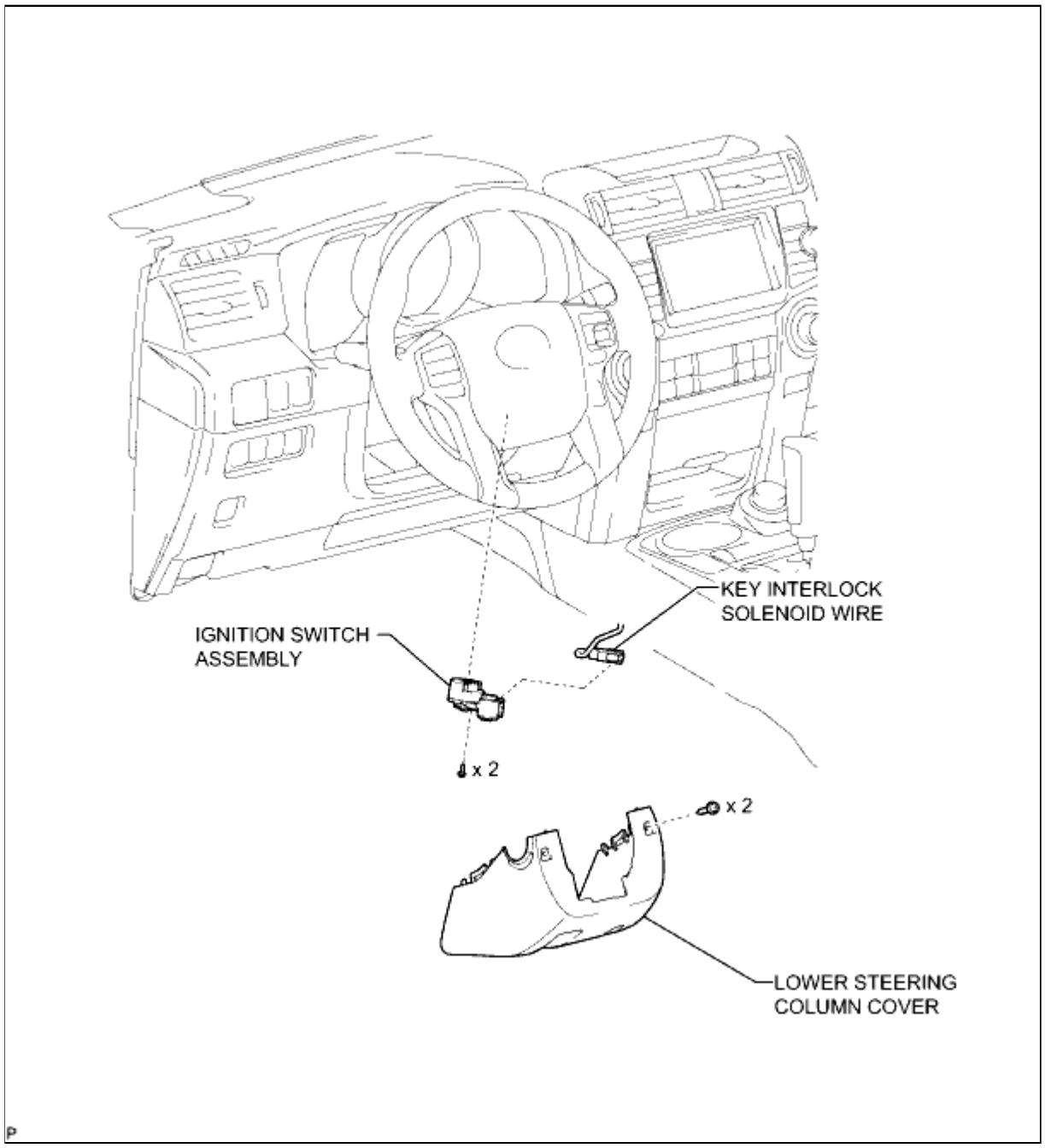
(c) Connect the ignition switch connector and key interlock solenoid connector and attach the wire harness clamp.

2. INSTALL LOWER STEERING COLUMN COVER

Last Modified: 5-10-2010	6.4 K	**From:** 200908
Model Year: 2010	**Model:** 4Runner	**Doc ID:** RM0000047CC001X
Title: 2TR-FE STARTING: IGNITION SWITCH: COMPONENTS (2010 4Runner)		

COMPONENTS

ILLUSTRATION



Last Modified: 5-10-2010	6.4 A	**From:** 200908
Model Year: 2010	**Model:** 4Runner	**Doc ID:** RM000000YK101IX
Title: 2TR-FE STARTING: IGNITION SWITCH: REMOVAL (2010 4Runner)		

REMOVAL

1. REMOVE LOWER STEERING COLUMN COVER

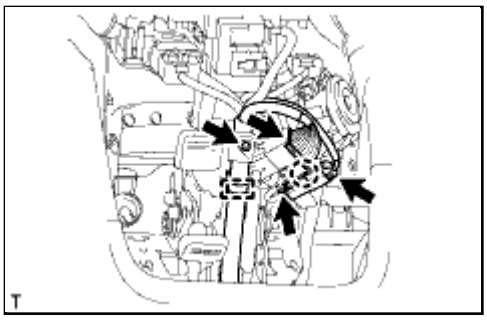
(a) Remove the 2 screws.

HINT:

Turn the steering wheel to the right and left as necessary to remove the 2 screws.

(b) Detach the 2 claws to remove the lower steering column cover.

2. REMOVE IGNITION SWITCH ASSEMBLY



(a) Disconnect the ignition switch connector and key interlock solenoid connector and detach the wire harness clamp.

(b) Remove the 2 screws and ignition switch.

(c) Detach the claw and disconnect the key interlock solenoid wire harness from the ignition switch.

Last Modified: 5-10-2010	6.4 G	**From:** 200908
Model Year: 2010	**Model:** 4Runner	**Doc ID:** RM000000YK002RX
Title: 2TR-FE STARTING: IGNITION SWITCH: INSPECTION (2010 4Runner)		

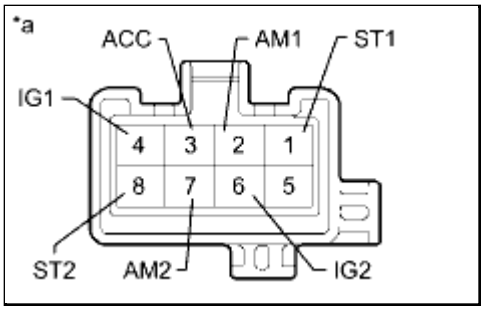
INSPECTION

1. INSPECT IGNITION SWITCH ASSEMBLY

(a) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
-	LOCK	10 kΩ or higher
2 (AM1) - 3 (ACC)	ACC	Below 1 Ω
2 (AM1) - 3 (ACC) 2 (AM1) - 4 (IG1) 6 (IG2) - 7 (AM2)	ON	Below 1 Ω
1 (ST1) - 2 (AM1) 1 (ST1) - 4 (IG1) 6 (IG2) - 7 (AM2) 6 (IG2) - 8 (ST2)	START	Below 1 Ω



Text in Illustration

*a	Component without harness connected (Ignition Switch)

If the result is not as specified, replace the ignition switch assembly.

Last Modified: 5-10-2010	6.4 A	**From:** 200908
Model Year: 2010	**Model:** 4Runner	**Doc ID:** RM000000YJZ01HX
Title: 2TR-FE STARTING: IGNITION SWITCH: INSTALLATION (2010 4Runner)		

INSTALLATION

1. INSTALL IGNITION SWITCH ASSEMBLY

(a) Attach the claw to connect the key interlock solenoid wire harness to the ignition switch.

(b) Install the ignition switch with the 2 screws.

(c) Connect the ignition switch connector and key interlock solenoid connector and attach the wire harness clamp.

2. INSTALL LOWER STEERING COLUMN COVER

(a) Attach the 2 claws to install the lower steering column cover.

(b) Install the 2 screws.

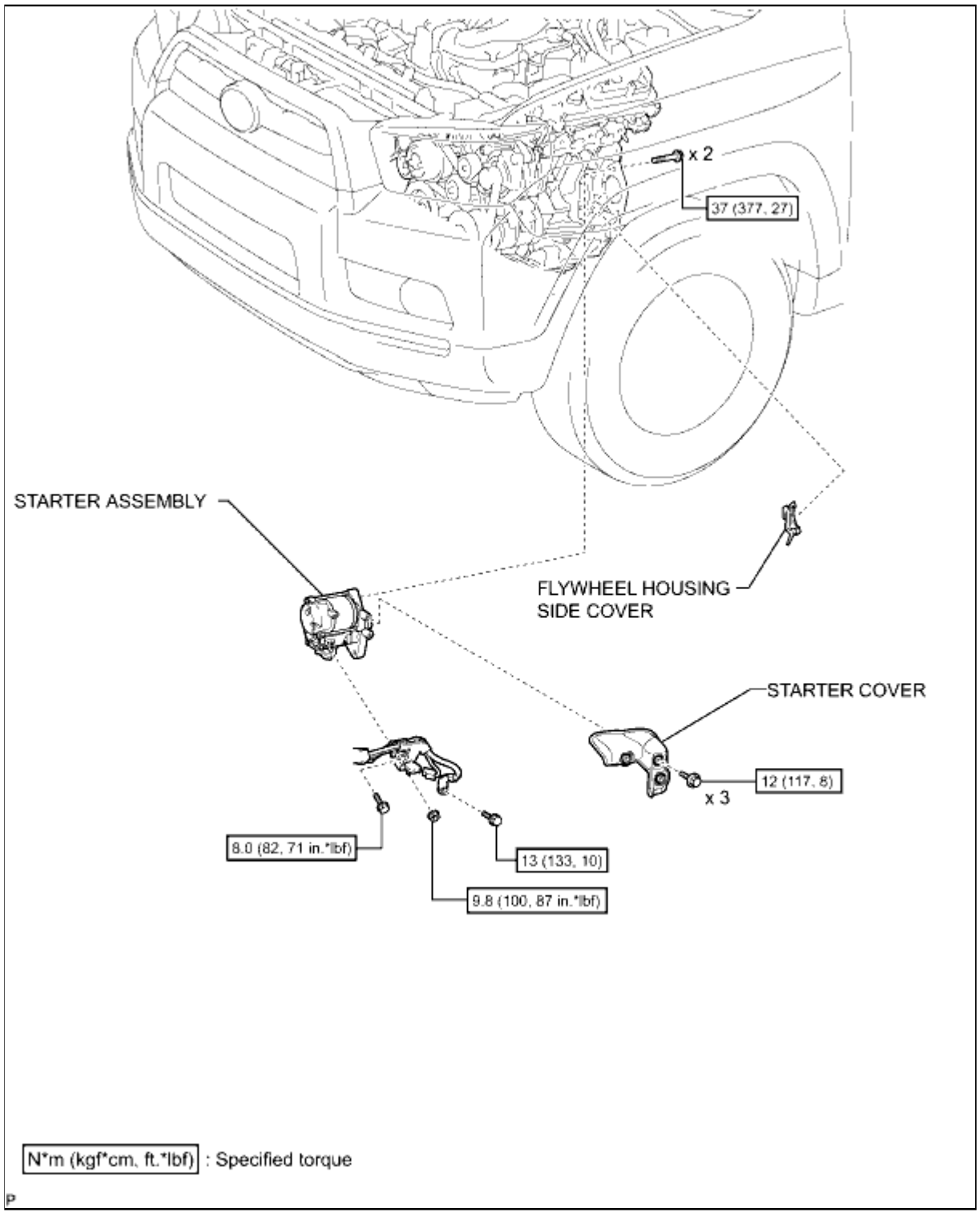
HINT:

Turn the steering wheel to the right and left as necessary to install the 2 screws.

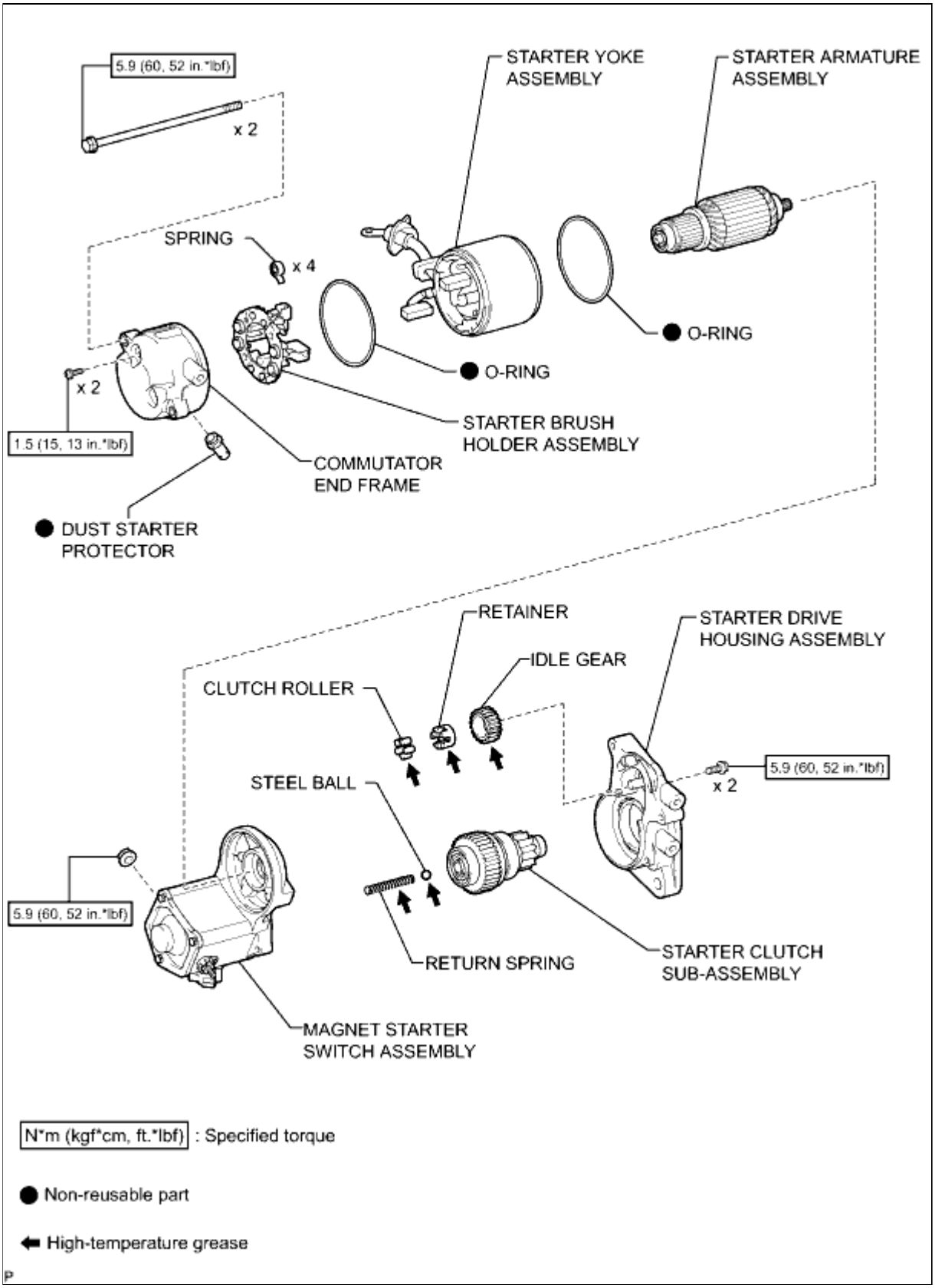
Last Modified: 5-10-2010	6.4 K	**From:** 200908
Model Year: 2010	**Model:** 4Runner	**Doc ID:** RM0000046OK000X
Title: 1GR-FE STARTING: STARTER: COMPONENTS (2010 4Runner)		

COMPONENTS

ILLUSTRATION



ILLUSTRATION



Last Modified: 5-10-2010	6.4 G	**From:** 200908
Model Year: 2010	**Model:** 4Runner	**Doc ID:** RM0000015XW00MX
Title: 1GR-FE STARTING: STARTER: INSPECTION (2010 4Runner)		

INSPECTION

1. INSPECT STARTER ASSEMBLY

CAUTION:

As a large electric current passes through the cable during this inspection, a thick cable must be used. If not, the cable may became hot and cause injury.

NOTICE:

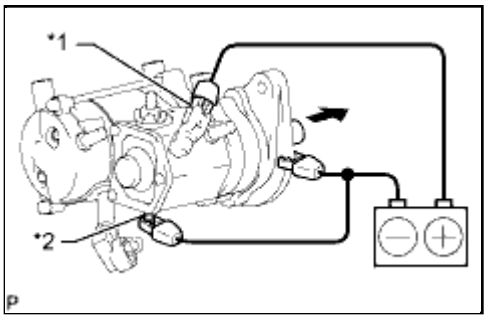
Each of the following tests must be performed within 3 to 5 seconds to prevent the coil from burning out.

(a) Mount the starter in a vise between aluminum plates.

(b) Perform a pull-in test.

(1) Remove the nut, and then disconnect the lead wire from terminal C.

(2) Connect the battery to the magnet starter switch as shown in the illustration. Then check that the clutch pinion gear extends.



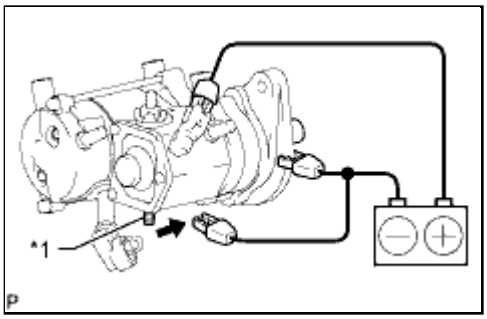
Text in Illustration

*1	Terminal 50
*2	Terminal C

If the clutch pinion gear does not move, replace the magnet starter switch assembly.

(c) Perform a holding test.

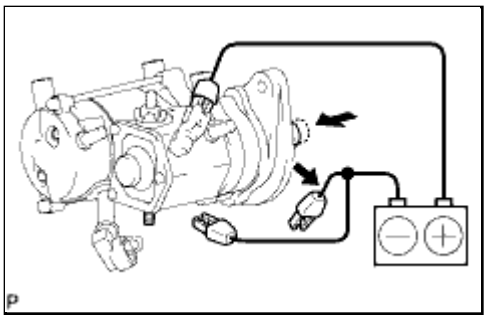
(1) Disconnect the negative (-) terminal lead from terminal C with the conditions specified in the pull-in test above being maintained. Check that the pinion gear remains out.



Text in Illustration

*1	Terminal C

If the clutch pinion gear returns inward, replace the magnet starter switch assembly.



(d) Inspect the clutch pinion gear return.

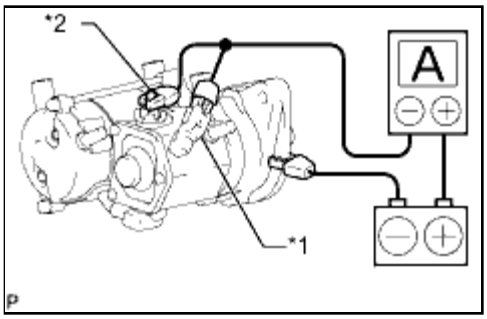
(1) Disconnect the negative (-) terminal lead from the starter body. Check that the clutch pinion gear returns inward.

If the clutch pinion gear does not return inward, replace the magnet starter switch assembly.

(e) Perform an operation test without load.

(1) Connect the lead wire to terminal C.

Torque: 5.9 N·m (60 kgf·cm, 52in·lbf)



(2) Connect the battery and an ammeter to the starter as shown in the illustration.

Text in Illustration

*1	Terminal 50
*2	Terminal 30

(3) Check that the starter rotates smoothly and steadily while the pinion gear is extended. Then measure the current.

Standard current:
90 A or less at 11.5 V

If the result is not as specified, inspect the starter brush holder assembly, starter yoke assembly and starter armature assembly.

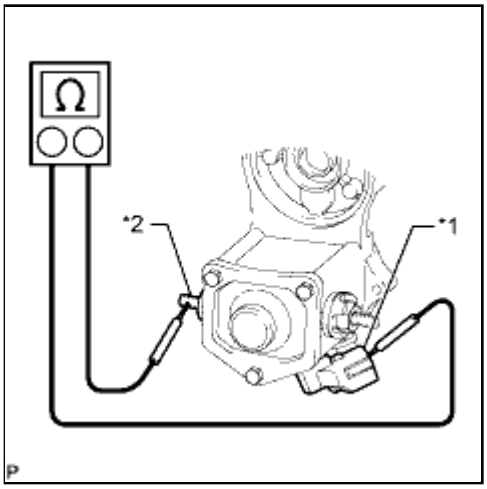
2. INSPECT MAGNET STARTER SWITCH ASSEMBLY

(a) Inspect the pull-in coil.

(1) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
Terminal 50 - Terminal C	Always	Below 1 Ω



Text in Illustration

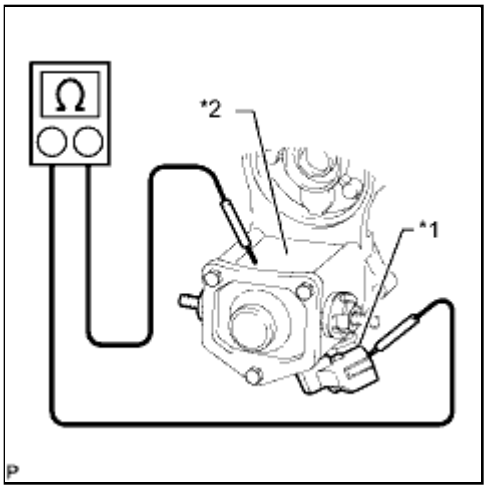
*1	Terminal 50
*2	Terminal C

If the result is not as specified, replace the magnet starter switch assembly.

(b) Inspect the holding coil.

(1) Measure the resistance according to the value(s) in the table below.

Standard Resistance:



TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
Terminal 50 - Switch body	Always	Below 2 Ω

Text in Illustration

*1	Terminal 50
*2	Switch Body

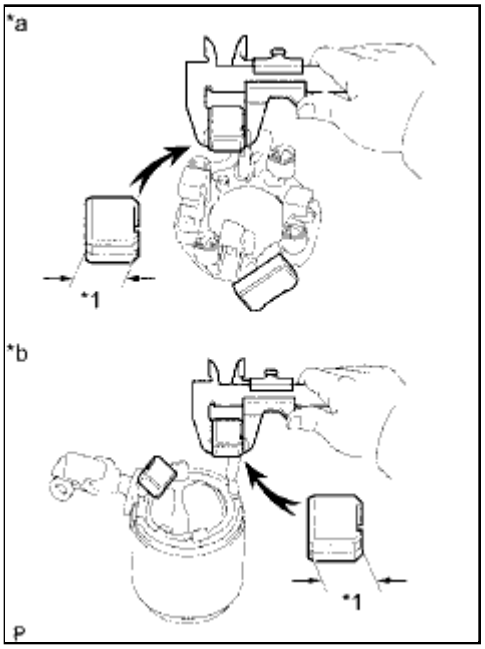
If the result is not as specified, replace the magnet starter switch assembly.

3. INSPECT BRUSH

(a) Using a vernier caliper, measure the brush length.

Standard length:
15.5 mm (0.610 in.)
Minimum length:
8.5 mm (0.335 in.)

Text in Illustration



*1	Length
*a	Brush Holder Side
*b	Starter Yoke Side

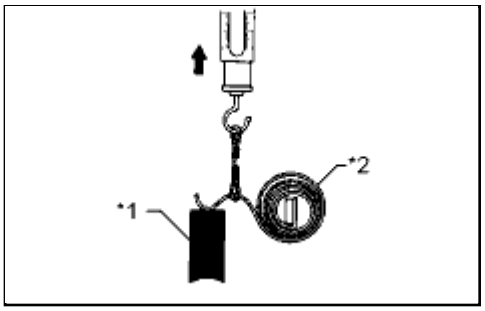
If the length is less than the minimum, replace the starter brush holder assembly and starter yoke assembly.

4. INSPECT STARTER BRUSH HOLDER ASSEMBLY

(a) Check the brush spring load.

(1) Take a pull scale reading immediately after the brush spring separates from the brush.

Standard spring load:
18 to 24 N (1.8 to 2.4 kgf, 4.0 to 5.3 lbf)
Minimum spring load:
12 N (1 kgf, 2.7 lbf)



Text in Illustration

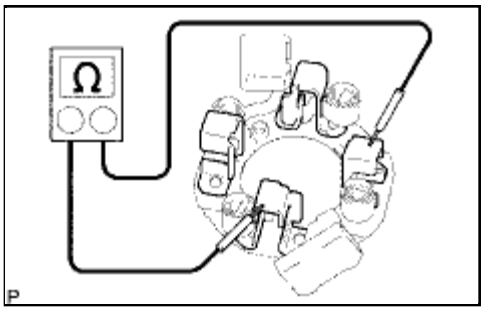
*1	Brush
*2	Brush Spring

If the spring load is less than the minimum, replace the starter brush holder assembly.

(b) Inspect the insulation.

(1) Measure the resistance according to the value(s) in the table below.

Standard Resistance:



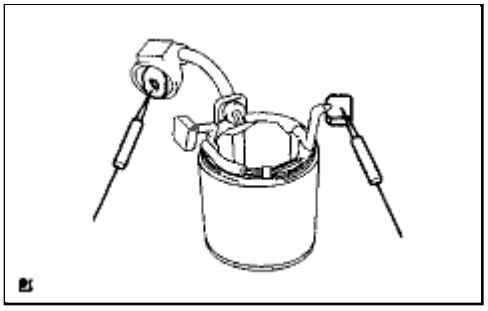
TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
Positive (+) brush holder - Negative (-) brush holder	Always	10 kΩ or higher

If the result is not as specified, replace the starter brush holder assembly.

5. INSPECT STARTER YOKE ASSEMBLY

(a) Inspect the field coil for an open circuit.

(1) Measure the resistance according to the value(s) in the table below.

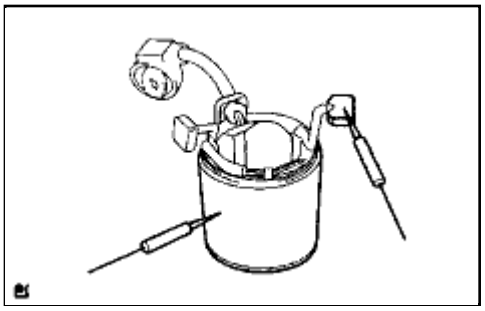


Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
Lead wire - Brush	Always	Below 1 Ω

If the result is not as specified, replace the starter yoke assembly.

(2) Measure the resistance according to the value(s) in the table below.



Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
Starter yoke body - Brush	Always	10 kΩ or higher

If the result is not as specified, replace the starter yoke assembly.

6. INSPECT STARTER ARMATURE ASSEMBLY

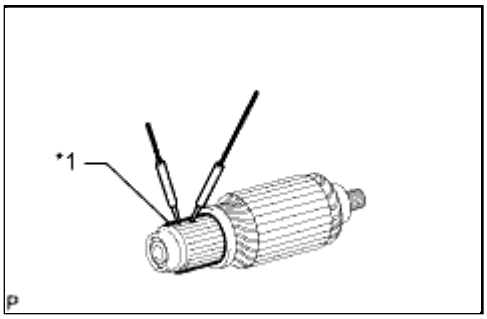
(a) Check the commutator for dirt and/or burns on the surface.

If the surface is dirty or burnt, correct it with sandpaper (No. 400) or a lathe. If necessary, replace the starter armature assembly.

(b) Inspect the commutator for an open circuit.

(1) Measure the resistance according to the value(s) in the table below.

Standard Resistance:



TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
Segment - Segment	Always	Below 1 Ω

Text in Illustration

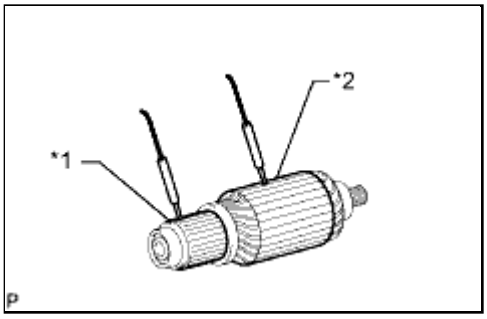
*1	Segment

If the result is not as specified, replace the starter armature assembly.

(c) Inspect the commutator for a short circuit.

(1) Measure the resistance according to the value(s) in the table below.

Standard Resistance:



TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
Segment - Coil core	Always	10 kΩ or higher

Text in Illustration

*1	Segment
*2	Coil Core

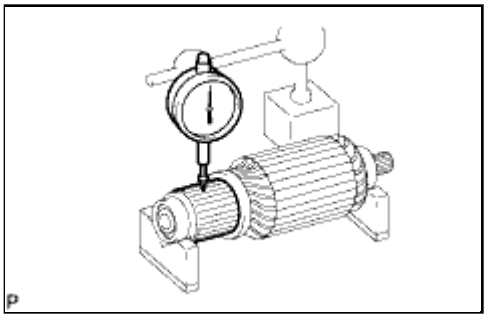
If the result is not as specified, replace the starter armature assembly.

(d) Check the commutator circle runout.

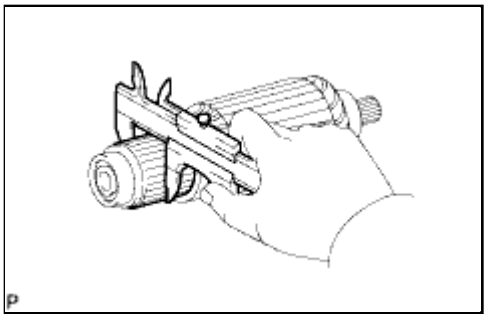
(1) Place the commutator on V-blocks.

(2) Using a dial indicator, measure the circle runout.

Maximum runout:
0.05 mm (0.00197 in.)



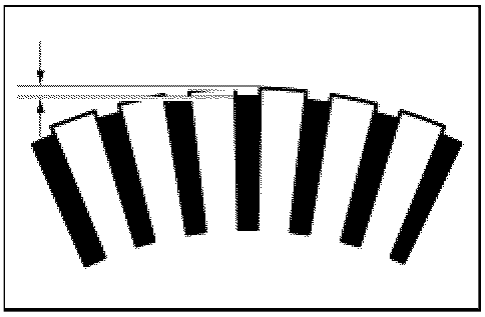
If the circle runout is more than the maximum, replace the starter armature assembly.



(e) Using a vernier caliper, measure the commutator diameter.

Standard diameter:
30.0 mm (1.18 in.)
Minimum diameter:
29.0 mm (1.14 in.)

If the diameter is less than the minimum, replace the starter armature assembly.



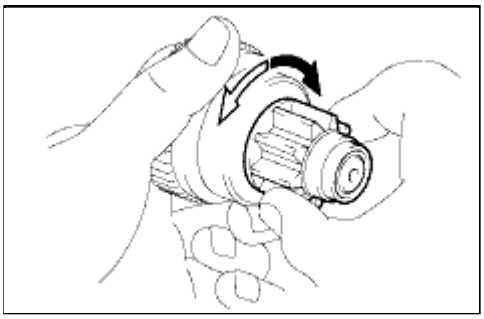
(f) Using a vernier caliper, measure the undercut depth of the commutator.

Standard undercut depth:
0.6 mm (0.0236 in.)
Minimum undercut depth:
0.2 mm (0.00787 in.)

If the undercut depth is less than the minimum, replace the starter armature assembly.

7. INSPECT STARTER CLUTCH SUB-ASSEMBLY

(a) Rotate the pinion gear clockwise and check that it turns freely. Try to rotate the pinion gear counterclockwise and check that it locks.



Text in Illustration

	Free
	Lock

If the result is not as specified, replace the starter clutch sub-assembly.

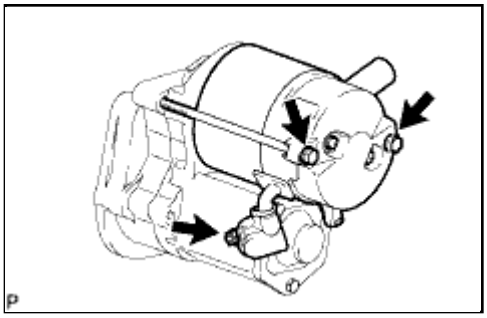
(b) Turn the pinion gear by hand while applying inward force and check the movement of the bearing.

If resistance is felt or the bearing sticks, replace the starter clutch sub-assembly.

Last Modified: 5-10-2010	6.4 A	**From:** 200908
Model Year: 2010	**Model:** 4Runner	**Doc ID:** RM000000DZD00JX
Title: 1GR-FE STARTING: STARTER: DISASSEMBLY (2010 4Runner)		

DISASSEMBLY

1. REMOVE STARTER YOKE ASSEMBLY



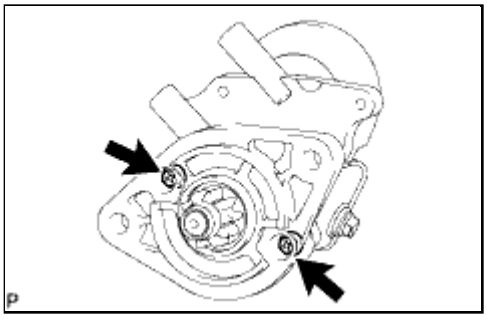
(a) Remove the nut and disconnect the lead wire from terminal C.

(b) Remove the 2 bolts.

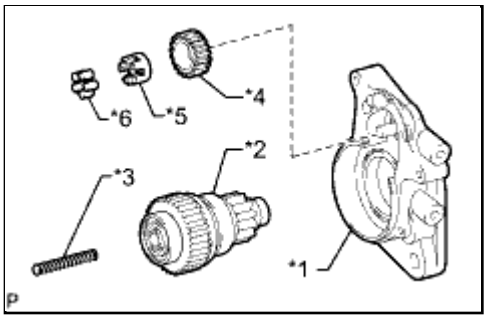
(c) Pull out the starter yoke and starter commutator end frame together with the starter armature.

(d) Remove the O-ring from the starter yoke.

2. REMOVE MAGNET STARTER SWITCH ASSEMBLY



(a) Remove the 2 bolts and magnet starter switch.

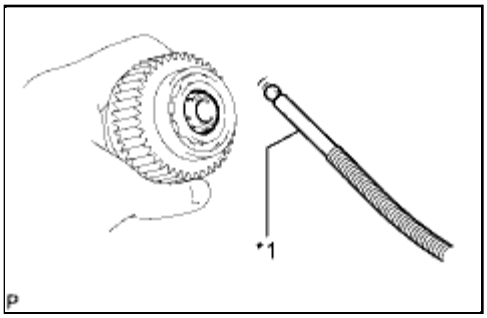


(b) Remove the idle gear, retainer, clutch roller, return spring and starter clutch from the starter drive housing.

Text in Illustration

*1	Starter Drive Housing
*2	Starter Clutch
*3	Return Spring

*4	Idle Gear
*5	Retainer
*6	Clutch Roller

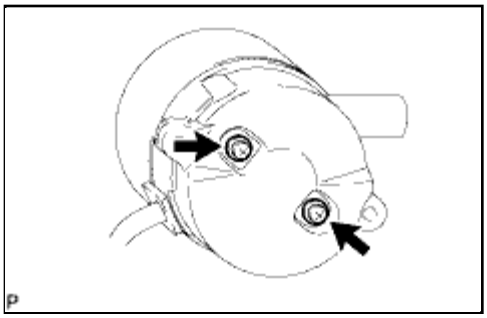


(c) Using a magnet hand, remove the steel ball from the starter clutch hole.

Text in Illustration

*1	Magnet Hand

3. REMOVE STARTER BRUSH HOLDER ASSEMBLY



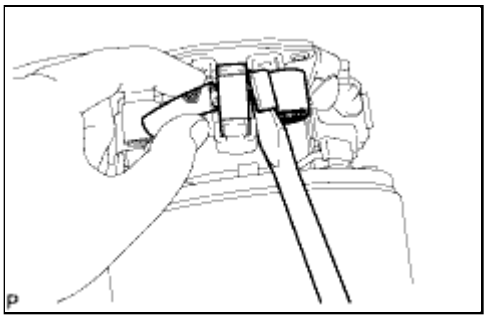
(a) Remove the 2 screws, and then remove the commutator end frame from the starter yoke.

NOTICE:

While holding down the lead wire, remove the starter commutator end frame.

(b) Remove the dust starter protector from the commutator end frame.

(c) Remove the O-ring from the starter yoke.



(d) Disconnect the 4 brushes from the starter brush holder.

(1) Using a screwdriver, hold back the brush spring.

(2) Disconnect the brush from the starter brush holder.

(e) Remove the starter brush holder.

4. REMOVE STARTER ARMATURE ASSEMBLY

(a) Remove the starter armature from the starter yoke.

Last Modified: 5-10-2010	6.4 A	**From:** 200908
Model Year: 2010	**Model:** 4Runner	**Doc ID:** RM0000022AC00DX
Title: 1GR-FE STARTING: STARTER: REMOVAL (2010 4Runner)		

REMOVAL

1. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL

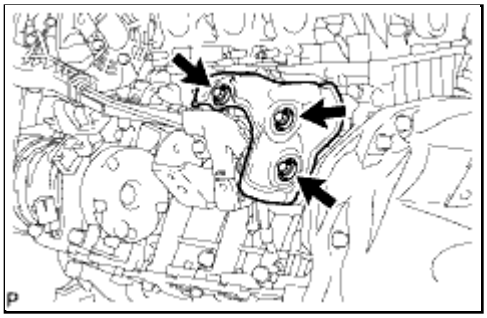
NOTICE:

When disconnecting the cable, some systems need to be initialized after the cable is reconnected INFO .

2. REMOVE EXHAUST MANIFOLD SUB-ASSEMBLY LH

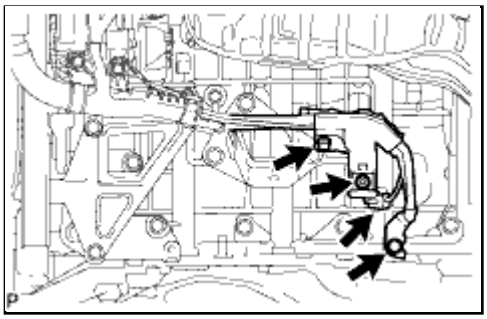
(a) Remove the exhaust manifold sub-assembly LH INFO .

3. REMOVE STARTER COVER



(a) Remove the 3 bolts and starter cover.

4. REMOVE STARTER ASSEMBLY



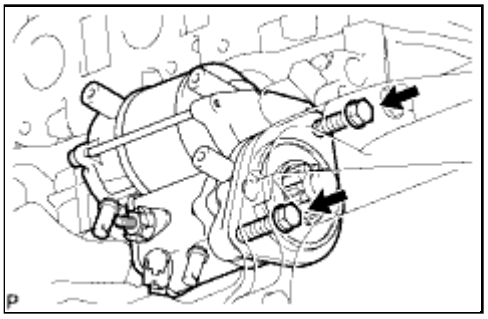
(a) Remove the bolt and disconnect the ground wire.

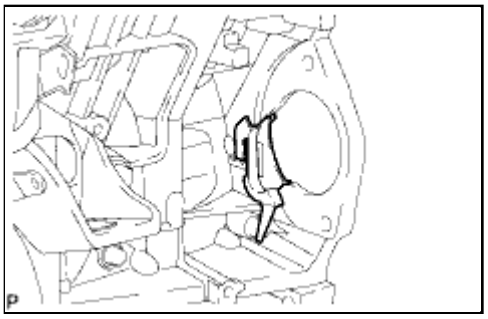
(b) Disconnect the starter connector.

(c) Open the terminal cap.

(d) Remove the nut and bolt, and then disconnect the starter wire.

(e) Remove the 2 bolts and starter.





5. REMOVE FLYWHEEL HOUSING SIDE COVER

Last Modified: 5-10-2010	6.4 A	**From:** 200908
Model Year: 2010	**Model:** 4Runner	**Doc ID:** RM000000DZF00JX
Title: 1GR-FE STARTING: STARTER: REASSEMBLY (2010 4Runner)		

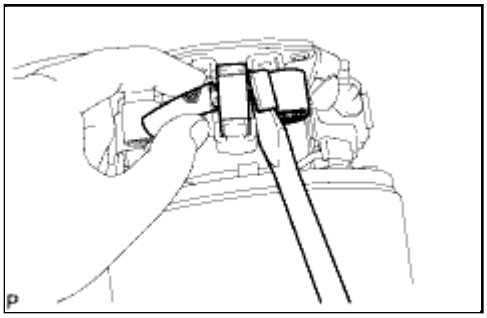
REASSEMBLY

1. INSTALL STARTER ARMATURE ASSEMBLY

(a) Install the starter armature to the starter yoke.

2. INSTALL STARTER BRUSH HOLDER ASSEMBLY

(a) Install the starter brush holder.



(b) Connect the 4 brushes to the starter brush holder.

(1) Using a screwdriver, hold back the brush spring.

NOTICE:

Check that the positive (+) lead wires are not grounded.

(2) Connect the brush to the starter brush holder.

(c) Place a new O-ring in position on the commutator end frame.

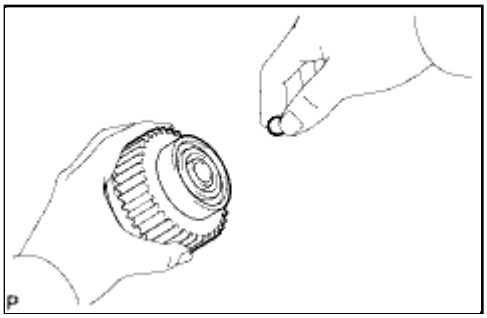
(d) Install a new dust starter protector to the commutator end frame.

(e) Install the commutator end frame with the 2 screws.

Torque: 1.5 N·m (15 kgf·cm, 13in·lbf)

3. INSTALL MAGNET STARTER SWITCH ASSEMBLY

(a) Apply high-temperature grease to the idle gear, steel ball, return spring, clutch roller and retainer.



(b) Insert the steel ball into the starter clutch.

(c) Insert the return spring into the starter clutch.

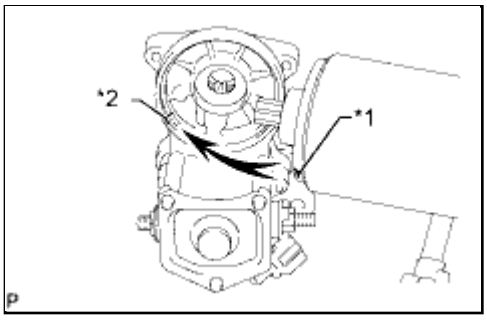
(d) Install the starter clutch, idle gear, retainer and clutch roller to the starter drive housing.

(e) Install the starter drive housing to the magnet starter switch with the 2 bolts.

Torque: 5.9 N·m (60 kgf·cm, 52in·lbf)

4. INSTALL STARTER YOKE ASSEMBLY

(a) Install a new O-ring to the groove of the starter yoke.



(b) Align the claw of the starter yoke with the groove of the starter switch.

Text in Illustration

*1	Claw
*2	Groove

(c) Install the starter yoke to the magnet starter switch with the 2 bolts.

Torque: 5.9 N·m (60 kgf·cm, 52in·lbf)

(d) Connect the lead wire to terminal C with the nut.

Torque: 5.9 N·m (60 kgf·cm, 52in·lbf)

Last Modified: 5-10-2010	6.4 A	**From:** 200908
Model Year: 2010	**Model:** 4Runner	**Doc ID:** RM0000022A900DX
Title: 1GR-FE STARTING: STARTER: INSTALLATION (2010 4Runner)		

INSTALLATION

1. INSTALL FLYWHEEL HOUSING SIDE COVER

2. INSTALL STARTER ASSEMBLY

(a) Install the starter with the 2 bolts.

Torque: 37 N·m (377 kgf·cm, 27ft·lbf)

(b) Connect the starter wire with the bolt and nut.

for bolt - Torque: 8.0 N·m (82 kgf·cm, 71in·lbf)
for nut - Torque: 9.8 N·m (100 kgf·cm, 87in·lbf)

(c) Close the terminal cap.

(d) Connect the starter connector.

(e) Connect the ground wire with the bolt.

Torque: 13 N·m (133 kgf·cm, 10ft·lbf)

3. INSTALL STARTER COVER

(a) Install the starter cover with the 3 bolts.

Torque: 12 N·m (117 kgf·cm, 8ft·lbf)

4. INSTALL EXHAUST MANIFOLD SUB-ASSEMBLY LH

(a) Install the exhaust manifold sub-assembly LH INFO .

5. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL

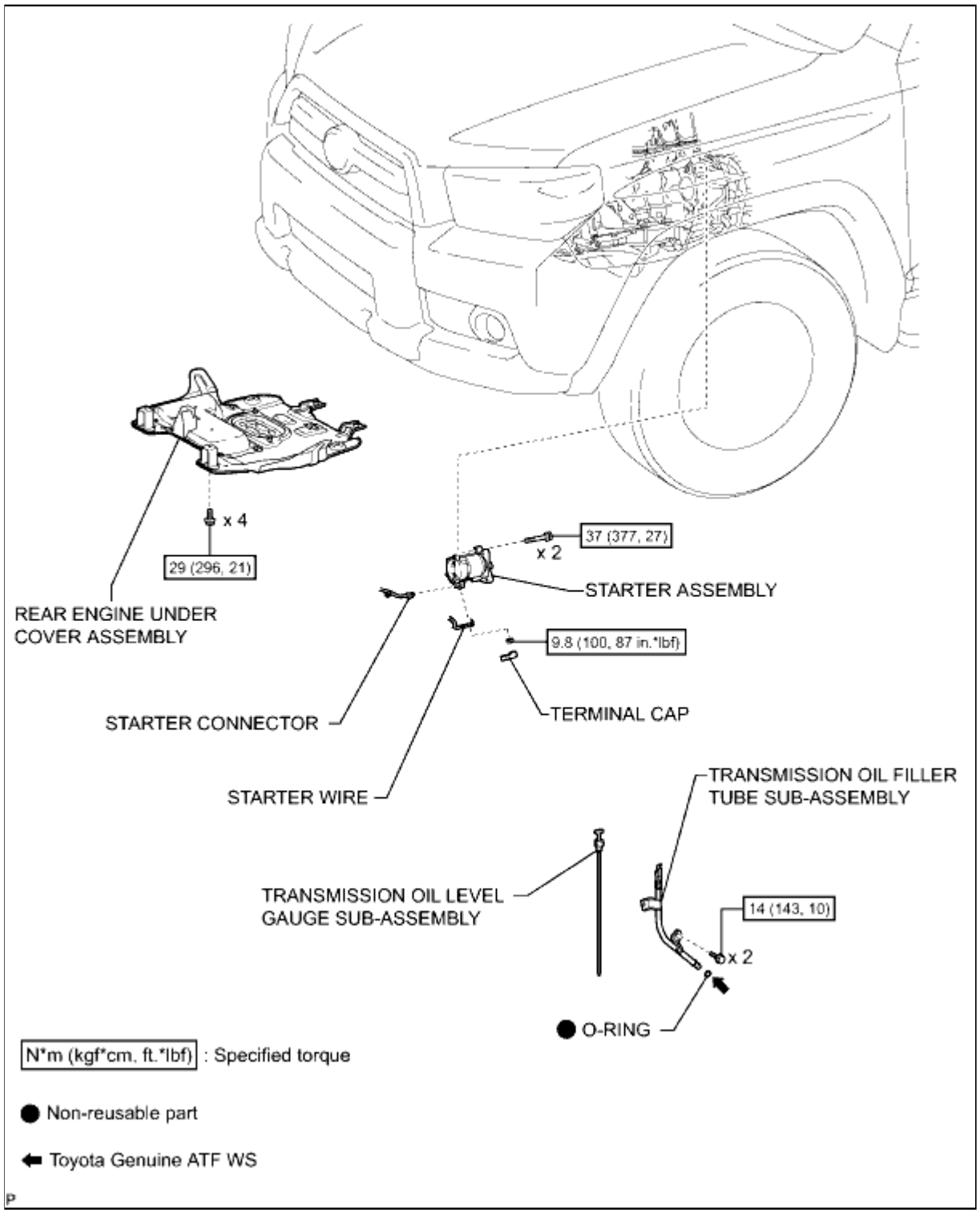
NOTICE:

When disconnecting the cable, some systems need to be initialized after the cable is reconnected INFO .

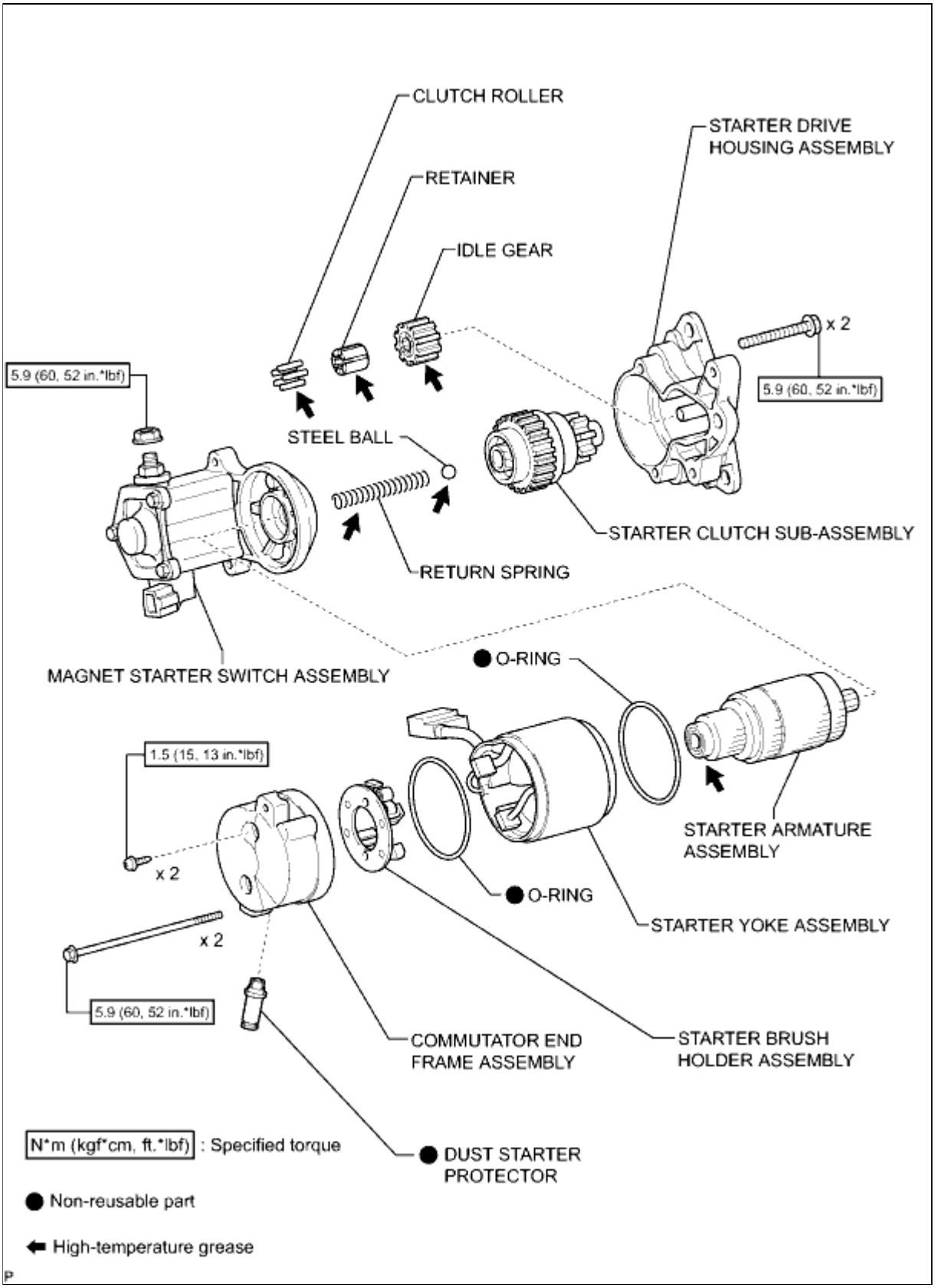
Last Modified: 5-10-2010	6.4 K	**From:** 200908
Model Year: 2010	**Model:** 4Runner	**Doc ID:** RM0000045FW002X
Title: 2TR-FE STARTING: STARTER: COMPONENTS (2010 4Runner)		

COMPONENTS

ILLUSTRATION



ILLUSTRATION



Last Modified: 5-10-2010	6.4 G	**From:** 200908
Model Year: 2010	**Model:** 4Runner	**Doc ID:** RM00000179K009X
Title: 2TR-FE STARTING: STARTER: INSPECTION (2010 4Runner)		

INSPECTION

1. INSPECT STARTER ASSEMBLY

CAUTION:

As a large electric current passes through the cable during this inspection, a thick cable must be used. If not, the cable may become hot and cause injury.

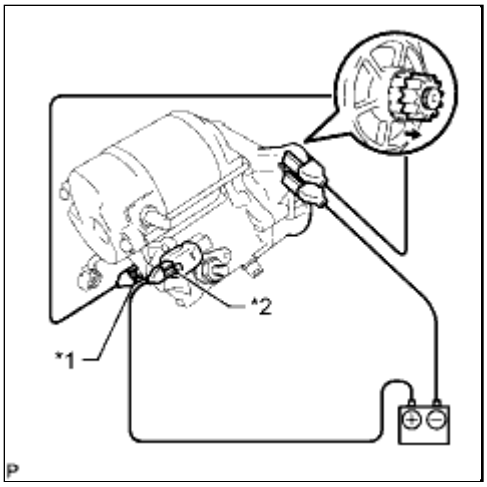
NOTICE:

The following tests must each be performed within 3 to 5 seconds to prevent the coil from burning out.

(a) Mount the starter in a vise between aluminum plates.

(b) Perform a pull-in test.

(1) Remove the nut, and then disconnect the lead wire from terminal C.



(2) Connect the battery to the magnet starter switch as shown in the illustration. Check that the clutch pinion gear extends.

Text in Illustration

*1	Terminal C
*2	Terminal 50

If the clutch pinion gear does not move, replace the magnet starter switch assembly.

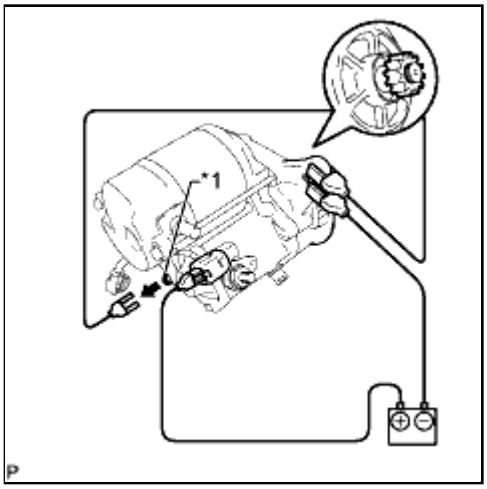
(c) Perform a holding test.

(1) Disconnect the negative (-) terminal lead from terminal C with the conditions specified in the pull-in test above being maintained. Check that the pinion gear remains extended.

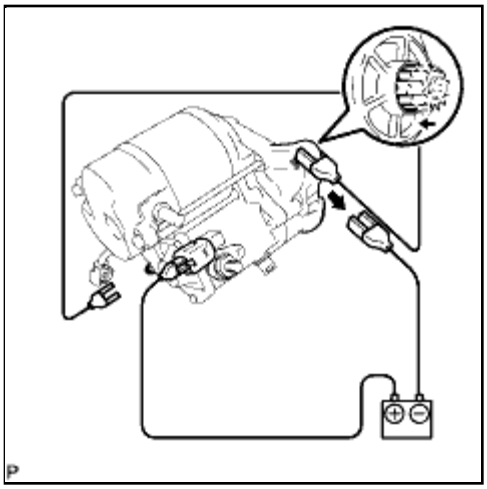
Text in Illustration

*1	Terminal C

If the clutch pinion gear returns inward, replace the magnet starter switch assembly.



(d) Inspect the clutch pinion gear return.



(1) Disconnect the negative (-) terminal lead from the starter body. Check that the clutch pinion gear returns inward.

If the clutch pinion gear does not return inward, replace the magnet starter switch assembly.

(e) Perform an operation test without load.

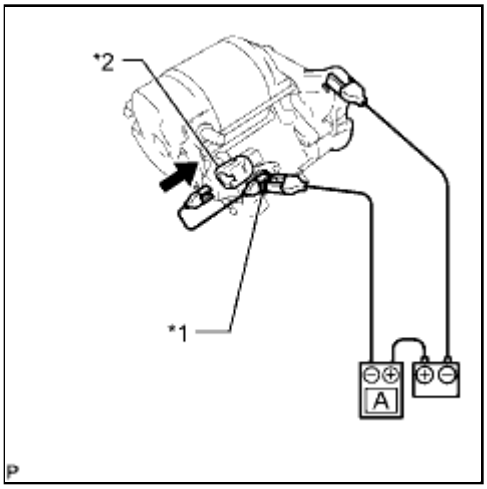
(1) Connect the lead wire to terminal C.

Torque: 5.9 N·m (60 kgf·cm, 52in·lbf)

(2) Connect the battery and an ammeter to the starter as shown in the illustration.

Text in Illustration

*1	Terminal 30
*2	Terminal 50



(3) Check that the starter rotates smoothly and steadily while the pinion gear is extended. Then measure the current.

Standard current:

90 A or less at 11.5 V

If the result is not as specified, inspect the starter brush holder assembly, starter yoke assembly and starter armature assembly.

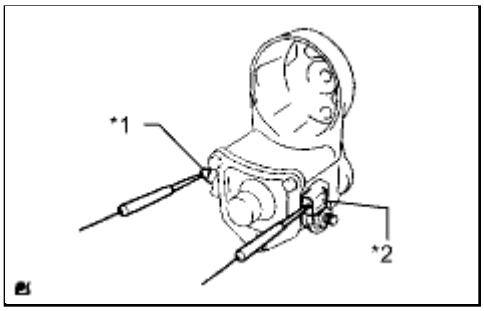
2. INSPECT MAGNET STARTER SWITCH ASSEMBLY

(a) Inspect the pull-in coil.

(1) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
Terminal 50 - Terminal C	Always	Below 1 Ω



Text in Illustration

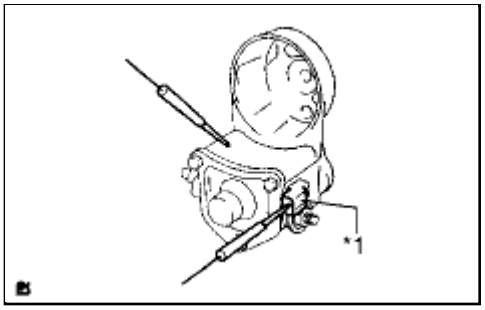
*1	Terminal C
*2	Terminal 50

If the result is not as specified, replace the magnet starter switch assembly.

(b) Inspect the holding coil.

(1) Measure the resistance according to the value(s) in the table below.

Standard Resistance:



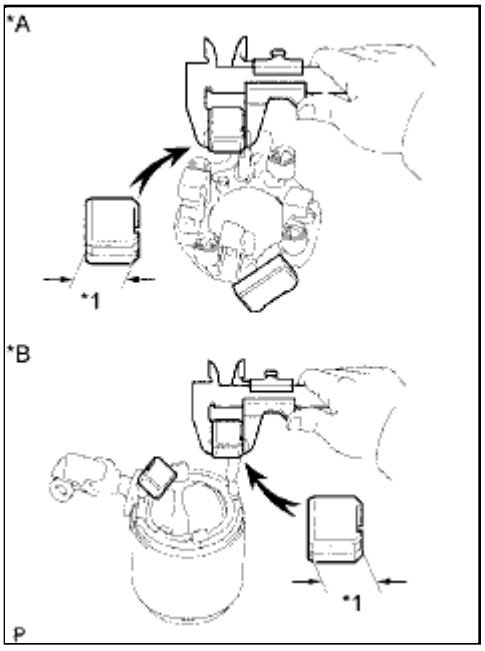
TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
Terminal 50 - Switch body	Always	Below 2 Ω

Text in Illustration

*1	Terminal 50

If the result is not as specified, replace the magnet starter switch assembly.

3. INSPECT BRUSH



(a) Using a vernier caliper, measure the brush length.

Standard length:
15.5 mm (0.610 in.)
Minimum length:
8.5 mm (0.335 in.)

Text in Illustration

*A	Brush Holder Side
*B	Starter Yoke Side
*1	Length

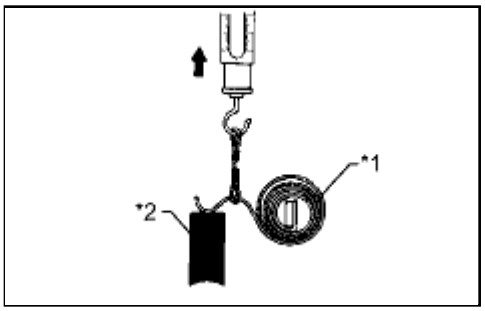
If the length is less than the minimum, replace the starter brush holder assembly and starter yoke assembly.

4. INSPECT STARTER BRUSH HOLDER ASSEMBLY

(a) Check the brush spring load.

(1) Take a pull scale reading as soon as the brush spring separates from the brush.

Standard spring load:
18 to 24 N (1.8 to 2.4 kgf, 4.0 to 5.3 lbf)
Minimum spring load:
12 N (1 kgf, 2.7 lbf)



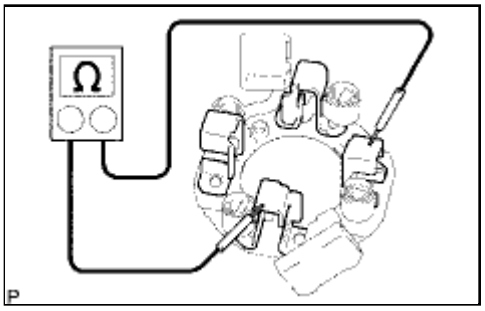
Text in Illustration

*1	Brush Spring
*2	Brush

If the spring load is less than the minimum, replace the starter brush holder assembly.

(b) Inspect the insulation.

(1) Measure the resistance according to the value(s) in the table below.



Standard Resistance:

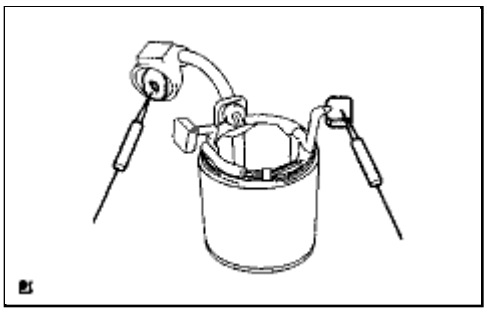
TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
Positive (+) brush holder - Negative (-) brush holder	Always	10 kΩ or higher

If the result is not as specified, replace the starter brush holder assembly.

5. INSPECT STARTER YOKE ASSEMBLY

(a) Inspect the field coil.

(1) Measure the resistance according to the value(s) in the table below.

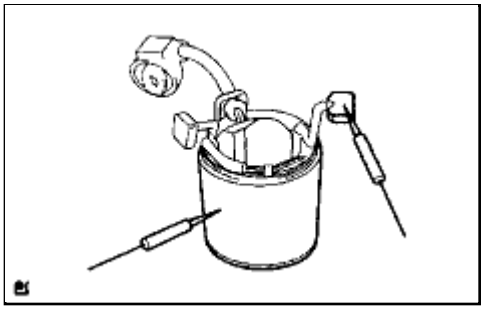


Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
Lead wire - Brush	Always	Below 1 Ω

If the result is not as specified, replace the starter yoke assembly.

(2) Measure the resistance according to the value(s) in the table below.



Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
Starter yoke body - Brush	Always	10 kΩ or higher

If the result is not as specified, replace the starter yoke assembly.

6. INSPECT STARTER ARMATURE ASSEMBLY

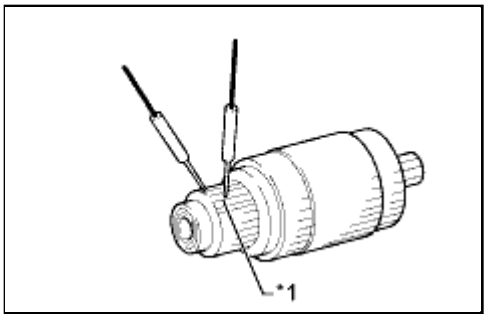
(a) Check the commutator for dirt and/or burns on the surface.

If the surface is dirty or burnt, correct it with sandpaper (No. 400) or a lathe. If necessary, replace the starter armature assembly.

(b) Inspect the commutator for an open circuit.

(1) Measure the resistance according to the value(s) in the table below.

Standard Resistance:



TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
Segment - Segment	Always	Below 1 Ω

Text in Illustration

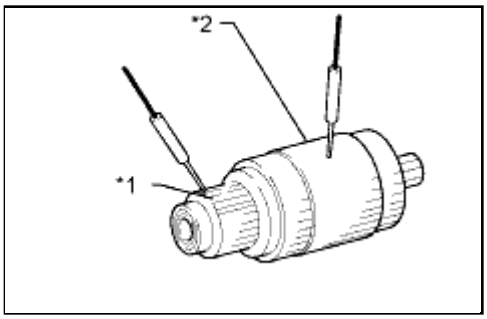
*1	Segment

If the result is not as specified, replace the starter armature assembly.

(c) Inspect the commutator for a short circuit.

(1) Measure the resistance according to the value(s) in the table below.

Standard Resistance:



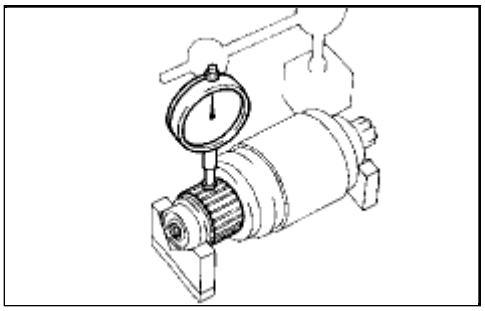
TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
Segment - Coil core	Always	10 kΩ or higher

Text in Illustration

*1	Segment
*2	Coil Core

If the result is not as specified, replace the starter armature assembly.

(d) Check the commutator circle runout.



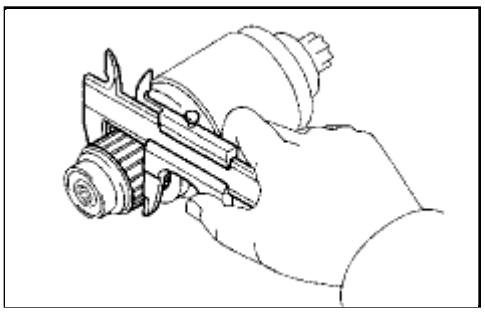
(1) Place the commutator on V-blocks.

(2) Using a dial indicator, measure the circle runout.

Maximum runout:
0.05 mm (0.00197 in.)

If the circle runout is more than the maximum, replace the starter armature assembly.

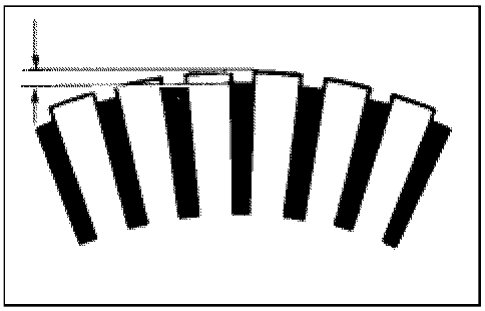
(e) Check the commutator diameter.



(1) Using a vernier caliper, measure the commutator diameter.

Standard diameter:
30.0 mm (1.18 in.)
Minimum diameter:
29.0 mm (1.14 in.)

If the diameter is less than the minimum, replace the starter armature assembly.



(f) Check the undercut depth.

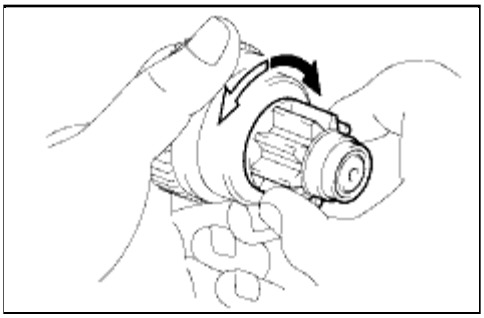
(1) Using a vernier caliper, measure the undercut depth of the commutator.

Standard undercut depth:
0.6 mm (0.0236 in.)
Minimum undercut depth:
0.2 mm (0.00787 in.)

If the undercut depth is less than the minimum, replace the starter armature assembly.

7. INSPECT STARTER CLUTCH SUB-ASSEMBLY

(a) Rotate the pinion gear clockwise and check that it turns freely. Try to rotate the pinion gear counterclockwise and check that it locks.



Text in Illustration

➡	Free
⇨	Lock

If the result is not as specified, replace the starter clutch sub-assembly.

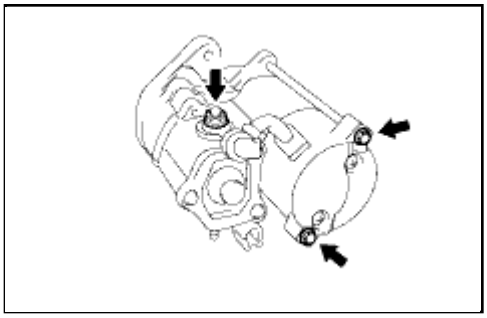
(b) Turn the pinion gear by hand while applying inward force and check the movement of the bearing.

If resistance is felt or the bearing sticks, replace the starter clutch sub-assembly.

Last Modified: 5-10-2010	6.4 A	**From:** 200908
Model Year: 2010	**Model:** 4Runner	**Doc ID:** RM00000179N009X
Title: 2TR-FE STARTING: STARTER: DISASSEMBLY (2010 4Runner)		

DISASSEMBLY

1. REMOVE STARTER YOKE ASSEMBLY



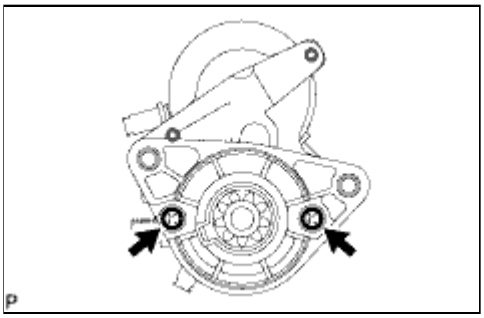
(a) Remove the nut, and then disconnect the lead wire from terminal C.

(b) Remove the 2 through bolts.

(c) Pull out the starter yoke together with the starter armature.

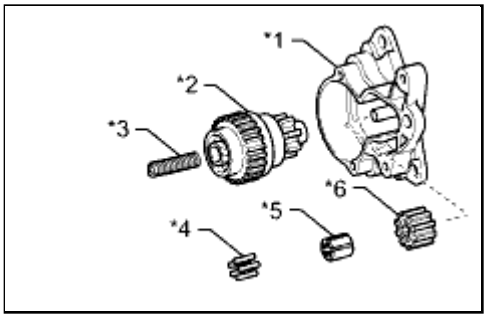
(d) Remove the O-ring from the starter yoke.

2. REMOVE MAGNET STARTER SWITCH ASSEMBLY



(a) Remove the 2 screws and magnet starter switch.

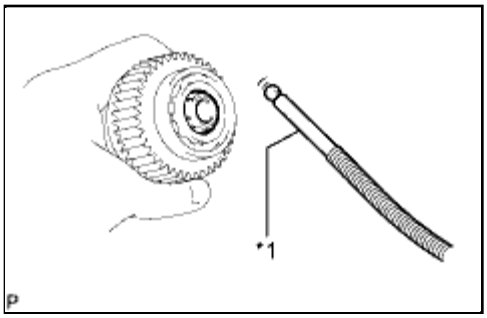
(b) Remove the idle gear, retainer, clutch roller, return spring and starter clutch from the starter drive housing.



Text in Illustration

*1	Starter Drive Housing
*2	Starter Clutch
*3	Return Spring

*4	Clutch Roller
*5	Retainer
*6	Idle Gear

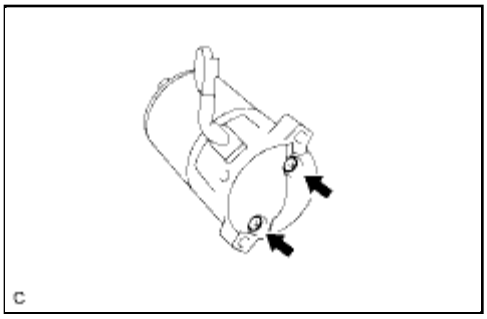


(c) Using a magnet hand, remove the steel ball from the starter clutch hole.

Text in Illustration

*1	Magnet Hand

3. REMOVE STARTER BRUSH HOLDER ASSEMBLY

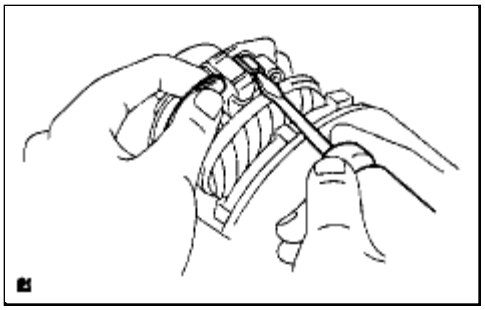


(a) Remove the 2 screws and commutator end frame from the starter yoke.

(b) Remove the O-ring from the starter yoke.

(c) Remove the dust starter protector from the commutator end frame.

(d) Disconnect the 4 brushes from the starter brush holder.

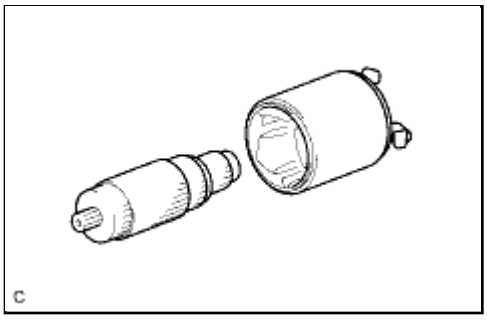


(1) Using a screwdriver, hold back the brush spring.

(2) Disconnect the brush from the brush holder.

(e) Remove the brush holder from the starter armature.

4. REMOVE STARTER ARMATURE ASSEMBLY



(a) Remove the starter armature from the starter yoke.

Last Modified: 5-10-2010	6.4 A	**From:** 200908
Model Year: 2010	**Model:** 4Runner	**Doc ID:** RM00000179M00AX
Title: 2TR-FE STARTING: STARTER: REMOVAL (2010 4Runner)		

REMOVAL

1. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL

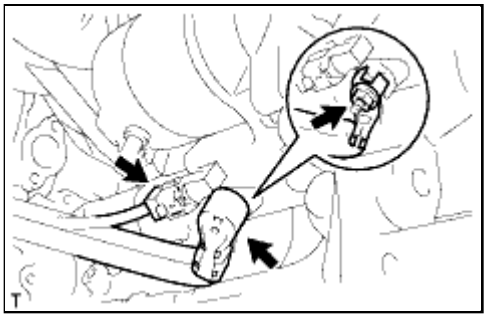
NOTICE:

When disconnecting the cable, some systems need to be initialized after the cable is reconnected INFO **.**

2. REMOVE REAR ENGINE UNDER COVER ASSEMBLY INFO

3. REMOVE TRANSMISSION OIL FILLER TUBE SUB-ASSEMBLY INFO

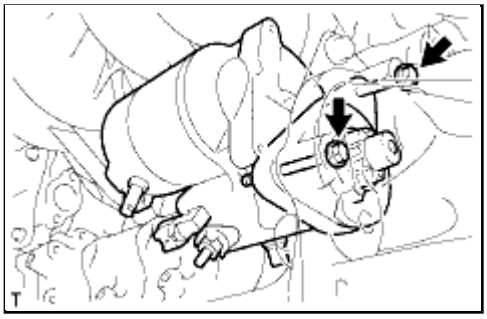
4. REMOVE STARTER ASSEMBLY



(a) Disconnect the starter connector.

(b) Remove the terminal cap.

(c) Remove the nut and disconnect the starter wire.



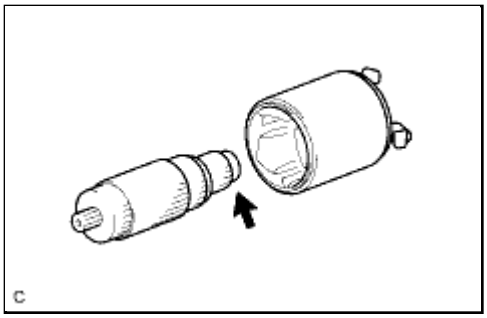
(d) Remove the 2 bolts and starter.

Last Modified: 5-10-2010	6.4 A	**From:** 200908
Model Year: 2010	**Model:** 4Runner	**Doc ID:** RM00000179O009X
Title: 2TR-FE STARTING: STARTER: REASSEMBLY (2010 4Runner)		

REASSEMBLY

1. INSTALL STARTER ARMATURE ASSEMBLY

(a) Apply high-temperature grease to the starter armature bearing.



(b) Install the starter armature to the starter yoke.

2. INSTALL STARTER BRUSH HOLDER ASSEMBLY

(a) Install the starter brush holder.

(b) Connect the 4 brushes to the starter brush holder.

(1) Using a screwdriver, hold back the spring.

(2) Connect the brush to the brush holder.

NOTICE:

Check that the positive (+) lead wires are not grounded.

(c) place a new O-ring in position on the commutator end frame.

(d) Install a new dust starter protector to the commutator end frame.

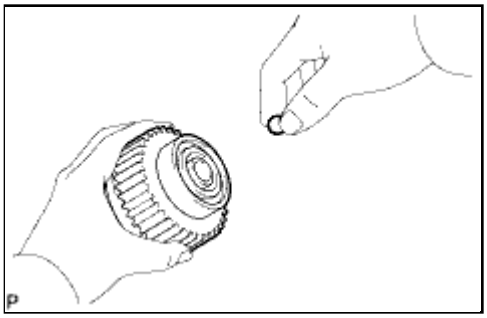
(e) Install the commutator end frame with the 2 screws.

Torque: 1.5 N·m (15 kgf·cm, 13in·lbf)

3. INSTALL MAGNET STARTER SWITCH ASSEMBLY

(a) Apply high-temperature grease to the idle gear, steel ball, return spring, clutch roller and retainer.

(b) Insert the steel ball into the starter clutch hole.



(c) Insert the return spring into the starter clutch hole.

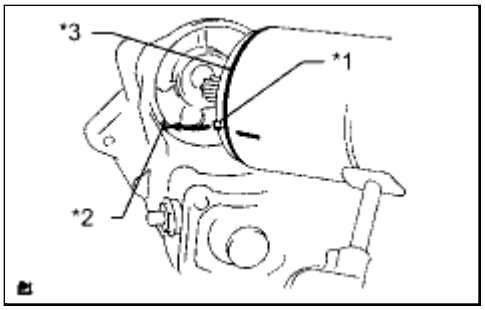
(d) Install the starter clutch, idle gear, retainer and clutch roller to the starter drive housing.

(e) Install the starter drive housing to the magnet starter switch with the 2 screws.

Torque: 5.9 N·m (60 kgf·cm, 52in·lbf)

4. INSTALL STARTER YOKE ASSEMBLY

(a) Place a new O-ring in position on the starter yoke.



(b) Align the claw of the starter yoke with the groove of the starter switch.

Text in Illustration

*1	Claw
*2	Groove
*3	New O-Ring

(c) Install the starter yoke to the magnet starter switch with the 2 through bolts.

Torque: 5.9 N·m (60 kgf·cm, 52in·lbf)

(d) Connect the lead wire to terminal C with the nut.

Torque: 5.9 N·m (60 kgf·cm, 52in·lbf)

Last Modified: 5-10-2010	6.4 A	**From:** 200908
Model Year: 2010	**Model:** 4Runner	**Doc ID:** RM0000179J00AX
Title: 2TR-FE STARTING: STARTER: INSTALLATION (2010 4Runner)		

INSTALLATION

1. INSTALL STARTER ASSEMBLY

(a) Install the starter with the 2 bolts.

Torque: 37 N·m (377 kgf·cm, 27ft·lbf)

(b) Connect the starter connector.

(c) Connect the starter wire harness with the nut.

Torque: 9.8 N·m (100 kgf·cm, 87in·lbf)

(d) Install the terminal cap.

2. INSTALL TRANSMISSION OIL FILLER TUBE SUB-ASSEMBLY INFO

3. INSTALL REAR ENGINE UNDER COVER ASSEMBLY INFO

4. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL

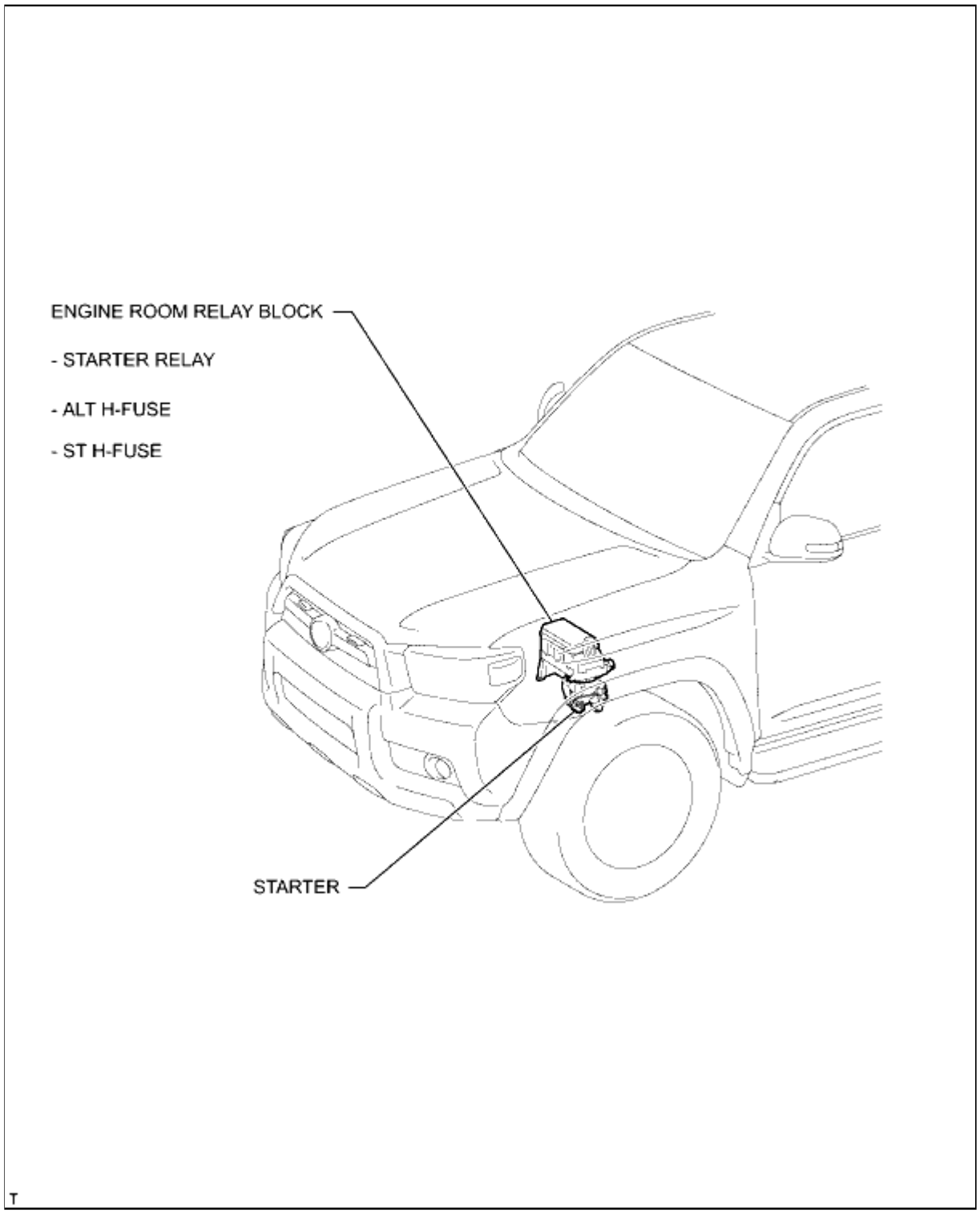
NOTICE:

When disconnecting the cable, some systems need to be initialized after the cable is reconnected INFO .

Last Modified: 5-10-2010	6.4 R	**From:** 200908
Model Year: 2010	**Model:** 4Runner	**Doc ID:** RM0000046OL000X
Title: 1GR-FE STARTING: STARTING SYSTEM: PARTS LOCATION (2010 4Runner)		

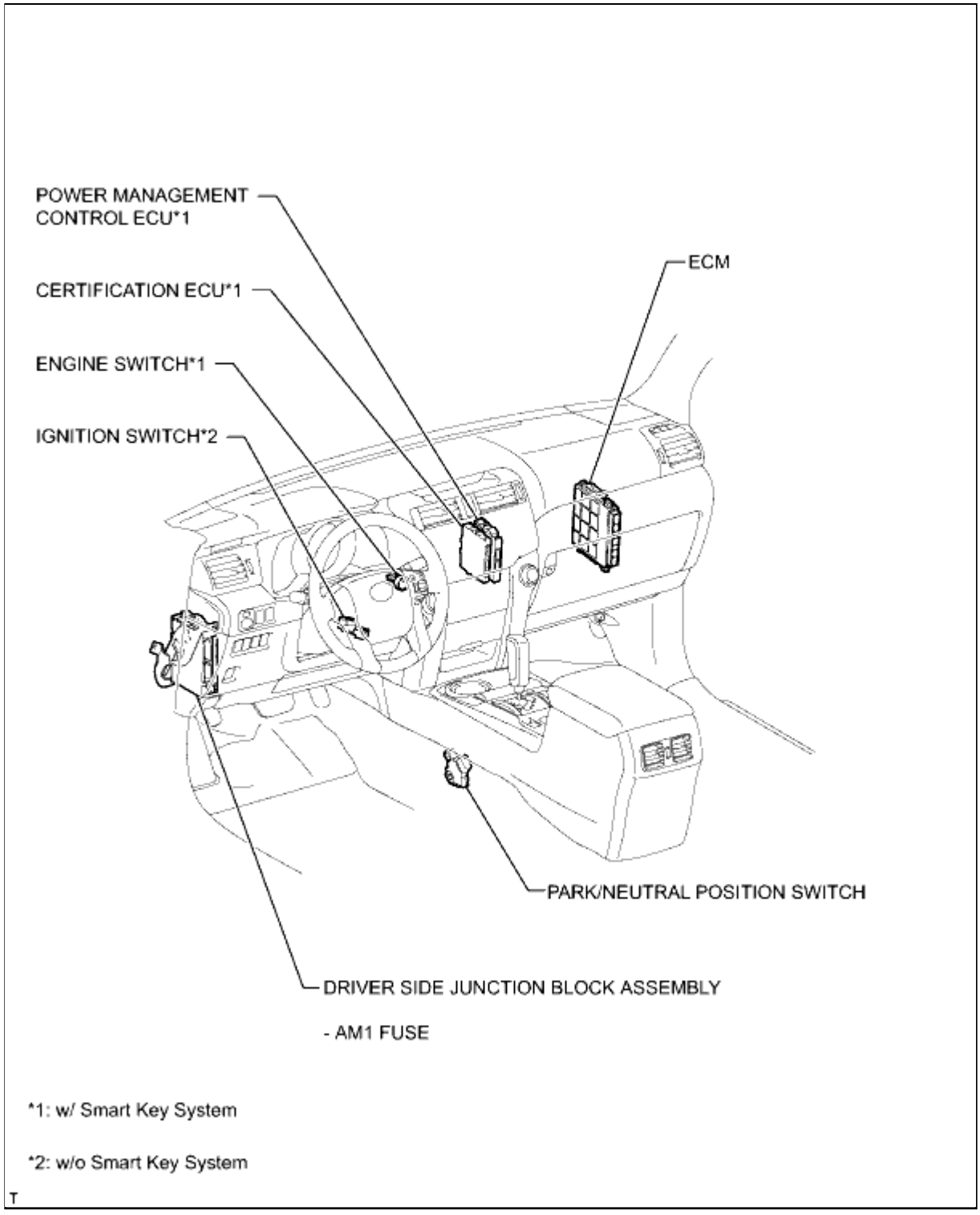
PARTS LOCATION

ILLUSTRATION



T

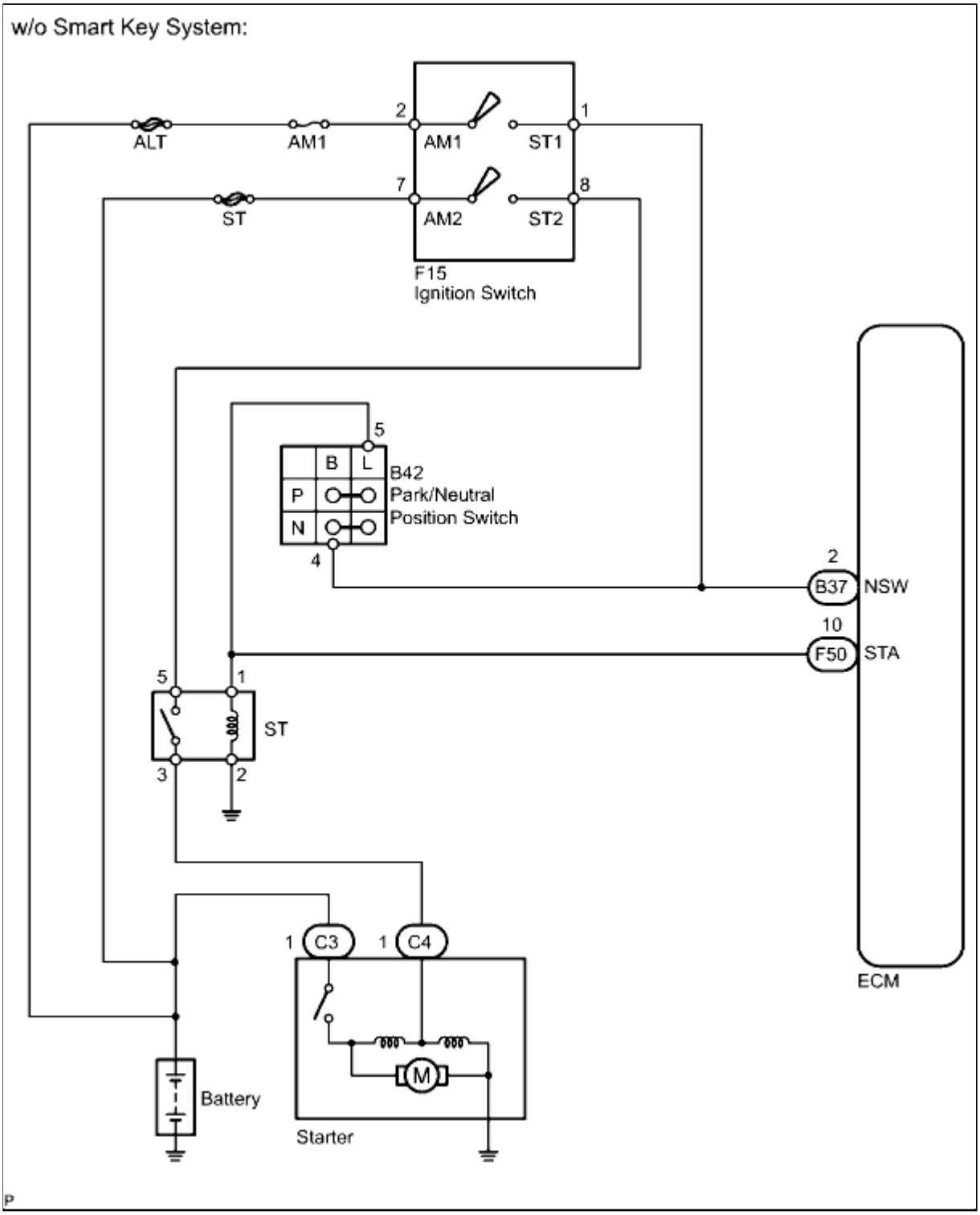
ILLUSTRATION



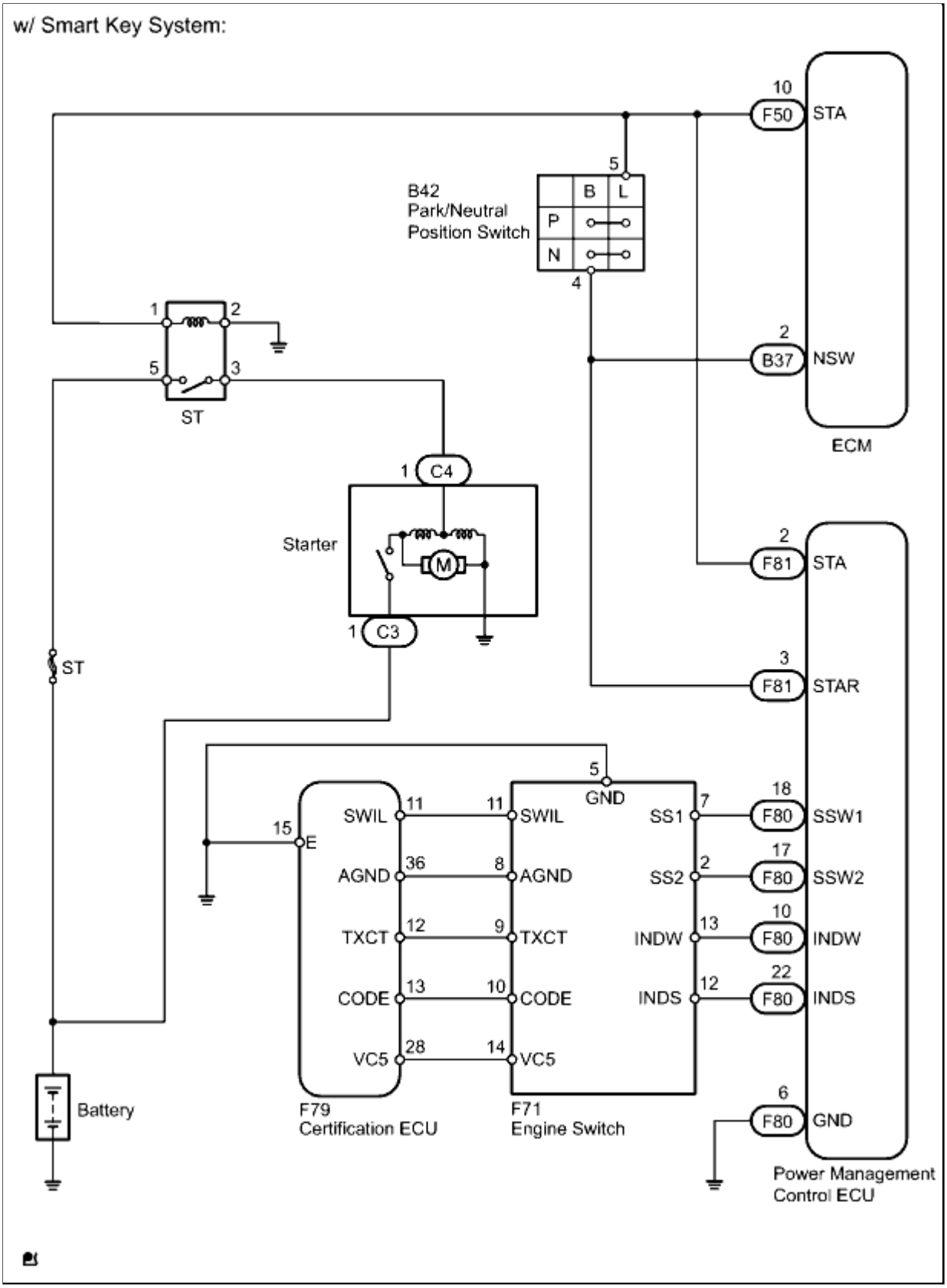
T

Last Modified: 5-10-2010	6.4 U	**From:** 200908
Model Year: 2010	**Model:** 4Runner	**Doc ID:** RM0000046OM000X
Title: 1GR-FE STARTING: STARTING SYSTEM: SYSTEM DIAGRAM (2010 4Runner)		

SYSTEM DIAGRAM



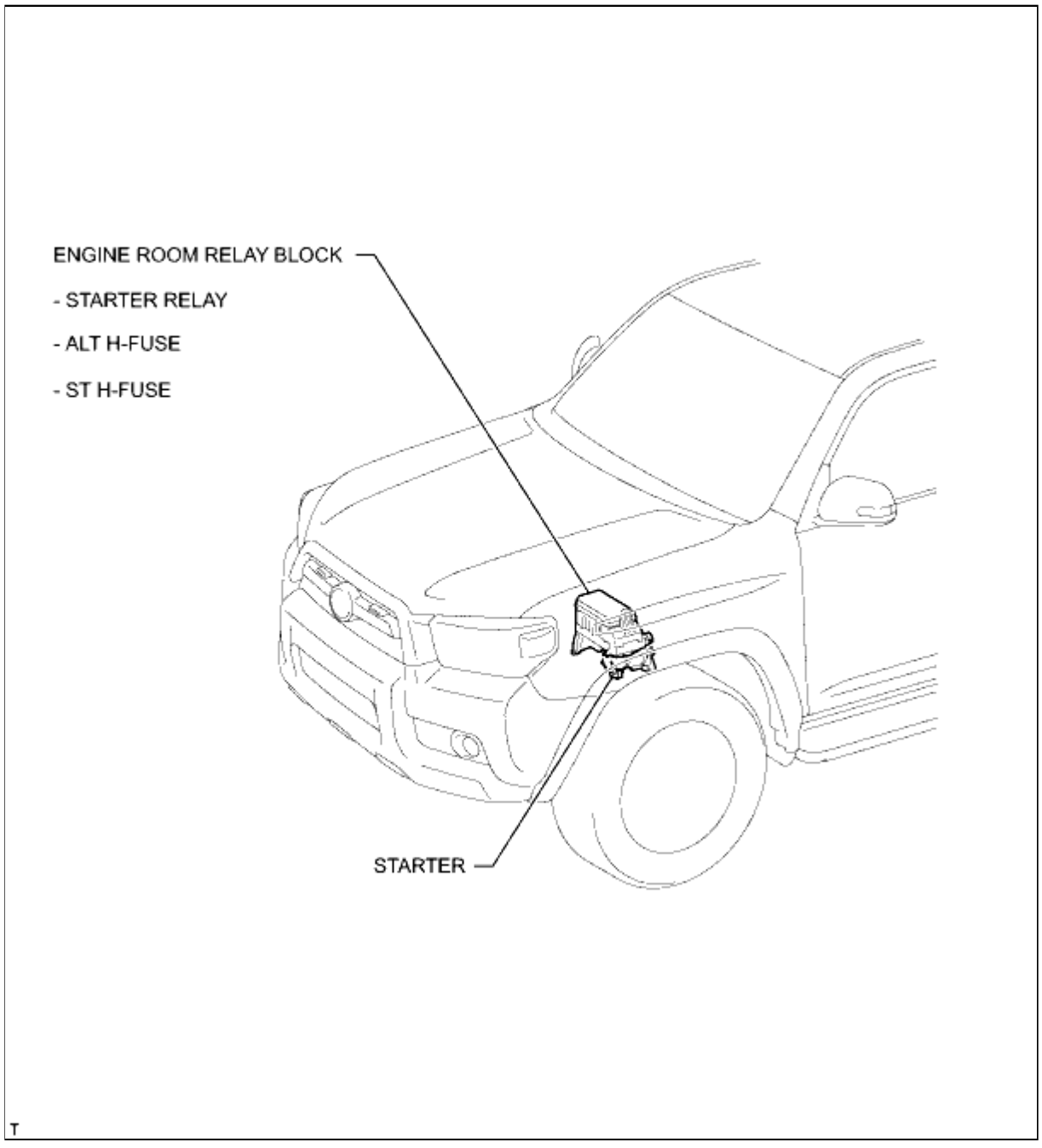
w/ Smart Key System:



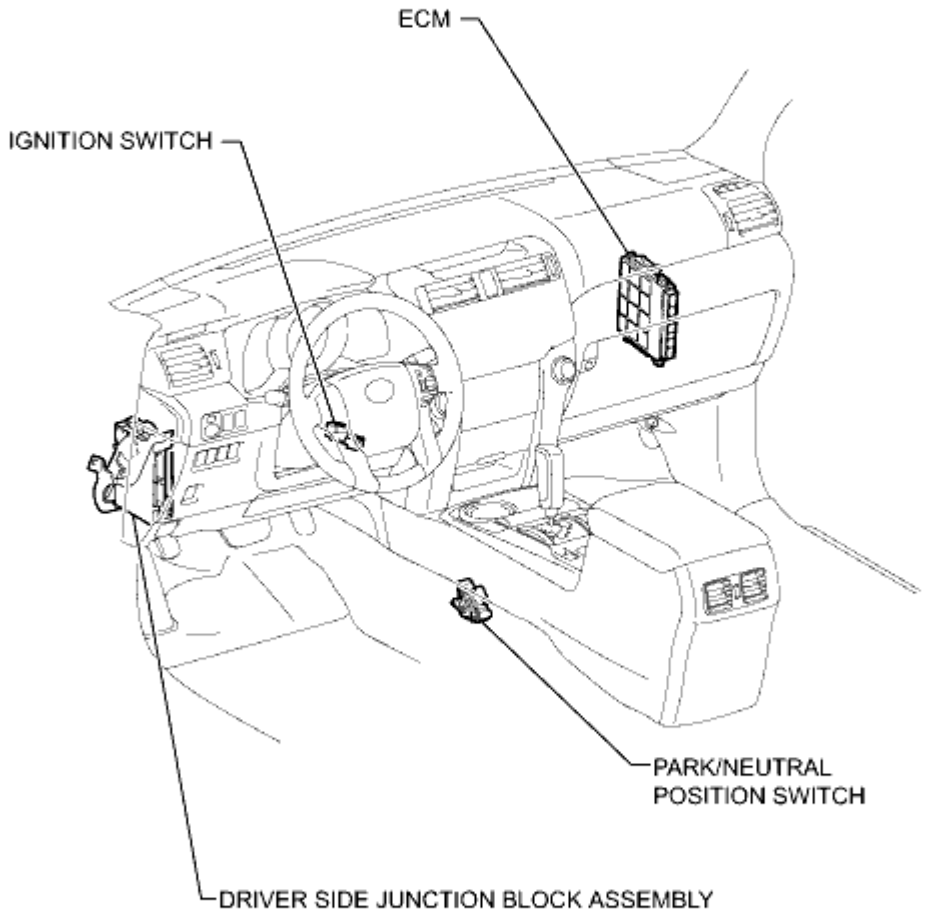
Last Modified: 5-10-2010	6.4 R	**From:** 200908
Model Year: 2010	**Model:** 4Runner	**Doc ID:** RM0000047CA001X
Title: 2TR-FE STARTING: STARTING SYSTEM: PARTS LOCATION (2010 4Runner)		

PARTS LOCATION

ILLUSTRATION



ILLUSTRATION



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Last Modified: 5-10-2010	6.4 U	**From:** 200908
Model Year: 2010	**Model:** 4Runner	**Doc ID:** RM000004AFL001X
Title: 2TR-FE STARTING: STARTING SYSTEM: SYSTEM DIAGRAM (2010 4Runner)		

SYSTEM DIAGRAM