

# STARTER

## 1993 Toyota Celica

1993 ELECTRICAL  
Toyota Starters

Celica

### DESCRIPTION

Celica uses a Nippondenso 4-brush, solenoid-actuated, gear reduction-type starter, equipped with an overrunning clutch. The brush holder assembly retains 4 brushes and springs in the starter housing.

Reduction gear type starters contain an integral solenoid attached to drive housing, a reduction idler gear and bearing installed into starter housing, and a clutch drive assembly. The clutch drive assembly is mounted to starter housing and is driven by the reduction idler gear from armature shaft. The brush holder assembly retains 4 brushes and 4 springs in the end cover of field frame housing.

Manual transmission vehicles use a clutch start switch and automatic transmission vehicles use a park/neutral switch to energize starter relay. On models with theft deterrent system, theft deterrent system ECU provides ground for starter relay.

NOTE: Starter type and kilowatt (kW) rating can be found on a metal label attached to side of starter.

### TROUBLE SHOOTING

1) If a no-start condition exists and battery is known to be good, connect test light or voltmeter between starter solenoid terminal No. 50 and ground. See Fig. 8.

2) Turn ignition switch to START position. If test light or voltmeter does not indicate voltage, check main fusible links and large ampere main fuses in engine compartment relay box. If fusible links and fuses are okay, see IGNITION SWITCH CONTINUITY TEST and/or STARTER RELAY TEST under ON-VEHICLE TESTING.

### ON-VEHICLE TESTING

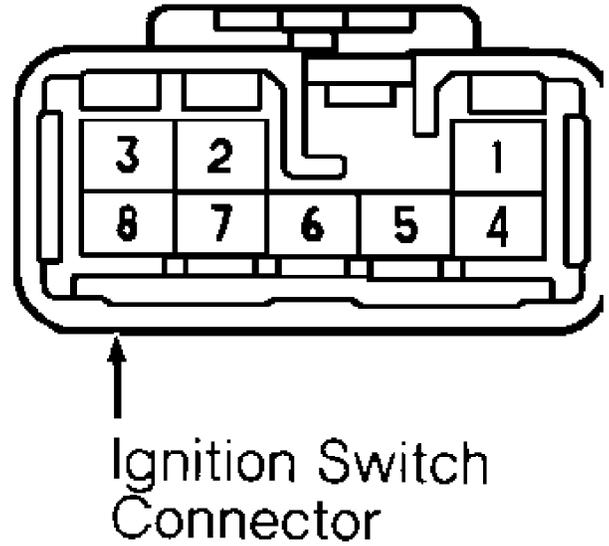
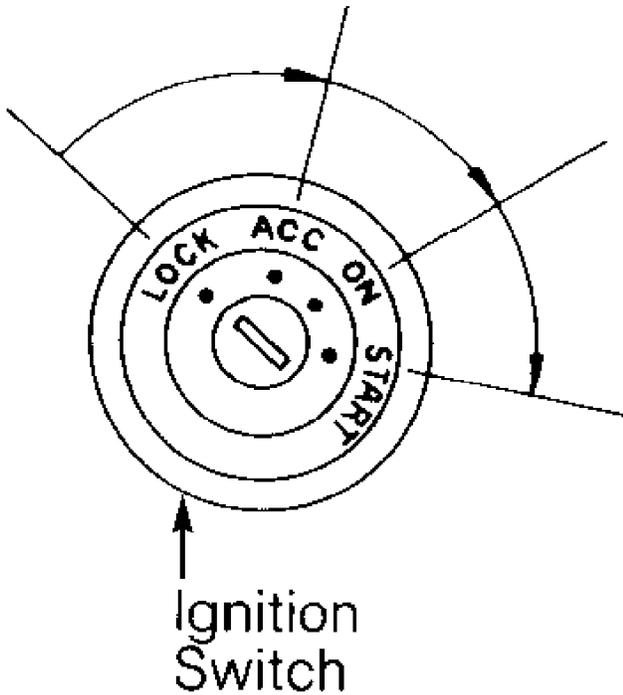
NOTE: Before testing, ensure battery is fully charged, battery cables and terminal ends are tight and clean, and engine grounds are secure.

#### CLUTCH START SWITCH TEST

1) Switch is located above clutch pedal on bracket. Disconnect wiring harness connector from switch.

2) Connect ohmmeter probes to switch terminals. Depress clutch pedal. If continuity does not exist, adjust or replace clutch start switch. If continuity exists, check circuit to starter relay for open, and check starter relay. See STARTER RELAY TEST.

#### IGNITION SWITCH CONTINUITY TEST

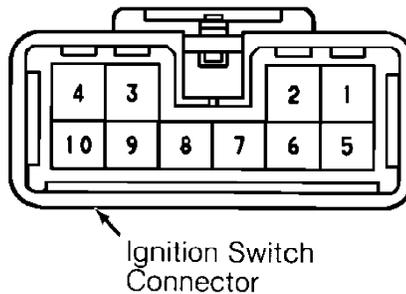
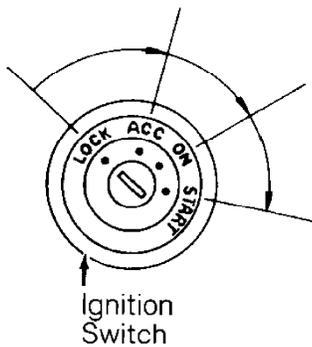


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Fig. 1: Ignition Switch 8-Pin Connector ID  
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

1) Disconnect negative battery cable. Remove driver's lower instrument panel cover. Remove upper and lower steering column covers if needed. Locate ignition switch wiring harness 10-pin connector. See Fig. 2.

2) With ignition switch in LOCK position, there should be no continuity between any terminals. With ignition switch in ACC position, there should be continuity between terminals No. 3 and 4. With ignition switch in ON position, there should be continuity between terminals No. 2, 3 and 4, and between terminals No. 9 and 10. With ignition switch in START position, there should be continuity between terminals No. 2, 4 and 7, and between terminals No. 6, 9 and 10. If continuity is not as specified, replace switch.



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Fig. 2: Ignition Switch 10-Pin Connector ID  
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

PARK/NEUTRAL SWITCH

NOTE: If vehicle will not start with shift lever in Park/Neutral position, verify correct park/neutral switch adjustment. If park/neutral switch is correctly adjusted, verify switch continuity.

#### Adjusting Park/Neutral Switch

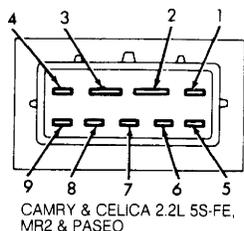
Locate park/neutral switch at transmission or transaxle. Loosen park/neutral position switch bolt(s) and verify shift selector is in "N" position. Align switch shaft groove with neutral basic line on switch. Hold switch in position and tighten switch bolt(s) to 48 INCH lbs. (5.4 N.m).

#### Park/Neutral Switch Continuity Check

Disconnect electrical connector from park/neutral switch at transmission or transaxle. Using ohmmeter, check for continuity at specified terminals with gearshift in proper positions. See Figs. 3 and 4. See PARK/NEUTRAL SWITCH CONTINUITY table. Replace switch if defective.

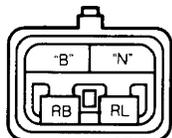
#### PARK/NEUTRAL SWITCH CONTINUITY

Gearshift Position	Check Between Terminals
<b>2.2L 5S-FE</b>	
Park	2 & 3, 1 & 6
Reverse	5 & 6
Neutral	2 & 3, 6 & 7
Drive	6 & 8
2	6 & 9
Low	4 & 6
<b>1.6L 4A-FE</b>	
Park	"B" & "N"
Reverse	RB & RL
Neutral	"B" & "N"



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Fig. 3: Park/Neutral Switch Terminal ID (2.2L)  
Courtesy of Toyota Motor Sales, U.S.A., Inc.



CELICA 1.6L 4A-FE

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Fig. 4: Park/Neutral Switch Terminal ID (1.6L)  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

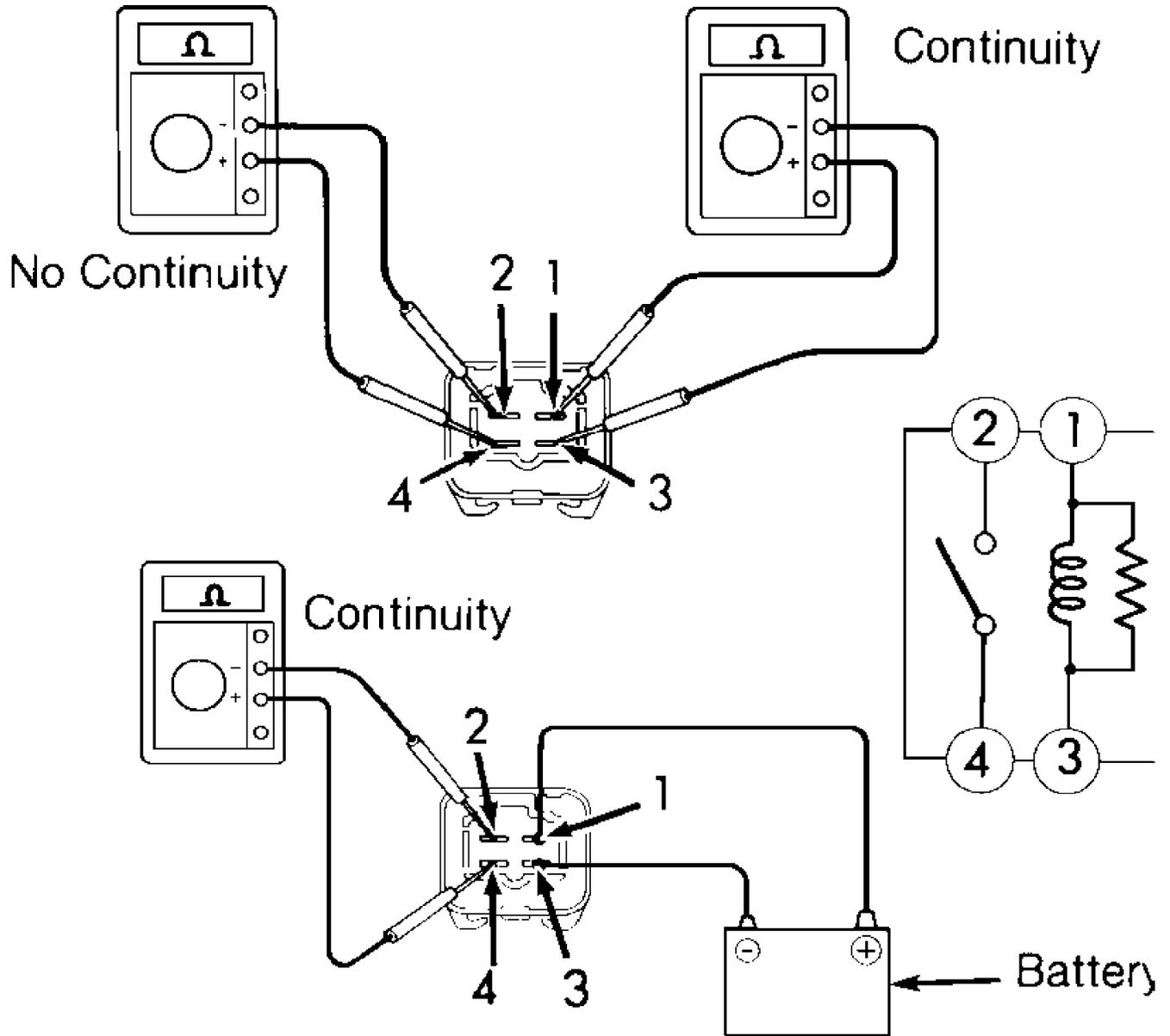
### STARTER RELAY TEST

Starter Relay With Terminals No. 1, 2, 3 & 4

1) Locate and remove starter relay. Relay is located behind right kick panel, on relay box No. 4. See Fig. 7. Using ohmmeter,

verify continuity between relay terminals No. 1 and 3. See Fig. 5. Continuity should not exist between terminals No. 2 and 4. If continuity is not as indicated, replace relay.

2) Check relay operation by applying battery voltage through terminals No. 1 and 3. See Fig. 5. Continuity should now exist between terminals No. 2 and 4. If relay does not test as indicated, replace relay.



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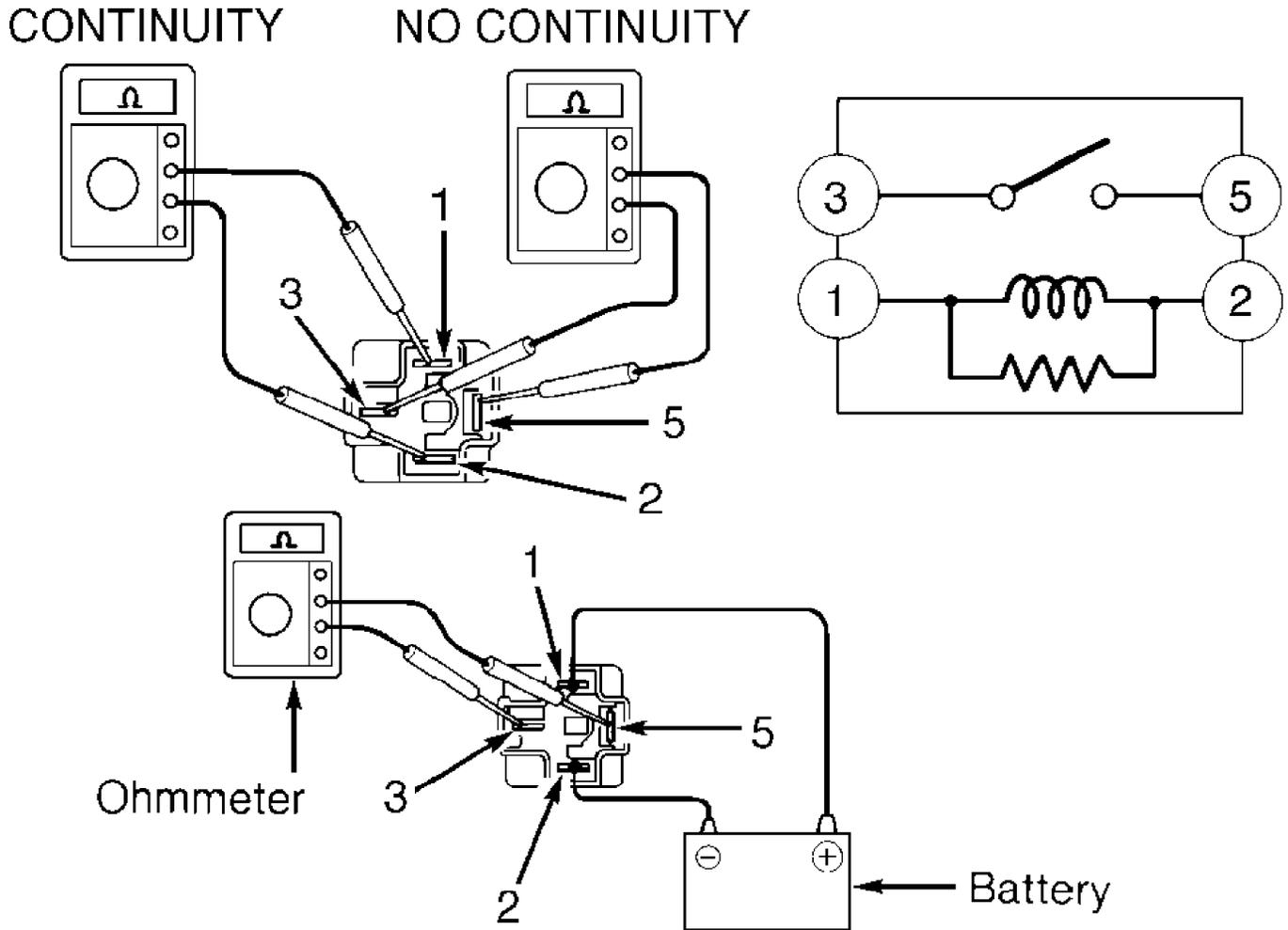
Fig. 5: Testing Starter Relay With Terminals No. 1, 2, 3 & 4  
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

Starter Relay With Terminals No. 1, 2, 3 & 5

1) Locate and remove starter relay. Relay is located behind

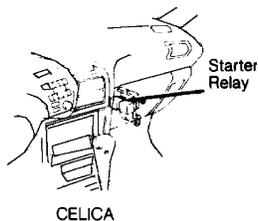
right kick panel, on relay box No. 4. See Fig. 7. Using ohmmeter, verify continuity between relay terminals No. 1 and 2. See Fig. 6. Continuity should not exist between terminals No. 3 and 5. If continuity is not as indicated, replace relay.

2) Check relay operation by applying battery voltage through terminals No. 1 and 2. See Fig. 6. Continuity should now exist between terminals No. 3 and 5. If relay does not test as indicated, replace relay.



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Fig. 6: Testing Starter Relay With Terminals No. 1, 2, 3 & 5  
 Courtesy of Toyota Motor Sales, U.S.A., Inc.



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Fig. 7: Locating Starter Relay  
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

## BENCH TESTING

### NO-LOAD TEST

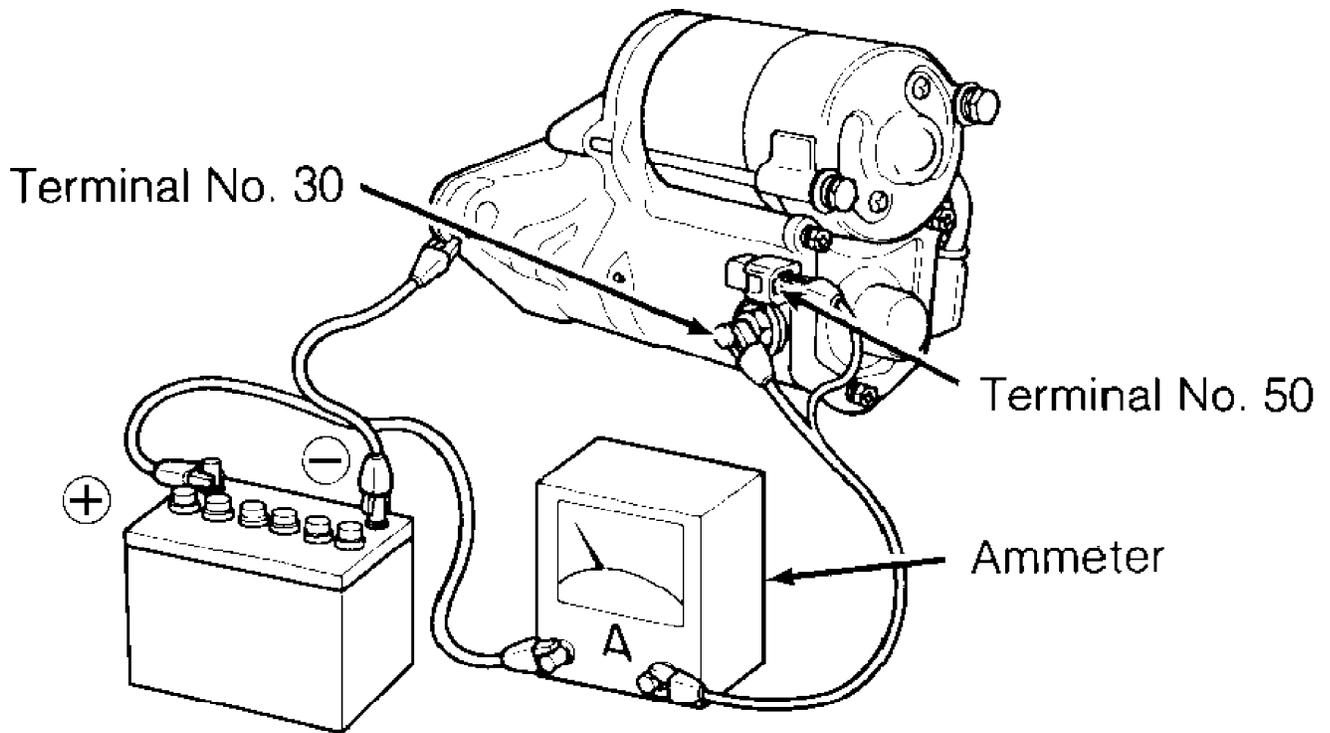
CAUTION: DO NOT engage starter solenoid for more than 5 seconds during testing or damage to coil winding will result.

1) Remove starter. Connect ammeter in series between starter motor terminal No. 30 (battery terminal) and a fully charged 12-volt battery. Connect battery negative to starter case ground. See Figs. 8 and 9. Connect voltmeter to battery to observe voltage draw readings.

2) Connect remote starter or jumper wire to terminal No. 30 and to terminal No. 50 to engage starter. Starter drive pinion gear should extend quickly and spin smoothly. Verify starter amperage draw and battery voltage draw to be within specifications. See NO-LOAD TEST SPECIFICATIONS table. Replace starter if not within specification.

#### NO-LOAD TEST SPECIFICATIONS

Application	Max. Amps @ (Volts)	RPM
(1.0 kW) .....	90 (11.5) .....	3000
(1.4 & 1.6 kW) .....	90 (11.5) .....	3500



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Fig. 8: Testing Starter No-Load (Reduction Gear)  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

### SOLENOID TESTS

CAUTION: DO NOT engage starter solenoid for more than 5 seconds during testing or damage to coil winding will result.

#### Pull-In Coil Test

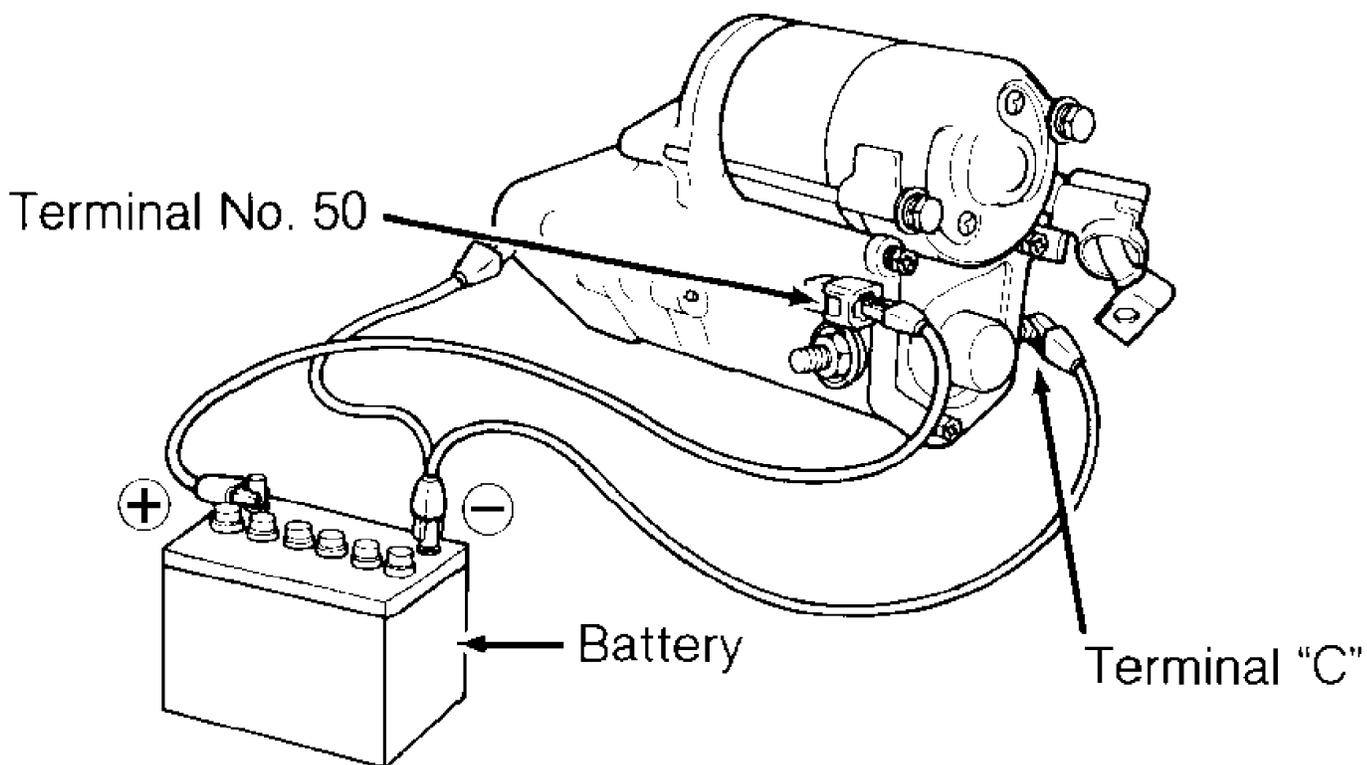
Disconnect field coil lead from terminal "C". Connect jumper wires from negative battery terminal to terminal "C" and to starter housing. When wire is connected from positive battery terminal to terminal No. 50, clutch pinion gear should extend fully. See Figs. 9-11. If clutch pinion gear does not move, replace solenoid. If clutch pinion gear does move, go to next test.

#### Hold-In Coil Test

With battery connected as in previous test and clutch pinion gear still extended, disconnect jumper wire from starter terminal "C". See Figs. 9-11. Clutch pinion gear should remain extended. If clutch pinion gear does not remain extended, replace solenoid. If clutch pinion gear does remain extended, go to next test.

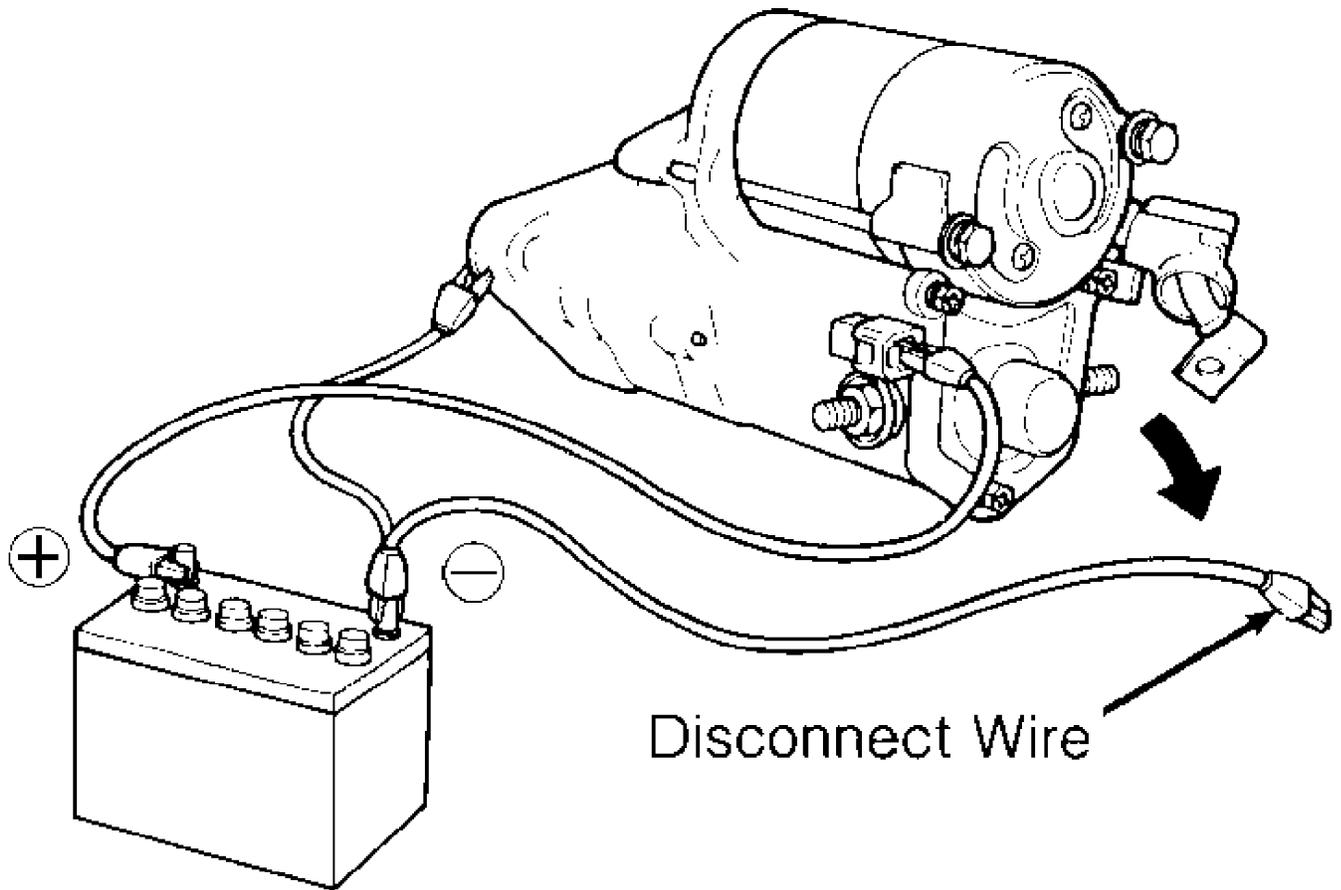
#### Drive Pinion Return Test

Disconnect jumper wire from negative battery terminal to starter housing. See Figs. 9-11. Pinion gear should now retract. If it does not retract, replace solenoid.



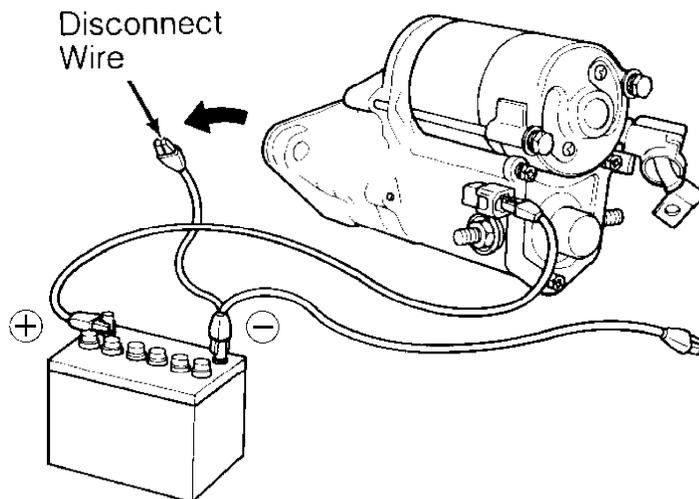
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Fig. 9: Testing Solenoid Pull-In Coil  
Courtesy of Toyota Motor Sales, U.S.A.Inc.



93D02166

Fig. 10: Testing Solenoid Hold-In Coil  
 Courtesy of Toyota Motor Sales, U.S.A.Inc.



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Fig. 11: Testing Solenoid Drive Pinion Return  
 Courtesy of Toyota Motor Sales, U.S.A.Inc.

STARTER COMPONENT INSPECTION

#### Armature Coil

1) Using ohmmeter, check for continuity between armature coil core and insulation between commutator segments. If continuity is present, replace armature. Check armature for shorts using a growler. Replace armature as necessary.

2) Check for continuity between segments of commutator. If continuity is not present between any segment, replace armature.

#### Brushes & Springs

1) Check brush length. If length is less than specification, replace brushes. See NIPPONDENSO STARTER SPECIFICATIONS table under STARTER SPECIFICATIONS.

2) Check brush holders, springs, spring clip and insulation between positive and negative holders. Verify no continuity between positive and negative brush holders. Repair or replace components as needed.

#### Clutch Assembly & Gears

1) Inspect teeth on pinion gear, idler gear and clutch assembly for wear or damage. If damaged, replace gear or clutch assembly and inspect flywheel ring gear for wear or damage.

2) Inspect clutch pinion gear by rotating pinion gear. Depending on engine, pinion gear will rotate freely in one direction and lock when rotated in opposite direction. On 3S-GTE and 5S-FE, clutch pinion gear will lock when rotated in a clockwise direction. On all other models, lock in a counterclockwise direction. If necessary replace, clutch assembly.

#### Commutator

1) If commutator surface is dirty or burnt, it can be cleaned with No. 400 grit sandpaper or on a lathe. If commutator runout (out-of-round) is more than .002" (.05 mm), turn commutator on a lathe. Wear or cutting limit of commutator diameter is 1.06" (27 mm) for 0.8 kW starter, 1.14" (29.0 mm) for 1.2, 1.4 and 1.6 kW starter, and 1.34" (34 mm) for 2.2 kW starter. If commutator diameter is less than minimum, replace armature.

2) Ensure undercut depth between commutator segments are clean, free of debris, and that edges are smooth. Minimum undercut depth is .008" (.20 mm). If undercut depth is less than minimum use a hacksaw blade to correct to a depth of .008-.024" (.20-.60 mm).

#### Field Frame (Field Coil)

Verify continuity between lead wire and field coil brush lead. If continuity is not present, replace field coil. Verify there is no continuity between field coil end and field frame. If continuity exists, replace or repair field frame.

## REMOVAL & INSTALLATION

### STARTER MOTOR

**NOTE:** Only starters with specific removal procedures are listed. On models not listed, disconnect negative battery cable and remove starter. To install, reverse removal procedure. See TORQUE SPECIFICATIONS.

#### Removal & Installation (4A-FE)

Disconnect negative battery cable. Raise vehicle. Remove suspension lower crossmember to access lower starter bolt. Remove air cleaner cap to access upper starter bolt. Remove starter, then remove starter terminal/wire cover and remove starter wires. To install, reverse removal procedure. Tighten starter mounting bolts to 29 ft.

lbs. (39 N.m). Tighten suspension lower crossmember to 112 ft. lbs. (152 N.m).

#### Removal & Installation (3S-GTE)

1) Disconnect negative battery cable. Disconnect electrical connectors and hoses from air cleaner assembly. Remove air intake tube from throttle body. Remove air intake tube and air cleaner top cap as an assembly. Remove air filter and air cleaner case from engine compartment.

2) Remove engine relay box from battery bracket. Remove battery and tray. Remove starter terminal/wire cover and remove starter wires. Remove starter. To install, reverse removal procedure. Tighten starter mounting bolts to 29 ft. lbs. (39 N.m).

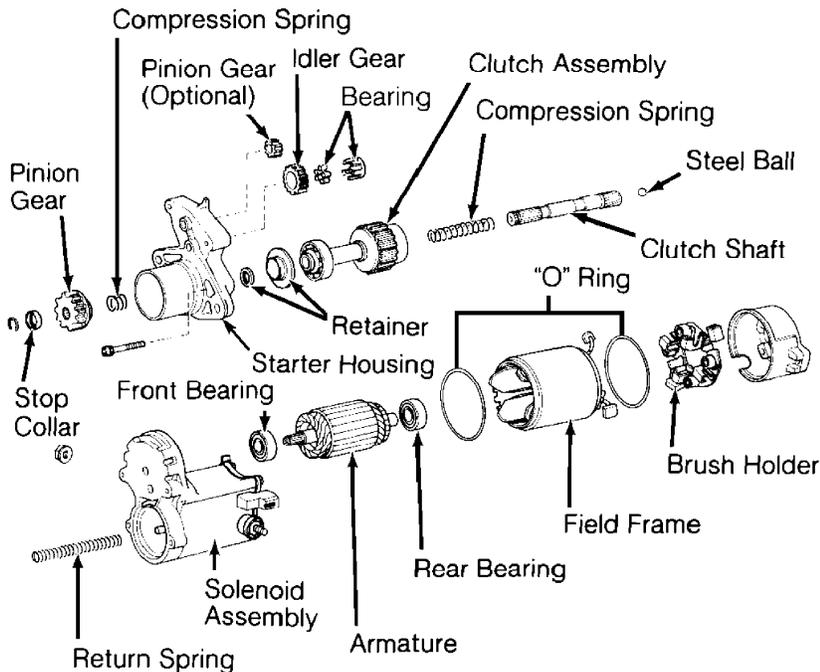
#### Removal & Installation (5S-FE)

1) Disconnect negative battery cable. Disconnect air intake temperature sensor connector from air cleaner assembly. Remove air intake tube from throttle body. Remove air intake tube and air cleaner from throttle body. Remove air filter and air cleaner case from engine compartment.

2) Remove engine relay box and locate out of way. Remove cruise control actuator on models equipped with ABS brakes. Remove starter terminal/wire cover and remove starter wires. Remove starter. To install, reverse removal procedure. Tighten starter mounting bolts to 29 ft. lbs. (39 N.m).

## OVERHAUL

NOTE: Overhaul procedures are not available from manufacturer. For exploded views of starters, see Fig. 12.



92J01589

Fig. 12: Exploded View of Gear Reduction Starter (3S-GTE, 5S-FE)  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

## STARTER SPECIFICATIONS

NIPPONDENSO STARTER SPECIFICATIONS

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Application	Specification
Brush Minimum Length	
1.4 & 1.6 kW	.394" (10.0 mm)
1.0 kW (1)	.335" (8.5 mm)
Brush Spring Load	
1.4 & 1.6 kW	3.9-5.3 Lbs. (18-24 N)
Commutator Minimum Diameter	
0.8 kW	1.06" (27 mm)
1.0, 1.2, 1.4, 1.6 kW	1.14" (29.0 mm)
2.2 kW	1.34" (34 mm)
Commutator Minimum Undercut Depth	.008" (.2 mm)
Commutator Runout	.002" (.05 mm)
Armature	
Core Runout	.002" (.05 mm)
End Play	.002" (.05 mm)

(1) Reduction gear.

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**TORQUE SPECIFICATIONS**

TORQUE SPECIFICATIONS

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Application	Ft. Lbs. (N.m)
Lower Crossmember Bolts (4A-FE)	112 (152)
Starter Mounting Bolts (All Others)	29 (39)

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