

## 1994 Mazda MX-5 Miata

STARTER - REDUCTION GEAR 1994 ELECTRICAL Mazda Starter - Reduction Gear

### STARTER - REDUCTION GEAR

#### 1994 ELECTRICAL Mazda Starter - Reduction Gear

## DESCRIPTION

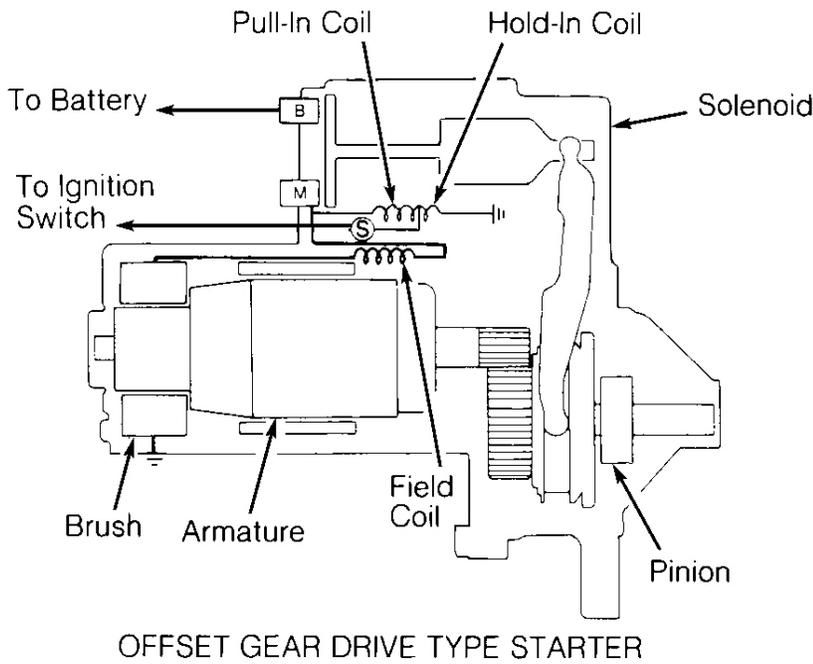
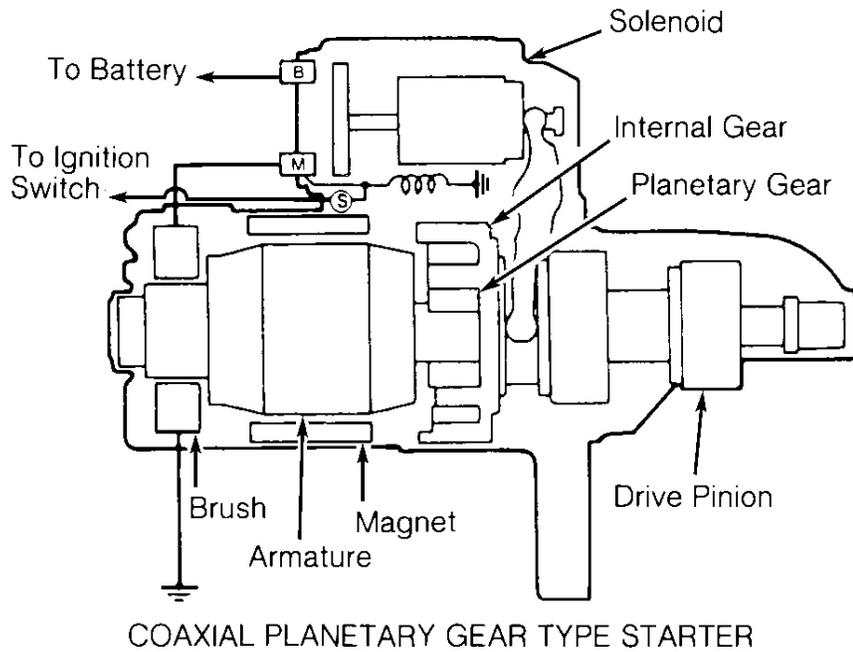
The Nippondenso reduction gear starter is a conventional 12-volt, 4-pole, brush-type starter. The integral solenoid is attached to the drive housing.

Gear reduction is performed by coaxial planetary gear set. See Fig. 1 .

**NOTE:** For information on Miata M/T, STARTER - DIRECT DRIVE article in the ELECTRICAL section.

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**Fig. 1: Nippondenso Reduction Gear Type Starters**  
Courtesy of MAZDA MOTORS CORP.

**TROUBLE SHOOTING**

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**NOTE:** See **TROUBLE SHOOTING - BASIC PROCEDURES** article in **GENERAL INFORMATION** section.

### ON-VEHICLE TESTING

**NOTE:** On Miata A/T, obtain code number and deactivate audio anti-theft system before disconnecting battery.

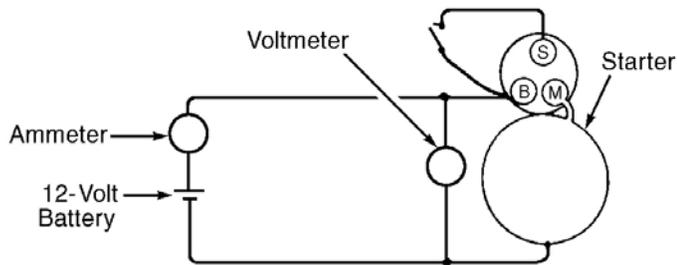
**NOTE:** Before testing, ensure battery is fully charged, battery cables and terminals are clean and tight and engine grounds are good.

### CIRCUIT TEST

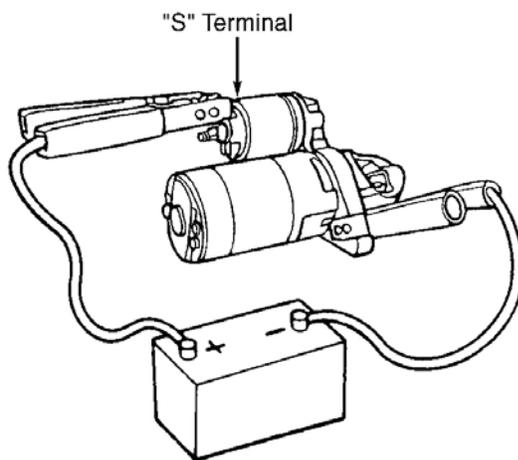
If starter does not operate, check voltage at starter "S" terminal with ignition switch in START position (and clutch depressed on M/T). See **Fig. 1**. If voltage is greater than 8 volts and vehicle does not crank, repair or replace starter as required. If voltage is less than 8 volts, check ignition switch, park/neutral switch (A/T), interlock switch (M/T) and wiring.

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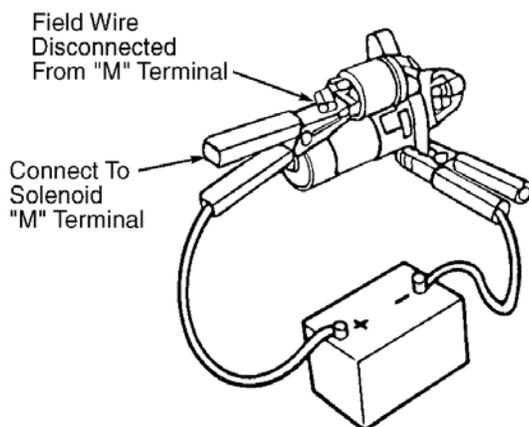
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NO-LOAD TESTING HOOKUP



SOLENOID PULL-IN TEST



SOLENOID RETURN TEST

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**Fig. 2: Testing Reduction Gear Starter Circuits**  
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**INTERLOCK SWITCH (M/T) (CLUTCH START SWITCH)**

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Interlock switch is mounted on bracket near top front of clutch pedal. Disconnect interlock switch wiring connector. Using ohmmeter, ensure continuity exists between interlock switch connector terminals when clutch pedal is depressed and no continuity exists when clutch pedal is released. If continuity is not as described, adjust or replace interlock switch.

## BENCH TESTING

### NO-LOAD TEST

Connect fully-charged 12-volt battery, voltmeter and ammeter to starter. See **Fig. 2** . Using remote starter wires or jumper, engage solenoid. Starter should spin smoothly. Compare readings with specifications. See NO-LOAD TEST SPECIFICATIONS table. If voltage is less than specified, amperage is more than specified or shaft speed is less than specified, disassemble and inspect starter components.

### NO-LOAD TEST SPECIFICATIONS

| Application               | Specification |
|---------------------------|---------------|
| Voltage (Minimum)         | 11.0          |
| Amperage (Maximum)        | 90            |
| Shaft Speed (Minimum RPM) | 3000          |

### SOLENOID TESTS

**CAUTION: Perform solenoid tests with starter and solenoid assembled. DO NOT engage starter solenoid for more than 10 seconds during testing or damage to coil winding may result.**

#### Solenoid Pull-In Test

Connect positive battery lead to solenoid "S" terminal and negative battery lead to starter body. See **Fig. 2** . Starter pinion drive gear should extend outward and stop. If starter pinion drive gear does not extend, replace solenoid.

#### Solenoid Hold-In Test

After performing solenoid pull-in test, with positive battery lead connected to solenoid "S" terminal and negative battery lead connected to starter body, disconnect field lead ("M" terminal wire) at solenoid. Starter pinion drive gear should remain extended. If starter pinion drive gear returns, replace solenoid.

#### Solenoid Return Test

Disconnect field lead ("M" terminal wire) at solenoid. Connect positive battery lead to solenoid "M" terminal and negative battery lead to starter body. See **Fig. 2** . Using screwdriver, pry overrunning clutch pinion drive outward. Release screwdriver and ensure overrunning clutch pinion drive returns to original position.

#### Solenoid

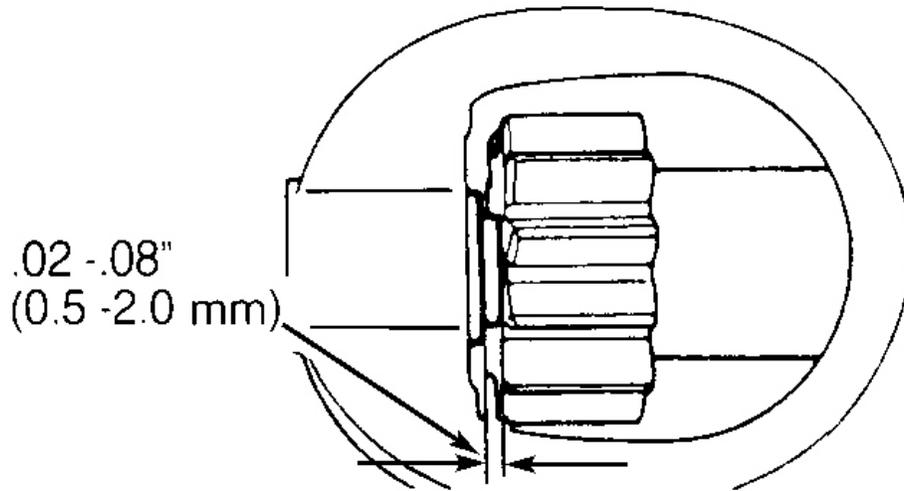
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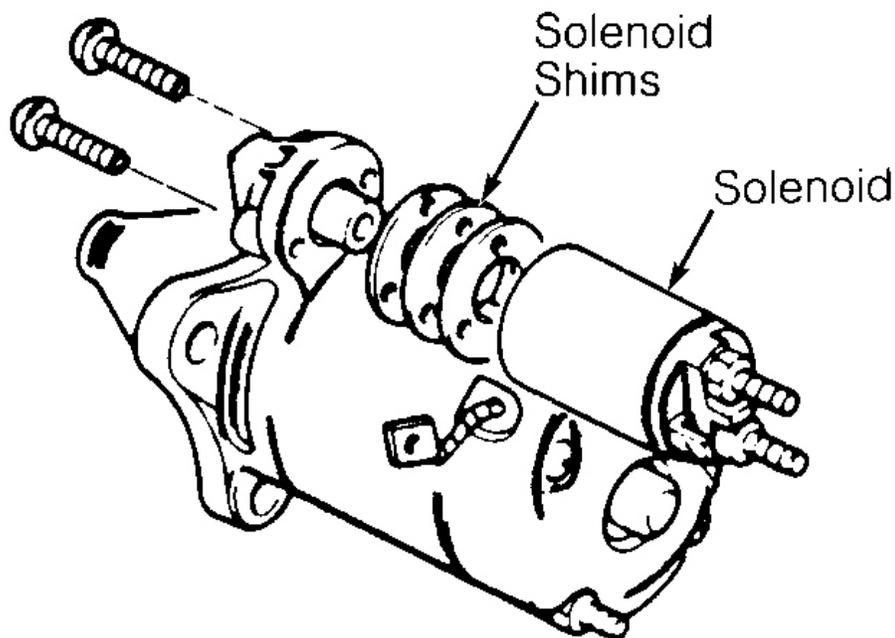
1. Disconnect all wires from solenoid, including "M" terminal wire between solenoid and starter. Using ohmmeter, ensure continuity exists between "S" and "M" terminals, and between "S" terminal and solenoid body. See **Fig. 1** and **Fig. 2** . If continuity does not exist between specified terminals, replace solenoid.
2. Using ohmmeter, ensure continuity does not exist between "M" and "B" terminals. If continuity exists, replace solenoid.

### **PINION GAP ADJUSTMENT**

1. Disconnect field lead ("M" terminal wire) at solenoid. See **Fig. 2** . Connect positive battery lead to solenoid "S" terminal and negative battery lead to starter body. Starter pinion drive gear should extend outward and stop.
2. Quickly measure pinion gap between end of pinion drive and circlip retainer. See **Fig. 3** . DO NOT operate starter solenoid for more than 10 seconds. Pinion gap should be .02-.08" (0.5-2.0 mm).
3. If pinion gap is not within specification, adjust by increasing or decreasing thickness of solenoid shims located between solenoid and drive housing.



CHECKING PINION GAP



ADJUSTING PINION GAP

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**Fig. 3: Checking & Adjusting Pinion Gap**  
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1. Place armature in growler. Turn on growler and hold a piece of hacksaw blade over armature. Slowly rotate armature. If hacksaw blade is attracted to core or if it vibrates, replace armature.
2. Remove armature from growler. Using an ohmmeter, check continuity between commutator and core. If continuity exists, replace armature. Check continuity between commutator and shaft. If continuity exists, replace armature.
3. Check continuity between each commutator segment. If an open exists between any 2 segments, replace armature.

### COMMUTATOR TEST

1. Clean surface and polish with No. 400 sandpaper if required. If surface is scored, out of round or pitted, turn commutator in a lathe.
2. Maximum commutator runout and minimum diameter of commutator must not exceed specification after turning. See COMMUTATOR SPECIFICATIONS table.
3. Commutator mica undercut depth should be .020 -.030" (.50 -.80 mm). Minimum mica undercut depth is .008" (.20 mm). If not within specification, undercut to standard depth.

### COMMUTATOR SPECIFICATIONS

| Application | Maximum Runout In. (mm) | Minimum Diameter In. (mm) |
|-------------|-------------------------|---------------------------|
| A/T         | .001 (.03)              | 1.21 (30.8)               |

### BRUSH TEST

1. Connect one ohmmeter lead to positive brush holder and other lead to negative brush holder. If continuity exists, replace brush holder assembly.
2. Check brush length. See BRUSH LENGTH SPECIFICATIONS table. If brush length is less than specified, replace brushes.
3. Using brush spring scale, measure spring tension. See BRUSH TENSION SPECIFICATIONS table. If tension is less than specified, replace brush holder assembly. Ensure brushes move freely in holders.

### BRUSH LENGTH SPECIFICATIONS

| Application | Standard In. (mm) | Minimum In. (mm) |
|-------------|-------------------|------------------|
| A/T         | .69 (17.5)        | .47 (12.0)       |

### BRUSH TENSION SPECIFICATIONS

| Application | Standard Ft. Lbs. (N) | Minimum Ft. Lbs. (N) |
|-------------|-----------------------|----------------------|
| A/T         | (1)                   | (1)                  |

(1) Information is not available from manufacturer.

### FIELD WINDING TEST

1. Connect one ohmmeter lead to field coil lead ("M" terminal wire). Connect other lead of ohmmeter to soldered portion of brush lead. If continuity does not exist, repair or replace field coil.

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2. Check field coil for short to ground by connecting one ohmmeter lead to field coil lead ("M" terminal wire) and other ohmmeter lead to field coil housing. If continuity exists, repair or replace field coil.

### OVERRUNNING CLUTCH PINION DRIVE

Hold overrunning clutch housing and turn pinion gear by hand. If pinion turns in both directions or does not turn at all, clutch is faulty. Replace clutch. DO NOT clean overrunning clutch with solvent, as it is packed with grease and sealed by manufacturer.

### REMOVAL & INSTALLATION

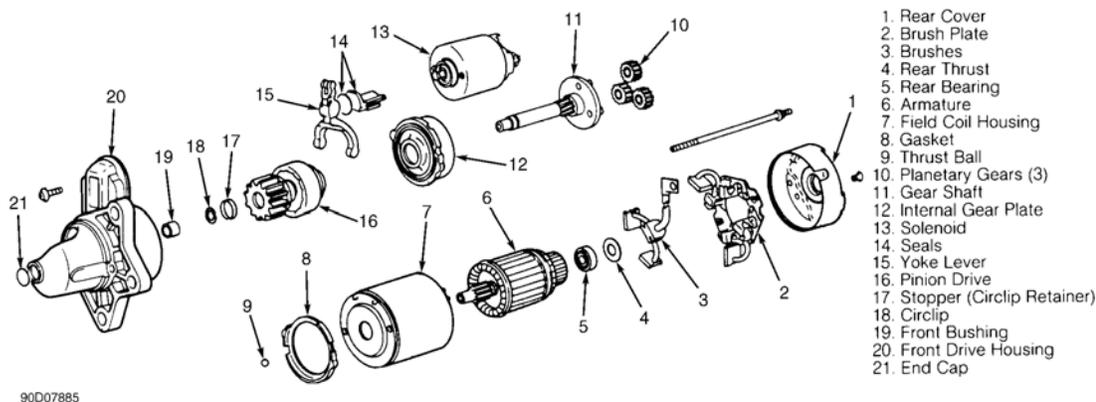
**NOTE:** On Miata A/T, obtain code number and deactivate audio anti-theft system before disconnecting battery.

### REMOVAL & INSTALLATION

Disconnect negative battery cable. Raise vehicle on hoist. Remove engine undercover (if equipped). Disconnect wiring from starter. Remove starter mounting bolts and starter. To install, reverse removal procedure. Tighten starter mounting bolts to specification. See TORQUE SPECIFICATIONS.

### OVERHAUL

**NOTE:** Overhaul procedures are not available from manufacturer. See illustrations for exploded views of starters. See [Fig. 4](#) or [Fig. 5](#).



**Fig. 4: Exploded View Of Coaxial Planetary Gear Type Starter (A/T)**

Courtesy of MAZDA MOTORS CORP.

### TORQUE SPECIFICATIONS

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|--|--|
|  |  |
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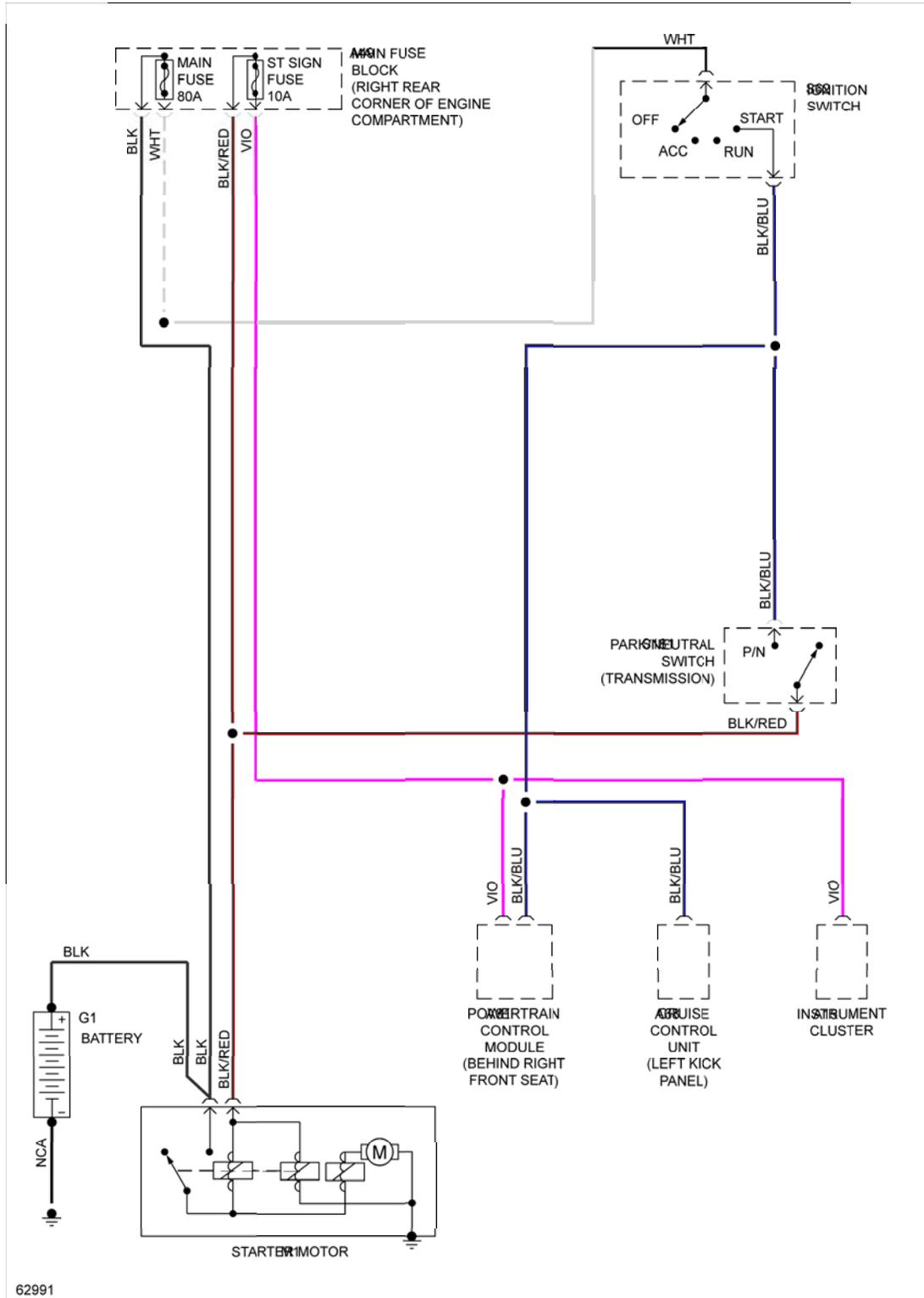
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| <b>Application</b>                        | <b>Ft. Lbs. (N.m)</b>  |
|---|------------------------|
| Starter Mounting Bolts                    | 27-38 (37-51)          |
|   | <b>INCH Lbs. (N.m)</b> |
| Battery Cable Nut (Solenoid Terminal "B") | 78-113 (9-13)          |

**WIRING DIAGRAM**

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**Fig. 5: Starting System Wiring Diagram (Miata A/T)**