

## 1994 Mazda MX-5 Miata

STARTER - DIRECT DRIVE 1994 ELECTRICAL Mazda Starter - Direct Drive

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## DESCRIPTION

Nippondenso direct drive starter is a conventional 12-volt, 4-pole, brush-type starter. The integral solenoid is attached to the drive housing. The overrunning clutch pinion drive is mounted directly on end of armature shaft drive.

**NOTE:** For information on Miata A/T, see **STARTER - REDUCTION GEAR** article in the **ELECTRICAL** section.

## TROUBLE SHOOTING

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

## ON-VEHICLE TESTING

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

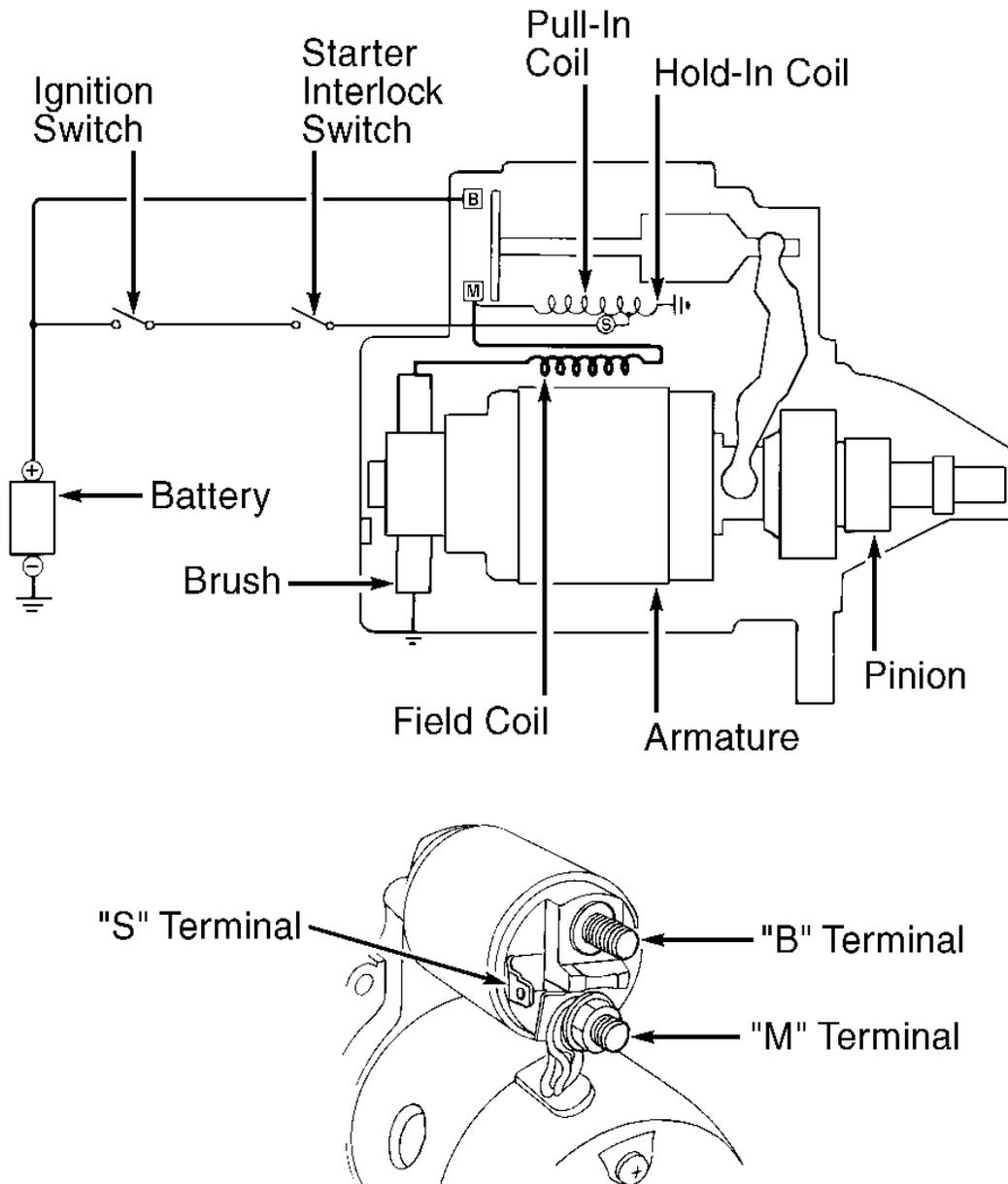
**NOTE:** Before testing, ensure battery is fully charged, battery cables and terminals are clean and tight and engine grounds are good.

## CIRCUIT TESTING

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, 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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**Fig. 1: Nippondenso Direct Drive Type Starter**  
Courtesy of MAZDA MOTORS CORP.

### INTERLOCK SWITCH (M/T) (CLUTCH START SWITCH)

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

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pedal is depressed. If continuity does not exist, adjust or replace interlock switch.

### BENCH TESTING

#### NO-LOAD TEST

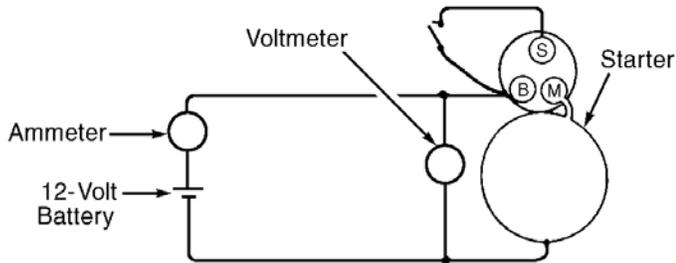
Connect fully-charged 12-volt battery, voltmeter and ammeter to starter. See **Fig. 2** . Using remote starter wires or jumper, engage solenoid. Starter should spin smoothly. Compare readings with specifications. See NO-LOAD TEST SPECIFICATIONS table. If voltage is less than specified, amperage is more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

#### NO-LOAD TEST SPECIFICATIONS

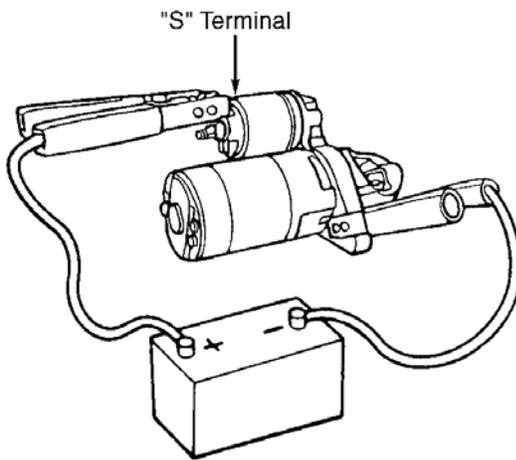
Application	Specification
Miata M/T	
Voltage (Minimum)	11.5
Amperage (Maximum)	60
Shaft Speed (Minimum RPM)	6600

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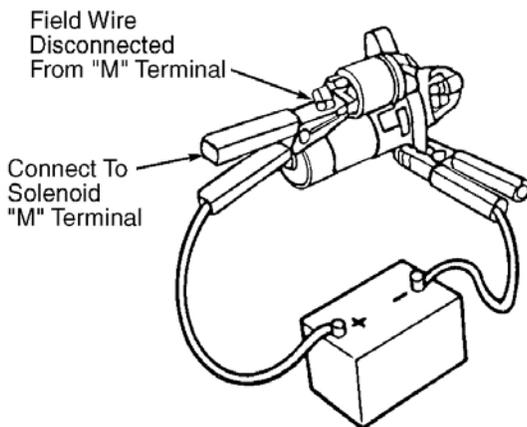
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NO-LOAD TESTING HOOKUP



SOLENOID PULL-IN TEST



SOLENOID RETURN TEST

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**Fig. 2: Testing Direct Drive Starter Circuits**  
Courtesy of MAZDA MOTORS CORP.

### SOLENOID TESTS

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**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

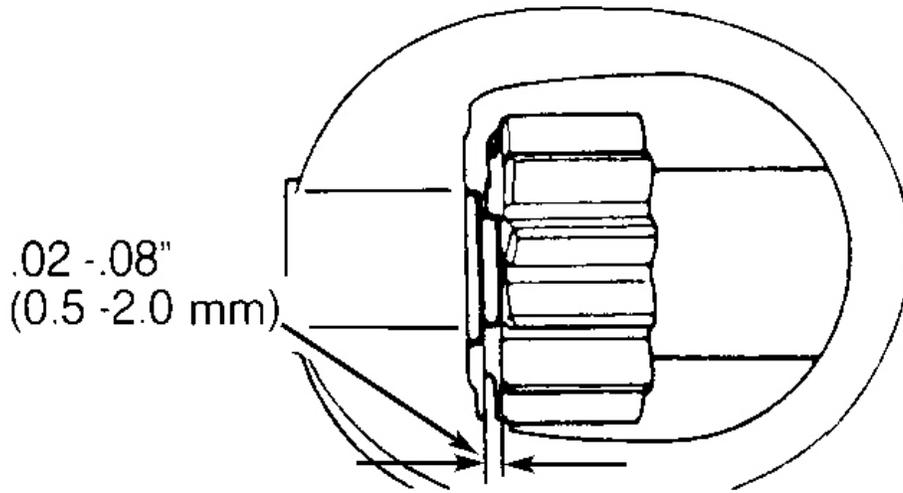
Disconnect field lead ("M" terminal wire) at solenoid. Connect positive battery lead to solenoid "M" terminal and negative battery lead to starter body. See **Fig. 2** . Using screwdriver, pry overrunning clutch pinion drive outward. Release screwdriver and ensure overrunning clutch pinion drive returns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

### Solenoid

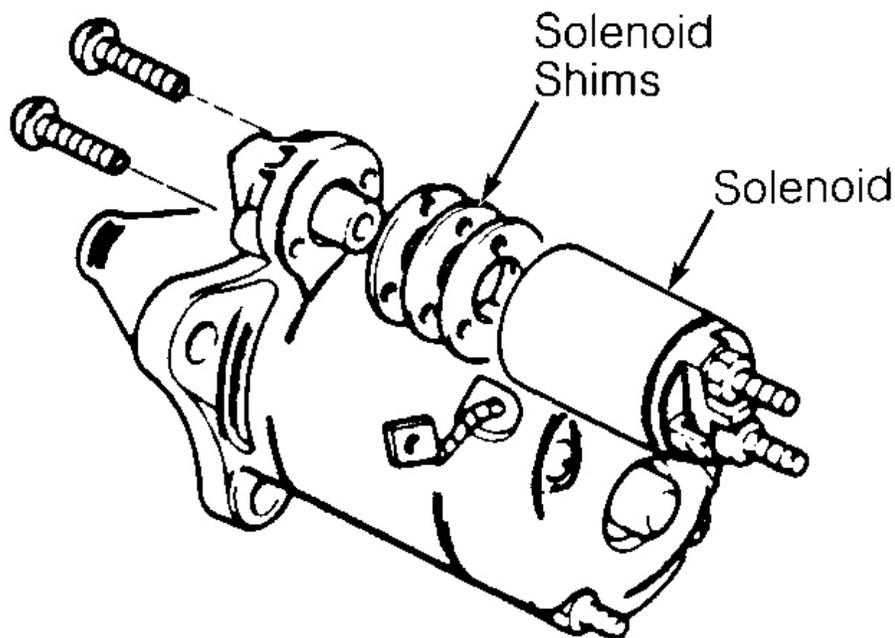
1. Disconnect all wires from solenoid, including "M" terminal wire between solenoid and starter. Using ohmmeter, ensure continuity exists between "S" and "M" terminals, and between "S" terminal and solenoid body. See **Fig. 1** and **Fig. 2** . If continuity does not exist between specified terminals,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

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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)
Miata M/T	.001 (.03)	1.21 (30.8)

### BRUSH TEST

1. Connect 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 Length In. (mm)	Minimum Length In. (mm)
Miata M/T	.67 (17.0)	.45 (11.5)

### BRUSH TENSION SPECIFICATIONS

Application	Standard Ft. Lbs. (N)	Minimum Ft. Lbs. (N)
Miata M/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

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soldered portion of brush lead. If continuity does not exist, repair or replace field coil.

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 M/T, obtain code number and deactivate audio anti-theft system before disconnecting battery.

### REMOVAL & INSTALLATION

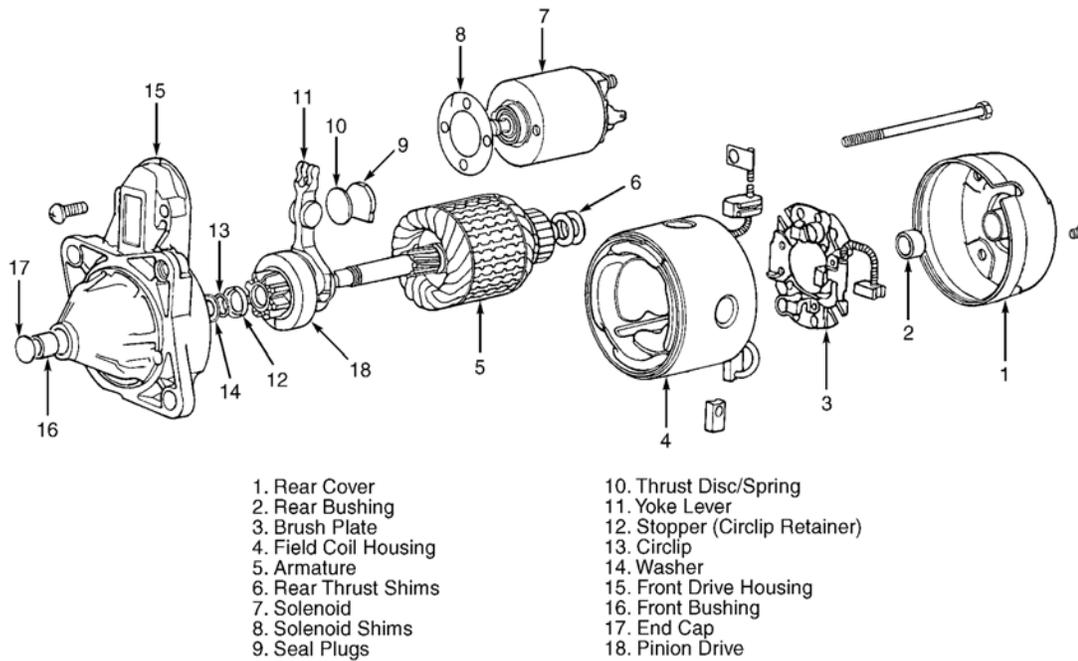
Disconnect negative battery cable. Raise vehicle on hoist. Remove engine undercover (if equipped). Disconnect wiring from starter. Remove starter mounting bolts and starter. To install, reverse removal procedure. Tighten starter mounting bolts to specification. See TORQUE SPECIFICATIONS.

### OVERHAUL

**NOTE:** Overhaul procedures are not available from manufacturer. See illustration for exploded view of starter. See Fig. 4 .

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1. Rear Cover
2. Rear Bushing
3. Brush Plate
4. Field Coil Housing
5. Armature
6. Rear Thrust Shims
7. Solenoid
8. Solenoid Shims
9. Seal Plugs

10. Thrust Disc/Spring
11. Yoke Lever
12. Stopper (Circlip Retainer)
13. Circlip
14. Washer
15. Front Drive Housing
16. Front Bushing
17. End Cap
18. Pinion Drive

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**Fig. 4: Exploded View Of Direct Drive Starter**  
 Courtesy of MAZDA MOTORS CORP.

## TORQUE SPECIFICATIONS

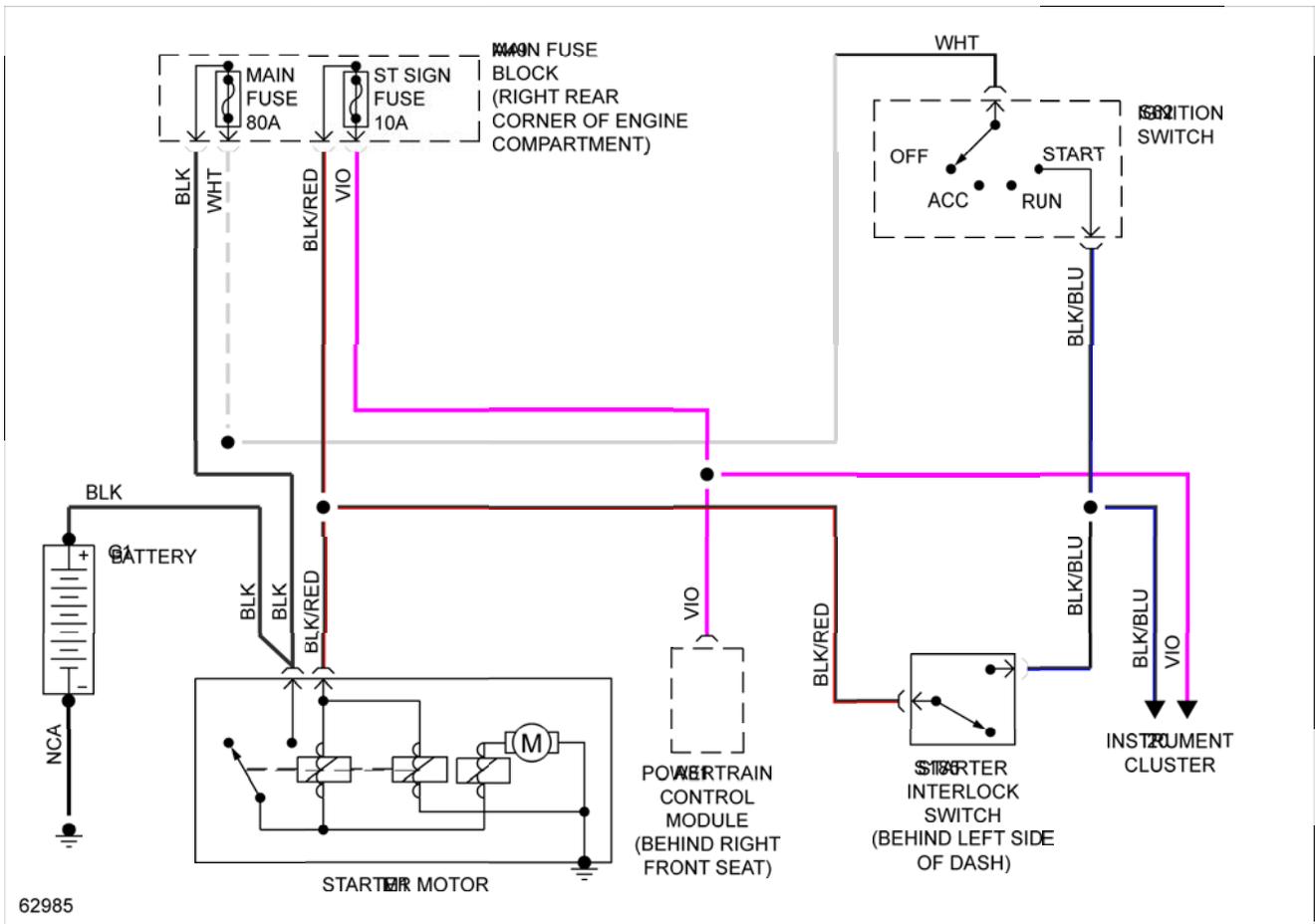
### TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Starter Mounting Bolts	27-38 (37-52)
Starter-To-Bracket Bolt	12-16 (16-22)
	INCH Lbs. (N.m)
Battery Cable Nut (Solenoid Terminal "B")	87-104 (9.8-11.7)

## WIRING DIAGRAM

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