

STARTER - REDUCTION GEAR

1992 Subaru SVX

1991-92 ELECTRICAL
Starters - Reduction Gear

Legacy, Loyale, XT, XT6
1992 SVX

DESCRIPTION

Legacy & Loyale use Nippondenso and XT and XT6 use Mitsubishi 4-brush, solenoid-actuated, reduction gear starters, equipped with overrunning clutches. The 4-brush holder assembly retains brushes and springs in the rear cover of starter housing.

TROUBLE SHOOTING

STARTING SYSTEM

STARTING SYSTEM TROUBLE SHOOTING

PROBLEM	Action
Possible Cause	

STARTER FAILS TO OPERATE

Anti-Theft System Starter	See BYPASSING ANTI-THEFT
Interrupt Activated (SVX Only)	SYSTEM STARTER INTERRUPT
Dead Battery	Check/Replace Battery
Bad Connections/Wiring	Repair Connections/Wiring
Faulty Ignition Switch	Check Switch Circuit
Faulty Solenoid/Relay	Replace Solenoid/Relay
Faulty Ground	Check/Repair Ground

STARTER FAILS TO OPERATE - LIGHTS DIM

Faulty Battery	Replace Battery
Bad Cable Connections	Check/Repair Connections
Grounded Starter Windings	Test/Repair Starter
Faulty Bearing/Bushing	Replace Bearing/Bushing
Faulty Ground	Check/Repair Ground
Corroded Terminals	Clean Terminals

STARTER TURNS - ENGINE DOES NOT

Faulty Starter Drive	Replace Starter Drive
Broken Drive Housing	Replace Drive Housing
Faulty Pinion Shaft	Clean/Repair Shaft
Faulty Flywheel	Check Flywheel/Starter

STARTER DOES NOT CRANK ENGINE

Faulty Starter Drive	Replace Starter Drive
Broken Drive Housing	Replace Drive Housing
Missing Flywheel Teeth	Replace Flywheel
Faulty Ground	Check/Repair Ground
Frozen Engine	Check Engine
Liquid-Locked Engine	Pressure Test Cooling System

STARTER ROTATES ENGINE SLOWLY

BYPASSING ANTI-THEFT SYSTEM STARTER INTERRUPT (SVX ONLY)

Vehicle anti-theft system has a starter interrupt feature which can be turned off or bypassed to enable the vehicle to be started conventionally. To deactivate anti-theft system, use appropriate button on remote transmitter. If transmitter is lost or not functioning properly, the following procedure must be used.

Enter vehicle, (this should cause the alarm system to sound), and completely close the door. Do not touch the security switch or open any of the doors or trunk. Turn parking lights ON, and start engine. Turn parking lights OFF.

ON-VEHICLE TESTING

CRANKING TEST

1) Ensure vehicle has fully charged battery. Connect voltmeter to battery terminals and ammeter to battery cables as per meters' instructions. Disable distributor from firing spark plugs.

2) Crank engine for less than 30 seconds. When cranking engine, note and record voltmeter reading (voltage drop) and ammeter reading (current draw).

3) Normal average starter cranking voltage should be greater than 8 volts with a current draw of about 200 amps or less.

CIRCUIT TEST

Legacy A/T

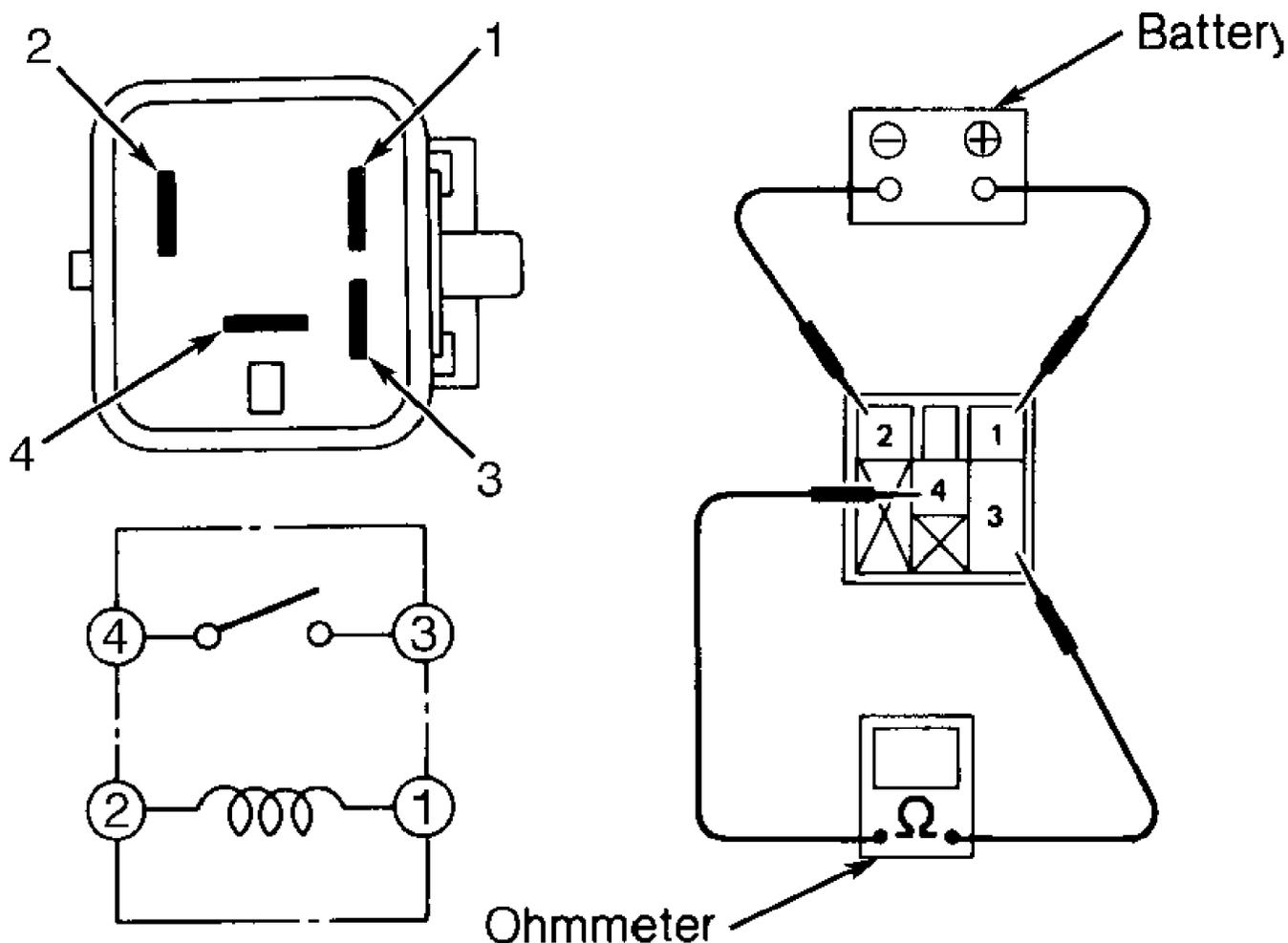
1) Turn ignition switch to START position and check for near battery voltage at starter solenoid terminal No. 50 (Red/Yellow wire). If near battery voltage exists and starter does not crank, repair or replace starter. If voltage does not exist, check for voltage at inhibitor switch Red/Yellow wire terminal.

2) Inhibitor switch is located on gear select lever, under console. Ensure lever is in Park or Neutral. If voltage exists at inhibitor switch Red/Yellow wire terminal, check for open or short in wiring to starter. If low or no voltage exists at inhibitor switch, check inhibitor switch Blue/Red wire for input voltage when ignition switch is turned to START position.

3) If voltage exists at inhibitor switch Blue/Red wire terminal, replace inhibitor switch. If voltage does not exist at inhibitor switch Blue/Red wire terminal, check for near battery voltage at ignition switch "S" terminal (Blue/Red wire) when ignition switch is turned to START position. If voltage does not exist at ignition switch Blue/Red wire, check for battery voltage to ignition switch. If battery voltage exists at battery terminal (BAT) of switch, replace ignition switch.

Legacy M/T

1) Turn ignition switch to START position and check for near battery voltage at starter solenoid terminal No. 50 (Red/Yellow wire). If near battery voltage exists and starter does not crank, repair or replace starter. If voltage does not exist, check for voltage at terminal No. 3 (Red/Yellow wire) of interlock relay with clutch pedal fully pressed to floor. See Fig. 1.



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Fig. 1: Testing Interlock Relay (Legacy, XT & XT6 - M/T)
 Courtesy of Subaru of America, Inc.

2) When clutch pedal is pressed to floor, clutch switch grounds interlock relay terminal No. 1 (Green/Yellow wire), which energizes interlock relay. Interlock relay has a Blue 4-terminal connector and is located on brake pedal bracket, next to brakelight switch. Clutch switch is located at top of clutch pedal arm.

3) If voltage exists at relay terminal No. 3 (Red/Yellow wire), repair wiring between relay and starter. If voltage does not exist, check for near battery voltage at interlock relay terminals No. 2 and 4 (Blue/Red wires) when ignition switch is turned to START position. See Fig. 1. If voltage exists at relay terminals No. 2 and 4, go to step 5).

4) If voltage does not exist at relay terminals No. 2 and 4, check for voltage to ignition switch BAT terminal and from ignition switch START terminal. Repair wiring or replace switch as required. If voltage exists at START terminal, repair Blue/Red wiring between ignition switch and relay terminals No. 2 and 4.

5) If voltage exists at relay terminals No. 2 and 4, ground interlock relay terminal No. 1 (Green/Yellow wire) using jumper wire. Check for near battery voltage at relay terminal No. 3 (Red/Yellow wire). If voltage exists, replace clutch switch. If voltage does not exist, replace relay.

Loyale A/T

1) Ensure gear select lever is in Park or Neutral. Turn ignition switch to START position and check for near battery voltage at starter solenoid terminal No. 50 (Black/White wire). If near battery voltage exists and starter does not crank, repair or replace starter. If voltage does not exist, check for voltage at inhibitor switch Black/White wire terminal.

2) Inhibitor switch for models equipped with 3AT transmission is located on gear select lever, under console. Inhibitor switch for models equipped with 4AT transmission is located on transmission lever. If near battery voltage exists at inhibitor switch Black/White wire terminal, repair wiring between inhibitor switch and starter.

3) If voltage does not exist at inhibitor switch Black/White wire terminal, check for voltage at Black/Yellow wire terminal of transmission inhibitor switch. If voltage does not exist at inhibitor switch Black/Yellow wire terminal, check for voltage to ignition switch BAT terminal and from ignition switch START terminal to inhibitor switch Black/Yellow wire terminal. If voltage does not exist, repair wiring as required or replace ignition switch.

Loyale M/T

1) Turn ignition switch to START position, press clutch pedal to floor and check for near battery voltage at starter solenoid terminal No. 50 (Black/White wire). If near battery voltage exists and starter does not crank, repair or replace starter. If voltage does not exist, check for voltage at clutch switch Black/White wire terminal when clutch pedal is pressed to floor.

2) Clutch switch is located at top of clutch pedal arm. If voltage exists at Black/White wire terminal of clutch switch, repair wiring between clutch switch and starter. If voltage does not exist, check for voltage at Black/Yellow wire terminal of clutch switch. If voltage exists, replace clutch switch.

3) If voltage does not exist at Black/Yellow wire terminal of clutch switch, check for near battery voltage at ignition switch "S" terminal (Black/Yellow wire). If voltage exists, repair Black/Yellow wire between ignition switch and clutch switch.

4) If voltage does not exist at ignition switch "S" terminal (Black/Yellow wire), check for battery voltage at ignition switch battery terminal. If voltage does not exist, replace ignition switch.

XT & XT6 (A/T)

1) Ensure gear select lever is in Park or Neutral. Turn ignition switch to START position and check for near battery voltage at starter solenoid "S" terminal (Black/Yellow wire). If near battery voltage exists and starter does not crank, repair or replace starter. If voltage does not exist, check for voltage at inhibitor switch Black/Yellow wire terminal.

2) Inhibitor switch is located on transmission lever. If voltage exists at inhibitor switch Black/Yellow wire terminal, repair wiring to starter. If voltage does not exist, check for voltage from ignition switch to inhibitor switch Black/White wire terminal.

3) If voltage exists at inhibitor switch Black/White wire terminal, replace inhibitor switch. If voltage does not exist, check for voltage at ignition switch "S" terminal (Black/White wire). If voltage exists here, repair Black/White wire between ignition switch and inhibitor switch. If voltage does not exist at ignition switch "S" terminal, replace ignition switch.

XT & XT6 (M/T)

1) Turn ignition switch to START position, press clutch pedal to floor and check for near battery voltage at starter solenoid "S" terminal (Black/Red wire). If near battery voltage exists and starter

does not crank, repair or replace starter. If voltage does not exist, check for voltage at interlock relay terminal No. 3 (Black/Red wire). See Fig. 1.

2) Interlock relay has a Blue 4-terminal connector and is located behind center console, above radio. When clutch pedal is pressed to floor, clutch switch grounds interlock relay terminal No. 1 (Green/Yellow wire), which energizes interlock relay. Clutch switch is located at top of clutch pedal arm.

3) If voltage exists at interlock relay terminal No. 3 (Black/Red wire), repair wiring to starter. If voltage does not exist, check for near battery voltage at interlock relay terminals No. 2 and 4 (Black/White wires) when ignition switch is turned to START position. See Fig. 1. If voltage exists at relay terminals No. 2 and 4, go to step 5).

4) If voltage does not exist at relay terminals No. 2 and 4, check for voltage to ignition switch BAT terminal and from ignition switch START terminal. Repair wiring or replace switch as required. If voltage exists at START terminal, repair Black/White wiring between ignition switch and interlock relay terminals No. 2 and 4.

5) If voltage exists at relay terminals No. 2 and 4, ground interlock relay terminal No. 1 (Green/Yellow wire) using jumper wire. Check for near battery voltage at relay terminal No. 3 (Black/Red wire). If voltage exists, replace clutch switch. If voltage does not exist, replace relay.

SVX

1) Ensure gear select lever is in Park or Neutral position. Turn ignition switch to START position and check for near battery voltage at starter solenoid terminal "S" (Black/Yellow wire). If near battery voltage exists and starter does not crank, repair or replace starter. If voltage does not exist, check for voltage at inhibitor switch Black/Yellow wire terminal.

2) Inhibitor switch is located on transmission lever. If voltage exists at inhibitor switch Black/Yellow wire terminal, repair wiring to starter. If voltage does not exist, check for voltage from ignition switch to inhibitor switch Black/White wire terminal.

3) If voltage exists at inhibitor switch Black/White wire terminal, replace inhibitor switch. If voltage does not exist, check for voltage at ignition switch terminal "S" (Black/White wire). If voltage exists, repair Black/White wire between ignition switch and inhibitor switch. If voltage does not exist at ignition switch terminal "S", replace ignition switch.

STARTER INTERLOCK RELAY TEST

Legacy M/T

1) Interlock relay has a Blue 4-terminal connector and is located on brake pedal bracket, next to brakelight switch. Locate and unplug relay.

2) Connect test light to terminal No. 3 (Red/Yellow wire) of interlock relay. See Fig. 1. Using jumper wire, apply 12 volts to terminals No. 2 and 4 (Blue/Red wires) of relay. Using another jumper wire, connected to ground, momentarily touch terminal No. 1 (Green/Yellow wire) of relay. If test light does not illuminate, replace relay.

XT M/T

1) Interlock relay has a Blue 4-terminal connector and is located behind center console, above radio. Clutch switch is located at top of clutch pedal arm.

2) Connect test light to terminal No. 3 (Black/Red wire) of interlock relay. See Fig. 1. Using jumper wire, apply 12 volts to terminals No. 2 and 4 (Black/White wires) of relay. Using another

jumper wire, connected to ground, momentarily touch terminal No. 1 (Green/Yellow wire) of relay. Test light should illuminate. If test light does not illuminate, replace relay.

IGNITION SWITCH TEST

Start Circuit Test

1) Remove lower instrument panel below steering wheel. Remove air duct. Remove harness connector from rear of ignition switch.

2) Using jumper wire, apply 12 volts to ignition switch terminal "B". Connect test light to switch terminal "S". Turn ignition switch to START position. If test light does not illuminate, replace relay.

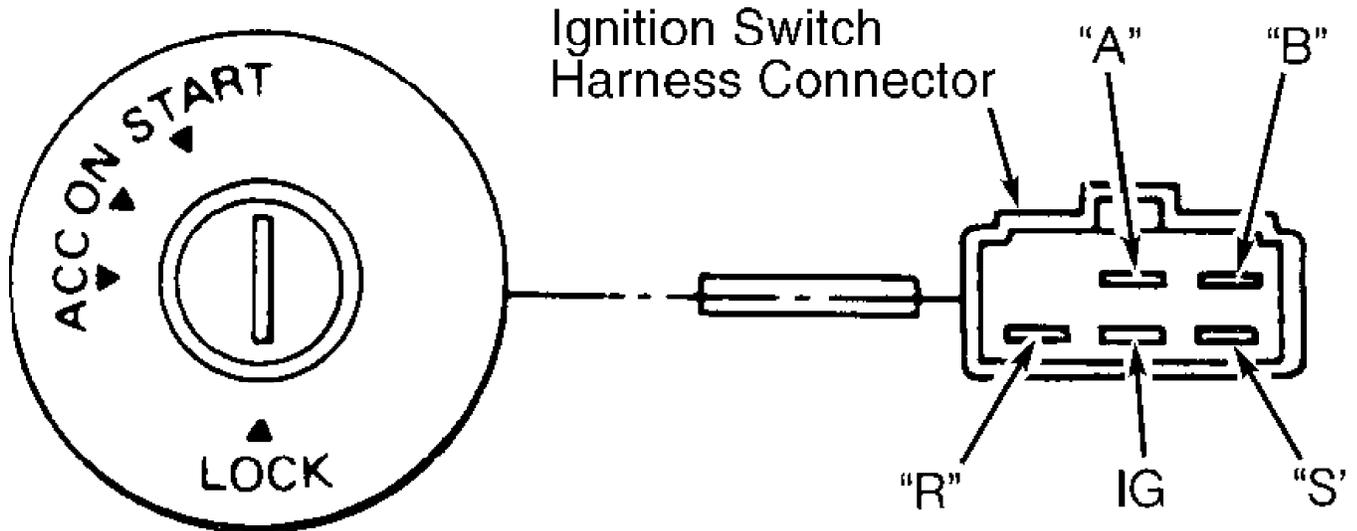
Continuity Test

Ensure continuity is as specified. See IGNITION SWITCH CONTINUITY SPECIFICATIONS table. See Fig. 2. Repair or replace as necessary.

IGNITION SWITCH CONTINUITY SPECIFICATIONS

Switch Position	Continuity Between Terminals
Lock	No Continuity
OFF	No Continuity
ACC	A & B
ON	A, B & IG
START	B, IG, (1) R & S

(1) - XT & XT6 models do not have terminal "R".



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Fig. 2: Identifying Ignition Switch Testing Terminals
 Courtesy of Subaru of America, Inc.

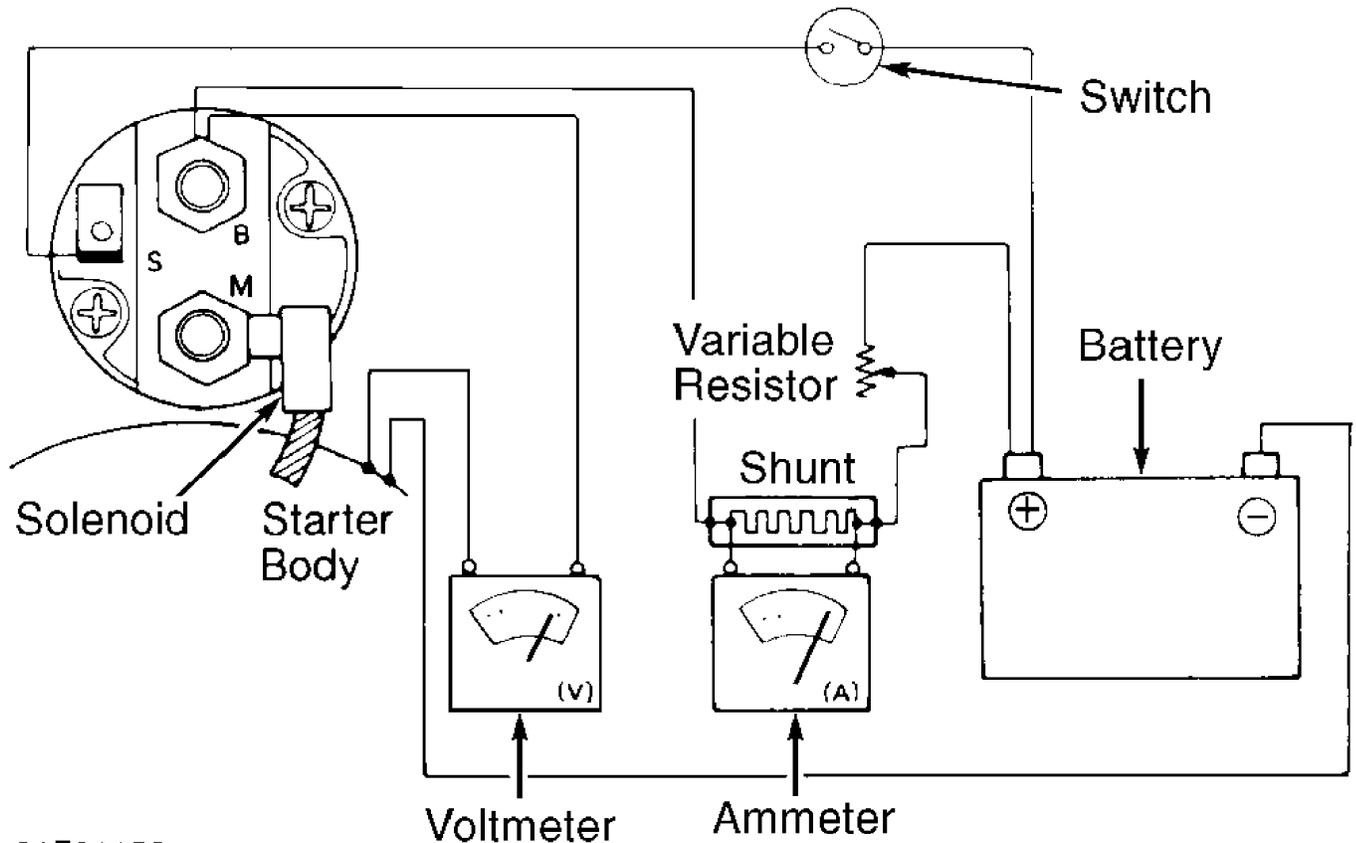
BENCH TESTING

CAUTION: Perform tests in less than 30 seconds to prevent solenoid coil and armature damage.

NO-LOAD TEST

1) Clamp starter in bench tester or in vise. Connect test equipment to starter. See Fig. 3. Close switch to engage starter. Measure current draw, rotating speed and voltage drop. See STARTER SPECIFICATIONS table at end of article.

2) Low rotating speed or excessive current draw may be caused by high friction rotating resistance caused by worn bushings or improper assembly.



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Fig. 3: Testing Starter No-Load Performance (XT Shown; Others Similar)

Courtesy of Subaru of America, Inc.

LOAD TEST

1) Using proper starter bench tester, connect test equipment and apply specified load to starter. See STARTER SPECIFICATIONS table at end of article. Engage tester switch for less than 30 seconds. Note and record voltage drop and current draw.

2) Voltage should not drop to less than 8 volts. On A/T models, current draw should be less than 370 amps and rotating speed should be greater than 880 RPM. On M/T models, see STARTER SPECIFICATIONS table.

LOCK TEST

1) Using proper starter bench tester, connect test equipment and lock starter armature. Engage tester momentarily while measuring starter torque, current draw and voltage drop.

2) Check specifications for minimum torque, voltage drop (minimum volts) and current draw (maximum amps). See STARTER SPECIFICATIONS table at end of article.

3) Low current draw and no torque during lock test may be caused by excessive resistance between brushes and commutator. Normal current draw but low torque speed may be caused by a shorted commutator and/or poor insulation.

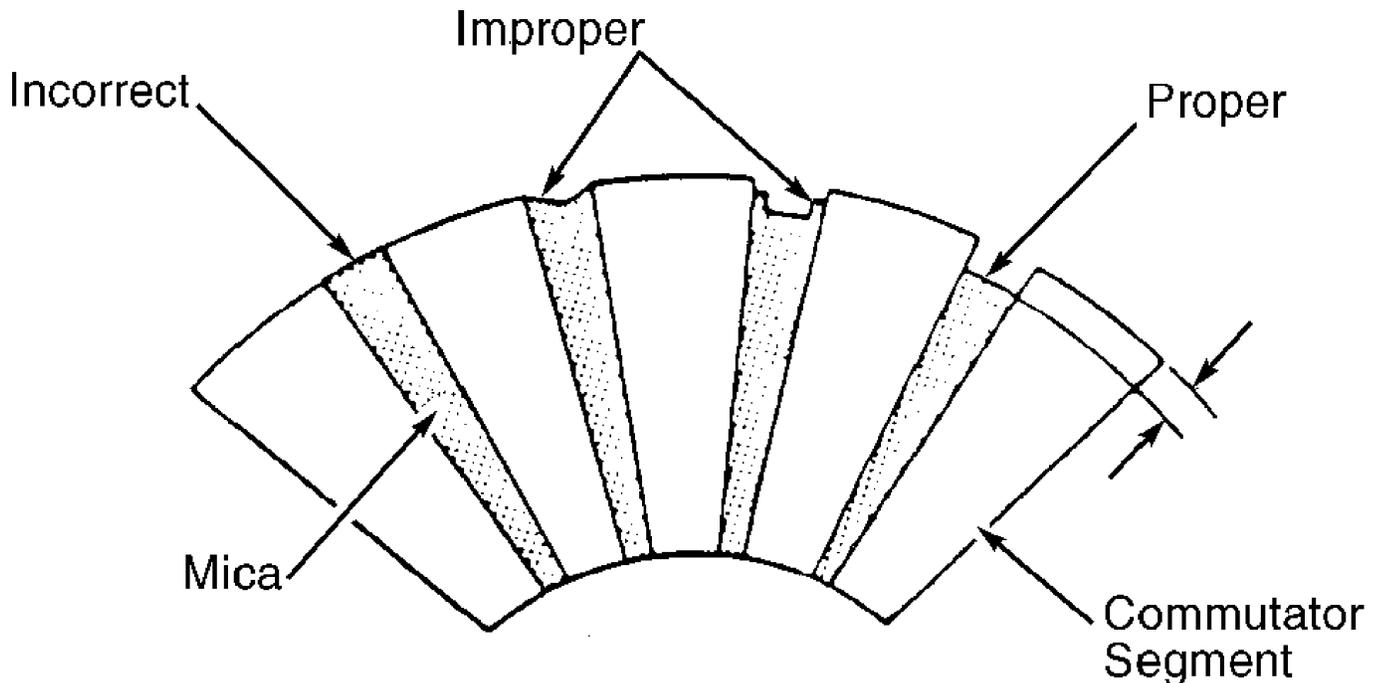
ARMATURE TEST

1) With starter disassembled, check armature for shorts using a growler. Hold hacksaw blade against armature while slowly rotating armature. A shorted armature will cause hacksaw blade to vibrate when passed over shorted area. Replace as necessary.

2) Use an ohmmeter to check for grounded armature. Touch one probe to each segment of commutator and hold other probe to armature core. If continuity exists, replace armature.

3) Use ohmmeter to check for open circuit. If continuity is not present between any 2 commutator segments, replace armature. Check commutator for outside diameter wear, runout and mica insulation depth. See STARTER SPECIFICATIONS table at end of article.

4) If correcting runout condition, DO NOT reduce armature size beyond specification. Undercut mica insulation if it is even or higher than commutator surface. See Fig. 4. See STARTER SPECIFICATIONS table.



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Fig. 4: Undercutting Commutator Mica
Courtesy of Subaru of America, Inc.

BRUSH HOLDER TEST

Check condition of brush holder springs, spring clip and insulation between positive and negative holders. Continuity should not exist between brush holder and holder plate. Repair or replace as needed.

FIELD COIL TEST

Check for open circuits in field coils of yoke assembly. Continuity should exist between lead wire and field coil brush lead. If continuity does not exist, replace field coil. Check for continuity between field coils and yoke assembly (end frame). If continuity exists, field coil is shorted to ground. Replace field coil.

OVERRUNNING CLUTCH TEST

Ensure pinion rotates smoothly in direction of rotation. Pinion should not rotate in opposite direction. Inspect teeth for excessive wear and damage. Replace as necessary.

SOLENOID TESTS

Shunt Coil Test (XT & XT6)

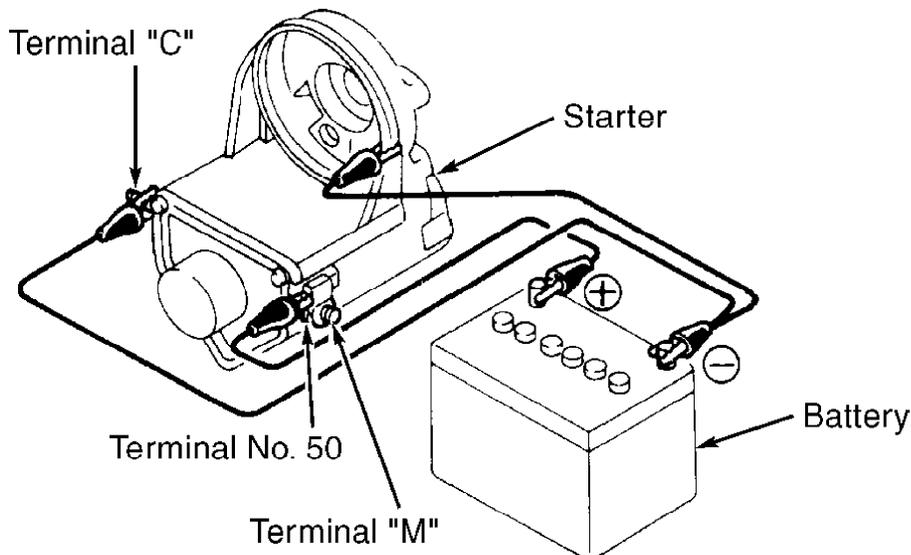
Ensure continuity exists between solenoid terminal "S" and solenoid body (ground). Ensure continuity exists between solenoid terminals "M" and "S". If continuity does not exist, solenoid is open and requires replacement.

Contact Continuity Test (XT & XT6)

Continuity should exist between terminal "M" and terminal "B" with solenoid plunger pushed in. If continuity does not exist, replace solenoid.

Solenoid Pull-In Test (Legacy & Loyale)

Connect 2 jumper wires from negative terminal of 12-volt battery to starter solenoid case and to terminal "C". See Fig. 5. Pinion should extend when jumper wire from battery positive terminal is connected to solenoid terminal No. 50. If pinion does not extend as specified, replace starter.



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Fig. 5: Starter Solenoid Pull-In/Hold-In Windings Test (Legacy & Loyale)

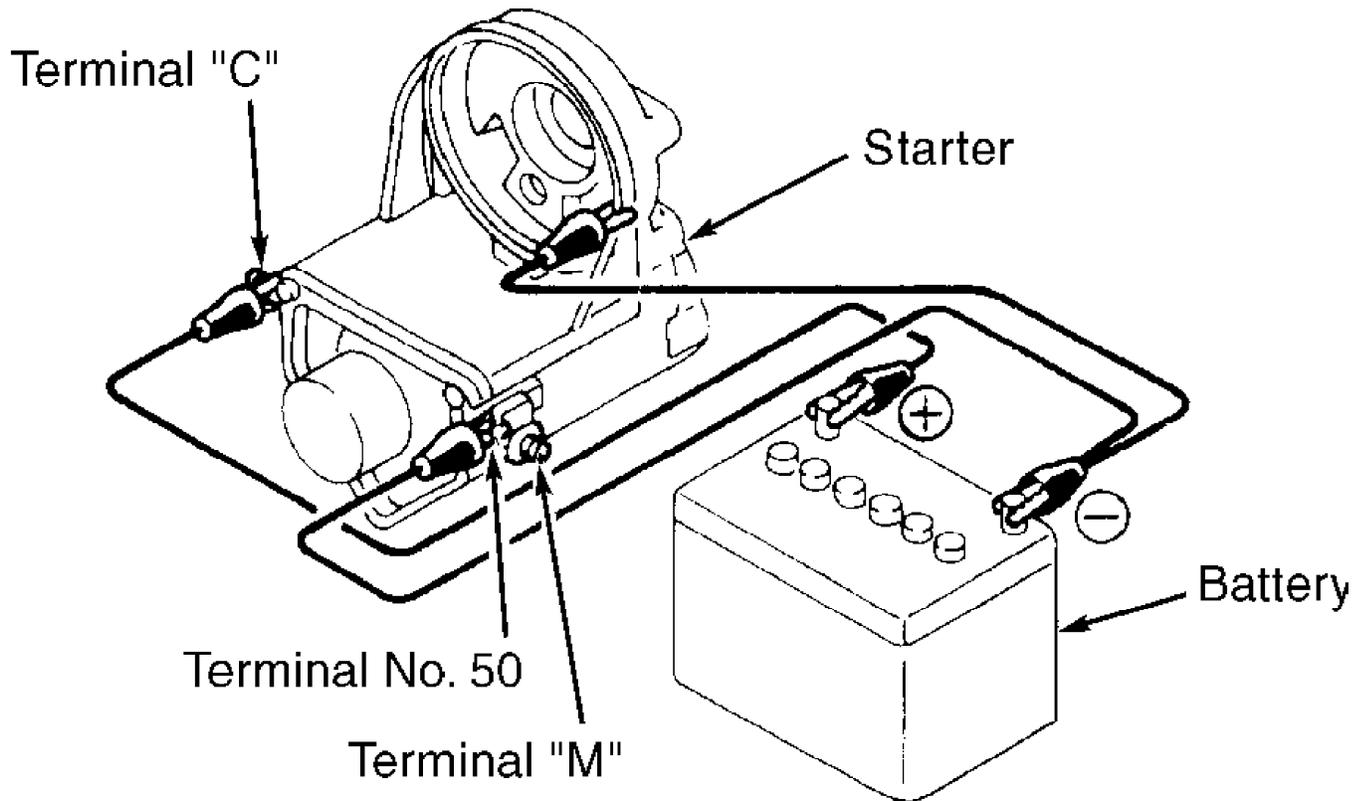
Courtesy of Subaru of America, Inc.

Solenoid Hold-In Test (Legacy & Loyale)

Disconnect jumper wire from solenoid terminal "C" with pinion extended. Pinion should remain extended. If pinion does not remain extended, replace starter.

Pinion Gear Return Test (Legacy & Loyale)

Connect 2 jumper wires from negative terminal of 12-volt battery to starter solenoid case and to terminal No. 50. See Fig. 6. Momentarily touch positive jumper wire to terminal "C". Pinion gear should return immediately. If pinion gear does not return immediately, replace starter.

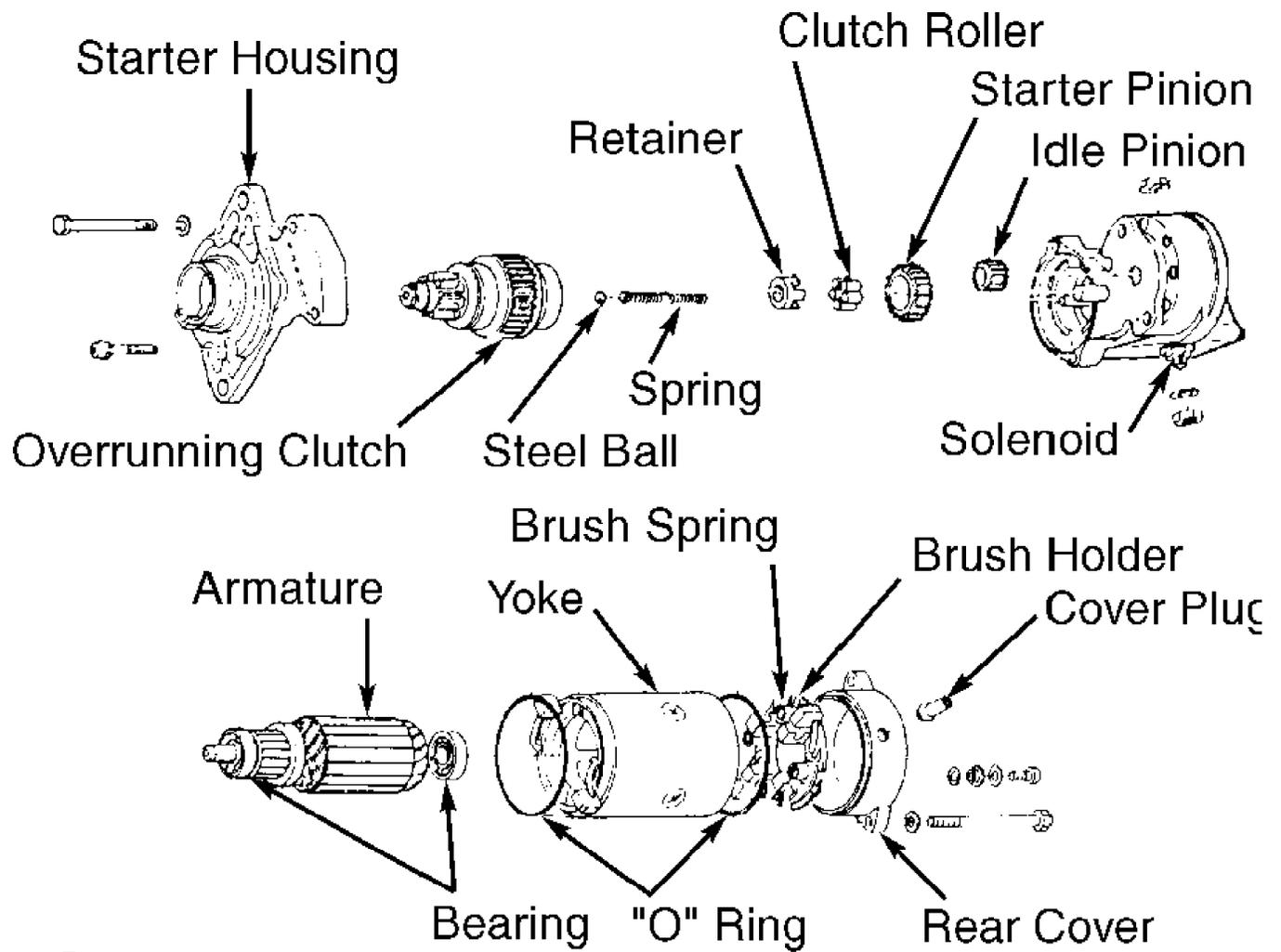


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Fig. 6: Testing Starter Solenoid Pinion Return (Legacy & Loyale)
Courtesy of Subaru of America, Inc.

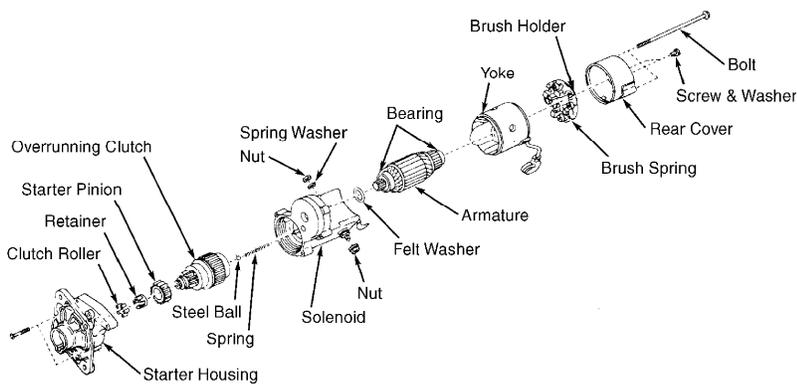
OVERHAUL

NOTE: Overhaul procedures not available at time of publication. For exploded view of starter, see Fig. 7, 8 or 9.



90B09440

Fig. 7: View of Nippondenso Reduction Gear Starter (Legacy/Loyale A/T)
 Courtesy of Subaru of America, Inc.



90D09441

Fig. 8: View of Nippondenso Reduction Gear Starter (Legacy/Loyale M/T)
 Courtesy of Subaru of America, Inc.

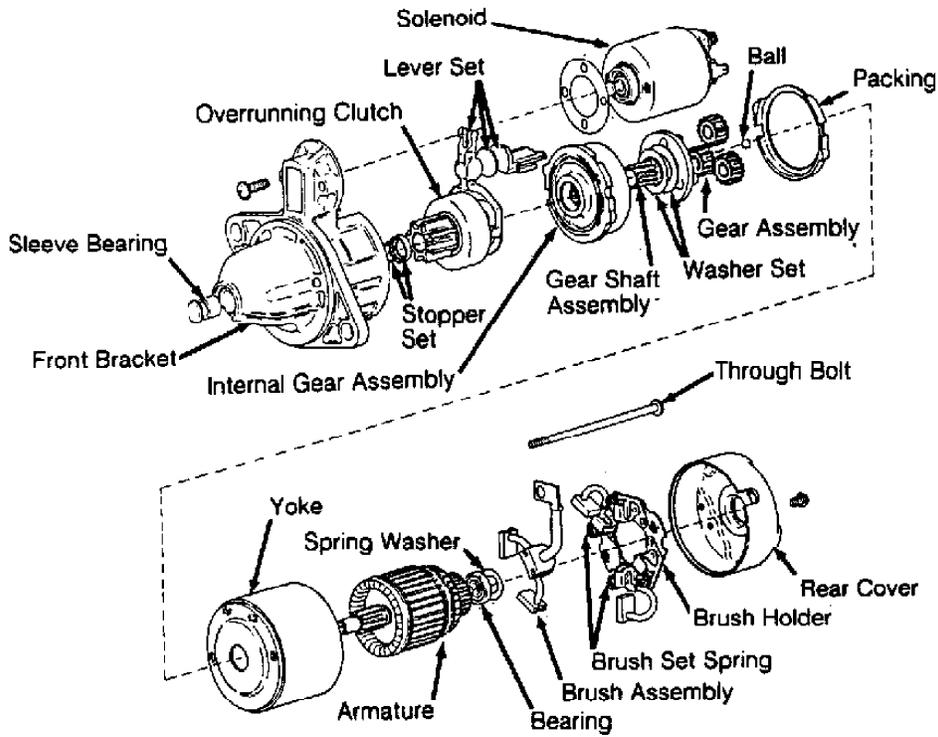


Fig. 9: View of Mitsubishi Reduction Gear Starter (XT & XT6)
 Courtesy of Subaru of America, Inc.

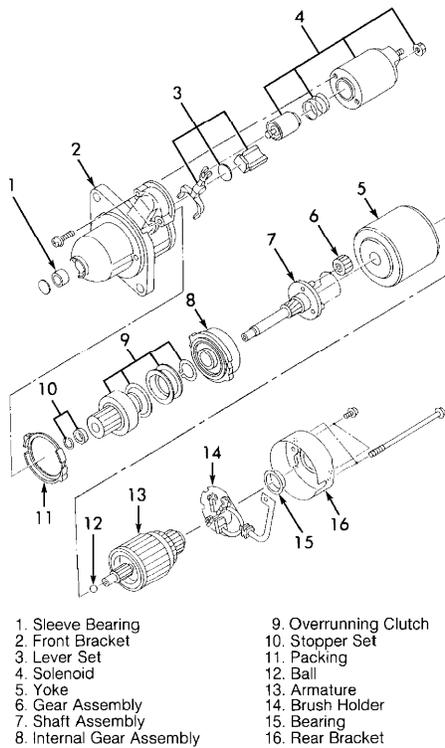


Fig. 10: View of Mitsubishi Reduction Gear Starter (SVX)
 Courtesy of Subaru of America, Inc.

STARTER SPECIFICATIONS

STARTER SPECIFICATIONS

Application	Specification
Carbon Brushes	
Legacy A/T & Loyale	
Minimum Length .....	.39" (10.0 mm)
Standard Length .....	.59" (15.0 mm)
Legacy M/T	
Minimum Length .....	.34" (8.5 mm)
Standard Length .....	.51" (13.0 mm)
SVX	
Minimum Length .....	.45" (11.5 mm)
Standard Length .....	.67" (17.0 mm)
Commutator	
Runout	
Legacy & Loyale	
Limit .....	.0020" (.050 mm)
Standard .....	.0008" (.020 mm)
SVX	
Limit .....	.0039" (.100 mm)
Standard .....	.0020" (.050 mm)
Outside Diameter	
Legacy & Loyale	
Limit	1.14" (29.0 mm)
Standard	1.18" (30.0 mm)
SVX	(1)
Mica Depth	
Limit .....	.008" (.20 mm)
Standard .....	.020-.031" (.50-.80 mm)
Load Test	
Legacy	
Load	7 Ft. Lbs. (9.5 N.m)
Maximum Amps	
A/T	370 Amps
M/T	280 Amps
Minimum RPM	
A/T	880 RPM
M/T	900 RPM
Voltage Drop (Minimum)	8 Volts
Loyale	
Load	4.7 Ft. Lbs. (6.4 N.m)
Maximum Amps	
A/T	370 Amps
M/T	230 Amps
Minimum RPM	
A/T	880 RPM
M/T	1180 RPM
Voltage Drop (Minimum)	8 Volts
SVX	
Load	7 Ft. Lbs. (9.5 N.m)
Maximum Amps	300 Amps
Minimum RPM	1000 RPM
Voltage Drop (Minimum)	7.7 Volts
Lock Test	
Legacy	
Minimum Voltage	5 Volts
Maximum Amps	
A/T	735 Amps

M/T	800 Amps
Minimum Torque	20 Ft. Lbs. (27 N.m)
Loyale	
A/T	
Minimum Voltage	5 Volts
Maximum Amps	735 Amps
Minimum Torque	20 Ft. Lbs. (27 N.m)
M/T	
Minimum Voltage	2.5 Volts
Maximum Amps	300 Amps
Minimum Torque	5.1 Ft. Lbs. (7.0 N.m)
SVX	
Minimum Voltage	4 Volts
Maximum Amps	980 Amps
Minimum Torque	17 Ft. Lbs. (23 N.m)
No-Load Test	
Legacy	
Maximum Amps	90 Amps
Minimum RPM	
A/T	3350 RPM
M/T	3000 RPM
Voltage Drop (Minimum)	11 Volts
Loyale	
Maximum Amps	90 Amps
Minimum RPM	
A/T	4000 RPM
M/T	3000 RPM
Voltage Drop (Minimum)	11 Volts
SVX	
Maximum Amps	90 Amps
Minimum RPM	3000 RPM
Voltage Drop (Minimum)	11 Volts

(1) - Information not available at time of publication.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Starter Bolts	(1)

(1) - Information not available at time of publication.
