BOSCH

Audi
BMW
Fiat
Fiesta
Mercedes-Benz
Peugeot
Porsche
Saab
Volkswagen
Volvo

DESCRIPTION

Starter is a brush type, series wound electric motor equipped with an overrunning clutch. Integral solenoid mounted on the starter engages starter pinion gear with flywheel ring gear when starter is engaged. Field frame is enclosed by commutator end frame and drive bushing and carries pole shoes and field coils. A spline on the drive end of the armature shaft carries the overrunning clutch and pinion assembly. Armature shaft is supported in sintered bronze bushings in the commutator end frame and drive end housings.

APPLICATION

Model	①Bosch Part No.
Audi	
4000	211 218
5000	311 122
5000 Diesel	362 069
BMW	
320i	311 100
528i, 633CSi & 733i	314 025
Fiat Strada & X1/9	212 210
Fiesta	211 227
Mercedes-Benz	
240 & 300 Series	362 047
280 & 450 Series	314 018
Peugeot	
504	362 044
505 Diesel	362 045
505 Gasoline	208 211
604	311 124
Porsche	
911SC	312 100
924	311 122
924 Turbo (Standard)	208 221
924 Turbo (Heavy Duty)	311 134
928	312 102
Saab 99, 900 & 900 Turbo	311 108
Volkswagen	
Dasher	
Gasoline	211 218
Diesel	314 014
Jetta, Rabbit & Scirocco (Gasoline)	
Man. Trans.	211 223
Auto. Trans.	212 206
Rabbit (Diesel)	
Man. Trans.	314 012
Auto. Trans.	312 105
Vanagon	
Man. Trans.	211 221
Auto. Trans.	212 208
Volvo	
DL, GL & GT	311 103
GLE & Coupe	311 105
Diesel	②1257325

① – Bosch starter basic part number is 0 001.
② – Volvo part number.

TESTING

Lock Test– Mount starter in a test stand to allow starter torque measurement (follow manufacturers instructions). With voltage adjusted to specifications, ammeter reading and starter torque should be within specifications.

Free Running Test– With starter in test bench, take readings of starter current, voltage and RPM. Readings should be within specifications.

NOTE – *Starter must be mounted to prevent meshing of pinion and ring gear even in engaged position. If starter has warmed up during previous tests, RPM will be higher.*

SPECIFICATIONS

Brush Length & Spring Tension

Application	In.(mm)	Lbs. (g)
208 xxx	.52 (13)	2.5-3.1(1150-1350)
211 xxx	.52 (13)	2.5-2.9(1150-1300)
212 xxx	.52 (13)	2.4-2.7(1080-1220)
311 xxx	.39 (10)	2.5-2.9(1150-1300)
312 xxx	.39 (10)	1.8-2.0(800-900)
314 xxx	.52 (13)	2.5-2.9(1150-1300)
362 xxx	.61 (15.5)	2.5-2.9(1150-1300)

OVERHAUL

DISASSEMBLY

1) Clamp starter in vise and remove nut and washer from solenoid main terminal connection. Remove solenoid mounting screws and guide solenoid body away from drive end housing and plunger. Disconnect plunger from actuating lever.

2) Remove screws and cap with rubber seal from commutator end housing. Wipe grease from armature shaft and remove "C" clip with shims. Remove through bolts or nuts from studs and lift off commutator end housing.

3) Lift springs clear of brushes and slide brushes from holders. Remove brush plate from housing. Separate drive end housing and armature assembly from yoke by tapping apart.

4) Remove armature assembly from drive end housing while at the same time uncoupling actuating arm. If necessary to remove actuating arm, first remove rubber insert from drive end housing. Remove pivot arm screw and nut and extract actuating arm.

5) To remove drive pinion assembly from armature shaft, separate thrust collar from over "C" clip. Remove "C" clip from its groove and drive pinion assembly off armature shaft.

BOSCH (Cont.)

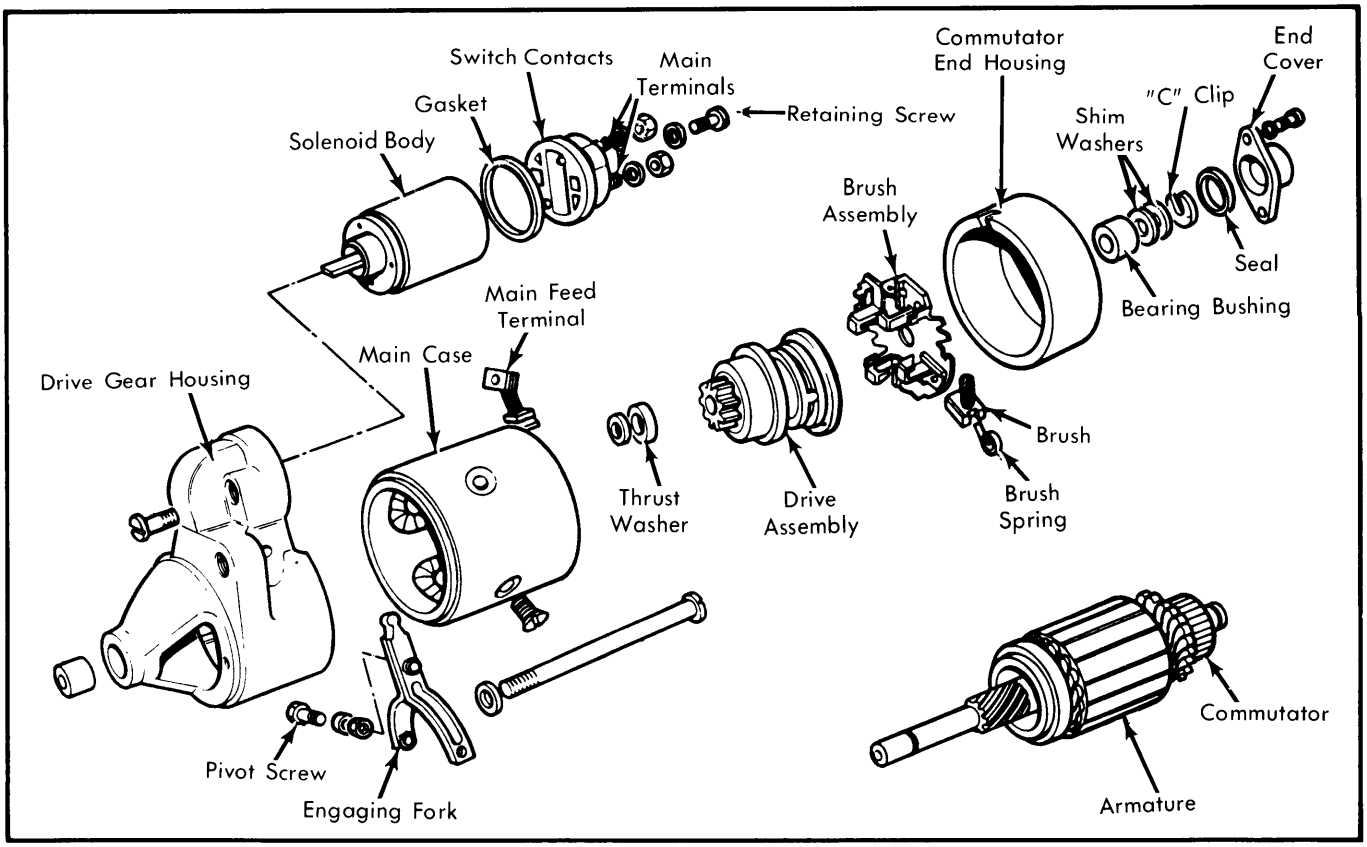

Fig. 1 Disassembled View of Typical Bosch Starter

CLEANING & INSPECTING

Clean all parts with suitable cleaning agent. Inspect for wear or damage, then apply thin coat of oil to running surfaces.

PARTS REPLACEMENT & TESTING

Brushes & Springs –Check brush spring pressure with suitable spring scale. Check brushes for minimum length and freedom of movement in holders. If replacement is necessary, replace all brushes by cutting old brush leads midway between connection and old brush. Solder new brushes to original leads.

Armature – 1) Check commutator to shaft (or core) for short circuit with 110 volt AC test lamp. Test lamp should not light, however slight glow may occur due to dampness. Check armature coils for short circuit between windings using an armature growler.

2) Check commutator for pits, burns or rough surface. If out of round exceeds .002" (.05 mm), or grooves or burned spots cannot be removed with fine crocus cloth, commutator must be turned. Undercut insulation between commutator bars to a maximum depth of .024" (.6 mm).

NOTE – *Never use emery cloth or a file on commutator; turn on a lathe only.*

Bushings – Self-lubricating bushings should be replaced only when worn or damaged. Force out bushings with suitable mandrel. Clean hole and remove burrs. Before pressing new bushing in place, soak bushing in suitable lubricant for at least 30 minutes.

Drive Assembly – Replace drive when damaged or teeth are worn. *See Disassembly.*

Solenoid Plunger (Armature) – Plunger must move in and out of solenoid body when disconnected from pinion drive lever. If corroded, clean thoroughly before proceeding with tests.

Solenoid Pull-In Coil – Connect jumper wires between a 12 volt battery and the solenoid as shown in *Fig. 2.* Armature should pull in suddenly and return when electrical connection is broken.

BOSCH (Cont.)

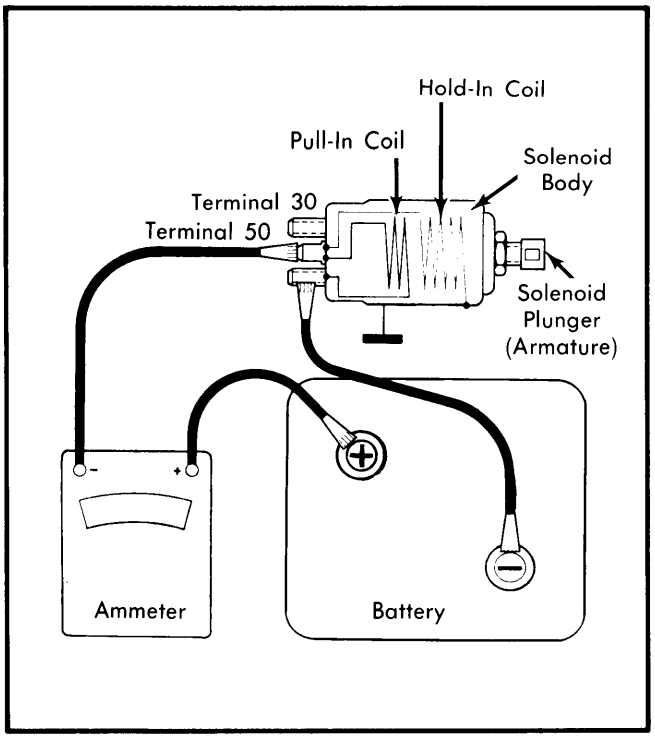

Fig. 2 Typical Connections for Pull-In Test

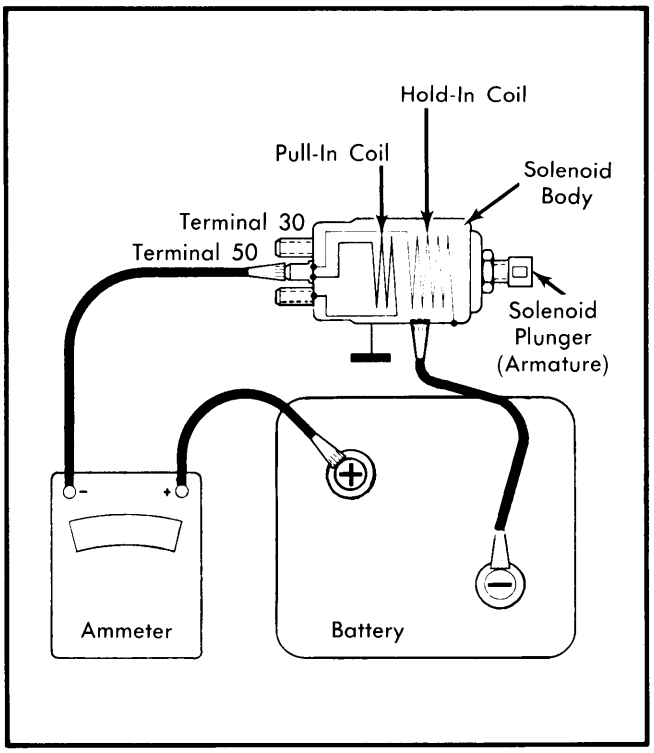

Fig. 3 Typical Connections for Hold-In Test

Hold-In Coil – Connect jumper wires as shown in *Fig. 3* while pressing armature into solenoid by hand. Armature should remain held in. Disconnect jumper terminal 50 and armature should immediately return to its outer position.

NOTE – *Do not attempt to repair solenoid. If either test is unsatisfactory, install new solenoid.*

REASSEMBLY

1) Slide drive pinion assembly and thrust washer onto armature shaft. Install "C" clip into groove in armature shaft and pull thrust washer up over clip. Align fork in drive end housing and insert pivot pin. Slide armature assembly into drive end housing, coupling the shift fork onto the drive pinion flange.

2) Install rubber insert in drive end housing. Guide yoke assembly over armature while aligning notch with rubber insert. Tap yoke into full contact with drive end housing.

3) Install brush assembly noting that cutouts in brush plate slide over through bolts on models so equipped. On models with screws, brush plate cutouts align with loops in field windings. Plates are properly positioned when screws are installed in commutator end housing. Install brushes and springs assuring that field winding brush leads do not contact yoke.

4) Slide commutator end housing into position and secure with nuts and washers or screws, as appropriate. Install drive end housing. Install shims onto armature shaft at commutator end to eliminate end play and install "C" clip in groove.

5) Install bearing cap seal on commutator end housing. Lubricate end of armature shaft with lithium based grease and install bearing cap. Lubricate plunger hook and place in position over shift fork in drive end housing. Install solenoid body with return spring properly positioned, then tighten mounting screws and field connections.

STARTER PERFORMANCE SPECIFICATIONS

Model	No Load Test		Amps.	Lock Test Volts	Torque	Solenoid Pull-In Volts
	Amps.	RPM				
208 xxx	35-55	6000-8000	320-410	8.5	9.4 ft.lbs.	7.5
211 xxx	35-55	6000-9000	340-430	8.5	8.7 ft.lbs.	8.0
212 xxx	35-55	6000-8000	320-410	8.5	9.4 ft.lbs.	7.5
311 xxx	30-50	5500-7500	350-450	8.5	13.0 ft.lbs.	7.5
312 xxx	55-85	8500-10,500	650-730	6.0	13.7 ft.lbs.	8.0
314 xxx	50-80	7300-9300	690-780	6.0	16.6 ft.lbs.	7.5
362 xxx	65-95	6500-8500	1100-1300	7.0	32.5 ft.lbs.	7.5