BOSCH

Audi
BMW
Capri
Fiesta
Lancia
Mercedes-Benz
Porsche
Saab
Volkswagen
Volvo

DESCRIPTION

Starter is a brush type, series wound, electric motor, equipped with an overrunning clutch (inner-wedge or outer-wedge type). Unit may or may not be equipped with a solenoid. Field frame is enclosed by commutator end frame and drive bushing and carries the pole shoes and field coils. A spline, located on drive end of armature, carries overrunning clutch and pinion assembly. Armature shaft is supported in sintered bronze bushings in the commutator end frame and drive end housings (these bushings are packed with lubricant at assembly and require no further lubrication).

APPLICATION

Model	①Bosch Part No.
Audi	
5000	311 122
Fox	211 218
BMW	
320i	311 045
530i, 633CSi, 733i	311 042
Capri	
4 Cyl.	311 121
V6	311 120
Fiesta	211 227
Lancia	311 116
Mercedes-Benz	
230, 280, 450	314 018
6.9	312 101
240D, 300D, 300CD, 300SD Turbo	362 047
Porsche	
924	311 122
911SC & Turbo	312 100
928	312 102
Saab 99	311 108
Volkswagen	
Type 1	
M/T	211 993
A/T	212 005
Type 2	
M/T	211 221
A/T	211 206
Dasher	
M/T	211 218
A/T	211 206
Rabbit & Scirocco	
M/T	211 223
A/T	212 206
Diesel	314 012
Volvo	
4 Cyl.	311 103
V6	311 105

① — Bosch starter basic part number is 0 001.

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)
211 xxx	.52(13)	2.5-3.0(1150-1300)
211 xxx	.52(13)	2.4-2.7(1080-1220)
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.

CLEANING & INSPECTING

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

BOSCH (Cont.)

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 – Check coil and commutator to shaft (or core) for short circuit, with 110 volt ac control lamp. Control lamp should not illuminate (slight illumination is possible due to dampness). Check coil to commutator for short circuit with a 6 volt DC control lamp, touching every coil on armature and its corresponding bar, brightness of lamp should not change. Check coils on armature for short circuit between windings using a growler.

Check out of round of commutator to core, it should not exceed .00197" (0.5 mm). Commutator should have a smooth greyish-blue surface with no grooves or burned spots otherwise, it must be turned. Minimum commutator diameter is 1.32" (33.5 mm). After turning commutator, undercut insulation to a depth of .0197-.0236" (0.5-0.8 mm), decrease diameter by .0039" (0.1 mm). Do not use emery cloth, turn on a lathe only.

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

Bushings – Self-lubricating bushings should be replaced only when worn or damaged. Force out bushings, using a suitable mandrel, remove burrs and clean hole. Before pressing in new bushing, soak bushing in a suitable oil for not less than 30 minutes. After replacing, cross check inner diameter of bushing by pulling a smoothing mandrel through.

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.

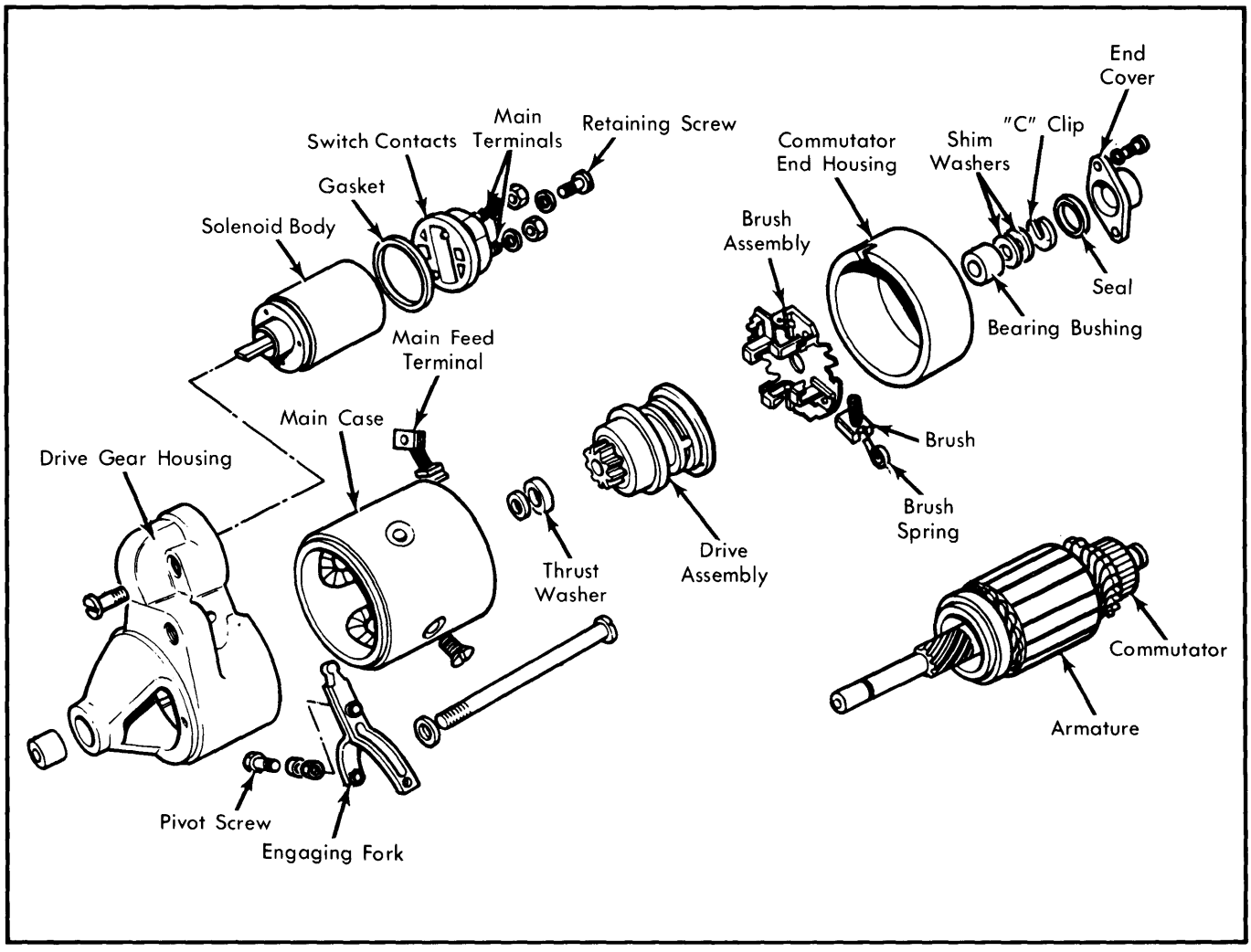

Fig. 1 Disassembled View of Typical Bosch Starter

BOSCH (Cont.)

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

Model①	No Load Test		Lock Test		
	Amps.	RPM	Amps.	Volts	Torque
211 xxx	30-50	6000-9000	300-390	9.0	8.7 ft.lbs.
211 9xx	30-50	6500-9500	320-410	8.5	8.3 ft.lbs.
212 xxx	35-55	6000-8000	320-410	8.5	9.4 ft.lbs.
311 xxx	30-50	5500-7500	350-450	8.5	13.0 ft.lbs.
312 1xx	55-85	8500-10500	650-730	6.0	13.7 ft.lbs.
314 xxx	50-80	7300-9300	690-780	6.0	16.6 ft.lbs.
362 xxx	65-95	6500-8500	1100-1300	7.0	32.5 ft.lbs.

① — Bosch Basic Part Number is 0 001.