BOSCH

Alfa Romeo
Audi
BMW
Capri II (1976)
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.
Alfa Romeo	311 110
Audi	
100LS	②058 911 023A
Fox	②056 911 023A
BMW	
2002,2002A,2002tii	311 016
3.0, 530i	311 042
Capri II (1976)	
4 Cyl.	③D5RY-B
V6	③D5RY-C
Mercedes-Benz	
240D, 300D	④002 151 3001
All Others	④002 151 3101
Porsche	
1.8 Liter	⑤003 911 023A
2.0 Liter	⑤039 911 023
911 & Carerra Models	312 100
Saab 99	311 108
Volkswagen	
Dasher,Rabbit,Scirocco	
Man. Trans.	212 204
Auto. Trans.	212 206
All Others	
Man. Trans.	211 993
Auto. Trans.	212 005
Volvo	
4 Cylinder	311 103
6 Cylinder	311 027

① – Basic Bosch Part No. 0 001
② – Audi Part No.
③ – Ford Part No.
④ – Mercedes-Benz Part No.
⑤ – Porsche Part No.

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 (follow test manufacturers instructions), take readings of starter current, voltage and RPM. *NOTE – Starter must be mounted so as to prevent meshing of pinion and ring gear even in engaged position, also if starter has warmed up during previous tests, the RPM will be higher.*

SPECIFICATIONS

Brush Spring Tension

Application	Lbs. (Kg)
208 XXX	2.54-2.98 (1150-1350)
211 XXX	2.54-2.98 (1150-1350)
211 9XX	2.38-2.69 (1080-1220)
212 XXX	2.38-2.69 (1080-1220)
311 XXX	2.54-2.87 (1150-1300)
312 1XX	1.76-1.98 (800-900)
313 XXX	2.54-2.87 (1150-1300)
362 XXX	2.54-2.87 (1150-1300)

Min. Brush Length

Application	In. (mm)
312 1XX	.394 (10)
362 XXX	.611 (15.5)
All Other Starters	.512 (13)

NOTE – For performance test data, see specification table.

OVERHAUL

DISASSEMBLY

1) With starter removed from vehicle, remove dust cover (by removing retaining screws) or remove dust cover band and felt gasket. Lift out brush springs using a wire hook, pull out brushes to ¾ of their length. Remove screws connecting field coil terminals to brush boxes.

2) Disconnect field coil to solenoid strap, remove hex nut on one side of drive end cover and remove screw. Remove screws securing solenoid and remove solenoid. On mechanical starters, remove collar belt with cotter pin and washer.

3) Remove commutator end assembly (must be forced out if made of sheet metal), remove through bolts and pull complete drive end assembly forward. Take all washers off armature shaft, noting their proper location for reassembly.

4) If commutator end assembly was removed by unscrewing hex nuts, remove the threaded pins remaining, using hex nut and counter hex nut. Place this unit, consisting of drive end and armature, into a vise, after removing starter housing.

5) Remove yoke lever, then from armature shaft, remove cotter pin and left hand threaded castle nut. Remove snap ring using an aluminum or lead-jawed vise (to prevent damage to threads). Discard old snap ring. To prevent damage to bushing in drive end, be sure no burrs are left after removal of ring.

6) Remove drive assembly, intermediate bearing with bushing (if equipped) and armature brake, spring plate washer unit or washer spring jaw unit (depending on model).

CLEANING & INSPECTING

Wash all parts, except field coils and armature, in oil or carbontetrachloride. Field coils and armature may be cleaned in carbontetrachloride only. All parts must be dried immediately, using compressed air. Inspect all parts for wear or damage. Check all terminals for tight connections and good insulation. Lubricate polished surfaces (except commutator) with clean crankcase oil.

BOSCH (Cont.)

PARTS REPLACEMENT & TESTING

Brushes & Springs – Check brush spring pressure with suitable spring scale. Check brushes for minimum length (see specifications), if necessary, replace **all** brushes.

Armature – Check coil and commutator to shaft (or core) for short circuit, with 110 volt AC; 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" (.5-.8 mm), decrease diameter by .0039" (.1mm), do not use emery cloth, but turn on a lathe.

Housing – Check field coils for shorted or open circuits. Remove burned or damaged coils, mark location of coils and pole shoes for installation. Replace pole shoes with coils, using a suitable pole shoe screwdriver and mandrel.

Drive Assembly – Replace drive when damaged or teeth are worn. When drive assembly consists of pinion and clutch, disassemble as follows: Pull pinion with left hand (turning to left), then pull guide discs toward commutator, also giving these a left hand turn. Mark all parts for reassembly, then remove intermediate bearing, spring, spring seat, and plate from armature shaft. Carefully remove spring ring using a screwdriver and pushing stop ring back. Take off inner and outer spring, guiding piece, locking piece, disc and thrust ring, from drive cup. Remove spring ring from drive cup, using a screwdriver. Remove pinion with clutch discs, taking care not to lose disc. Remove stamping marks between stop ring and spring ring, push stop ring back and carefully lift out spring ring. Slacken clutch nut from pinion by twisting, being very careful of small springs inside nut. If pinion, stop disc or plate is damaged, force out ring so new parts may be installed.

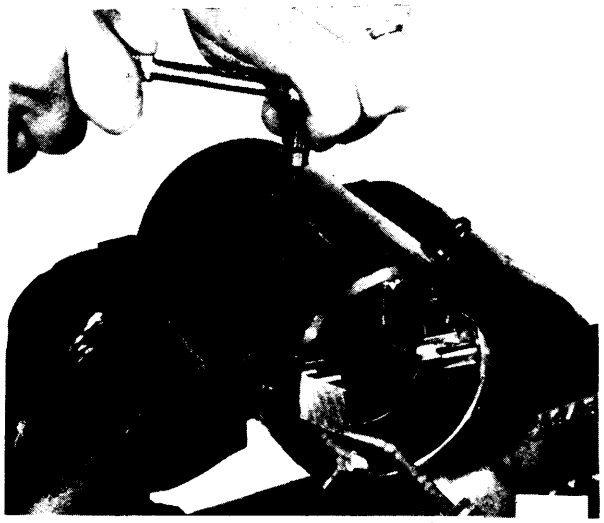

Fig. 1 Removing the Pole Shoes

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

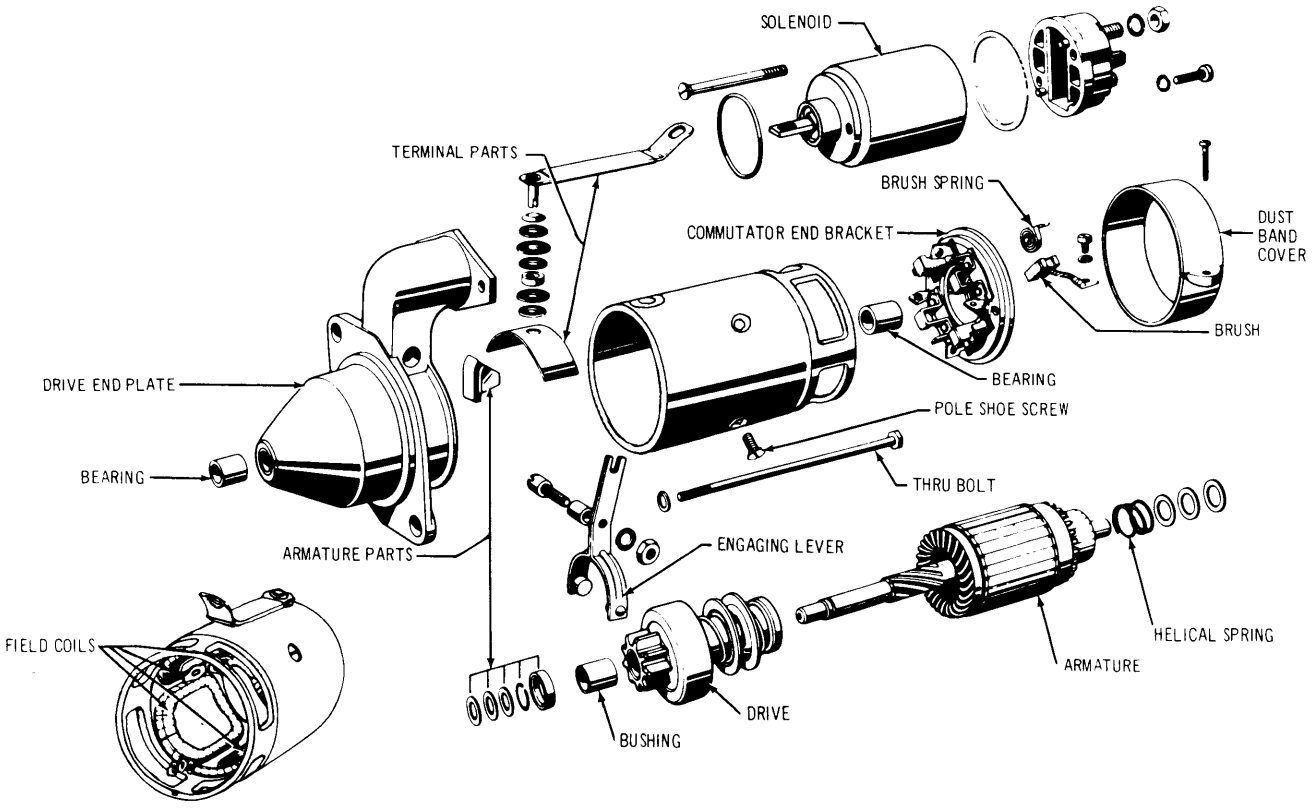

Fig. 2 Disassembled View of Bosch Starter

BOSCH (Cont.)

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

NOTE – When reassembling, use all new gaskets, and when reassembly complete, paint all main joints on starter (including solenoid) with gum-lac, or an equivalent.

1) Clamp armature in a suitable holding fixture, line up armature brake unit and intermediate bearing. The bent ends of the spring plate washer unit must engage into holes of cupped washer of intermediate bearing.

2) Push drive over armature shaft, then push spring ring into groove (using suitable tool); use conical piece to force ring over after adjusting it with hex bolts, so that tube pushes spring ring straight into groove. Install castle nut and adjust with cotter pin.

3) Insert yoke lever, slipping drive end assembly over drive, being sure guide pins on fork are between guiding discs and that fork is in center of casting throat. Replace rubber seal to joint of drive end housing (on starters with intermediate bearing only).

4) Install intermediate bearing to drive end assembly and install through bolts in the reverse manner of their removal. Be certain intermediate bearing is properly seated to drive end assembly. Check armature brake spring ends to ensure proper positioning.

5) Insert armature, with drive end assembly into housing, do not damage field coils. Install washers on armature shaft as they were marked at disassembly, replace commutator end assembly. Check play of armature, this should not exceed .0029-.0118", adjust with shims if necessary.

6) Hook in joint fork of solenoid, pushing back engagement fork. Be certain rubber seal is installed between solenoid and drive end and copper washer on bearing bolt. Attach solenoid and field coil terminal to solenoid.

7) Connect field coil terminal to brush box and install brushes, making sure leads of brushes do not interfere with cover. Fasten dust cover, being certain to install gasket, bend tongues of lock washers.

STARTER PERFORMANCE SPECIFICATIONS

Model	No Load Test		Lock Test		
	Amps.	RPM	Amps.	Volts	Torque
208 XXX	35-55	6000-8000	320-410	8.5	9 ft. lbs.
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 ft. lbs.
311 XXX	30-50	5500-7500	350-450	8.5	13 ft. lbs.
312 1XX	55-85	8500-10500	650-730	6.0	13.7 ft. lbs.
313 XXX	50-80	8300-10300	520-610	6.5	12.3 ft. lbs.
362 XXX	65-95	6500-8500	1100-1300	7.0	32.5 ft. lbs.