BOSCH

Alfa Romeo (1963-73)
Audi (1970-73)
BMW (1963-73)
Capri (1970-73)
Mercedes Benz (1963-73)
Opel (1966-73)
Porsche (1963-73)
Saab (1965-73)
Volkswagen (1963-73)
Volvo (1963-73)

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).

TESTING

Short Circuit Test – With starter in test bench (follow manufacturer's instructions), read current and voltage just before starter stops (see specifications).

Load Test – With starter in test bench (follow manufacturer's instructions), turn on starter and brake until specified current is reached, then read voltage and RPM, (see 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.*

APPLICATION

Model	Bosch Part No.
ALFA ROMEO	
Giulietta (1963)	①AL/EDD 0.5/12R
Giulia 1600	
T1, Spider, Sprint (1963-68)	①AL/EEF 0.7/12R11
All Others (1963-68)	①EF(R)12V 0.7PS
1750 & 2000 (1969-72)	①EF12V 0.7PS
2000 (1973)	0001 211 025
AUDI	
S90 (1970)	0001 208 047
S90 (1971-72)	0001 208 046
100LS (1970-71)	0001 208 047
100LS (1972)	0001 311 007, 0001 211 023
100LS (1973)	0001 208 023
Fox (1973)	0001 211 209, 0001 211 204
BMW	
1500, 1600, 1600-2, 1800 (1963-69)	0001 310 010
1600-2 (1967-69)	0001 208 032
1600 ti & GT (1968)	0001 311 016
1800 ti (1963-68)	0001 310 013
2000 & 2002 (1966-73)	0001 311 016
2500, 2800, 3.0 (1969-71)	0001 311 025, 0001 314 001
3.0 (1972-73)	0001 311 025
CAPRI	
1600 (1970-72)	0001 208 049, 0001 211 989
2000 (1971)	0001 311 038
2000 (1972-73)	0001 211 989, 0001 311 033, 0001 311 038
2600 (1972-73)	0001 311 033

APPLICATION (Cont.)

Model (Cont.)	Bosch Part No.
MERCEDES BENZ	
4 Cylinder Carburetor Models	
190C, 220 (1963-68)	0001 208 003
Application (Cont.)	**Bosch Part No.**
200, 220 (1968-72)	0001 313 003
220 (1973)	0001 313 007
4 Cylinder Diesel Models	
190D, 200D (1963-68)	0001 354 064
220D (1968-72)	0001 362 001
6 Cylinder Carburetor Models	
220B, 220SB (1963-65)	0001 208 001
230, 230S (1965-68)	0001 208 003
230/8, 250/8, 280S/8 (1968-72)	0001 313 003
250S (1965-69)	0001 208 026
250, 250C (1972)	0001 313 005
280, 280C (1973)	0001 313 007
6 Cylinder Fuel Injection Models	
220SEB (1963-65)	0001 208 001
230SL (1963-66)	0001 208 009
230SL (1967)	0001 208 026
250 All Models (1965-70)	0001 208 026
280 All Models (1967-68)	0001 208 026
280 All Models (1969-71)	0001 313 003
280 All Models (1972)	0001 313 005
300 All Models (1963-67)	0001 313 005
8 Cylinder Fuel Injection Models	
3.5 Engine (1969-71)	0001 313 003
4.5 Engine (1972)	0001 313 005
4.5 Engine (1973)	0001 313 007
6.3 Engine (1964-68)	0001 356 002
6.3 Engine (1969-72)	0001 356 003
OPEL	
All Models (1966-67)	0001 157 001
1100 (Early 1968)	0001 157 001
1100 (Late 1968-71)	0001 157 003
1500 (1968-70)	0001 208 023
1900 (1968-72)	0001 208 023, 0001 208 038
1900 (1973)	0001 208 053
PORSCHE	
1600 (1963-65)	0001 207 002
912 (1966-69)	0001 212 002, 0001 212 005
914/4 (1970-72)	
Man. Trans.	0001 211 997
Auto. Trans.	0001 212 006
914/4 (1973)	②③022 905 115
914/6 (1970-71)	0001 212 006
911 All Models (1966-68)	0001 212 002
911 All Models (1969-72)	0001 212 005
911 All Models (1973)	
Man. Trans.	②④916 604 101 00
Auto. Trans.	②④901 604 102 03
SAAB	
95, 96, Sport (1965-68)	0001 155 003
Monte Carlo (1965-67)	0001 155 003
Monte Carlo (1968)	0001 208 029
Sonett II (1967-72)	0001 208 029
V4 Engine (1967-72)	0001 311 024, 0001 208 029
V4 Engine (1973)	0001 311 023
99 Models (1969-73)	0001 311 039
VOLKSWAGEN	
All Models (1963-64)	0001 207 001
Type 2 (1965)	0001 310 007
All Others (1965)	0001 207 001
Type I (1966)	0001 207 001
All Others (1966)	0001 310 007

BOSCH (Cont.)

APPLICATION (Cont.)

Model (Cont.)	Bosch Part No.
Volkswagen (Cont.)	
All Models (1967-68)	
Man. Trans.	0001 211 012
Auto. Trans.	0001 212 006
All Models (1969)	
Man. Trans.	0001 211 013
Auto. Trans.	0001 211 006
All Models (1970-71)	
Man. Trans.	0001 211 997
Auto. Trans.	0001 212 006
Type 2 (1700) (1972)	0001 211 993
All Other Models (1972)	
Man. Trans.	0001 211 992
Auto. Trans.	0001 212 006
"The Thing" (1973)	0001 212 005
All Other Models (1973)	
Man. Trans.	0001 211 993
Auto. Trans.	0001 212 005
VOLVO	
4 Cyl. (1963-72)	① GF12V 1PS
4 Cyl. (1973)	0001 311 001
6 Cyl. (1969-72)	① GF12V 1PS
6 Cyl. (1973)	0001 311 027

① – Bosch starter type designation.
② – Porsche part number.
③ – Bosch part number 0001 211 997 (Man. Trans.); 0001 212 005 (Auto. Trans.).
④ – Bosch part number 0001 312 100.

SPECIFICATIONS

Brush Spring Tension

Application	Tension
1963-72	32-40 oz. (907-1134 g)
1973	①40-48 oz. (1134-1360 g)

① – Starter No. 0 001 312 100 - 28-32 oz. (794-907 g).

Minimum Brush Length

Application	Length
All Models	½" (13 mm)

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.

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.

BOSCH (Cont.)

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.

REMOVING 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 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.

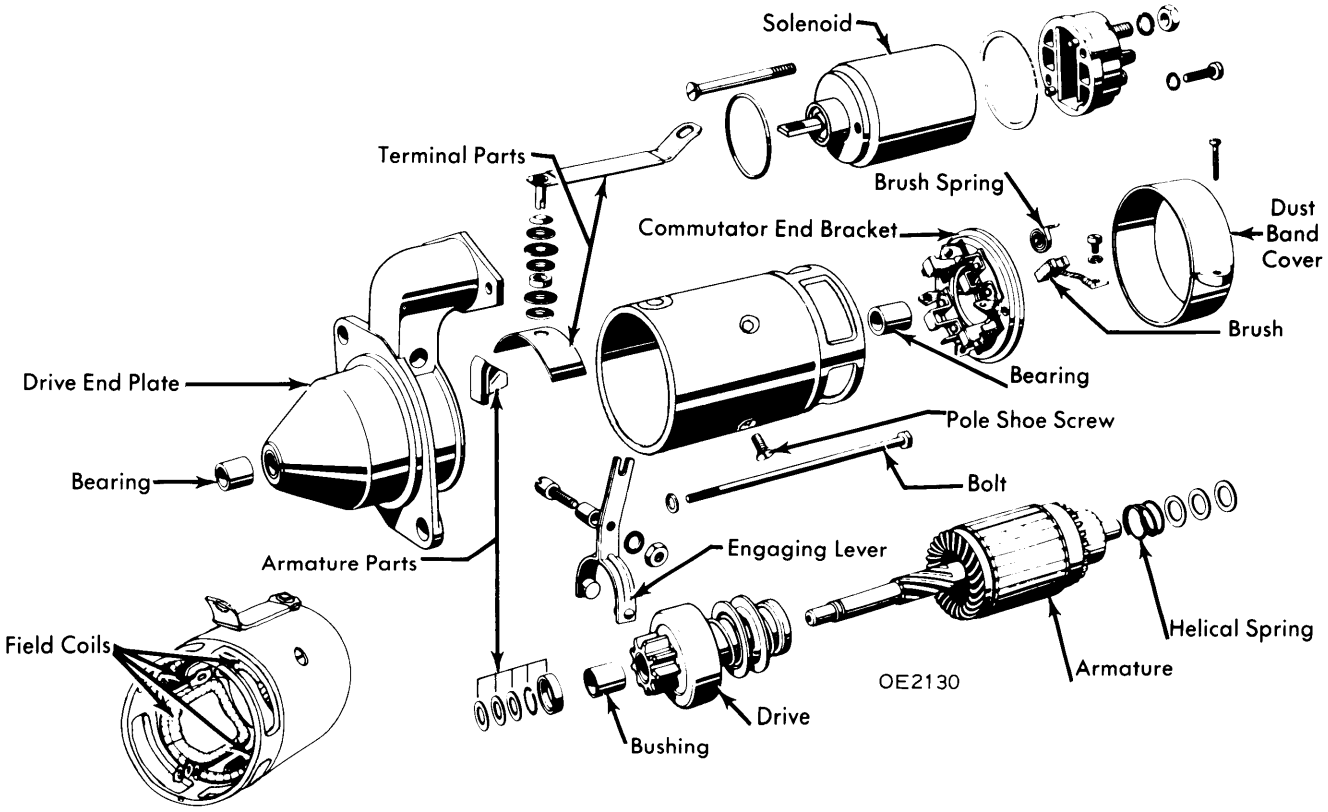
1) Clamp armature in a suitable holding fixture, line up armature brake unit and intermediate bearing. The bent ends of the spring plate washer unit must engage into holes of cupped washer of intermediate bearing.

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.



BOSCH STARTER (TYPICAL)

BOSCH (Cont.)

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

Bosch① Part Number & (Type Number)	No Load Test		Lock Test		
	Amps.	RPM	Amps.	Volts	Torque
0001 155 --- (DD 12V 0.5PS)	20-40	6500-8500	260-340 230-310	9.0 8.0	6.4 ft. lbs. 5.6 ft. lbs.
0001 157 --- (DF 12V 0.5PS)	20-40	6500-8500	320-400 280-360	9.0 8.0	6.7 ft. lbs. 5.9 ft. lbs.
0001 207 --- (EF 6V 0.5PS)	50-70	5500-7500	300-380 230-320	2.5 2.0	4.7 ft. lbs. 3.6 ft. lbs.
0001 208 --- (EF 12V 0.8PS)	35-55	6000-8000	320-410 280-370	8.5 7.5	9.0 ft. lbs. 7.9 ft. lbs.
0001 211 0-- (EF 12V 0.7PS)	30-50	6000-9000	300-390 260-350	9.0 8.0	8.7 ft. lbs. 7.2 ft. lbs.
0001 211 9-- (EF 12V 0.7PS)	30-50	6500-9500	320-410 270-360	8.5 7.5	8.3 ft. lbs. 7.2 ft. lbs.
0001 212 --- (EB 12V 0.8PS)	35-55	6000-8000	320-410 280-370	8.5 7.5	9.0 ft. lbs. 7.9 ft. lbs.
0001 310 --- (GF 6V 0.6PS)	35-65	4500-6500	290-370 220-300	2.5 2.0	5.1 ft. lbs. 4.0 ft. lbs.
0001 311 --- (GF 12V 1PS)	30-50	5500-7500	350-450 310-400	8.5 7.5	13.0 ft. lbs. 11.6 ft. lbs.
0001 312 1-- (GB 12V 1.5PS)	55-85	8500-10500	....	....	13.7 ft. lbs. ② 11.6 ft. lbs. ②
0001 313 --- (GF 12V 1.4PS)	50-80	8300-10300	....	....	12.3 ft. lbs. ② 10.7 ft. lbs. ②
0001 314 --- (GF 12V 1.4PS)	50-80	7300-9300	....	....	16.6 ft. lbs. ② 13.7 ft. lbs. ②
0001 354 --- (JD 12V 1.8PS)	60-90	5000-7000	740-680 620-780	8.5 7.5	26.8 ft. lbs. ② 23.9 ft. lbs. ②
0001 356 --- (JB 12V 1.8PS)	60-90	5000-7000	720-850 620-750	8.0 7.0	29.6 ft. lbs. ② 26.0 ft. lbs. ②
0001 362 --- (JF 12V 2.5PS)	65-95	6500-8500	1100-1300 900-1100	7.0 6.0	32.5 ft. lbs. ② 26.8 ft. lbs. ②

① – All starters of a particular part number group (i.e. 0001 211 --- or 0001 211 9--) can be tested according to specifications following that group.
② – With 12 volt, 143 amp batteries connected in parallel.