Distributors & Ignition Systems

BOSCH ELECTRONIC IGNITION SYSTEM

BMW 320i; Fiat X1/9; Mercedes-Benz 380 Series; Porsche 911SC & 928; Volvo GLE & GLT Turbo

NOTE: The Fiat Spider uses the Marelli Electronic Ignition System. The Porsche 924 uses a Bosch Hall Effect Electronic Ignition System. Other BMW, Porsche and Volvo models use computer-controlled systems. See appropriate articles in the Computerized Engine Control section.

DESCRIPTION

The Bosch electronic ignition system consists of a control module, a breakerless distributor, a single or dual resistor, a high output ignition coil, an ignition switch, and battery.

Some models may use a resistor wire rather than resistors, while Mercedes-Benz models use no resistors. Standard centrifugal and vacuum advance/retard mechanisms are used. *See Figs. 1 and 2.*

The distributor contains a rotating trigger wheel and a stationary magnetic pick-up coil (unless it is repositioned by vacuum diaphragm).

OPERATION

Inside the distributor, a trigger wheel turns with the distributor shaft. The trigger wheel has one tooth or lug for each engine cylinder.

As the trigger wheel rotates past the pole of the magnetic pick-up coil, a magnetic field is created that continually builds and collapses. This produces a low voltage electrical signal.

This signal passes to the control module, which controls the dwell angle and at the same time interrupts the ignition coil's primary circuit. This induces the high secondary coil output voltage that fires the spark plugs.

SPECIFICATIONS

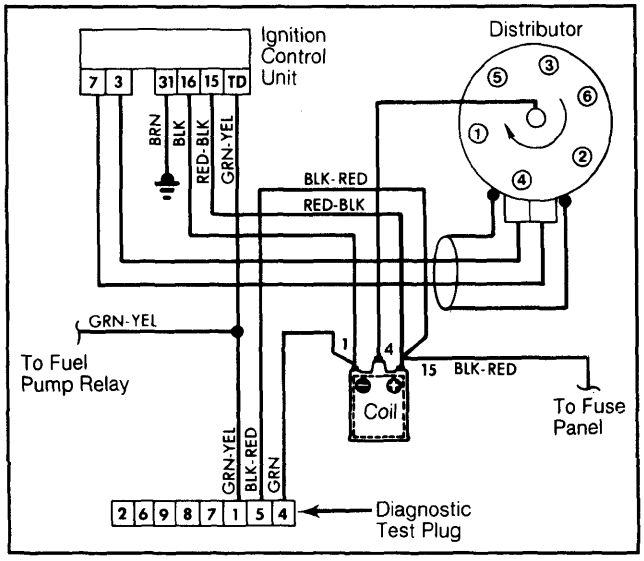
DWELL ANGLE

Dwell angle is controlled by the electronic control module, and is non-adjustable. Refer to table later in this article.

CENTRIFUGAL & VACUUM ADVANCE AND/OR RETARD

See the appropriate Distributor Specifications Tables in this section.

Fig. 2: Wiring Diagram of Mercedes-Benz Bosch Electronic Ignition System

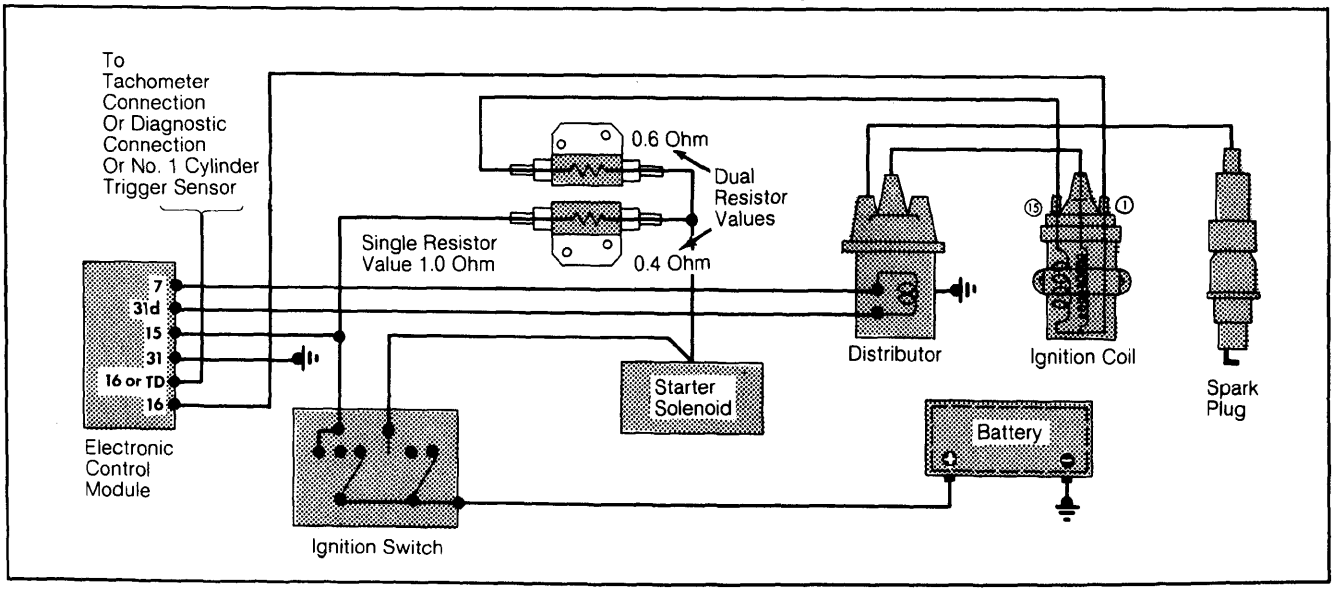


No resistors or resistor wires are used.

ADJUSTMENT

No adjustment should be attempted on ignition system, except spark plug gap and ignition initial timing.

Fig. 1: Wiring Diagram of Typical Bosch Electronic Ignition System (Except Mercedes-Benz)



BOSCH ELECTRONIC IGNITION SYSTEM (Cont.)

Air gap is non-adjustable. However, it should be visually checked when testing. If specified clearance does not exist, replace components.

TESTING

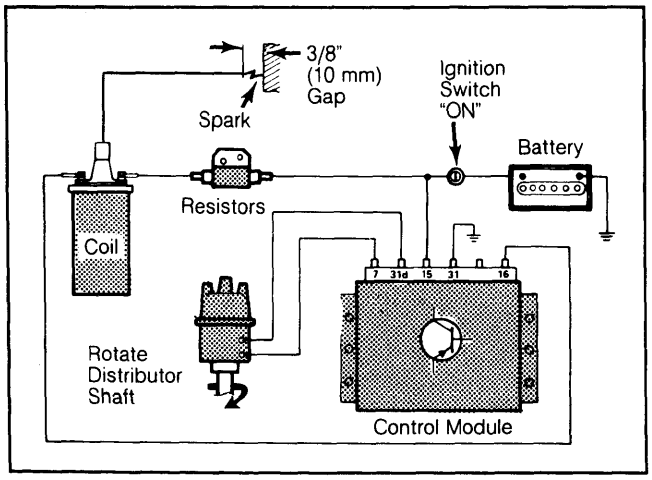
Before testing ignition system, be sure battery is fully charged and in good condition, that all wires are sound, and connections are good. Due to high voltage, use care when working on electronic ignition system.

SYSTEM SPARK TEST

NOTE: Do not perform this test on Mercedes-Benz vehicles. Use an oscilloscope to check spark results on Mercedes-Benz.

1) If starter turns but engine will not start or if engine fails to develop sufficient power), hold distributor end of coil wire about 3/8" (10 mm) from engine block. Crank engine. *See Fig. 3.*

Fig. 3: Coil Wire Hookup For Making an Ignition System Spark Test



Do not use this test on Mercedes-Benz models.

2) If spark jumps gap, check distributor cap, rotor, cables and spark plugs. Be sure ignition timing and fuel system are OK. If no sparks occur, perform the following tests.

ROTOR RESISTANCE CHECK

Set an ohmmeter to the x1000 scale. With ignition switch "OFF" and distributor cap removed, attach ohmmeter leads to rotor. Resistance should be 1000 ohms for Mercedes-Benz or approximately 5000 ohms for other models.

SPARK PLUG WIRE RESISTANCE

If the spark plug connectors have sheet metal jackets, identified by the following symbol ( ), they contain "air gap" resistors. Wires cannot then be checked for resistance using an ohmmeter. An oscilloscope must be used.

RESISTOR RESISTANCE CHECK

NOTE: This test does not apply to Mercedes-Benz vehicles.

Set an ohmmeter in the low scale. Be sure ignition switch is "OFF". Check resistance of each resistor in the primary circuit. *See Fig. 4.* Some manufacturers use resistor wires instead of ballast resistors. Most use 2 ballast resistors.

RESISTOR RESISTANCE SPECIFICATIONS

Application	Ohms
BMW	0.4 and 0.6
Fiat	.85-.95
Porsche	0.4 and 0.6
Volvo	1.0

IGNITION COIL RESISTANCE CHECK

1) Turn ignition switch "OFF". Remove coil wires. Using an ohmmeter set at the low scale, attach leads to ignition coil primary terminals 1 and 15 (wires removed). *See Fig. 4.* Take primary resistance reading.

Fig. 4: Ohmmeter Hookup for Ignition Coil Primary and Secondary Resistance Checks

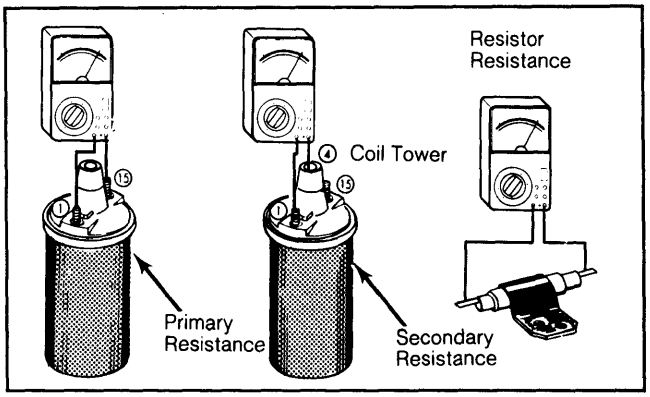


Diagram also shows ohmmeter hookup for ballast resistor check.

2) On Mercedes-Benz models, the coil has a pressure relief plug located on top of the coil. Make sure the plug has not popped out. If it has popped out, replace coil.

3) Set ohmmeter to x1000 scale. Connect ohmmeter leads to negative terminal 1 and coil tower terminal 4 (high tension). Take secondary resistance reading.

4) If either the primary or the secondary reading was not within specifications, replace coil.

IGNITION COIL RESISTANCE SPECIFICATION

Application	Primary	Secondary
BMW	.4	....
Fiat	1.1-1.7	6000-10,000
Mercedes-Benz	.7	8000-11,000
Porsche	.33-.46	7000-12,000
Volvo	1.0-2.0	....

IGNITION COIL VOLTAGE CHECK

Mercedes-Benz Models

1) Connect voltmeter positive lead to diagnostic plug terminal 5 (terminal 15 on coil). Connect voltmeter negative lead to ground. Turn ignition switch "ON".

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2) Voltage reading should be the same as battery voltage. If voltage reading is not correct, check voltage readings back to battery (checking through ignition switch).

3) Connect voltmeter negative lead to diagnostic plug terminal 4 (terminal 1 on coil). Voltage reading should be zero.

4) If reading is not zero, turn ignition switch "OFF" immediately. Replace electronic control unit.

All Other Models

1) Connect voltmeter negative lead to ground and positive lead to terminal 15 of coil. Turn ignition switch "ON". Voltage reading should be 4-7 volts.

2) If less than 4-7 volts, check wires, connections at ignition switch, resistors, coil and control unit to eliminate voltage drop. If more than 4-7 volts, check for defective resistors.

3) Connect voltmeter positive lead to negative coil terminal 1. Attach negative lead to a good ground. Reading should be 0.5-2.0 volts (maximum 2.0 volts).

4) If previous tests and pick-up coil resistance, starting voltage, and control module voltage checks prove OK, substitute a known good control module. If system is now operative, install a new module.

STARTING VOLTAGE CHECK

NOTE: This test does not apply to Mercedes-Benz vehicles.

1) Disconnect wire leading to starter terminal 15a at the .4 ohm resistor (most models). Attach voltmeter and crank engine. Voltage should be the same as battery voltage.

2) If battery voltage is not present, check for break in electrical supply wire or contact 15a in starter relay.

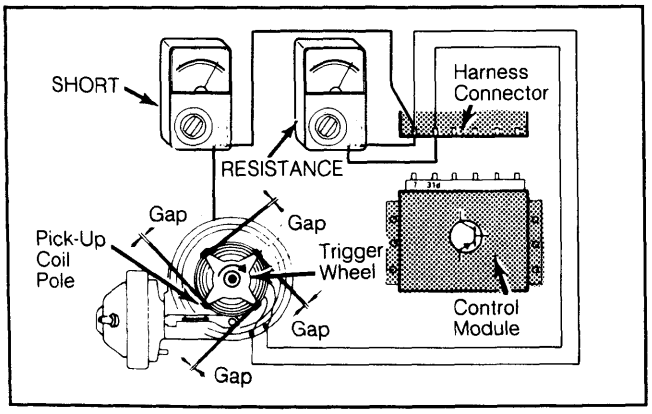
PICK-UP COIL RESISTANCE CHECK

Mercedes-Benz Model

1) Make sure ignition switch is "OFF". Disconnect pick-up coil connector (Green cable) from control module. Set ohmmeter to x1000 scale. Attach ohmmeter leads to center pin (terminal 7) and to larger, outer, circular pin (terminal 3) of Green cable.

2) If resistance readings are not to specifications, remove connector from distributor, and take reading at pick-up coil pins at distributor. If readings are now correct, replace wiring harness. If readings are still not to specifications, replace pick-up coil.

Fig. 5: Ohmmeter Hookups for Pick-Up Coil Resistance and Short Checks



All Other Models

1) Turn ignition switch "OFF", and disconnect harness connector from control module. Set ohmmeter to x100 scale. Connect ohmmeter leads to terminals 7 and 31d of harness connector. *See Fig. 5.* Measure pick-up coil resistance.

2) If resistance readings are not to specifications, remove connector from distributor, and take reading at pick-up coil pins at distributor.

3) If readings are still not to specifications, replace pick-up coil. If correct readings are obtained at distributor, but not at harness connector, replace harness.

PICK-UP COIL RESISTANCE SPECIFICATIONS

Application	Ohms
BMW	520-700
Fiat	890-1285
Mercedes-Benz	500-700
Porsche 928	485-700
Volvo	
GLT Turbo 4-Cylinder	950-1250
GLE V6	540-660

DWELL ANGLE CHECK AND VISUAL CHECK OF PICK-UP COIL ASSEMBLY

1) Visually check trigger wheel and pick-up assembly for damage. Also check air gap between trigger wheel and pick-up coil. *See Fig. 5.*

2) If damaged or if air gap is not to specifications, replace distributor (if components cannot be replaced individually).

3) Check dwell angle, and compare it with specifications. If not within specifications, repeat Pick-Up Coil Resistance, Short, and Visual Checks. If OK, then replace control module.

DWELL ANGLE & AIR GAP SPECIFICATIONS

Application	Dwell Angle @ RPM	Air Gap In. (mm)
BMW	32-53°@1500	.014-.028 (.36-.72)
Fiat	[1]	.012-.019 (.3-.5)
Mercedes-Benz	7-25°@ [2]	[3]
Porsche		
911SC	[1]	[1]
928	25-39°@1500	[1]
Volvo		
GLT Turbo	45-63°@1500	[1]
GLE	45-60°@1500	[1]

[1] — Specification not available from manufacturer.
[2] — At cranking speed.
[3] — Not adjustable.

PICK-UP COIL SHORT CHECK

1) On Mercedes-Benz vehicles, connect one ohmmeter lead to ground. Attach other lead to control module harness terminal 3 and then to terminal 7.

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2) On all other models, connect one ohmmeter lead to ground. Attach other lead to terminal 7, then to terminal 31d. Resistance reading should be greater than 200,000 ohms for Mercedes-Benz vehicles and infinity for all other models.

3) If resistance reading was not correct, disconnect harness from distributor. Connect ohmmeter leads to ground and to each pick-up coil pin in distributor. If readings are now correct, replace harness. If readings are still incorrect, replace pick-up coil.

CONTROL MODULE VOLTAGE

NOTE: This test does not apply to Mercedes-Benz vehicles.

1) Disconnect connector from control module, and turn ignition switch "ON". Attach voltmeter positive lead to terminal 15 of control module harness connector. Connect negative lead to ground.

2) Battery voltage should be shown. If not, check for voltage drop in harness between ignition switch and control module.

CONTROL MODULE GROUND CHECK

NOTE: This test does not apply to Mercedes-Benz vehicles.

1) Disconnect connector at control module. Turn ignition switch "ON". Connect voltmeter positive lead to terminal 31 of control module (not harness). Connect negative lead to ground.

2) Reading should show continuity. If not, check module ground wire and repair as necessary.

FINAL CONTROL MODULE OR IGNITION COIL CHECK

NOTE: This test does not apply to Mercedes-Benz vehicles.

1) If ignition coil is suspected of being defective, substitute a known good coil, and attempt to start vehicle. If it starts, reinstall old coil and start vehicle.

2) If it then fails to start, replace with new coil. If control module is suspected, substitute a known good module, and start vehicle. If it starts, reinstall original module. If vehicle fails to start now, install new control module.

3) If system still fails to operate, disconnect tachometer connector at instrument cluster. Attempt to start engine. If engine now starts, replace tachometer.

OVERHAUL

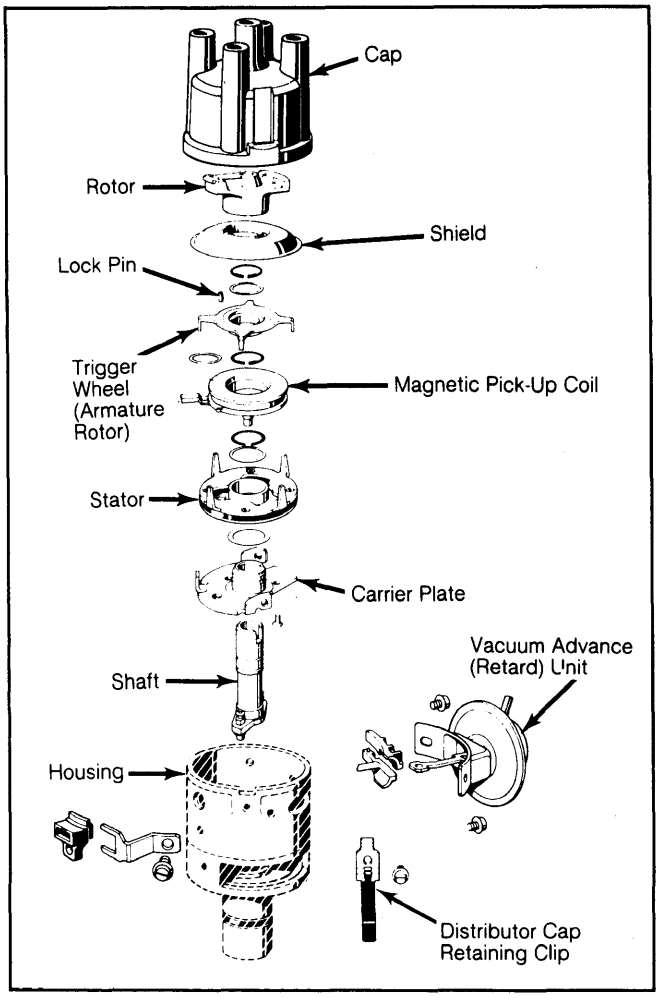
DISASSEMBLY

1) Remove distributor cap, rotor, and dust cover. Remove vacuum unit screws and lock clasp screws. Remove screws securing electrical leads, and remove leads by carefully pulling straight out.

NOTE: Keep screws with components they attach, as screws are different lengths. Damage could result if installed in wrong location.

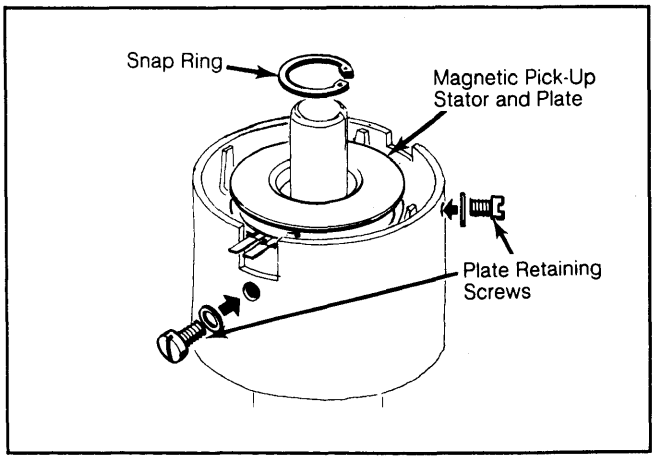
2) Remove trigger wheel snap ring and then shims. Using 2 screwdrivers, carefully pry upward on trigger wheel. Remove trigger wheel and lock pin. Remove screws securing pick-up coil and stator assembly carrier plate. *See Fig. 6.*

Fig. 6: Exploded View of Bosch Electronic Distributor



3) Remove snap ring and retaining clips. Lift carrier plate and stator straight up off shaft. Remove 3 screws to separate stator winding from carrier plate.

Fig. 7: Removing or Installing Pick-Up Coil, Stator, and Carrier Plate



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4) Disconnect springs to centrifugal governor. Mark drive shaft relationship to distributor shaft, and then secure drive shaft in a soft-jawed vise.

5) Carefully tap on distributor housing with a plastic mallet until circlip releases. If equipped, remove triggering contacts and attaching screws.

6) Remove resilient ring. Mark location of flange to distributor shaft. Support distributor shaft, and using a pin punch, remove pin. Remove flange and distributor shaft. Remove lock springs for centrifugal weights and then weights.

INSPECTION

Check the following components, and replace defective parts, as necessary:

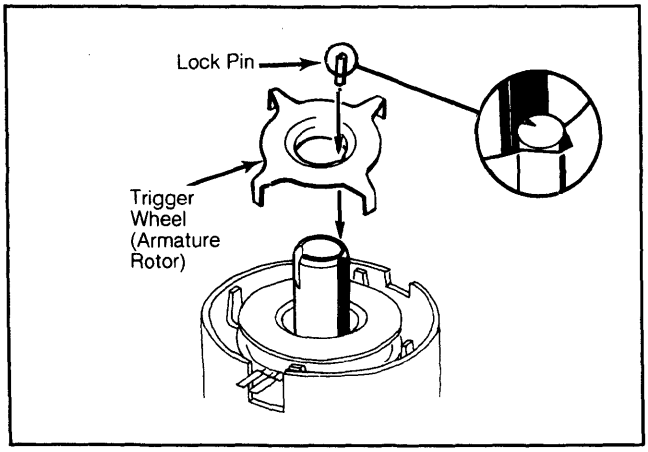
- Springs for weights must not be deformed or damaged in any manner.
- Holes in centrifugal governor weights must not be oval or deformed.
- Distributor shaft-to-cam clearance should not exceed .004" (.1 mm).
- Distributor shaft-to-housing clearance should not exceed .008" (.2 mm).

REASSEMBLY

1) To reassemble distributor, reverse disassembly procedure, while noting the following: Place a light coat of grease on weights and a couple of drops of oil on felt wick in center of shaft. Do not get grease or oil on pick-up coil and stator assembly.

2) When attaching stator to plate, the connector pins should be positioned opposite and above the attachment ear for carrier plate. Install lock pin with lip facing ridge on distributor shaft. Slot on trigger wheel should be aligned with groove on distributor shaft.

Fig. 8: Installing Wheel and Lock Pin



Be sure lock pin is properly installed.