BOSCH HALL EFFECT ELECTRONIC IGNITION

Audi 4000, 5000, 5000 Turbo; Porsche 924; Saab 900, 900 Turbo; Volkswagen Models with CIS & Calif. Vanagon Only

NOTE: Federal Vanagon models use a Bosch single breaker distributor. The Audi Quattro uses the Bosch-Hitachi Digital Timing Control system. See appropriate article in the Computerized Engine Control section.

DESCRIPTION

The Bosch Hall Effect electronic ignition system consists of a breakerless Hall Effect distributor, a Hall (ignition) control unit, ignition coil, ignition switch, and battery.

Closely allied with the ignition system on Audi, Porsche and Volkswagen models is an idle stabilizer, a solid state control unit located between the Hall (ignition) control unit and the distributor's Hall generator.

It replaces the distributor in sending signals to the ignition control unit when engine speeds fall below 940 RPM.

NOTE: Saab models do not use an idle stabilizer. On Audi 4000 (with 5-cylinder engines) and 5000 models, a gray-colored impedance transformer is installed in place of the idle stabilizer. Its purpose is to prevent interference and protect instruments from excessive voltage.

The Hall Effect distributor has normal centrifugal and vacuum advance mechanisms. *See Figs. 1 and 10.*

OPERATION

The Hall generator (sending unit or pick-up coil) is mounted inside the distributor on a switch plate. A trigger wheel (segmented shutter) attached to the distributor shaft under the rotor, passes in and out of the air gap of the Hall generator.

At speeds greater than 940 RPM (all speeds on Saab models), the Hall generator signals the Hall (ignition) control unit to make and break the current flow in the primary circuit of the ignition coil.

There is 1 trigger wheel shutter or tooth for each cylinder of the engine. Shutter width determines dwell, which is not adjustable.

As the Hall control unit breaks the primary circuit through the coil, secondary voltage is released through the high tension wiring, distributor cap and rotor to the spark plugs. *See Fig. 1.*

If engine speed drops below 940 RPM on Audi, Porsche and Volkswagen models, the idle stabilizer takes over the duty of producing the signal to the ignition control unit (instead of the Hall generator).

The idle stabilizer is mounted on the same bracket as the Hall control unit and is wired between the distributor and the Hall control unit. It senses engine speed earlier, causing ignition timing to advance.

Advancing ignition timing causes idle speed to increase, and the Hall generator to resume its normal operation.

SPECIFICATIONS

CENTRIFUGAL & VACUUM ADVANCE

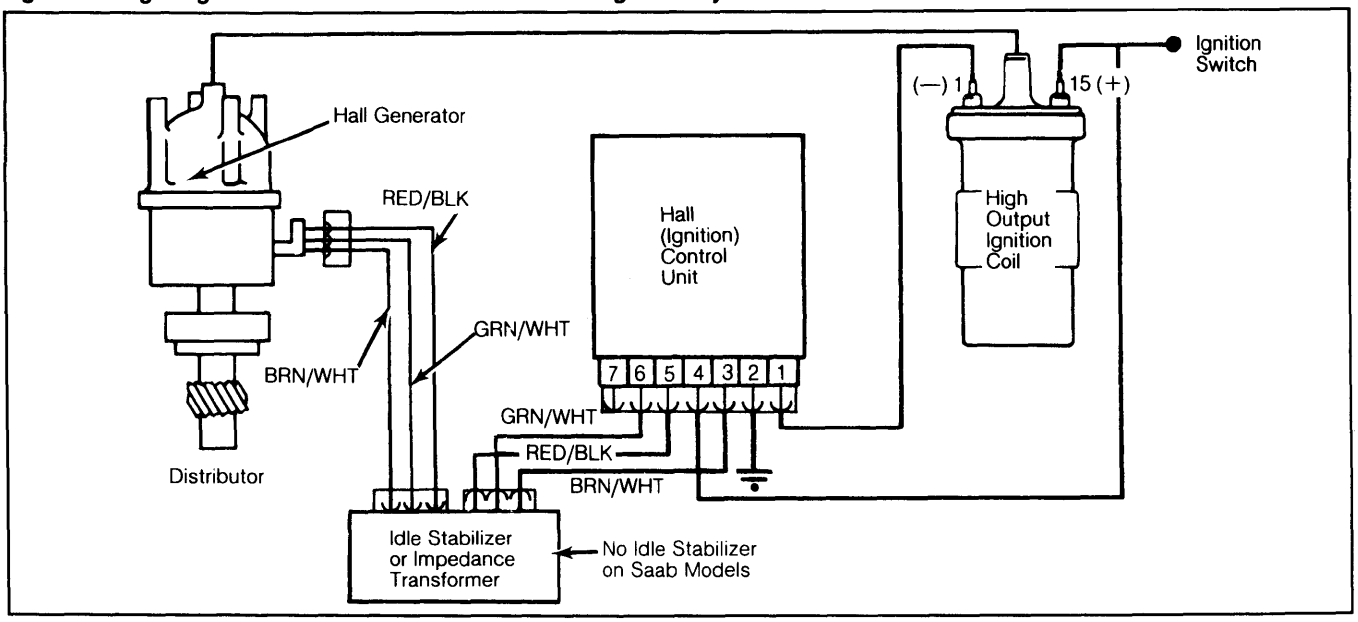
See the appropriate Distributor Specifications Table in this section.

ADJUSTMENTS

HALL EFFECT AIR GAP

Air gap is pre-set and cannot be adjusted.

Fig. 1: Wiring Diagram of Bosch Hall Effect Electronic Ignition System



Saab models do not use an idle stabilizer. Control unit is connected directly to distributor. Also see chassis wiring in WIRING DIAGRAM Section.

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TESTING — AUDI, PORSCHE & VOLKSWAGEN

PRE-TESTING PROCEDURES

Be sure battery is at full charge and in good condition before making tests. Check all wiring harnesses, ignition switch, ignition coil, spark plug cables and connectors.

CAUTION: Do not connect any 12-volt test instruments on terminal 15 of ignition coil, as this could damage electronic components. Do not connect any condenser/suppressor or powered test light to terminal 1 of ignition coil. Connect and disconnect test instruments only when ignition is turned "OFF".

On Audi 4000 (with 5-cylinder engines) and 5000 models, a gray-colored impedance transformer is installed in place of the idle stabilizer. When adjusting ignition timing, DO NOT disconnect the plugs from the impedance transformer.

However, when trouble shooting the ignition system, by-pass this unit just as you do the idle stabilizer. To do so, disconnect plugs of impedance transformer and plug them together.

CAUTION: Do not touch or remove high tension wires when engine is running or cranking. Disconnect ignition wires only when ignition is "OFF". Do not crank engine unless high tension wire is removed from distributor cap and is grounded by a jumper wire or secured as indicated under System Spark Test.

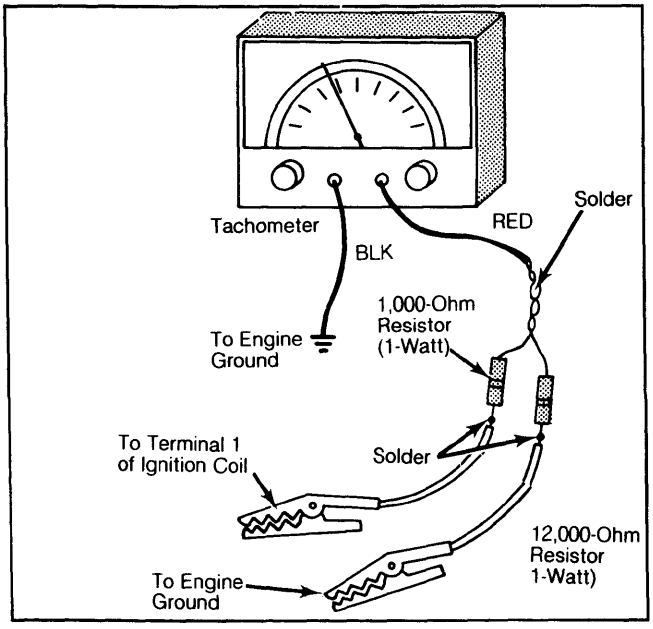
TACHOMETER ADAPTER

1) An adapter is necessary when attaching a conventional tachometer into the Hall Effect electronic ignition system. *See Fig. 2.* Tachometer Black lead is attached to engine ground. Attach adapter to tachometer Red lead.

2) Adapter is formed from 2 wires soldered together at one end. One wire (leading to coil terminal 1) must be equipped with a 1000-ohm, 1-watt resistor.

3) The second wire (leading to engine ground) must be equipped with a 12,000-ohm, 1-watt resistor. Both resistors should be soldered to attaching wires.

Fig. 2: Assembling and Installing Tachometer Adapter



Resistor connections should be soldered securely.

SYSTEM SPARK CHECK

1) If vehicle will not start or does not run properly, ensure first that starter speed is normal and that fuel system is OK. If so, check secondary voltage.

2) Remove coil high tension wire with suppressor from distributor cap. Hold wire approximately 3/8" from engine ground, using insulated pliers.

CAUTION: Wire must not be hand held. Each end of wire should be equipped with a 1000-ohm suppressor.

3) Crank engine and check for a constant blue spark at gap to ground. If there is no spark, proceed to Idle Stabilizer Check. If there is a good spark, but engine would not start, suspect externally-damaged ignition coil.

4) Check to see if sealing compound is oozing from coil housing. If damaged, replace ignition coil and proceed to Control Unit Voltage Check.

5) If coil was not damaged, check coil high tension wire, distributor cap, rotor, spark plug wires, spark plugs, (fuel system and engine mechanical components have already been determined OK).

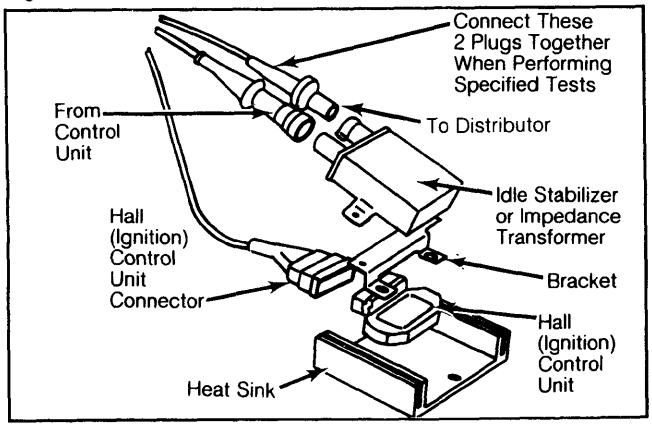
6) Rotor arm resistance should be 600-1400 ohms. Resistance of spark plug connectors should be 600-1400 ohms (suppressed) or 4000-6000 ohms (not suppressed). Suppressor resistance should be 600-1400 ohms. Replace defective parts if not to specifications.

7) If components in step **5)** were not defective, check for proper ignition timing, centrifugal advance, or vacuum advance. If OK, problem is not with ignition system. If ignition timing is not to specifications, adjust timing or repair ignition distributor.

IDLE STABILIZER CHECK

1) If engine will not start, check idle stabilizer first. Remove both connectors from idle stabilizer, and

Fig. 3: Idle Stabilizer and Hall Control Unit



By-pass gray impedance transformer in same manner as an idle stabilizer.

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connect them together. *See Fig. 3.* This by-passes the idle stabilizer, connecting the Hall control unit directly to the distributor's Hall generator.

NOTE: On models equipped with an impedance transformer, testing procedures are performed in same manner as with an idle stabilizer.

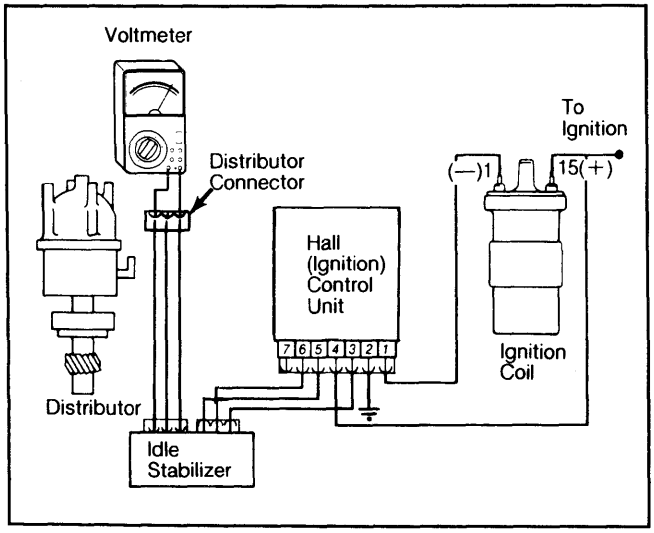
2) If engine now starts, check contacts and sleeves in idle stabilizer connectors for correct location or for damage. If OK, install new idle stabilizer. If engine would not start with idle stabilizer by-passed, proceed to Distributor Voltage Supply Check.

DISTRIBUTOR VOLTAGE SUPPLY CHECK

1) Remove 3-wire connector from distributor. Connect voltmeter positive lead to Red/Black wire of harness connector. Connect negative lead to Brown/White wire. *See Fig. 4.* Turn ignition switch "ON". Voltage reading should be at least 5 volts. Turn ignition "OFF".

2) If voltage checks OK, proceed to Hall Control Unit Check. If there is no voltage, check wiring harness from distributor to Hall control unit. Then proceed to Control Unit Voltage Check.

Fig. 4: Voltmeter Hookup for Distributor Voltage Check



Observe proper polarity when installing voltmeter.

HALL CONTROL UNIT CHECK

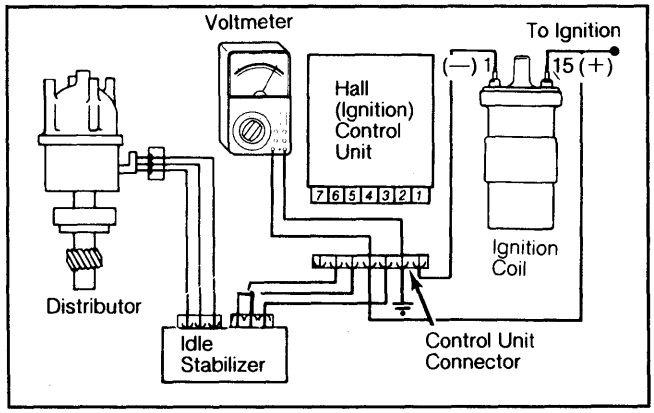
NOTE: For quick check procedures, see Hall Generator Check, Quick Check.

1) Be sure all connectors are securely connected. Connect voltmeter positive lead to ignition coil terminal 15. Attach negative lead to coil terminal 1. Turn ignition "ON". *See Fig. 5.*

2) Reading should be 2 volts, and then fall to 0 (zero) volts after 1-2 seconds. Leave voltmeter connected, but turn ignition "OFF". If voltage reading is correct, replace Hall control unit.

3) If readings were not to specifications, disconnect 3-wire connector at distributor. Insert a metal pin in center contact of harness connector (Green/White wire). *See Fig. 6.*

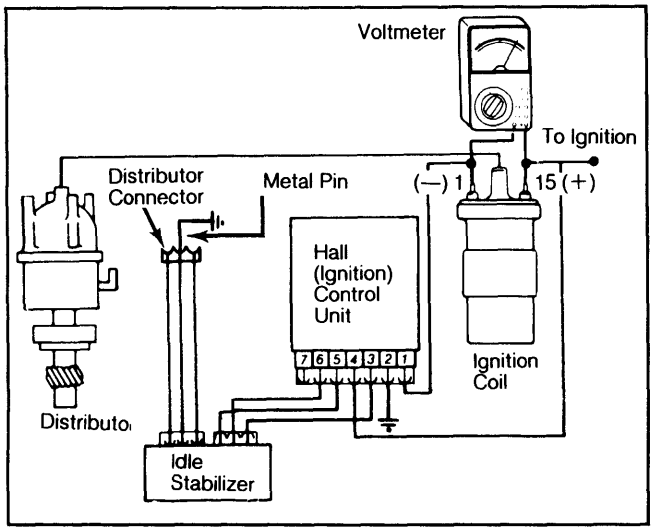
Fig. 5: Checking Hall Control Unit



Check voltage at ignition coil primary terminals.

4) Ground metal pin briefly. Turn ignition "ON". Voltage should increase briefly to at least 2 volts. Turn ignition "OFF". Remove pin and reconnect harness connector to distributor.

Fig. 6: Checking Hall Control Unit



Momentarily ground pin inserted in center terminal.

5) If test results were satisfactory, proceed to Hall Generator (Sending Unit) Check. If not to specifications, check for open circuit in wiring. If none is found, replace Hall control unit.

HALL GENERATOR CHECK

Quick Check

1) Connect a voltmeter or a test lamp between ignition coil terminal 15 and ground. Start engine and observe voltmeter or test lamp.

2) If voltmeter needle pulsates or test lamp flickers, the Hall sender and control unit are probably OK.

Thorough Check

1) Remove high tension cable from distributor cap, and ground it. Be sure control unit harness connector is attached to control unit. *See Fig. 7.*

2) Pull back rubber boot on connector. Attach voltmeter positive lead to connector terminal 6, and negative lead to terminal 3. Be sure connector is securely plugged into control unit.

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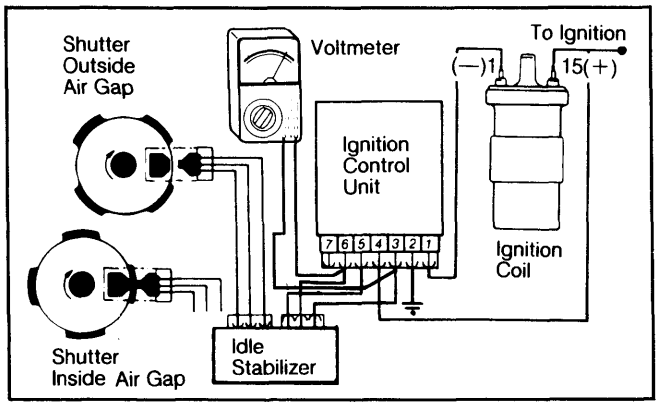
Fig. 7: Voltmeter Hookups for Hall Generator Check



Harness must be connected to Hall control unit.

3) Turn ignition switch "ON". Turn engine over by hand, and check voltage reading. It should be 0-2 volts. Turn ignition "OFF". If not to specifications, replace Hall generator unit in distributor or replace distributor.

4) If Hall generator met specifications, replace ignition coil. If you think coil may be faulty, check its primary and secondary resistance.

IGNITION COIL RESISTANCE CHECK

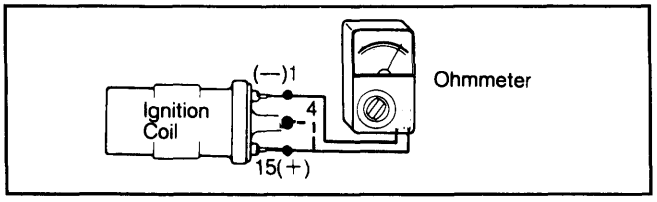
Primary Resistance

Turn ignition "OFF". Remove all wires from ignition coil. Set an ohmmeter in the low scale and attach its leads to ignition coil primary terminals 1 and 15. *See Fig. 8.* Coil primary resistance should be .52-.76 ohm.

Secondary Resistance

Reset ohmmeter to x1000 scale, and connect leads to primary terminal 1 and to coil tower, terminal 4. *See Fig. 8.* Resistance should read 2400-3500 ohms.

Fig. 8: Ohmmeter Hookups for Coil Resistance Checks



Replace ignition coil if not to specifications.

CONTROL UNIT VOLTAGE CHECK

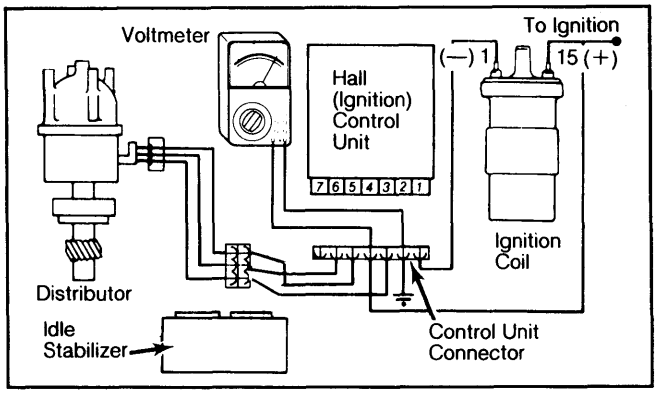
1) Disconnect connectors from idle stabilizer (or impedance transformer) and connect them to each other. Reconnect connector to distributor.

2) Remove connector from electronic ignition control unit. *See Fig. 9.* Connect positive voltmeter lead to terminal 4 of control unit harness connector. Attach negative lead to terminal 2 (ground).

3) Turn ignition switch "ON". Voltmeter should register approximately battery voltage. Turn ignition "OFF". If battery voltage was not present, check and repair wiring circuit from battery to control unit.

4) If battery voltage was present, check for open circuit in wiring from Hall control unit to idle stabilizer (or impedance transformer) and on to Hall generator in distributor. Repair or replace wiring as necessary. If wiring is OK, replace Hall control unit.

Fig. 9: Voltmeter Hookup for Control Unit Voltage Check



By-pass idle stabilizer during this test.

5) If tests do not disclose a definite problem, substitute a new Hall control unit or Hall generator, and attempt to start engine.

TESTING — SAAB

SYSTEM SPARK CHECK

1) Remove coil wire from distributor cap, and hold it 1/2" from ground. Crank engine, and check for spark at gap to ground.

2) If spark occurs, proceed to System Check With Spark. If none occurs, proceed to System Check Without Spark.

SYSTEM CHECK WITH SPARK

1) If spark occurred in System Spark Check, turn control unit around grounded bolt until fuse is visible from side. Pull back rubber cover from fuse, but do not remove fuse.

2) Connect voltmeter positive lead to terminal 4 and negative lead to terminal 2. Turn ignition switch "ON". Battery voltage should be read. If not, check wiring back to battery.

3) If battery voltage was present, check ignition coil primary and secondary resistance in same manner as for Audi and Volkswagen models.

4) Primary resistance should be .52-.76 ohms. Secondary resistance should be 7,000-9,000 ohms. If not to specification, replace ignition coil.

5) If coil resistance is satisfactory, remove coil wire from distributor. Connect voltmeter positive lead to terminal 15 and negative lead to terminal 1 of ignition coil.

6) Turn ignition switch "ON". The voltmeter should drop from 6 volts to zero (0) volts within 1-2 seconds. If not, replace control unit. If so, engine should start.

SYSTEM CHECK WITHOUT SPARK

1) If there was no spark in System Spark Check, test high tension part of ignition system.

2) Coil wire resistance should be 800-1200 ohms. Spark plug wire resistance for cylinders 1 and 2 should be 2,600-3,900 ohms; for cylinders 3 and 4, the resistance should be 2,400-3,600 ohms. Distributor rotor resistance should be 5,000 ohms.

3) Recheck for spark across 1/2" gap to ground. If spark occurs, turn control unit around grounded

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bolt until fuse is visible from side. Pull back rubber cover from fuse, but do not remove fuse.

4) Connect voltmeter positive lead to terminal 4 and negative lead to terminal 2. Turn ignition switch "ON". Battery voltage should be read. If not, check wiring back to battery.

5) If voltage is correct, remove connector from distributor and check voltage at connector's positive and negative terminals. Battery voltage should be read. If not, check wiring back to control unit. If satisfactory, replace control unit.

6) If battery voltage was present, connect voltmeter positive lead to control unit terminal 6 and negative lead to terminal 3. Remove distributor cap and dust cover. Turn engine over so the shutter blades are outside the Hall switch.

7) Turn ignition switch "ON". Voltage should read about .4 volt. If so, turn engine over until shutter blades enter Hall switch gap. Voltage should now read 1 volt or more. If readings are not to specifications, replace distributor.

8) If voltage in step **7)** was correct, perform steps **3)** through **6)** of System Check With Spark.

OVERHAUL

DISASSEMBLY

NOTE: The Hall Effect switch and trigger wheel (segmented shutter) cannot be removed on Saab models. If problem exists, entire distributor must be replaced.

1) Loosen ground strap and remove static shield from distributor cap. *See Fig.10*. Remove cap, rotor, carbon brush and spring. Remove dust cover.

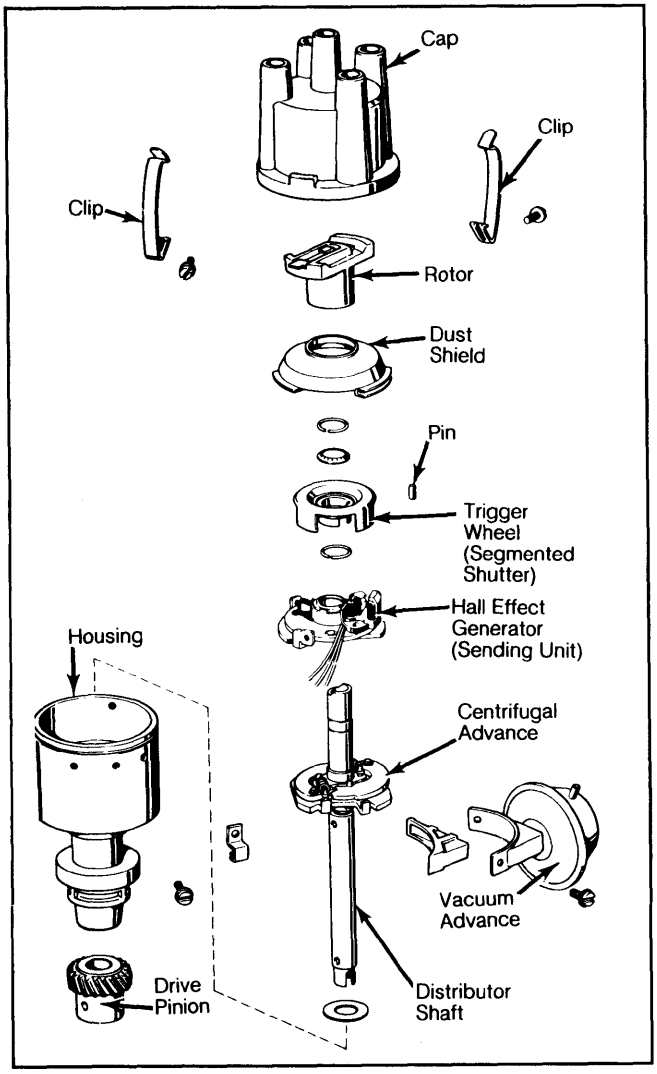
2) Remove connector from distributor (connects Hall generator and harness leading to idle stabilizer). Remove retaining snap ring and trigger wheel (segmented shutter). Remove washers. Remove screws and lift out Hall sending unit and connecting socket.

3) Remove base plate and vacuum unit. Remove pin and distributor drive pinion and shims.

REASSEMBLY

To reassemble, reverse disassembly procedure. If a new Hall generator is to be installed, a special repair kit is available containing all necessary parts. Replace seals, and check components for cracks, corrosion and wear. Clean cap before installing.

Fig. 10: Exploded View of Bosch Hall Effect Distributor



A special kit is available for replacing Hall generator on Audi and Volkswagen models..