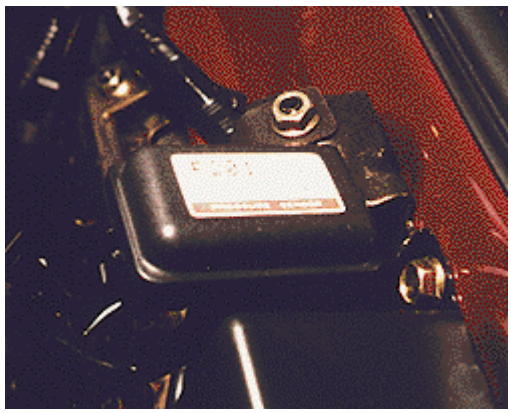
51. absolute pressure sensor



Function

The absolute pressure sensor measures the atmospheric pressure.

Specifications

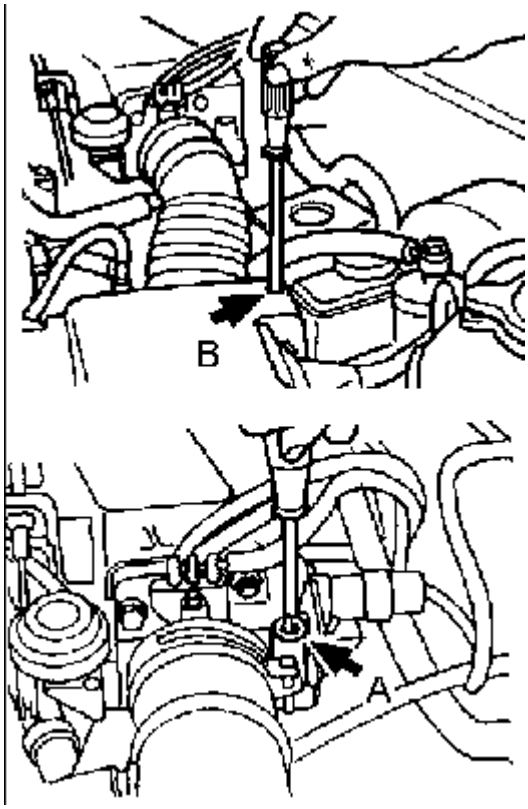
supply voltage: 5 V
output voltage sea level: 3.5 - 4.5 V
output voltage at 2000m: 2.5 - 3.5 V

Adjustment Data

MAZDA - 626 - 2.0i 8V - FE

Engine (general)

Item	Values	Units
Engine code	FE	
Capacity	1998	(cc)
Idle speed	850 - 900	(rpm)
Automatic	900 - 950	(rpm)
Valve clearance		
Hot		
Inlet	0.30	(mm)
Exhaust	0.30	(mm)
Compression pressure		
Normal	13.0	(bar)
Minimum	9.1	(bar)
Oil pressure	1.5 - 2.5/1000	(bar / rpm)
Fuel system (make & type)	EGI	
Fuel system (make & type)	EGI	
Adjustment screws (A = idle speed B = CO)		



Firing order	1-3-4-2	
Timing stroboscopic (before TDC)	6 ± 1/850	(° / rpm)
Start	0 ± 2/125	(° / mmHg)
End	18 - 22/300	(° / mmHg)
Start	0 ± 2/1000	(° / rpm)
End	16 - 20/5800	(° / rpm)

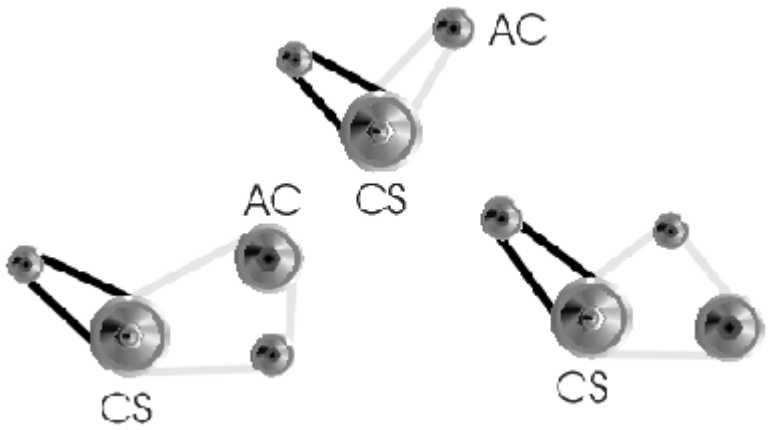
Ignition-coil resistance, primary	1.04 - 1.27	(ohms)
Ignition-coil resistance, secondary	7100 - 9700	(ohms)
Spark plugs (make & type)	NGK/BPR6E-11	
Spark-plug gap	1.0 - 1.1	(mm)
Fuel-pump pressure	4.5 - 6.0	(bar)
Injection pressure / system pressure	2.04 - 2.8	(bar)
CO exhaust gas	< 0.5	(%)
CO2	13 - 16	(%)
HC	300	(ppm)
O2	0.5 - 2.0	(%)
Lambda	0.97 - 1.03	
Lambda change (Delta Lambda)	0.02	
Oil temperature during test	60	(°C)
Fast-idle speed	2500 - 2800	(rpm)
CO at fast-idle speed	< 0.3	(%)
Closed-loop test at: (rpm)	600 - 1000	(rpm)

Cooling system

Item	Values	Units
Cap pressure	0.75 - 1.05	(bar)
Thermostat opens at	86 - 90	(°C)
Fan on at	97	(°C)

Belt layout

Item	Values	Units
Drawing		



Electrical

Item	Values	Units
Battery	60	(Ah)
Alternator	70	(A)

Brakes

Item	Values	Units

Disc thickness, front, min.	22.0	(mm)
Drum diameter, rear, max.	201.5	(mm)

Steering and wheel alignment

Item	Values	Units
Toe-in, front	18' ± 18'	(°)
Camber, front	17' ± 45'	(°)
Castor, front	1° 13' ± 45'	(°)
K.P.I., front	12° 47'	(°)
Toe-in, rear	0 ± 18'	(°)
Camber, rear	-30' ± 45'	(°)

Wheels and tyres

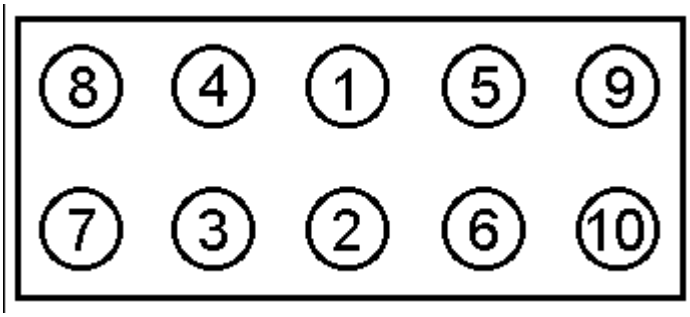
Item	Values	Units
Tyre size	185/70R14	
Front tyre pressure	2.0	(bar)
Rear tyre pressure	2.0	(bar)

Capacities

Item	Values	Units
Engine sump, incl. filter	3.8	(l)
Manual transmission		
Gearbox refill	3.35	(l)
Automatic transmission		
Gearbox refill	6.2 - 6.8	(l)
Cooling system	7.5	(l)

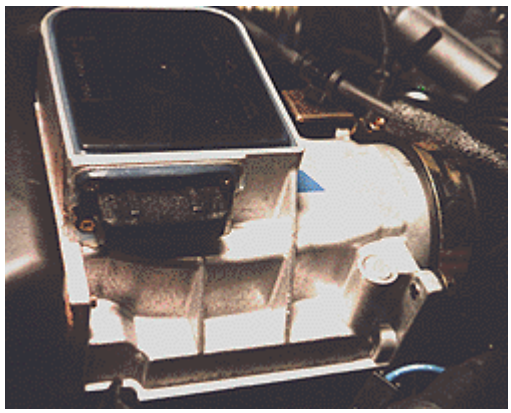
Torque settings

Item	Values	Units
Cylinder head		



Stage 1	20 - 26	(Nm)
Stage 2	50 - 56	(Nm)
Stage 3	80 - 86	(Nm)
Front hub	235 - 319	(Nm)
Rear hub	98 - 117	(Nm)
Wheel nuts	88 - 118	(Nm)
Spark plugs	15 - 23	(Nm)

30. airflow meter



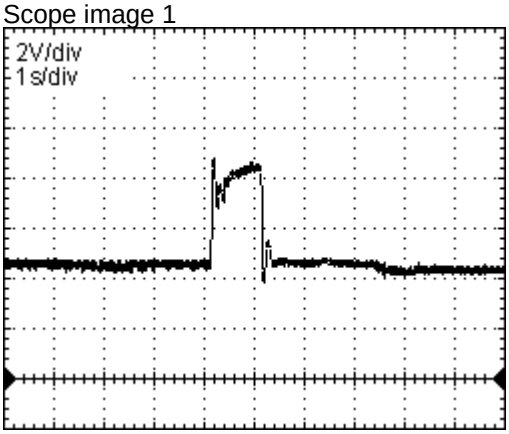
Function

The airflow meter uses an air temperature sensor and a movable vane connected to a potentiometer, which return a signal to the control unit, proportional to the temperature and volume of air entering the engine. When air enters the engine, the airflow meter closes the fuel-pump contact, activating the fuel pump.

Specifications

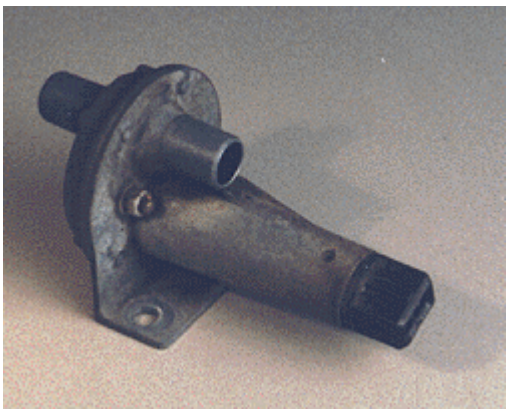
supply voltage: 12 V
output voltage: 0 - 12 V
resistance air temperature sensor: 2,000 - 3,000 ohms / 20°C
waveform information: output signal during acceleration

Scope image 1



Pins to ground: 2E

9. auxiliary valve



Extra Info

Function

The auxiliary air valve supplies additional air to the inlet system, which increases engine rpm during a cold start. The valve consists of an electrically heated bi-metallic strip, which closes the by-pass airflow as temperature rises.

Specifications

supply voltage: 12 V
resistance heater element: 35 - 45 ohms

AUXILAIRY AIR VALVE

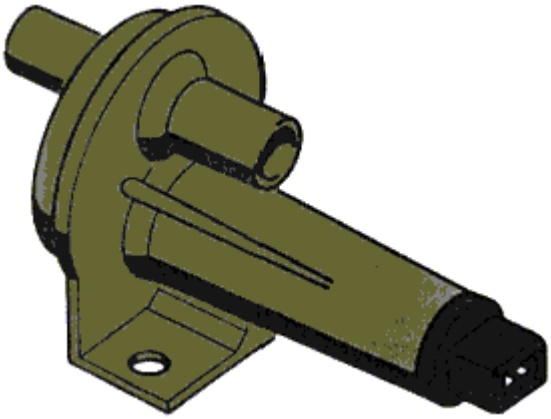
Function

The auxiliary air valve supplies the engine with an addition amount of air during the warm up phase. The auxiliary air valve is located in a tube bypassing the throttle. The valve consists of an electrically heated bi-metallic strip which closes an air by-pass. The air by-pass closes as the temperature rises.

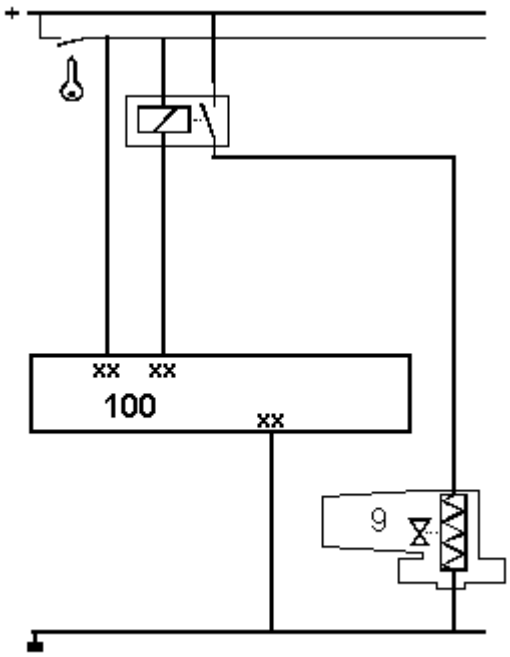
The bi-metallic strip is heated up by an electrical heating element and by the engine temperature.

Specifications

resistance heating element	± 30 - 50 ohms
supply voltage	12 Volts



Electrical control



The auxiliary air valve has a connector with two terminals. One of those terminals is continuously connected with ground. The other terminal is connected with a relay switching the power to the heating element.

Electrical diagnosis

STATIC

- disconnect the connector.

- check the if the supply voltage exists on one of the two terminals of the connector.
- check if continuity exists between the other terminal of the connector and ground.
- check the resistance of the heating element.

Mechanical diagnosis

- Remove the auxiliary air valve without disconnecting the connector.
- Turn the ignition on and make sure that the valve closes as the heating element heats-up the bi-metallic strip.

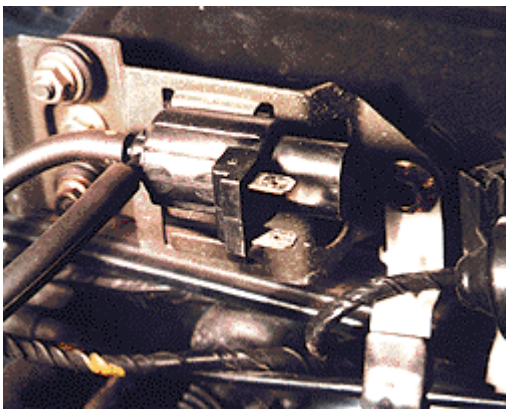
Engine code FE 8V

MAZDA - FE 8V

Compression			
Compression ratio	8.6	: 1	
Compression pressure	11.5	bar	
Idle speed	800 - 850	1/min	
Exhaust gas emissions			
CO content at idle speed	1.5 - 2.5	vol. %	
Thermostat opening temperature	86 *	°C	
Valve timing			
Intake opens	16	°	**before TDC**
Intake closes	54	°	**after BDC**
Outlet opens	54	°	**before BDC**
Outlet closes	16	°	**after TDC**
Valve clearance			
Condition			**hot**
Intake	0.30	mm	
Outlet	0.30	mm	
Firing order	1-3-4-2		
Ignition timing, static / dynamic	6 ± 1	°	**before TDC**

* Data from secondary source; No manufacturer's information

2. canister purge solenoid



Extra Info

Function

The evaporative canister is equipped with a purge solenoid valve. The control unit switches the solenoid on or off. This controls the amount of vapour purged into the inlet manifold.

Specifications

supply voltage: 12 V
resistance: 30 - 40 ohms

Diagnosis

Check connector(s): Inspect the connector(s) and if necessary clean or fix them to make sure the connection is good.
Check resistance:
Turn ignition off. Remove connector from solenoid.
Measure resistance between the two pins of the solenoid. Compare with specified resistance. Alternatively, check solenoid function by applying battery voltage to its pins. The solenoid should "click".
Check supply voltage:
Turn ignition off. Remove connector from solenoid.
Start the engine and measure voltage between one connector terminal and the negative terminal of the battery. Check the second terminal. One of the two should equal battery voltage. If not check wiring and, if present, fuse(s) and relay.

Check connection to ECU:
Turn ignition off. Remove connector from solenoid and ECU.
Measure the resistance between one of the two connector terminals and the corresponding terminal in the ECU connector. Check the other terminal. One of the two should be < 1 ohm. If not check wiring.

CANISTER PURGE SOLENOID

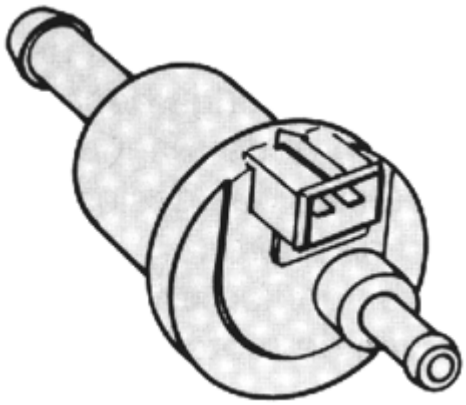
Function

The evaporative gases produced in the fuel tank are absorbed by the activated charcoal in the carbon canister. As The purge control solenoid valve opens these gases are delivered to the intake manifold for combustion purposes. The purge control solenoid valve is controlled by the control unit. The control unit operates this valve during the time the lambda control loop is active.

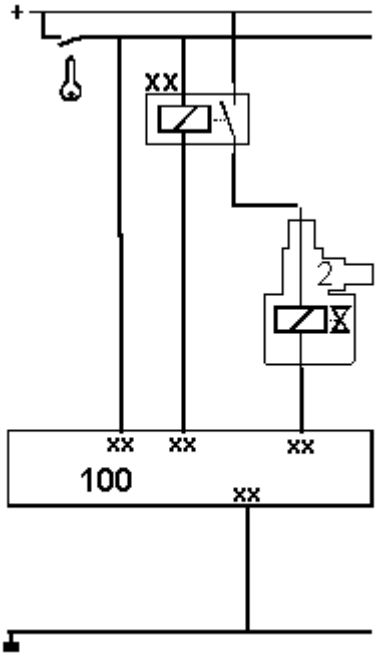
Specifications

RESISTANCE:

resistance:	± 50 ohms
supply voltage:	12 Volts
current:	± 250 mA



Electrical control



Most solenoids are normally closed. This means that the connection between the canister and the intake manifold is closed. The solenoid has a connector with two terminals. On one of those terminals is connected to the battery voltage. This supply-voltage is often switched with a relay. The other terminal leads directly to the control unit. The current through the solenoid is switched on during the time the control unit connects this terminal to ground. The voltage on this terminal is during this time 0 Volts. During the time the solenoid is switched off, the voltage on this terminal is 12 Volts. Some motormanagement systems control the amount gases delivered to the intake manifold switching the solenoid on and of with a certain duty cycle. In this case the duty-cycle depends on engine RPM and engine load.

Electrical diagnosis

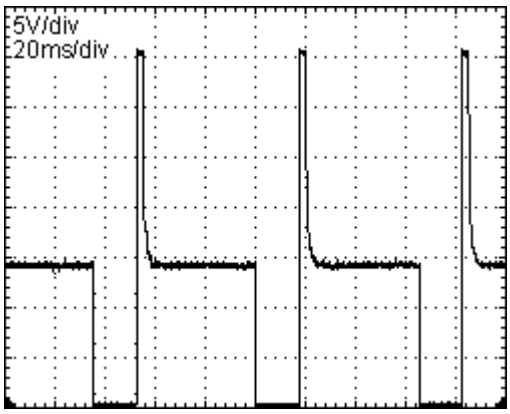
STATIC

General

- To perform this measurements the relay switching the power to the solenoid should be closed. Short circuit the switch in the relay if necessary.

Measurements

- Measure the voltage on the control unit. Use the pin which switches the solenoid.



result: **12 V**

- solenoid and wiring are electrically OK

0 V

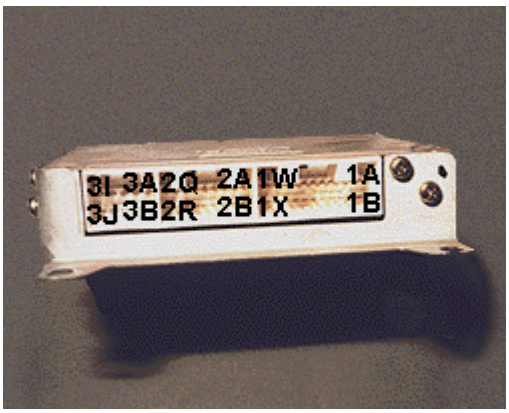
- check the relay switching the power to the solenoid
- check the wiring between the relay and the solenoid
- check the solenoid resistance
- check the wiring between the solenoid and the control unit
- check the control unit

Capacities

MAZDA - 626 - 2.0i 8V - FE

Item	Values	Units
Engine sump, incl. filter	3.8	(l)
Manual transmission		
Gearbox refill	3.35	(l)
Automatic transmission		
Gearbox refill	6.2 - 6.8	(l)
Cooling system	7.5	(l)

100. control unit



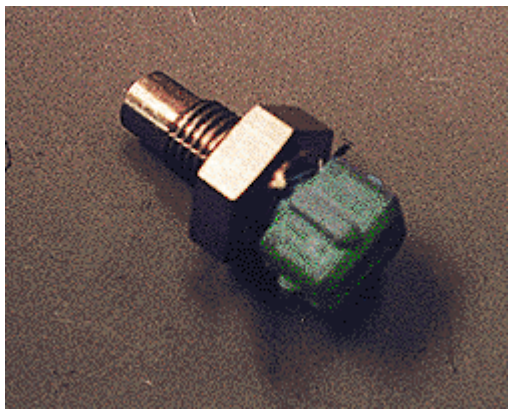
Function

The control unit receives signals from sensors that monitor various engine operating parameters. The control unit generates output signals to provide optimal air/fuel ratio and idle speed control.

Diagnosis

Check connector(s): Inspect the connector(s) and if necessary clean or fix them to make sure the connection is good.
When you suspect the control unit is faulty, make sure all sensors and actuators function properly, and that signals from other control unit(s) are received properly. Next check the supply voltage and ground connections of the control unit:
Turn ignition off. Remove ECU connector.
Locate the supply voltage connections. Turn ignition on. Measure voltage between corresponding connector terminal(s) and the negative terminal of the battery. They should equal battery voltage. If not check wiring and fuse.
Turn ignition off. Locate the ground connections. Measure resistance between corresponding connector terminal(s) and the negative terminal of the battery. They should be < 1 ohm.

42. coolant temperature sensor

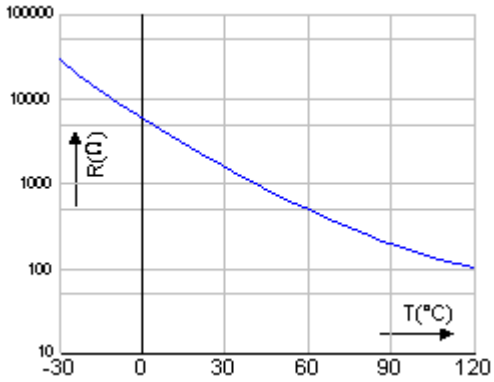


Function

The coolant temperature sensor is a temperature-sensitive resistor. Low temperature causes high resistance while high temperature causes low resistance. The control unit determines the temperature by monitoring the voltage across the sensor.

Specifications

supply voltage: 5 V (connector disconnected)
resistance: 2,000 - 3,000 ohms / 20°C
resistance: 200 - 300 ohms / 90°C



Diagnosis

Check connector(s): Inspect the connector(s) and if necessary clean or fix them to make sure the connection is good.
Check resistance:
Turn ignition off. Remove connector from sensor.
Measure resistance between both pins of the sensor. Compare with specified resistance.
Check supply voltage:
Turn ignition off. Remove connector from sensor.
Turn ignition on and measure voltage between both connector terminals and the negative terminal of the battery. One should be 5 V. If not check wiring then check ECU.
Check connection to ECU:
Turn ignition off. Remove connectors from sensor and ECU.
Measure the resistance between supply voltage connector terminal and the corresponding terminal in the ECU connector. It should be < 1 ohm. If not check wiring.
Check ground:
Check in schematic if ground connection is connected to a direct ground or to the ECU. When it is connected directly to ground: Turn ignition off. Remove connector from sensor and measure resistance between ground connector terminal and the negative terminal of the battery. It should be < 1 ohm. If not check wiring. When it is connected to the ECU: Turn ignition off. Remove connector from sensor and ECU. Measure resistance between ground connector terminal and the corresponding terminal in the ECU connector. It should be < 1 ohm. If not check wiring.

190. coolant temperature switch

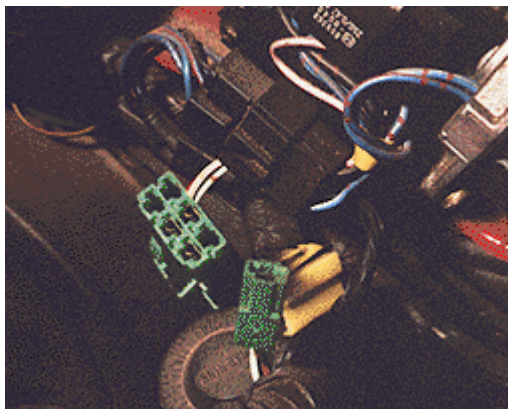
Function

The coolant temperature switch returns a signal to the control unit at temperatures above 17°C.

Specifications

the temperature switch closes at 17°C.

83. diagnostic connector



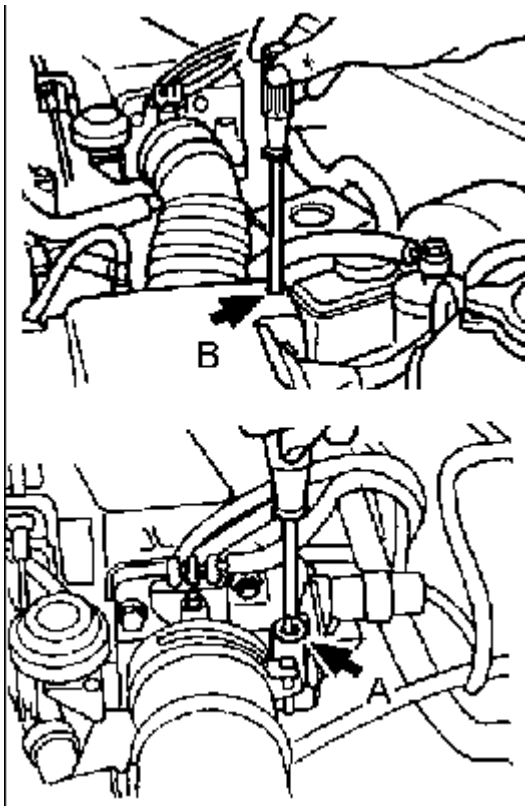
Function

This connector is used to communicate with the control unit.

Environmental Data

MAZDA - 626 - 2.0i 8V - FE

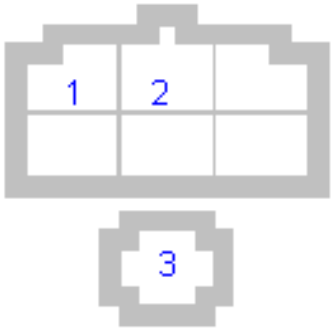
Item	Values	Units
Engine code	FE	
Idle speed	850 - 900	(rpm)
Automatic	900 - 950	(rpm)
Fuel system (make & type)	EGI	
Fuel system (make & type)	EGI	
Adjustment screws (A = idle speed B = CO)		



Timing stroboscopic (before TDC)	6 ± 1/850	(° / rpm)
Start	0 ± 2/125	(° / mmHg)
End	18 - 22/300	(° / mmHg)
Start	0 ± 2/1000	(° / rpm)
End	16 - 20/5800	(° / rpm)
Fuel-pump pressure	4.5 - 6.0	(bar)
Injection pressure / system pressure	2.04 - 2.8	(bar)
CO exhaust gas	< 0.5	(%)
CO2	13 - 16	(%)
HC	300	(ppm)
O2	0.5 - 2.0	(%)
Lambda	0.97 - 1.03	
Lambda change (Delta Lambda)	0.02	
Oil temperature during test	60	(°C)
Fast-idle speed	2500 - 2800	(rpm)
CO at fast-idle speed	< 0.3	(%)

Closed-loop test at: (rpm)	600 - 1000	(rpm)

Error codes



Diagnostic plug

Diagnostic plug (green, 6-pin):
1 = Datalink LED tester (green/black wire)
2 = positive battery terminal (+B, red/brown wire)
Diagnostic plug (green, 1-pin):
3 = activation error codes

Read-out

-Connect LED tester to positive battery terminal (+B) and diagnostic-plug terminal 1.
-Connect terminal 3 (diagnostic plug, green, 1-pin) to ground.
-Turn ignition on.
-LED will light for 3 to 5 seconds.
-Error codes will appear on LED tester.

Reset

-Turn ignition off.
-Disconnect negative terminal of the battery.
-Depress brake pedal for at least 2 seconds.
-Connect negative terminal of the battery.
-Turn ignition on and wait at least 6 seconds.
-Start and warm up the engine. Let the engine run for 3 minutes at 2500-3000 rpm.
-Verify that no error codes are displayed.

Signal

-Digit 1 (tens position): Light pulse 1.2 seconds long, 0.4 seconds pause in-between.
-Pause 1.6 seconds light-off.
-Digit 2 (units position): Light pulse 0.4 seconds long, 0.4 seconds pause in-between.
-Pause 4.0 seconds light-off.

Error codes

01 Ignition pulse no signal.
08 Airflow meter, open or short circuit.
09 Coolant temperature sensor, open or short circuit.
10 Air temperature sensor, open or short circuit.
12 Throttle position sensor, open or short circuit.
14 Absolute pressure sensor (inside ECU), open or short circuit.
15 Oxygen sensor, lean signal for longer than 120 seconds, engine speed is higher than 1500 rpm, warm engine.
17 Oxygen sensor signal does not change for 20 seconds, engine speed is higher than 1500 rpm.
25 Increased fuel pressure solenoid, open or short circuit.
26 Canister purge solenoid, open or short circuit.
28 EGR purge solenoid.
34 Idle speed control solenoid (C) open or short circuit.
35 Idle speed control solenoid (B) open or short circuit.

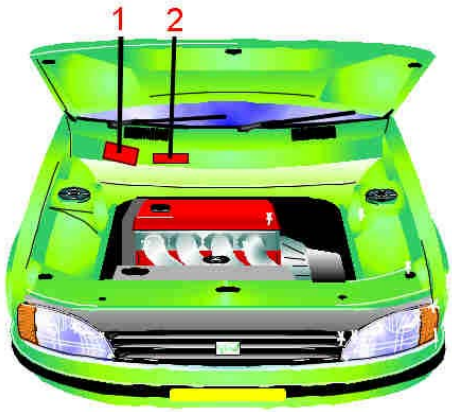
ID Location

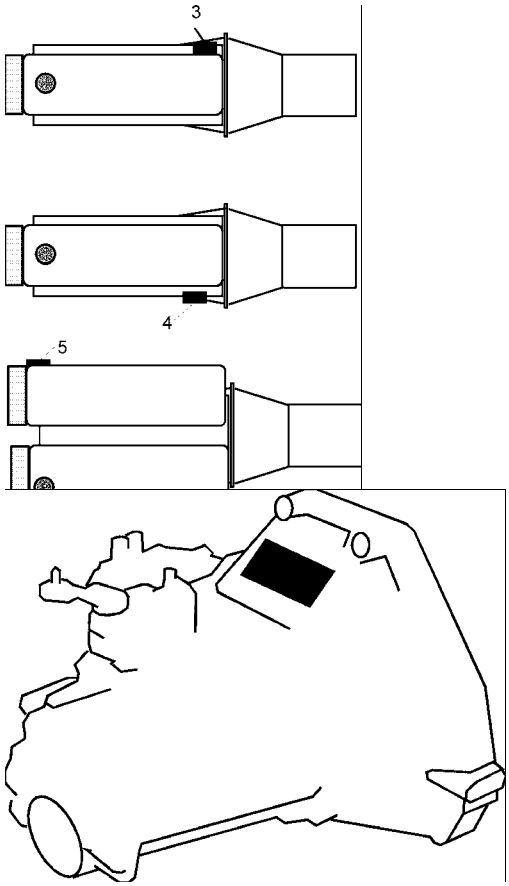
MAZDA - 626 - 2.0i 8V - FE

1 Identification plate
2 VIN

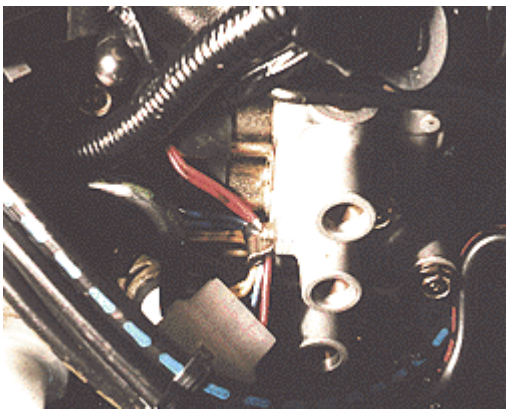
3 Engine code B3 / B5 / B6 / PN
4 Engine code BP / FP / FS
5 Engine code 6-cylinder

6 Manual transmission code





6. idle speed control valve



Extra Info

Function

The idle speed control valve regulates the by-pass airflow.

Specifications

supply voltage: 12 V
resistance coil with red wires: 30 - 35 ohms
resistance coil with blue wires: 30 - 35 ohms
resistance coil with yellow wires: 20 - 25 ohms

IDLE SPEED CONTROL VALVE

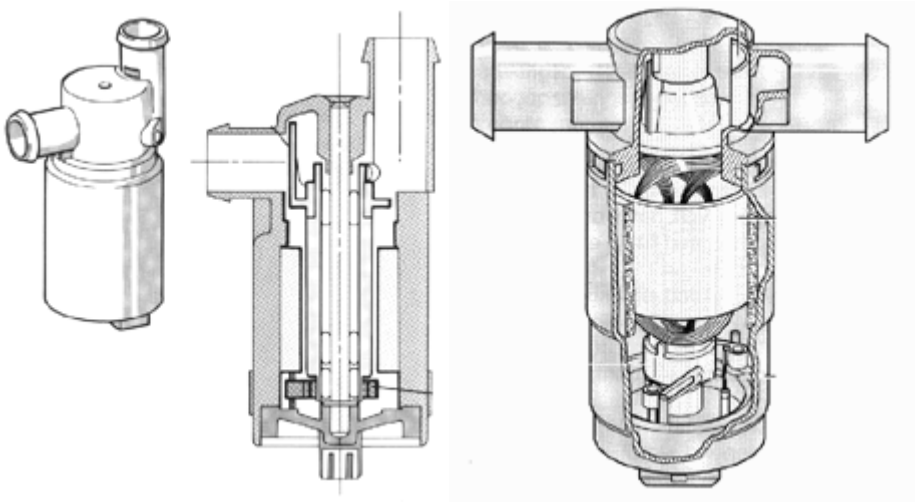
Function

The idle control valve is located in a tube bypassing the throttle. The control unit controls this device to ensure stable idling in all operating conditions.

Specifications

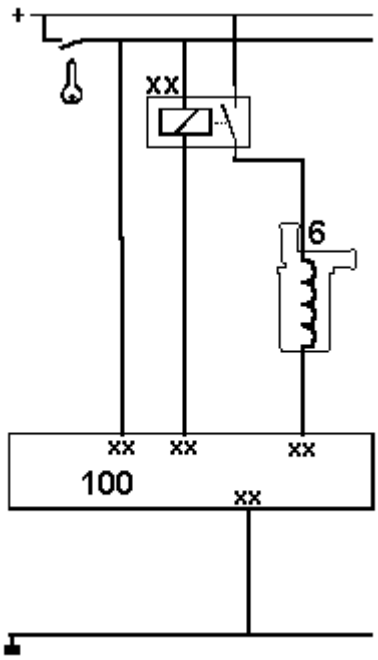
resistance coil(s):	± 20 ohms
supply voltage:	12 Volts

A rotary slide valve attached to the armature is turned to open the air bypass until the desired idle speed is obtained. The position of the armature is controlled by the force of an internal spring opposing the force of a solenoid (types with to terminals) or controlled by two solenoids energised alternately which exerts opposing forces on the armature (types with three terminals).



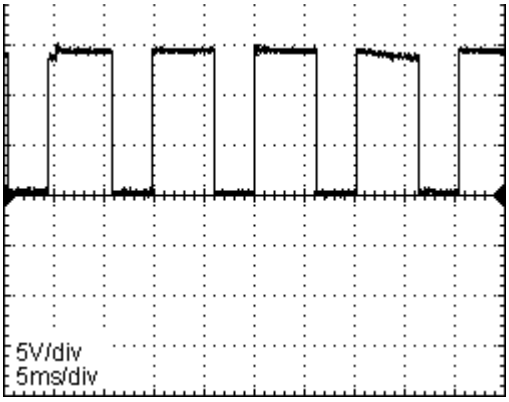
Electrical control

Types with two terminals



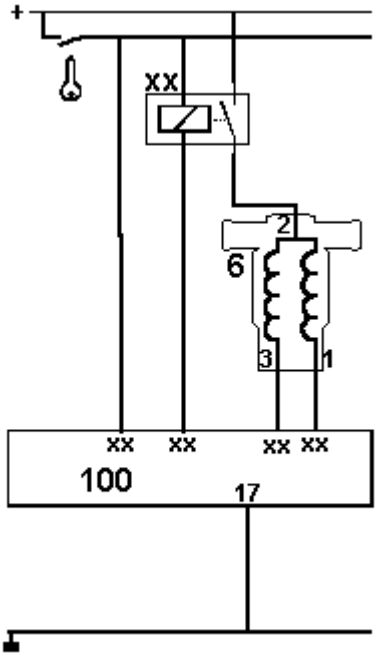
As a current flows through the coil the armature is turned against the spring force. As the current increases the airflow and the idle speed increases. If the current through the coil is switched off due to a mall functioning system, the valve is forced into a position which results in a (too) high idle speed.

The idle control valve has a connector with two terminals. On one of those terminals is connected to the battery voltage. This supply-voltage is often switched with a relay. The other terminal leads directly to the control unit. The current through the coil is switched on during the time the control unit connects this terminal to ground. The voltage on this terminal is during this time 0 Volts. During the time the current through the coil is switched off, the voltage on this terminal is 12 Volts.

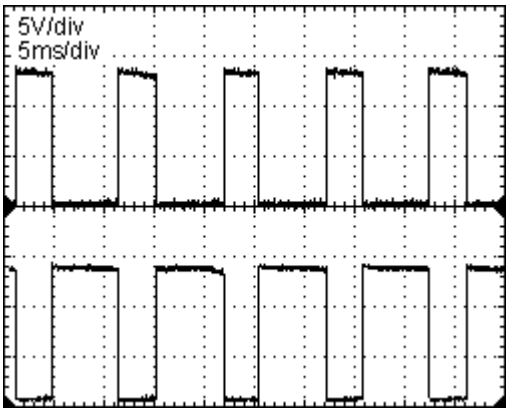


The control unit controls the current through the coil switching the current on and off with a certain duty cycle. The current increases as the duty-cycle increases. The duty cycle varies between approx. 35% (valve closed) and 85% (valve opened). Nominal idle speed is obtained when slightly open.

Three terminal types



The two coils inside this type of idle speed control valve are connected with the supply voltage using one common terminal. The other two terminals lead directly to the control unit. The control unit switches the current through the solenoid on and off alternately with a duty cycle between 35 and 85%.



Electrical diagnosis

STATIC

- To perform this measurements the relay switching the power to the idle control valve should be closed. Short circuit the switch in the relay if necessary.

  Measurements:

  Disconnect the connector and

DYNAMIC TESTS THREE TERMINAL TYPES

- Remove the idle control valve but leave the electrical connections in place. Fully open or close the rotating plunger. Switch on the ignition.

measure the resistance of the coil(s). The nominal value is app. 20 ohms.

- Check the relay switching the power to the idle control valve
- Check the wiring between the relay and the idle control valve
- Check the wiring between the idle control valve and the control unit
- Check the control unit

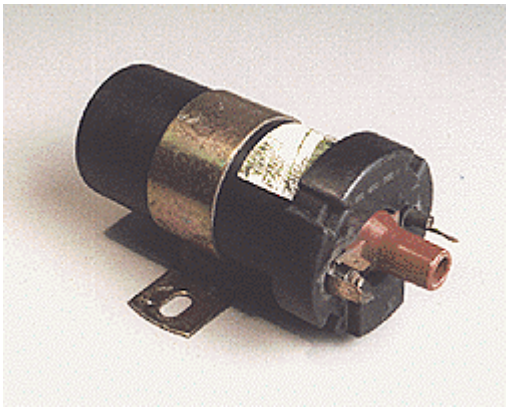
result:

- Switch on the ignition. The rotating plunger must move to a position equivalent to app. 50% opening, and remain there.

Mechanical diagnosis

- Check the air chamber on air leakage.
- Check engine on air leaks into the intake system.
- Remove the idle control valve. The plunger should rotate or move easily. Clean if necessary.

11. ignition coil



Extra Info

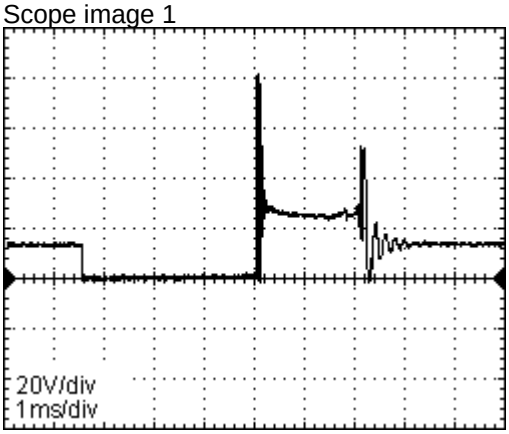
Function

The ignition coil stores energy when current is passed through the coil primary. When the current is switched off a high voltage is induced in the coil secondary.

Specifications

supply voltage: 12 V
resistance primary coil: 0.5 - 2.0 ohms
resistance secondary coil: 7,000 - 10,000 ohms
waveform information: engine running at idle

Scope image 1



Diagnosis

Check connector(s): Inspect the connector(s) and if necessary clean or fix them to make sure the connection is good.
Check resistance primary coil:
Turn ignition off. Remove connectors from ignition coil.
Measure resistance between supply voltage connector pin and primary switching connector pin of the ignition coil.
Compare with specified resistance.
Check resistance secondary coil:
Turn ignition off. Remove connectors from ignition coil.
Measure resistance between central lead terminal and primary switching connector pin. Compare with specified resistance.
Check supply voltage:
Turn ignition off. Remove connectors from ignition coil.
Turn ignition on and measure voltage between supply voltage connector terminal and the negative terminal of the battery. It should equal battery voltage. If not check wiring and, if present, fuse(s) and relay.
Check connection to ignition module:
Turn ignition off. Remove connector from ignition coil and ignition module.
Turn ignition on and measure resistance between primary switching connector terminal and corresponding terminal in ignition module connector. It should be < 1 ohm. If not check wiring.
Check ignition signal:
Connect oscilloscope to the ignition module pin corresponding to the primary switching wire of the ignition coil and ground. Start the engine and compare to the scope image shown.

IGNITION COIL

Function

The ignition coil transforms the battery voltage into the high voltage needed to create a spark.

The ignition coil consists of an electromagnet (the primary coil) and a high voltage coil (secondary coil).

By switching the current through the primary coil on, a magnetic field is induced. The moment the current is switched of, the magnetic field suddenly disappears.

This change of magnetic field creates an induction voltage in the secondary coil, high enough to ionise the mixture. The ionised mixture is a conductor and a current flows through the spark plug.

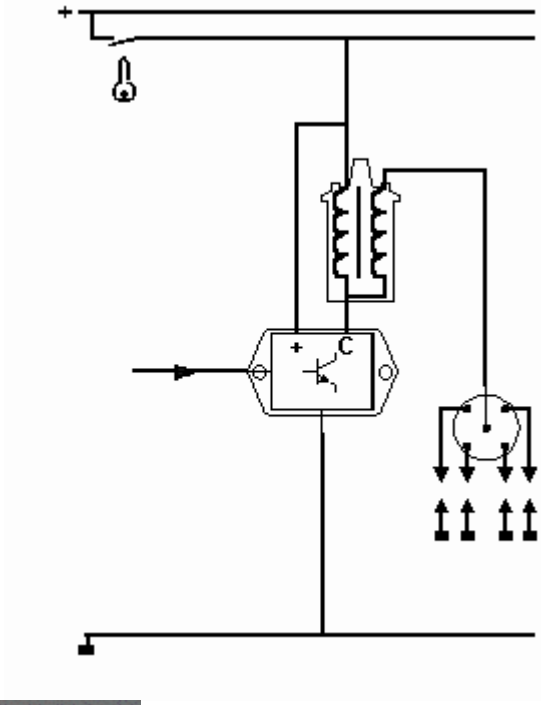
Specifications

RESISTANCE:	
primary:	± 0,3 - 2 ohms
secondary	± 5k - 20k ohms
supply voltage:	12 V
current limited at:	± 7A

Systems with a distributor

Ignition coils used in combination with a distributor consists of one primary and one secondary coil.

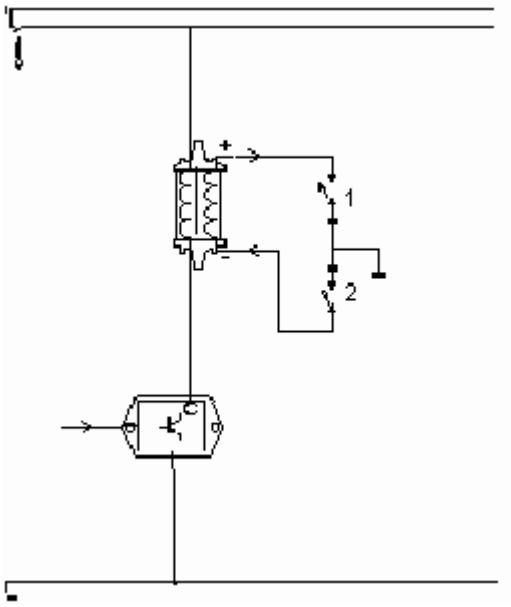
The high voltage, induced in the secondary coil is connected to one of the spark plugs



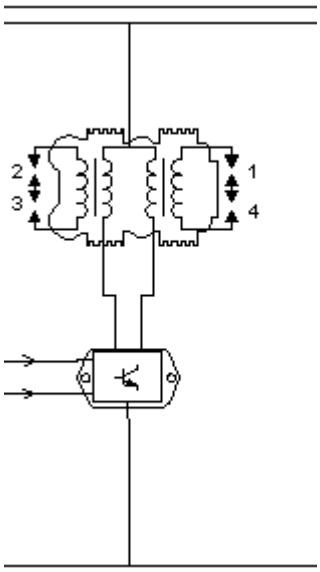
selected by the distributor.

Wasted spark ignition coils

The secondary coil has two ends. In a normal ignition coil one of those ends delivers the high
The other end is connected to either the positive (15) or the negative (1) terminal of the prir
In a wasted spark ignition coil both ends are connected to a spark plug. Therefore both spark
will spark at the same time.

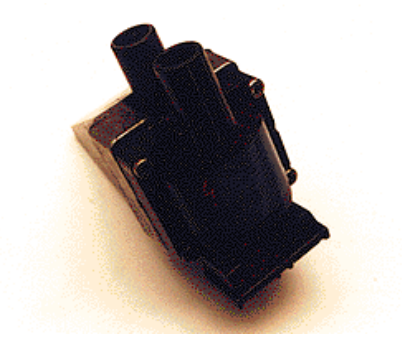


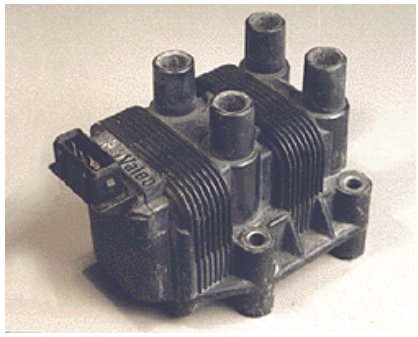
wasted spark ignition coil on 2- cylinder 4-stroke engine



a wasted spark ignition coil on a 4- cylinder 4-str

To supply the four spark plugs of an 4 cylinder engine, two ignition coils are needed. The pic
below (left) shows an ignition coil for two spark plugs. The ignition coil in the right picture
incorporates two of those. This ignition coil supplies four spark plugs.

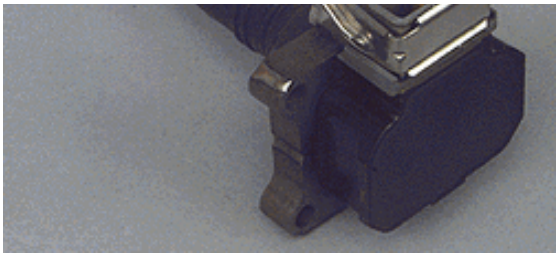


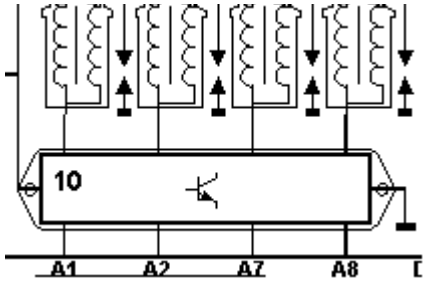


Sequential ignition

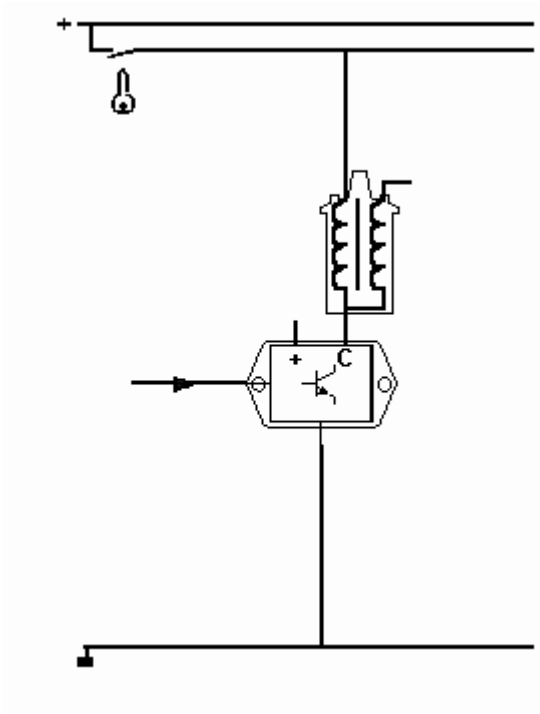
Sequential ignition systems are distributor less ignition systems using one ignition coil per
cylinder.

Each ignition coil is controlled by the control unit individually.





Electrical control



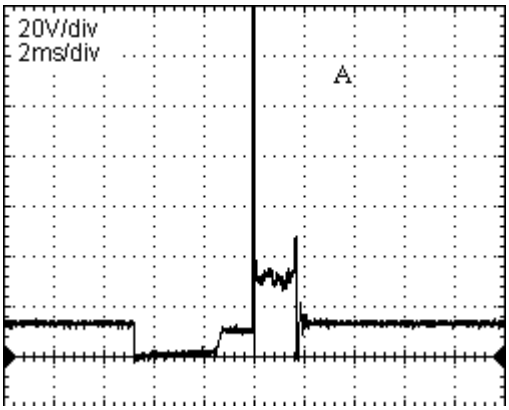
A current through the primary coil induces a magnetic field. The moment the current is switched of, the magnetic field suddenly disappears. This change of magnetic field induces an induction voltage and causes a spark.

The amperage before switching the current off should be high enough to create a high change of magnetic field the moment the current is switched off.

Therefore the current through the primary coil is controlled electronically.

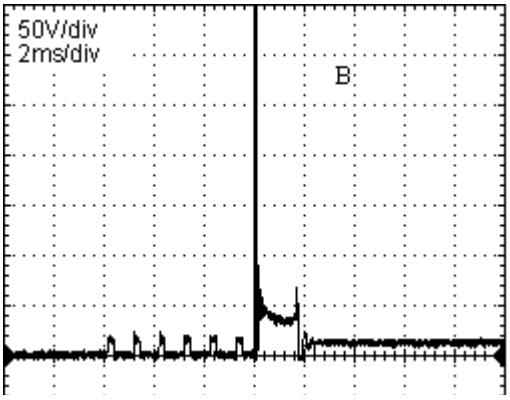
The ignition module is supplied with a current limited circuit. Using this in combination with a low resistance ignition coil the amperage does not depend on the battery voltage.

During the time the current is switched off, the voltage over the ignition module is 12 Volts. The moment the current is switched on, the voltage drops to 0 Volts. From this moment on the current increases until the limiting value is reached.



The oscilloscope images A and B gives you an example of the primary voltage measured on two different current limiting circuits.

By increasing the voltage over the ignition module, the voltage over the primary coil decreases. This causes a limited current in oscilloscope image A.



The ignition module in oscilloscope image B switches the current on and off to limit the current.

Electrical diagnosis

STATIC

To perform this measurements the ignition should be switched on.

Measurements:

- Measure the primary and secondary resistance of the ignition coil.
- Measure the voltage on the positive terminal of the ignition module.

The voltage should be equal to the battery voltage.

result: **Voltage is lower than battery voltage.**

- disconnect positive terminal and repeat measurement

result: **Voltage is equal to battery voltage.**

- check primary resistance of the ignition coil
- check ignition module
- check wiring between ignition module and ignition module.

result **Voltage is still lower than battery voltage.**

- check ignition lock
- check wiring between ignition lock and ignition coil

DYNAMIC

Start the engine and measure the primary voltage using an oscilloscope.

result: **0 V**

- check power supply.

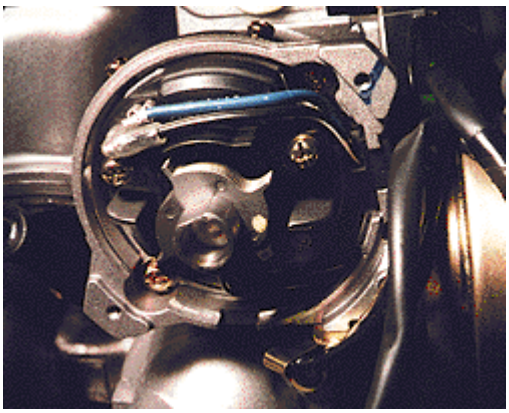
12 V

- check ignition module

Mechanical diagnosis

Not available for this subject !

10. ignition module



Extra Info

Function

The ignition module receives its input signal from the magnetic pickup sensor and switches the current through the coil primary circuit on and off.

Specifications

supply voltage: 12 V

IGNITION MODULE

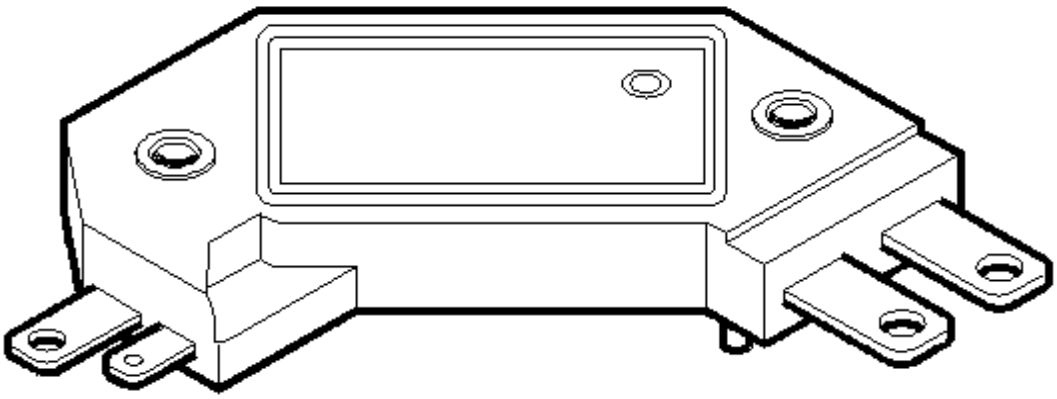
Function

The ignition module switches the current through the primary ignition coil on and off. The ignition module charges the ignition coil during the time the current is switched on. The moment the ignition module switches the current 'off' the ignition coil induces an induction voltage which causes the spark.

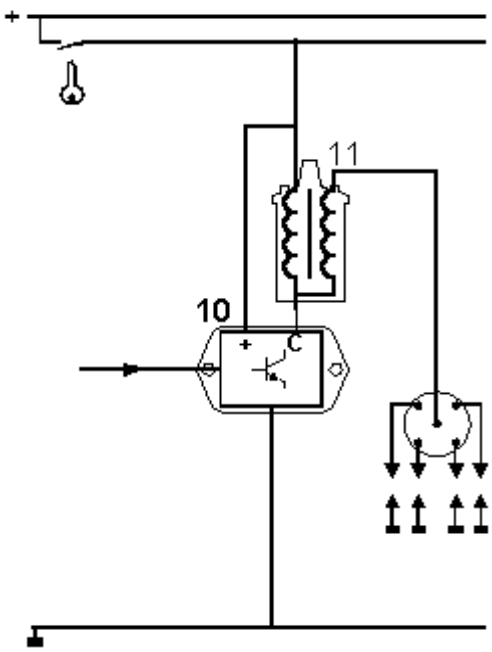
An ignition module switches the current on and off according to an input signal. This input is delivered by the control unit. On older systems the input signal is delivered by an inductive, Hall or opto-coupled sensor mounted in the distributor.

Specifications

resistance	-
supply voltage	-



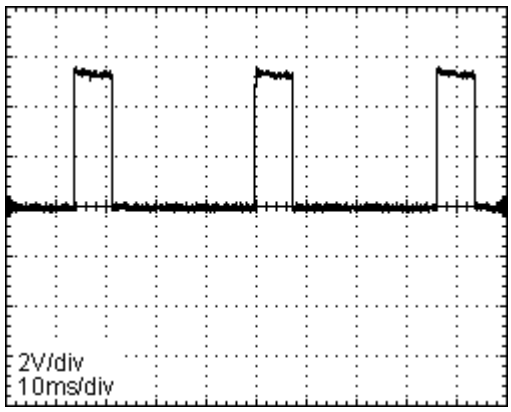
Electrical control



The connector of the ignition module has several terminals. The following terminals are used on common ignition modules.

- a terminal connected with the ignition coil. By this terminal the current through the ignition coil is switched on and of.
- a terminal connected with the supply voltage (12 Volts)
- a terminal connected with ground.
- terminal(s) to receive the input signal. If the input signal is delivered by an inductive sensor two terminals are needed.

The output voltage of an inductive sensor is delivered by an internal coil. This coil induces an almost sine wave output voltage. If the input signal is delivered by an Hall-sensor or opto-coupler three terminals are needed. Two of those three terminals are used to supply the sensor. The supply voltage is either 5 or 12 Volts. The third terminal receives the output signal from the sensor. The output voltage of these sensors is a square wave signal.



Addition terminals are possible. For example to send out a RPM signal to the revolution counter. Sometimes the input signal is delivered by a sensor while the ignition timing is controlled by the control unit. In this case the received input signal from the sensor is converted into a square wave signal by the ignition module and send out to the control unit. The control unit receiving this signal computes this input information and other input information from various engine parameters and sends out a new square wave signal to the ignition module. This signal is used by the ignition module to switch the current through the primary ignition coil on and off.

During the time the input signal for the ignition module is 'high' the current is switched 'on'. The moments this input signals falls to 'low' the current is switched 'off'. This moment the spark will appear

Electrical diagnosis

- Start the engine and measure (using an oscilloscope) the input signal delivered by the control unit or input sensor. The square wave signal or sine wave signal from a inductive sensor should be visible.

signal not OK:

- Disconnect the ignition module's connector and check the wiring between the ignition module and the control unit or input sensor.
- replace the ignition module if the signal appears on the disconnected connector and disappears on the connected connector.

If the output signal remains invisible the failure is not in the component.

signal OK:

- check the power supply of the ignition module.
- check the primary voltage using an ignition oscilloscope or normal oscilloscope with a suitable probe.
- check the wiring between the ignition module and the ignition coil.

The voltage should be nearly 0 Volt during the period the ignition module receives an 'high' input voltage from the sensor or control unit.

Mechanical diagnosis

- Remove the auxiliary air valve without disconnecting the connector.
- Turn the ignition on and make sure that the valve closes as the heating element heats-up the bi-metallic strip.

167. increased fuel pressure solenoid

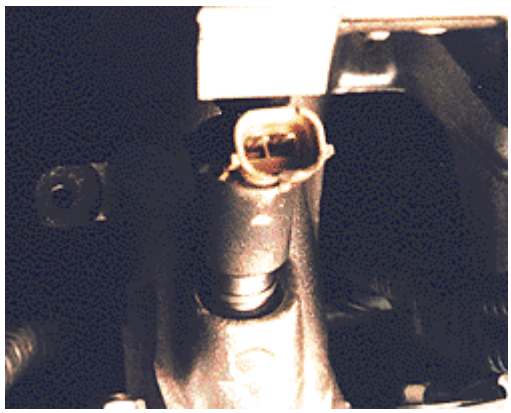
Function

The vacuum solenoid (P.R.C.) regulates the connection between the fuel pressure regulator and the inlet manifold vacuum. The vacuum solenoid is activated by the control unit at air temperatures above 20°C, at engine speeds below 1500 rpm, and with the idle switch closed.

Specifications

supply voltage: 12 V
resistance: 35 - 45 ohms

1. injector



Extra Info

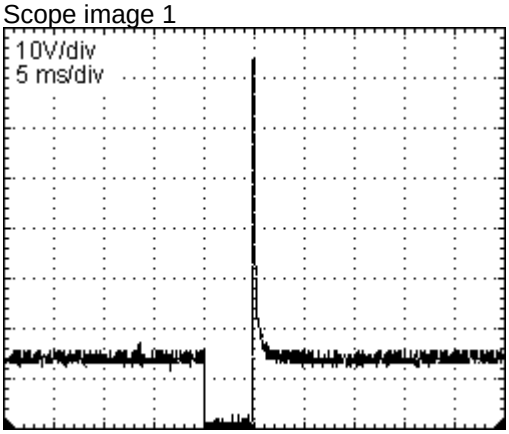
Function

A fuel injector is an electrically operated solenoid valve which is powered by the control unit. The fuel injector injects fuel into the inlet manifold.

Specifications

supply voltage: 12 V
resistance: 13 - 17 ohms
waveform information: engine running at idle

Scope image 1



Pins to ground: 3C, 3E

Diagnosis

Check connector(s): Inspect the connector(s) and if necessary clean or fix them to make sure the connection is good.
Check resistance:
Turn ignition off. Remove connector(s) from injector(s). Measure resistance between the two pins of the injector. Compare with specified resistance.
Check supply voltage:
Turn ignition off. Remove connector(s) from injector(s). Crank the engine and measure voltage between one connector terminal and the negative terminal of the battery. Check the second terminal, one of the two should equal battery voltage. If not check wiring and, if present, fuse(s) and relay or power supply control unit.
Check connection to ECU:
Turn ignition off. Remove connector(s) from injector(s) and ECU. Measure the resistance between one of the two connector terminals and the corresponding terminal in the ECU connector. Check the other terminal. One of the two should be < 1 ohm. If not check wiring.
Check injector activation:
Connect oscilloscope to one of the signal wire pin(s) of the ECU and ground. Start or crank the engine and compare to the scope image shown.

INJECTOR

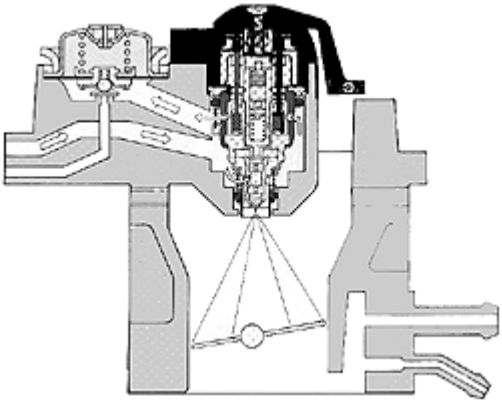
Function

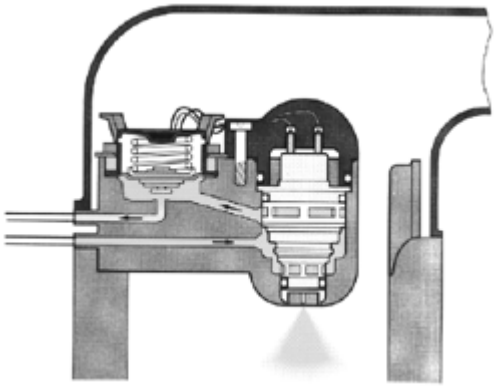
Injectors are electronically operated electromagnetic valves. Using the injectors the control unit is able to inject an exact quantity of fuel. Adding this quantity of fuel to the air, a mixture with the demanded air/fuel ratio is created. Depending on the kind of motormanagement system either one injector per cylinder (multipoint systems) or one injector for all cylinders (singlepoint systems) are used.

Specifications

RESISTANCE:	
high impedance:	± 15 ohms
low impedance:	± 0,5 - 2,5 ohm
flow:	± 50 - 200
gr/minsupply voltage:	1- 12 Volts
current:	± 0,75Amps

Single-point systems





Single-point fuel injection systems use one central placed injector to create the required air/fuel ratio. The injector is mounted in the throttle-body and injects the fuel on top of the throttle. The fuel is delivered by a fuel pump and kept at a constant level by the fuel pressure regulator mounted on the throttle body. The fuel pressure on single-point systems is usually between 0,6 and 1,2 bars.

Multipoint systems

Multipoint fuel injection systems use one injector for each cylinder. The injectors are mounted in the intake manifold. The fuel is injected in the direction of the inlet valves. The fuel is delivered by a fuel pump. The pressure difference between the air pressure in the intake manifold and the fuel pressure is kept at a constant level by the fuel pressure regulator. Therefore the fuel pressure regulator increases the fuel pressure as the intake manifold pressure increases. The fuel pressure on multipoint systems is usually between 2 and 3 bars. The fuel pressure regulator is mounted on the fuel rail.

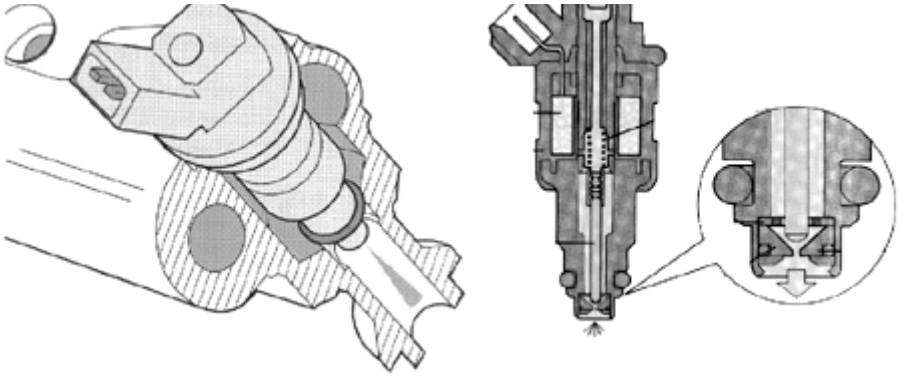
Sequential fuel injection

Sequential fuel injection is a method used by multipoint systems to control the air/fuel ratio and the injection timing per cylinder. Each injector of a sequential injection system is controlled by the control unit individually..

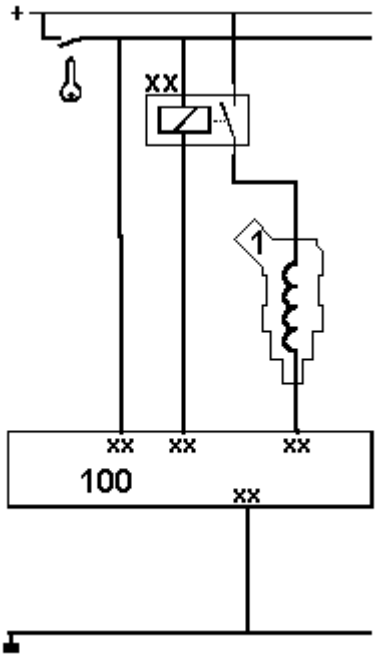
Bottom- and top-feed injectors

The injector fuel inlet can be at the

top or at the bottom. Bottom-feed injectors are often used on singlepoint injection systems while top-feed injectors more often are used as multipoint injectors.



Electrical control

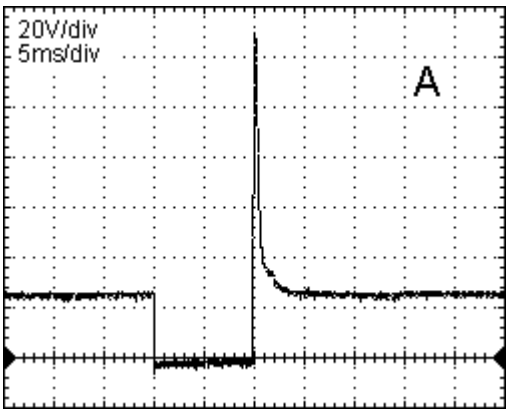


The electrical behaviour of an injector is determined by the coil inside. As a current flows through the coil the injector needle is pulled up against the spring force which courses the fuel to be injected. Two types of injector coils are used. The resistance of a normal coil is approximate 15 ohms. Other injection systems use low resistance coils (approximate 1-2,5 ohms).

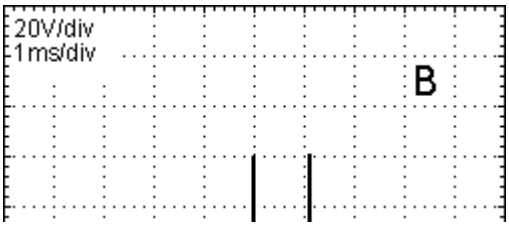
Low impedance injector can be switched on in two different ways:

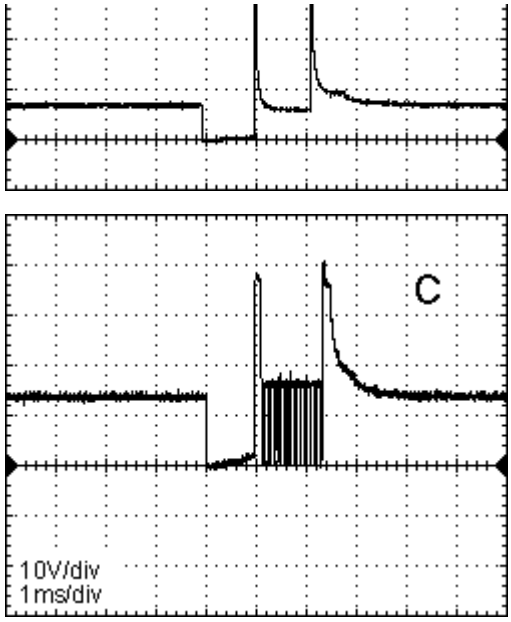
- using an extra external resistance to limit the current
- using a current limiting circuit inside the control unit.

An injector has an electrical connector with two pins. On one of those pins is connected with the battery voltage. This supply-voltage is often switched to the injector using a relay. The other pin leads directly to the control unit. The current through the injector is switched on during the period the control unit connects this pin to ground. The voltage on this pin is during this time 0 Volts. During the period the injector is not switched on, the voltage on the pin is 12 Volts



Oscilloscope image A shows the voltage signal measured on an high impedance injector or low impedance injector with external resistance.





Oscilloscope images B and C show two different current limiting circuits used on low impedance injectors.

Electrical diagnosis

STATIC

- To perform this measurements the relay switching the power to the injector(s) should be closed. Short circuit the switch in the relay if necessary. Perform the tests on one injector at the time. Disconnect parallel switched injectors.

  Measurements

  Measure the voltage on the control unit. Use the pin which switches the injector current.

result: **12 V**

- injector and wiring are electrically OK

0 V

- check the relay switching the power to the injector(s)
- check the wiring between the relay and the injector
- check the injector resistance
- check the wiring between the injector and the control unit
- check the control unit

DYNAMIC

- Connect all injectors. Start the engine and measure using an oscilloscope the voltage on the control unit's pin switching the injector current.

result: **0 V**

- perform static tests.

12 V

- control unit does not switch the injector(s).

Mechanical diagnosis

- check fuel system pressure
- check injectors on leakage and pollution
- bottom-feed injectors: check the seal between the injector and the throttle body
- multipoint systems: disconnect the hose between the fuel pressure regulator and the intake manifold. No fuel should leak out of the fuel pressure regulator.

Lubricants and Fluids

MAZDA - 626 - 2.0i 8V - FE

Engine		
Motor oil API SG	Below 0 °C	SAE 5W-30
Motor oil API SG	Above -25 °C	SAE 10W-30
Cooling system		
Coolant	All temperatures	
Manual transmission		
Gear oil API GL-4	All temperatures	SAE 75W-90
Gear oil API GL-5	All temperatures	SAE 75W-90
Gear oil API GL-4	Above 5 °C	SAE 80W-90
Gear oil API GL-5	Above 5 °C	SAE 80W-90
Automatic transmission		
ATF Dexron II	All temperatures	
ATF M-III	All temperatures	
Transfer box		
Gear oil API GL-5	Above -20 °C	SAE 90
Gear oil API GL-5	Below -20 °C	SAE 80W
Differential, rear (4x4)		
Gear oil API GL-5	Above -20 °C	SAE 90
Gear oil API GL-5	Below -20 °C	SAE 80W
Power steering		
ATF Dexron II	All temperatures	
ATF M-III	All temperatures	
Brakes system		
Brake fluid DOT 3	All temperatures	

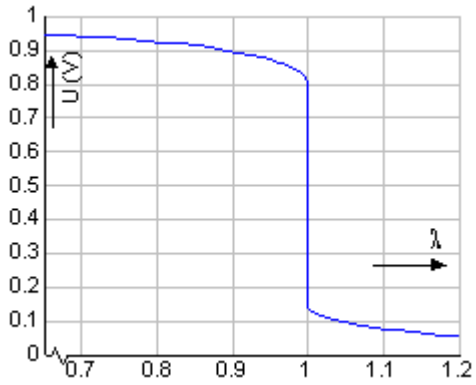
37. oxygen sensor

Function

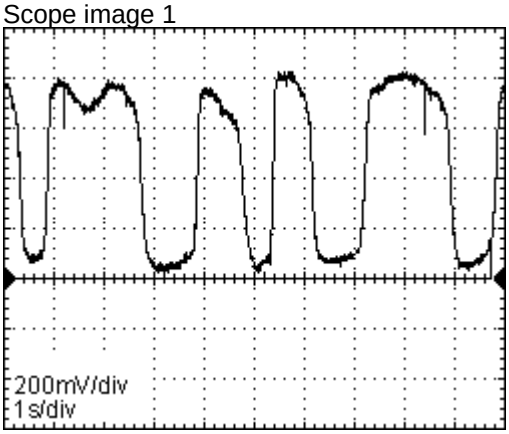
The oxygen sensor is exposed to exhaust gas flow. It monitors the oxygen content of the exhaust gases. A low oxygen content (rich mixture) increases the output voltage of the sensor. In this way a constantly updated air/fuel ratio is returned to the control unit.

Specifications

output voltage: 200 - 850 mV
waveform information: hot engine running at idle



Scope image 1



Pins to ground: 2D

47. power-steering pressure switch

Function

The power-steering pressure switch detects reduced pressure in the steering circuit and returns a signal to the control unit, which increases the idle speed.

Specifications

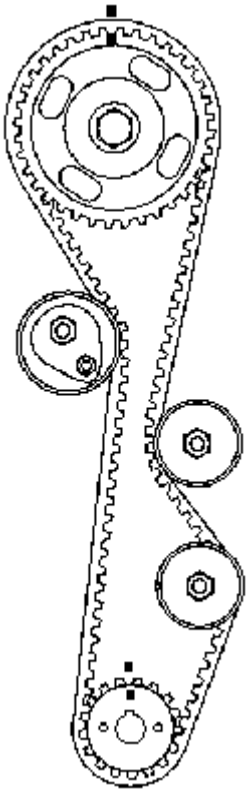
switch is normally open

Timing

MAZDA - 626 - 2.0i 8V - FE

General

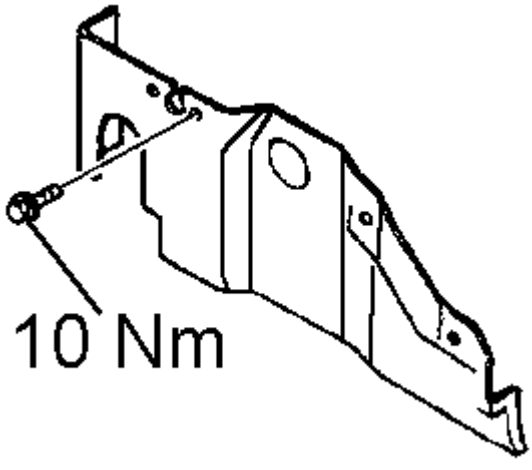
Item	Note
Always check the timing marks before timing belt removal	



Before disconnecting the battery cable, check the audio system security code

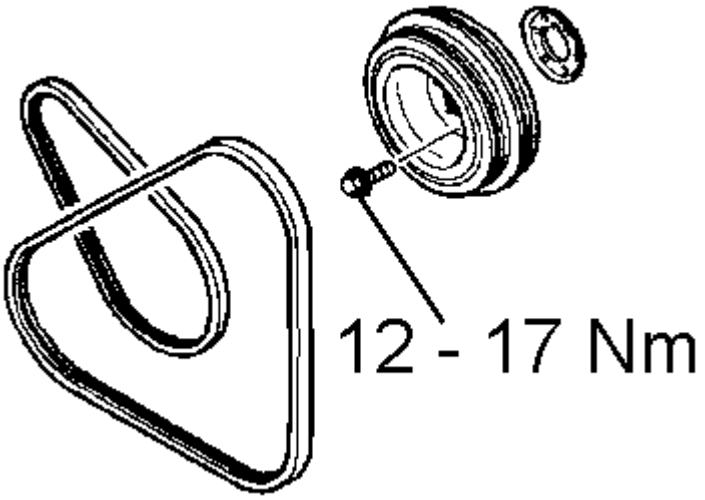
Removal

Item	Note
Disconnect the battery	
Disconnect the spark-plug leads	
Remove the spark plugs	
Remove the lower cover	

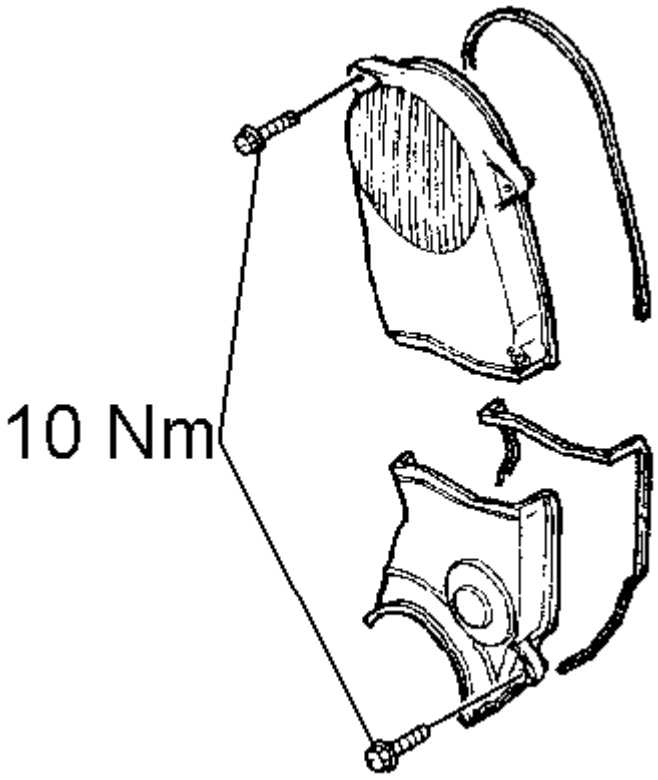


Remove the ancillary drive belt

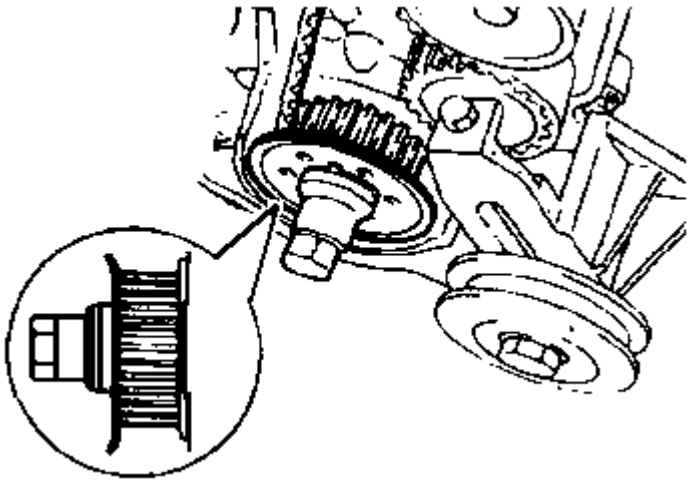
Remove the crankshaft pulley



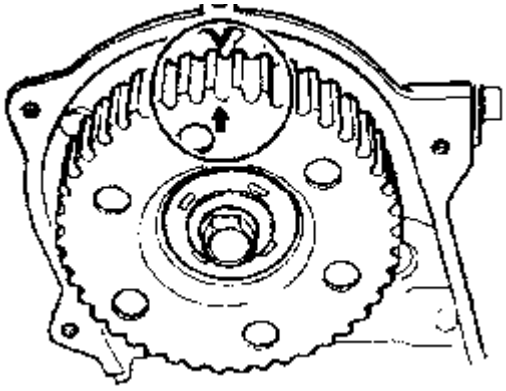
Remove the timing-belt covers

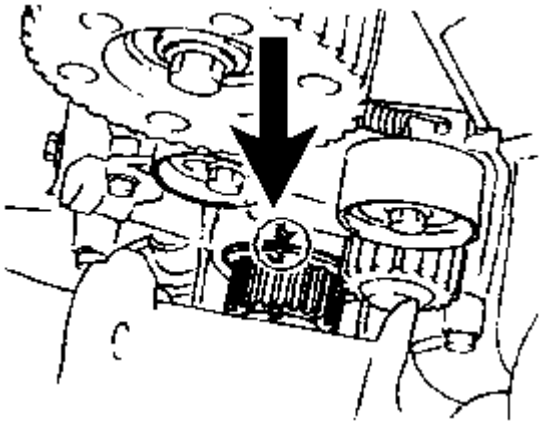


Remove the guide plates

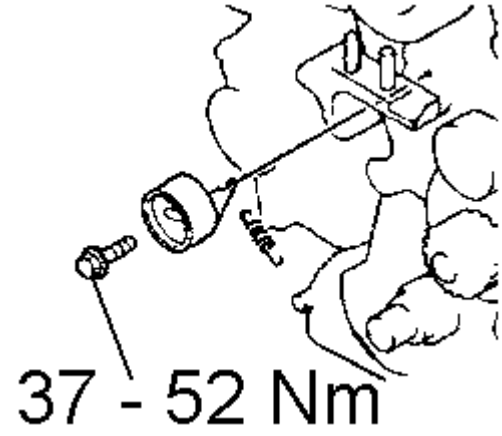


Align the timing marks





Loosen the tensioner



Push the tensioner pulley away from the timing belt

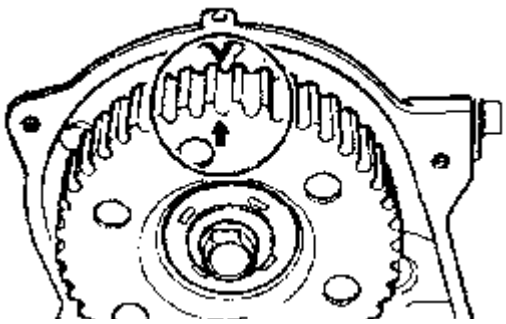
Tighten the tensioner

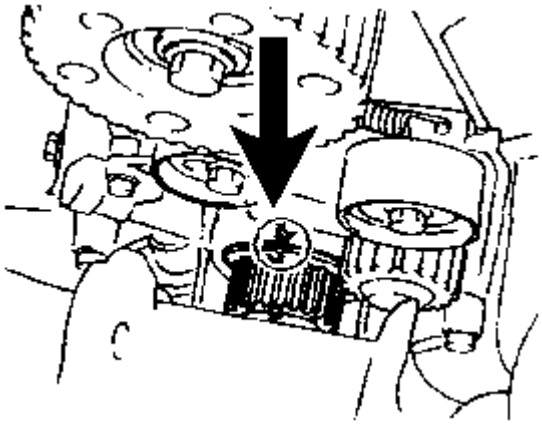
Remove the timing belt

Installation

Item	**Note**

Check the timing marks





Fit the timing belt

Turn the engine 2 rotations by hand

Check the timing marks

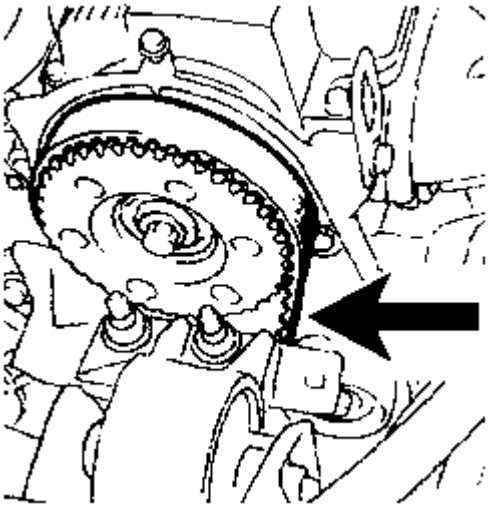
Loosen the tensioner

Tighten the tensioner	37 - 52 Nm

Turn the engine 2 rotations by hand

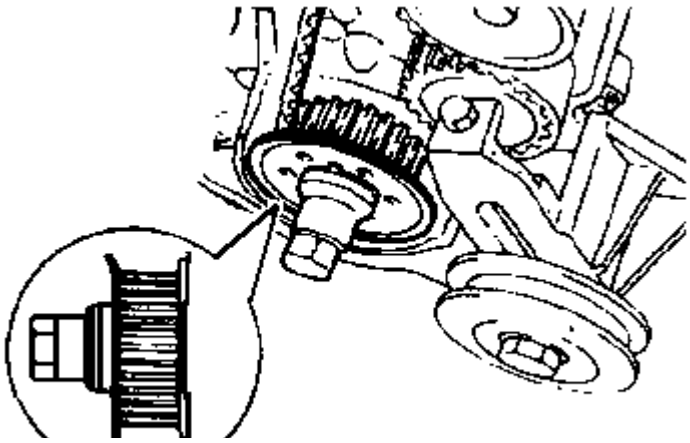
Check the timing marks again

Measure the timing belt deflection	98 N

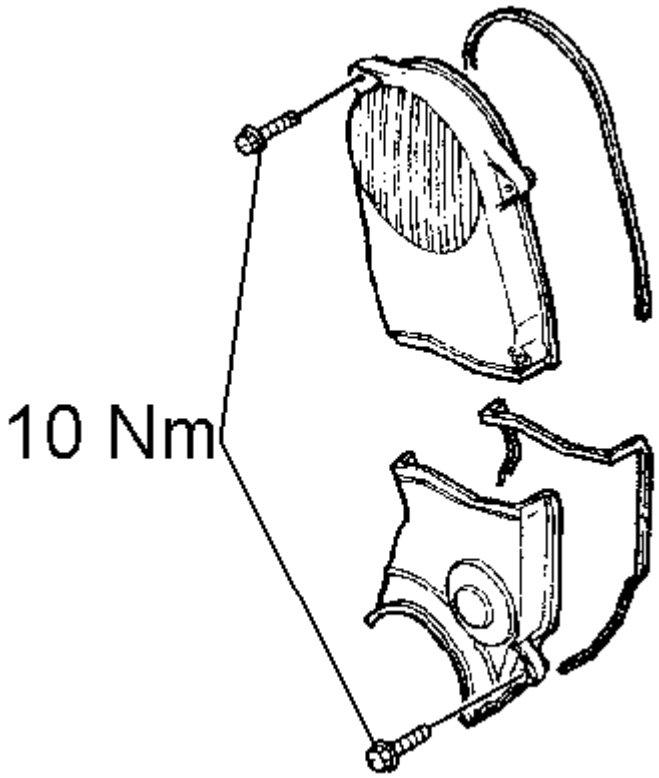


The tension is set at a deflection of:	5.5 - 6.5 mm

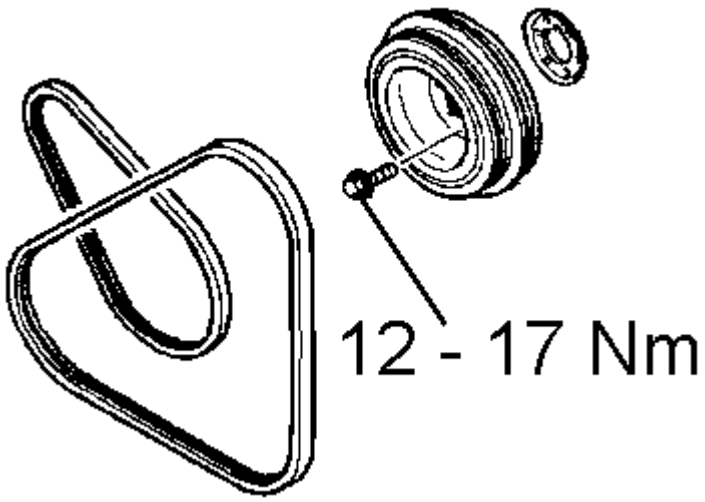
Refit the timing belt guide plates



Refit the timing belt covers

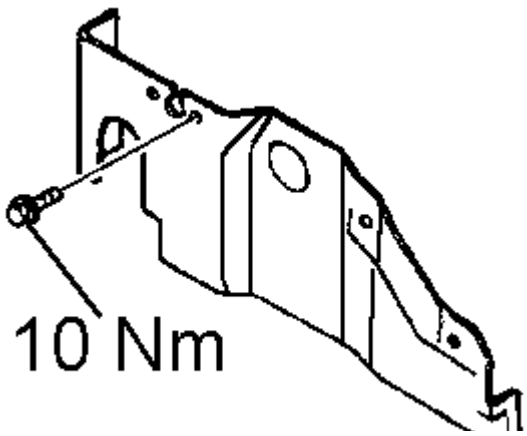


Refit the crankshaft pulley



Fit the ancillary drive belt

Refit the engine lower covers



Refit the spark plugs

Refit the spark plug leads

Reconnect the battery earth cable

Torque settings

Item	Note
Tensioner	37 - 52 Nm
Crankshaft pulley:	12 - 17 Nm
Spark plugs:	15 - 23 Nm

Special tools

Item	Note
Special tools are not required	

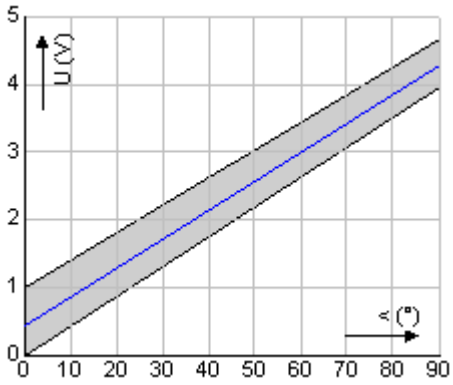
34. throttle position sensor with idle switch

Function

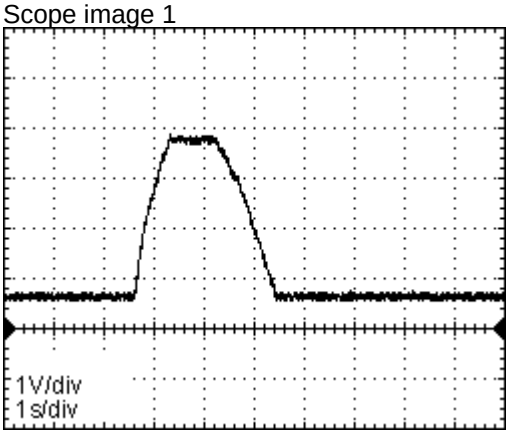
The throttle position sensor measures the angle of the throttle shaft using a potentiometer. The idle switch in the position sensor is closed when the throttle is fully closed.

Specifications

supply voltage: 5 V
output voltage: 0 - 5 V
waveform information: output signal while opening throttle.



Scope image 1



Pins to ground: 2G