

– Engines with electronically controlled carburettor

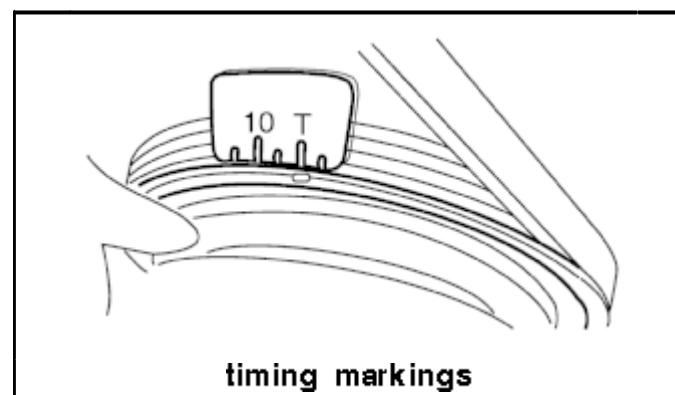
Ignition

This is a transistorized ignition with conventional vacuum and centrifugal advance.

technical specifications	
spark plugs; make and model	NGK BPR6ES-11; ND W20EPR-11
spark plug gap	1,0 - 1,1 mm
coil resistance, primary	approx. 1,0 Ω
coil resistance, secondary	20000 - 30000 Ω
ballast resistor	1,2 - 1,5 Ω
HT-leads resistance	no data

Adjustments

Ignition timing



ignition timing	
engine speed 700 - 900/min	4±2°BTDC

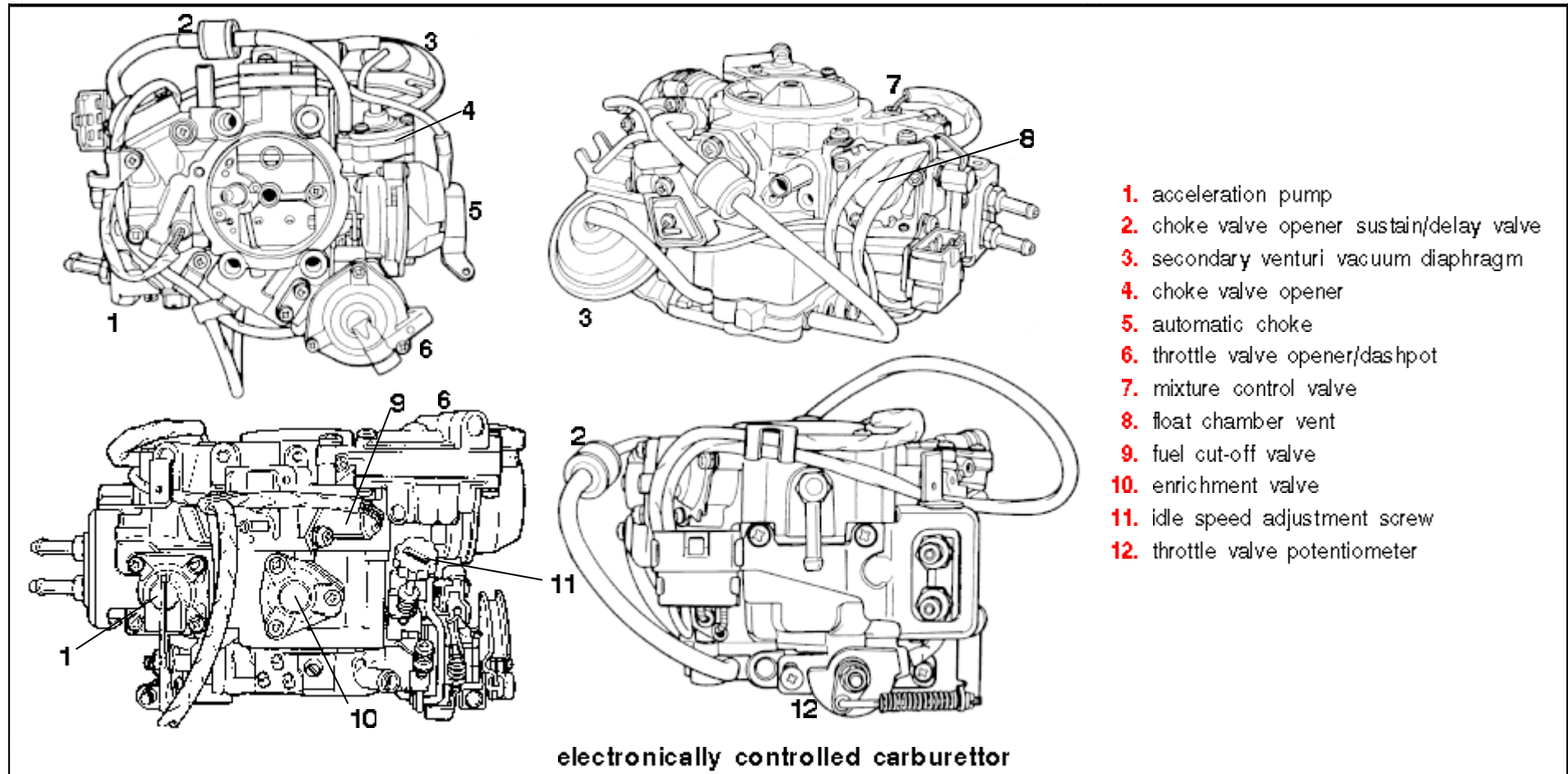
Run the engine to operating temperature. Switch off all electrical consumers. Place automatic transmission in "N" or "P". Check the ignition timing with a rev. counter and a timing light. Set the ignition timing by turning the distributor.

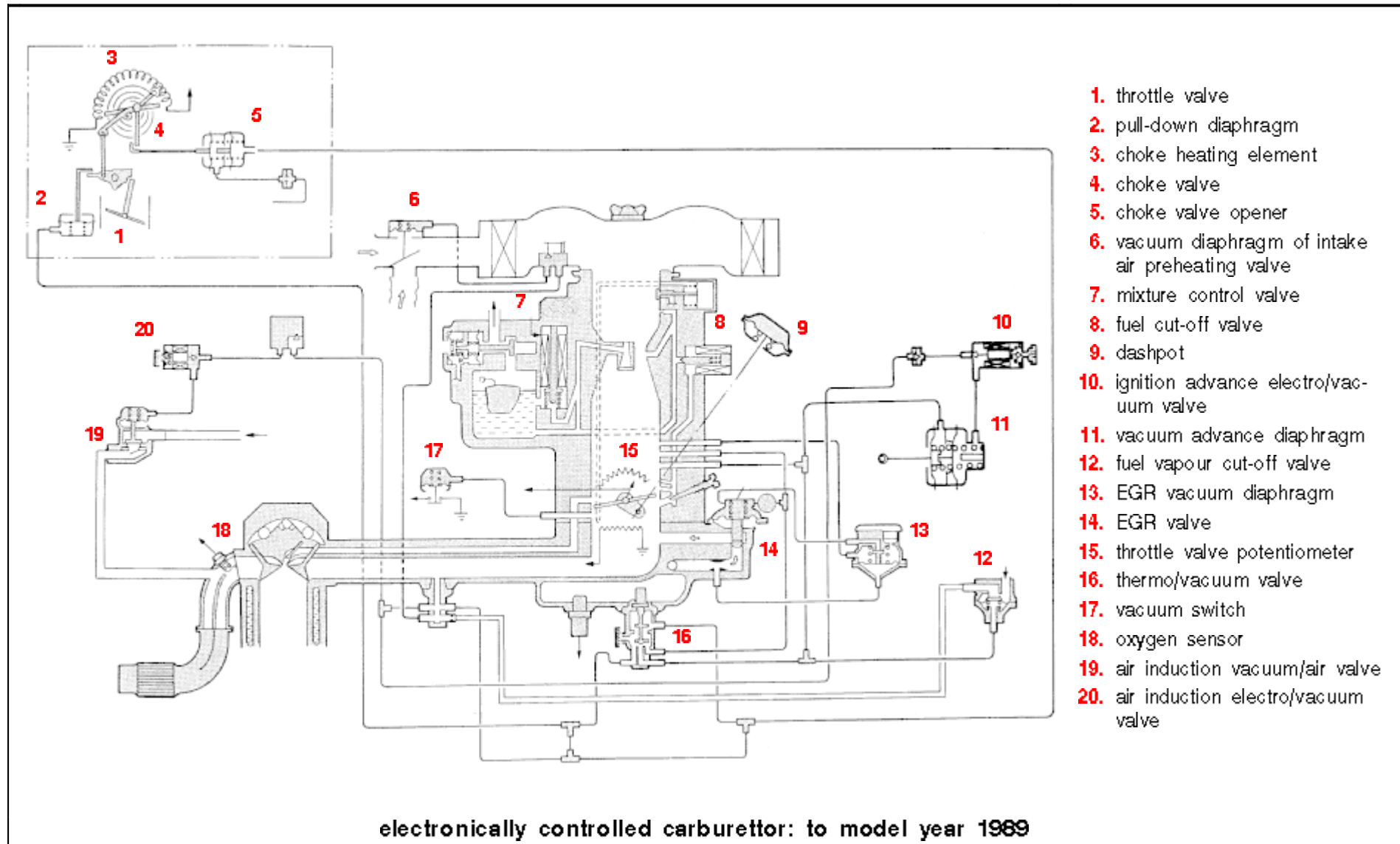
Advance

Disconnect the distributor hose(s) and blank off. Connect a rev. counter and timing light. Check the centrifugal advance. With engine speed increase: the ignition timing must advance.

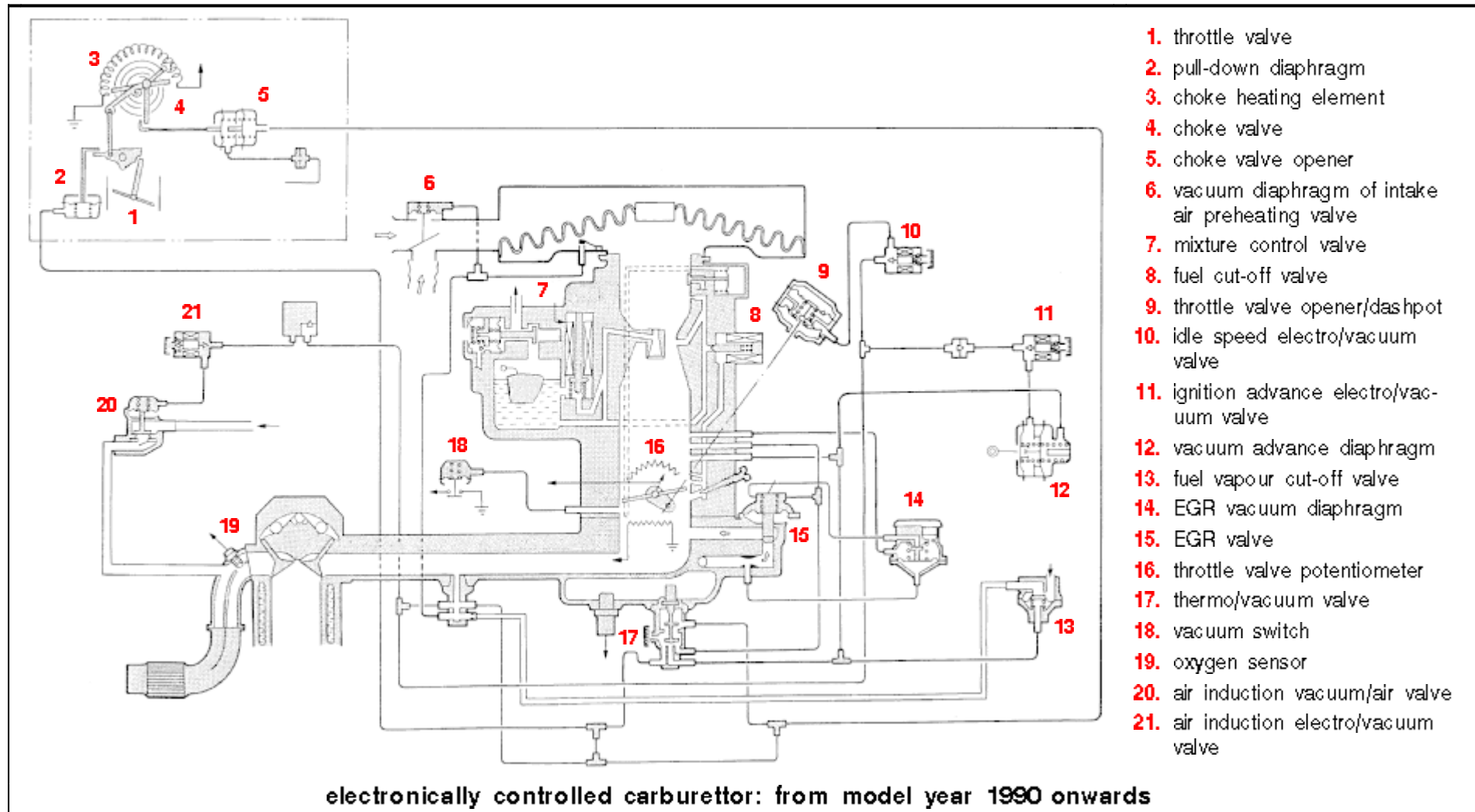
Check the vacuum advance at idle speed. Connect a timing light. Disconnect the distributor hose(s) and blank off. Apply vacuum to the vacuum diaphragm. Check that the ignition timing is advanced. On versions with two vacuum diaphragms: both vacuum advances can be tested similarly.

Carburettor

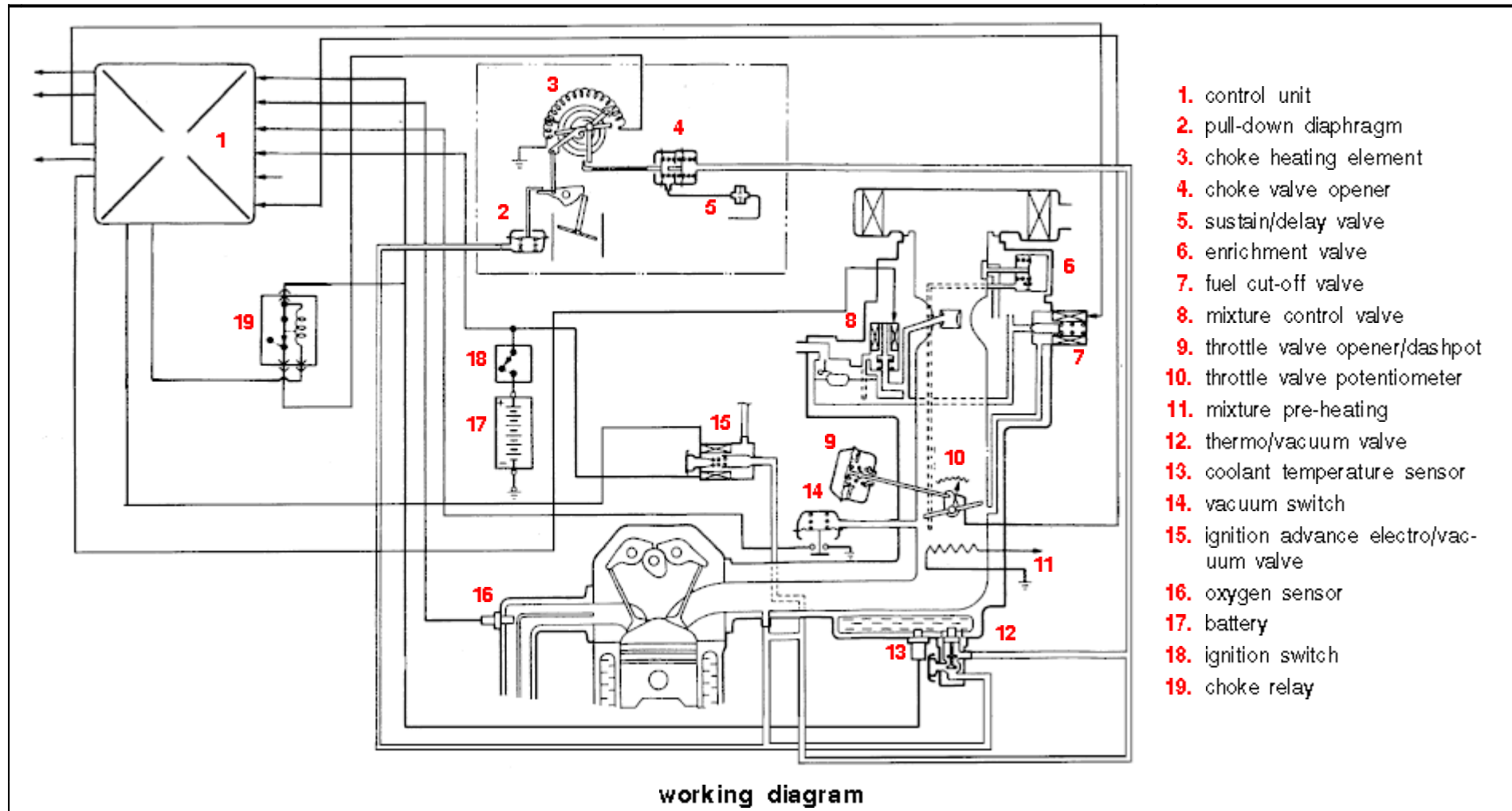




1. throttle valve
2. pull-down diaphragm
3. choke heating element
4. choke valve
5. choke valve opener
6. vacuum diaphragm of intake air preheating valve
7. mixture control valve
8. fuel cut-off valve
9. dashpot
10. ignition advance electro/vacuum valve
11. vacuum advance diaphragm
12. fuel vapour cut-off valve
13. EGR vacuum diaphragm
14. EGR valve
15. throttle valve potentiometer
16. thermo/vacuum valve
17. vacuum switch
18. oxygen sensor
19. air induction vacuum/air valve
20. air induction electro/vacuum valve



1. throttle valve
2. pull-down diaphragm
3. choke heating element
4. choke valve
5. choke valve opener
6. vacuum diaphragm of intake air preheating valve
7. mixture control valve
8. fuel cut-off valve
9. throttle valve opener/dashpot
10. idle speed electro/vacuum valve
11. ignition advance electro/vacuum valve
12. vacuum advance diaphragm
13. fuel vapour cut-off valve
14. EGR vacuum diaphragm
15. EGR valve
16. throttle valve potentiometer
17. thermo/vacuum valve
18. vacuum switch
19. oxygen sensor
20. air induction vacuum/air valve
21. air induction electro/vacuum valve



1. control unit
2. pull-down diaphragm
3. choke heating element
4. choke valve opener
5. sustain/delay valve
6. enrichment valve
7. fuel cut-off valve
8. mixture control valve
9. throttle valve opener/dashpot
10. throttle valve potentiometer
11. mixture pre-heating
12. thermo/vacuum valve
13. coolant temperature sensor
14. vacuum switch
15. ignition advance electro/vacuum valve
16. oxygen sensor
17. battery
18. ignition switch
19. choke relay

technical specifications	
carburettor code	
versions to 05/1990	30-32 DIDEF-334
versions from 06/1990 onwards	30-35 DIDEF-50
venturi diameter	primary: 30 mm secondary to 05/1990: 32 mm secondary from 06/1990 onwards: 35 mm
choke heating element; resistance	approx. 6 Ω
choke valve opening at cold start	step 1: 1,4 - 1,6 mm step 2: 2,9 - 3,1 mm
mixture control valve; resistance	54 - 66 Ω
fuel cut-off valve; resistance	48 - 60 Ω
throttle valve potentiometer; resistance	3500 - 6500 Ω
mixture pre-heating	PTC-resistance
fuel pump pressure	0,19 - 0,26 bar

This is an electronic down draught two-stage carburettor with automatic choke, dashpot system and electric mixture pre-heating.

The control unit can operate under two principles:

Open loop control

With open loop control, the oxygen sensor signal is not used, and the control unit operates with fixed values. This is the case, for example, at cold start and driving with throttle valve fully open.

Closed loop control

With closed loop control, the oxygen sensor signal is used to control the mixture composition. This is the case when driving under light load with engine at operating temperature.

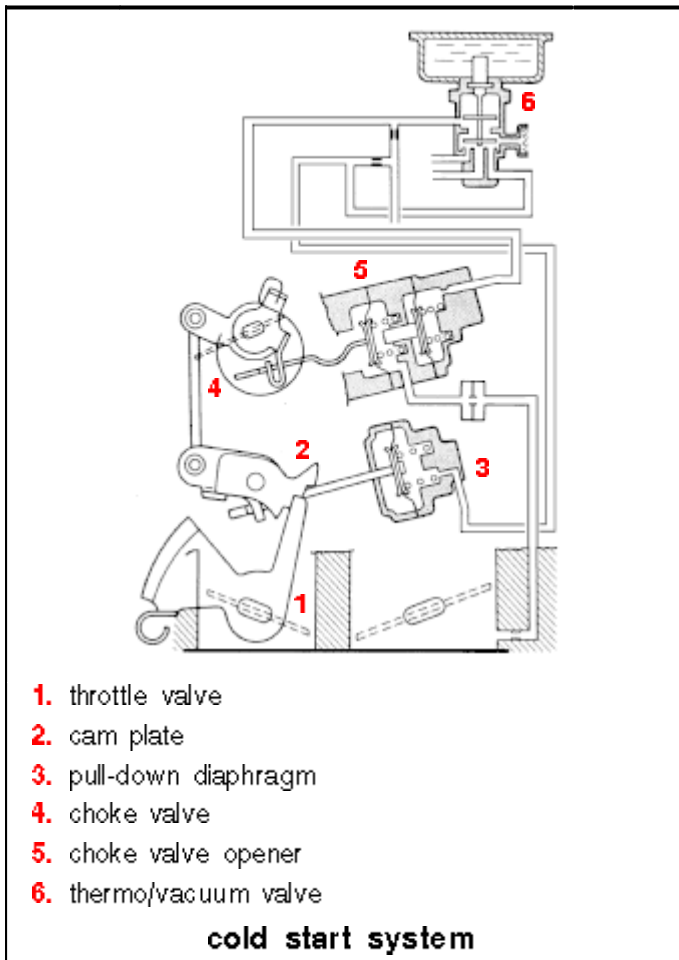
Operation

The control unit controls the mixture control valve at a frequency of 10 Hz. The duty-cycle of this frequency determines the air/fuel ratio.

The fuel cut-off valve is also controlled by the control unit, and does not operate with a duty cycle control. During normal driving the valve is activated. During deceleration the valve is not activated. During the control both valves are, or are not, switched to earth by the control unit.

The carburettor has a number of provisions differing from the usual systems for cold start, fast idle speed, engine speed compensation with air-conditioning switched on, etc.

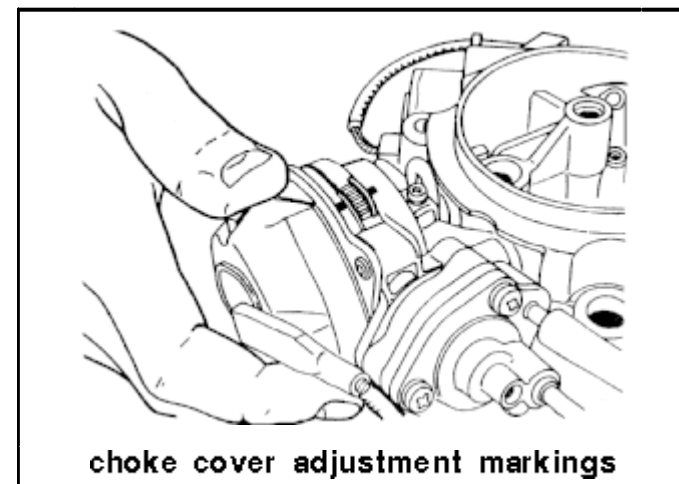
Cold start system

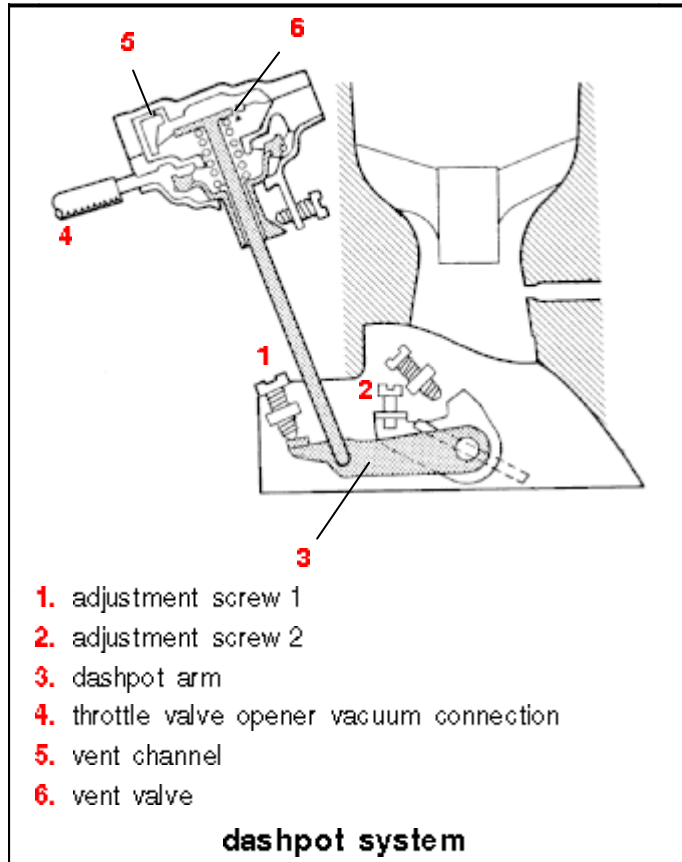


Before starting the cold engine, the accelerator pedal is depressed once. The choke valve and cam plate take up their correct positions. After firing, the inlet manifold vacuum operates the choke valve opener to prevent an over rich mixture. At a temperature above 18 °C: the inlet manifold vacuum is led to the second choke valve opener via the thermo/vacuum valve. The choke valve opens further.

After a short time, the choke heating element has warmed the bi-metal spring enough to open the choke valve. If the accelerator pedal is not operated, the engine speed will rise. By operating the accelerator pedal the cam plate will turn and adjust the engine speed to a lower value.

To prevent the engine speed rising too high during warm-up with the throttle valve untouched, a pull-down diaphragm is fitted. Above 65 °C: the thermo/vacuum valve controls the inlet manifold vacuum to operate the pull-down diaphragm. The cam plate turns anti-clockwise, the engine speed drops.



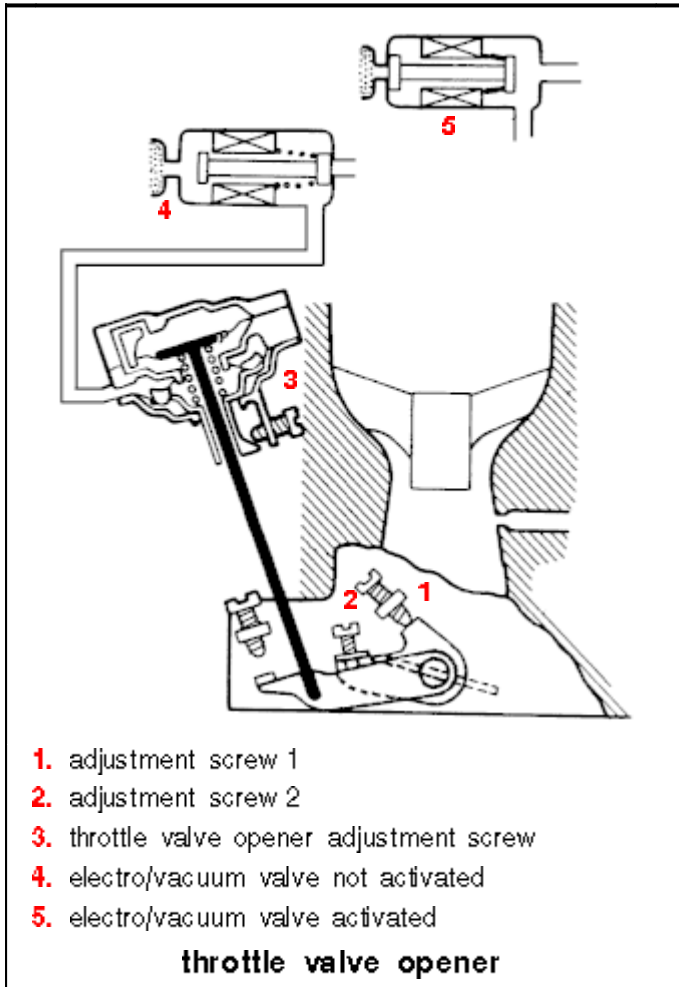
Dashpot system

Whilst driving: the dashpot pin is depressed and the dashpot arm rests against adjustment screw 1. When the accelerator pedal is released, the throttle valve will close until adjustment screw 2 in the throttle valve arm touches the dashpot arm. The throttle valve closure is now retarded through vacuum in the upper dashpot chamber being slowly released by air flowing through the vent channel. The vent valve in the upper dashpot prevents delay in throttle valve opening.

Dashpot touch speed adjustment

Run the engine at idle speed. Turn the throttle valve until adjustment screw 2 touches the dashpot arm.

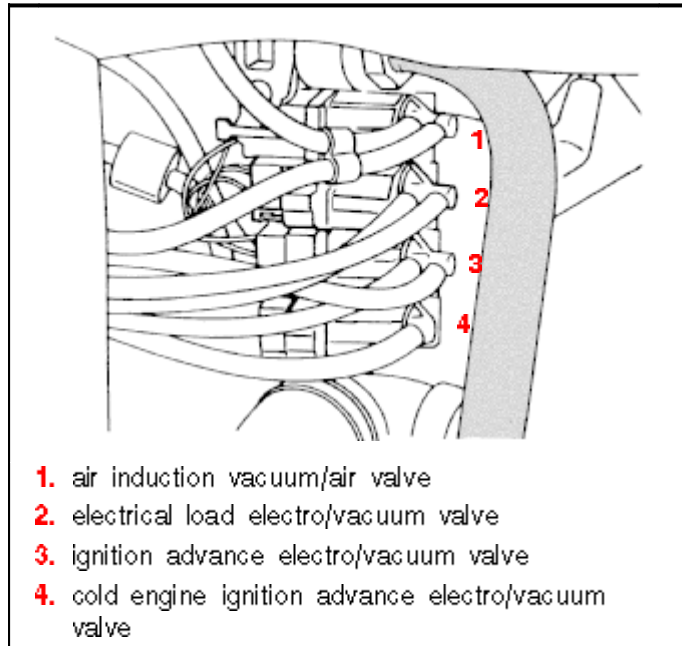
dashpot touch speed	1800/min
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Throttle valve opener

The carburettor has one or two throttle valve openers. The throttle valve opener, that is activated when switching on current consumers, or with power steering running, is built as a unit with the dashpot system. On versions with air-conditioning: a second throttle valve opener is fitted. Both throttle valve openers are operated by the inlet manifold vacuum. The vacuum operates the throttle valve openers if the electro/vacuum valves are activated by the control unit.

EGR system

With coolant temperatures below 70 °C: the thermo/vacuum valve is open. The EGR valve is not activated. With the engine at idle speed and at full load: the vacuum is too low to operate the EGR valve.

Air induction system

The air induction system provides an air supply to the exhaust system so that after burning can take place in the exhaust. The air induction vacuum/air valve is controlled by the carburettor control unit. The activation of the system depends on: the inlet vacuum, coolant temperature and throttle valve position.

Air compensation system

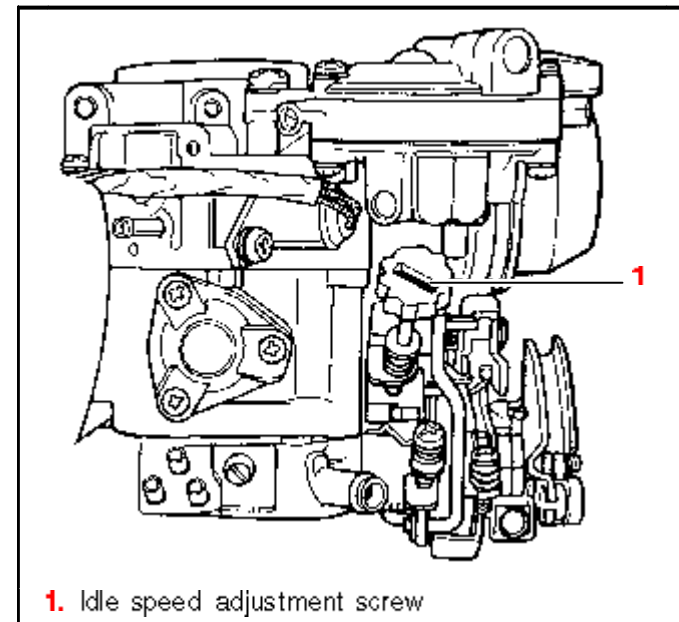
The air filter has a thermo valve that opens at temperatures above approx. 60 °C. When the thermo valve is opened: the engine induces a small amount of air to the inlet system. The result is a leaner mixture.

Adjustments

Run the engine to operating temperature. Switch off all electrical consumers. Place automatic transmission in "N" or "P". On versions with power steering: place the wheels straight ahead. The ignition timing setting must be correct.

Idle speed

idle speed	
versions with manual gearbox	800 ± 50 /min
versions with automatic transmission	850 ± 50 /min



Depress the accelerator pedal once to switch off the fast idle speed. Set the idle speed with the adjustment screw.

CO-percentage

CO-percentage	1,0 ± 0,5%
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The CO-percentage does not normally need adjustment.

Fast idle speed

fast idle speed	2800 /min
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Fault finding

All measurements are made with control unit connected. The connectors in the tables are the connector terminals of the various components. With any deviations: first check the wiring to the control unit and its earth connection before renewing components. The *control unit connection* and *connector No.* are the same as shown in the wiring diagram.

ignition switch		
location: on the steering column		
signal ; connector connected; ignition on		
<i>control unit connection</i>	<i>component connector No.</i>	<i>test value</i>
7	4	11,0 - 13,0 V
earth	—	
signal ; connector disconnected; ignition on; measure in the connector on wiring harness side		
<i>control unit connection</i>	<i>component connector No.</i>	<i>test value</i>
7	4	11,0 - 13,0 V
earth	—	

throttle valve potentiometer		
location: on the throttle shaft		
feed ; connector disconnected; ignition on; measure in the connector on wiring harness side		
<i>component connector No.</i>	<i>test value</i>	
1	5,0 V	
earth		
signal ; connector connected; ignition on		
<i>control unit connection</i>	<i>component connector No.</i>	<i>test value</i>
13	2	accelerator pedal released: 0,4 - 0,7 V
earth	—	accelerator pedal fully depressed: 4,5 - 5,5 V

resistance ; connector disconnected; ignition off; measure in the connector	
<i>component connector No.</i>	<i>test value</i>
3	continuity
earth	
resistance ; connector disconnected; ignition off; measure on the throttle valve potentiometer	
<i>component connector No.</i>	<i>test value</i>
3	accelerator pedal released: 0 Ω
2	accelerator depressed: 3500 - 6500 Ω

coolant temperature sensor		
signal ; connector connected; ignition on		
<i>control unit connection</i>	<i>component connector No.</i>	<i>test value</i>
12	1	+0 °C: 3,4 - 3,6 V +20 °C: 2,4 - 2,7 V
earth	—	+40 °C: 1,5 - 1,8 V +80 °C: 0,5 - 0,7 V
feed ; connector disconnected; ignition on; measure in the connector on wiring harness side		
<i>component connector No.</i>		<i>test value</i>
1		4,4 - 5,0 V
earth		
resistance ; sensor removed; measure on the sensor at different temperatures		
<i>component connector No.</i>		<i>test value</i>
1		+0 °C: 5900 Ω +20 °C: 2500 Ω
2		+40 °C: 1100 Ω +80 °C: 300 Ω

oxygen sensor		
location: in exhaust manifold		
signal ; connector connected; run warm engine at not less than 1300/min		
<i>control unit connection</i>	<i>component connector No.</i>	<i>test value</i>
1	1	voltage fluctuates
earth	—	

engine speed sensor		
location: in the distributor		
signal ; run engine at idle speed		
<i>control unit connection</i>	<i>component connector No.</i>	<i>test value</i>
10	ignition coil negative	2,0 - 8,0 V pulses
earth	—	

ignition coil	
resistance ; connectors disconnected; measure on the ignition coil	
<i>component connector No.</i>	<i>test value</i>
primary resistance	1,08 - 1,32 Ω
secondary resistance	11700 - 15800 Ω
ballast resistor	1,22 - 1,49 Ω

vacuum switch	
location: against firewall	
feed ; connector disconnected; ignition on; measure in the connector on wiring harness side	
<i>component connector No.</i>	<i>test value</i>
2	11,0 - 13,0 V
earth	

signal; connector connected		
<i>control unit connection</i>	<i>component connector No.</i>	<i>test value</i>
5	2	ignition on; engine cold: 9,0 - 13,0 V run at idle speed: max. 0,6 V
earth	—	
resistance ; connector disconnected; ignition off; measure on the vacuum switch; raise vacuum with a vacuum pump		
<i>component connector No.</i>		<i>test value</i>
1		no vacuum: open circuit vacuum: continuity
2		

power steering switch	
location: in the power steering pump	
feed ; connector disconnected; ignition on; measure in the connector on wiring harness side	
<i>component connector No.</i>	<i>test value</i>
1	11,0 - 13,0 V
earth	
resistance ; connector disconnected; engine at idle; measure on the switch	
<i>component connector No.</i>	<i>test value</i>
power steering switch connection	steering straight ahead: open circuit
earth	steering at full lock: continuity

mixture control valve		
location: in the carburettor		
feed ; connector connected		
<i>control unit connection</i>	<i>component connector No.</i>	<i>test value</i>
59	1	ignition on: 11,0 - 13,0 V run warm engine at idle speed: 2,0 - 12,0 V
earth	—	
feed ; connector disconnected; ignition on; measure in the connector on wiring harness side		
<i>component connector No.</i>		<i>test value</i>
4		11,0 - 13,0 V
earth		

function test; connector disconnected	
<i>component connector No.</i>	<i>test value</i>
battery positive to 4	mixture control valve must click
battery negative to 1	
resistance; mixture control valve removed	
<i>component connector No.</i>	<i>test value</i>
measure between the connector terminals	54 - 66 Ω
measure between connector terminals and housing	open circuit

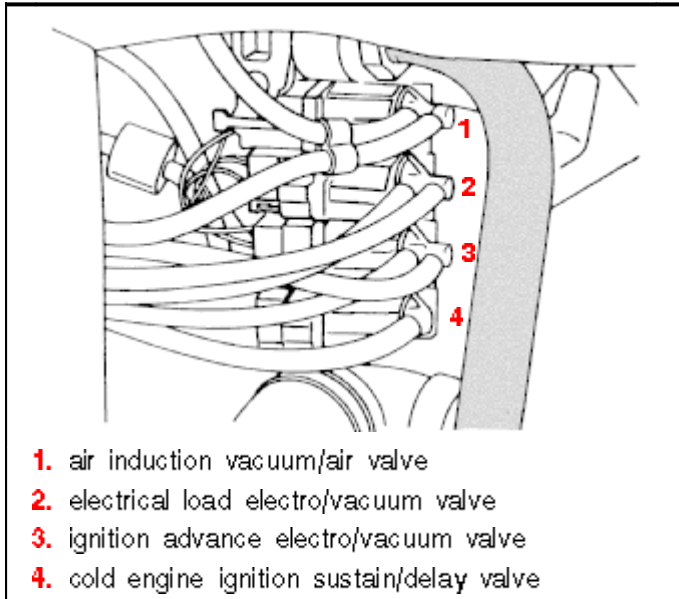
fuel cut-off valve		
location: in the carburettor		
signal; connector connected		
<i>control unit connection</i>	<i>component connector No.</i>	<i>test value</i>
53	2	run engine at idle speed: 0,0 - 0,6 V release throttle at 4000/min: 13,0 - 15,0 V
earth	—	
feed; connector disconnected; ignition on; measure in the connector on wiring harness side		
<i>component connector No.</i>		<i>test value</i>
5		11,0 - 13,0 V
earth		

function test; connector disconnected	
<i>component connector No.</i>	<i>test value</i>
battery positive to 5	fuel cut-off valve must click
battery negative to 2	
resistance; fuel cut-off valve removed	
<i>component connector No.</i>	<i>test value</i>
measure between the connector terminals	48 - 60 Ω
measure between the connector terminals and housing	open circuit

air induction vacuum/air valve		
signal; connector connected; engine at operating temperature		
<i>control unit connection</i>	<i>component connector No.</i>	<i>test value</i>
55	2	run engine for a short time: voltage rises from 0 V to 13,0 - 15,0 V release throttle at 2000/min: voltage drops back briefly
earth	—	
feed; connector disconnected; ignition on; measure in the connector		
<i>component connector No.</i>		<i>test value</i>
2		11,0 - 13,0 V
earth		
resistance; connector disconnected		
<i>component connector No.</i>		<i>test value</i>
measure between the connector terminals		38 - 44 Ω

ignition advance electro/vacuum valve		
signal ; connector connected; engine at operating temperature		
<i>control unit connection</i>	<i>component connector No.</i>	<i>test value</i>
52	1	run engine at idle speed: 0,0 - 0,6 V
earth	—	run engine at 2000/min: 13,0 - 15,0
feed ; connector disconnected; ignition on; measure in the connector on wiring harness side		
<i>component connector No.</i>		<i>test value</i>
2		11,0 - 13,0 V
earth		
resistance ; connector disconnected		
<i>component connector No.</i>		<i>test value</i>
measure between the connector terminals		38 - 44 Ω

function test ; connector disconnected; vacuum hoses disconnected; vacuum pump to black connection	
<i>component connector No.</i>	<i>test value</i>
battery positive to 2	continuity
battery negative to 1	
no supply voltage	closed
function test ; connector disconnected; vacuum hoses disconnected; vacuum pump to blue/striped connection	
<i>component connector No.</i>	<i>test value</i>
battery positive to 2	closed
battery negative to 1	
no supply voltage	continuity



cold engine ignition advance electro/vacuum valve	
feed; connector disconnected; ignition on; measure in the connector on wiring harness side	
<i>component connector No.</i>	<i>test value</i>
2	11,0 - 13,0 V
earth	
resistance; connector disconnected	
<i>component connector No.</i>	<i>test value</i>
measure between the connector terminals	38 - 44 Ω
function test; connector disconnected; vacuum hoses disconnected; vacuum pump to yellow/striped connection	
<i>component connector No.</i>	<i>test value</i>
battery positive to 2	closed
battery negative to 1	
no supply voltage	continuity

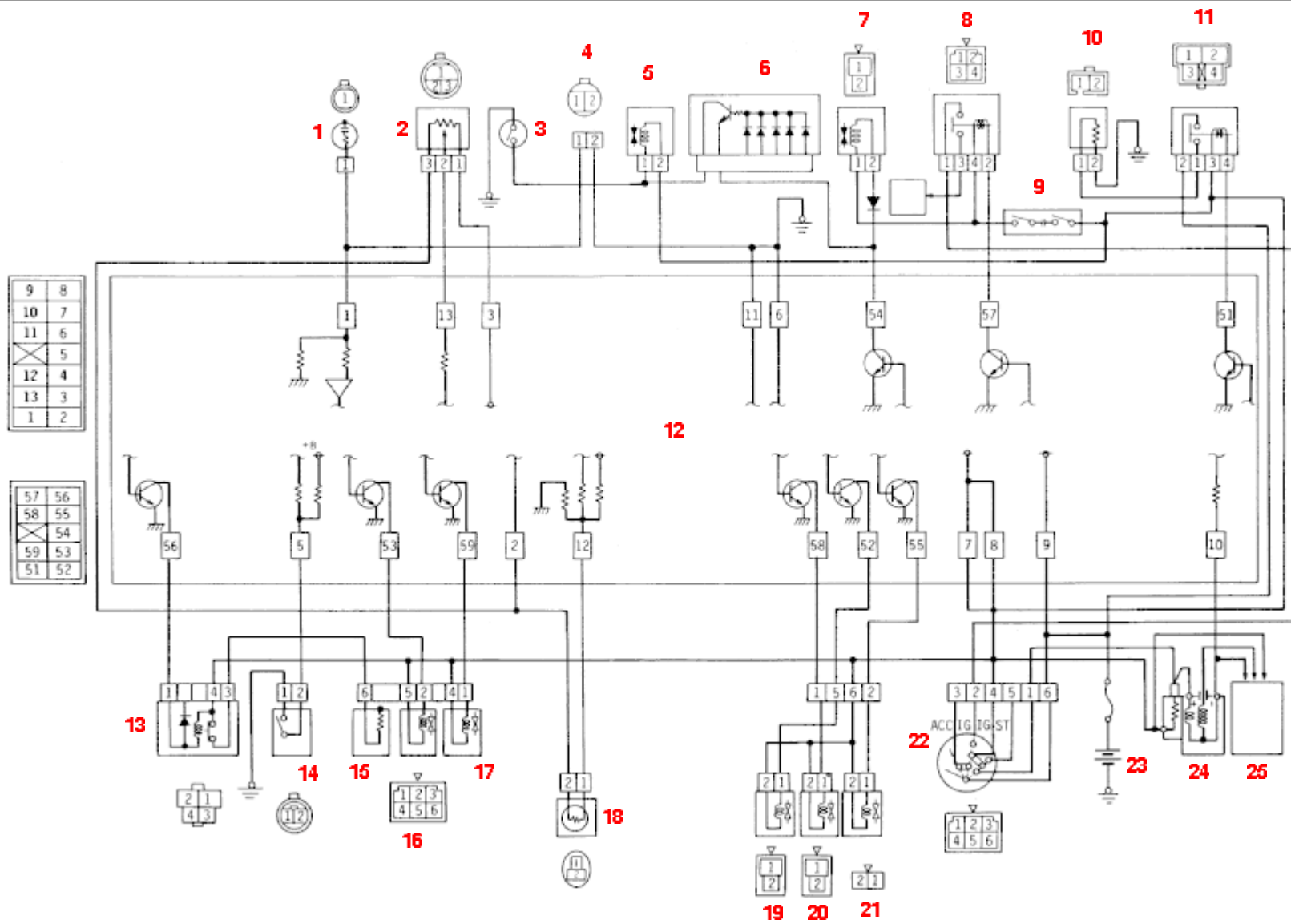
electrical load throttle valve adjuster		
signal ; connector connected; engine at operating temperature; lighting switched on		
<i>control unit connection</i>	<i>component connector No.</i>	<i>test value</i>
54	1	run engine at idle speed: 0,0 - 0,6 V
earth	—	run engine at 2000/min: 13,0 - 15,0
feed ; connector disconnected; ignition on; measure in the connector on wiring harness side		
<i>component connector No.</i>		<i>test value</i>
2		11,0 - 13,0 V
earth		
resistance ; connector disconnected		
<i>component connector No.</i>		<i>test value</i>
measure between the connector terminals		38 - 44 Ω

Check relay**Mixture pre-heating and choke heating relays**

Check the mixture pre-heating and choke heating element relays by checking the feed with reference to the wiring diagram. The relays are energised by the control unit.

Electrical load relay (transistor relay)

The electrical load relay is activated if a number of electrical consumers are switched on. The idle speed electro/vacuum valve is activated. The inlet manifold vacuum flows to the throttle valve opener. The idle speed increases.



- | | | | |
|--------------------------------------|-------------------------------|---|---|
| 1. oxygen sensor | 9. air-conditioning switch | 16. fuel cut-off valve | 21. thermo/air valve |
| 2. throttle valve potentiometer | 10. mixture pre-heating | 17. mixture control valve | 22. ignition switch |
| 3. power steering switch | 11. mixture pre-heating relay | 18. coolant temperature sensor | 23. battery |
| 4. oxygen sensor test connection | 12. control unit | 19. ignition advance electro/vacuum valve | 24. ignition coil with ballast resistor |
| 5. idle speed electro/vacuum valve | 13. choke heating relay | 20. cold engine ignition advance electro/vacuum valve | 25. distributor |
| 6. electrical load relay | 14. vacuum switch | | |
| 7. idle speed electro/vacuum valve | 15. choke heating element | | |
| 8. air-conditioning compressor relay | | | |

electronically controlled carburettor