

PRINCIPLES OF OPERATION : COOLING SYSTEM

The DW10BTED4 engines have a cooling circuit with a new regulation system : Cooling system with electronic regulation.

This system permits control of :

- The heat exchanging circuit (Control of the flows and volume of coolant used)
- The flow of air at the front panel

3 components are used to carry out this function :

- A degas solenoid valve which controls the opening and closing of the degas branch of the cylinder head
- A coolant flow solenoid valve which controls the opening and closing of the by-pass branch of the engine
- A single effect mechanical thermostat which controls the opening and closing of the radiator branch

The reduction of the flow of coolant inside the engine during the starting phases permits :

- Speeding up of the increase in the temperature of the walls of the combustion chamber
- A significant reduction in the heat losses at the walls and of the friction of the piston/rings/cylinder assembly

The reduction in the useful volume of coolant during the starting phases permits speeding up of the increase in temperature :

- Coolant
- Passenger compartment by means of a faster supply of power at the heater matrix (Increase in passenger compartment temperature of 2 to 3 degrees Celsius)

1. Identification

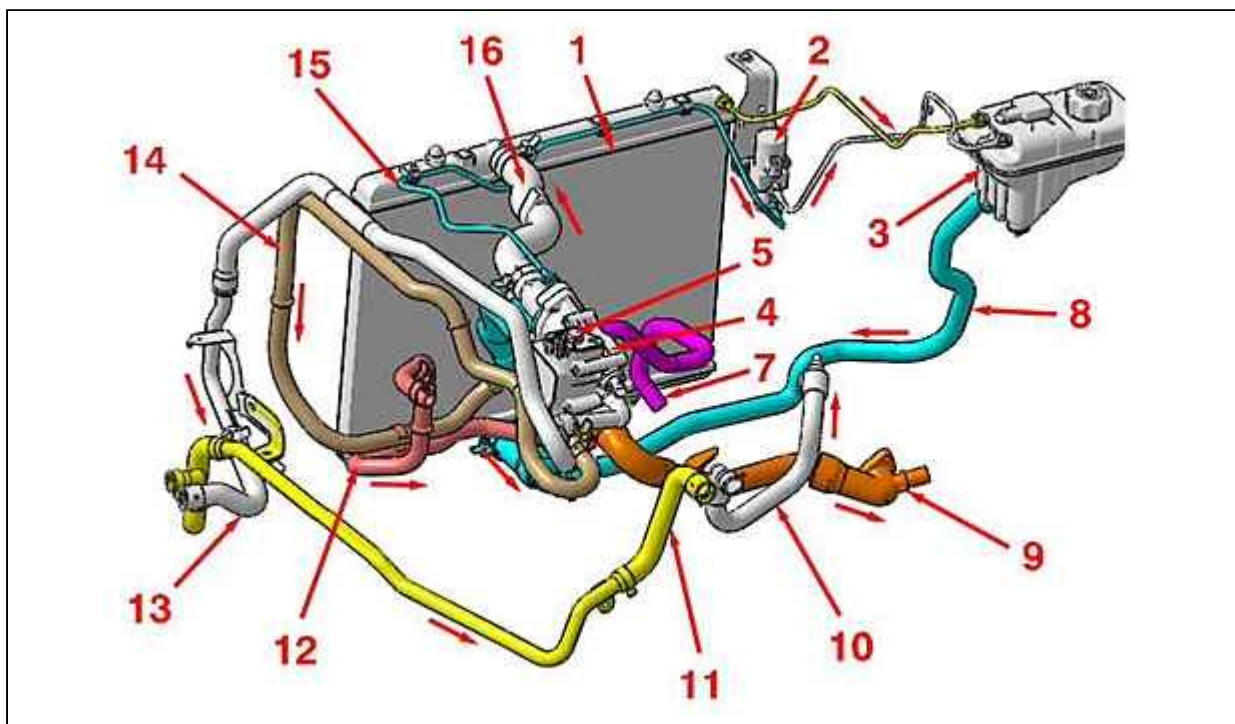


Figure : B1GKB22D

- (1) Radiator.
- (2) Coolant degas solenoid valve .
- (3) Expansion chamber.
- (4) Water outlet housing .
- (5) Coolant flow solenoid valve .

Water pipes :

- (7) Water/oil heat exchanger outlet (engine)
- (8) Radiator outlet
- (9) By-pass pipe (Water outlet housing to the water inlet manifold)
- (10) Heater matrix outlet
- (11) Additional burner outlet - To the heater matrix inlet (According to specification)
- (12) Water/automatic gearbox oil exchanger inlet (According to specification)
- (13) Additional burner inlet (According to specification)
- (14) Water/oil heat exchanger outlet (automatic gearbox - According to specification)
- (15) Cylinder head degassing
- (16) Radiator inlet

2. Description

2.1. Coolant degas solenoid valve (2)

The solenoid valve controls the volume of coolant in the degas circuit during the temperature increase phase.

The solenoid valve limits the circulation of coolant from the water outlet housing to the expansion chamber (permits circulation of the residual air bubbles of the coolant circuit).

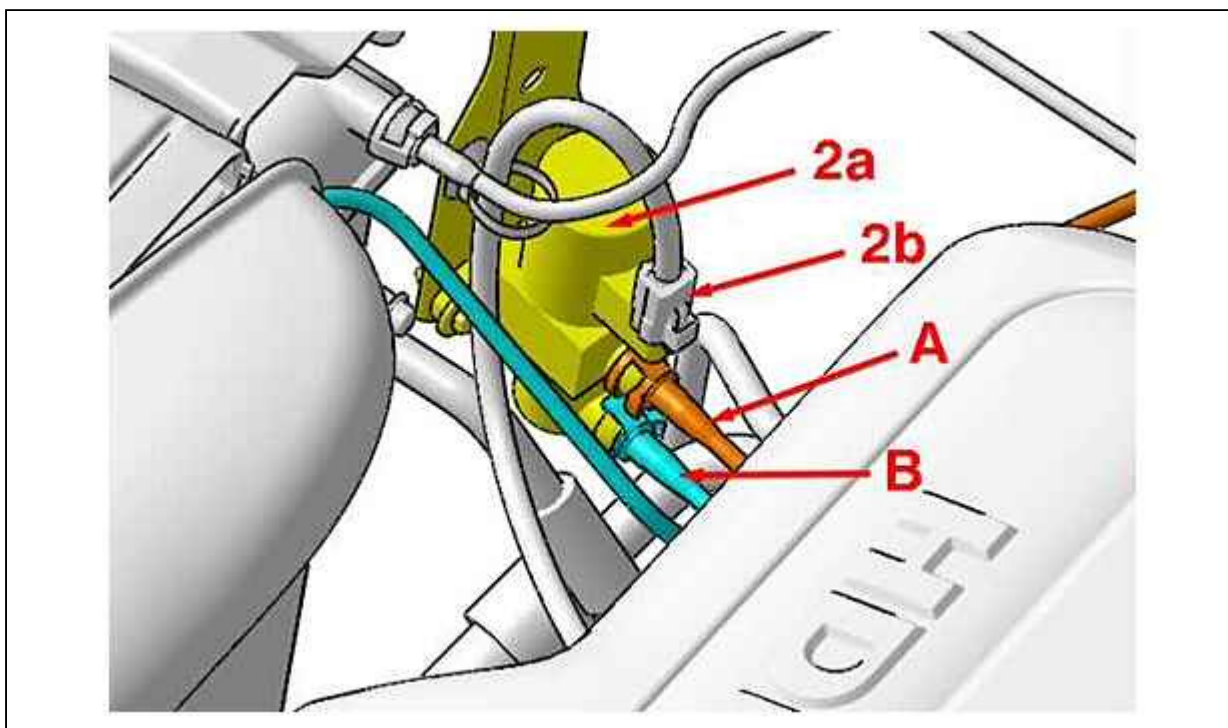


Figure : B1GKB23D

- (2a) Coil control.
- (2b) Electrical connector.

(A) Outlet to the expansion chamber .

(B) Water outlet housing feed .

The solenoid valve control is of the all or nothing type and is managed by a map (injection ecu) :

- Supply = Solenoid valve closed (No circulation of coolant)
- No supply = solenoid valve open (Water circulation)

Installation :

- 307 : On the radiator
- 407 : On a support lug near the radiator

2.2. Coolant flow solenoid valve (5)

The solenoid valve controls the flow of coolant in the by-pass circuit during the temperature increase phase.

The solenoid valve limits the circulation of coolant inside the engine in order to speed up the increase in the temperature of the engine.

The solenoid valve closes the by-pass circuit in order to force the flow into the radiator.

Installation : Incorporated in the water outlet housing.

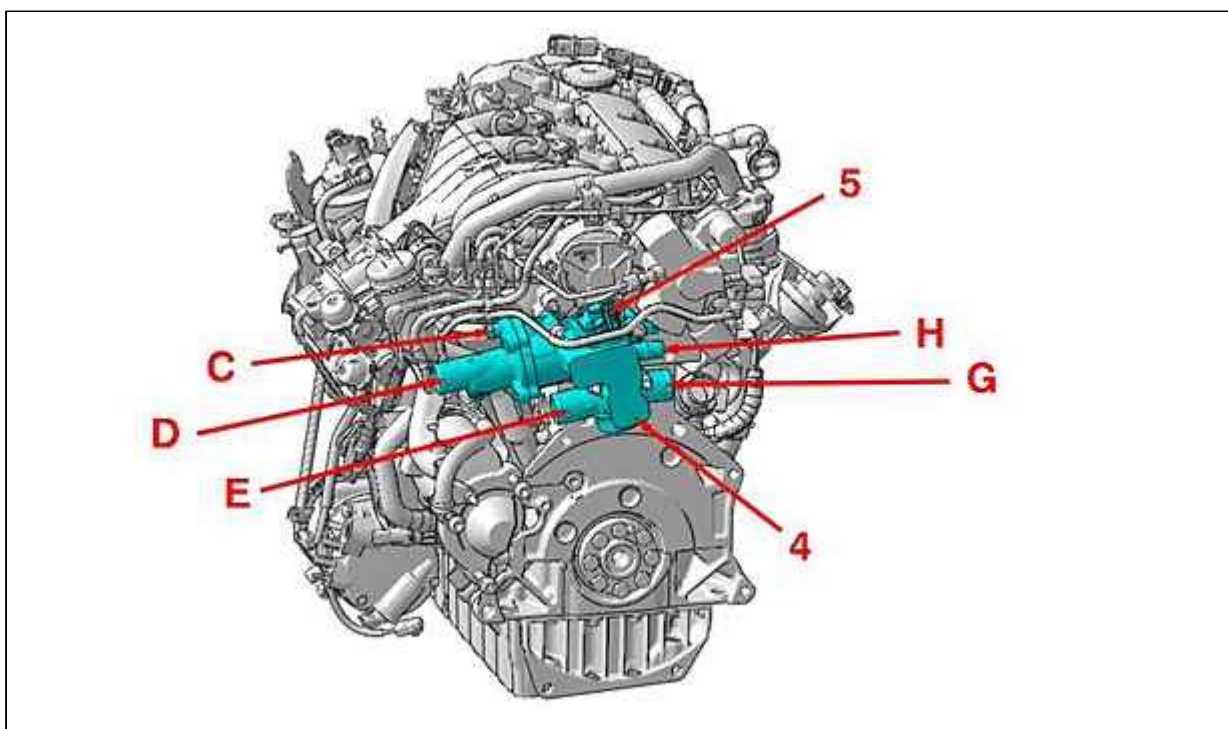


Figure : B1GKB24D

(4) Water outlet housing .

(5) Electrovalve.

(C) Outlet to the expansion chamber (Via the degas solenoid valve) .

(D) Outlet to the radiator .

(E) Radiator return .

(G) Outlet to the water inlet manifold .

(H) Outlet to the heater matrix .

Operation : The piston moves under the action of the magnetic field created by an electromagnet.

The flow of coolant is regulated by movement of the slide valve/piston/modification of the calibration of the spring.

The control of the solenoid valve is of the progressive type and is managed by a map :

- Max voltage = Solenoid valve closed (No flow of coolant inside the engine, leak off only)

- Min voltage = solenoid valve open (Flow of coolant in the engine)

URGENT : Use the approved coolant only ; Any other coolant results in a malfunction of the coolant flow solenoid valve.

2.3. Single effect mechanical thermostat (6)

The thermostat controls the opening and closing of the radiator branch.

Installation : Incorporated in the water outlet housing.

Operation : When the coolant warms up :

- The wax element expands and increases the volume
- The increase in volume acts on a piston which is in contact with the fixed body via a rubber diaphragm
- The small valve opens (Partial flow)
- The large valve opens (Total flow)

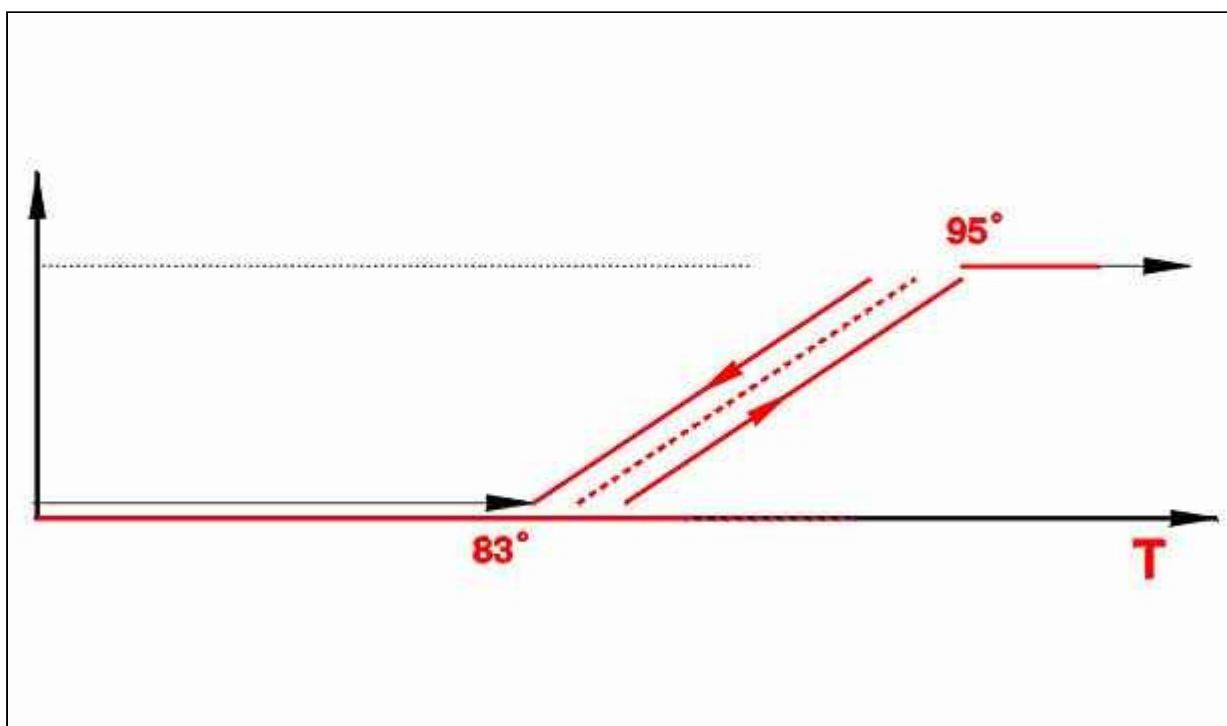


Figure : B1GKB25D

Thermostat	Engine coolant temperature (T : In degrees C)
Start of opening	83
Full opening	95

CAUTION : Any work on the components of the thermostat is prohibited.

3. Operation

3.1. Engine cold

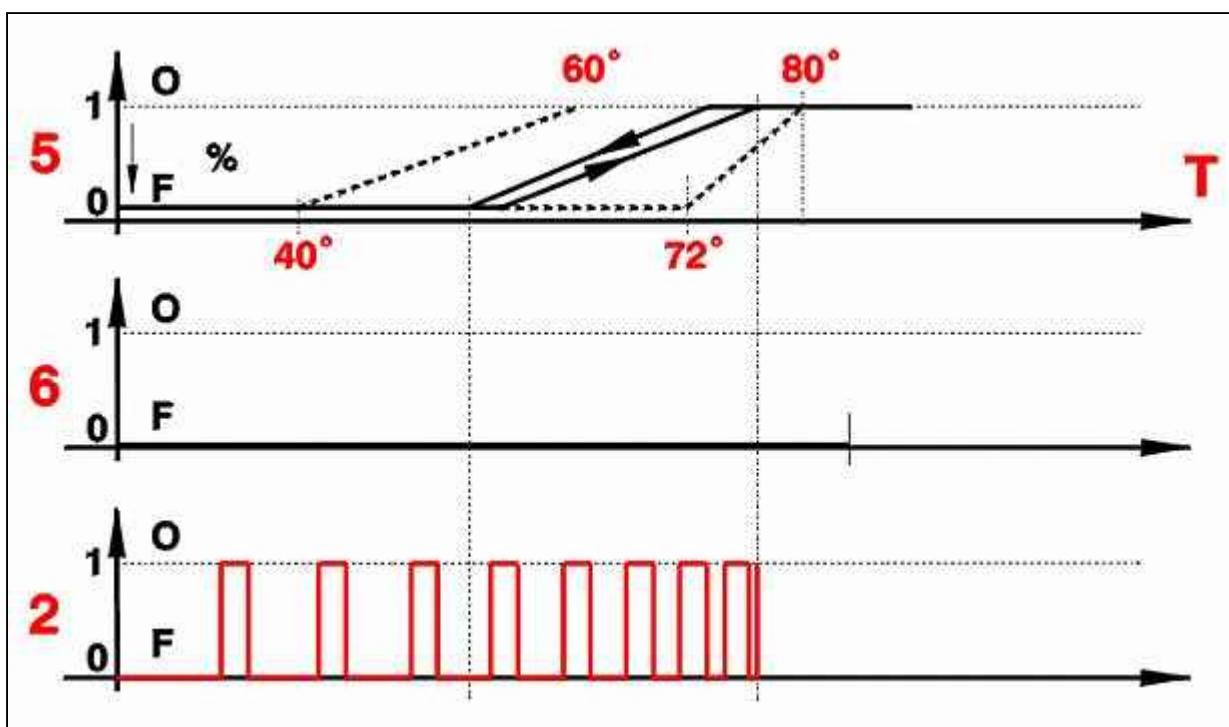


Figure : B1GKB27D

T : Engine coolant temperature (In degrees C) .

% : Variable voltage control .

O : Open.

F : Closed.

Coolant flow solenoid valve (5) :

- The by-pass valve is controlled (= closed position) (Leak off only)
- During the temperature increase phase, the by-pass valve progressively returns to the open position, in relation to the temperature of the coolant

Mechanical thermostat (6) : The thermostat is in the closed position.

Coolant degas solenoid valve (2) :

- The purpose of the control of the volume of coolant used is to reduce the temperature lag of the cooling circuit
- This speeds up the increase in the temperature of the coolant

N.B. : The cylinder head degas circuit represents up to 50% of the volume of coolant used during the engine cold phase.

In order to avoid down-grading the functions of the degas circuit, the flow is controlled in relation to the temperature of the engine.

The degas branch is closed periodically.

3.2. With the engine hot

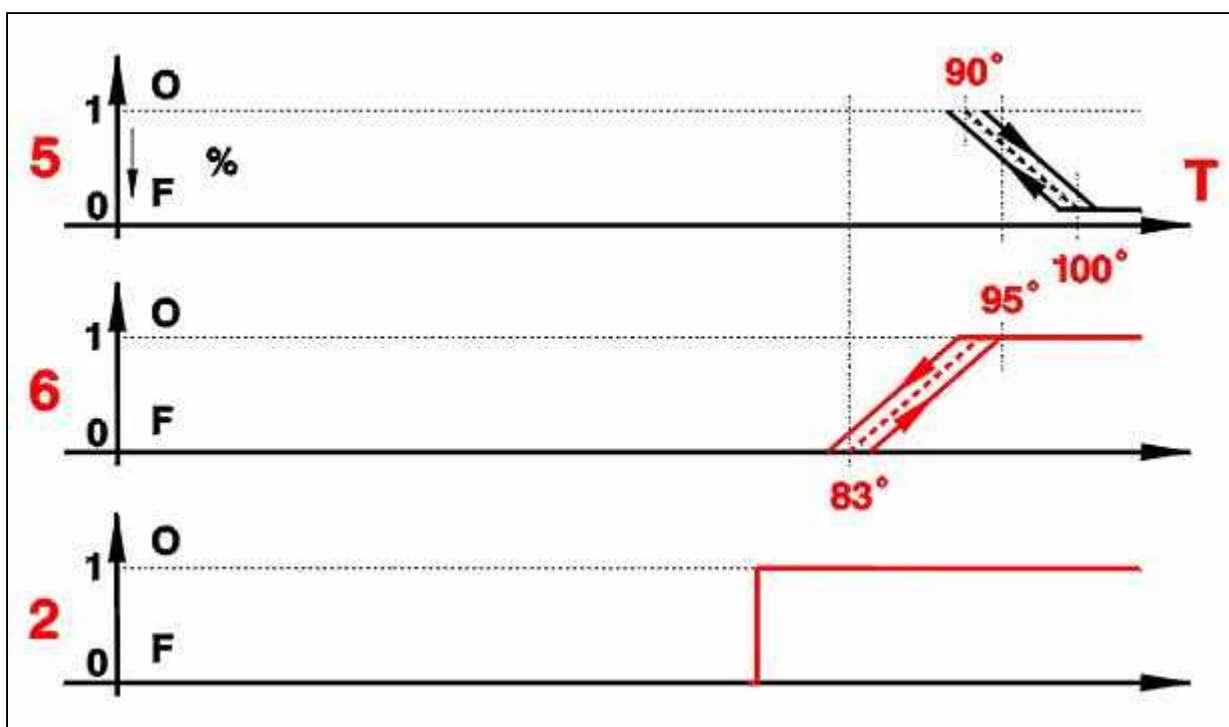


Figure : B1GKB26D

T : Engine coolant temperature (In degrees C) .

% : Variable voltage control .

O : Open.

F : Closed.

Coolant flow solenoid valve (5).

In order to force the flow into the radiator branch, the by-pass is closed again progressively in relation to the coolant temperature information.

Mechanical thermostat (6) : The thermostat is in the open position.

Coolant degas solenoid valve (2) : The solenoid valve remains open, the degas flow becomes continuous again.

4. Circulation of the coolant

4.1. Engine cold

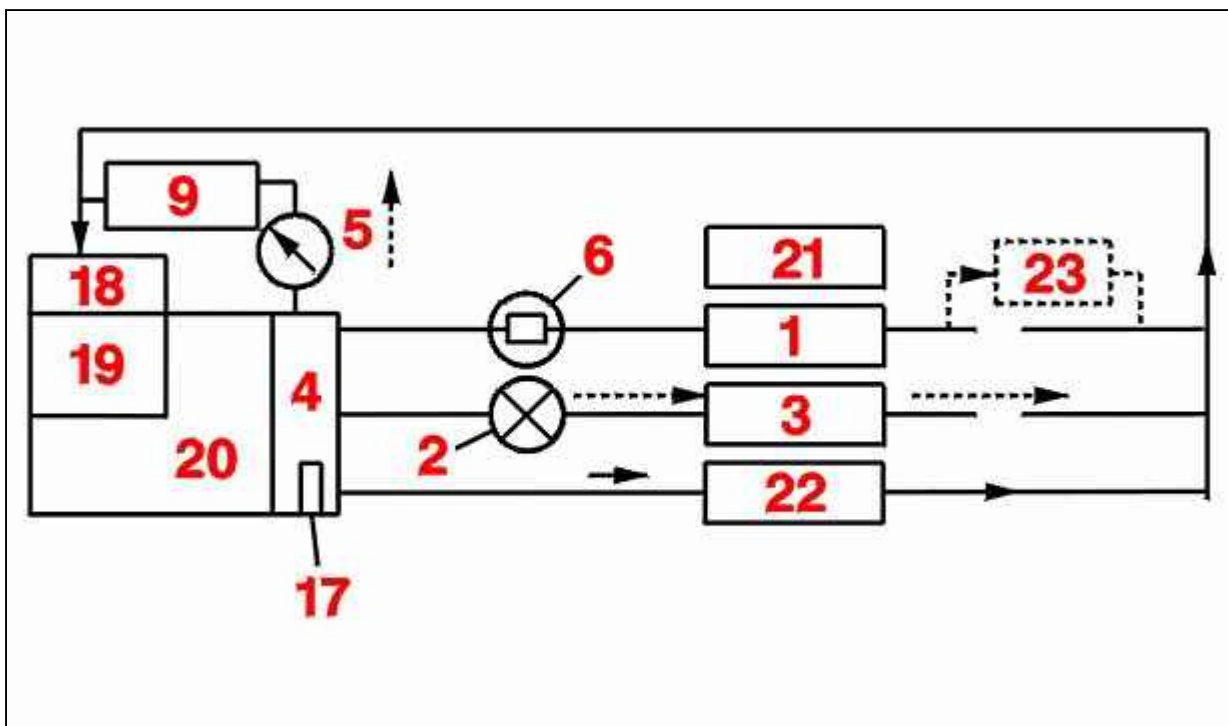


Figure : B1GKB28D

Key :

- Circulation of the coolant (Continuous line arrow)
- Partial circulation of the coolant (Dotted line arrow)

- (1) Radiator.
- (2) Degas solenoid valve .
- (3) Expansion chamber.
- (4) Water outlet housing .
- (5) Coolant flow solenoid valve .
- (6) Mechanical thermostat .
- (9) By-pass pipe (Water outlet housing to the water inlet manifold) .
- (17) Coolant temperature sensor.
- (18) Coolant inlet manifold .
- (19) Coolant pump.
- (20) engine.
- (21) Fan.
- (22) heater matrix.
- (23) Water/fluid heat exchanger (automatic gearbox) .

4.2. Rise in engine temperature

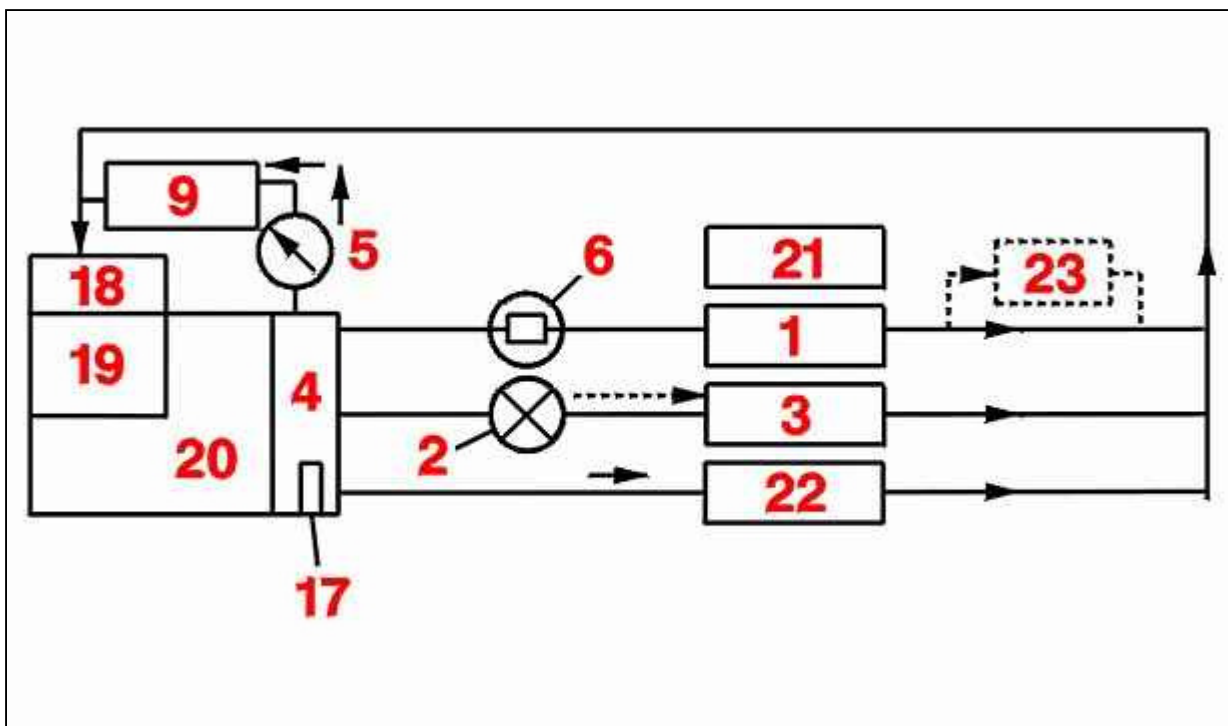


Figure : B1GKB29D

Key :

- Circulation of the coolant (Continuous line arrow)
- Partial circulation of the coolant (Dotted line arrow)

- (1) Radiator.
- (2) Coolant degas solenoid valve .
- (3) Expansion chamber.
- (4) Water outlet housing .
- (5) Coolant flow solenoid valve .
- (6) Mechanical thermostat .
- (9) By-pass pipe (Water outlet housing to the water inlet manifold) .
- (17) Coolant temperature sensor.
- (18) Coolant inlet manifold .
- (19) Coolant pump.
- (20) engine.
- (21) Fan.
- (22) heater matrix.
- (23) Water/fluid heat exchanger (automatic gearbox) .

4.3. With the engine hot

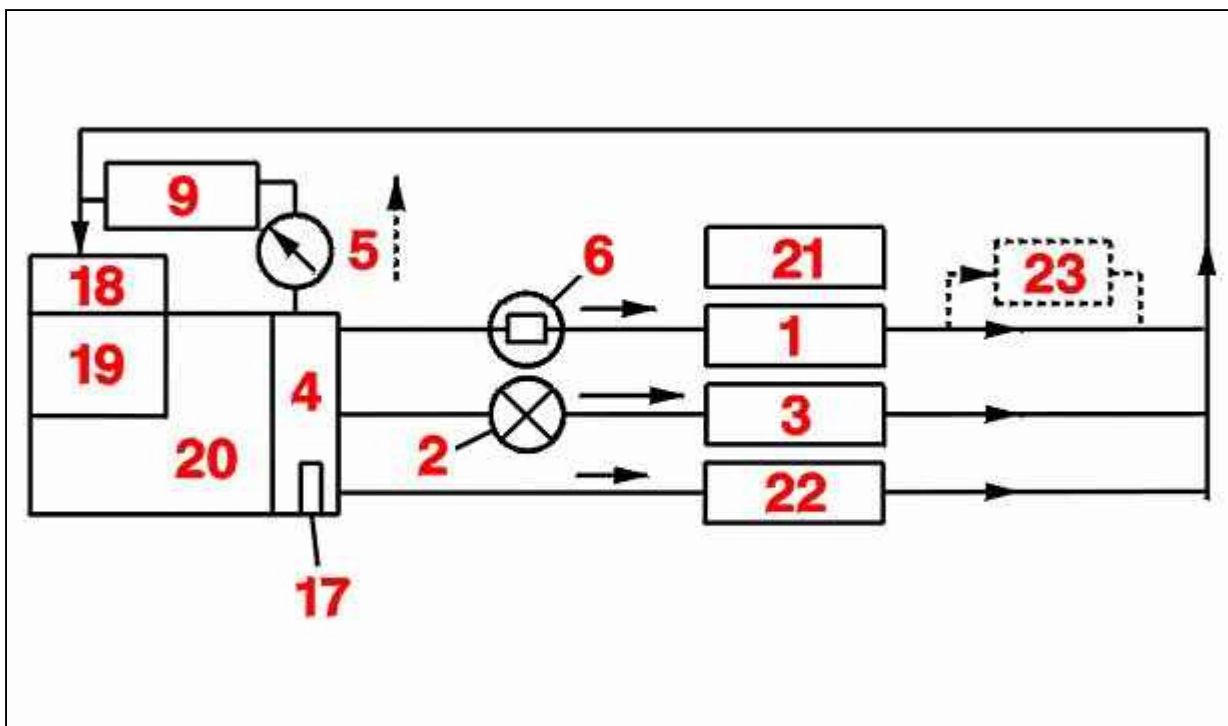


Figure : B1GKB2AD

Key :

- Circulation of the coolant (Continuous line arrow)
- Partial circulation of the coolant (Dotted line arrow)

- (1) Radiator.
- (2) Degas solenoid valve .
- (3) Expansion chamber.
- (4) Water outlet housing .
- (5) Coolant flow solenoid valve .
- (6) Mechanical thermostat .
- (9) By-pass pipe (Water outlet housing to the water inlet manifold) .
- (17) Coolant temperature sensor.
- (18) Coolant inlet manifold .
- (19) Coolant pump.
- (20) engine.
- (21) Fan.
- (22) heater matrix.
- (23) Water/fluid heat exchanger (automatic gearbox) .