Document title	Heat management, basic function
Document number	gf0710p9900a

Engine all (CAR)

Overview

This document contains information on:

- **General**
- **Function requirements**
- **Function**

General

Heat management essentially controls and regulates the following systems:

- Engine cooling
- Transmission cooling (in automatic and dual-clutch transmissions)
- Charge air cooling
- Vehicle interior heating

The combustion engine control unit regulates the coolant temperature, the exhaust gas temperature and the fuel pressure of the engine. The following advantages arise from this:

- Rapid reaching of the optimal operating temperature
- Reduction of the exhaust emissions
- Fuel savings
- Improved heating comfort
- Component protection for a high engine load

To control the heat management, the combustion engine control unit reads in e.g. the following signals:

- Engine oil temperature sensor
- Charge air temperature
- Intake air temperature
- Boost pressure
- Coolant temperature
- Temperature sensor upstream of diesel particulate filter or gasoline particulate filter
- DPF or OPF differential pressure sensor
- Accelerator pedal position
- Fuel temperature
- Engine speed
- Temperature in combustion engine control unit

The combustion engine control unit also evaluates the following variables:

- Status of the air conditioning system for rotational speed and torque adjustment
- Vehicle speed
- Wheel speed
- Transmission oil temperature (in automatic and dual-clutch transmissions)
- Outside temperature

Function requirements

- Circuit 87M (Engine management ON)
- Engine in operation

Function

Heat management is controlled by the combustion engine control unit and the powertrain control unit. The combustion engine control unit regulates and controls liquid cooling in the engine. The powertrain control unit controls and regulates air cooling of the engine, as well as the components that are to be cooled by the low and medium-temperature circuits.

The thermal management function encompasses the following subfunctions:

- *Coolant thermostat heating*
- *Fan control*
- *Overheating protection*
- *Heating system switch-off*
- *Air flap control*

Coolant thermostat heating

The temperature of the coolant can be controlled variably by the heated coolant thermostats. The coolant thermostats contain heating elements that are actuated as required by the combustion engine control unit using a ground signal.

Fan control

The powertrain control unit actuates the fan motor directly. The combustion engine control unit sends the specified fan speed to the powertrain control unit. If the powertrain control unit does not receive a valid fan request, the fan motor is actuated at maximum rpm. In the case of a fault in the signal line (loss of frequency) by the powertrain control unit, the fan motor switches itself to the maximum rpm (fan emergency mode).

The climate control control unit sends the status of the air conditioning system and the fan request to the electronic ignition lock and the powertrain control unit.

Delayed fan switch off:

If the coolant temperature, the temperature of the combustion engine control unit or a heat input integral calculated from engine load, coolant temperature, vehicle speed and outside temperature exceeds a specified threshold value, the fan motor continues to run for up to 5 min after ignition OFF. If the battery voltage drops down a lot, the delayed fan switch off is suppressed.

The delayed fan switch off is not broken off by "ignition ON". When starting the engine in delayed fan switch off the fan regulation for normal operation is suppressed until the delayed fan switch off is completed.

Overheating protection

In a case of thermal overload the overheating protection protects the catalytic converters against engine damage and overheating damage.

To do so, the combustion engine control unit reads in the signals from the coolant temperature sensor and the engine oil temperature sensor.

The following action is initiated to prevent overheating of the engine:

- map-dependent ignition angle setting in the direction "retarded", depending on engine load and engine speed
- map-dependent reduction of the injection quantity
- Regulation of the injection period through actuation of:
  - Quantity control valve
  - Fuel injectors
- Reduced opening of the throttle valve actuator, depending on the engine load and engine speed
- Actuation of the coolant thermostat heating element by the combustion engine control unit

Heating system switch-off

To heat the combustion engine more quickly, the combustion engine control unit switches off the coolant circuit of the heating system by means of the heating system shutoff valve.

Air flap control

The air flowing through the engine compartment is routed via an air duct (passive duct) at the hood in a targeted manner into the area between the cylinder banks in order to then flow into the component parts positioned there (exhaust gas turbocharger, catalytic converters and particulate filter).

In certain operating conditions, the air duct must be sealed via the air flap in order to prevent recirculation of the radiator exhaust air via the air duct, e.g. during engine fan operation at low vehicle speeds. The air flap releases or closes the cross section. The air flap is actuated via the engine cooling air flap actuator motor. The powertrain control unit controls the engine cooling air flap actuator motor.

	Function schematics		
	Function schematic for thermal management	Engine 608 in model 118, 177, 247	PE20.00-P-2502-97A
		Engine 282 in model 118, 177, 247	PE20.00-P-2502-97B
		Engine 260 in model 118, 177, 247Engine 264 in model 167	PE20.00-P-2502-97C
		Engine 176, 177 in model 167	PE20.00-P-2502-97D
		Engine 254, 264 in model 213, 238, 257 as of model year 2021Engine 256 in model 167Engine 256 in model 213, 238 as of model year 2021	PE20.00-P-2502-97E
		Engine 139 in model 118, 177	PE20.00-P-2502-97F
	Additional basic functions		
	Charge air cooling, basic function	Engine all (CAR)	GF09.41-P-1000A
	Engine cooling, basic function	Engine all (CAR)	GF20.00-P-1002A
	Control units		
	Combustion engine control unit, basic function	Engine all (CAR)	GF07.08-P-9890A
	Powertrain control unit, basic function	Engine all (CAR)	GF54.21-P-9894A