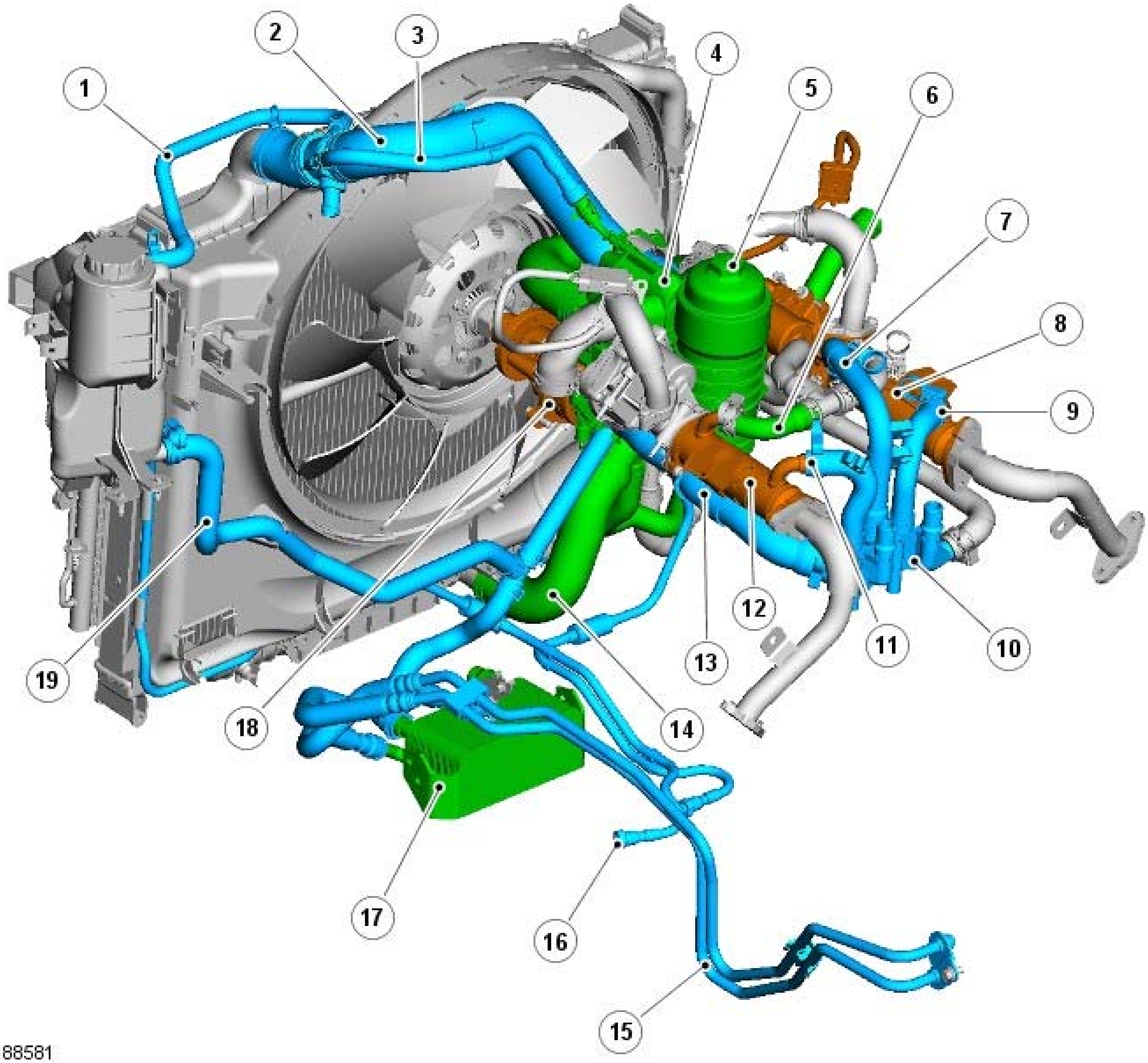

Item	Part Number	Description
1	-	Hose, radiator top hose to degas tank
2	-	Radiator top hose
3	-	Hose, engine bleed
4	-	Thermostat housing
5	-	Oil filter and oil/fuel cooler assembly
6	-	Hose, Exhaust Gas Recirculation (EGR) cooler inlet
7	-	Hose, engine oil cooler outlet
8	-	RH EGR cooler
9	-	Hose, Exhaust Gas Recirculation (EGR) cooler outlet
10	-	Coolant hose connection assembly
11	-	Hose, Exhaust Gas Recirculation (EGR) cooler inlet
12	-	LH EGR cooler
13	-	Transmission oil cooler pipes
14	-	Bottom hose
15	-	Transmission oil cooler
16	-	Fuel cooler pipes

17	-	Transmission oil cooler
18	-	Engine coolant pump
19	-	Hose, engine coolant return

After the initial warm-up phase is complete (coolant temperature between 40°C (104°F) and 70°C (158°F), depending on ambient temperature), the EGR mixer valve begins to blend cold water from the radiator outlet. This has the effect of reducing the temperature of the coolant supplied by to the EGR coolers, thus improving their effectiveness and reducing the emissions of Nitrogen Oxides (NOx). The flow rate of this coolant is controlled by a thermostatic valve located in each EGR cooler exit and ensures that maximum EGR cooling is delivered without compromising engine warm-up or cabin heater performance.

As the temperature and pressure increases the bypass valve is forced open allowing coolant to circulate through the bypass valve. When the temperature reaches 88°C (190°F) the main engine thermostat and transmission oil cooler mixer thermostat begin to open allowing coolant to circulate through the main radiator. As the thermostat progressively opens (fully open at 95°C (203°F)), the bypass valve progressively closes forcing any coolant through the heater or radiator.

Coolant flows through the radiator from the top RH tank to the bottom LH tank and is cooled by air passing through the matrix. A small flow of coolant from the radiator and the top of the engine is directed to the degas tank where any trapped air is separated.

In arduous driving conditions such as towing and/or in high ambient temperatures the radiator sub-cooled section and dedicated fuel sub-cooler radiator supply low temperature coolant to the oil/fuel coolers. This enables sufficient heat exchange into the coolant from these systems to maintain the fluid temperatures within their required limits.

The temperature of the cooling system is monitored by the ECM via the Engine Coolant temperature (ECT) sensor located in the coolant housing. The ECM uses signals from this sensor to control the cooling fan operation.

Regulation of the coolant temperature is achieved via engagement of the electro-viscous fan assembly. This is controlled by a Pulse Width Modulated (PWM) signal with a duty cycle of between 0 and 100%, provided by the ECM and derived from inputs based on:

- Coolant temperature
- Ambient air temperature
- Engine inlet air temperature
- Air Conditioning (AC) system pressure
- AC switch operation
- Transmission oil temperature

Fan speed control is variable; however, because the fan is driven directly from the engine, the maximum fan speed available is tied to engine speed. At high engine speeds the fan is progressively disengaged to protect the clutch unit. This system provides very high levels of fan power, up to 5 kilo Watts (kW), with enhanced noise and fuel economy benefits compared to mechanically controlled viscous fans.

The speed of the cooling fan is also influenced by vehicle road speed. The ECM adjusts the speed of the cooling fans, to compensate for the ram effect of vehicle speed, using the Controller Area Network (CAN) road speed signal received from the Anti-lock Braking System (ABS) module.
For additional information, refer to: Air Conditioning (412-03D Air Conditioning - TDV8 3.6L Diesel, Description and Operation).