

# DESCRIPTION AND OPERATION

## ENGINE

The 3.5L Gasoline Turbocharged Direct Injection (GTDI) (4V) is a V-6 engine with the following features:

- Dual overhead camshafts
- Four valves per cylinder
- **GTDI**
- A composite intake manifold
- Aluminum cylinder heads
- An aluminum, 60-degree V-cylinder block
- Timing chain driven coolant pump
- Twin independent Variable Camshaft Timing (VCT) system
- The electronic ignition system with 6 ignition coils

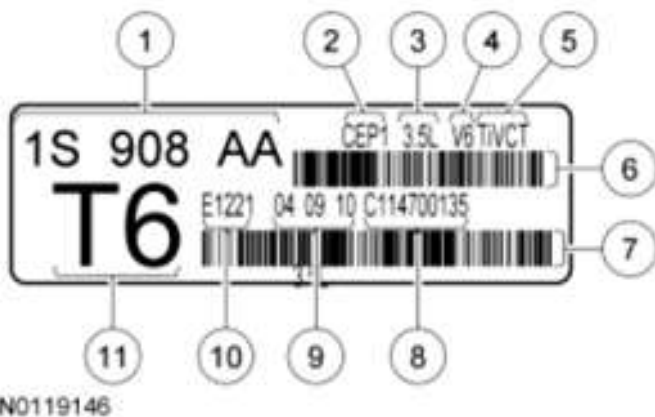
### Engine Identification

For quick identification, refer to the safety certification decal.

- The decal is located on the LH front door lock face panel.

### Engine Code Information Label

The engine code information label, located on the front side of the valve cover, contains the following:



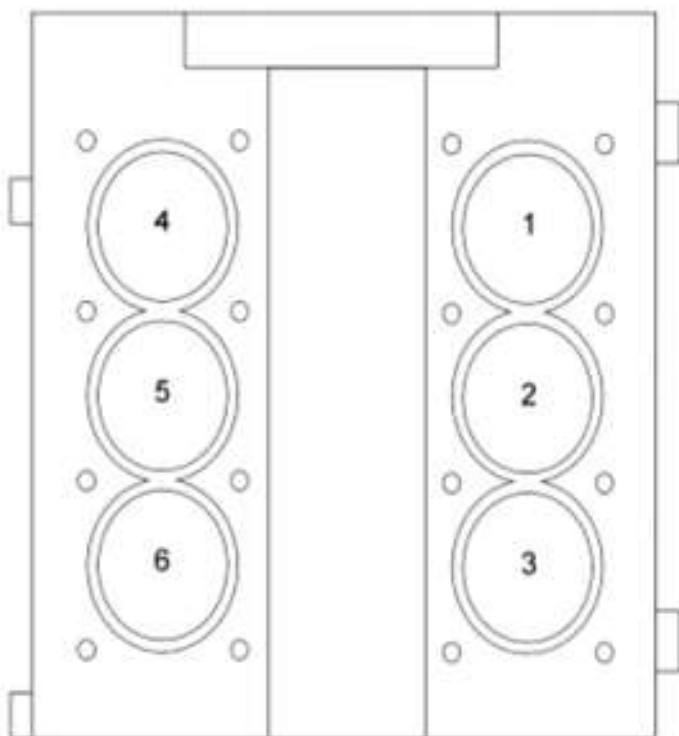
**Fig. 1: Identifying Engine Code Information Label**  
Courtesy of FORD MOTOR CO.

### ENGINE CODE INFORMATION LABEL DESCRIPTION CHART

Item	Description
1	Engine part number
2	Engine plant (Cleveland)
3	Engine displacement
4	Engine configuration

5	Twin independent Variable Camshaft Timing (VCT)
6	Bar code
7	Bar code
8	Running number
9	Engine build date (DDMMYY)
10	Plant shift line
11	Derivative code

### Engine Cylinder Identification



N0069904

**Fig. 2: Engine Cylinder Identification**  
 Courtesy of FORD MOTOR CO.

### Exhaust Emission Control System

Operation and required maintenance of the exhaust emission control devices used on this engine is covered in the **INTRODUCTION - GASOLINE MODELS** .

### Induction System

The **GTDI** is Pulse Width Modulated (PWM).

Fuel is metered directly into each combustion chamber. Fuel injectors pulse to follow engine firing order, in

accordance with engine demand.

The various sensors detect any changes in the operating conditions and send signals to the PCM. This permits the PCM to control the opening duration (pulse width) of the fuel injectors and maintain optimum exhaust emission control and engine performance for all operating conditions.

### **Valve Train**

The valve train uses Direct Acting Mechanical Buckets (DAMB). The camshaft lobes are positioned directly above mechanical buckets which are positioned on top of the valves.

### **Twin Independent Variable Camshaft Timing (VCT) System**

The twin independent VCT system allows variable control of intake valve closing which optimizes combustion at full load providing improved power and low speed torque (broadening the torque curve) which enables variable valve overlap which provides better fuel economy and emissions and provides optimized cold start operation with improved exhaust emissions.

### **PCV System**

All engines are equipped with a closed-type PCV system recycling the crankcase vapors to the upper intake manifold.

### **Lubrication System**

The engine lubrication system is of the force-feed type in which oil is supplied under full pressure to the crankshaft, connecting rod bearings, piston cooling jets, turbochargers, timing chain tensioners and VCT solenoids. The flow of oil to the valve tappets and valve train is controlled by a restricting orifice located in the cylinder head, front camshaft cap.

### **Oil Pump**

The lubrication system is designed to provide optimum oil flow to critical components of the engine through its entire operating range.

The heart of the system is a positive displacement internal gear oil pump.

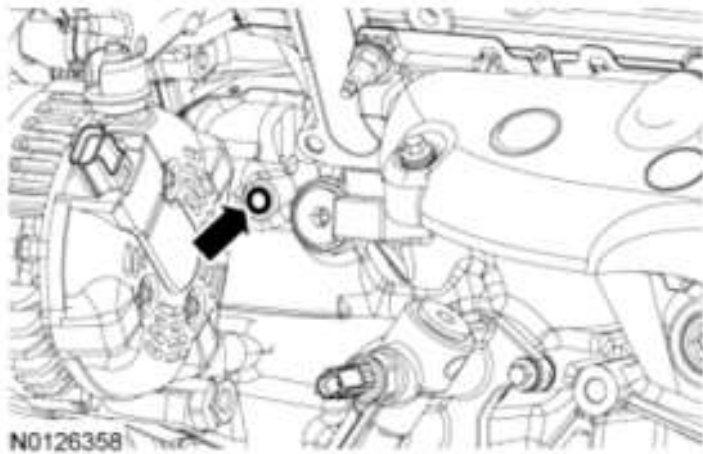
Generically, this design is known as a gerotor pump, which operates as follows:

- The oil pump is mounted on the front face of the cylinder block.
- The inner rotor is piloted on the crankshaft post and is driven through flats on the crankshaft.
- System pressure is limited by an integral, internally-vented relief valve which directs the bypassed oil back to the inlet side of the oil pump.
- Oil pump displacement has been selected to provide adequate volume to make sure of correct oil pressure both at hot idle and maximum speed.
- The relief valve calibration protects the system from excessive pressure during high-viscosity conditions.
- The relief valve is designed to provide adequate connecting rod bearing lubrication under high-temperature and high-speed conditions.

### **Cooling System**

The engine cooling system includes the following:

- Radiator
- Timing chain driven coolant pump
- Electric fan assembly(s)
- Degas bottle (aids in maintaining the correct volume of engine coolant)
- Coolant thermostat
- Coolant hoses



**Fig. 3: Locating Weep Hole**  
Courtesy of FORD MOTOR CO.

The channel cover plate is located under the engine front cover mounted to the cylinder block. It contains a timing chain idler and press-in-place gaskets separating engine coolant and engine oil. A weep hole is provided on the front left side of the engine behind the generator. If oil or coolant is leaking from the weep hole, then a gasket has failed and must be replaced.