NEW FORD DRAGON

Ford 1.5L EcoBoost L-3 Engine

BY **DAVE HAGEN**

The Dragon is a 1.5L turbocharged three-cylinder engine from Ford Motor Company used to power subcompact and compact cars and utility vehicles, or more commonly known as CUVs. Featuring a dual overhead cam (DOHC) design, in an inline configuration, the Ford Dragon architecture is an evolution of the Ford Fox design and has been part of the Ford EcoBoost family of turbocharged engines since 2014.

The Ford 1.5L EcoBoost Dragon engine is a direct expansion of the previous 1.0L L3 Fox unit, even though it does not share bore or stroke. Like its brethren, it utilizes cylinder deactivation technology for optimal efficiency, as well as an all-aluminum design with integrated exhaust manifold and low inertia variable turbochargers. The engine also combines both port fuel injection and direct fuel injection, again, in the name of efficiency. The Ford 1.5L Dragon engine powers the following 2020 vehicles: Ford Escape, Ford Fiesta ST and Ford Focus.

Out of the three cars listed above, only the Ford Escape is currently sold in the U.S. and Canada.

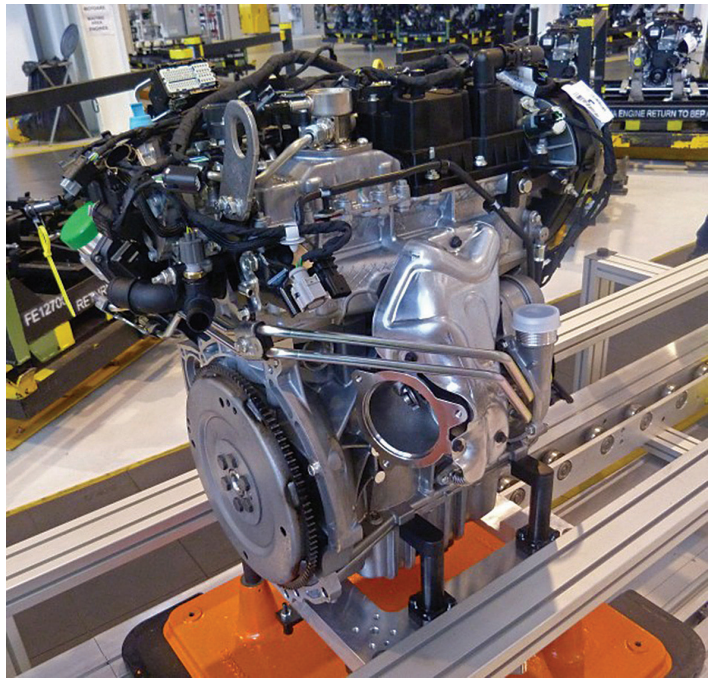
There are several key features in this engine including:

- Cylinder deactivation
- Direct fuel injection and Port Fuel Injection (PFI)
- Balance shaft in the engine block

Cylinder Deactivation

The biggest innovation to the 1.5L EcoBoost engine is the cylinder deactivation. During operation at partial load, the first engine cylinder can be deactivated hydraulically. This reduces the fuel consumption and the emissions of the engine or vehicle.

If only minimal engine power is required, the system stops the gasoline injection and the valve actuation. The connection between the camshaft and the intake and exhaust valves of the first cylinder is interrupted via a new camshaft module and a special rocker arm



by means of engine oil pressure. The PCM calculates the optimal time using the engine speed, throttle position, and load condition.

The intake and exhaust valves remain closed and enclose the mixture in the combustion chamber. This should balance the forces acting on the cylinders by means of a kind of 'spring effect'.

The temperature within the deactivated combustion chamber is also maintained in this way, which increases the efficiency of the combustion when the cylinder is activated again.

The activation and deactivation only take approximately 14 milliseconds. The system operates at engine speeds of up to 4,500 RPM. The friction and pump losses within the engine are reduced. The fuel consumption and CO2 emissions decrease by up to 6%.

Overview

Engine family: EcoBoost
Displacement: 1.5 liter
Aspiration: Turbo
Configuration & cylinders: Inline, L3 cylinders
Vehicle engine orientation: Transverse
Valve configuration: Dual overhead cam (DOHC) with variable camshaft timing (VCT)
Assembly site: Craiova, Romania
Predecessor: Ford Sigma engine
Successor: Currently none

Specifications

Bore: 79.0 mm (3.10 in)
Stroke: 76.4 mm (3.00 in)
Compression ratio: 10.0:1
Max power @ RPM: 197 @ 6,000 rpm
Max torque @ RPM: 214 @ 1,600 rpm
Cylinder head: Cast aluminum
Cylinder block: Cast aluminum
Camshaft drive: Belt

Vehicle Applications

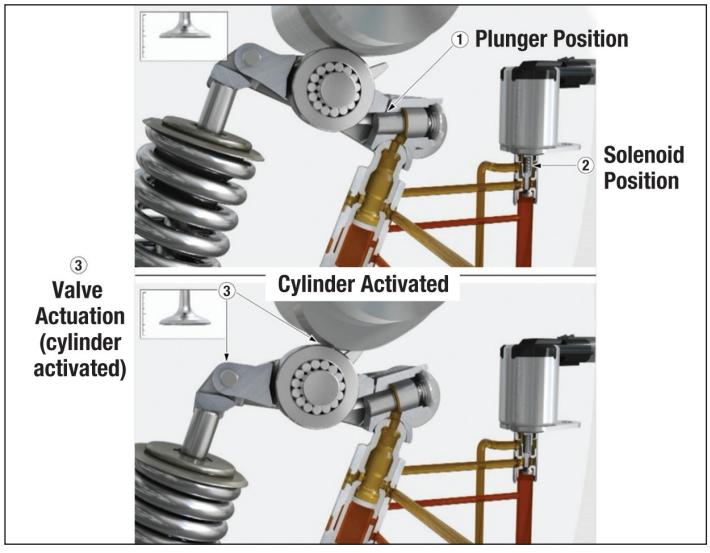
- **Ford Escape**
  Eight-speed automatic, FWD / AWD,
  Power: 180 @ @ TBA, Torque: 177 @ TBA
- **Ford Fiesta ST** (Europe and Asia)
  Six-speed manual, FWD,
  Power: 197 @ 6,000, Torque: 214 @ 1,600
- **Ford Focus** (Europe and Asia)
  Eight-speed automatic / Six-speed manual,
  FWD, Power: 150 @ TBA, Torque: 177 @ TBA

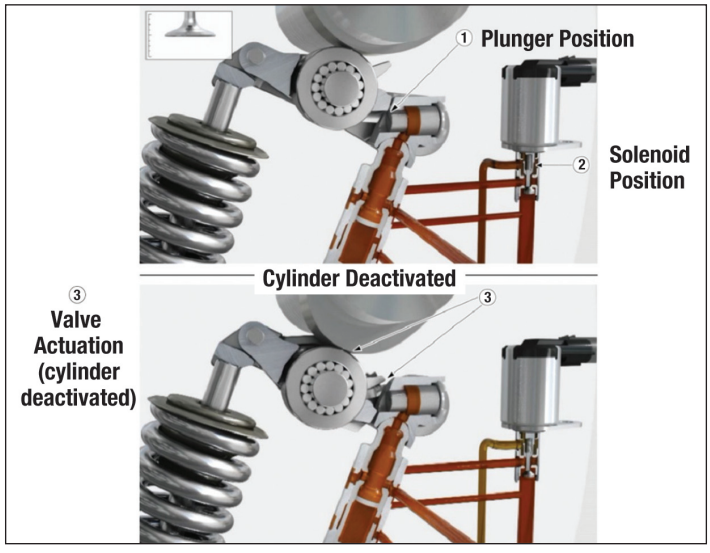
Cylinder deactivation technology temporarily shuts off one cylinder when coasting or cruising.

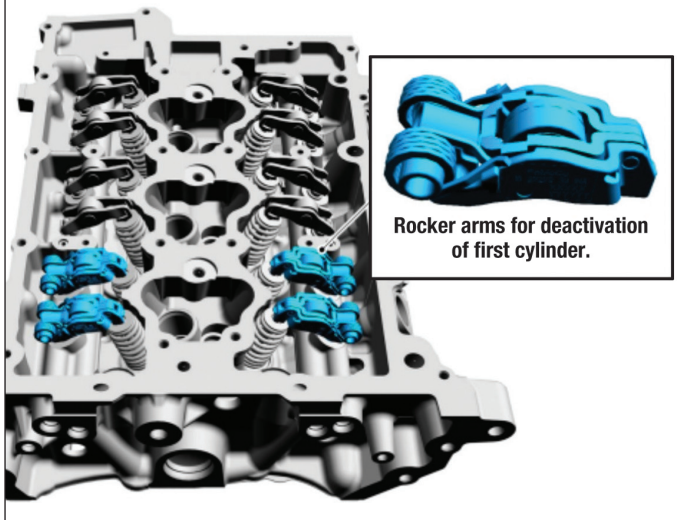
The PCM actuates a solenoid to deactivate the first cylinder. The solenoid controls the oil pressure for actuating a spring-loaded plunger in the rocker arm. When the solenoid is actuated, it applies engine oil pressure to the plunger in the rocker arm, pushing it back and releasing the freewheel mechanism of the rocker arm.

If the cam of the camshaft now presses against the rocker arm it is pressed downwards, but without actuating the valve. If the required engine power increases again, the PCM actuates the solenoid again and deactivates cylinder deactivation. (The pictures shown below illustrate the cylinder deactivation function.)

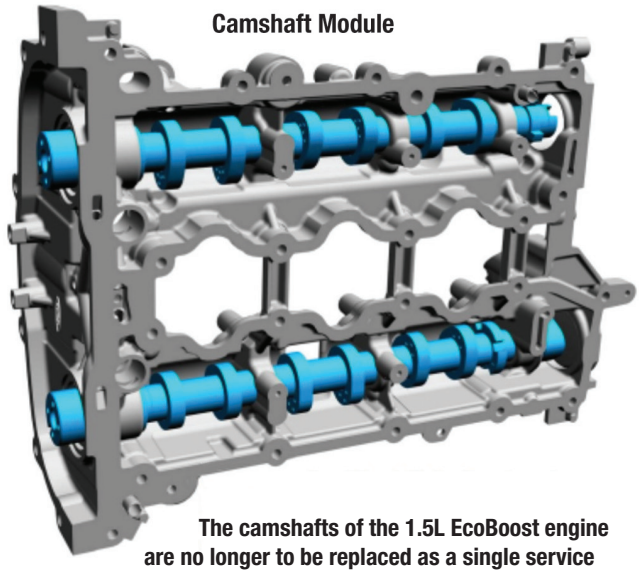
The combustion process produces forces that act on the piston crown. The upward and downward movements of the pistons and connecting rods, together with the rotational movement of the crankshaft, generate inertia forces that cause different types of vibrations in the cylinder block. The 1.5L EcoBoost engine has a balance shaft for compensating these vibrations.







To guarantee the durability of the engine, the camshaft drive has been modified and the rocker arm is produced using a new injection molding process.



The camshafts of the 1.5L EcoBoost engine are no longer to be replaced as a single service part in the cast of a repair, but as a module consisting of the two camshafts and the cylinder head cover.

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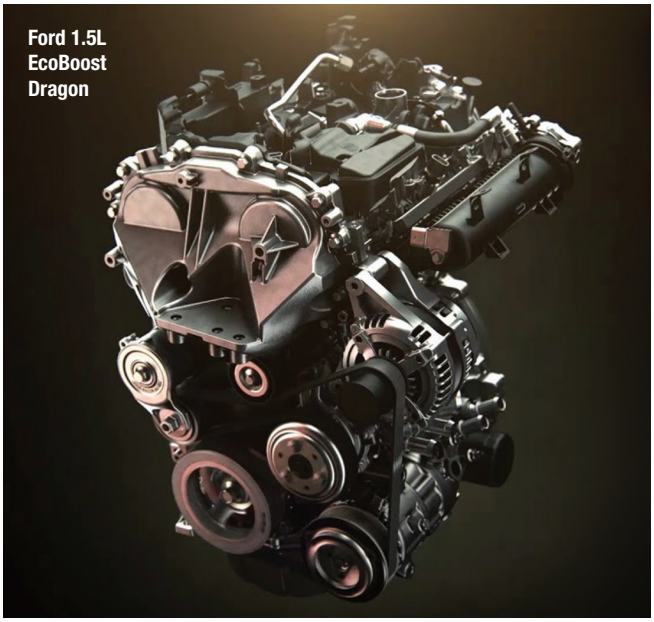
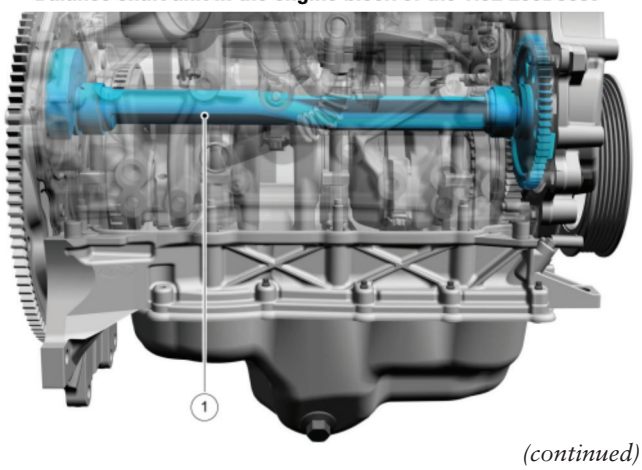


The balancer shaft, quiet camshaft chain and rigid engine structure help reduce noise and vibrations.

Balancer Shaft Unit

The balance shaft drives the oil pump and is driven via a gear in the front, which in turn is driven by the crankshaft. When working on the balance shaft, the correct setting of the timing must be ensured (see picture) or engine vibrations may exist.

Balance shaft unit in the engine block of the 1.5L EcoBoost



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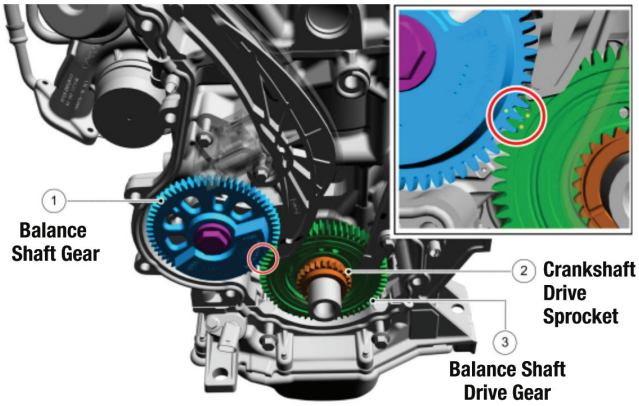
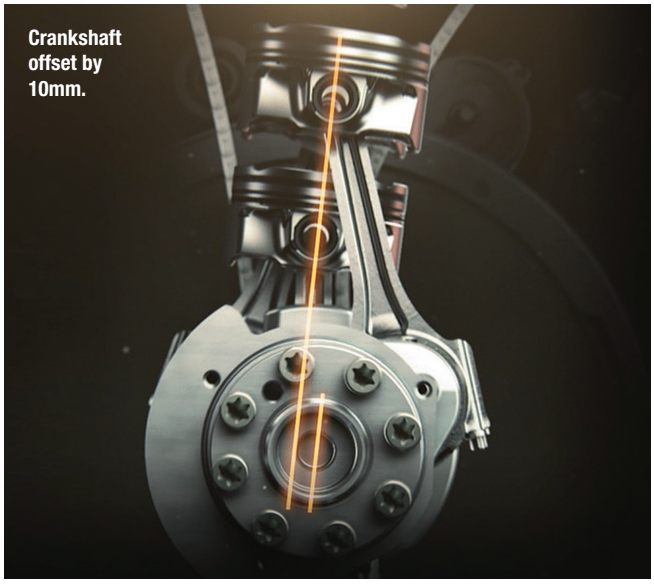
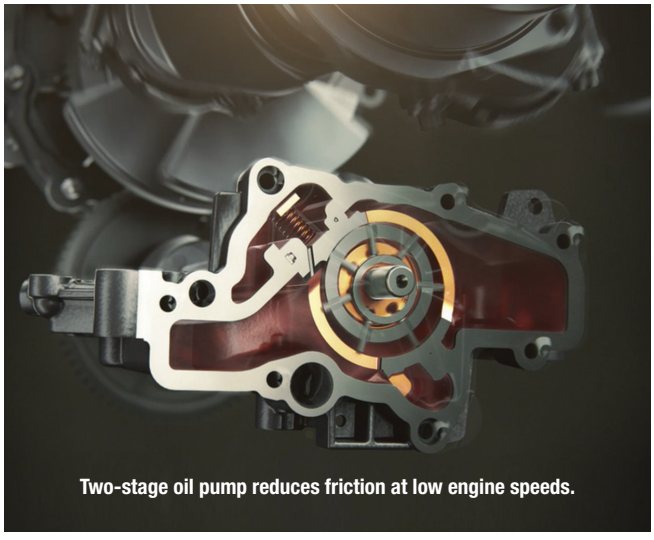
Balance Shaft Timing





Offset Cylinder Centerline

The crankshaft centerline is offset by 10MM from the cylinder centerlines, along with coated pistons and very low-tension piston rings. This engine features a two-stage variable displacement oil pump and uses 5W-20 synthetic blend motor oil and features the Intelligent Oil-Life Monitor™ system.



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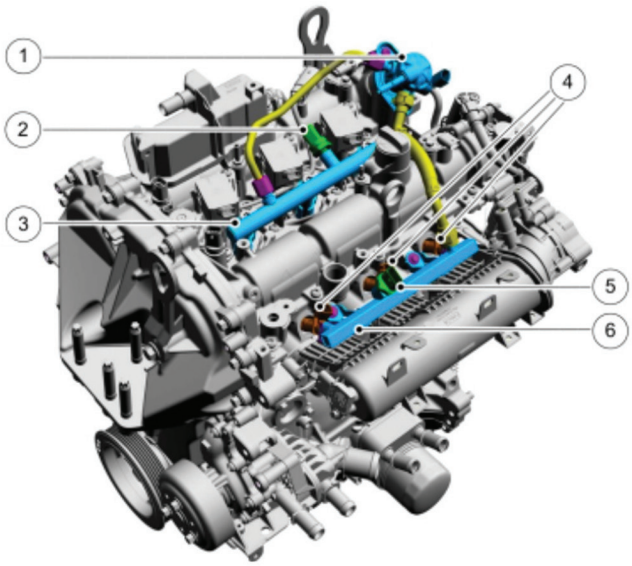

1. High-pressure fuel pump
2. High-pressure fuel sensor
3. High-pressure fuel rail
4. Injectors
5. Fuel pressure sensor
6. Fuel rail

Injection System

The 1.5L EcoBoost engine features both direct fuel injection (DI) and a port fuel injection (PFI) system. Combining the two injection systems in the 1.5L EcoBoost engine optimizes power output, economy, and emissions in all driving situations. Using both types of fuel injection has proven to show less carbon build-up that most other DI engines exhibit. Using both, not only provides better fuel economy but provides optimum long-term performance.■

AERA Technical Specialist Dave Hagen has over 44 years of experience in our industry. As an ASE-certified Master Machinist, Dave specialized in cylinder head work and complete engine assembly for the first 17 years of his career. For more information, email: dave@aera.org.

__From the author:__ Thank you to Ford's Dan Jones for his contributions to this article. You can reach Dan by emailing him at djone602@ford.com.

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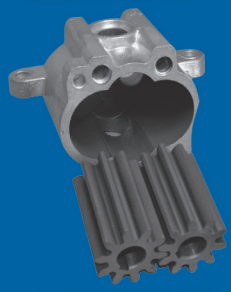
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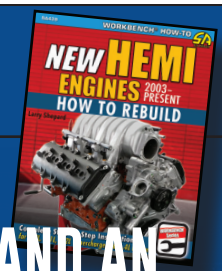

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