The New Tribeca 3.6L Engine

Subaru has developed a new, technologically-advanced 3.6L engine for the 2008 Tribeca. This paves the way for future Subaru engines. Here's the basic technical information and service tips you'll want to know.

The redesigned 2008 Subaru Tribeca is now on the road and selling like the proverbial "hotcakes." While the stunning new body style and interior are the first things you see, it's the new engine under the bonnet you'll want to know more about. It's brand new and different from the Subaru engines you've been servicing.

When Subaru launched the 2006 Tribeca B9, it was powered by the same 250-hp 3.0L, 6-cylinder engine found in the Outback. The same engine was used in the 2007 model.

For the 2008 model (now just named Tribeca), the company developed a techno-logically-advanced engine that provides more power, is more efficient, emits lower emissions, is lighter and operates on regular fuel. This engine will undoubtably set the pattern for future Subaru engines.

The new 3.6L six (designated EZ 36) pumps out 256 horsepower @ 6,000 rpm and 247 ft.lbs. of torque @ 4,400 rpm. This raises the prevevious levels of power (250 hp, 219 ft.lbs.) found in the 3.0L. This improvement was accomplished by increasing the displacement (bore and stroke), the use of upgraded mechanical and sophisticated electronic systems.

The new 3.6L engine in the 2008 Tribeca uses cutting-edge technologies for fuel efficiency, increased horsepower and lower emissions.

Engine Specifications

Here are the 3.6L basic engine specs, compared to the 3.0L engine:

	3.6L	3.0L
Bore	92mm	89.2mm
Stroke	91mm	80mm
Displacement	3,630 cc	2,999 cc
Weight	395 lbs.	397 lbs.
Compression	10.5:1	10.7:1
Fuel AKI	87	91

3.6L Enhancements and Changes

Several changes are incorporated into the new 3.6L engine. Among them are:

- The introduction of the Dual Active Valve Timing System to replace the Variable Valve Lift System.
- A redesigned cooling system.
- A new timing chain design that uses three chains.
- Let's take a look at each of these innovations:

Dual Active Valve Timing System

The Dual Active Valve Timing System controls both the intake and exhaust camshafts. The intake camshaft is advanced, while the exhaust camshaft is retarded. This process can alter the timing to increase the torque in low- to mid-range engine speeds and also provides greater cylinder efficiency in higher engine rpm levels to improve fuel economy.

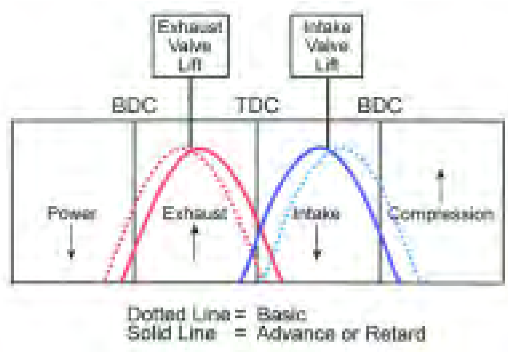
Both camshafts are operated by an Oil Charge Valve (OCV) that receives a duty ratio from the Engine Control Module (ECM). The higher the degree of duty ratio input, the higher the degree of actuation.

The intake (left) and exhaust (right) Oil Charge Valves respectively control the advance and retard of the camshafts.

The intake camshaft can advance up to 51 degrees ahead of its basic idle setting. When it advances, it is rotated in the same direction as the engine operates (clockwise as viewed from the front of the engine). When the intake camshaft is advanced, it allows more air and fuel to enter the cylinders and results in more power from the combustion.

The exhaust camshaft can retard up to 21 degrees behind its basic idle setting. When it retards, it is rotated in the opposite direction as the engine operates (counter-clockwise as viewed from the front of the engine). When the exhaust camshaft is retarded, it allows the expanding gases of the power stroke to push on the piston for a longer period of time, resulting in better fuel efficiency.

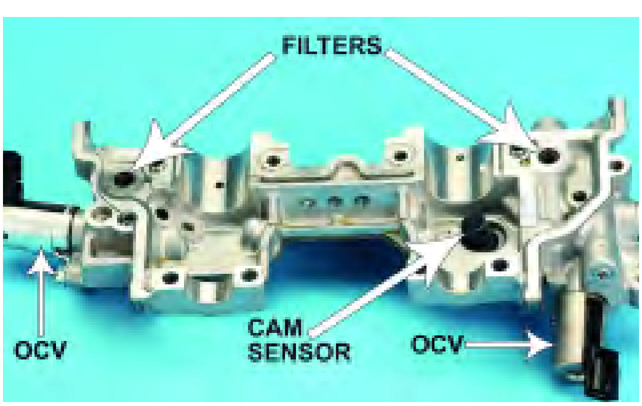
By combining the precise control of both camshafts, a condition is created where the intake and exhaust valves work together to create better scavenging of the cylinders, reduced pumping losses and better EGR effect.



This graph shows how the Dual Active Valve Timing System controls the intake and exhaust camshafts to advance and retard the timing.

Cam actuation is achieved by oil pressure delivered to the apply and release sides of actuators of the intake and exhaust sprockets through oil ports in the end of each camshaft. The camshaft cap houses the OCV of each camshaft and a small oil filter is installed into the camshaft cap to filter the oil before it enters the OCV.

A small oil filter in the camshaft cap strains out impurities that could cuase OCV malfunctions.

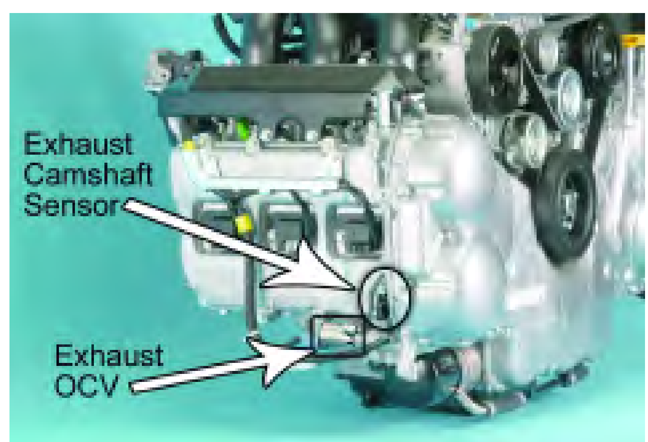


Note the placement of the oil filters, oil charge valves (OCVs) and cam sensor on the camshaft cap.

The Dual Active Valve Timing System requires additional space in the timing chain cover to allow room for the exhaust sprocket.

The timing chain cover bulges out to encase the Dual Active Valve Timing System exhaust sprocket.

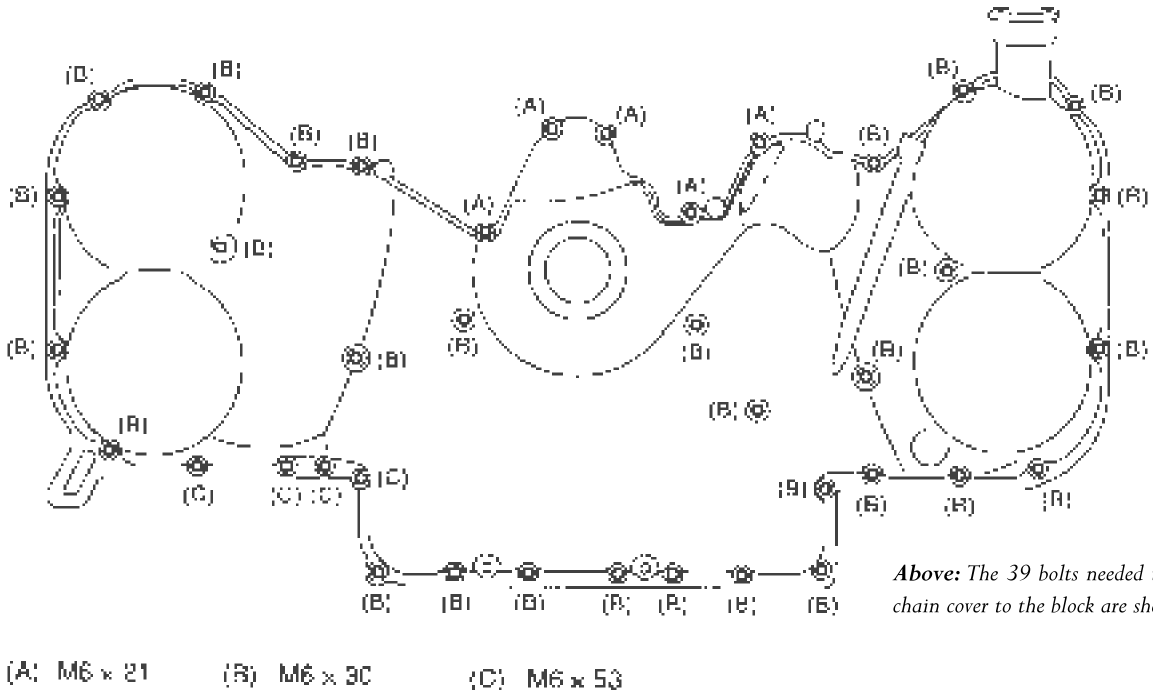
The larger shape of the valve cover and the front cam-shaft cap allows installation of the exhaust Oil Charge Valve (OCV) and the exhaust camshaft sensor.



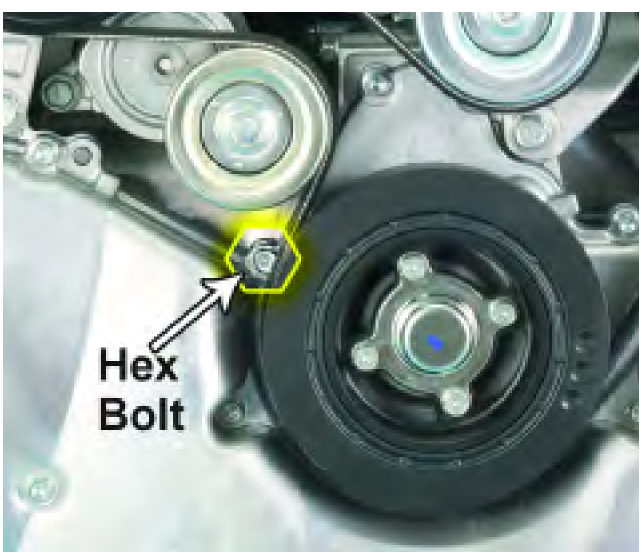
The exhaust camshaft sensor and exhaust OCV are mounted to the enlarged valve cover.

The 3.6L engine is designed with the inner timing chain cover incorporated on the front surface of the engine block and cylinder heads. The outer timing chain cover is secured to the engine with 39 bolts and sealed with Three-Bond.

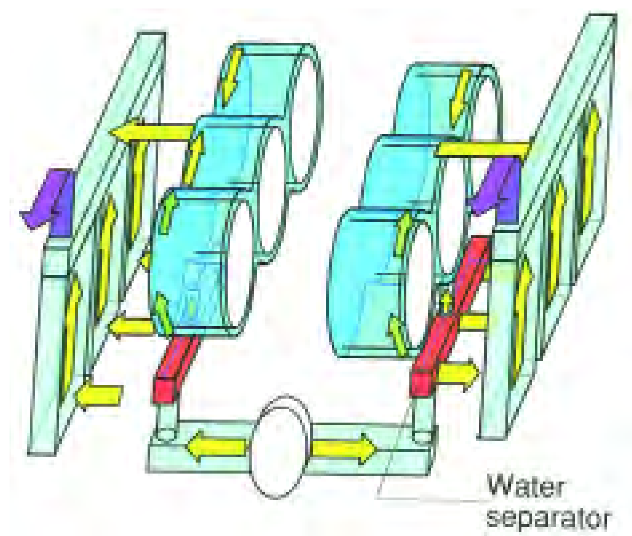
Three different length bolts are used to secure the timing chain cover. All are 6mm Allen-type bolts, except for one 6mm hex bolt located at the upper right side behind the crankshaft pulley.



Above: *The 39 bolts needed to fasten the timing chain cover to the block are shown here.*



Note the position of the lone 6mm hex bolt, behind the crankshaft pulley, used to retain the timing chain cover.



The new 3.6L Tribeca engine uses a parallel flow type of cooling system to create cooler operation, which helps control engine knock.

Redesigned Cooling System

The cooling system for the new 3.6L engine is a parallel flow type. This design utilizes a water separation chamber in the block that allows coolant to flow to and across the cylinders and to and through the cylinder heads simultaneously. This produces a more even engine coolant temperature throughout the entire engine and assists with controlling engine knock. Ignition timing can remain advanced as cooler temperatures do not promote spark knock.

The new design provides an increase in the lower end of the rpm range to improve the torque curve. It decreases by 50% the difference in temperatures from one cylinder to another, allowing for timing advance in the low- to mid-rpm range and increases torque without inducing knock.

New Timing Chain Design

The 3.6L engine uses three timing chains. A 10mm chain drives an idler from the crankshaft sprocket and two

8mm chains, driven by the idler, operate the left and right bank camshafts.

The 3.6L is an interference type engine. Incorrect chain installation or turning of the camshafts out of synchronization will result in valve-to-piston contact. Always follow the correct procedures when working on the timing chain components.

Above: *The crankshaft gear drives the idler gear, which then drives the right and left banks.*

Left: *The new 3.6L engine uses three chains to operate the timing system: the central crank gear and idler gear chain; the right bank chain and the left bank chain.*

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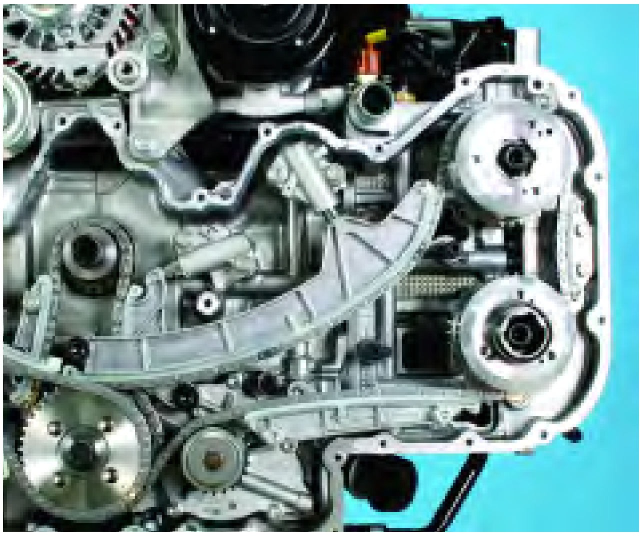


The left engine bank timing and camshaft drive system.

New Diagnostic Trouble Codes for 3.6L Engine

New diagnostic trouble codes (DTCs) have been set in place for the 3.6L engine. They deal directly with the operation of the Dual Active Valve Timing System) and exhaust gas recirculation (EGR).

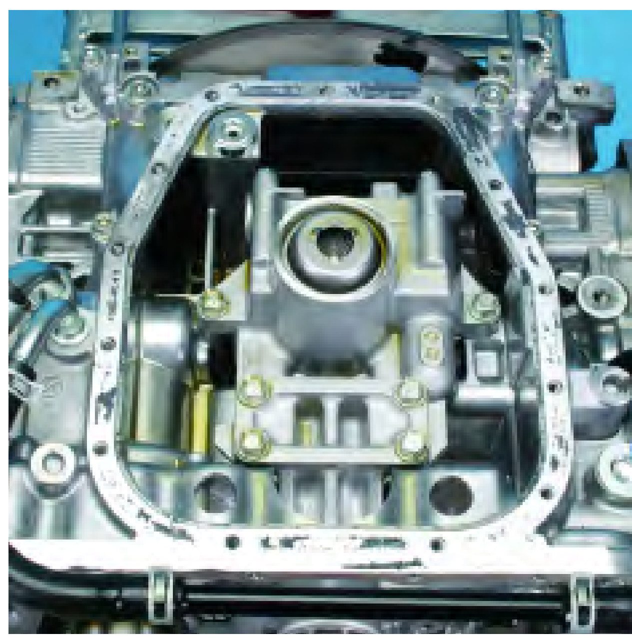
This type of system is generically called an Active Valve Control System (AVCS) to the automotive engineering industry. Here's a list of those new codes you'll want to know and refer to as needed:

DTC	Item
P0014	Exhaust AVCS system 1 (range/performance)
P0017	Crank and Cam timing B system failure (Bank 1)
P0019	Crank and Cam timing B system failure (Bank 2)
P0024	Exhaust AVCS system 2 (range/performance)
P0365	Camshaft Position Sensor "B" Circuit (Bank 1)
P0390	Camshaft Position Sensor "B" Circuit (Bank 2)
P0400	Exhaust Gas Recirculation Flow
P1492	EGR Solenoid Valve Signal #1 Circuit Malfunction (low Input)
P1493	EGR Solenoid Valve Signal #1 Circuit Malfunction (High Input)
P1494	EGR Solenoid Valve Signal #2 Circuit Malfunction (low Input)
P1495	EGR Solenoid Valve Signal #2 Circuit Malfunction (High Input)
P1496	EGR Solenoid Valve Signal #3 Circuit Malfunction (low Input)
P1497	EGR Solenoid Valve Signal #3 Circuit Malfunction (high Input)

DTC	Item *(continued)*
P1498	EGR Solenoid Valve Signal #3 Circuit Malfunction (low Input)
P1499	EGR Solenoid Valve Signal #3 Circuit Malfunction (high Input)
P2090	Exhaust Camshaft Position Actuator Control Circuit Low (Bank 1)
P2091	Exhaust Camshaft Position Actuator Control Circuit High (Bank 1)
P2094	Exhaust Camshaft Position Actuator Control Circuit Low (Bank 2)
P2095	Exhaust Camshaft Position Actuator Control Circuit High (Bank 2)

Other New 3.6L Engine Systems and Components: Oil Pump

The lower oil pan is attached to the upper oil pan with 13 bolts and sealed with liquid gasket compound. Six bolts secure the oil pump to the upper oil pan and two O-rings seal the oil pump to the upper pan. Cylinder head removal is required to remove the upper pan.

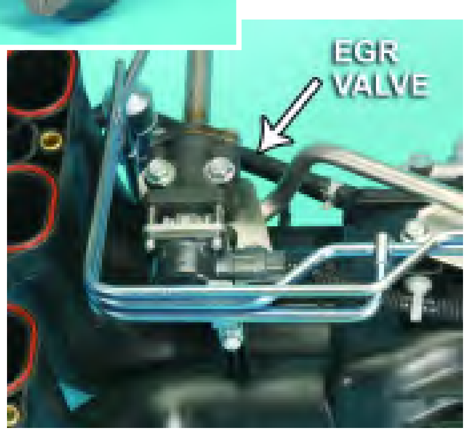


The oil pump is attached to the upper oil pan assembly.

Connecting Rods and Caps

The connecting rod and cap are made in one piece then the cap is broken or "snapped" off during the finishing process. This allows for a perfect fit between the two parts, eliminating the need for dowel pins or other alignment devices when fitting the two parts together.

Left: *Connecting rod cap separated from rod, showing seam.*



Right: *The EGR valve is fitted to the underside of the intake manifold.*

EGR Valve

The electronic EGR valve is mounted to the underside of the intake manifold. An exhaust port located at the rear of the left bank cylinder head supplies the exhaust gas to the EGR valve through a metal pipe.

Learn More – Be Prepared

You can learn all about the new 3.6L engine in the 2008 Tribeca from the 2008 New Model Update Technician Reference Booklet, Module 917 (Subaru P/N MSA5P0804C), which you can order from your local Subaru N.E.W. Horizons Dealer. The publication will also soon be available on the Subaru Technical Information System website at *http://techinfo.subaru.com*.

The full service manual for the 2008 Tribeca is also available from your local Subaru N.E.W. Horizons Dealer. ■

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