Engine Rattle at Startup

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Startup engine rattle in the LT5 is referred to by most people as chain rattle. This is not correct. The camshaft chains do not cause the noise. Some people think that a secondary camshaft chain is making contact with the engine. That is not true. I have never seen evidence of a chain rubbing on the block or a cylinder head. The chains ride on nylon faced guides and are very well controlled.

The right pivoting secondary chain guide makes the noise. At startup the tension on the right chain may be less than what is needed to keep the chain tight. When the chain is loose the pivoting guide can bounce as the engine cranks at startup, and fires. Excess bouncing will cause the pivoting guide to tap on the cylinder head. The noise stops when oil pressure re-tensions the chain.

The correct description for the noise is chain guide rattle.

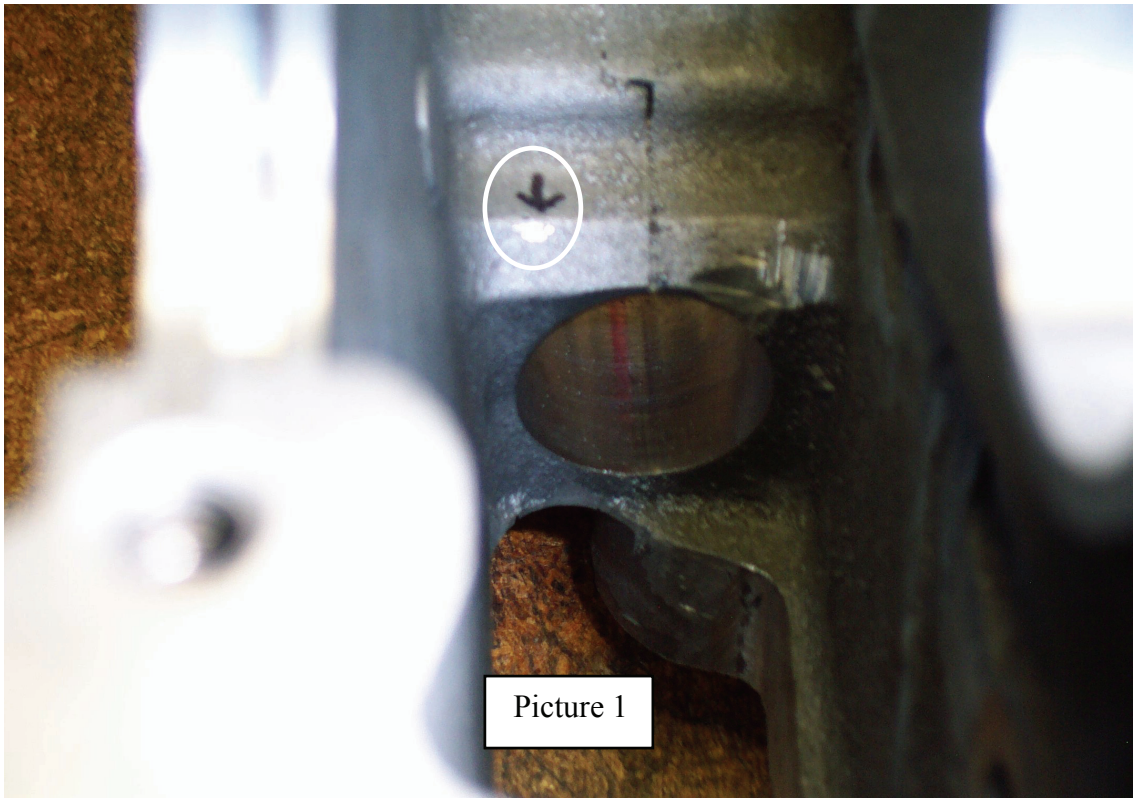
Variations In The Rattle

A few engines never rattle. Some do it occasionally. About 25% of the engines rattle on most starts for about a second. The start-to-start variation is caused by changes in the individual engine's stop point; most engines stop at one of about four places. If the secondary chain tension unloads at the beginning of cranking the noise will be worse.

If the anti-drain back valve in the oil filter leaks, the noise will occur for about one second longer because oil pressure establishment is delayed while refilling the filter.

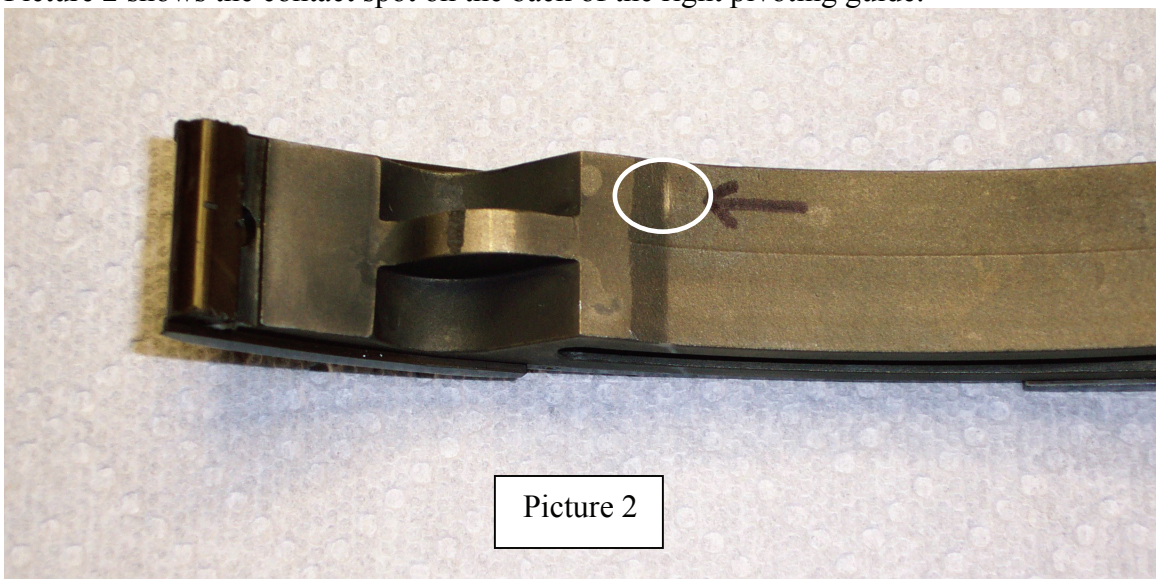
The Source Of The Noise

Picture 1 shows where the right pivoting secondary chain guide taps on the cylinder head. The arrow points to the contact spot just above the tensioner bore.



Picture 1

Picture 2 shows the contact spot on the back of the right pivoting guide.

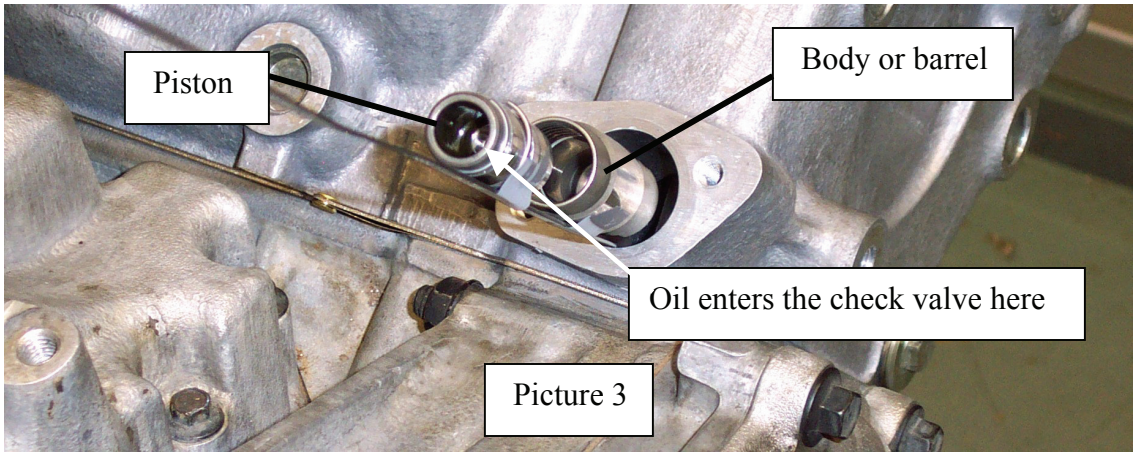


Picture 2

The Root Cause Of The Noise

The tensioners work a lot like hydraulic valve lifters. If air enters the tensioner it becomes soft and the pivoting chain guide is uncontrolled. The left tensioner does not have a problem with noise. Understanding how a correctly functioning tensioner works makes it easy to understand the problem with the right tensioner.

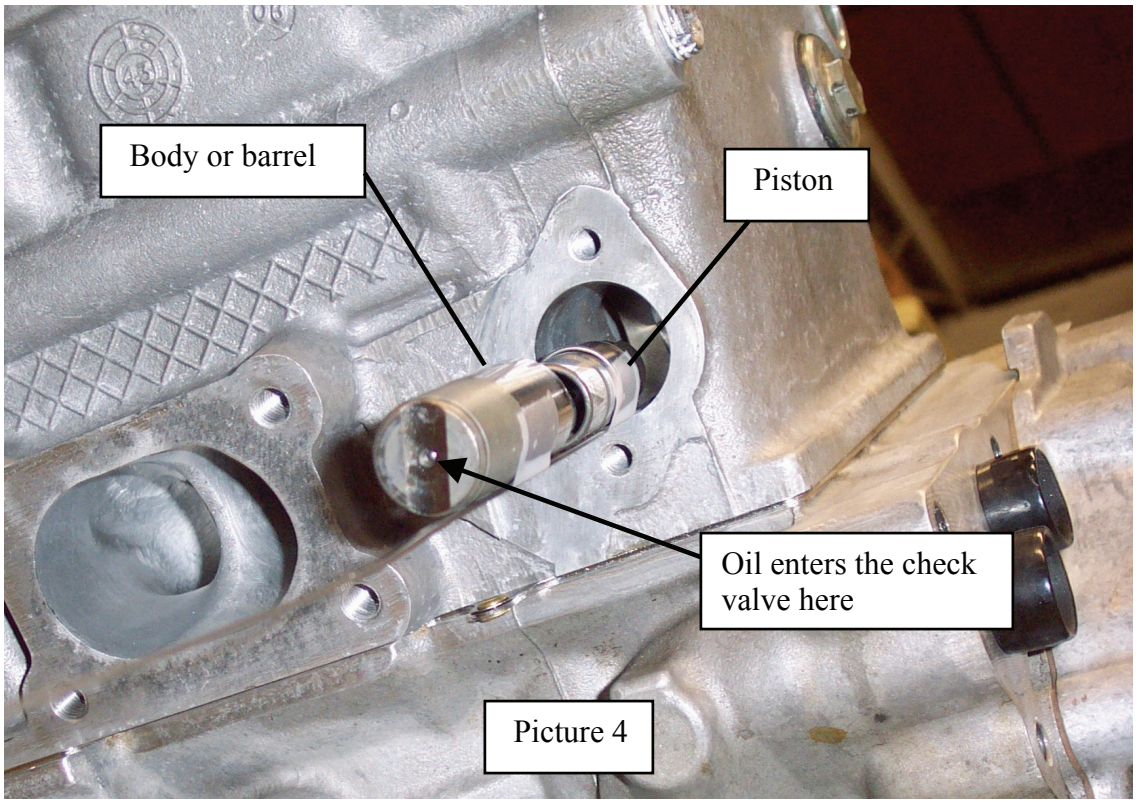
Picture 3 shows the location of the left tensioner. This is an exploded view with the parts taped to a metal strip. It shows the body of the tensioner, and the piston that fits inside, located above it.



Picture 3

Pressurized oil enters into the open end of the piston. The oil inlet check valve is at the bottom of the piston. About 1cc of oil always covers the check valve when the engine is off because the end of the piston points upward. When the engine is cranked, if the chain tension relieves, some of the stored oil is drawn into the tensioner to extend it and hold it firm. After the engine starts oil pressure is applied.

Picture 4 shows the right tensioner. On the right side the tensioner oil inlet is pointed downward.

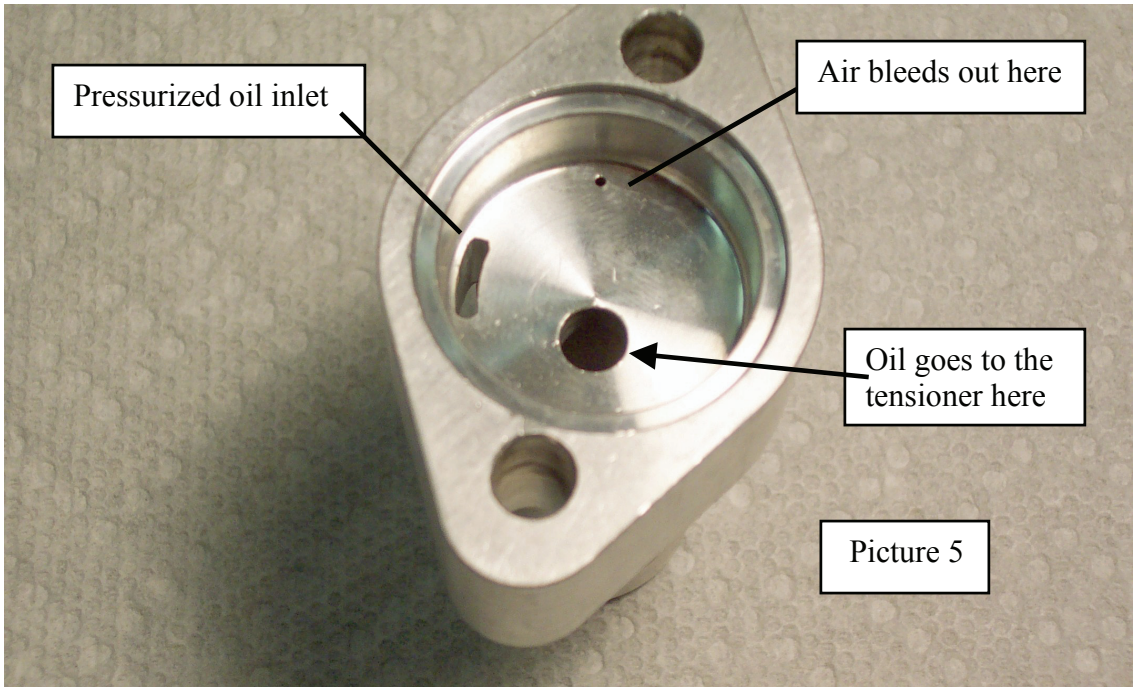


When the engine is off the oil for the tensioner drains back to the oil pump. When the engine is cranked, the chain may lose some tension. The tensioner reacts by extending. Since the check valve is open to air, the tensioner can draw air inside. The air in the tensioner compromises its ability to hold the chain tight. If it gets too loose the pivoting chain guide will rap against the cylinder head. After the oil pressure builds the air is purged out of the tensioner, it refills with oil and it holds the chain firmly.

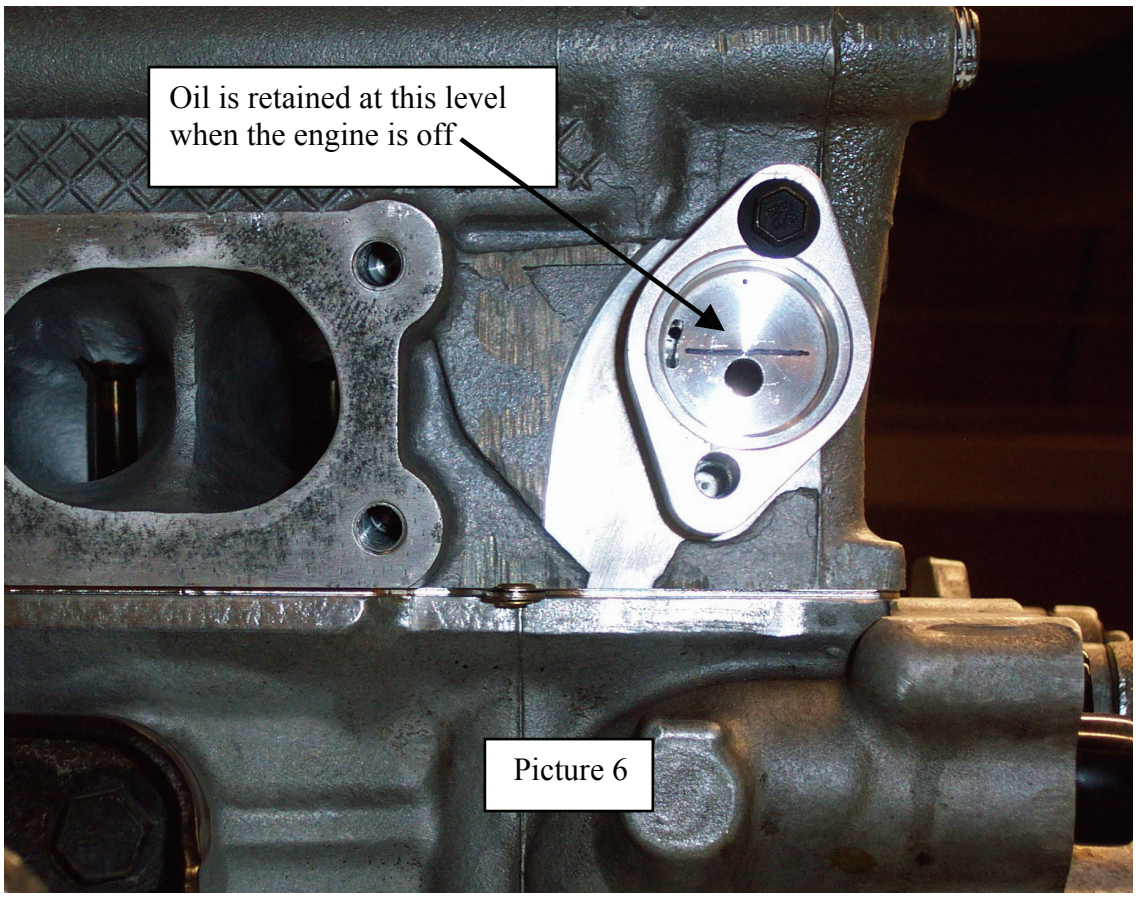
The designers addressed the right tensioner oil drain back problem by adding a reservoir to retain oil that covers the oil inlet check valve. This was designed into the third major upgrade to the cylinder heads. These heads were manufactured by the Dunn foundry and are embossed with the Dunn name on the center of the exhaust outlet side.

An improved tensioner holder was designed for a service upgrade to the earlier Birmal castings. It was issued part number 12550580.

Picture 5 is close-up of the lower end of the improved tensioner holder.



Picture 6 shows the tensioner holder on the engine without the outer cover.



In picture 6 a line has been drawn to show the upper level of the oil that is retained in the tensioner housing when the engine is off. Because the oil galley inlet has been raised, oil remains in the tensioner holder when the engine is off. This way the oil inlet check valve for the tensioner is always covered with oil. When the engine is cranked, oil is available immediately for the tensioner to draw-in until the oil galley refills with oil.

I wish to thank Graham Behan who provided valuable information. I did not ask Graham to edit this article; any inconstancies herein are my own.