MINI Timing Chain Replacement

An engine with a rattle that could not be ignored

Timing chains have a greater extended working life compared to timing belts, with most chain issues falling outside of the original vehicle manufacturer's warranty period. Timing chain kit failures can usually be attributed to infrequent servicing, fuel ingress and metallic and carbon-based particles in the oil. Contaminated engine oil can easily block oil-feed channels; particles can become suspended within the oil, causing the tensioner, oil control valves and variable-valve timing sprockets to fail due to a reduction in oil volume and pressure. This compromises the hydraulic efficiency - causing wear in the timing chain, tensioner and VVT units. As a consequence, rattling noises can become apparent and will potentially lead to a timing chain system failure.

The vehicle featured in this article is a 2012 MINI Countryman equipped with the popular 1.6 PSA-group 'Prince' engine, which had been reported to have a persistent rattle from the timing chain area; this could not be ignored. The engine is also used in many other Peugeot, Citroen, MINI and BMW applications.

Timing chain kit replacement procedure

Before starting any timing chain kit replacement, it is essential that the vehicle manufacturer's repair procedures are followed precisely. The engine should be at an ambient temperature and any special tools required should be attained in advance. It is also worth checking for any engine management fault codes that can be affected by any of the timing chain components listed above.

With the bonnet open, remove the right headlamp and bonnet-slam panel to give greater access to the engine.

Then, with the vehicle raised, remove the right-front wheel and wheel-arch liner to gain access to the auxiliary drive belt. This engine is equipped with a conventional tensioner for the belt that drives the alternator and air conditioning compressor, and an additional electronic tensioner assembly with a friction wheel. When engaged it transmits power from the crankshaft pulley to the water pump pulley, which controls the flow of coolant. Both tensioners, the auxiliary drive belt and TVD crankshaft pulley need to be removed and inspected, and replaced if necessary.

After further raising the vehicle, drain the engine oil, then lower the vehicle back down to a working height to access the engine. Remove the engine dipstick; it hinders the removal of the timing chain if left in place.
Next, the ignition coils, spark plugs and wiring harness should all be removed, followed by the air cleaner assembly and the rocker cover prior to setting up the static engine timing.

The engine should be turned clockwise until the timing tool can be inserted into the crankshaft. (Fig.1)

Once in position, check the height of the pistons through the spark plug holes with a suitable metal rod. This is to see if the pistons are at the halfway point in the mid-travel position. (Fig.2)

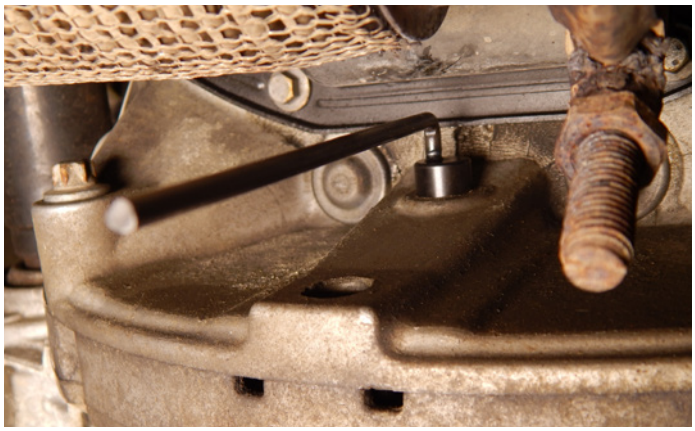

Figure 1

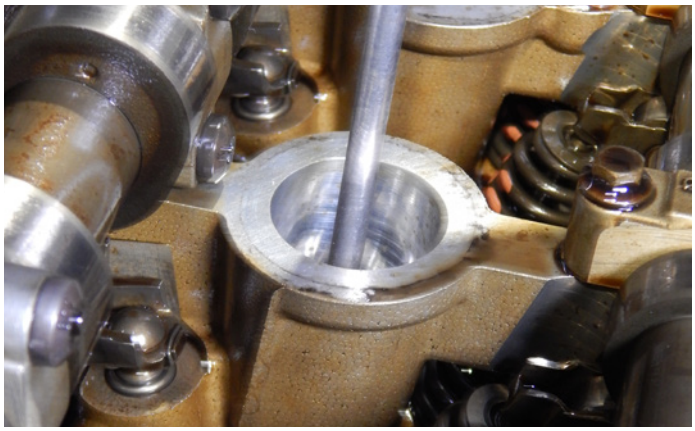

Figure 2

Subsequently, the camshaft-locking tools can be fitted to the camshafts - ensure both the cam and crankshaft are set in the correct position before removing the timing chain. (Fig.3)

With the engine supported and the engine mounting removed (to give better access to the engine), the throttle body can then be removed in order to access the timing chain tensioner for removal.

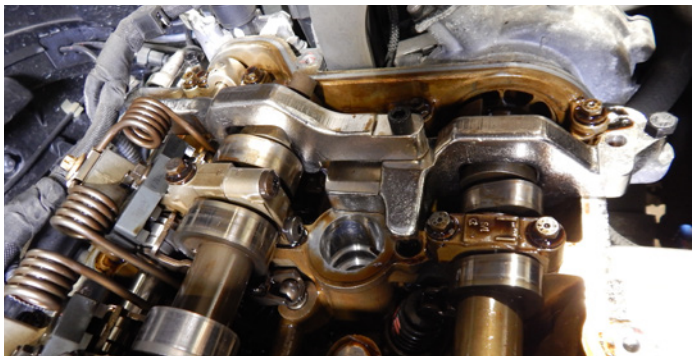

Figure 3

Remove the upper timing chain guide rail and upper exhaust side chain guide retaining bolt, then loosen both the variable valve-timing sprocket bolts.

Next, the crankshaft counter hold tool can be attached before undoing the crankshaft- hub retaining bolt. (Fig.4)

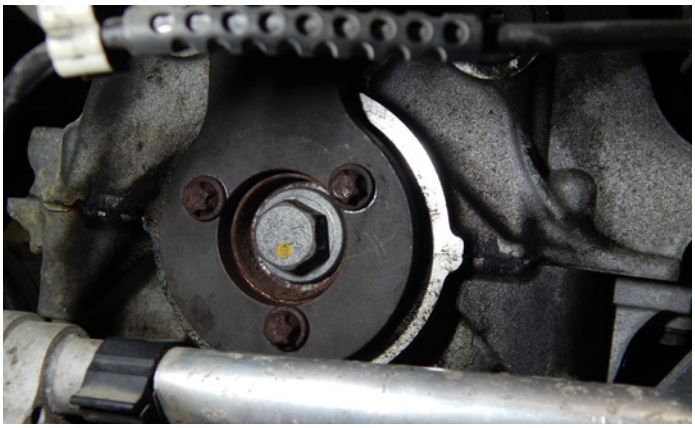

Figure 4

Undo and discard the bolt, then remove the tool. Remove the two chain guide bolts ready for the timing chain to be taken out from the top of the engine. Remove the VVT retaining bolts and carefully remove the sprockets from the camshafts, while supporting the timing chain. With an assistant, carefully remove the crankshaft hub - this hub unit slides into the drive sprockets to retain the engine timing and the oil pump drive. Therefore, the oil pump drive sprocket must remain in place on the crankshaft. If the sprocket falls into the sump, the sump will have to be removed. (Fig.5) With the chain free, slide the timing chain with the guides and the crankshaft sprocket up and out of the engine, leaving the oil pump drive in place.

Figure 5

Figure 6

For the replacement timing chain, febi kit 171910 was chosen. This kit includes the timing chain, tensioner, all three guide rails, crankshaft sprocket and bolt, inlet and exhaust variable valve timing units, and a crankshaft oil seal.

Assemble the left and right guide rails and then slide the chain into place with the crankshaft sprocket. Afterwards, these assembled parts can carefully be lowered into the engine until the crankshaft sprocket is in line with the crankshaft. The hub can then be slid through the sprocket and secured into place. (Fig.6)

Next, fit the new variable-valve timing sprockets; these are clearly marked ''IN'' for inlet and ''EX'' for exhaust. It is essential that they are fitted to the correct camshaft. Insert the bolts, but do not fully tighten them, leaving the sprockets to move - this is to allow the chain to be tensioned correctly. (Fig.7)

With the chain, guides and all three sprockets installed in place, refit the three guide rail retaining bolts but do not tighten them at this stage. Install the dummy timing chain tensioner and tighten to 0.6 Nm. With the timing chain tensioned correctly, tighten the crankshaft hub, VVT retaining bolts and the guide rail bolts. Remove the dummy tensioner, fit the new tensioner, and refit the throttle body. Remove all timing tools and rotate the engine clockwise twice - then refit the timing tools to recheck the static timing and ensure everything is aligned.

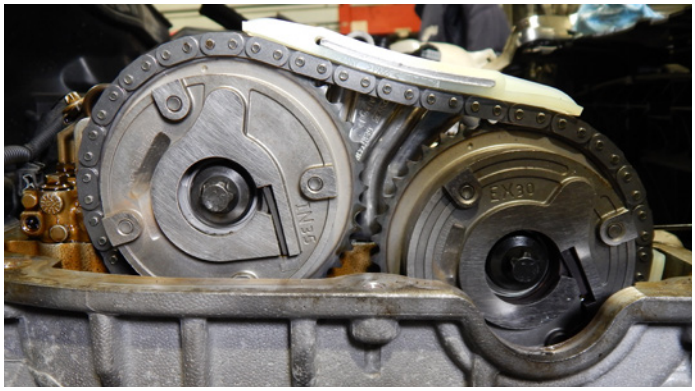

Figure 7

Once completely satisfied that the camshafts and crankshaft are aligned, remove the timing tools. Lightly oil the new crankshaft oil seal and install, before refitting the TVD pulley. The rocker cover was refitted with a new gasket, along with the spark plugs and the air-cleaner assembly. Reinstall the auxiliary belt and both tensioners, followed by the wheel arch liner, headlamp and slam panel.

Replace the engine oil filter and fill the engine with fresh oil of the correct grade and to the correct level. Start the engine and allow it to idle so that the new oil flows through the engine - checking for any leaks and/or abnormal noises in the process. Switch the engine off, recheck the oil level and top up as necessary. Then, carry out a road test to ensure everything is running quietly and smoothly again.

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