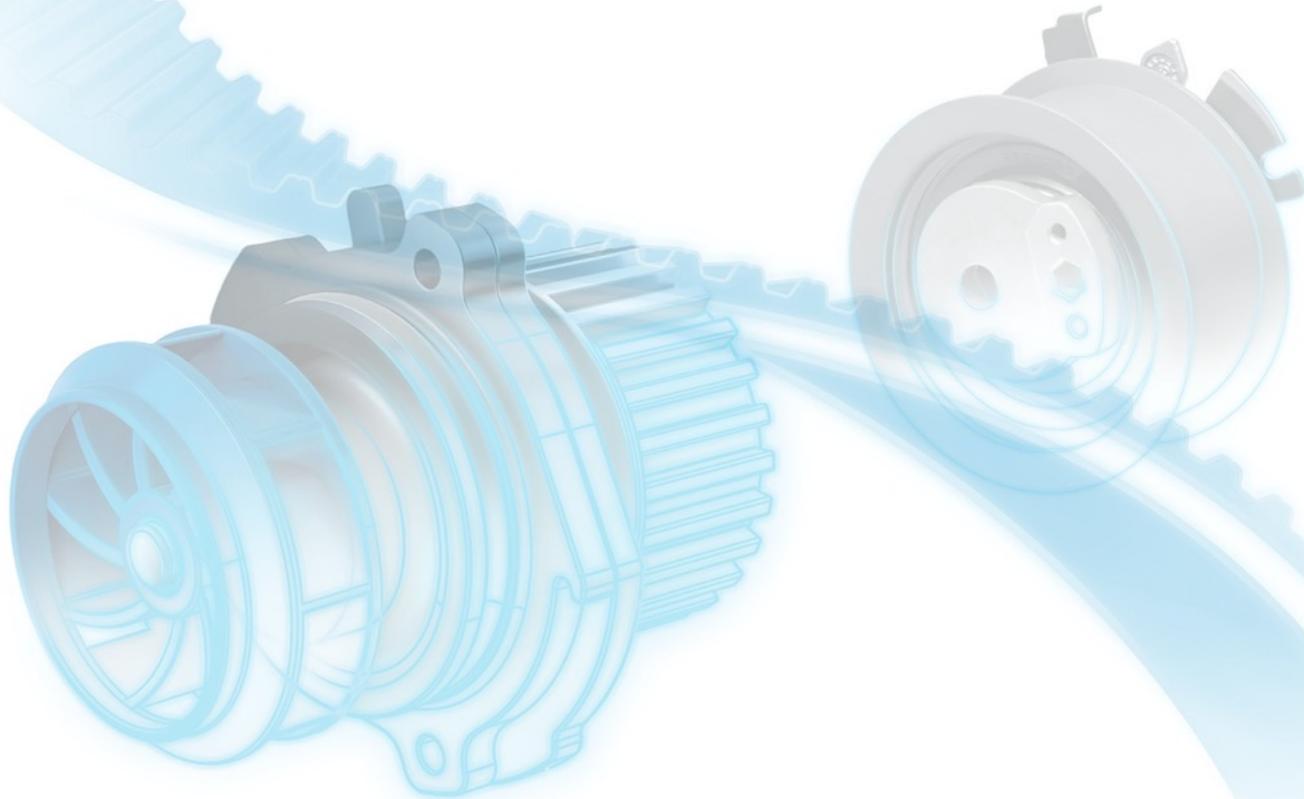


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Timing Chain Kits

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**TECHKNOW** SERIES  
by DAYCO<sup>SM</sup>



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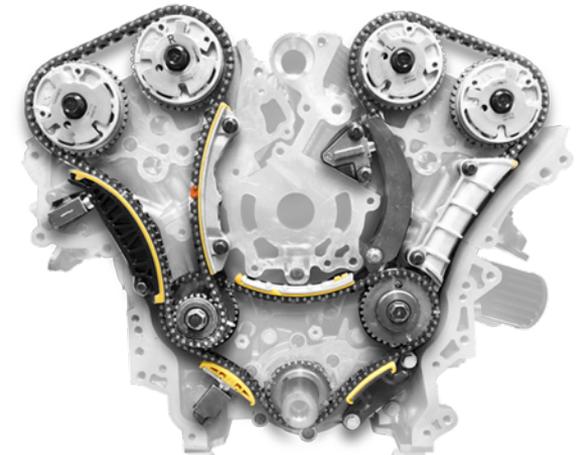
# Reasons for Timing Chain Replacement

## Reason 1: Chain Wear

Will cause a PCM code P0016, which is related to CKP (crank position sensor) and CMP (camshaft position sensor) correlation and noise at idle (rattle).

Potential causes:

- A faulty cam or crank sensor
- Cam or crank circuit is open or shorted (wiring)
- Timing belt/chain is out of time (wear)
- Cam or crank tone ring is slipped/broken
- A problem in the VVT system (sludge)
- Poor oil change maintenance, using incorrect oil
- The PCM is faulty – least likely





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## Reasons for Timing Chain Replacement

### Reason 2: Chain Guide and Tensioner Wear

This type of issue will cause engine noise.

Potential causes:

- Poor oil pressure to tensioners (alarm!)
- Worn plastic guides due to high mileage
- Worn timing sprocket teeth
- Metal shavings in oil



\*Both scenarios warrant chain replacement BUT only after verifying oil change intervals, oil pressure, compression test, leak down test and removal of the valve cover to inspect for sludge.\*



## Reading Diagnostic Codes

Diagnosis is the first step in determining if and when timing systems need to be replaced.

- DTC: [P0010](#) “A” Camshaft Position Actuator Circuit (Bank 1)
- DTC: [P0011](#) “A” Camshaft Position – Timing Over-Advanced or System Performance (Bank 1)
- DTC: [P0012](#) “A” Camshaft Position – Timing Over-Retarded (Bank 1)
- DTC: [P0013](#) “B” Camshaft Position – Actuator Circuit (Bank 1)
- DTC: [P0014](#) “B” Camshaft Position – Timing Over-Advanced or System Performance (Bank 1)  
\*See Trouble Code [P0011](#)
- DTC: [P0015](#) “B” Camshaft Position – Timing Over-Retarded (Bank 1) \*See Trouble Code [P0012](#)
- DTC: [P0016](#) Crankshaft Position – Camshaft Position Correlation (Bank 1 Sensor A)
- DTC: [P0017](#) Crankshaft Position – Camshaft Position Correlation (Bank 1 Sensor)
- DTC: [P0018](#) Crankshaft Position – Camshaft Position Correlation (Bank 2 Sensor A)
- DTC: [P0019](#) Crankshaft Position – Camshaft Position Correlation (Bank 2 Sensor)
- DTC: [P0020](#) “A” Camshaft Position Actuator Circuit (Bank 2)
- DTC: [P0021](#) “A” Camshaft Position – Timing Over-Advanced or System Performance (Bank 2)
- DTC: [P0022](#) “A” Camshaft Position – Timing Over-Retarded (Bank 2)
- DTC: [P0023](#) “B” Camshaft Position – Actuator Circuit (Bank 2) \*See Trouble Code [P0020](#)
- DTC: [P0024](#) “B” Camshaft Position – Timing Over-Advanced or System Performance (Bank 2)  
\*See Trouble Code [P0021](#)
- DTC: [P0025](#) “B” Camshaft Position – Timing Over-Retarded (Bank 2) \*See Trouble Code [P0022](#)





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## 5 Reasons NOT to Replace TCK System

It's important to verify engine condition prior to replacement by confirming correct oil, oil pressure test, compression test, leak down test, or by removing a valve cover to inspect for sludge.

These are the five scenarios where you should avoid timing chain kit replacement:

1. Vehicle has been poorly maintained, no oil change records available
2. Poor oil pressure
3. Sensor and wiring harness have not been tested
4. Engine sludge
5. Carbon deposits internally





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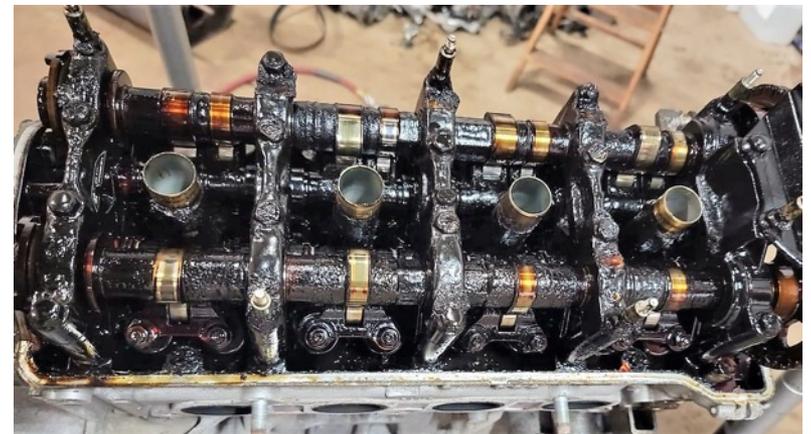
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# Timing Chain Kit Replacement

**YES**



**NO**





## Dayco Warning and Warranty Info

PLEASE READ THESE IMPORTANT INSTRUCTIONS BEFORE BEGINNING THE REPAIR.

### CAUTION

Most timing chain failures are related to poor engine maintenance. To ensure the success of your repair job, you must thoroughly inspect the oiling system functionality of the engine. Engines with sludge or carbon debris are not good candidates for timing chain replacement. If you find the engine has sludge or carbon build up, the customer should be advised that total engine repair is the only option. Timing chain kits should never be installed on an engine in poor condition. The proper functioning of timing system components is dependent on clean, clear oil passages with no dirt, sludge or obstructions. Timing tensioners, VVT solenoids and cam phasers are all dependent on a clean engine with proper oil pressure. The engine should always have the oil and filter changed when performing timing chain replacement. Use a quality filter with OE recommended oil. Installing the Dayco kit on an engine in poor condition will void the warranty. Dayco always recommends using master kits that include cam phasers and all sprockets. Reusing sprockets may be necessary for some customers but will influence chain longevity.

### INSTRUCTIONS

Scan the QR code on the side of the box for the OE service instructions. Always review the instructions before starting the job as some engines require special tools that may need to be procured before starting the job. If you require tech help by phone, call 833-721-2355 or email [partssupport@dayco.com](mailto:partssupport@dayco.com). You can find installation videos for popular kits here:

Insert QR  
code

### WARRANTY

Dayco timing chain kits are warranted for 24 months or 60K miles, whichever comes first. For this warranty to be in effect, the kit must be installed on a healthy engine by a professional technician. Please retain purchase receipt and repair order on file. Full warranty statement can be found here:

Insert QR  
code



# Parts Identification – Nomenclature



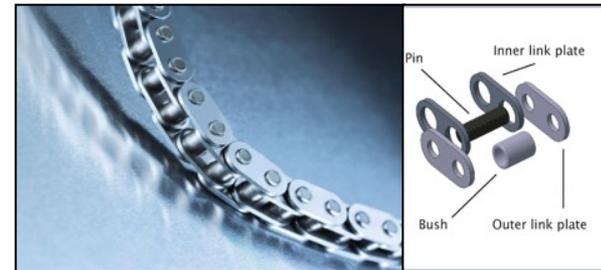


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## Chain Types

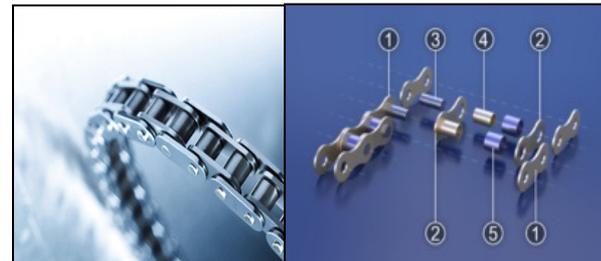
### Bushing

Bushing type chains with forged bushings provide greater strength and durability, and are the lowest cost.



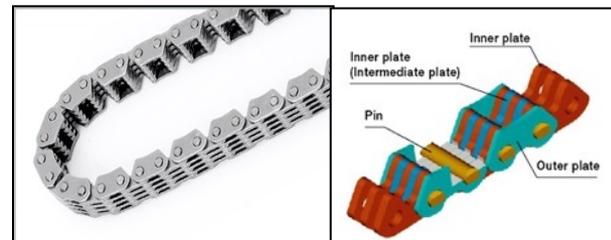
### Roller

Roller chains offer strength and durability, without compromising noise and weight performance. They are lower friction and longer lasting than bushing type chains.



### Silent

Silent chains further improve noise performance and are most commonly used in modern vehicles.





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## System Components

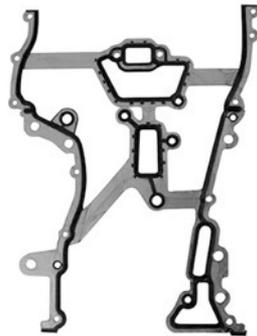
### Hydraulic Tensioner

Pushing either directly on a chain or on a pivoting guide, the tensioner controls noise, chain tension and vibration resonances. Tensioners can be mechanic or hydraulic or a combination of both.



### Chain Guide and Lever

The guide's role is to provide a low friction, wear resistant platform to lead the chain span between sprockets. The lever design allows it to pivot with a function similar to the guide. A lever is used in conjunction with a tensioner to take up chain slack and control chain motion and harmonics.

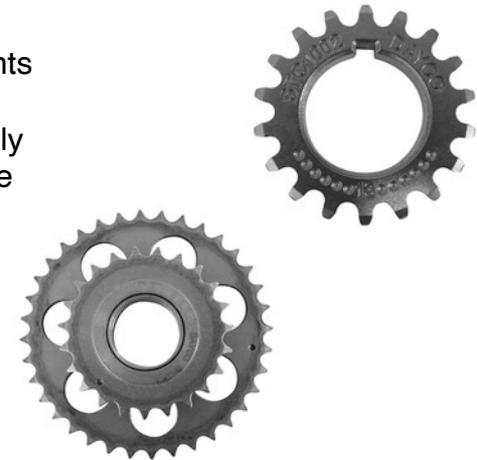


### Gasket

Gaskets form a seal where liquid or gas could pass. Most are made to be used only once.

### Chain Sprocket

The rotating elements driven by the chain. Their design is tightly controlled to ensure mesh, strength and durability.



### Oil Seal

The function of the oil seals is to provide sealing between the rotating crankshaft and the outside.





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## The Role of the Tensioner

**Tensioners play a very important role in automotive chain drive systems.**

- Pushing either directly on a chain or on a pivoting guide, takes up slack in the chain circuit, and extends to make up for chain wear and thermal expansion.
- Dampens and limits chain movement, which is important to control noise, chain tension and vibration harmonics.
- Tensioners can be mechanically and hydraulically tuned to meet customer and component requirements.
- Tensioner bodies are made from high strength steel, cast iron, or cast aluminum alloys to attain the optimum combination of fit, weight and durability. Most tensioners on modern vehicles use a combination of mechanical spring with hydraulic (engine oil pressure) back up.



PROPER ENGINE OIL TYPE AND VISCOSITY ARE CRITICAL TO LONG TENSIONER LIFE.



## The Role of Chain Sprockets

**High-quality materials are critical when it comes to chain sprockets.**

- The rotating elements driven by the chain, sprocket design is tightly controlled to ensure proper mesh, strength and durability.
- Various materials, fabrication methods and heat treat options can be selected, depending on chain type, load and speed.
- Sprockets are made with quality material—usually carbon steel, sintered process. Heat-treated carbon steel provides long wear life, resists abrasion and heavy shock loads.



**CHAINS AND SPROCKETS SHOULD ALWAYS BE REPLACED TOGETHER FOR LONGEST LIFE.**



## The Role of Chain Guides and Levers

**The role of fixed guides is to provide a low friction, wear resistance platform to guide the chain span between sprockets.**

- The guide shape is dictated by chain span requirements, interference features, material wear and strength properties.
- The chain contact portion of the guide shoe is wear resistant nylon, while the base material is glass filled plastic, aluminum or steel depending on strength and mounting constraints. Smaller or lightly loaded guides can also be all plastic if loading conditions allow.
- The lever design and function is similar to the guide, except its design allows it to pivot. A lever is used in conjunction with a tensioner to take up chain span slack and control chain motion.



DAYCO USES THE SAME PLASTICS ON GUIDES AS OEMS.



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## The Role of Camshaft Phasers

The camshaft phasers alter valve timing for best engine efficiency. Using this system increases power, fuel economy and emissions. Using engine oil pressure from a VVT solenoid, a mechanical actuator or electrically operated, the sprocket moves from its base position to advance or retard when the valves open and close.



CAMSHAFT PHASERS ENSURE OPTIMUM ENGINE EFFICIENCY.



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## Variable Valve Timing Explained

Advancing or retarding valve timing for best engine emissions/output/economy

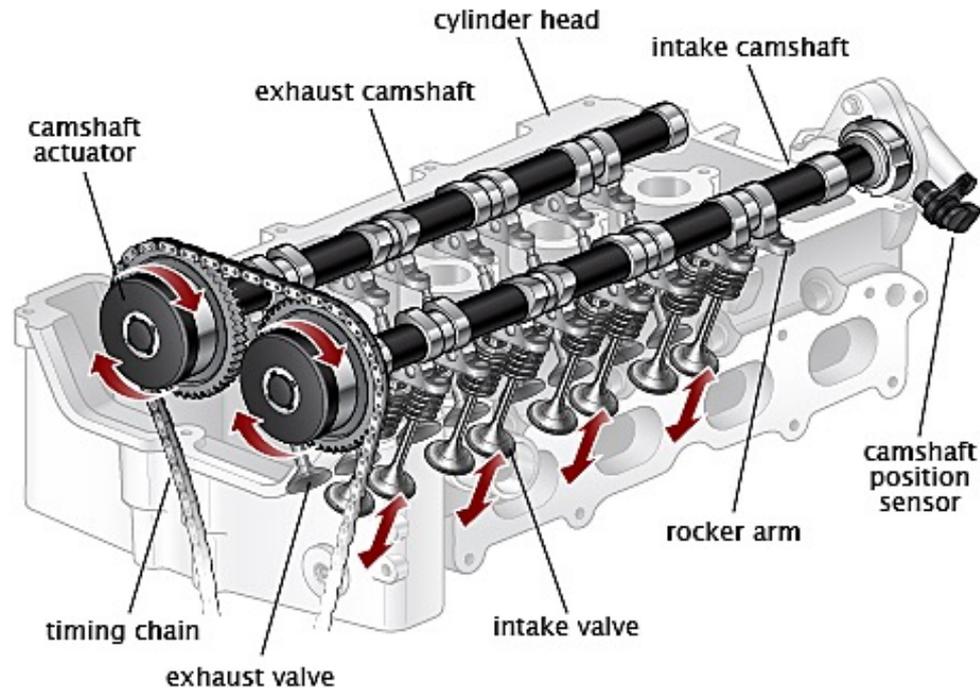


Image courtesy of ClearMechanic.com

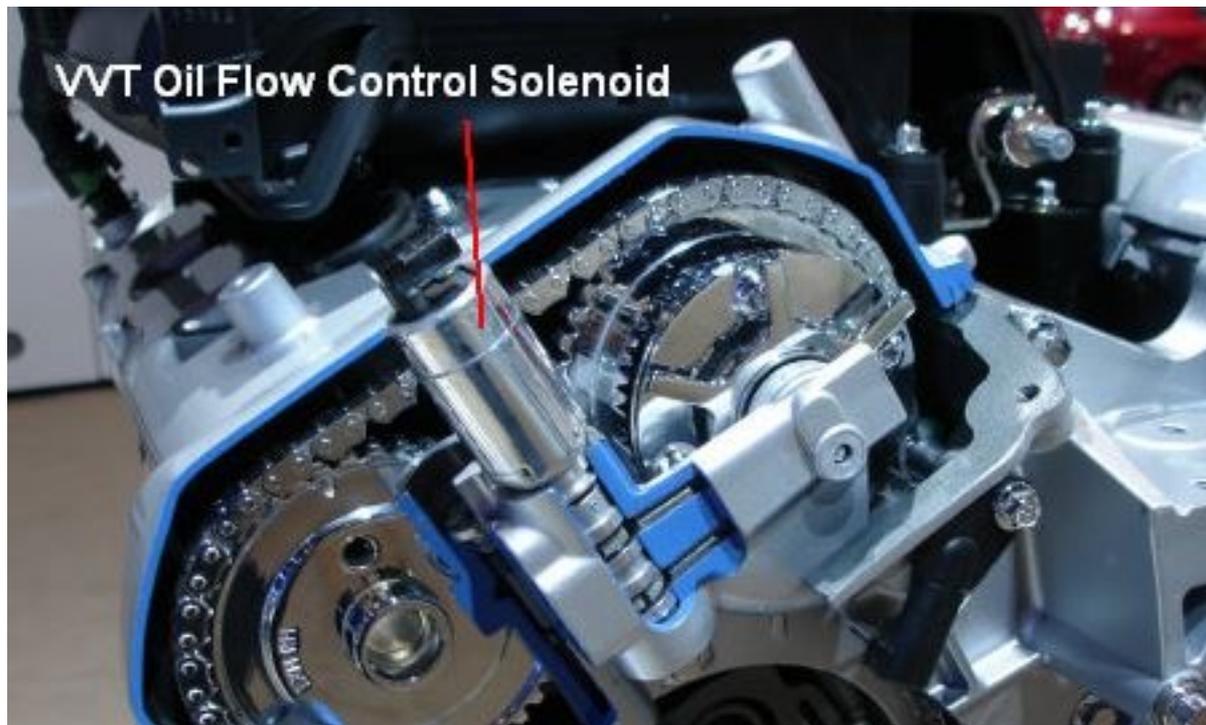


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## The Role of VVT Timing Solenoids

The ECM directs engine oil pressure through solenoids to the cam phaser to alter camshaft valve timing. Using sensors for engine load and speed, it changes when the valves open and close for optimum power and efficiency.





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## Diving Into Diagnostics

### Engine fault codes **MUST** be diagnosed first

- If there are no MIL lights or codes, proceed with mechanical diagnosis.

### The **VVT** system and some cam phasers are operated by the **PCM**

- Not diagnosing the electrical issues first can lead to a false diagnosis.

### Most common causes of engine codes are:

- Bad sensors
- Corroded connectors
- VVT solenoids plugged with sludge
- Cam phasers broken, sludged up or worn out





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## NVH Related Problems

### Excessive Chain Noise

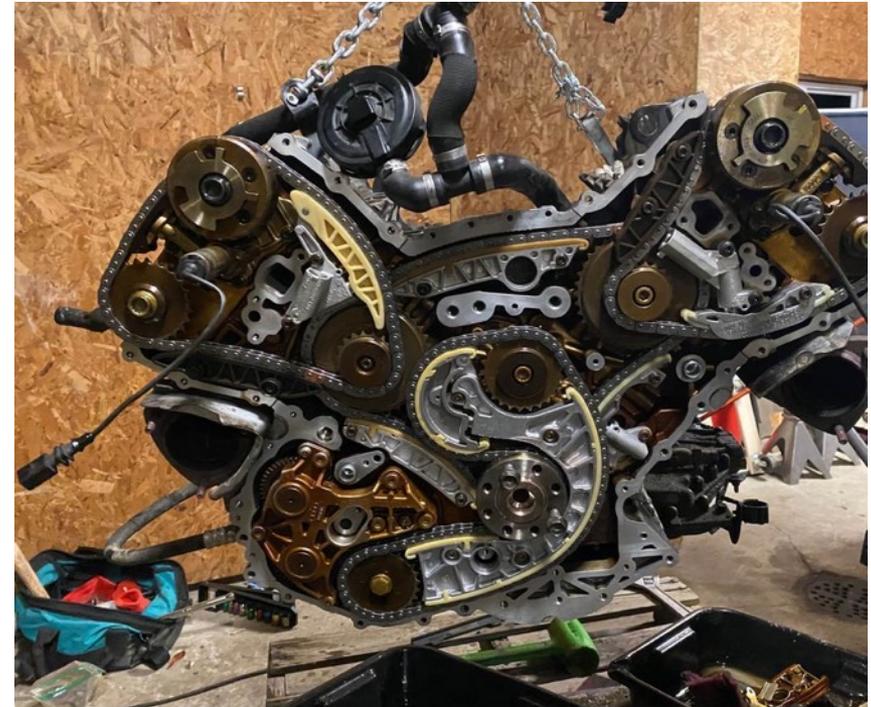
- Broken links or seized rollers
- Extreme misalignment or elongation
- Chain jumping sprocket teeth
- Loose sprockets, broken teeth, interference by foreign objects
- Contacting a fixed object

### Excessive Vibration

- Unbalanced rotating parts
- Broken or missing rollers
- Too much chain slack,
- Loose or misaligned sprockets or shafts

### Unusual Noises

- Improper installation of the sprocket or shaft (not properly torqued)
- Worn bearing or bushings
- Excessive or insufficient slack in the chain
- Lack of or unsuitable lubrication
- Excessively worn chain or sprocket





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## Chain Related Problems

### Catastrophic Chain Failure

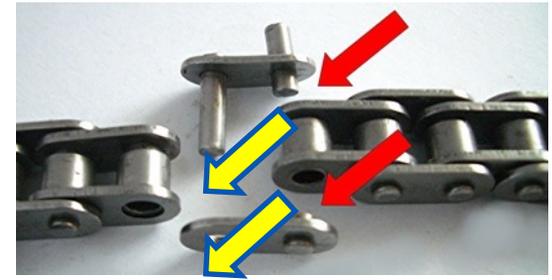
- The failure of the chain may be due to the failure of another component of the drive.
- A seized gear can cause chain breakage.
- A broken chain is not a sign of a poor quality chain.

### Deformation of Link Plate Holes

- Excessive load (seized or partially seized gears) or improper lubrication
- Operating a chain at high load without proper lubrication can create friction between the pin and bushing, preventing the pin from rotating.
- In this situation, the pin may come out, leading to chain breakage.
- Fatigue breakage due to wear

### Roller and/or Bushing Cracks (falls off)

- Occurs when the chain impacts the sprocket teeth.
- Excessive load or rotational speed.
- Inadequate lubrication.





## Alignment Related Problems

**An incorrect alignment of the sprockets, forcing the chain into incorrect mesh with the gears causing lateral wear of the chain link plates and sprocket tooth wear. Pay attention to spacers, bushings and chain alignment.**

- Check for surface roughness or binding when the chain engages or disengages from the sprocket.
- Inspect the sprocket teeth for reduced tooth section and hooked tooth tips. If these conditions are present, the sprocket teeth are excessively worn and the sprocket **MUST** be replaced.
- Check for and eliminate any buildup of debris or foreign material between the chain and sprockets





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## Tensioner Related Problems

**The hydraulic actuator, must have constant chain tension using a mechanism of oil pressure and a helical spring**

- If there is a lack of oil pressure (especially during engine start or at very low speed), all the force is taken by the spring and the piston movement will be increased. This can cause banging of the piston teeth against the ratchet.
- Vibration of chain will amplify the movement causing the piston to strike the sleeve insert generating very high impulse force on tensioner and chain. As a result of this, piston teeth will be damaged.





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## Guide Related Problems

**The rate of wear or long term durability of chain guides is very closely related to lubrication. Chain guides can last 300,000 miles when proper oil maintenance is followed.**

Symptom of worn guides = Chain slap noise at idle speeds

- Severe engine damage can occur if guide plastic is worn through allowing the chain to ride directly on the aluminum or steel backer. Metal shavings in the oil is cause for engine replacement, not timing chain kit replacement.
- Proper oil maintenance is defined as using oil and filters that meet or exceed OEM specifications and changing at or before required change intervals.



### Examples:



Excessive vibration of the chain caused by elongation or bad tensioner, can also damage the metal part of the of pivoting guides causing further chain misalignment

Chain guides showing wear and damage. The worn and broken plastic guide fragments are dangerous because they can block the oil pick up filter





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## Tech Tips Prior to Replacement

- Verify all engine codes are properly diagnosed and repaired.
- Verify mechanical condition of the engine using compression test, leakdown test and inspection for sludge.
- Discuss oil change habits with the vehicle owner.
- Use an engine flush as directed before disassembling the engine.
- Replace water pump if driven by timing chain.
- Recommend replacing water pump as part of the repair.
- Use oil and filter that meet or exceed OEM specifications.



# Top Applications



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## General Motors Ecotec Platforms

- Popular GM four cylinder applications
- 2.0L and 2.4L engines

### KTC1333



### KTC1334





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## General Motors Ecotec Platform

- Popular GM four cylinder applications
- 2.0L, 2.2L and 2.4L engines

### KTC1338



### KTC1342





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## General Motors Ecotec Platform

- Popular GM four cylinder applications
- 2.2L and 2.4L engines

### KTC1340



### KTC1341





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## General Motors HFV6 Platform

General Motors has several versions of the HFV6 spread across Chevrolet, GMC, Cadillac, Holden and Saab. The engine block was designed for applications ranging from 2.8L to 3.6L. The most notable configuration is the 3.6L that uses the code name LY7. These kits are designed to fit the entire range of the GM HFV6 powerplants.

### KTC1337



### KTC1344





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## Ford Triton V8 Platform

- Popular Ford V8 engines, pick up trucks and Lincoln SUVs

### KTC1335



### KTC1336





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## Ford Cyclone 3.5 & 3.7L Platform

- Very popular late model Ford and Lincoln SUV engines
- Also found on the Ford Taurus and Ford Flex

### KTC1339



### KTC1346





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## Chrysler Platforms

### KTC1448

- Large array of Chrysler engines dating from 1956-2203
- Most popular are the Magnum six cylinders and Magnum eight cylinder engines



### KTC1343

- Popular V8 Hemi engines in trucks, SUVs and Dodge cars





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## General Motors 1957-1986 Platforms

### KTC1345

- Wide array of General Motors engines
- Most popular is the 350 small block



# Applications Spanning Multiple Kits



## General Motors HFV6

### KTC1344



### KTC1391



### KTC1337



- General Motors has several versions of the HFV6 spread across Chevrolet, GMC, Cadillac, Holden and Saab
- The engine block was designed for applications ranging from 2.8L to 4.0L
- Most notable configuration is the 3.6L that uses the code name LY7
- Designed to fit the entire range of the GM HFV6 powerplants



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## General Motors LS Series

### KTC1350



### KTC1358



- Made famous by the LS1 in the C5 Corvette
- LS engines are aluminum block, pushrod V8s used in an expansive list of vehicles in the General Motors lineup
- Kit will fit engine displacements ranging from 4.8L to 6.2L



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## Honda K Series; K24Z

### KTC1360



### KTC1387



- Popular Honda and Acura motor
- 2.4L displacement
- Found in the Accord, CR-V, Civic Si, TSK and ILX



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## Toyota AZ; 2.4L

### KTC1401



### KTC1104



- Used in a wide range of Toyota vehicles
- This engine code is 2AZ-FE and the displacement is 2.4 liters
- Also used in the Pontiac Vibe which has the same bones as a Toyota Matrix



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## General Motors Ecotec; L61 and LE5

### KTC1349



### KTC1340



- Used in a wide range of General Motors vehicles
- The L61 is the Ecotec 2.2L
- The LE5 is the 2.4L
- These kits will fit both engine sizes



## Chrysler PowerTech V6



### KTC1369



### KTC1402



- Work horse engine for Dodge and Jeep vehicles
- Displacement is 3.7L



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## Toyota GR Engine; 4.0L

### KTC1107



### KTC1382



- Widely popular Toyota 4.0L
- Kit works in the 4Runner, FJ Cruiser, Tacoma and Tundra



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## General Motors Small Block V8

**KTC1394**



**KTC1405**



- Late 80's to mid 90's GM V8 and V6 power plants



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## Ford Cyclone; 3.5L & 3.7L

### KTC1384



### KTC1347



### KTC1346



- Very popular late model Ford and Lincoln SUV engine
- Also found on the Ford Taurus and Ford Flex

# 1970's Chevrolet 7.4L; VIO 111,000



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**KTC1413**



**KTC1425**



# 1980's and 90's Toyota 2.4L; VIO 303,000



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**KTC1379**



**KTC1396**





**Thank you**

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