

Timing Belt Training

History of the Timing Belt

The lineage of the timing belt can be traced back all the way to the 1940's when a sewing machine manufacturer replaced its noisy and expensive timing chain with a rubber timing belt. After several decades and various material and profile changes, the timing belt was introduced to the automobile.

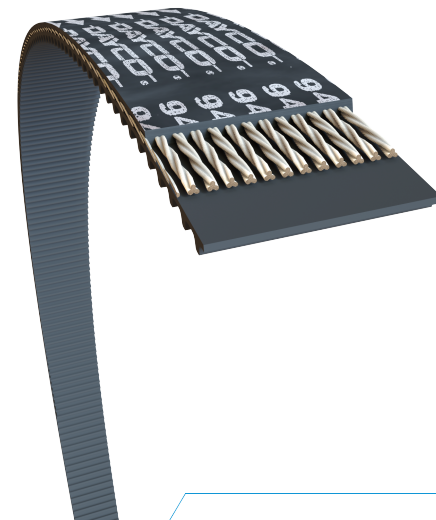
In 1961, GLAS, introduced the S 1004 which became the first production car credited with using a timing belt. Timing belts were introduced to American vehicles when Pontiac manufactured the first belt driven engine in the mid-1960's.

While trends in the automotive industry have fluctuated to and from the use of the timing belt, it offers several advantages over the timing chain. Some advantages of the timing belt are that it does not require lubrication like the timing chain, it is lighter, less expensive, and operates more quietly reducing engine noise.

What is a Timing Belt?

A timing belt synchronizes the rotation of the crankshaft and camshaft(s) ensuring the proper timing and allows the engine's valves to open and close during each cylinder's firing. The operation of this belt is critical in preventing the pistons from striking the valves causing damage in an 'interference' engine. This rubber belt is inside the engine behind the external belt drives.

It is important to note that a timing belt should be changed at the OE Manufacturer's recommended replacement mileage found in the vehicle's owner's manual.



Timing Belts — The Forgotten Belt

The timing belt is located inside the engine which requires several steps to get to the timing drive, making timing belt and timing drive component inspection difficult. Because the belt cannot be seen when opening the hood of a vehicle, the average consumer may forget or not even realize the importance of timing belt maintenance. The timing belt is often referred to as “The Forgotten Belt”.

LOCATING THE TIMING BELT

- Front End Accessory Drive (FEAD) – the common belt that can be seen upon opening the hood of a vehicle is the serpentine belt which is located on the FEAD. The first step is to remove the serpentine belt and belt related components.
- Timing Cover - The cover is designed to keep out contaminants. This is located behind the FEAD and must be removed to reach the timing drive.

As shown, it's difficult to access and change the timing belt. When replacing the timing belt, it's important that the tensioner, idler pulleys, and water pump are inspected as the timing components wear at a similar rate. These few timing components are inexpensive when compared to labor costs. Manufacturers recommend replacing the timing components when replacing the timing belt.

IMPORTANT:

If the timing components are not replaced along with the timing belt, the life of the newly replaced timing belt can be reduced by 50%.



FEAD



Timing Cover Removed



Timing Drive

Why is it Critical to Inspect and Replace?

ENGINE TYPES

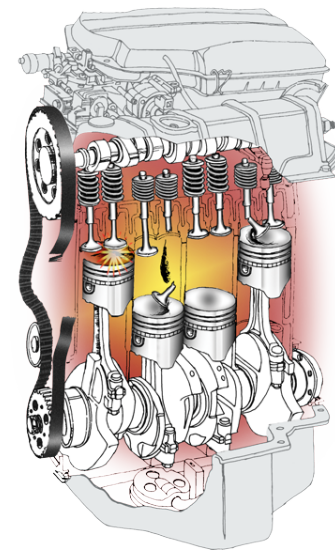
- **Interference:** An interference engine allows for a higher compression ratio, which means more power out of the same engine. Within an interference engine the pistons and the valves share the same space in the cylinder but move at different times. One or more valves may open into an area where the pistons travel.
- **Non-Interference:** A non-interference engine is one where an open valve never enters into an area where the piston travels.

TIMING BELT FAILURES

- **Interference Engine:** If the timing belt breaks on an interference engine and a piston makes contact with the valve(s), it can severely damage the engine. The amount of damage varies depending on engine speed at the time of failure.
- **Non-Interference Engine:** If you have a non-interference engine, a broken belt will not damage the engine, however the vehicle will not function until the belt is replaced. Replace the belt, and any other worn components, and the vehicle is back on the road.

OVERVIEW

Timing belts break most often at startup and shutdown of the engine when the maximum amount of tension is placed on the belt. If the timing belt is changed on schedule, there's little risk of a problem. To prevent timing belt failure, refer to the vehicle's owner's manual for recommended change intervals.



Interference Engine

Replacement Interval

IMPORTANT:

Manufacturers publish the OE Replacement Intervals for all timing belt driven applications and can be found in the vehicle's owner's manual.

AWARENESS:

- Replace if the vehicle is past its recommended replacement interval (one owner vehicle).
- Replace if the OE belt is found on the application and the mileage is beyond the recommended change interval. NOTE: It is possible that the vehicle's belt has been replaced by a dealer or with dealer parts after the vehicle reached its recommended change interval. Inspect the related components along with timing belts in this situation.
- If an aftermarket belt is found on the application and is beyond its recommended change interval, the belt has likely been replaced. Inspect the related components along with the timing belt in this situation. As mentioned previously, if the timing components are not replaced with the timing belt, the life of the newly replaced timing belt can be reduced by 50%.

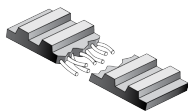
IMPORTANT:

The timing components i.e. tensioner, idler pulleys and water pump wear at a similar rate as the timing belt.

Signs of Wear or Belt Failure

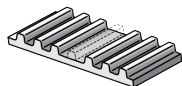
Over 80% of all belt failures and replacements occur after the vehicle passes 85,000 miles / 137,000 kilometers. The fact is, peak belt replacements occur between 90,000 - 100,000 miles / 145,000 - 160,000 kilometers on vehicles that are seven to 10 years old. Consequently, the average age of cars on the road today is nearly 10 years with over 100,000 miles / 160,000 kilometers.

Tensile (cord) Failure



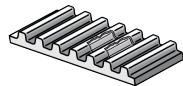
- Belt crimped
- Foreign body in drive
- Excessive tension
- Moisture or antifreeze getting on belt and invading to the cord

Loose Teeth



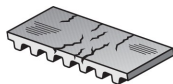
- Low working tension of the belt
- Loss of tension in the belt
- Penetration of foreign materials in the transmission

Worn Timing Belt Teeth



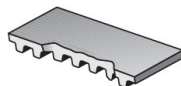
- Irregular tension
- Pulleys with worn teeth
- Incompatibility with pulley

Worn and Cracked Timing Belt Back



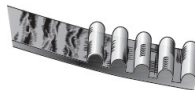
- Operating at excessively high or low temperatures
- Locking of a transmission component
- Worn pulleys

Side Wear



- Misalignment of the tensioner or one of the transmission components

Contamination



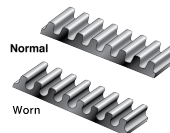
- Timing belt cover or seal damage or improper installation
- Water, gasoline or oil line leaks
- Rubber deposits from wobbling belts or misalignment

Noisy Timing Belt



- Timing belt cover or seal damage or improper installation
- Rubber deposits from wobbling belts or misalignment
- Water, gasoline, or oil line leaks

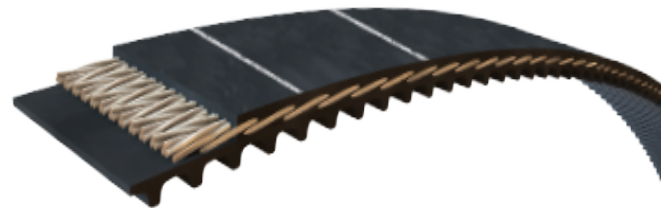
Worn Land Area



- Excessive tension
- Worn pulleys

Did You Know?

- 73% of all timing belt applications have a water pump driven by a timing belt.
- Approximately 74% of vehicles equipped with a water pump driven by a timing belt are manufactured with an interference engine.
- Replacement mileage intervals have increased by over 13% since 2005.
- 69% of motorists are unaware or surpass routine timing belt maintenance.
- A new timing belt on worn timing components can reduce the life of the timing belt by 50%.



FAQs

Balance Shafts

Balance shaft is a special shaft with eccentrically mounted weights used in an internal combustion engine to reduce vibrations. Balance shafts are most common in straight four or six cylinder engines. Though due to their design asymmetry, have an inherent second order vibration (vibrating at twice the engines RPM) that cannot be eliminated no matter how well the internal components are balanced. Balance shafts use timed eccentrically mounted weights to counter the vibration.

Timing Marks

Different engines have different timing patterns depending on the firing pattern used by their ignition system, the length of travel of their pistons, and other engine design factors. Timing marks are critical to help ensure a new timing belt is installed so that it correctly synchronizes the movements of the cylinder heads and crankshaft during the operation of the engine. If the timing marks are not in the correct position the vehicle may not start OR hard start, the vehicle may experience a lack of power OR dieseling, or there may be indications of a rough idle. Improper installation can also cause an error code to appear on your dashboard, like the check engine light.

FAQs Continued

Arrows (Directional Install)

Arrows on timing belts are used to establish the direction of travel of the timing belt (Fig. A). The arrows should point with the belt, or across the belt depending on manufacture. This is to ensure once a direction is established on the belt, it should always rotate the same direction after any system maintenance is performed utilizing the old belt. Timing belts by design are neutral tracking by dual spinning belt cord in opposing directions (one cord wound one direction and the one next to it wound in the opposite direction (Fig. B)).

Fig. A

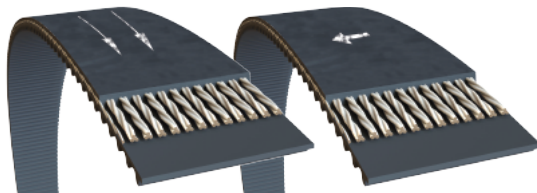
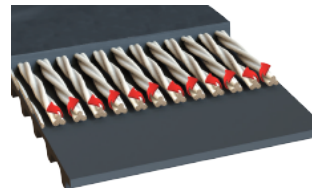


Fig. B



Timing Belt Cam Tool

A Timing Belt Cam Tool is designed for locking timing belt gears during service. To retain engine timing position during timing belt removal and installation, twin camshafts must be locked on their timing marks. A Timing Belt Cam Tool's adjustable arms fit into the gear's teeth and expand to securely hold in place gear sizes from 4" to 6" (101mm to 152mm) with gear separation up to 3" (76mm). If the timing gears get out of position the system will have to be re-timed causing extra work and effort to get the timing system back in sync.



Benefits of Replacing all Worn Components

- When working on the timing drive, the job should be done right the first time by replacing all worn components at the same time the timing belt is replaced.
- If the technician has to access the timing drive more than once, the labor rates could more than double.
- All parts will have the same life as the timing belt.

Cam Shaft Seal (A)

Leaking or worn seals will contaminate the timing belt causing premature belt failure leading to major engine damage.

Timing Belt (B)

A timing belt is a wear item and must be replaced within the recommended OE replacement interval. When a timing belt breaks, severe engine damage can occur and your engine will no longer run.

Tensioner & Idler Pulleys (C & D)

One of the most common causes of timing belt failures is worn tensioners or idler pulleys. Additional labor costs are minimal when changing a timing belt.

Hydraulic Timing Belt Tensioner (E)

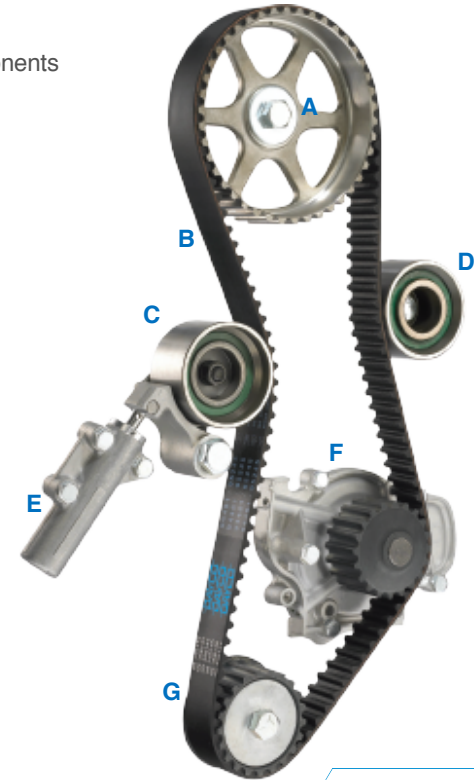
Hydraulic timing belt tensioners help set or maintain constant tension on the system. Loss of timing belt tension may lead to major engine damage.

Water Pump (F)

Water pumps driven by a timing belt should be replaced when changing the timing belt. Engine coolant from a worn leaking water pump can contaminate and destroy a new timing belt.

Crank Shaft Seal (G)

Leaking or worn seals will contaminate the timing belt causing premature belt failure leading to major engine damage.



Thank you

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