

MOVE FORWARD. ALWAYS.™

# Water Pump Best Practices **TECHKNOW** SERIES

#### The Water Pump's Purpose



The purpose of a car's water pump is to push coolant through the car's engine block, radiator and hoses to help pull the engine heat away from the system. Most frequently, the water pump is belt driven off the crankshaft pulley. It can also be hidden under the timing belt cover on the front of the engine on vehicles with a timing belt.

The **pump** is operated by the **engine's** drive belt – as the belt turns, the **pump** turns. The coolant that gathers between the impeller blades travels outward using centrifugal force, and suction draws the coolant into the water pump from the radiator.

After the coolant enters the water pump, it goes through the whole engine, where it absorbs the heat that the combustion process produces, and then it goes to the radiator, so the heat can exit to the outside air.





#### Water Pump Design

- **Inlet** This comes from the cool side of the radiator feeding coolant into the pump.
- **Outlet** Cooled water is pushed through the engine to absorb heat.
- **Hub** This may be a smooth pulley or a hub that a pulley can be bolted to.
- **Bearings and shaft** The hub end bearing is a case-hardened roller bearing. Some low-cost pumps will use a ball bearing at the hub end. Dayco uses roller bearings for excellent durability. A case-hardened ball bearing is used on the impeller end.
- **Impeller** Designed to flow a precise amount of coolant through the system. Dayco's are frequently designed with upgraded material.
- **Seal** A silicon/carbide seal keeps the pump leak free.



#### **The Importance of Bearings**

Many low-cost pumps will use hardened ball bearings on both ends. This was acceptable in the past as water pump replacements typically took place at 80,000 kilometers or so. But on new vehicles, higher quality pumps – such as Dayco – will use the more robust case-hardened roller bearings on the hub end to carry the larger loads. We include it on every model that OE calls for it. Using only ball ball for lower cost on newer water pumps could lead to premature bearing failure. We do not sacrifice quality for cost – we improve it.

#### **Ball Ball Design**



This bearing design is used for high-speed rotating water pumps, and water pumps that have little or no attachments. Many grey iron from late 1970s and 1980s are BB style bearings. Still in use on some low-cost products.

Ball ball design does not have a high load rating for HUB Side of water pump.

#### **Ball Roller Design**



Ball Roller bearings are used where the HUB LOAD is severe, such as later model applications and all Heavy Duty and agricultural applications.

As vehicles become more technologically advanced, this bearing type is being used much more often. Our case-hardened design allows some flexibility without damaging the pump or bearing.





#### The Role of the Fan Clutch

Many vehicles, especially those with HD cooling systems will use a fan clutch. The fan clutch uses a viscous coupling that lets the fan run full bore at low engine speeds and allows the fan to slip at high speeds for fuel economy. These units are very heavy and require a roller bearing water pump.

The fan clutch should always be replaced when the water pump is replaced on these types of vehicles. Dayco provides a tag on each water pump where it is necessary to replace the fan clutch to validate the warranty.



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#### **The Benefit of Unitized Seals**

Today's water pumps feature a modern seal design that is one-piece or unitized. Unlike earlier ceramic two-piece designs, they are typically made of a silicone, carbide composite.

Unitized seals provide less contamination risk and in the case of Dayco's design, prevent leaks for well beyond the life of the expected warranty.

Older style seals are lower in cost and many are not compatible with today's modern organic acid coolants.



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#### The Hub

- The water pump hub does the heavy work as there can be multiple pulleys and/or a big heavy fan clutch mounted on it.
- Dayco takes extreme care to make sure the hub is pressed on the shaft to stop vibration or "wobble". This kind of vibration can destroy a new pump very quickly. Each hub has to be pressed to the exact perpendicularity of the shaft to ensure no "wobble" under high RPM rotation. This is important in controlling the run-out specification of the hub – Vibration can be the death of a bearing and it stems from a misaligned hub and worn attached components.
- Water pump hubs are press fit to the bearing shaft of each water pump. These press fit requirements are SKU specific. For instance, later model design pumps that have additional attachments that bolt to hub such as a simple pulley to a fan clutch with fan.



#### **Impeller Function and Facts**

- Cooling system maintenance is critical to long impeller life. The water pump circulates coolant throughout the engine, keeping the temperature controlled. Poor cooling system maintenance can cause cavitation and ultimately lead to impeller failure.
- Impeller material along with engine requirements is key for specific applications. Dayco matches the OE impeller material in most cases.
- Impellers are typically cast iron (pic A), die cast aluminum or stamped steel (pic B). Cast iron and die cast are most durable, but also more costly and most often used with heavy duty vehicles. Stamped steel is durable but is susceptible to deformation.
- Some OE impellers are plastic and do not last as long as their metal counterparts. Dayco always mimics the OE impeller material design with the exception of plastic. Plastic impellers have had a high failure rate so Dayco builds those specific pump applications with a metal impeller to alleviate that issue.
- Impeller C pictured has cavitation damage and will not perform properly. The cavitation damage is a direct result of poor cooling system maintenance. It occurs when there are air bubbles in the coolant. These bubbles hit metal parts in the engine at extremely high pressure resulting in metal corrosion. Modern coolants have additives that prevent cavitation. These additives do get depleted over time even though the freeze protection still exists.







#### **Castings – Key Facts**

The casting is the body of the water pump. It must be machined to exact specifications from the bearing bore diameter to the sealing surface of the engine block.

Dayco will always use the same material as OE for its water pump castings, specifically cast iron for iron and cast aluminum for aluminum.

A very precise CMM machine is used to be sure the design is an exact replica of the OE part.

- · Every mounting hole is verified based on bolt pattern of the engine prior to machining for exact fit
- The bearing bore measurement is 100% verified

Dayco recommends using parts that look and fit like OE. Do not use generic style pumps that fit multiple applications.





#### Gaskets



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Dayco pumps come with all gaskets, seals and O-rings needed for installation. Making life simple for technicians and shop owners, everything needed to install the pump is included in the box.

We use the highest quality gaskets made from HBNR rubber Orings, silicone impregnated gaskets that are just like or better than the OE product.

All Dayco water pump *premium quality* gaskets include:

- 8902 interface material
- HNBR rubber material (O-ring)
- Upgraded MP-15 sealing material





#### **Basic Installation** A simple, exact and easy job if done in the correct way!











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#### The Importance of Kits

- Dayco's Timing Belt Kits with Water Pumps are designed for the most popular applications with 99% coverage for today's domestic and import vehicles.
- The kit ensures technicians or DIYers have all the parts needed to perform a complete repair job, so they can change out all worn components and eliminate possible comeback issues.
- The pulleys, timing belts and tensioners mirror Dayco's OE solutions and each of the water pumps is assembled using Programmable Logic Control (PLC), providing quality data during the manufacturing process.
- Additionally, each water pump features 100% new cast aluminum or iron material and meets TS16949 quality standards.





#### **Cooling System Maintenance**

It is extremely important to flush and refill the cooling system with the OE recommended coolant when changing a water pump to avoid any type of premature part failure.

Coolant has changed dramatically in the last

**20 years.** All modern vehicles started using **OAT** (Organic Acid Coolants) in 1996 with GM DexCool. Most all other automakers adopted OAT coolants after that.

Asian carmakers use a version called **PHOAT** (Phosphate Hybrid OAT).

However, silicate coolant still accounts for nearly 60% of all antifreeze sales when the numbers should be 20%.

Whenever replacing a water pump, you MUST drain, flush and refill the system with the OE specified coolant chemistry.

The seal in the pump is designed only to work with this chemistry! This is the #1 cause of new water pumps leaking.



#### Weep Hole or Accumulator Design



The first design at left below is called a weep hole design. This design is used to allow small amounts of coolant to pass through, which lubricates the bearing shaft. A small weep may occur, this is referred to as "seating" meaning that the pump needs to be under operating pressure for the seal to be fully "seated" or sealed 100%. The actual time required for the seal to be fully "seated" varies from application to application. The weep hole is also a pressure release for the cooling system.

OEMs have upgraded the weep hole design to an "accumulator design" due to ZERO KLM leakage at shop level, causing returns that are not real or legitimate defects.

When the water pump begins to fail, the weep hole will begin to <u>leak</u> coolant not "weep"



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#### **Signs of Failure**

Signs of potential water pump failure include:

- Vehicle temperature fluctuation during operation
- Small leakage of coolant
- Squealing or noise during operation

#### All of these signs can be brought about by fluid contamination, the #1 cause of premature seal failure.

Contamination occurs when abrasive items come in contact with the pump, leading the shaft seal to fail prematurely. Improper coolant mix or pure water in the radiator can cause the steel and cast impellers to show signs of rust. This rust contaminates the entire cooling system and can cause multiple product failures including the water pump. In addition, the leaking fluid can also create cavitation damage as it literally eats away at the metal components.



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#### **Use of Liquid sealant**

In some applications the use of a sealing paste or silicone compounds are not required (check OEM specifications) excess use of sealing paste/silicone leads to early pump failure with the excess making its way through the water pump damaging shaft seals. Never use sealing paste/silicones on O ring type seals. If sealant is to be used ensure it is applied lightly and evenly to gasket.



#### **Dry Rotation**



Never turn the flange of the pump by hand DRY after removing from the box before fitting as this can damage the carbon seal. Always use <u>new</u> coolant fluid (do not recycle) and ensure the entire system is correctly flushed before starting the vehicle to ensure the water pump is lubricated and the system is free of foreign matter, failure to do so will damage the pumps carbon seal and cause leakage.



Signs of Overheating



Scratches on the Seal

#### **Replacement Schedule**

- Follow OEM guidelines for standard replacement intervals per application or vehicle make and model. The automaker provides the best guideline for water pump replacement if no warning signs are present.
- Dayco highly recommends changing all worn front end drive accessory components and timing belts when a water pump installation is deemed necessary. A systems approach is critical to component longevity.
- A good technician will also replace the water pump when performing a timing belt change because the pump is inexpensive and 90% of the pump replacement labor is done during the timing belt replacement.



#### **About Dayco Water Pumps**



With 98% coverage and more than 500 skus, Dayco Water Pumps meet or exceed OE specifications for fit, form and function. The highest quality standards are upheld with TS16949 certification.

- Our single source manufacturing allows us to control every quality aspect of product from RAW material out of the ground to your completely new water pump.
- **Impellers** have been improved from OE PPS plastic material to die cast aluminum where necessary increasing durability and providing a longer life. It can cost a few dollars more, but it is a superior product.
- On many popular applications, the pulleys have been upgraded to a **single piece forged pulley**, meaning we machine the pulley from raw steel. We do not weld the pulley together because the weld is the weakest part and can break under the pressure of the belt.
- All water pumps **feature new aluminum**, with absolutely no recycled material. We compile digital readings during the casting process to verify material composition during part production.
- **Dayco uses only case-hardened bearings** per OE design. The outside is hardened, but inside allows for some flex without breaking the bearing.
- Dayco offers an industry leading 2year 40,000 KLM warranty on all of its standalone automotive water pumps.

#### **Finding the Right Part the First Time**



Use the Dayco Parts app or website to search for the right part.

- Full Catalogue
  Application Guide
- Product Code Look-up
- Interchange search
  - Competitors
  - OEM





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