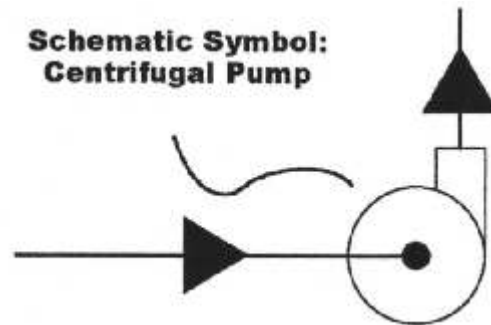


# Water Pumps 101

Mechanically driven WATER PUMPS, used to circulate coolant through AUTOMOTIVE ENGINES are generally the CENTRIFUGAL (pron: sen trif yoo gal) type. A CENTRIFUGAL PUMP creates a suction (a low pressure area into which higher pressure fluids will flow towards) at the center of its spinning IMPELLER. This is accomplished by flinging the water trapped between the IMPELLER VANES radially outward, creating a vacuum (level of negative pressure) at the axis of rotation. CENTRIFUGAL PUMPS are capable of creating an almost perfect vacuum, >25"HgR. The common schematic symbol for this type of PUMP is:



## Power Consumption

The amount of torque needed to drive a CENTRIFUGAL PUMP is related to flow, not pressure. CENTRIFUGAL PUMPS love pressure! At a high rate of flow they consume a great amount of power. As the discharge of one of these PUMPS is restricted, and high flow is exchanged for high pressure, the required torque (power consumption) to drive the PUMP decreases, not increases. When the discharge is completely blocked (dead headed), power consumption is surprisingly at a minimum, and discharge pressure is at a maximum.

This is opposite of the effect of restricting the discharge of a POSITIVE DISPLACEMENT PUMP, like the engine's OIL PUMP. Restricting the discharge of an OIL PUMP increases the required torque to drive the PUMP. The OIL PUMP reacts to restriction of flow opposite of the WATER PUMP.

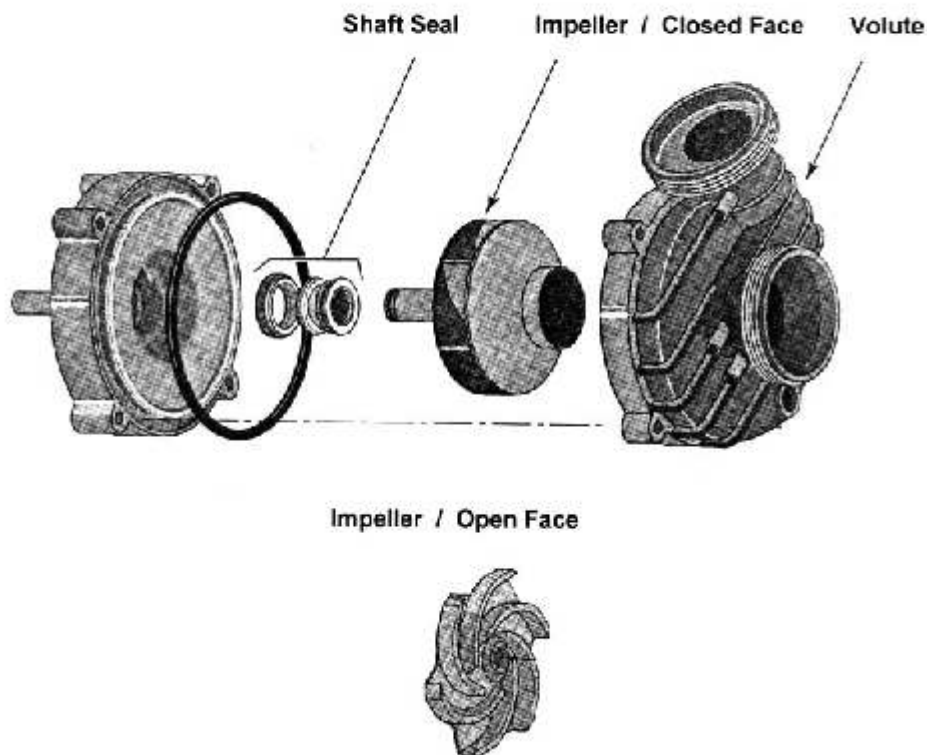
Similarly, as the SUCTION LINE delivering water to a CENTRIFUGAL PUMP is flow blocked, and the flow of water is reduced or stopped, power consumption decreases. The acceleration of flow also increases the amount of power required by the CENTRIFUGAL PUMP. The amount of power from the ENGINE which is consumed by a WATER PUMP is related to acceleration of flow, and the rate of flow, never pressure.

## Impeller Types

The VANES located on the face of a CENTRIFUGAL PUMP IMPELLER are produced either as straight lines, or as sections of parabolic curves. The CURVED VANES provide a much more efficient pump operation than STRAIGHT VANES.

Also, CENTRIFUGAL PUMP IMPELLERS are generally of two types: OPEN FACE or CLOSED FACE. If you can look at the face of the IMPELLER and see the vanes, it is an OPEN FACE IMPELLER, commonly used in AUTOMOTIVE WATER PUMPS. These VANES operate in close proximity to a stationary plate, the PRESSURE PLATE. The housing the IMPELLER spins within is called the VOLUTE.

### Typical Centrifugal Pump



If the IMPELLER VANES are housed between TWO CIRCULAR PLATES, the impeller is A CLOSED FACE IMPELLER. This type of impeller is measurably more efficient than an OPEN FACE IMPELLER, but is not commonly used in automotive cooling systems.

## Ceramic Shaft Seals

A CERAMIC SHAFT SEAL provides seal between the spinning PUMP SHAFT, and the PUMP HOUSING. These seals are normally composed of a CERAMIC BEARING, flattened to at least [2] helium lightbands, spring-loaded against an equally flat GRAPHITE BEARING. One bearing spins, and one is stationary. They are water cooled, but no fluid can enter between the BEARING FACES. Suspended solids (sand, dust, grit) within the coolant will not harm a CERAMIC SHAFT SEAL. What causes their failure, is a loss of cooling by running them dry. They overheat and then their BEARINGS shatter.

**Ceramic Bearing**



**Graphite Bearing (2 popular types shown)**

