

Display model A5

Centrifugal pump with Semi-open and single vane impeller

Introduction Centrifugal pumps with semi-open and single vane impellers are versatile and widely used in a lot of pumping scenarios like sewage and wastewater treatment, industries, and agriculture. They are typically used in applications which require the passage of small solid materials, such as soil or debris, suspended in the fluid flowing at a medium flow rate. These pumps are known for their reliable performance, good resistance to clogging, ease of maintenance, and ability to work with different kinds of viscous and abrasive fluids.

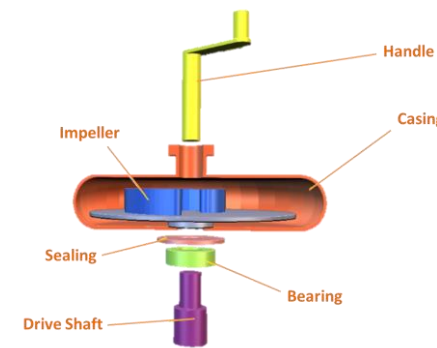


Figure 1. Model structure

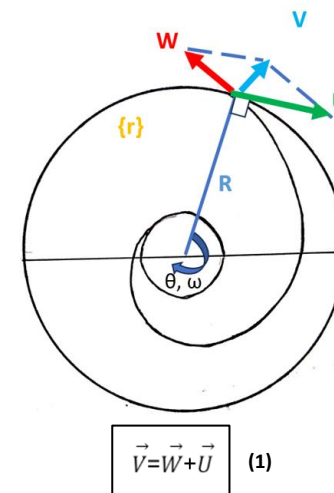


Figure 2. Velocity triangle

Working When the impeller of the pump is rotated, it imparts the centrifugal force to the surrounding fluid. Thus, the rotational mechanical energy is converted to the fluid energy. The progressively increasing shape of the volute accumulates fluid at the discharge end, consequently increasing the static pressure. Meanwhile, at the suction end, the displacement of fluid causes negative pressure and consequently, draws in more fluid into the impeller and continues the process.

Kinematics The movement of fluid, V , is the combination of its relative movement against the blade, W , and the blade movement due to the impeller rotation, U . This relation is shown in the equation 1. The relative velocity W is tangential to the blade profile and has close relation with the blade shape. The vector triangle caused by these vectors is called a velocity triangle.

The velocity triangle helps to do flow calculation for a centrifugal pump, which is essential to determine the main dimensions and blade angles of the impeller for a specified pumping task.

Comparison - By comparing the semi-open single-vane design with alternative designs, we can gain insight into the operational capabilities of this particular design.

As a shroud on an impeller gives mechanical strength to the design, the semi-open configuration has intermediate mechanical strength comparing to fully-closed or fully-open impeller. On the other hand, open configuration is much better for passing cloggy fluids due to the large clearance. Semi-open configuration can be used to pass small particles with the fluid.

Flow rates of the impellers with single vane impellers are typically higher than multi-vane impellers due to the presence of large clearance area reducing the obstruction to the fluid flow. However, multi-vane impellers normally have smoother flow as the fluid more evenly is distributed more evenly. Hence, single-vane impellers can experience reduced efficiency at low flow rates due to turbulence.