

## Performance Tests of Centrifugal Pumps

The performance of a pump is determined by the characteristic values listed below;

1. Volumetric flow rate (Q)
2. Manometric head (H<sub>m</sub>)
3. Hydraulic power (P<sub>h</sub>)
4. Effective power (P<sub>e</sub>)
5. Overall pump efficiency (η<sub>p</sub>)

H<sub>m</sub>, P<sub>o</sub>, P<sub>e</sub> and η<sub>p</sub> are all functions of flow rate and the curves representing the variation of the values with the flow rate is named as pump characteristic curves.

### Definitions

#### 1) Volumetric Flow Rate (Q)

It is the amount of fluid that flows in a given time (m<sup>3</sup>/s)

#### 2) Manometric Head (H<sub>m</sub>)

It is the usable mechanical work transferred by the pump to the pumped liquid and expressed in terms of potential force of the pumped liquid under the local gravitational force. The equation for it is:

The notation “e” denoting pump inlet and “b” the pump outlet;

$$H_m = H_b - H_e = \left( \frac{P_b}{\rho g} + \frac{v_b^2}{2g} + z_b \right) - \left( \frac{P_e}{\rho g} + \frac{v_e^2}{2g} + z_e \right)$$

$$H_m = \frac{P_b - P_e}{\rho g} + \frac{v_b^2 - v_e^2}{2g} + (z_b - z_e)$$

#### 3) The Hydraulic Power Output (P<sub>h</sub>)

It is the usable power transferred by the pump to the pumped media.

$$P_h = \rho \cdot g \cdot Q \cdot H_m$$

#### 4) Effective Power (Pe)

It is the power input at the coupling or pump shaft. It is higher than the hydraulic power output by the amount of the pump losses.

#### 5) Overall pump efficiency ( $\eta_p$ )

It is the ratio of the pump hydraulic power output to the absorbed power at the pump coupling or shaft at the operating point.

Pe is in watts in this formula.

$$\eta_p = \frac{P_h}{P_e} = \frac{\rho \cdot g \cdot Q \cdot H_m}{P_e}$$