

To Utilize Pump Head For Linear Distribution Of Fluid.

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Abstract:

This study has been undertaken to calculate the extent distribution of fluid based on distribution pump head & density of fluid.

This is an useful aspect in engineering & Projects to select a pump capacity based on maximum coverage with fluid having specific density.

Date of Submission: 01-04-2026

Date of Acceptance: 10-04-2026

I. Introduction:

Centrifugal & positive displacement pumps are widely used in industry. Usually pump capacity is defined based on flow rate & head.

Head defines maximum discharge height. Now the basic concern of the study is what would be the maximum horizontal coverage of discharge when discharge height becomes minimal.

Need Of The Study

In chemical, pharmaceutical, API plants there is distribution for chilled water, RO & purified water to various stations of the plant.

So horizontal coverage is as important as discharge height.

So a simplified equation is carried out based on pump capacity with respect to fluid characteristics & linear distribution/distribution coverage.

Equation:

Fluid pumps are selected based on two aspects a) Flow rate b) Pump head.

Flow rate is defined as cu.m/hr & pump head in mwc (m -meters, WC- water column).

Let us consider the pump head as H in m & velocity of fluid is v m/s.

$H = v^2/2g$ kg- m/kg (v^2 - square of v , g- acceleration due to gravity)...1

Equation 1 represents upward fluid motion.

Let us now work on horizontal fluid motion where there won't be a gravity effect which will impact the motion, instead fluid will face frictional resistance.

As we have seen in equation 1 , the unit of H comes as

kg-m / kg in horizontal flow; it would be N-m/N (N - Newton, m - meter).

In horizontal flow force to be considered instead of mass like gravitational force, frictional force, weight etc.

So the equation for horizontal distance which the fluid can travel would be : $S = v^2 / 2 \dots\dots 2$

It's just to multiply equation 1 by g (g = acceleration due to gravity).

After considering frictional loss the equation would be:

$S = v^2/2 - hf$ (hf - losses of flow head due to friction applying Darcy's formula).

Nevertheless hf is negligible.

Theoretical framework

Variables with theory based on extensive study of different types of pumps, Centrifugal blowers , root blower & their limitations.

II. Research Methodology

It is based on observations over various projects & applied at different projects as per requirements.

The above mentioned principle is applied in liquid pumps, vacuum pumps, vacuum blowers etc.

III. Conclusion:

Multiply pump head by g (acceleration due to gravity) to get approximate horizontal flow length of fluid.