Tesla Disc Pump Performance Analysis for Five Horsepower and Ten Horsepower Water Pumping Applications

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Engineering assessment of Tesla disc pump flow rates and head pressure for five horsepower and ten horsepower motors using three inch and six inch inlets with six inch and twelve inch disc diameters

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Tesla Disc Pump Performance Analysis for Five Horsepower and Ten Horsepower Water Pumping Applications

This article evaluates the real world hydraulic performance of Tesla disc pumps driven by five horsepower and ten horsepower motors at thirty six hundred RPM, comparing expected water flow rates and head pressures while explaining the physical limits imposed by disc diameter, tip speed, and motor power

Tesla Disc Pump Fundamentals

A Tesla disc pump transfers energy to fluid through viscous shear between closely spaced rotating discs. Unlike conventional centrifugal impellers, the fluid is dragged by boundary layer adhesion rather than by blade impact. This makes the Tesla disc pump highly tolerant of dirty water, suspended solids, fibrous material, and entrained gases.

However, this same operating principle results in lower efficiency than a well designed centrifugal pump. For water service, overall efficiencies typically fall between twenty percent and forty five percent depending on disc spacing, surface finish, stack width, housing geometry, and clearances.

Because of this, Tesla disc pump performance is best evaluated using three governing limits

Tip speed determines the theoretical head potential
Motor horsepower limits the achievable combination of flow and head
Inlet diameter controls suction velocity and cavitation margin but not total power capability

Case One

Five horsepower motor at thirty six hundred RPM
Three inch inlet
Six inch disc diameter

Tip Speed and Head Potential

With a six inch disc spinning at thirty six hundred RPM, the disc edge travels about ninety four feet per second. This corresponds to a theoretical head scale of roughly two hundred seventy six feet of water.

A Tesla disc pump typically achieves only a fraction of this due to viscous slip. A realistic operating fraction ranges from five percent to twenty five percent of the theoretical scale. This produces a practical head range of approximately forty to seventy feet of water, equivalent to seventeen to thirty pounds per square inch.

Power Limited Flow

Five horsepower equals three point seven three kilowatts of motor input. With realistic efficiency between thirty and forty percent, usable hydraulic power ranges from one point one to one point five kilowatts.

At forty feet of head, expected flow is approximately one hundred fifty to two hundred gallons per minute.