Tesla Disc Pump Engineering Assessment

Infinity Turbine LLC

[TEL] 1-608-238-6001

[Email] greg@infinityturbine.com

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Engineering assessment with 1 mm disc spacing for dirty water service
You have now specified the key parameter that drives a Tesla disc pump's behavior: disc-to-disc gap = 1.0 mm. With that, we can tighten the estimate for both capacity and efficiency, and make practical recommendations for gold-sluice duty where water is dirty and abrasive.
I am still anchoring the analysis to the geometry implied by your drawings:
• Disc outside diameter is 6.000 inches
• The assembly shows 10 disc plates plus 10 disc spacers
1) What 1 mm spacing means physically
A Tesla disc pump relies on viscous shear coupling in the boundary layers on each disc surface. For clean water at 3600 rpm, the effective boundary layer thickness is far smaller than 1 mm.
Practically:
• 1 mm is a wide gap for water, so viscous coupling per disc-pair is weaker than it would be at tighter spacing.
• But 1 mm is a strong choice for dirty water, because it:
  • passes grit better
  • reduces clogging risk
  • tolerates small fibrous debris
  • reduces the chance that a single rock chip locks the rotor
So the trade is simple:
• tighter spacing yields higher hydraulic efficiency and higher pressure capability for the same horsepower
• wider spacing yields better solids tolerance, lower clogging, and better survivability in abrasive service
For gold-sluice water that may be dirty, your 1 mm choice is defensible.
2) Capacity, head, pressure, and efficiency for a 6 inch, 10 disc, 1 HP unit
Because we still do not have an empirical pump curve, the most honest result is a bounded operating envelope. For wash plant supply, the typical duty is high flow and low to moderate head. That aligns with where a Tesla pump can do useful work on 1 HP.
Assumptions used for this estimate:
• Pump rotor: 6 inch disc diameter, 10 discs
• Speed: up to 3600 rpm via VFD
• Fluid: water with suspended solids (density close to water, viscosity close to water unless heavily loaded)
• Spacing: 1.0 mm
• Overall efficiency target range for this configuration in dirty water: 15% to 30% (wide gap reduces coupling, solids add slip and losses)
Practical operating envelope at 3600 rpm
These are realistic values for wash plant supply head levels.
A) Low head supply, best case for sluicing
• Differential pressure: 10 to 15 psi (0.7 to 1.0 bar)
• Head: 23 to 35 ft (7 to 11 m)
• Flow: 40 to 90 gpm (9 to 20 m3/h)
• Notes: this is where the pump will feel strong on 1 HP, assuming plumbing is not restrictive.
B) Moderate head, longer hose runs, restrictive spray bars
• Differential pressure: 15 to 25 psi (1.0 to 1.7 bar)
• Head: 35 to 58 ft (11 to 18 m)
• Flow: 20 to 55 gpm (5 to 12 m3/h)
• Notes: expect noticeably lower flow if your system peaks down to smaller lines, tight valves, or many fittings