Hydra-Cell Pro Pumps Compared to Internal Gear Pumps

A Practical Comparison for Metering and Process Applications

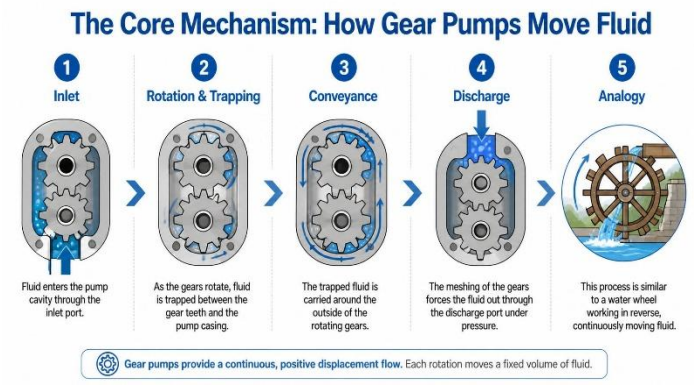
By: Chris Pasquali, CEO Factory Direct Pipeline Products, Inc.

In previous articles we have examined the advantages Hydra-Cell Pro pumps offer when pumping difficult-to-handle liquids and specifically compared a Hydra-Cell metering pump to an external gear pump. Because the sealless multi-diaphragm design of Hydra-Cell Pro pumps competes with several styles of positive displacement pumps, it is useful to broaden the discussion to include both internal and external gear pumps as well as their magnetically driven (mag-drive) versions.

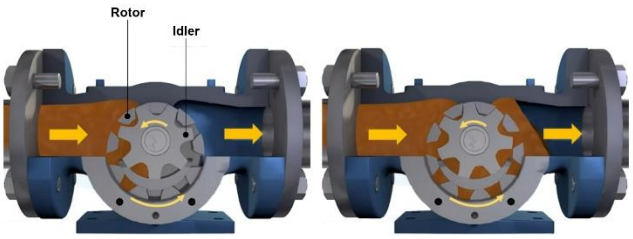
All of these pumps are positive displacement designs that can deliver accurate flow rates independent of discharge pressure (within their design limits). The practical differences, however, are significant and often determine long-term reliability, maintenance cost, and suitability for a given liquid.

Design Overview

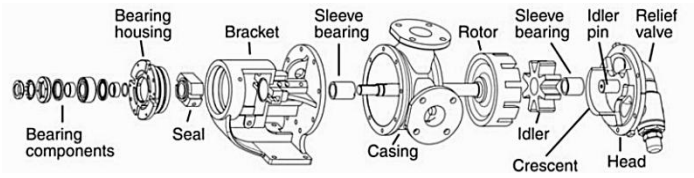
External gear pumps use two identical gears that mesh externally. Liquid is carried in the spaces between the gear teeth and the casing from the inlet to the outlet. They are relatively simple, can generate higher pressures than internal gear designs, and are common in hydraulic and transfer service.



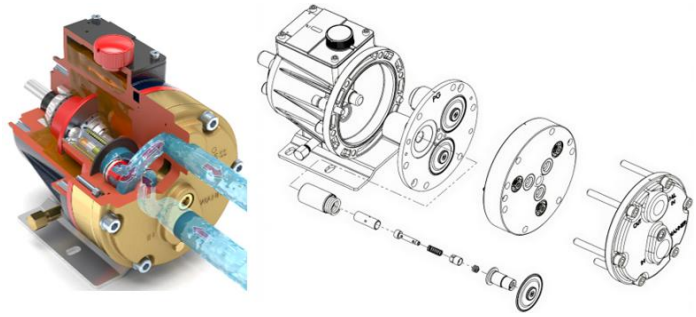
Internal gear pumps use a larger outer gear with internal teeth and a smaller pinion gear. A crescent-shaped separator creates the pumping chambers. This arrangement produces smoother flow and handles higher viscosities more effectively than external gear pumps, but maximum pressure capability is generally lower.



Magnetically driven versions of both styles eliminate the dynamic shaft seal by using a magnetic coupling. This removes a common leak path and is attractive for hazardous, toxic, or expensive liquids. The trade-off is that the process fluid must lubricate the internal bearings inside the containment shell, and the magnetic coupling itself imposes torque and heat limitations.



Hydra-Cell Pro pumps are multi-diaphragm, sealless positive displacement pumps. The pumped liquid is isolated from the drive end by hydraulically balanced diaphragms. There are no dynamic seals in contact with the process fluid. Check valves control flow direction. Models with three or five diaphragms produce very low pulsation.



Key Performance Differences

Seals and Wear Components

Gear pumps (even mag-drive) rely on close-fitting gears, bushings or bearings, and in sealed versions a mechanical seal or packing. All of these parts are in contact with the process liquid and are subject to wear from abrasives, non-lubricating fluids, or dry running. Mag-drive versions still require the process fluid to lubricate the internal bearings; dry running or loss of prime quickly damages the pump.

Hydra-Cell Pro pumps have only the check valves and elastomers in contact with the liquid. The diaphragms form a static seal. There are no dynamic seals, gears, or bearings running in the process fluid. Check valves are the primary wear item and can be replaced in the field with simple tools. The pump can run dry indefinitely without damage.

Filtration Requirements

Because of the tight clearances in gear pumps, manufacturers often recommend filtration to 5 microns absolute or better when solids or abrasives are present. This adds both capital and ongoing filter cartridge cost.

Hydra-Cell Pro pumps will pass solids up to several

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Feature	Mag-Drive External Gear	Mag-Drive Internal Gear	Hydra-Cell Pro
Design	Two external meshing gears	Outer gear + pinion + crescent	Multi-diaphragm sealless
Flow pulsation	Moderate	Low	Lowest (virtually pulse-free)
Noise (est. dBA)	75–85	65–75	60–75
Viscosity range	~0.2–10,000 cSt	~1–55,000 cSt	Up to 1,500 cSt
Pressure range	Up to ~500 PSIG	Typically ≤200 PSIG	Up to ~5,000 PSIG (some ~3,500)
Flow rate range	Low–medium (typically <220 GPM)	Low–medium (to ~440 GPM)	Up to ~130 GPM
Low-flow capability	Limited by slip & min speed	Limited by slip & min speed	Excellent
High pressure at low flow	Limited	Limited	Excellent
Relative cost	Lowest	Medium	Medium
Best for	Higher pressure, clean fluids	High viscosity, quiet transfer	Abrasives, dry-run, high-P low-flow

hundred microns (model dependent) without damage. Nominal-rated filtration is normally sufficient, lowering both initial and operating filtration expense.

Viscosity and Efficiency

Gear pumps lose volumetric efficiency with thin liquids because of internal slip through the clearances. High viscosity increases torque demand and, in mag-drive versions, can cause magnetic decoupling or excessive heat. Internal gear designs handle high viscosity better than external, but both have practical limits.

Hydra-Cell Pro efficiency is largely independent of viscosity within its published range. The spring-loaded check valves respond quickly and the design has no close-fitting rotating clearances that create slip paths.

Pressure Capability at Low Flow

This is an area where Hydra-Cell Pro pumps have a clear advantage. Gear pumps can reduce speed to achieve low flow, but slip increases and accuracy suffers, especially at higher differential pressures. Mag-drive gear pumps are further limited by the torque capacity of the magnetic coupling.

Hydra-Cell Pro pumps maintain high volumetric efficiency across a wide speed range and can deliver high pressure at very low flow rates without the same efficiency loss. Models are available that reach 5,000 PSIG while still providing precise metering performance.

Pulsation and Noise

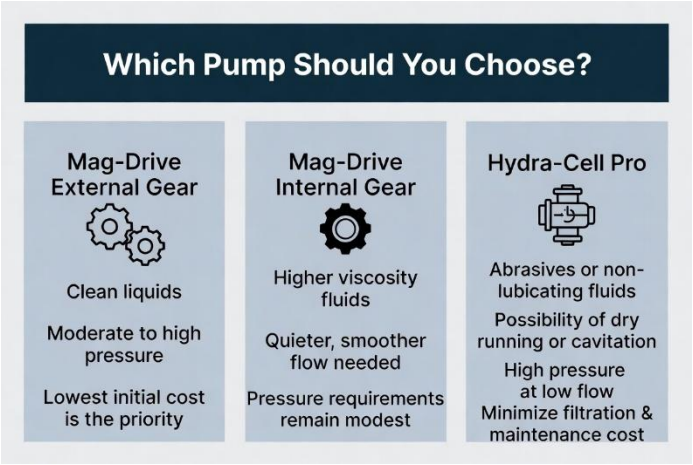
External gear pumps produce more noticeable flow pulsation. Internal gear pumps are smoother. Multi-diaphragm Hydra-Cell Pro pumps (three or five chambers) produce the lowest residual pulsation of the three designs and generally operate more quietly.

Materials Flexibility

Hydra-Cell Pro pumps offer a wide selection of liquid-end materials (metallic and non-metallic) and elastomer options. Mag-drive gear pumps are more constrained by the materials required for the gears, bearings, and containment shell.

Cost of Ownership

Initial purchase price for a mag-drive external gear pump is often the lowest of the three. Internal gear and Hydra-Cell Pro pumps are typically in a similar medium range. The difference appears in operating cost: filtration, seal or bearing replacements, downtime from dry-run or abrasive damage, and the cost of specialized tools or factory rebuilds for high-precision gear pumps. Hydra-Cell Pro check-valve kits are relatively inexpensive and can be changed by plant personnel.



There is application overlap among these designs. If you currently experience reliability issues with gear pumps, high filtration costs, or seal failures, or if you are evaluating a new application and are unsure which technology offers the best long-term value, we are happy to review the details with you. Our application experience with Hydra-Cell Pro pumps spans more than three decades. A short discussion often clarifies whether a Hydra-Cell Pro pump is the better fit or whether another design is more appropriate.

Related Articles

- Hydra-Cell Pro Pumps vs. External Gear Pumps for Metering Applications
- Comparison of a Hydra-Cell Pro pump to AODD (Air Operated Double Diaphragm pump)
- Comparison of a Hydra-Cell Pro pump to Piston and Plunger pumps