Hydra-Cell®
Seal-less Pumps

High-Pressure Machine Tool Coolant Pumps with Superior Handling of Abrasive Fines and Metal Particles

Machine Tool Coolant




Wanner Engineering, Inc.

High-Pressure Coolant Delivery

Hydra-Cell® Pumps for Machine Tool Coolant

Compact, Seal-less Pumps Reduce Costs, Improve Cutting Performance and Boost Productivity

The use of high-pressure cooling for machine tool operations has increased significantly in recent years because of the added benefits it provides in the removal of abrasive chips and lubrication in machine tool operation, and in the cleaning and cooling of grinding wheels.

With more than 40 years of experience serving the industry, including many of the major global companies, Hydra-Cell has proved itself in a wide range of applications. Featuring a seal-less design, it is ideally suited for pumping machine tool coolant at high pressure. Screw pumps, centrifugal pumps, gear pumps, and multi-piston pumps cannot match the rugged construction, versatility, and performance of Hydra-Cell seal-less pumps for machine tool applications.

Advantages of Hydra-Cell

- Accurate flow control maintains a constant rate of pressure (up to 2500 psi) for better performance.
- Operational efficiencies reduce energy costs.
- Seal-less design can tolerate solids up to 800 microns in size depending on pump model.
- Ability to handle abrasive fines and metal particles enables operation without the expense of fine filtration.
- Any type of coolant can be processed with no loss of efficiency.
- Able to run dry without damage (or additional maintenance) to the pump in case of accident or operator error.
- Tolerates non-ideal operating conditions.
- Minimizes maintenance and downtime because there are no mechanical seals, packing, or cups to leak or replace.

The seal-less design of Hydra-Cell pumps provides many advantages over other machine tool coolant pumps including the ability to handle abrasive fines as well as larger-size particles.

Hydra-Cell Seal-less, Positive-Displacement Pumps

Hydra-Cell pumps are available in several models featuring a wide range of flows and pressures for a variety of applications.

Ten (10) seal-less Hydra-Cell models equipped with metallic liquid ends are ideal for delivery of high-pressure machine tool coolant.

Eight (8) models have a horizontal configuration and two (2) models a vertical configuration.

They are used throughout the industry to pump different types of coolants for typical metalworking functions:

Boring

Deep-Hole Drilling

EDM Machining

Grinding
(Wheel Cleaning & Cooling)

Milling

Multi-function Machining

Stand-alone Systems

Turning & Threading
(Chip Removal)

Three Hydra-Cell model D10 pumps deliver high-pressure coolant for a turret-type, multi-tasking boring machine with 16 tool stations for bar work and 12 tool stations for chuck work.

Typical Liquids Pumped	Challenges in Pumping	The Hydra-Cell Advantage
Cutting Oils (Hydrocarbon or Synthetic)	May contain abrasive metal fines that can damage other pumps unless used with an expensive fine-filtration system.	• Seal-less design can handle abrasive fine solids of up to 800 microns in size (depending on pump model). No need for fine filtration.
Water-Based Coolants	Water-thin liquids that can cause premature wear of dynamic seals immersed in the coolant.	• No dynamic seals to leak, wear, or replace. • Seal-less, positive displacement design to pump water-thin and high-viscosity liquids equally well.
	May contain abrasive metal fines that can damage other pumps unless used with an expensive fine-filtration system.	• Seal-less design can handle abrasive fine solids of up to 800 microns in size (depending on pump model). No need for fine filtration.
	May become aerated causing localized dry running conditions.	• Can run dry without damage to the pump.
Synthetic & Semi-Synthetic Water-Mix Fluids (Clear or Translucent)	May have poor lubricating properties causing premature wear of dynamic seals immersed in the coolant.	• Pumping action does not require lubrication.
	May become aerated causing localized dry running conditions.	• Can run dry without damage to the pump.
	May contain abrasive metal fines that can damage other pumps unless used with an expensive fine-filtration system.	• Seal-less design can handle abrasive fine solids of up to 800 microns in size (depending on pump model). No need for fine filtration.
EDM Fluids, De-ionized Water & Paraffinic Hydrocarbon Oils	May contain particles and fines that can damage other pumps unless used with an expensive fine-filtration system.	• Seal-less design can handle abrasive fine solids of up to 800 microns in size (depending on pump model). No need for fine filtration.
	Chemically aggressive and non-lubricating fluids that can cause leakage and wear problems for pumps with dynamic seals.	• No dynamic seals to leak, wear, or replace. • Pumping action does not require lubrication. • Seal-less design and pump head material options enable handling of aggressive fluids.

Precise, Controlled Flow Rate Optimizes Tool Life

Controlled delivery at high pressure

- Since flow rate is dependent upon the pump speed and not the discharge pressure, Hydra-Cell delivers precise, accurate flow best suited for the tool in use.
- Hydra-Cell can deliver the required flow rate whether pumping thin water-based emulsions, or thick cutting-oil coolants.
- There are no dynamic seals to "leak" pressure.

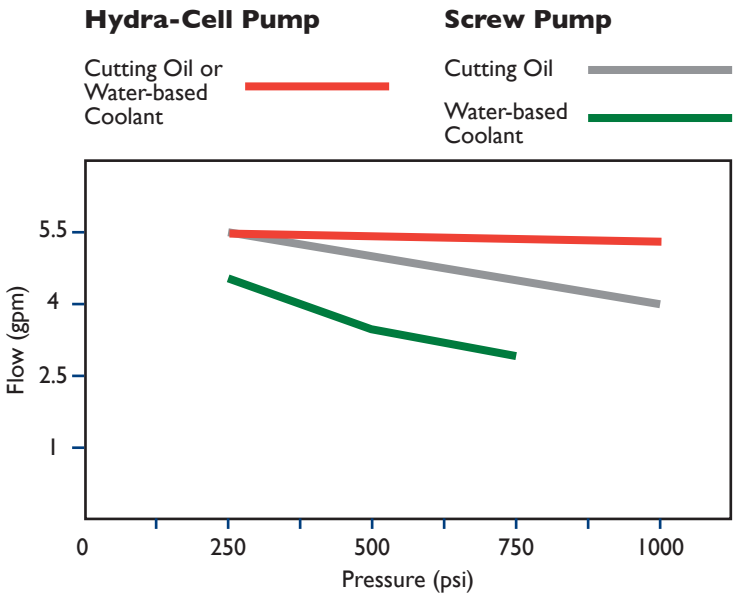
Predictable, optimal results

- At consistent high pressure with controlled flow, it is easier for Hydra-Cell to remove tool blockages.
- With optimal pressure and flow settings, Hydra-Cell provides more predictable tool life and work-piece quality.

Unlike pumps that decrease flow significantly as pressure increases, Hydra-Cell flow rates are proportional to the pump speed. Delivery of the machine tool coolant can remain at a consistent high pressure while pump flow is set for the rate best suited to the machine tool in use.

Pressure-flow comparison

- Regardless of the viscosity of the coolant being pumped, Hydra-Cell maintains consistent high pressure at the desired flow rate while a screw pump has to decrease its flow rate to maintain higher pressures.
- Screw pumps are less efficient at pumping thin, water-based coolants compared to more viscous cutting oils; however, Hydra-Cell will pump low-to-high viscosity fluids equally well at high efficiency.
- Screw pumps are also less efficient at low pump speeds making them less suitable for use with variable drive motors.



Simplicity of flow control

- Through simple, open-loop torque control of the motor, Hydra-Cell provides predictable, controllable pressure and flow rate of the coolant.
- A screw pump requires more equipment (e.g. flow and pressure sensors, bypass valves) to achieve the same result. This adds more initial cost, maintenance expense, and complexity to the system.

"At first we installed hydraulic gear pumps, but replaced them with Hydra-Cell pumps over two years ago. Since then we have seen an increase in production and a reduction in downtime. Although the initial cost of the gear pumps was less than Hydra-Cell, the pay back for Hydra-Cell versus the gear pumps in just the replacement part costs is unbelievable."

Handles Abrasive Metal Fines and Low-to-High Viscosity Fluids

Minimal filtration

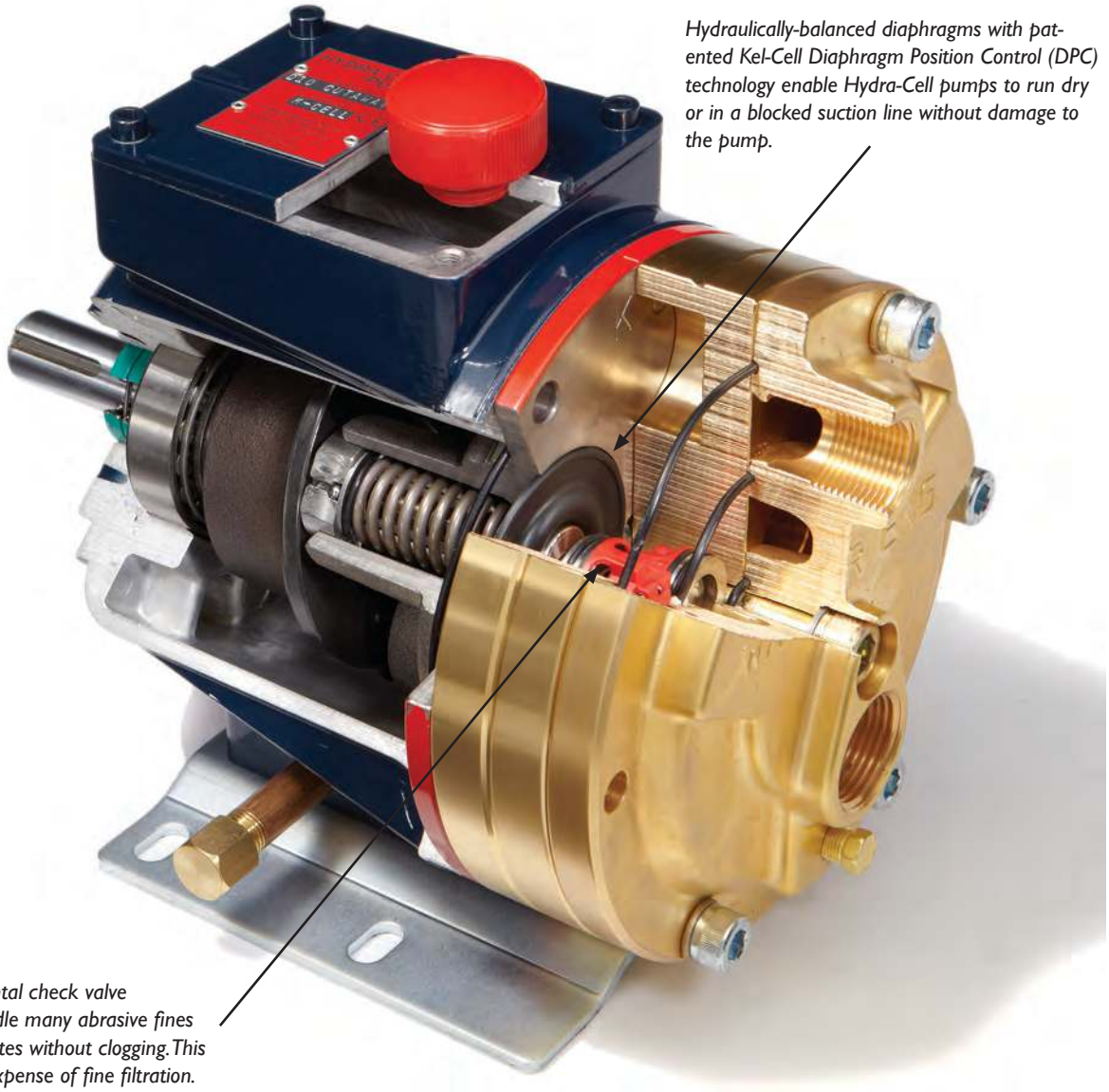
- Unlike gear pumps and screw pumps that wear excessively without fine filtration, Hydra-Cell has no dynamic seals or tight tolerances that need protection with fine filtration.
- Hydra-Cell can handle particles of up to 800 microns in size (depending on model) and tolerate fines up to 9 hardness on the Mohs scale. This eliminates the expense of 10-micron filters needed for other types of pumps.

Excellent coolant compatibility

- From non-viscous water-based coolants to high-viscosity cutting fluids, Hydra-Cell pumps can handle any type of coolant while maintaining the same high-efficiency operation.
- Hydra-Cell is ideal for cutting oils, water-based coolants, synthetic and semi-synthetic fluids, and dirty coolants containing particles and sludge.

Reduces chance of pump damage

- Running dry can damage or destroy gear pumps and screw pumps, requiring costly repairs or pump replacement, and resulting in lost production. Hydra-Cell pumps can run dry without damage to the pump.
- When an interruption in flow is caused by suction blockage or a valve closure, gear pumps and screw pumps can fail immediately. Hydra-Cell pumps equipped with patented Kel-Cell® Diaphragm Position Control (DPC) will not be affected, allowing for correction of the interruption.
- Foaming coolant and aeration can cause immediate and catastrophic failure in external gear and screw pumps, resulting in increased maintenance and repair costs. Hydra-Cell pumps can withstand these conditions without immediate failure, giving the user an opportunity to remedy the situation.
- With its simplicity of design, Hydra-Cell eliminates otherwise costly errors by operators or maintenance personnel.



Hydraulically-balanced diaphragms with patented Kel-Cell Diaphragm Position Control (DPC) technology enable Hydra-Cell pumps to run dry or in a blocked suction line without damage to the pump.

Hydra-Cell's horizontal check valve orientation will handle many abrasive fines and metal particulates without clogging. This can eliminate the expense of fine filtration.

Lower Energy and Overall Operating Costs

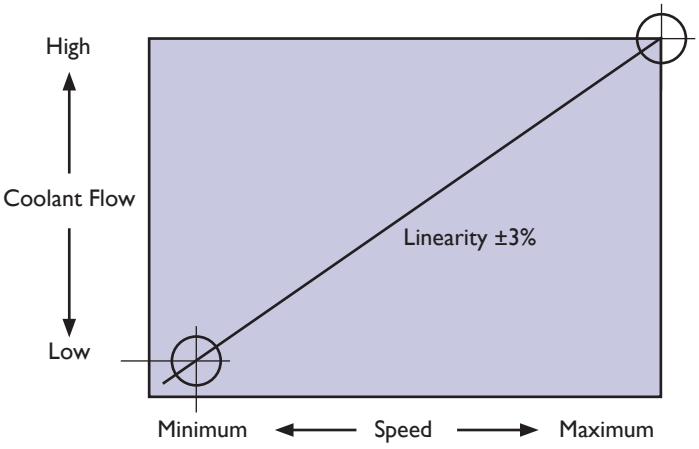
Low power consumption – 85% to 90% energy efficiency

- With no "leaking" dynamic seals, energy efficiency is independent of coolant technology in the seal-less Hydra-Cell pump.
- Positive displacement pumping action and seal-less design minimize energy losses even when pumping water-based emulsion coolants.
- The lower hp requirement of the Hydra-Cell pump achieves the same performance but with greater energy efficiency and less power consumption.

Energy savings from precise flow control

- Eliminates excessive bypass flow of coolant by using speed control to deliver the precise flow rate as required by the tool. Energy is not wasted pumping at a higher flow rate than needed.
- In addition, this does not unnecessarily heat the coolant, so the coolant chiller does not waste energy.
- Flow rate is directly proportional to pump speed (controlled from 18 to 1800 rpm) with linear flow and accuracy within ±3%, so the added expense of a flow sensor or pressure sensor is not required.

Linearity – Speed/Flow Rate Relationship



Hydra-Cell pumps provide consistent linear flow within ±3% at a fixed pressure, regardless of the flow rate or pump speed.

The multiple-diaphragm liquid head of Hydra-Cell pumps allows for a less expensive, energy-saving motor to be used.

Energy Cost Comparisons

Pump Type	Flow (gpm)	Pressure (psi)	Absorbed Power (kW)	Energy Usage	Annual Savings with Hydra-Cell
Screw Pump A **Hydra-Cell M03**	1.06 1.06	1160 1160	2.8 0.7	147% more energy than Hydra-Cell	$756
Screw Pump B **Hydra-Cell D10**	7.66 7.66	1000 1000	8.3 4.2	97% more energy than Hydra-Cell	$1,476
Screw Pump C **Hydra-Cell D35**	31.17 31.17	1160 1160	34.5 19.5	78% more energy than Hydra-Cell	$5,400
Centrifugal Pump A **Hydra-Cell D10**	7.66 7.66	580 580	5.6 2.5	112% more energy than Hydra-Cell	$1,116
Centrifugal Pump B **Hydra-Cell D35**	35.13 35.13	580 580	15.4 11.4	35% more energy than Hydra-Cell	$1,440

Efficiencies compiled from manufacturers' published data sheets.

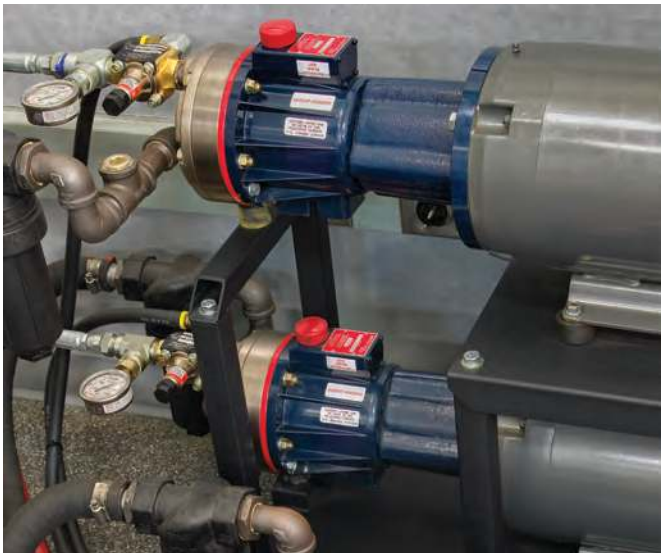
Energy cost savings are calculated based on pumps running 4,000 hours per year at 9 cents per kilowatt hour.

One Reliable, Low-Maintenance Pump Design

Hydra-Cell pumps can be installed within the frame of the machine tool system.

Strength in simplicity

- Robust construction with long service life and low cost for spare parts.
- No tight tolerances that could be susceptible to damage by abrasive fines.
- Seal-less design means no drop-off in performance due to seal wear.
- Can run dry without damage to the pump.
- No immediate damage caused by entrapped air in the coolant system.



Hydra-Cell pumps can also be mounted externally to the machine tool system.

Low maintenance

- Since there are no dynamic seals to wear or replace, Hydra-Cell pumps need little maintenance and will operate reliably under continuous duty at high pressure.
- Can operate up to 6,000 hours between lubricating oil changes.
- No special tools required and no critical tolerances to be aware of during maintenance.
- Any maintenance or repair can usually be performed on-site.

Tolerates non-ideal operating conditions

- Since there are no mechanical seals, cups, or packing, Hydra-Cell does not rely on the coolant being pumped for lubrication.
- Not damaged by particles that pass through filtration due to filter paper breakages, incorrect start-up procedures, or common operator errors.

Available as an option for Hydra-Cell Model M03, the Mono-Block pump features one-piece cartridge check valves.

Mono-Block valve assemblies are accessible without disturbing the plumbing, so disassembly is not necessary. This saves on maintenance and reduces production losses.

Hydra-Cell® Performance Advantages Compared to Other Types of Pumps

Triple Screw Pump Disadvantages:	Hydra-Cell Advantages:
• Close tolerances and running clearances require ultra-filtration (usually to <10 microns).	• Precisely-engineered tolerances and seal-less design eliminate the need for fine filtration.
• Performance characteristics sensitive to viscosity change.	• Pumps thin or highly viscous liquids with equal efficiency.
• Mechanical seals and packing require maintenance and replacement or adjustment.	• The seal-less design of Hydra-Cell means that there are no mechanical seals or packing to leak or replace.
• Does not tolerate solids, fines, abrasives or particulates.	• Seal-less pumping chamber with spring-loaded, horizontal disk check valves can pump fines up to 800 microns in size (depending on pump model).
• Inefficient at low speeds (usually requires minimum 1000 rpm).	• Runs at very low speeds (from 18 to 1800 rpm) while maintaining outlet pressures.
• Depends on pumped fluid for sealing and hydrodynamic lubrication. Pumping non-lubricating, water-thin grinding fluids can cause premature wear of the spindles.	• No requirement for the pumped fluid to seal or lubricate.
• Contains bushings in the pumped fluid.	• No bushings in the pumped fluid.
• Dry running and entrapped air cause immediate damage.	• Can run dry without damage to the pump. Tolerates entrapped air.
• Use of bypass valve to control discharge pressure for different tools wastes energy and excessively heats coolant.	• Ultimate controllability removes the need for bypass, saving energy and keeping the coolant cooler.
• A complicated arrangement of speed control and a bypass valve is required to control discharge pressure for different tools.	• Runs at very low speeds (from 18 to 1800 rpm) while maintaining outlet pressures.
• Incorrect direction of rotation results in damage to the pump.	• Hydra-Cell pumps are bidirectional, eliminating the risk of damage.

Plunger/Piston Pump Disadvantages:	Hydra-Cell Advantages:
• Packing requires frequent adjustments and then replacement as it wears.	• Seal-less design uses no packing, reducing downtime and maintenance costs.
• Packing must leak to provide lubrication - creating maintenance, containment, disposal, safety, and housekeeping issues with their associated costs.	• No packing means no secondary containment requirements, no clean-up or disposal issues, improved safety, and reduced maintenance costs.
• Packing causes plunger wear, which is made worse by abrasive media; the plunger, stuffing box, and packing must be compatible with the product being pumped.	• Diaphragm design allows pumping of abrasive and corrosive media without concern for wear, compatibility or replacement of packing or plunger/piston.
• May require external lubrication systems at an additional cost of up to $3,000 - another maintenance and repair factor.	• No lubrication necessary, resulting in less maintenance and lower cost of ownership expenses.

Centrifugal Pump (Multi-stage) Disadvantages:	**Hydra-Cell Advantages:**
• Double mechanical seals are expensive and require a fluid barrier system.	• The seal-less design of Hydra-Cell means that there are no mechanical seals or packing to leak or replace.
• Particulates and fines in the pumped fluid will cause wear in the case and the impellers.	• Seal-less pumping chamber with spring-loaded, horizontal disk check valves can pump particulates and fines up to 800 microns in size (depending on pump model).
• Difficult to maintain high efficiency while varying flow rate.	• Designed for efficient delivery at varying flow rates.
• Running dry can cause a catastrophic mechanical seal failure.	• Can run dry without damage to the pump. Entrapped air in the coolant does not cause immediate failure.
• Ineffective at low flow rates and high outlet pressures.	• Runs at very low speeds (from 18 to 1800 rpm) while maintaining outlet pressures.
• Flow rate is difficult to control effectively.	• Positive displacement design allows for accurate speed control.
• Higher pressure requires additional stages with an increasing footprint for horizontal pumps.	• Can meet same flow and pressure requirements with a much smaller footprint, saving space as well as investment and operation costs.

External Gear Pump Disadvantages:	**Hydra-Cell Advantages:**
• Mechanical seals and packing require maintenance and replacement or adjustment.	• The seal-less design of Hydra-Cell means that there are no mechanical seals or packing to leak or replace.
• Does not tolerate thin liquids, and cannot handle solids, abrasives, or particulates without fine filtration (usually to <10 microns).	• Seal-less pumping chamber and spring-loaded, horizontal disk check valves can pump solids, abrasive fillers and particulates while handling liquids thick or thin.
• Component wear reduces accuracy and efficiency.	• No internal gears to wear so efficiency is more stable and there is less maintenance and spare part replacement.
• Contains four bushings/bearings in the fluid area.	• No bushings/bearings in the pumped fluid.
• Fixed end clearances are typical.	• Design does not rely on clearances.
• Efficiency drops as outlet pressure increases.	• Efficiency remains relatively constant over its range of operating pressures.
• Depends on pumped liquid for lubrication.	• Seal-less design does not require pumped liquid for lubrication.

Advantages of High-pressure Machine Tool Coolant

Eliminates chip build-up

- Flushes chips from deep holes and deflects them away from work surfaces. Also reduces thermal shock and the potential of work hardening in the work-piece.

Prolongs tool life up to 750%

- Effective cooling and lubrication plus elimination of chips help prevent tool damage and reduce tool wear.

Improves work quality

- Efficient cooling, lubrication, and absence of debris promote consistent work-piece and surface finishes with greater accuracy.

Increases productivity

- Superior overall performance allows for higher feed rates and faster spindle speeds. This reduces cycle times for all operations – as much as 70% for drilling.

Lowers energy costs

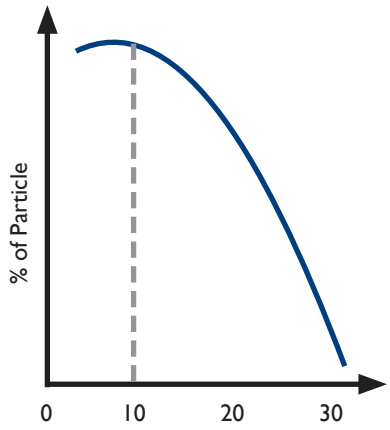
- Better lubrication reduces cutting forces and allows spindle motors to run more efficiently.

Enhances grinding performance

- Minimizes wheel loading and the burning of parts.

Filtration factors

Metal fines and particulates can get past sedimentary, centrifugal, and weir filtration systems and cause damage to certain types of pumps, especially those with dynamic seals.



- Fine particles produced by machining hard materials (e.g. Titanium, Nickel alloys)
- Fine particles produced by machining Aluminum alloys and other light metals
- Elongated particles such as splinters created in the milling process

In addition, every-day production environment events can occur that cause particulates to pass into the pump:

- Poor filter element management
- Particles dropping into the coolant during filter changes
- Particles falling off the filter paper band
- Filter paper tears

Hydra-Cell pumps can handle particulates and abrasive metal fines up to 800 microns in size (depending on pump model) that can damage or destroy other types of pumps. With Hydra-Cell, the added cost of fine filtration can often be eliminated.

Hydra-Cell Positive Displacement Diaphragm Pumps are Ideal for Pumping Low-to-high Viscosity Coolants at High Pressure

- Hydra-Cell heavy-duty coolant pumps are designed for high-pressure delivery of metalworking coolants ranging in viscosity from water-based fluids to cutting oils.
- Can handle any type of coolant, old or new, dirty or clean.
- Available in horizontal and vertical models for integration into virtually any high-pressure system.
- Features a seal-less design and horizontal disk check valves that enable the pump to handle particulates and metal fines that might damage or destroy other pumps.
- Simple, compact design reduces initial investment and lowers operating and maintenance costs.
- Available in a wide range of pump head materials of construction and diaphragm materials.
- Variety of options and accessories to optimize performance.

Hydra-Cell C62, C63, and C64 pressure regulating valves are ideal for use with Hydra-Cell high-pressure machine tool coolant pumps. Seal-less diaphragm construction enables handling of abrasives and particulates, while modified flow-through design reduces wear on the plunger and seat.

Flow Capacities and Pressure Ratings

Model[1]	Maximum Capacity gpm (l/min)	Maximum Discharge Pressure psi (bar)	Maximum Operating Temperature F (C)[2]	Maximum Inlet Pressure psi (bar)
M03	3.1 (11.7)	1000 (69)	250˚ (121˚)	250 (17)
D04	2.9 (11.2)	2500 (172)	250˚ (121˚)	500 (34)
D10[3]	4.3 (15.1)	1500 (103)	250˚ (121˚)	250 (17)
D10 & D12[4]	8.1 (30.6)	1000 (69)	250˚ (121˚)	250 (17)
D15	13.8 (52.3)	2500 (172)	250˚ (121˚)	500 (34)
H25	20.0 (75.7)	1000 (69)	250˚ (121˚)	250 (17)
D35[5]	23.1 (87.5)	1500 (103)	250˚ (121˚)	250 (17)
D35	36.5 (138)	1200 (83)	250˚ (121˚)	500 (34)
D66	65.7 (248.7)	700 (48)	250˚ (121˚)	250 (17)

1 Ratings are for cam design with the highest flow rate.
2 Consult factory for component selection from 160˚F (71˚C) to 250˚F (121˚C).
3 D10 @790 rpm maximum.
4 Model D12 is a vertical configuration.
5 D35 @700 rpm maximum.

For complete specifications and ordering information, consult the Hydra-Cell catalog.

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