Hydra-Cell®

Seal-less Pump Technology

Polyurethane Processing

Abrasives Handling and Accurate Metering

Polyurethane Processing – Dosing, Metering, Mixing, Pressure Injection, Spraying and Transfer

Compact seal-less Hydra-Cell® pumps for long life and high reliability.

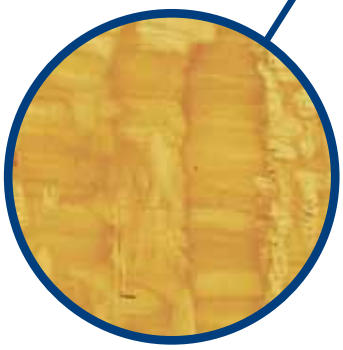
Furniture and Padding

Automotive

Packaging

Cast Elastomer Wheels

Footwaer



Insulation (Thermal and Sound)

- Acids
- Blowing Agents
- Catalysts and Additives

With over 35 years experience in serving the chemical and petrochemical industry, including many of the major global chemical companies, Hydra-Cell® pumps have proven performance in efficiently pumping the widest range of chemicals and petrochemicals including corrosive, hot, abrasive, viscous, non-lubricating, recycled, shear sensitive and liquids containing solids. Their unique multi-diaphragm, seal-less design provides 100% safe containment for even the most aggressive liquids.

Slabstock

Appliances

RIM Solid Plastics
(Enclosures for Business Machines, Medical and Electronic Equipment)

Sporting Goods and Facilities

C.A.S.E. (Coatings, Adhesives, Sealants and Elastomers)

Structural Foam and Simulated Wood

- DI Water
- Polyols and Isocyanates

Hydra-Cell® Economy and Efficiency

Lower initial cost and lower operating and maintenance costs

Pumping blowing agents requires a refrigeration unit. Significant capital savings are realized because spacesaving Hydra-Cell pumps can be housed in a smaller refrigeration unit compared to pump types with the same flow and pressure ratings.

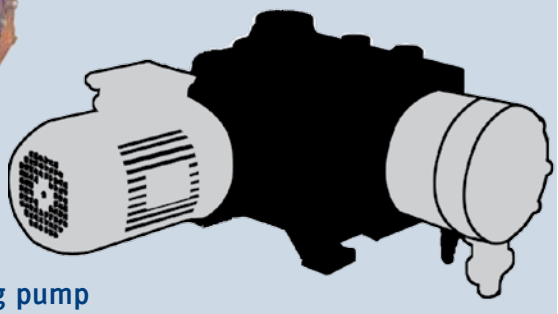
Hydra-Cell models have a more compact design and use lower kw motors compared to other pumps with the same performance ratings.

Hydra-Cell metering pump

Weight: 23 kg

Rated at 172 bar at 132 LPH

Motor: 0.75 kw



Traditional metering pump

Weight: 100 kg

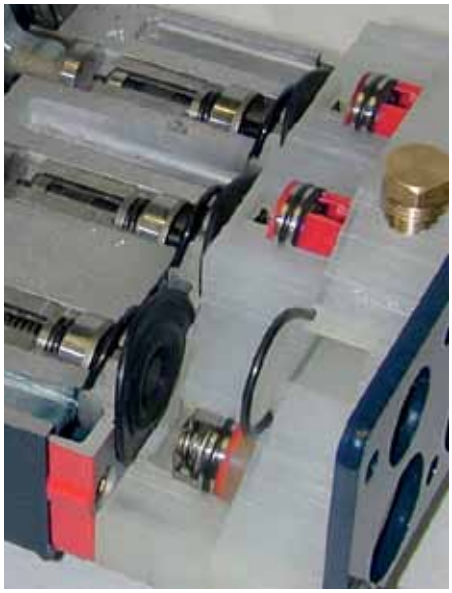
Rated at 172 bar at 110 LPH

Motor: 4.0 kw

- Although both pumps have the same pressure rating, the lighter, more compact Hydra-Cell has a higher flow rating while requiring a less expensive, lower kw motor. This means Hydra-Cell saves approximately 30% to 55% on initial costs.
- The lower kw requirement of the Hydra-Cell pump achieves the same performance, but with greater energy efficiency and lower power consumption

Low power consumption - 85% to 90% energy efficiency

- Hydra-Cell positive displacement pumps show significant energy savings when compared to screw pumps and multi-stage centrifugal pumps.



The multiple-diaphragm liquid head of Hydra-Cell also allows a less expensive, energysaving motor to be used.

Typical Chemicals and Liquids Pumped	Challenges in Pumping	The Hydra-Cell® Advantage
Acids (Formic, Sulfonic)	• Corrosive, abrasive substances that can damage pump.	• Seal-less design provides no leak path and handles abrasives. • Corrosion-resistant liquid head materials available.
	• Crystallisation can occur when excessive air is dragged in through seals and cause clogging and reduce efficiency.	• Spring-loaded, horizontal disk check valves reduce clogging and maintain efficiency.
Blowing Agents (Pentane, Freon)	• Non-lubricating with low vapour points requiring cooling and high inlet pressures to maintain in liquid form. The refrigeration unit must be large enough to accommodate the metering pump.	• Compact design can provide the same or greater metering capability with a much smaller footprint and up to 30% lower initial cost. • Can handle 17 - 34 bar inlet pressures (depending on pump model). • Smaller refrigeration unit needed, resulting in significant capital equipment, maintenance, and operational savings.
	• Vapours can leak through dynamic seals.	• 100% sealed pumping chamber; no leak paths.
Catalysts & Additives (Catalysts - BASF/DOW Proprietary Catalysts, Amine) (Additives - Silicone 1, Silicone 2, Silicone 3 Ester, DEOA, Health Guard, FLE 200, Fire Retardant 1, Fire Retardant 2, Colouring Dyes and Pigments)	• Require extremely accurate dosing, typically at very low flow rates.	• Exceeds API 675 performance standards for Steady-State Accuracy, Repeatability, and Linearity at flow rates as low as 0.12 LPH.
	• Need to operate across a wide range of low-to-high pressures.	• Several models available with maximum pressure ratings from 70 to 172 bar.
	• Additives can be difficult to pump and contain abrasives due to crystallisation when additives come into contact with air or other chemicals.	• Seal-less design and spring-loaded, horizontal disk check valves handle abrasives and reduce clogging. • Can run dry indefinitely without damage. • Variety of materials of construction (metallic and non-metallic) suited for fluids and additives pumped.
De-ionized Water (Pure, Distilled)	• Aggressive against metal surfaces; especially a problem for any tight tolerances.	• No tight tolerances in the pump head.
	• Non-lubricating.	• Pumping action does not need lubrication.
Isocyanates (TDI 80, PMDI)	• Exposure to air and moisture causes crystals to form. Crystals can cause premature wear of dynamic seals and other pump components that require a lubricating film. Frequent and expensive maintenance needed to replace seals.	• Seal-less design means no rotary shaft seals to wear or replace, preventing air and moisture contamination. • Seal-less design and spring-loaded, horizontal disk check valves also enable liquids with particulates up to 500 microns dia. to be pumped without damage to the pump.
Polyols (Standard, Filled, HR, Polymer, Melamine, Visco, Polyester)	• Abrasive substance that can vary in viscosity; less viscous Polyol often requires low-pulse flow.	• Liquids with viscosities up to 5000 cPs (depending on model) are handled. • Provides virtually pulse-free flow without expensive pulsation dampeners.
	• Very difficult to transfer using pumps that have dynamic seals.	• Seal-less design can handle difficult liquids containing particles.
	• Abrasive fillers often added that can damage many pumps.	• Seal-less design and vertical check valves can handle fillers up to 9 MOH hardness.
	• Pressure can vary due to chemical composition.	• Models can handle a wide range of pressure requirements.

Hydra-Cell® Advantages

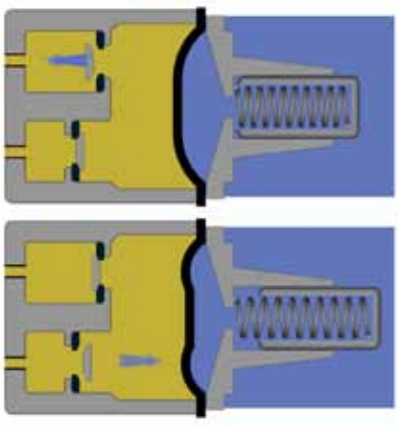
One pump design covers several polyurethane applications

The seal-less, positive displacement Hydra-Cell pump design includes 14 models that can be used for the broad spectrum of applications in the polyurethane production process. With one pump design to replace other pump types, Hydra-Cell reduces spare parts, training, and maintenance requirements.

Handles abrasives and particulates

- Seal-less design and spring-loaded, horizontal disk check valves provide superior handling of particulates - including abrasive fillers in Polyols and crystals that form in Isocyanates.

Hydra-Cell's horizontal check valves operate in a horizontal liquid flow and will handle abrasives and particulates without clogging or damage to the pump.



Runs dry without damage

- Seal-less, leak-free pumping chamber; no seal maintenance required.
- Liquids are 100% sealed from the atmosphere.
- No leak path for toxic vapours.
- Can pump liquids with solid particles up to 500 microns diameter, and up to 9 hardness on the MOH scale.
- Non-lubricating liquids can be pumped reliably.

Adaptable to many applications

- Can be fitted with ANSI or DIN flanges, IEC or NEMA motor mounts, or provided with ATEX certification to adapt to specific applications or meet international standards.
- Proven record of replacing different pump technologies (e.g. gear, magnetic drive, axial piston) with improved abrasives handling, less maintenance, and other benefits (as detailed on pages 10-11).
- One design with 14 models covers a wide range of operating flows and pressures.
- Minimises need for standby pumps and spare parts, which optimises training and service expertise, and reduces inventory size and expense.
- Simple change of liquid head materials of construction allows Hydra-Cell to be used for many different chemicals and liquids pumped.
- Available models include G Series for low-to-high volume transfer, spraying, pressure injection and mixing, and P Series metering pumps for precise dosing as well as spraying, pressure injection and mixing.

Virtually pulse-free flow

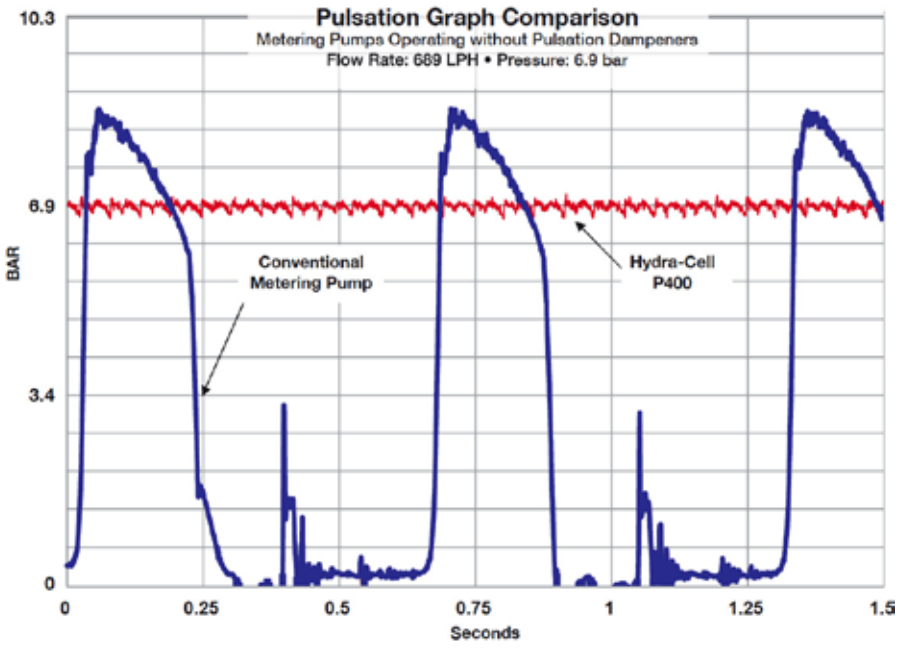
- Multiple-diaphragm design minimises pulsations, eliminating the need for expensive pulsation dampeners for most Hydra-Cell models.
- Reduces pipe strain.
- Enhances operating safety.
- Minimises maintenance.
- Reduces acceleration/friction loses in the suction line.
- Provides accurate metering with linear constant flow.
- Lowers system acquisition costs.

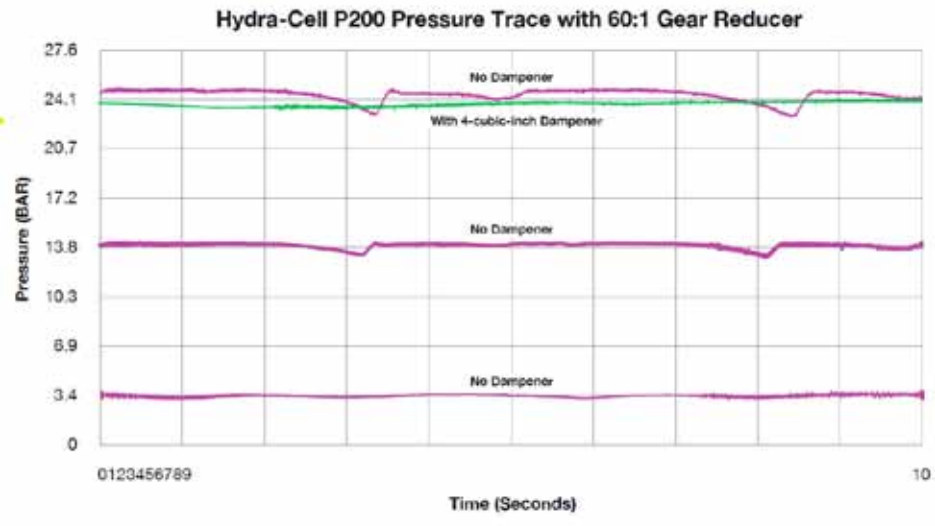
Injection of a proprietary catalyst into a high-volume polyurethane system. Hydra-Cell can provide precise metering and dosing when low flow rates are required.

Accurate electronic flow control

	G Series	P Series
Steady State Accuracy	›±1%	›±0.5%
Repeatability	›±3%	›±1%
Linearity	›±3%	›±1%

- Compared to pumps that rely on manual stroke adjustment or expensive actuators to change flow, Hydra-Cell pumps utilise speed control for greater accuracy throughout the turndown range.
- Can be equipped with solid-state electronic flow control where the volume per every stroke is constant and a known value.
- Electronic flow control also provides easy calibration of the desired feed rate and near instantaneous rate of change (0 to maximum RPM in 0.3 seconds).





Hydra-Cell® Features

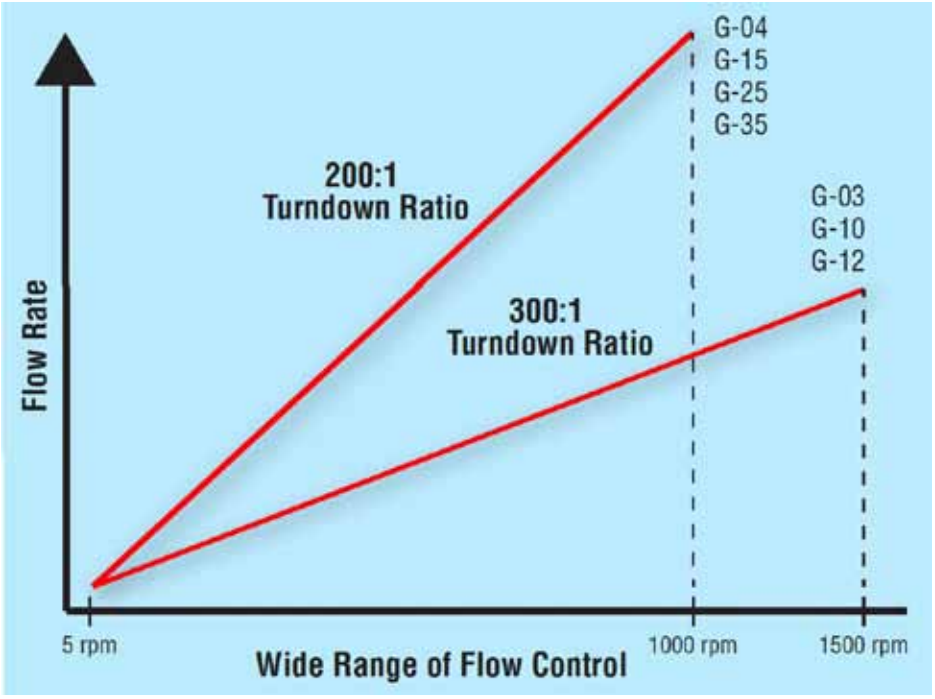
The seal-less technology and multiple-diaphragm design of Hydra-Cell provides precise, even dispersal while reducing maintenance and operating costs. Hydra-Cell pumps can be used in various points along the polyurethane production process to meet a wide range of low-to-high flow and pressure requirements.

Extensive operating range

- Shaft speeds from 5 rpm to 1500/1000 rpm, yielding a 300/200:1 turndown ratio.
- Maximum discharge pressures from 70 to 172 bar.
- Maximum flow rates for G Series from 3.8 to 140.0 LPM. For P Series from 78 to 2634 LPH.
- Minimum flow rates less than 0.6 LPH at approximately 6 rpm; custom pumps can operate at 0.12 LPH.

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.
- Typically run 6,000 hours before changing lubricating oil (compared to 1,500 hours recommended by many piston pump manufacturers).
- One design for all applications minimizes the need for standby pumps and spare parts, which optimizes training and service expertise and reduces



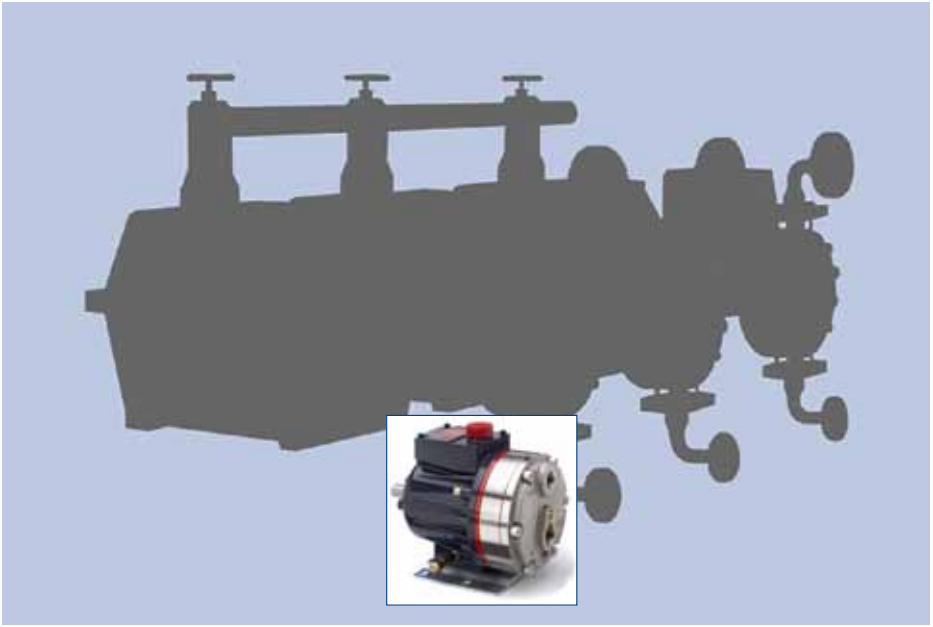
	Minimum	Maximum
Flow Rate	0.6 LPH	140 LPM
Discharge Pressure	0 bar	172 bar

ATEX

Hydra-Cell pump used in high-precision Pentane dosing. Hydra-Cell metering pumps can provide precise dosing at flow rates as low as 0.12 LPH.

Simple pump head design

- Low maintenance requirement.
- Low cost of spare parts.
- Liquid head materials can be changed readily, enabling Hydra-Cell to be used for many different chemicals and liquids pumped.



This Hydra-Cell pump shown to scale has the same flow capacity and pressure rating as this traditional triplex metering pump system.

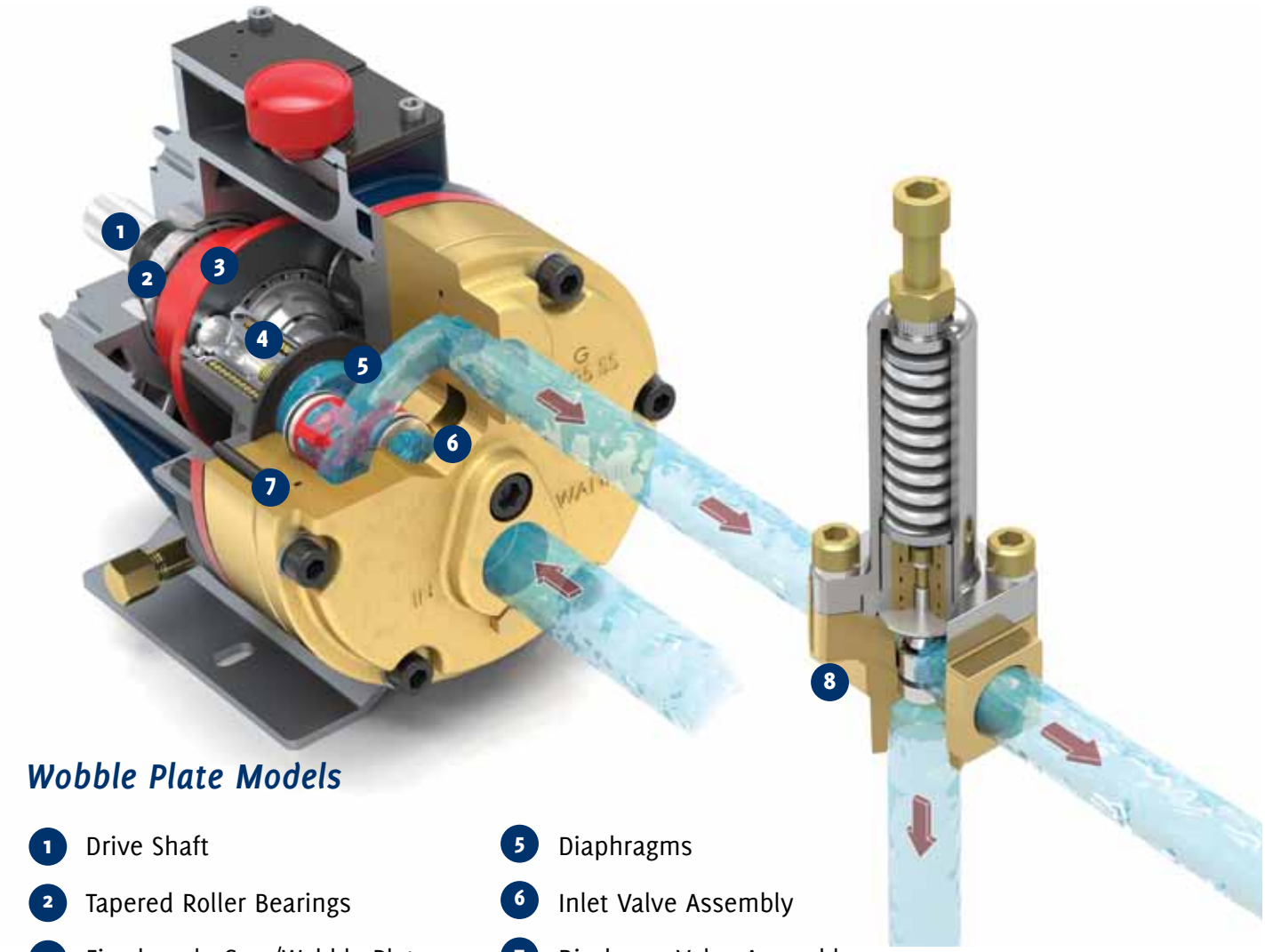
Low-shear pumping action

- Ideal for pumping and protecting shear sensitive polymers.
- Pumps non-viscous as well as viscous liquids up to 5000 cPs or more (depending on pump model).

Small footprint for savings

- Compact design can mean up to 30% lower initial cost compared to other pumps.
- Space-saving design leaves a smaller footprint for more efficient use of plant space and easier servicing.
- Significant savings because smaller refrigeration units can be used for pumping blowing agents.

Hydra-Cell® Principles of Operation - Wobble Plate



Wobble Plate Models

1. Drive Shaft
2. Tapered Roller Bearings
3. Fixed-angle Cam/Wobble Plate
4. Hydraulic Cells (Patented)
5. Diaphragms
6. Inlet Valve Assembly
7. Discharge Valve Assembly
8. C62 Pressure Regulating Valve

Reliable, Efficient Pumping Action

The drive shaft (1) is rigidly held in the pump housing by a large tapered roller bearing (2) at the rear of the shaft and a smaller bearing at the front of the shaft. Set between another pair of large bearings is a fixed-angle cam or Wobble Plate (3).

As the drive shaft turns, the swash plate moves, oscillating forward and back (converting axial motion into linear motion). The complete pumping mechanism is submerged in a lubricating oil bath.

The hydraulic cell (4) is moved sequentially by the Wobble plate and filled with oil on their rearward stroke. A ball check valve in the bottom of the piston ensures that the cell remains full of oil on its forward stroke.

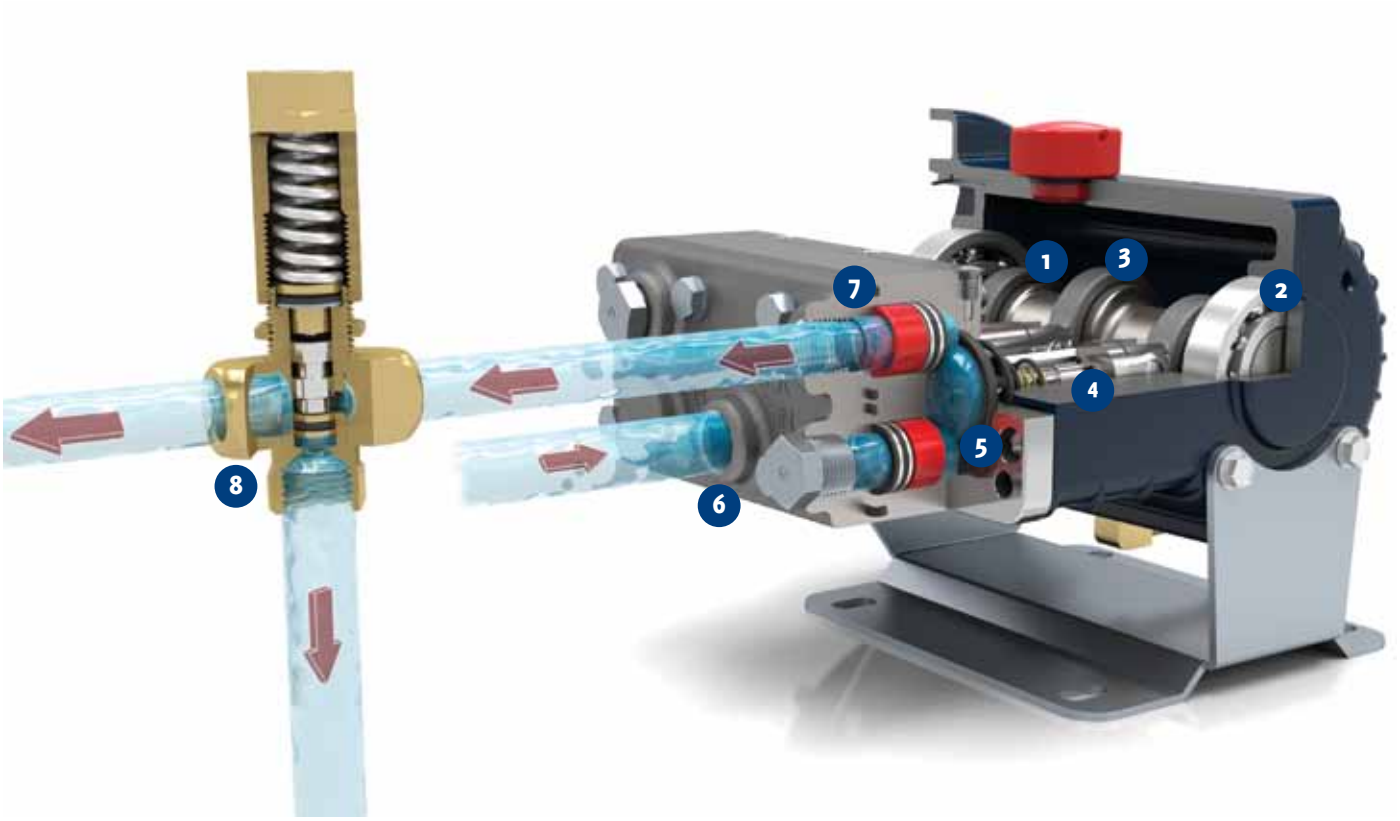
The oil held in the Hydra-Cell balances the back side of the diaphragms (5) and causes the diaphragms to flex forward and back as the Wobble plate moves. This provides the pumping action.

To provide long trouble-free diaphragm life, Hydra-Cell hydraulically balances the diaphragm over the complete pressure range of the pump. The diaphragm faces only a 0.21 bar pressure differential regardless of the pressure at which liquid is being delivered - up to 172 bar on standard Hydra-Cell models and Hydra-Cell metering pumps.

Hydra-Cell Wobble plate pumps can have up to five diaphragms, and each diaphragm has its own pumping chamber that contains an inlet and discharge self-aligning horizontal disk check valve assembly (6). As the diaphragms move back, liquid enters the pump through a common inlet and passes through one of the inlet check valves. On the forward stroke, the diaphragm forces the liquid out the discharge check valve (7) and through the manifold common outlet. Equally spaced from one another, the diaphragms operate sequentially to provide consistent, low-pulse flow.

A Hydra-Cell C62 pressure regulating valve (8) is typically installed on the discharge side of the pump to regulate the pressure of downstream process or equipment.

Hydra-Cell® Principles of Operation - Crankshaft



Crank-shaft Models

1. Drive Shaft
2. Precision Ball Bearings
3. Connecting Rods
4. Hydraulic Cells (Patented)
5. Diaphragms
6. Inlet Valve Assembly
7. Discharge Valve Assembly
8. C46 Pressure Regulating Valve (In-line)

Reliable, Efficient Pumping Action

The drive shaft (1) is supported in position by two precision ball bearings (2) positioned at either end of the shaft. Located between these bearings are either one or three cam shaft lobes with connecting rods (3) that are hardened, precision ground, and polished. Maintaining a high level of quality on the cam lobes and connecting rod surfaces ensures proper lubrication and reduced operating temperatures in the hydraulic end of the pump.

As the drive shaft turns, each cam actuates the attached connecting rod that is pinned into position at the end of each hydraulic piston. This action moves the piston forward and backward, converting the axial motion into linear pumping motion. The complete pumping mechanism is submerged in a lubricating oil bath.

Each piston contains a patented hydraulic cell (4) that is moved sequentially by the crank-shaft. The innovative and proprietary Hydra-Cell maintains the precise balance of oil behind the diaphragm (5) regardless of the operating conditions of the pump. The oil in Hydra-Cell is pressurized on the forward stroke of the piston causing the diaphragm to flex, which drives the pumping action. The oil held in the Hydra-Cell balances the diaphragm against the liquid being pumped, maintaining no more than a 0.21 bar differential regardless of the pressure at which the liquid is being delivered - up to 172 bar on standard Hydra-Cell models and Hydra-Cell metering pumps.

Hydra-Cell crank-shaft pumps can have up to three diaphragms, and each diaphragm has its own pumping chamber that contains an inlet and discharge self-aligning horizontal disk check valve assembly (6). As the diaphragms move back, liquid enters the pump through a common inlet and passes through one of the inlet check valves. On the forward stroke, the diaphragm forces the liquid out of the discharge check valve (7) and through the manifold common outlet. Equally spaced from one another, the diaphragms operate sequentially to provide consistent, low-pulse flow.

A Hydra-Cell C46 pressure regulating valve (8) is typically installed on the discharge side of the pump to regulate the pressure of downstream process or equipment.

Hydra-Cell® Performance Advantages

Compared to other pumps, Hydra-Cell requires minimal maintenance for polyurethane processors. Hydra-Cell has no packing or seals that leak or need to be replaced and no internal gears to wear.

Magnetic Drive Pump Disadvantages	Hydra-Cell® Advantages
• Cannot run dry without damage to the pump.	• Seal-less design enables Hydra-Cell® to run dry without damage.
• Requires monitoring to ensure liquid flow.	• Ensures proper liquid flow without monitoring.
• Designed to pump clean, low-viscosity liquids.	• Seal-less pumping chamber and spring-loaded, horizontal disk check valves can handle particulates and abrasive fillers.
• Higher power requirements and energy costs.	• Low-shear pumping action handles higher viscosity liquids.
• Can have a long horizontal footprint with higher acquisition and replacement costs.	• Smaller footprint compared to some magnetic drive pumps. • More energy efficient. • Easier to service. • Lower acquisition, operating and replacement costs.

Internal 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 seals or packing to leak or replace.
• Does not tolerate thin/non-lubricating liquids, and does not handle solids, abrasives or particulates well.	• Seal-less pumping chamber and spring-loaded, horizontal disk check valves can pump solids, abrasive fillers and particulates while handling liquids thick or thin.
• Designed for operating at low speeds and low pressure ratings. • Low volumetric efficiency.	• Operates at low-to-high speeds and at higher pressures with higher volumetric efficiency.
• Component wear reduces accuracy and efficiency.	• No internal gears to wear so there is less maintenance and spare part replacement. • Accuracy and efficiency are more stable.
• One bearing runs in the pumped liquid.	• No bearings in the pumped liquid.
• Unbalanced - overhung load on the shaft bearing.	• Hydraulically balanced design so there is no overhung load.

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 seals or packing to leak or replace.
• Does not tolerate solids, abrasives, or particulates.	• Seal-less pumping chamber and spring-loaded, horizontal disk check valves can pump solids, abrasive fillers and particulates.
• Component wear reduces accuracy and efficiency.	• No internal gears to wear so there is less maintenance and spare part replacement. • Efficiency is more stable.
• Contains four bushings in the fluid area.	• No bushings in the pumped fluid.
• Fixed end clearances.	• Design does not rely on clearances.
• Efficiency drops over 103 bar.	• Efficiency remains relatively constant over its range of operating pressures.

Axial Piston Pump Disadvantages:	Hydra-Cell® Advantages
• Tight tolerances prevent use in fluids with particulates greater than 7 microns, especially with liquids (e.g. Isocyanates) that react with air and form crystals in the liquid.	• Tolerances are not an issue because the seal-less design and spring-loaded, horizontal disk check valves enable Hydra-Cell to pump solids, abrasive fillers and particulates up to 500 microns or more in diameter.
• Filter and fluid reservoir necessary to maintain fluid cleanliness.	• Inherently simple design separates the lubricating film from the pumped liquid.
• Cylinder barrel can separate from valve plate, causing loss of lubricating film and damage to the barrel or plate.	• Requires no external filtration of pumped fluids.
• Back pressure can cause seal failure and mechanical damage.	• No packing and seal-less design, so it will not leak from seal failure.

Traditional Metering Pump Disadvantages	Hydra-Cell® Advantages
• Use manual stroke adjusters or expensive actuators to control flow, which can result in pumping inaccuracies, lost motion, operator error, and a greater chance of leakage.	• Hydra-Cell® employs optional Variable Frequency Drive (VFD) electronic flow control for greater accuracy and repeatability, eliminating lost motion, reducing the chance of operator error, and removing a potential leak path.
• Require expensive pulsation dampeners to minimize pulsations.	• Multiple-diaphragm design provides virtually pulse-free flow, so expensive pulsation dampeners may not be required.
• May only offer PTFE diaphragms, requiring frequent replacement due to stress and poor elastomeric memory.	• Available with a wide choice of cost-effective, elastomeric diaphragm materials.
• Large footprint to achieve required maximum flow and pressure.	• Can meet the same flow and pressure requirements with a much smaller footprint, saving space and costs.
• Different plunger and liquid end sizes needed to accommodate changes in operating pressures.	• Operates over a wide range of pressures without changes to the plunger or liquid end size.
• Integral gearing (necessary to prevent cross-contamination of actuating oil) is difficult and expensive to maintain.	• The simplicity of design means lower parts and maintenance costs. • Separate gearbox prevents cross-contamination of the actuating oil.

Pump selection

Hydra-Cell® G Series positive displacement diaphragm pumps for dosing, pressure injection, transfer, spraying

Hydra-Cell® G-series, heavy duty pumps are designed for transfer, pressure injection, dosing and spraying and have proven reliability in pumping aggressive, non-lubricating, corrosive, viscous, abrasive, hot liquids in many arduous applications.

Hydra-Cell®'s seal-less design provides no internal leak paths through which potentially harmful liquids or emissions could escape, ensuring 100% containment.

Available to Meet API 674!

Hydra-Cell® P-Series Extraordinary Metering Pumps - Exceeding API 675 performance standards

Designed for precision dosing of chemicals from 0.5 l/hr to 2500 l/hr when the high accuracy, control, simplicity and reliability of a hydraulically balanced diaphragm pump are needed.

Thanks to its modern design, the acquisition cost of Hydra-Cell® high precision metering and dosing pumps compare favourably with the cost of conventional metering pumps of similar performance.

Liquids that can crystallise and can cause damage to other pumps can usually be dosed very successfully and accurately with Hydra-Cell® P-Series pumps thanks to their inherently unique and ground-breaking design.

Materials

A variety of liquid head materials and diaphragm materials are available to suit the pumped liquid and varying performance conditions.

Liquid Head Materials	Diaphragm Materials	Pump Housing Materials
Hastelloy CW12MW Super Duplex 2507 Duplex Alloy 2205 316L Stainless Steel Brass Cast Iron Polypropylene Kynar	EPDM FKM FFKM PTFE Neoprene Buna Aflas	Cast Aluminium Ductile Iron for G10, G25 and G35

Hydra-Cell® Control Options

Electronic Control

- ATEX Dust Zone 21 (Ex tb III C T125c Db)
- IP55 Standard
- Flow adjustment scale via hand-wheel

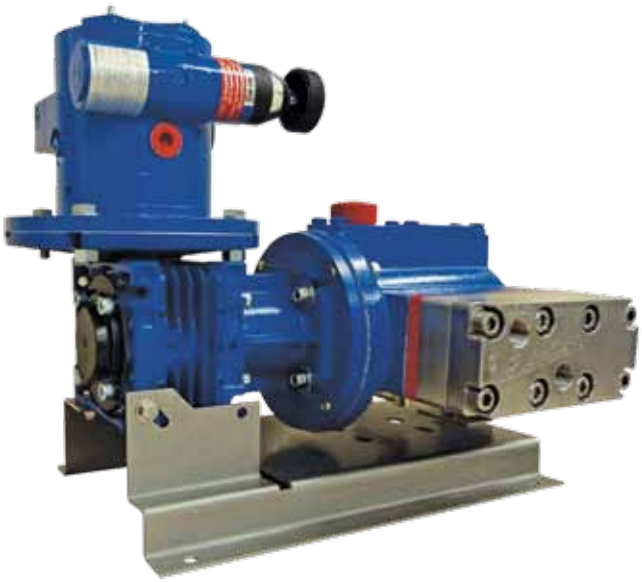
Control Freak

- Multiple Variable Frequency Dive (VFD) options
- Enables programming for flow rate or totalisation
- Option available to control multiple pumps with one Hydra-Cell “Control Freak”

Mechanical Adjustment

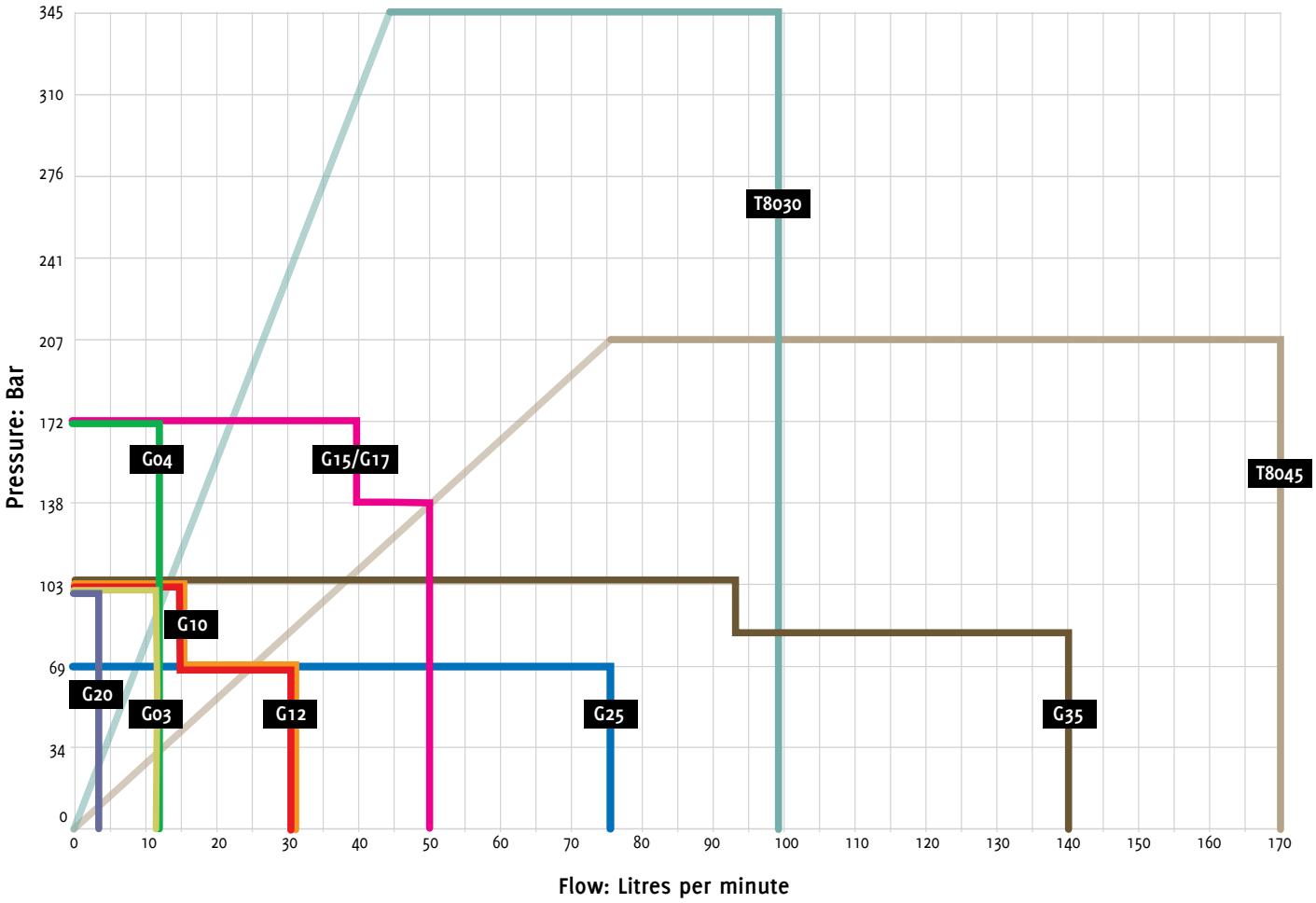
- ATEX Zone 1
- Linear fine adjustment scale on hand-wheel
- High reliability due to frictionless design

ATEX



Hydra-Cell® Flow Capacities and Pressure Ratings

G Series and T Series Seal-less Pumps



The graph above displays the maximum flow capacity at a given pressure for each model series. The table below lists the maximum flow capacity and maximum pressure capability of each model series.

Please Note: Some models do not achieve maximum flow at maximum pressure. Refer to the individual model specifications in this section for precise flow and pressure capabilities by specific pump configuration.

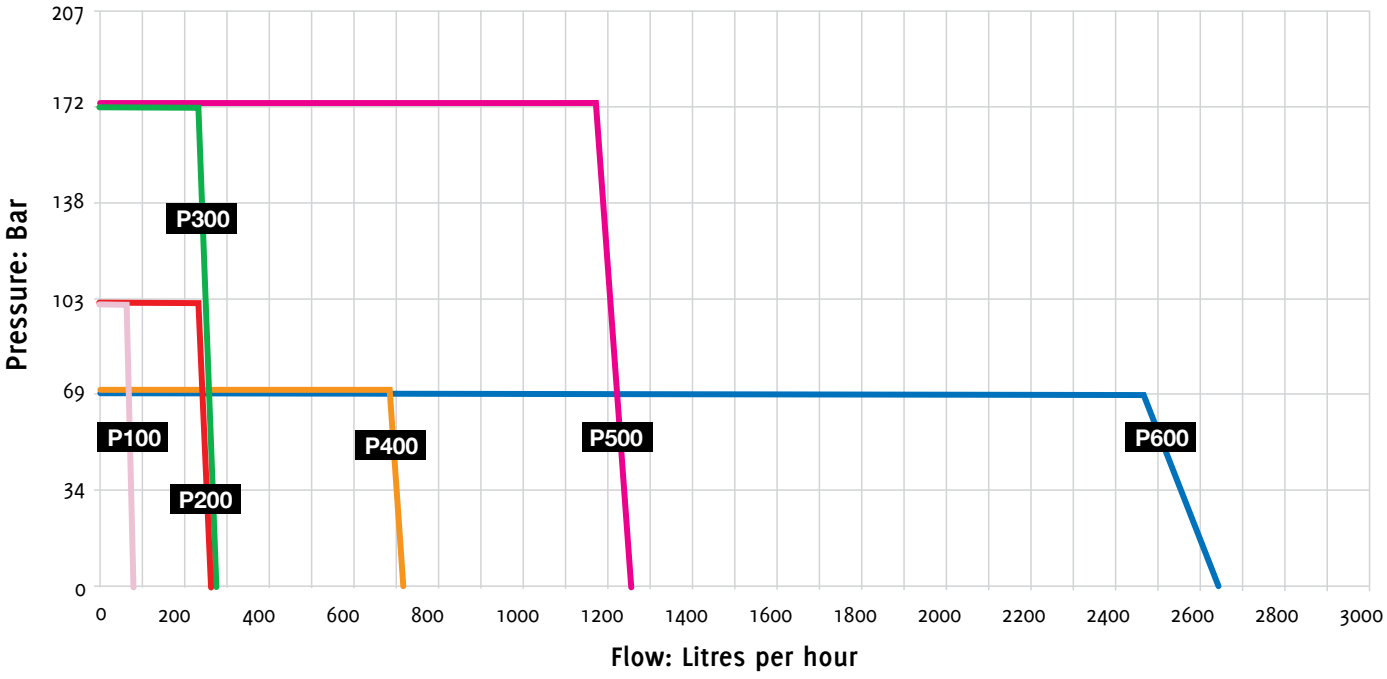
Model	Maximum Capacity l/min	Maximum Discharge Pressure bar		Maximum Operating Temperature °C[2]		Maximum Inlet Pressure bar
		Non-Metallic[1]	Metallic	Non-Metallic	Metallic	
G20	3.8	24	103	60°	121°	17
G03	11.7	24	103	60°	121°	17
G04	11.2	N/A	172	N/A	121°	34
G10	33.4	24	103	60°	121°	17
G12	33.4	N/A	103	N/A	121°	17
G15/17	58.7	N/A	172	N/A	121°	34
G25	75.9	24	69	60°	121°	17
G35	138	N/A	103	N/A	121°	34
T8045	170.4	N/A	207	N/A	82°	34
T8030	98.4	N/A	345	N/A	82°	34

1 24 bar maximum with PVDF (Kynar®) liquid end; 17 bar maximum with Polypropylene liquid end.

2 Consult factory for correct component selection for temperatures from 160°F (71°C) to 250°F (121°C).

HYDRA CELL® P Series Flow Capacities and Pressure Ratings

P Series Electronic Precision Metering Pumps



Model[1]	Maximum Capacity l/hr	Maximum Discharge Pressure bar		Maximum Operating Temperature °C[3]		Maximum Inlet Pressure bar
		Non-Metallic[2]	Metallic	Non-Metallic[2]	Metallic	
P100	78.0	24	103	60°	121°	17
P200	237.4	24	103	60°	121°	17
P300	242.1	N/A	172	N/A	121°	34
P400	714.9	24	69	60°	121°	17
P500	1255.1	N/A	172	N/A	121°	34
P600	2634.0	24	69	60°	121°	17

1 *Ratings are for X-Cam design*
2 *24 bar maximum with PVDF (Kynar®) liquid end; 17 bar maximum with Polypropylene liquid end.*
3 *Consult factory for correct component selection for temperatures above 71˚C*

HYDRA CELL® P Series Pumps Exceed API 675 Performance Standards

Hydra Cell Metering Solutions pumps meet or exceed API 675 performance standards for Steady-State Accuracy (± 1%), Linearity (± 3%) and Repeatability (± 3%).

Notes

WANNER

Hydra-Cell®

Partners in over 70 Countries

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