Hydra-Cell®

Seal-less Pump Technology

High Reliability Pumps for Mining, Tunnelling and Quarrying

Hydra-Cell® Mining, Tunnelling and Quarrying Pumps –

Hydra-Cell® pumps are used in a wide variety of applications, both below and above ground:

Explosive Injection

Charging liquid explosives into blast holes

Drill Head Cooling

Cooling the picks on coal cutters and tunnelling machines while reducing dust generation

Borehole Stabilisation

Injection of bore hole stabilising materials such as bentonite

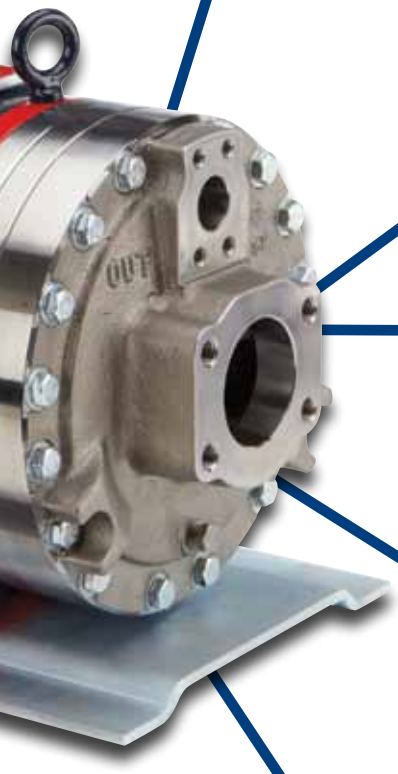
Dewatering

Continuous removal of contaminated, particle laden ground water

High reliability, seal-less and energy efficient design

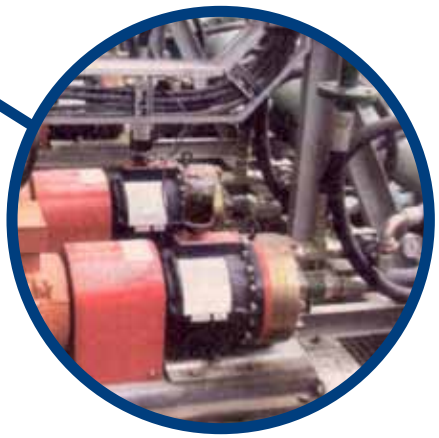
Dust Suppression
Pumping water or latex emulsions for airless spray

Conveyor Cleaning
Continuous duty 24/7 in high pressure jet cleaning



Grout Injection
Pumping abrasive slurries

Hazardous Chemical Pumping
e.g. metering cyanide solution in gold extraction

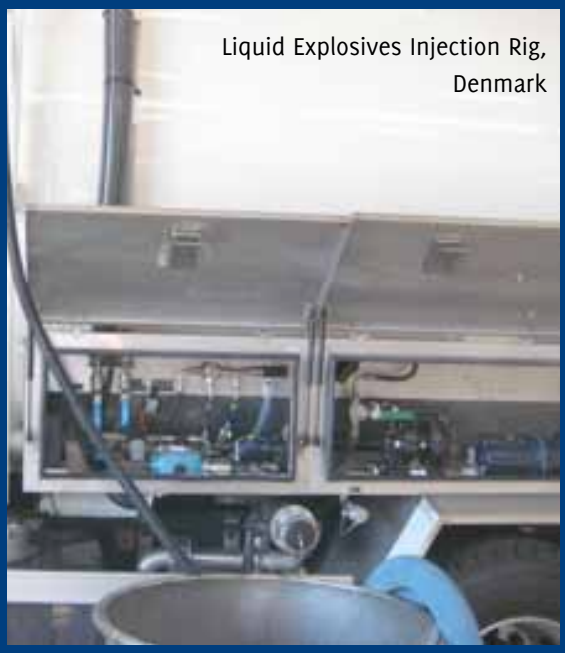


Seal Flushing
Protecting large slurry pumps from seal damage

Hydra-Cell®

Compact seal-less pumps for long life and high reliability

With over 35 years service in extraction industries, Hydra-Cell® pumps have proven performance and unmatched durability in difficult applications that destroy lesser pumps.



Liquid Explosives Injection Rig, Denmark

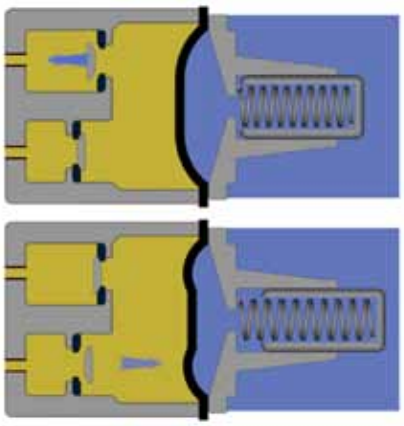
Typical Chemicals and Liquids Pumped	Challenges in Pumping	The Hydra-Cell® Advantage
Aggressive Chemicals… cyanide solutions, sulphur dioxide, acid mine drainage, acid rock drainage and leachate	• Corrosive… can contain solubilised impurities that form acidic solutions • Containment of potentially harmful liquids and vapours	• Corrosion resistant liquid head materials available • Seal-less pumping chamber. No dynamic seals to leak. Pumped liquid is 100% contained
Drill Head Cooling… water and drilling fluids	• Non-lubricating and aggressive	• No dynamic seals that need to be lubricated by the pumped liquid
	• Abrasive… water contains particles that can destroy dynamic seals in other pumps	• No dynamic seals to wear • Pumps abrasives successfully
Dust Suppression Chemical Binders… polymer blends including latex, acrylic, vinyl, resins and process water	• May shear thin easily, breaking down the chemistry • May flocculate if exposed to excessive temperatures • Premature failure of dynamic seals on other pump types in high pressure misting applications	• Low shear pumping action • Minimal heat transfer from the pump to the process liquid • No dynamic seals to wear
Grey Water… cleaning processes, mine dewatering and gland seal flushing	• Non-lubricating and aggressive	• No dynamic seals that need to be lubricated by the pumped liquid
	• Abrasive… water contains particles that can destroy dynamic seals in other pumps	• No dynamic seals to wear • Pumps abrasives successfully
	• Dry running operation causes other pump types to fail instantly / prematurely	• Can run dry indefinitely
Grouting Slurries… bentonite, cements	• Abrasive slurries cause wear to dynamic seals	• Seal-less design pumps abrasives and slurries successfully

Hydra-Cell® advantages

High reliability... low maintenance

Having **No Dynamic Seals** means high reliability.

- Run dry indefinitely
- No seals to wear
- No seals to leak any potentially harmful gases such as H_2S
- No tight tolerances that could be susceptible to corrosion or damaged by solid particles
- Pumps liquids with viscosities from 0.01 to 6000 cSt
- Pumps non-lubricating liquids reliably
- Pumps liquids with up to 500µm dia. particulate matter
- No 'drop-off' in performance due to seal wear



Unique horizontal check valves

- Efficient pumping of liquids with solids such as grouting slurries and sour/recycled water containing particulate matter.

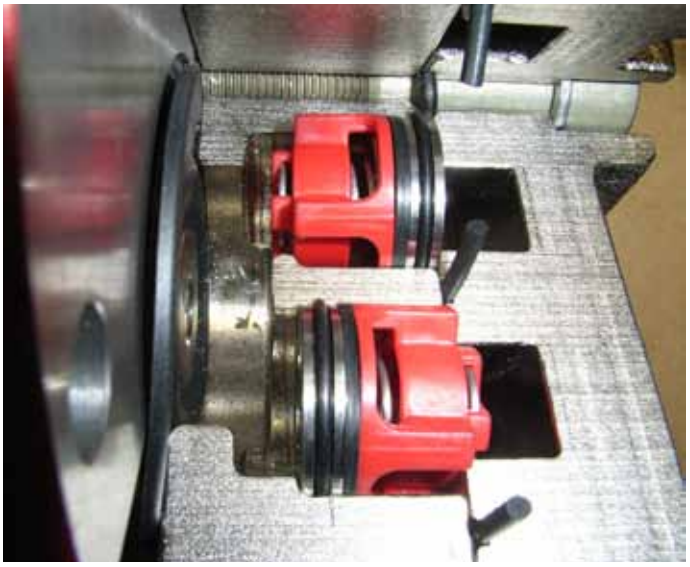
Compact design

For metering and dosing applications Hydra-Cell®'s compact design gives real advantages.

1. Space saving
2. Easier servicing
3. Lower initial purchase cost

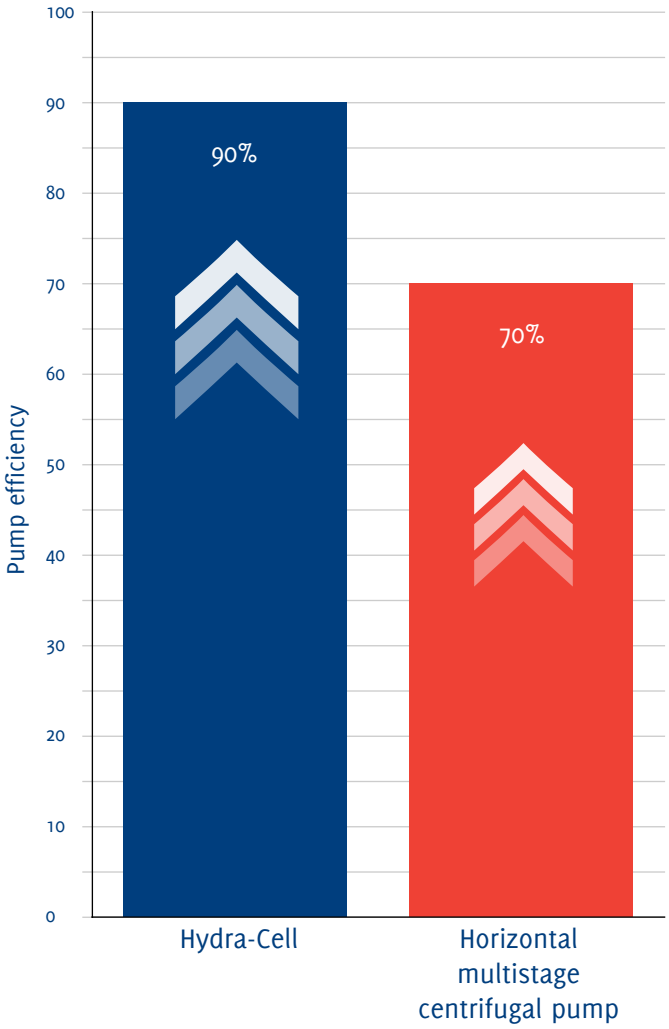
Simple robust design

- Designed and built for long service life
- Simple maintenance with no special tool requirements
- No critical tolerances to be aware of during maintenance
- On-site repair possible, no costly requirement for removal and transportation to workshops.



Energy saving

- Very economical to run compared with centrifugal pumps
- Smaller, more compact motors required

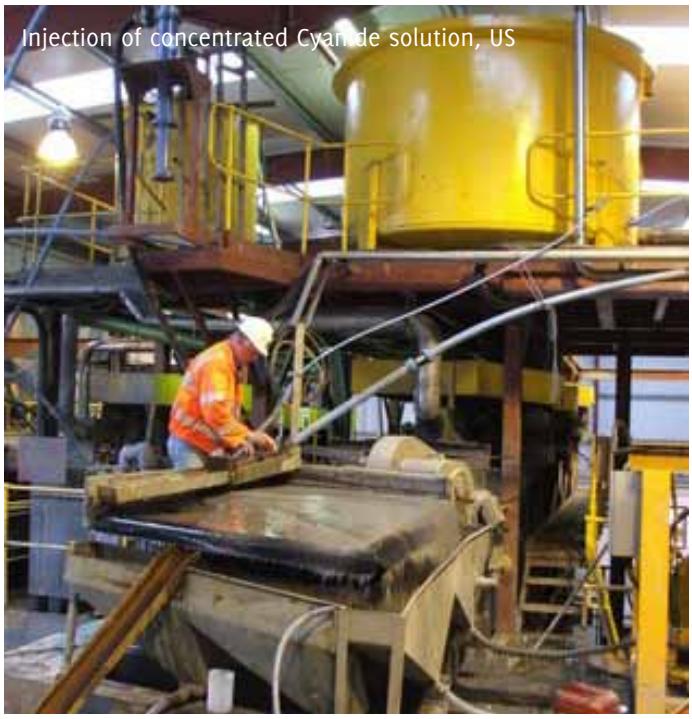


Explosion Proof

- All Hydra-Cell® G-series pumps can be supplied with ATEX approval for use in potentially explosive environments.

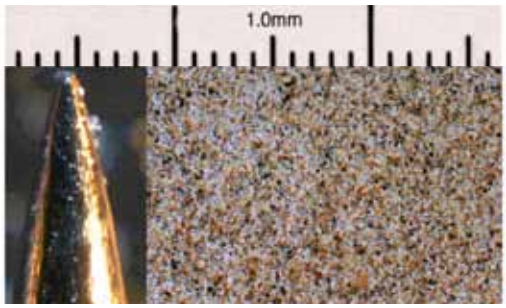
Low shear pumping action

- Due to the gentle pumping action, shear sensitive liquids, especially polymers, can be pumped without breaking down the long chain structures within the liquids.

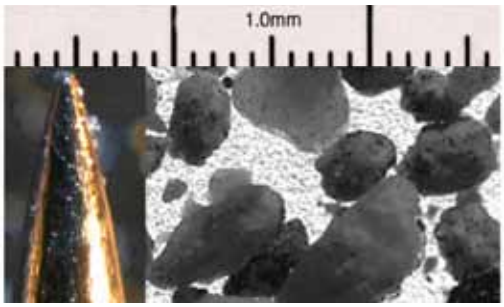

Injection of concentrated Cyanide solution, US

Minimal filtration

- No mechanical seals or tight tolerances that need protection by fine filtration. Hydra-Cell® pumps can handle particles up to 1mm, depending on model. Also liquids with non-dissolved solids up to 40%, depending on particle distribution.
- Unaffected by lapses in filtration reducing costly pump repairs
- Reduced filter maintenance & management, only requiring strainers of 200 to 400 microns.
- Often it is the sub 20 microns particles which cause seal & packing maintenance for pumps with dynamic seals.



25 Micron particles

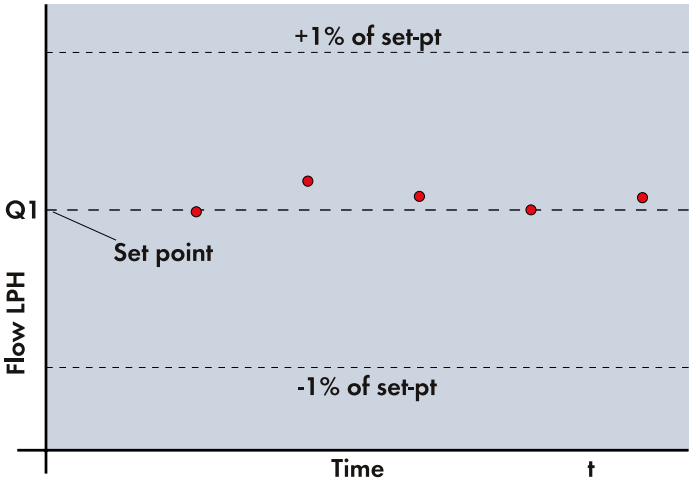


500 Micron particles

Ultimate Controllability for Metering and Dosing

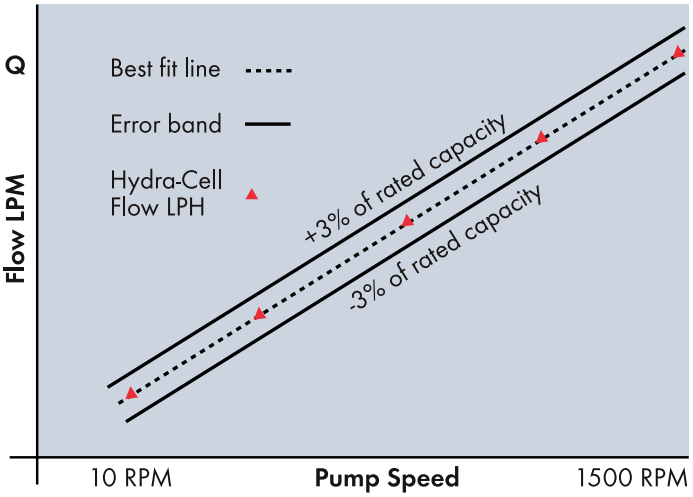
Metering and dosing performance better than API675.

- **Steady state accuracy** better than +/- 1%



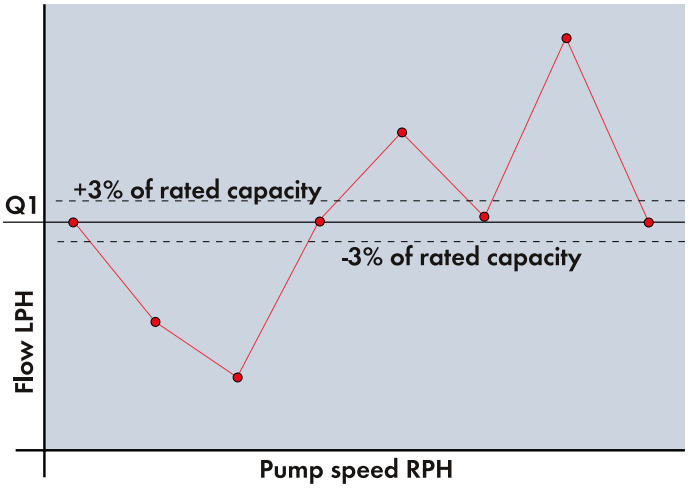
This is a measure of how well a set flow rate can be maintained.

- **Linearity** (Pump shaft speed/flow rate relationship) better than +/- 3%



This is a measure of how accurate the flow rate can be set by changing and setting pump speed.

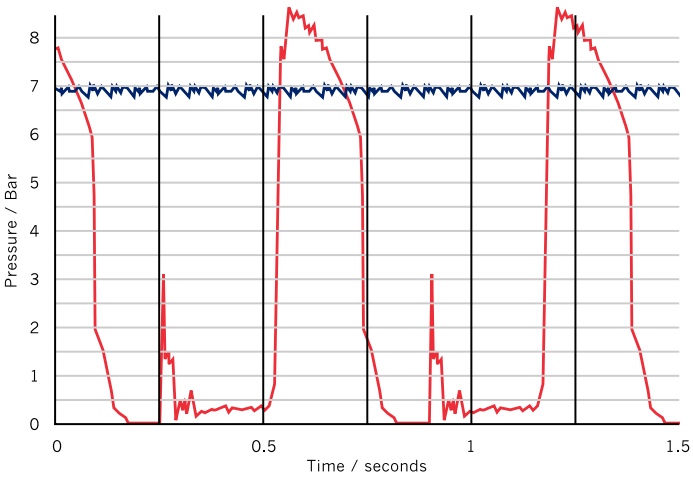
- **Repeatability** better than +/- 3%



This is a measure of how accurate the flow rate can be controlled when varying the pump shaft rpm away from a set point and returning to that set point.

Virtually pulse-less flow for accurate metering

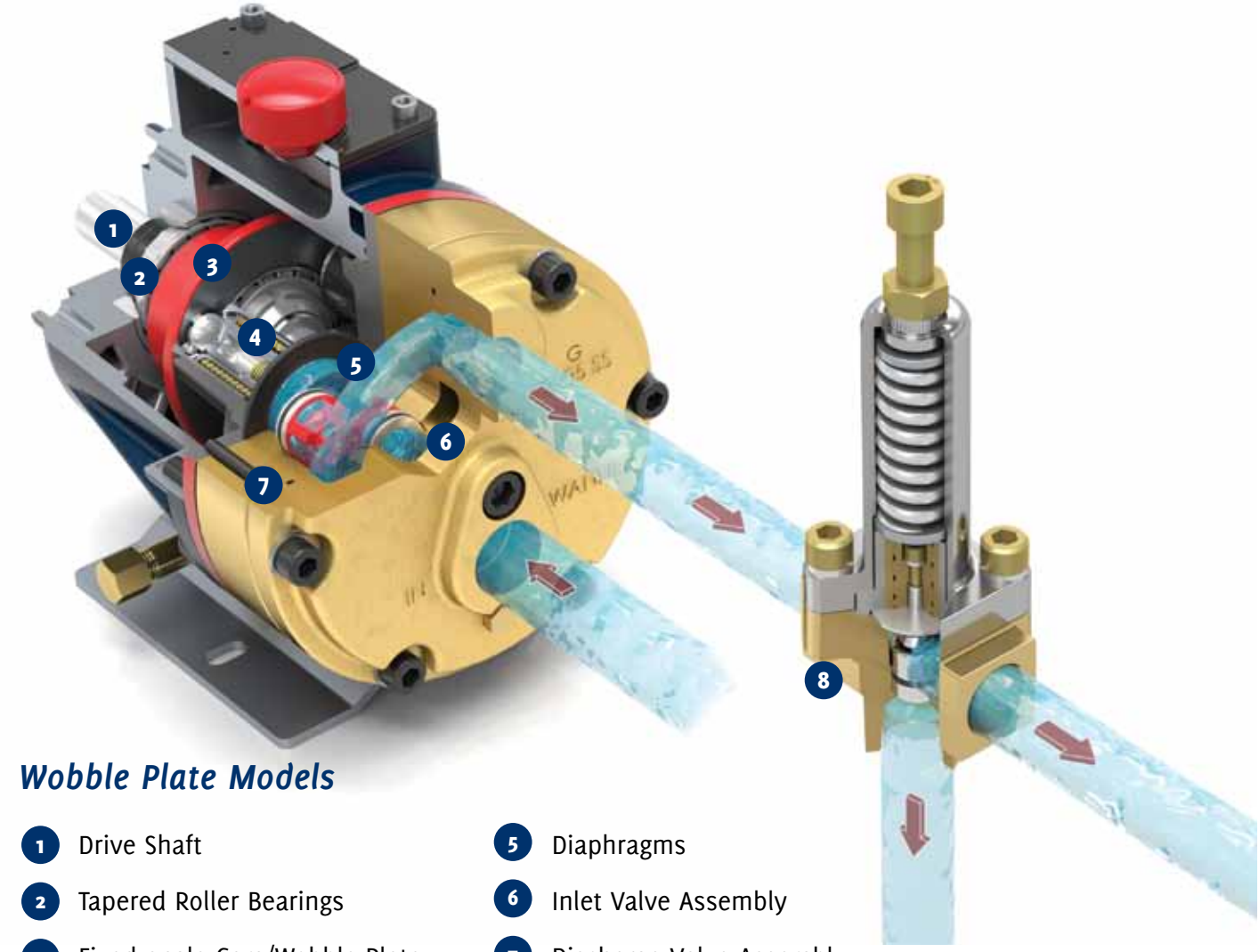
- Pulsation dampeners may not be required for most Hydra-Cell® pumps, thus reducing the risk of pipe strain
- More accurate control of flow rate and efficient use of chemicals.
- Significantly less inlet acceleration head issues than traditional single diaphragm metering pumps, especially with viscous liquids.



Hydra-Cell® pumps

Leading brand metering pump

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.

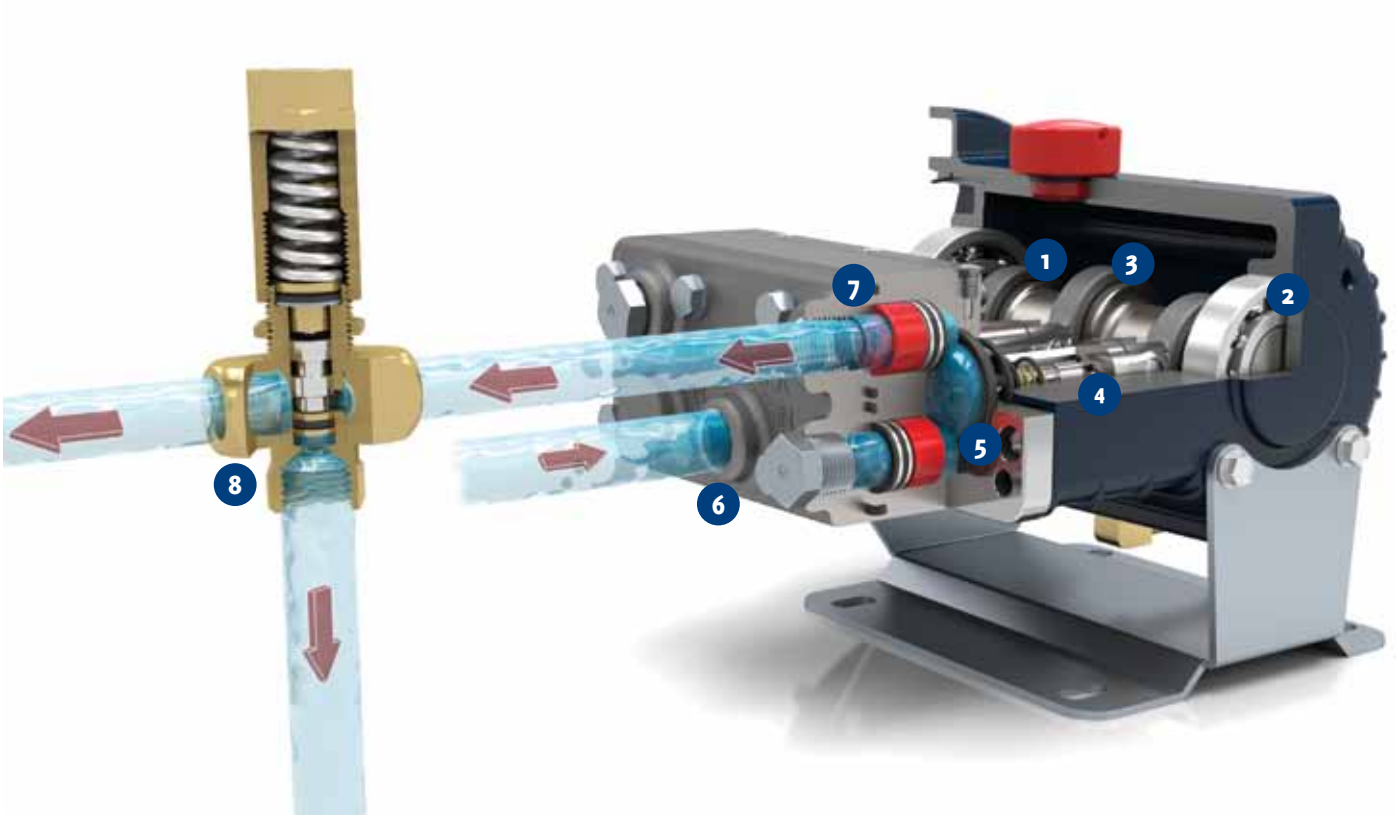
The oil held in the Hydra-Cell balances the back side of the diaphragms (5) and causes the diaphragms to flex forward and back as the Wobble plate moves. This provides the pumping action.

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 spring loaded 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.

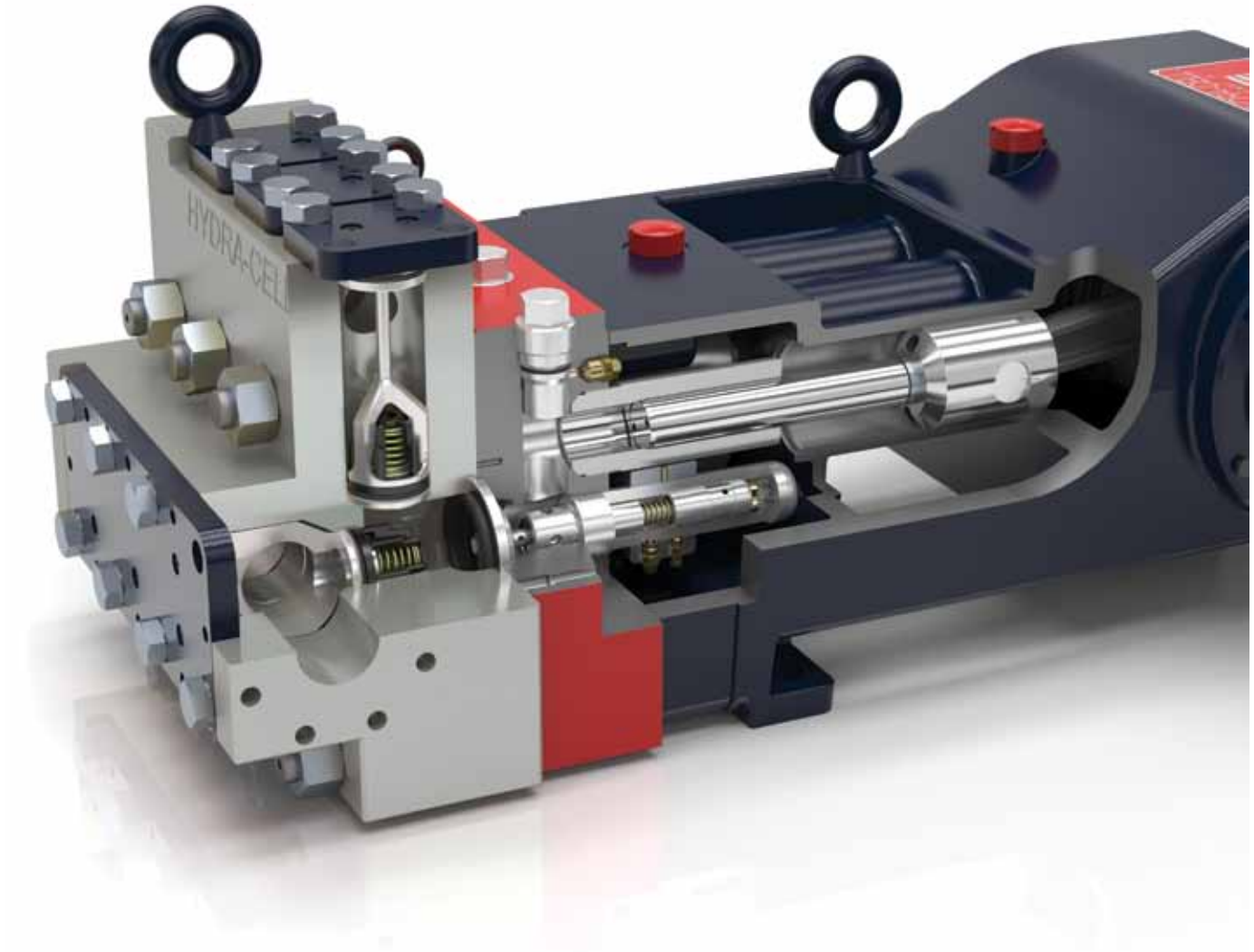
Hydra-Cell crank-shaft pumps can have up to three diaphragms, and each diaphragm has its own pumping chamber that contains an inlet and discharge self-aligning spring loaded check valve assembly (6). As the diaphragms move back, liquid enters the pump through a common inlet and passes through one of 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® Principles of Operation - T Series

API 674 option available

Exclusive Seal-less Diaphragm Design



- Seal-less design separates the power end from the process liquid end, eliminating leaks, hazards, and the expense associated with seals and packing
- Low NPSH requirements allow for operation with a vacuum condition on the suction - positive suction pressure is not necessary
- Can operate with a closed or blocked suction line and run dry indefinitely without damage, eliminating downtime and repair costs
- Unique diaphragm design handles more abrasives with less wear than gear, screw or plunger pumps
- Hydraulically balanced diaphragms to handle high pressures with low stress
- Provides low-pulse, linear flow due to its multiple diaphragm design
- Lower energy costs than centrifugal pumps and other pump technologies
- Rugged construction for long life with minimal maintenance
- Compact design and double-ended shaft provides a variety of installation options
- Hydra-Cell T-Series pumps can be configured to meet API 674 standards – consult factory for details

Hydra-Cell T80 Series pumps received a "Spotlight on New Technology" award from the Offshore Technology Conference.

Hydra-Cell® Control Options

Electronic Control

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

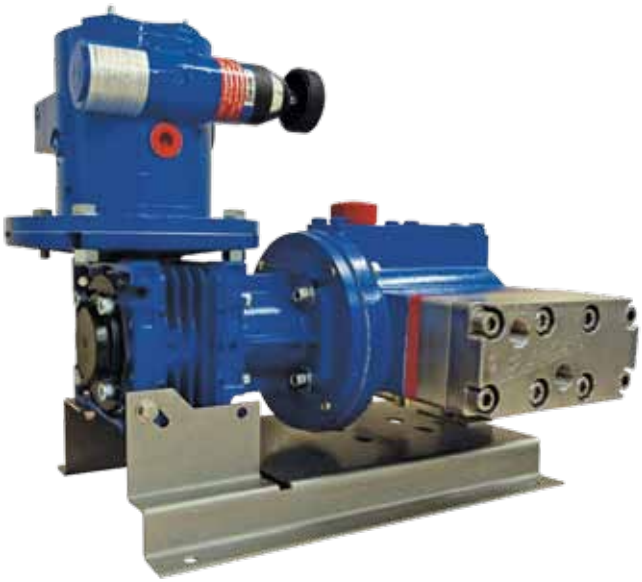
Control Freak

- 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® Materials of Construction

As part of our "Mass Customisation" philosophy, every Hydra-Cell pump is built with manifolds, elastomeric materials, and valve assemblies using construction materials specified by the customer. Hydra-Cell distributors and factory representatives are readily available to assist customers in selecting the materials best suited to the process application. (The range of material choices depends on each pump model – for example, models designed to operate at higher pressures are available with metallic pump heads only.)

Manifolds

Manifolds for Hydra-Cell pumps are available in a variety of materials to suit your process application. They are easy to replace and interchangeable to accommodate different liquids processed by the same pump. Special manifolds with a 2:1 dosing ratio are also available. (Consult factory.)

Non-metallic Pump Heads

Non-metallic pump heads are often used when a corrosive or aggressive liquid is being processed at lower pressures.

- Polypropylene
- PVDF

Metallic Pump Heads

Metallic pump heads can handle higher operating pressures. Hastelloy CW12MW or Stainless Steel is also selected for corrosion resistance and other properties.

- Brass
- Bronze
- Cast Iron (Nickel-plated)
- Duplex Alloy 2205
- Super Duplex Alloy 2507
- Hastelloy CW12MW
- 304 Stainless Steel
- 316L Stainless Steel

Diaphragms and O-rings

Diaphragms and corresponding o-rings are available in several elastomeric materials.

- Aflas (used with PTFE O-ring)
- Butyl
- Buna-N
- EPDM (requires EPDM-compatible oil)
- FFKM
- FKM
- Neoprene
- PTFE

Valve Materials

Hydra-Cell valve assemblies (seats, valves, springs, and retainers) are available in a variety of materials to suit your process application.

Valve Seats

- Ceramic
- Hastelloy CW12MW
- Nitronic 50
- Tungsten Carbide
- 17-4 PH Stainless Steel
- 316L Stainless Steel

Valves

- Ceramic
- Hastelloy CW12MW
- Nitronic 50
- Tungsten Carbide
- 17-4 PH Stainless Steel

Valve Springs

- Elgiloy (Exceeds SST grade 316L)
- Hastelloy CW12MW
- 17-7 PH Stainless Steel
- 316L Stainless Steel

Valve Spring Retainers

- Celcon
- Hastelloy CW12MW
- Nylon (Zytel)
- Polypropylene
- PVDF
- 17-7 PH Stainless Steel

Registered trademarks of materials:

Aflas®	Asahi Glass Co., Ltd.
Buna®-N (Nitrile)	E.I. Du Pont de Nemours and Company, Inc.
Celcon®	Celanese Company
Elgiloy®	Elgiloy Limited Partnership
Hastelloy® CW12MW	Haynes International, Inc.
Kynar® (PVDF)	Arkema, Inc.
Mesamoll®	Lanxess Deutschland GmbH
Neoprene®	E.I. Du Pont de Nemours and Company, Inc.
Nitronic® 50	AK Steel Corporation
Teflon® (PTFE)	E.I. Du Pont de Nemours and Company, Inc.
Viton® (FKM)	DuPont Performance Elastomers, LLC
Zytel® (Nylon)	E.I. Du Pont de Nemours and Company, Inc.

Hydra-Cell® S Series Solenoid Metering Pumps

The S Series pumps provide an economical choice for chemical injection in metering applications.

Solenoid driven, the S pumps feature a wide discharge-volume range, extensive choice of liquid end materials, various control functions, and a wide voltage range.

Materials of construction choices and versatile design options result in pumps perfected for specific applications including general chemicals, high-pressure boiler, high-viscosity fluids, outgassing and more.

Flow Rate	SM Series Models	SP/ST/SA Series Models
30 ml/min	SM030	SP/ST/SA-030
60 ml/min	SM060	SP/ST/SA-060
100 ml/min	SM100	SP/ST/SA-100
200 ml/min	N/A	SP/ST/SA-200
With Relief Valve		
30 ml/min	SM03R	SP/ST/SA-03R
60 ml/min	SM06R	SP/ST/SA-06R
100 ml/min	SM10R	SP/ST/SA-10R

SM030CAS manual control with stroke speed dial.

SP060HVS digital with pulse-in control.

ST03RPES digital with pulse-in control and timer.

SA03RPES digital with pulse-in and analog-in.

"Eco-friendly" Mode Reduces Power Consumption up to 55%

Unlike conventional pumps that are always turned on for a specific time period regardless of the discharge pressure, S Series "Eco-friendly" pumps with pulse control automatically cut the power-on time in accordance with the discharge pressure.

The "Eco-friendly" mode of SP/ST/SA models always monitors operation conditions and automatically shortens the power-on time during low-pressure operation in order to reduce power consumption and operating costs.

Safety Features to Handle Abnormal Pressure

Safe Mode - liquid transfer force is controlled during no-discharge operation to prevent abnormal pressure buildup. (Not available for SP/ST/SA-200 models or for boiler and high-pressure applications.)

Integral Relief Valve - releases abnormal pressure automatically if the pressure exceeds the set value. (Not available for high-viscosity and high-pressure applications.)

Abnormal Pressure Sensor - alarm sounds if abnormal pressure builds up due to clogged pipes or if the discharge valve is closed. (Available with SP/ST/SA models only.)

S Series Components and Accessories to Enhance System Performance

Double-ball Check Valve

Controls valve opening and closing speeds to help ensure metering accuracy and reduce the possibility of water hammer.

Anti-siphon Check Valve

Prevents clogging at the injection point and also aids in priming.

Flow Checker

Resistant to acids and alkalis to allow the injection operation of the pump to be verified at low cost.

Foot Valve

Designed to prevent backflow into chemical injection systems.

Degassing Joint

Separates absorbed air bubbles from the liquid to prevent air bubbles from entering the pump head.

Integral Relief Valve

Safety valve that automatically releases excess pressure that builds up inside the discharge side pipes. This can occur due to clogging of the pipes or if the discharge valve is closed.

Solution Tanks

For large-capacity chemical injection. Special features include a float switch that sounds an alarm when it is time to refill the tank, and a drain valve that drains excess moisture from the system.

30L (7.9 gal) *50L (13.2 gal)* *120L (31.7 gal)*

Spare Parts Kits

Spare parts kits to help extend service life.

SM Series Spare Parts Kit

SP/SA/ST Series Spare Parts Kit

Hydra-Cell G Series Seal-less Pumps

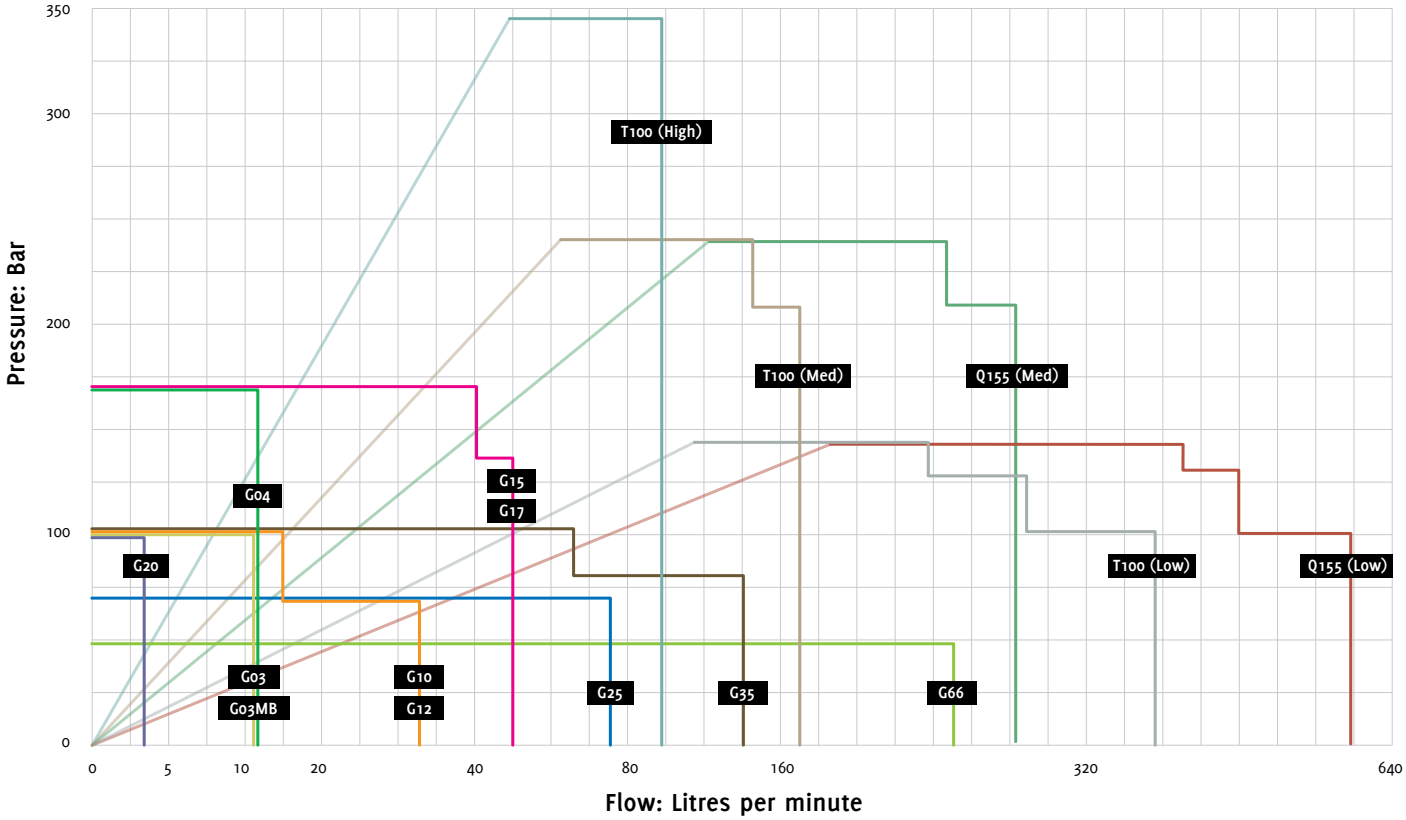
Hydra-Cell T Series Seal-less Pumps

Hydra-Cell Q Series Seal-less Pumps

Hydra-Cell P Series Seal-less Metering Pumps

Hydra-Cell® Industrial & Process Pumps

Flow Capacities and Pressure Ratings



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.

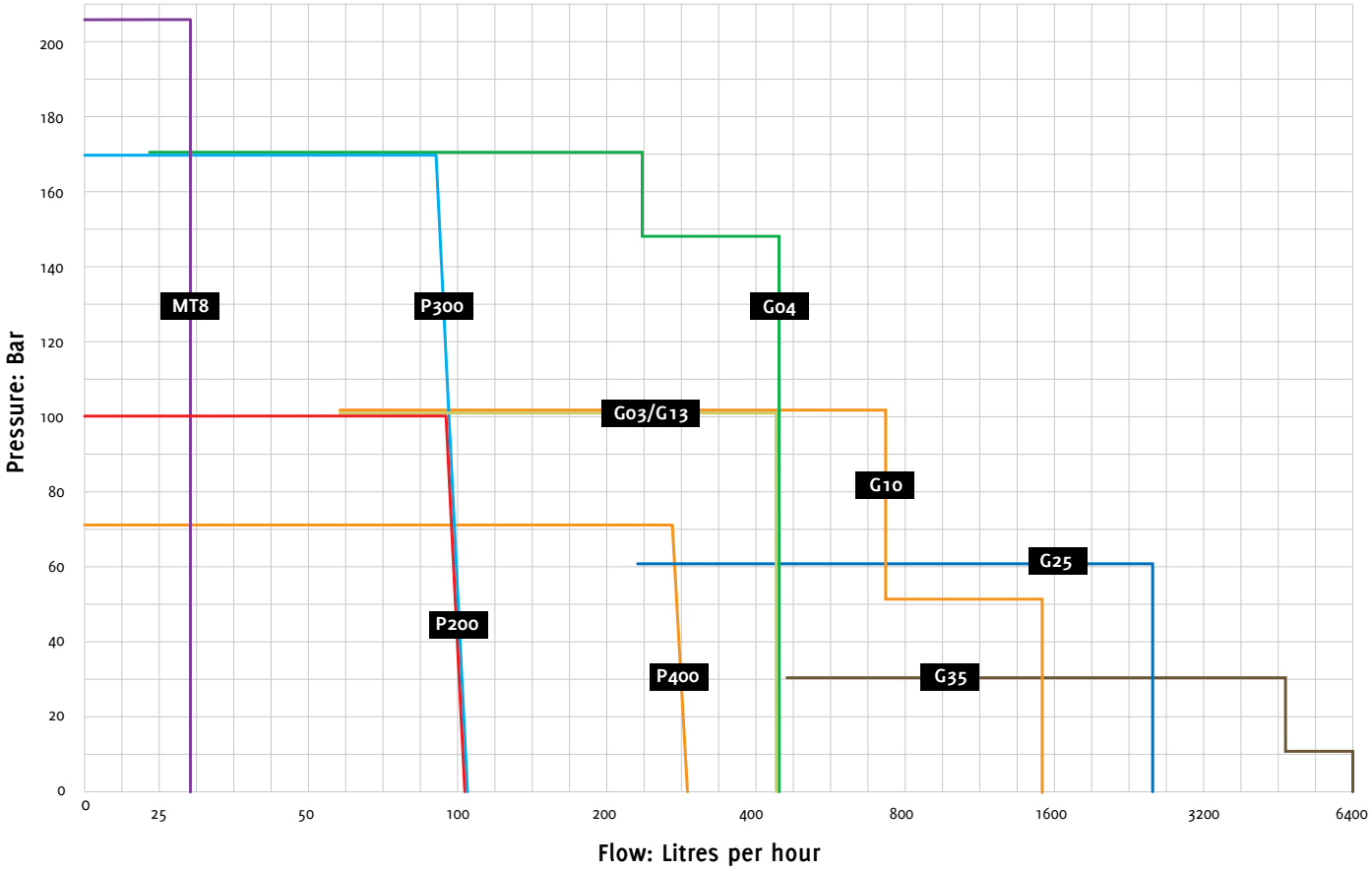
Model	Maximum Capacity l/min	Maximum Discharge Pressure bar		Maximum Operating Temperature °C[2]		Maximum Inlet Pressure bar
		Non-Metallic[1]	Metallic	Non-Metallic	Metallic	
G20	3.8	24	103	60°	121°	17
G03	11.7	24	103	60°	121°	17
G04	11.2	N/A	200	N/A	121°	34
G10	33.4	24	103	60°	121°	17
G12	33.4	N/A	103	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
G66	248	17	48	49°	121°	17
T100S	98	N/A	345	N/A	82°	34
T100M	144	N/A	241	N/A	82°	34
T100K	170	N/A	207	N/A	82°	34
T100H	259	N/A	145	N/A	82°	34
T100F	290	N/A	128	N/A	82°	34
T100E	366	N/A	103	N/A	82°	34
Q155E	595	N/A	103	N/A	82°	34
Q155F	490	N/A	127	N/A	82°	34
Q155H	421	N/A	144	N/A	82°	34
Q155K	295	N/A	207	N/A	82°	34
Q155M	253	N/A	241	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® Metering & Dosing Pumps – ATEX / Explosive Areas

Flow Capacities and Pressure Ratings

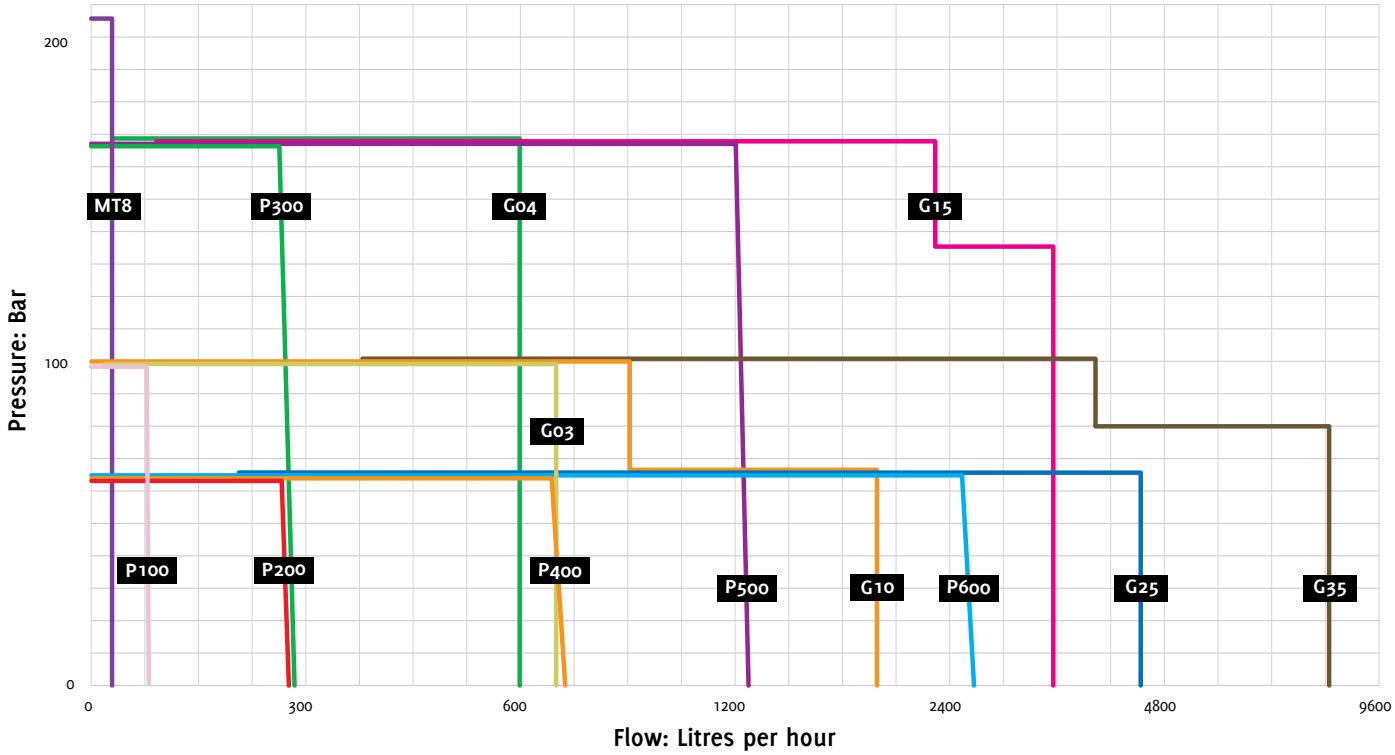


Model	Maximum Capacity l/hr	Maximum Discharge Pressure bar		Maximum Operating Temperature °C[2]		Maximum Inlet Pressure bar
		Non-Metallic[1]	Metallic	Non-Metallic	Metallic	
MT8	30	N/A	241	N/A	121°	17
P200	102	24	103	60°	121°	17
P300	95	N/A	172	N/A	121°	34
P400	305	24	69	60°	121°	17
G13 - M2H	462	24	103	60°	121°	17
G13 - M2M	462	24	60	60°	121°	17
G13 - M4L	230	24	20	60°	121°	17
G13 - M2L	462	24	20	60°	121°	17
G04 - M4H	226	N/A	172	N/A	121°	34
G04 - M2M	452	N/A	150	N/A	121°	34
G10 - M4H	732	24	103	60°	121°	17
G10 - M2M	1470	24	50	60°	121°	17
G10 - M4L	732	20	20	60°	121°	17
G10 - M2L	1470	20	20	60°	121°	17
G25 - M4L	2600	20	20	60°	121°	17
G25 - M4M	2600	24	60	60°	121°	17
G35 - M2L	6360	N/A	10	N/A	121°	10
G35 - M4L	4800	N/A	30	N/A	121°	17

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® Metering & Dosing Pumps – Electronic Control

Flow Capacities and Pressure Ratings



Model	Maximum Capacity l/hr	Maximum Discharge Pressure bar		Maximum Operating Temperature °C[2]		Maximum Inlet Pressure bar
		Non-Metallic[1]	Metallic	Non-Metallic	Metallic	
MT8	30	N/A	241	N/A	121°	17
P100	85	24	103	60°	121°	17
P200	255	24	103	60°	121°	17
P300	257	N/A	172	N/A	121°	34
P400	766	24	69	60°	121°	17
P500	1244	N/A	172	N/A	121°	34
P600	2808	24	69	60°	121°	17
G03	660	24	103	60°	121°	17
G04	660	N/A	172	N/A	121°	34
G10	1800	24	69	60°	121°	17
G10	900	24	103	60°	121°	17
G15	2940	N/A	138	N/A	121°	34
G15	2280	N/A	172	N/A	121°	34
G25	4560	24	69	60°	121°	17
G35	8280	N/A	83	N/A	121°	34
G35	3960	N/A	103	N/A	121°	17

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).

Notes

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