



# Hydra-Cell<sup>®</sup>

Seal-less Pumping Technology

**Hydra-Cell Pumps for High  
Pressure Cleaning**

**Dependable Pump Technology**



# High reliability high-pressure cleaning with hot or cold -

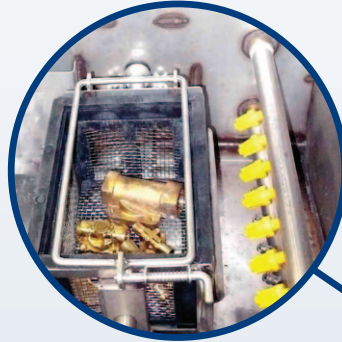
## Graffiti Removal

- Water, detergent and special sand mixture



## Metal Surface Preparation

- High pressure spray under emersion of Phosphate solutions



## Mining Industry

- Conveyor cleaning



## Paper and Pulp

- Shower and felt cleaning



## Service Centres

- Engine cleaning

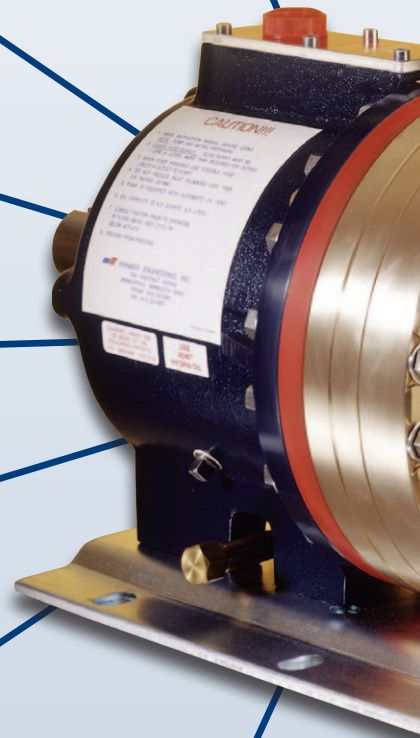


## Chemical Cleaning

- Latex transport tankers
  - Paint containers
- Gas Turbine nozzles



## Filter Press Cleaning



# Acids, chemicals, detergents, recycled liquids, solvents and water

## Electronics

- PCB cleaning



## Steel Industry

- Roller cleaning
- Strip steel cleaning



## IBC Cleaning

- Lance systems
- Container, tote and crate cleaning



## Food Industry

- Lance systems
- CIP systems Inline conveyer cleaning
- Tanker cleaning
- For food industry water needs to be at least 90°C for sanitising.



## Vehicle Cleaning

- Touch-less arc
- High pressure lance for carwash
- Truck wash • Train wash



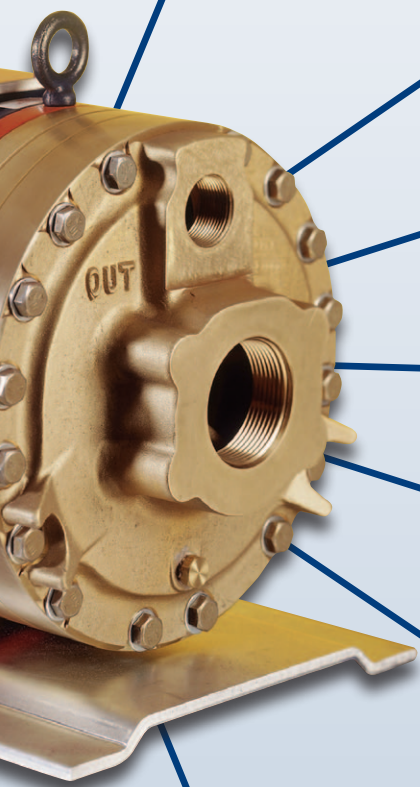
## Metal Working

- Parts degreasing • De-burring
- De-carbonising



## Marine

- Fishing boat wash down



| Typical Liquids Pumped                                                                           | Challenges in Pumping                                                                                                                                                                                                                                                     | The Hydra-Cell® Advantage                                                                                                               |
|--------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| <b>Cleaning Chemicals...</b><br>acids, caustics and detergents                                   | <ul style="list-style-type: none"> <li>Corrosive and non-lubrication</li> </ul>                                                                                                                                                                                           | <ul style="list-style-type: none"> <li>Corrosion resistant liquid head materials</li> <li>No dynamic seals to be corroded</li> </ul>    |
|                                                                                                  | <ul style="list-style-type: none"> <li>Escaping fumes can be hazardous</li> </ul>                                                                                                                                                                                         | <ul style="list-style-type: none"> <li>Seal-less design prevents leakage</li> </ul>                                                     |
|                                                                                                  | <ul style="list-style-type: none"> <li>Undissolved solids can be abrasive</li> </ul>                                                                                                                                                                                      | <ul style="list-style-type: none"> <li>Handles abrasives with ease</li> </ul>                                                           |
|                                                                                                  |                                                                                                                                                                                                                                                                           | <ul style="list-style-type: none"> <li>Seal-less design handles particles up to 1.5mm</li> </ul>                                        |
| <b>Fresh, Recycled and Grey Water</b>                                                            | <ul style="list-style-type: none"> <li>Solid particles may be present from poorly attended pre-filtration</li> </ul>                                                                                                                                                      | <ul style="list-style-type: none"> <li>Seal-less design handles particles up to 1.5mm dia.</li> </ul>                                   |
|                                                                                                  | <ul style="list-style-type: none"> <li>Non-lubricating</li> </ul>                                                                                                                                                                                                         | <ul style="list-style-type: none"> <li>Pumping action does not require any lubrication from pumped liquid</li> </ul>                    |
|                                                                                                  | <ul style="list-style-type: none"> <li>In hard water areas hardness salts (scale) build-up can wear dynamic seals</li> </ul>                                                                                                                                              | <ul style="list-style-type: none"> <li>No dynamic seals to wear and leak</li> </ul>                                                     |
|                                                                                                  | <ul style="list-style-type: none"> <li>Running dry by accident or operator error</li> </ul>                                                                                                                                                                               | <ul style="list-style-type: none"> <li>Can run dry indefinitely</li> </ul>                                                              |
| <b>Hot Liquids</b>                                                                               | <ul style="list-style-type: none"> <li>Pumping fluids at high temperature can be problematical for pumps with tight tolerances and dynamic seals</li> <li>For food industry needs water at least 90°C. Water at 90°C is 64 times as corrosive as water at 30°C</li> </ul> | <ul style="list-style-type: none"> <li>Operate at extreme temperatures with no detriment, permitting shorter cleaning cycles</li> </ul> |
|                                                                                                  |                                                                                                                                                                                                                                                                           | <ul style="list-style-type: none"> <li>No dynamic seals to be affected by differential expansion and corrosive water</li> </ul>         |
| <b>Solvents...</b><br>acetone, NH <sub>4</sub> OH, toluene, trichloroethylene, ketones, alcohols | <ul style="list-style-type: none"> <li>Generally non-lubricating liquids</li> </ul>                                                                                                                                                                                       | <ul style="list-style-type: none"> <li>Pumping action requires no lubrication from pumped liquid</li> </ul>                             |
|                                                                                                  | <ul style="list-style-type: none"> <li>Escaping fumes can be unpleasant or even hazardous</li> </ul>                                                                                                                                                                      | <ul style="list-style-type: none"> <li>100% Sealed unit prevents leaks and fumes</li> </ul>                                             |
|                                                                                                  | <ul style="list-style-type: none"> <li>'Searching' materials bypass dynamic seals</li> </ul>                                                                                                                                                                              | <ul style="list-style-type: none"> <li>No dynamic seals to leak</li> </ul>                                                              |

# Hydra-Cell®

## Advantages



### High efficiencies - low power consumption

- Compact and highly efficient, a Hydra-Cell® high-pressure pump can be fitted with a smaller, lower wattage motor than would be required by many much bigger, high pressure centrifugal pumps for equivalent flows and pressures.

Compared with multi-stage centrifugal pumping water at 20 Bar:

| Flow (m³/hr) | Energy used (kw) |             | Energy saving | Potential annual euro saving |
|--------------|------------------|-------------|---------------|------------------------------|
|              | Centrifugal      | Hydra-Cell® |               |                              |
| 0.6          | 1.54             | 0.5         | 67%           | €945                         |
| 1.5          | 2.0              | 1.44        | 28%           | €470                         |

Compared with multi-stage centrifugal pumping water at 40 Bar:

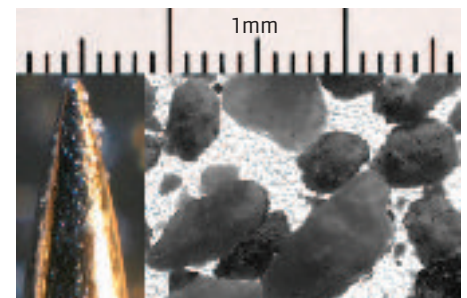
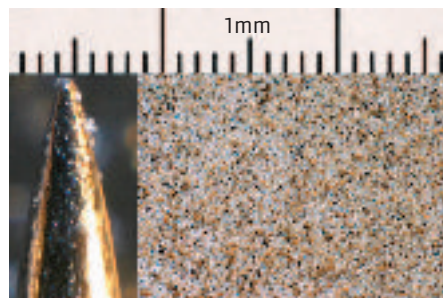
| Flow (m³/hr) | Energy used (kw) |             | Energy saving | Potential annual euro saving |
|--------------|------------------|-------------|---------------|------------------------------|
|              | Centrifugal      | Hydra-Cell® |               |                              |
| 4.2          | 9.34             | 6.1         | 35%           | €2,830                       |
| 7.6          | 15.4             | 11.0        | 28%           | €3,840                       |

### High reliability

- Designed for continuous or intermittent use
- Extended service intervals
- Operator proof - Can run dry without damage, indefinitely
- Closed suction line, blocked inlet filters or strainers will not damage the pump, unlike a piston pump.
- Ideal for Clean fluids - World class durability and dependability

### Recycled liquids with solids can be pumped reliably

Hydra-Cell®'s seal-less design and horizontal orientated check valves enable recycled liquids to be pumped reliably, removing the need for expensive fine pre-filtration to protect the pump.



Many pumps with dynamic seals can be destroyed by particulate matter as small as 25 µm in size. Hydra-Cell® can pump particulates up to 500 µm in size with no problems, and some models up to 1.5mm.

There are no positive-displacement pumps on the market more effective at handling recycled fluids and fluids containing particulate matter than Hydra-Cell®.

# Hydra-Cell®

## Advantages



High pressure multiple pump cleaning system, Netherlands



### Space efficient

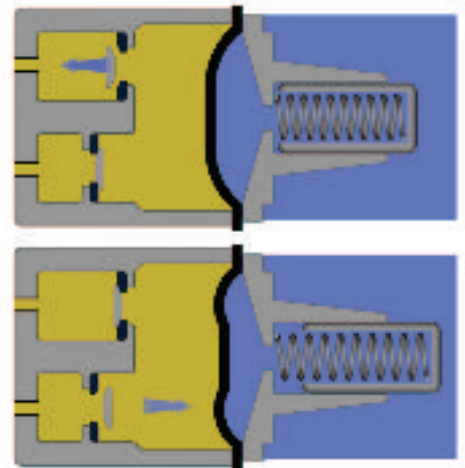
- Small footprint is a tremendous advantage where space is at a premium, as in mobile systems, cabinets etc
- Due to its unique design, Hydra-Cell® boasts a far more compact package than can be achieved with other pump technologies, such as multistage centrifugal or progressive cavity pumps.

### Low maintenance

- No seals, stuffing box packing or cups to replace
- 6000 hours oil change intervals under normal conditions
- Easy to handle during installation
- Quick to service
- Low cost of spare parts

### Seal-less pumping chamber

- Seal-less, leak-free pumping chamber
- Liquids are 100% sealed from the atmosphere
- No seal maintenance
- No leak path for toxic vapors
- Can pump liquids with solid particles up to 500 microns
- Non-lubricating liquids can be pumped reliably
- Unique horizontal check valves maintain pumping efficiency
- Low maintenance requirement
- Run-dry capability
- Can handle hot cleaning liquids up to 120°C



### Runs dry without damage

- No need for centrifugal feed pump saving system costs and energy costs
- Mistakes by operators do not damage the pump



Brass sheet cleaning hot water solvent mix, US

## Wide operating range

The Hydra-Cell® pump range has a wide controllable working window.

| Discharge Pressure Range                | Adjustable RPM Range                     |
|-----------------------------------------|------------------------------------------|
| 0 – 80 Bar<br>(172 Bar for some models) | 10 to 1000 rpm<br>(some models 1450 rpm) |

## Accurate controllable flow rate

Pumped volume is proportionate to pump shaft speed and independent of pressure, making flow control easy using variable frequency drive.

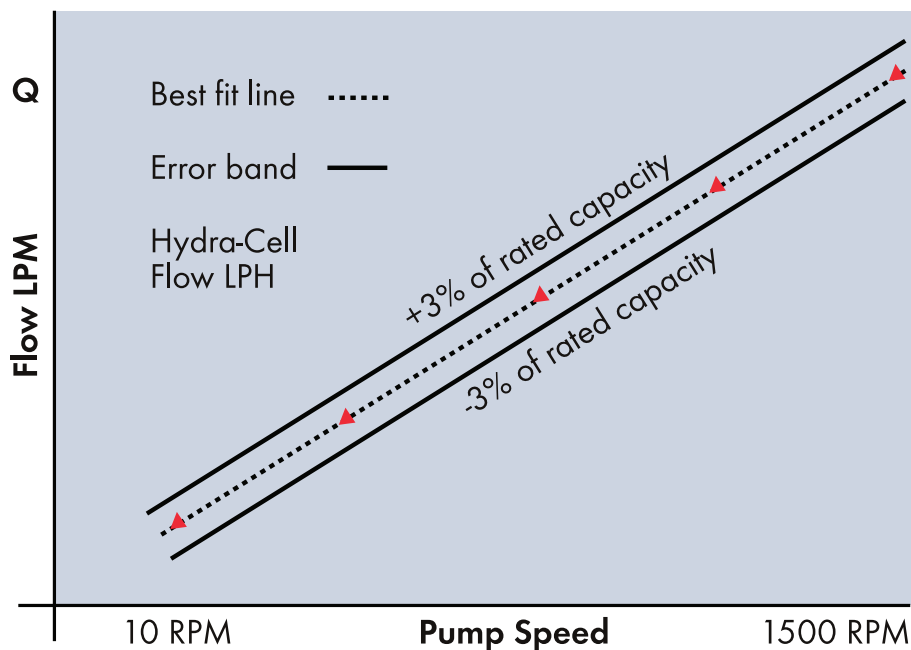
## Ability to withstand high inlet pressures

With inlet capabilities of up to 17 Bar (34 Bar some models) pressure regulating valves on the inlet to the pump are not needed. Saving installation and maintenance costs.

(Piston pump typically have a maximum of 5 bar.)

## Metering and dosing cleaning chemicals

- The Hydra-Cell® pump meets and exceeds the following metering characteristics:
  - Steady state accuracy +/- 1%
  - Linearity +/- 3%
  - Repeatability +/- 3%
- The unique single pump head multiple diaphragm arrangement results in a compact design and can be a very economical metering and dosing solution for cleaning chemical injection:
  - Low pressure, <15 bar, and flow rates above 150 lph
  - High pressure, >20 bar, and flow rates from 0.6 lph



## Wide range of pump head materials of construction

- Cast iron
- Brass
- 316L Stainless steel
- Duplex Alloy 2205
- Super Duplex Alloy 2507
- Hastelloy® CW12MW
- Kynar®
- Polypropylene

## Wide range of diaphragm materials of construction

- EPDM
- FKM
- FFKM
- PTFE
- Neoprene
- Buna
- Aflas



# Hydra-Cell®

## Performance

## Advantages



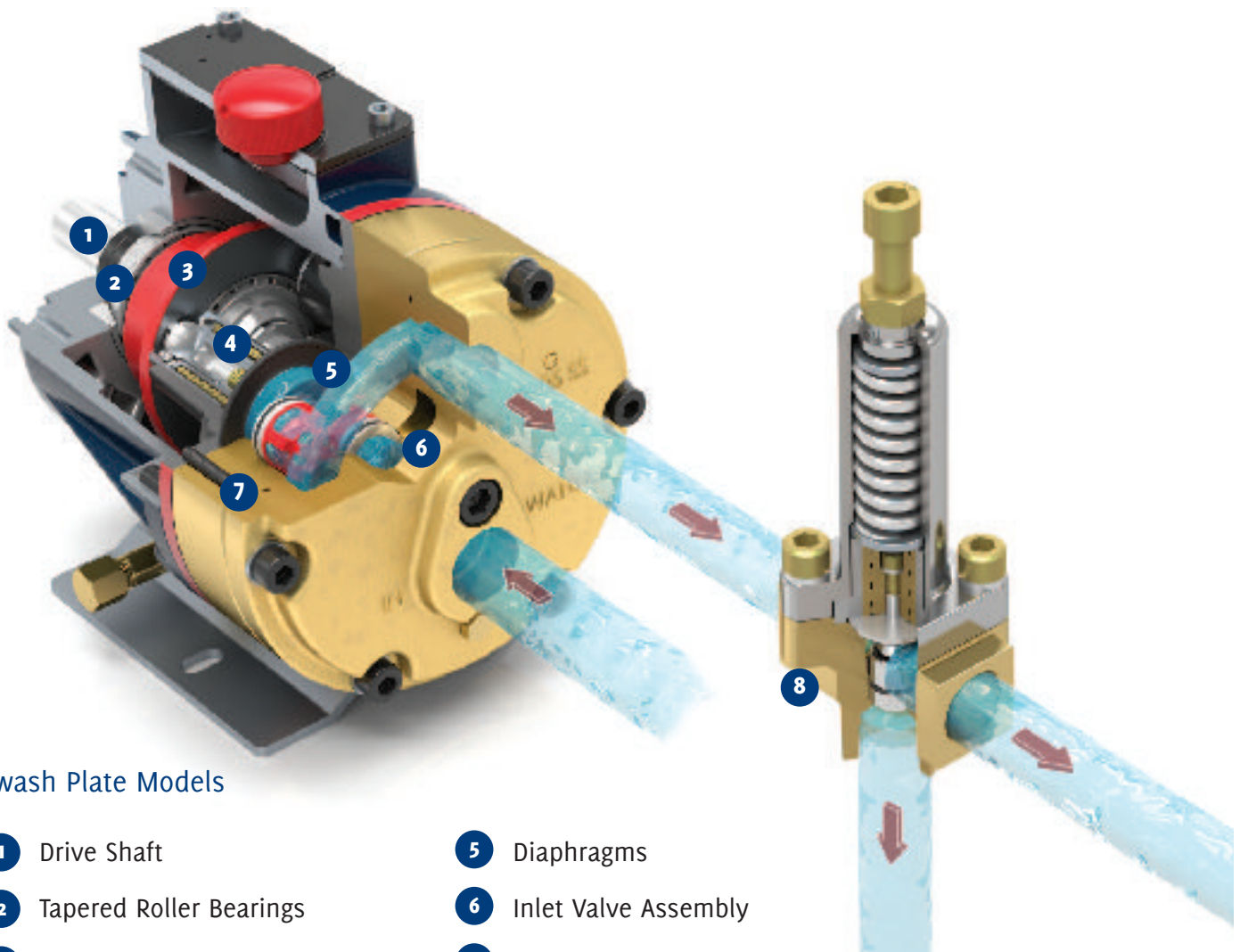
| Plunger Pump Disadvantages                                                                                                                                              | Hydra-Cell® Advantages                                                                                                                                                                                     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• Cannot run dry without damage to the pump.</li> </ul>                                                                          | <ul style="list-style-type: none"> <li>• Seal-less design enables the pump to run dry without damage.</li> </ul>                                                                                           |
| <ul style="list-style-type: none"> <li>• Requires fine filtration to protect dynamic seals.</li> </ul>                                                                  | <ul style="list-style-type: none"> <li>• No dynamic seals to protect no need for fine filtration to protect the pump. Recycled liquids and liquids containing particles can be pumped reliably.</li> </ul> |
| <ul style="list-style-type: none"> <li>• Hot liquids can damage packing and seals.</li> </ul>                                                                           | <ul style="list-style-type: none"> <li>• No dynamic seals can handle hot liquids reliably.</li> </ul>                                                                                                      |
| <ul style="list-style-type: none"> <li>• All dynamic seals deigned to leak resulting in crank oil contamination by liquid resulting in frequent oil changes.</li> </ul> | <ul style="list-style-type: none"> <li>• Crank oil and liquid are completely seperated resulting in significantly low frequency of oil change.</li> </ul>                                                  |

| High Pressure / High Speed Pitot pump Disadvantages                                                                                                                           | Hydra-Cell® Advantages                                                                                                                                                                                                 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• Mechanical seals require maintenance, replacement or adjustment.</li> </ul>                                                          | <ul style="list-style-type: none"> <li>• The seal-less design of Hydra-Cell® means that there are no seals, stuffing box packing or cups to leak or replace</li> </ul>                                                 |
| <ul style="list-style-type: none"> <li>• Seal failure will vent product to atmosphere, which is far from ideal for aggressive products (caustic or solvents etc.).</li> </ul> | <ul style="list-style-type: none"> <li>• With 100% containment, there are no seals to leak or replace.</li> </ul>                                                                                                      |
| <ul style="list-style-type: none"> <li>• High speed = High energy costs.</li> </ul>                                                                                           | <ul style="list-style-type: none"> <li>• A true positive displacement pump giving very high efficiency with low running costs.</li> </ul>                                                                              |
| <ul style="list-style-type: none"> <li>• Efficiency drops with increasing pressures or flow-rates.</li> </ul>                                                                 | <ul style="list-style-type: none"> <li>• Efficiency remains relatively constant over its range of operation.</li> </ul>                                                                                                |
| <ul style="list-style-type: none"> <li>• Runs with a continuous liquid bypass.</li> </ul>                                                                                     | <ul style="list-style-type: none"> <li>• Flowrate is directly proportional to pump RPM and can be set to any desired point within the operating range to offer maximum efficiency and minimum energy usage.</li> </ul> |
| <ul style="list-style-type: none"> <li>• Little choice for materials of construction.</li> </ul>                                                                              | <ul style="list-style-type: none"> <li>• Hydra-Cell® pumps can be manufactured in a wide range of materials to suit most applications.</li> </ul>                                                                      |



| Multistage Centrifugal Pump Disadvantages                                                                            | Hydra-Cell® Advantages                                                                                                                                                                    |
|----------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• Mechanical seals require maintenance, replacement or adjustment.</li> </ul> | <ul style="list-style-type: none"> <li>• The seal-less design of Hydra-Cell® means that there are no seals or packing to leak or replace, eliminating costly seal maintenance.</li> </ul> |
| <ul style="list-style-type: none"> <li>• Efficiency drop with increasing pressures or flow-rates.</li> </ul>         | <ul style="list-style-type: none"> <li>• Efficiency remains constant over its range of operation.</li> </ul>                                                                              |
| <ul style="list-style-type: none"> <li>• Large horizontal footprint with higher pressures.</li> </ul>                | <ul style="list-style-type: none"> <li>• Can meet the same flow and pressure requirements with a much smaller footprint, saving space and costs.</li> </ul>                               |
| <ul style="list-style-type: none"> <li>• Cannot run dry without damage to the pump</li> </ul>                        | <ul style="list-style-type: none"> <li>• Seal-less design enables Hydra-Cell® to run dry indefinitely without damage.</li> </ul>                                                          |
| <ul style="list-style-type: none"> <li>• Does not tolerate solids, abrasives, or particulates.</li> </ul>            | <ul style="list-style-type: none"> <li>• Seal-less pumping chamber and spring-loaded, horizontal check valves can pump solids, abrasives and particulates.</li> </ul>                     |
| <ul style="list-style-type: none"> <li>• Can overheat in low flow applications</li> </ul>                            | <ul style="list-style-type: none"> <li>• Hydra-Cell® pumps have a wide operating range from 5 - 1800 RPM</li> </ul>                                                                       |
| <ul style="list-style-type: none"> <li>• High energy usage</li> </ul>                                                | <ul style="list-style-type: none"> <li>• Significant energy savings, along with a shorter payback time</li> </ul>                                                                         |

# Hydra-Cell® Principles of Operation - Swash Plate



## Swash Plate Models

- |                               |                                 |
|-------------------------------|---------------------------------|
| 1 Drive Shaft                 | 5 Diaphragms                    |
| 2 Tapered Roller Bearings     | 6 Inlet Valve Assembly          |
| 3 Fixed-angle Cam/Swash Plate | 7 Discharge Valve Assembly      |
| 4 Hydraulic Cells (Patented)  | 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 Swash 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 swash 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 swash plate moves. This provides the pumping action.

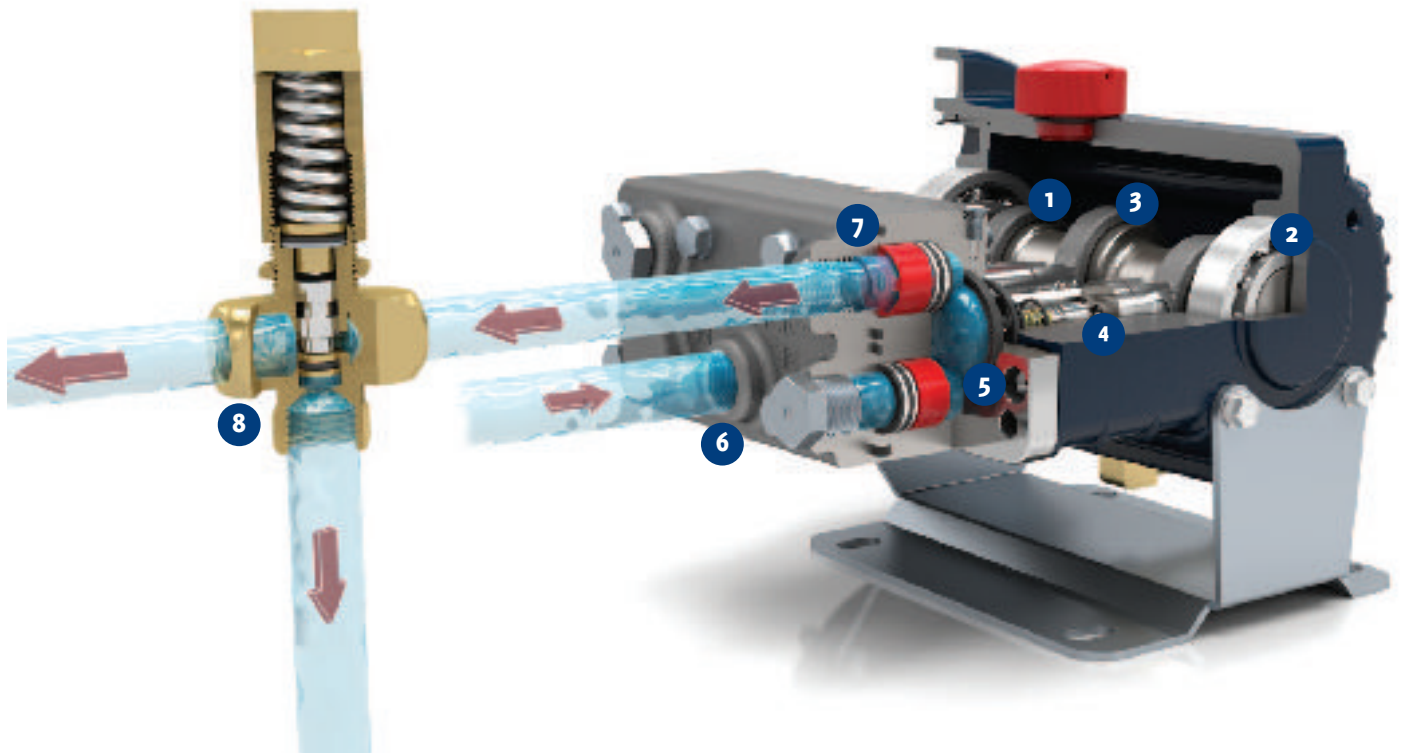
To provide long trouble-free diaphragm life, Hydra-Cell hydraulically balances the diaphragm over the complete

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 swash 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                | 5 Diaphragms                              |
| 2 Precision Ball Bearings    | 6 Inlet Valve Assembly                    |
| 3 Connecting Rods            | 7 Discharge Valve Assembly                |
| 4 Hydraulic Cells (Patented) | 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.

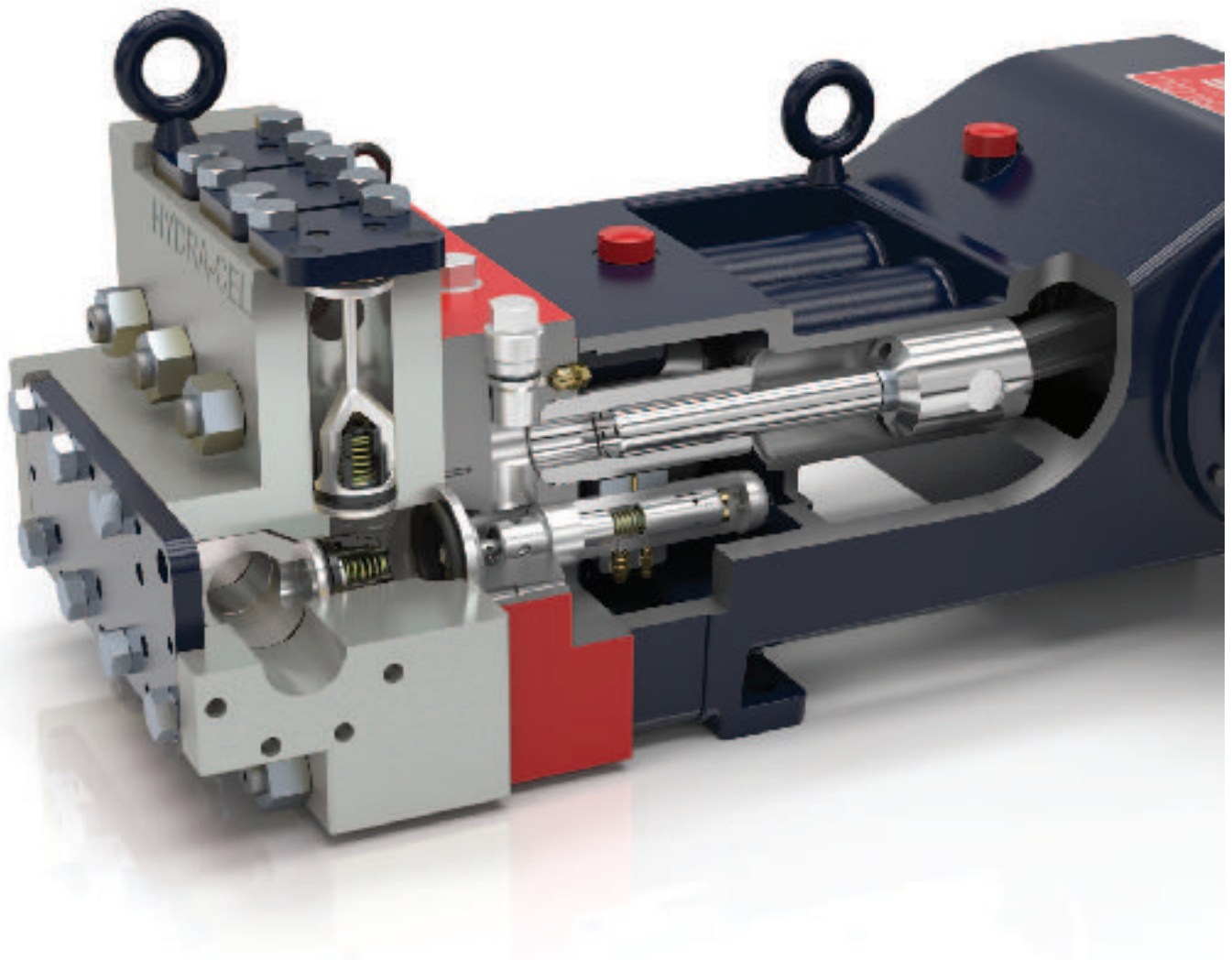
Hydra-Cell crank-shaft pumps can have up to three diaphragms, and each diaphragm has its own pumping chamber that contains an inlet and discharge self-aligning horizontal disk check valve assembly (6). As the diaphragms move back, liquid enters the pump through a common inlet and passes through one of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



# Pump Selection



## Hydra-Cell® G-Series High Performance, Positive Displacement Diaphragm Pumps

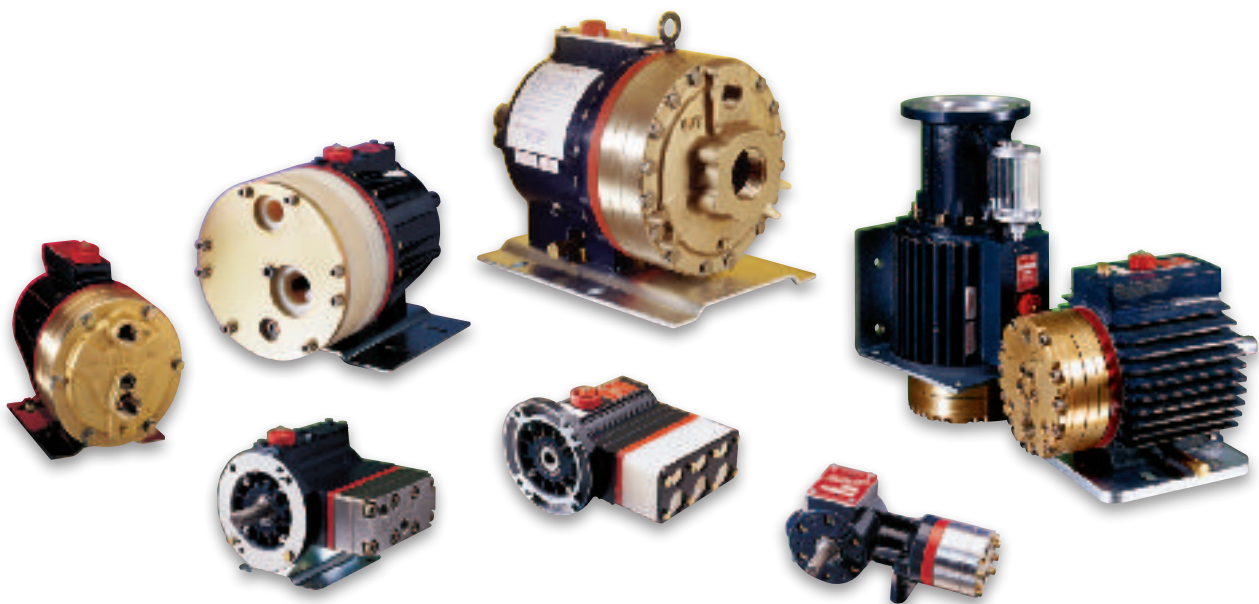
Hydra-Cell® G-series, heavy duty pumps are ideal for high pressure spray applications and have proven performance and reliability, pumping clean water, recycled water and aggressive chemicals, in a wide variety of cleaning and surface preparation applications.

Hydra-Cell®'s ability to tolerate particles enables them to pump 'grey water', enabling them to be used without fine filtration in many cleaning and filter press back flushing applications.

The hydraulically balanced diaphragm design assures long-life in a seal-less unit

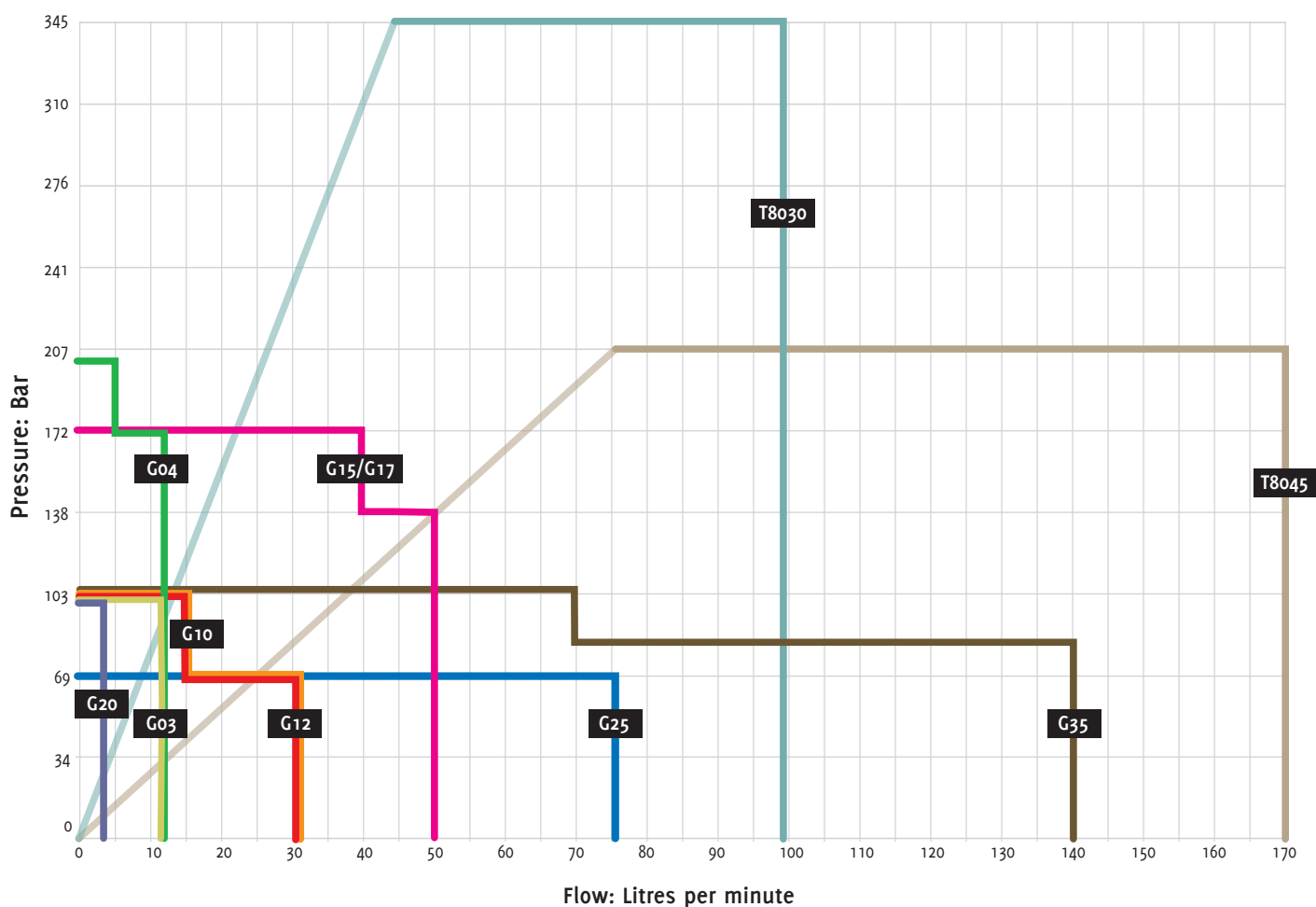
that is both compact and highly energy efficient.

Run-dry capable, the Hydra-Cell® requires little maintenance and delivers smooth, low pulsation flow without the use of pulsation dampeners.



# 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 <sup>2</sup> |          | Maximum Inlet Pressure bar |
|--------|------------------------|--------------------------------|----------|-----------------------------------------------|----------|----------------------------|
|        |                        | Non-Metallic <sup>1</sup>      | 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                         |
| T8045  | 170.4                  | N/A                            | 207      | N/A                                           | 82°      | 34                         |
| T8030  | 98.4                   | N/A                            | 345      | N/A                                           | 82°      | 34                         |

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

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

# Notes



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