Hydra-Cell® Seal-less Pump Technology

MAY 2006 ISSUE 02

Pumping matters

Introduction

For many years, Hydra-Cell pumps have been used to accurately meter, dose and inject liquids into processes. We have always been aware of the precise performance of the Hydra-Cell concept; the hydraulically balanced diaphragm. Many Hydra-Cell distributors and end users have been using them in applications that require accurate dosing or metered flow with great success.

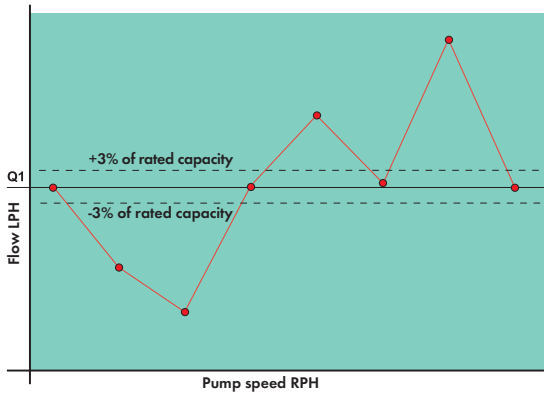
With this in mind, the R & D department at Wanner Engineering was set the task of conducting a series of tests to obtain data and verify the metering performance claims that users were already making. We now have hard data to prove that Hydra-Cell pumps will produce consistent, continuous flows that exceed the API 675 performance criteria.

Why should a customer consider using Hydra-Cell in a metering application? The reasons may vary, but there is one overriding factor that cannot be ignored and is always of great interest. The customer can save money. The greater the flow rates, the more money can be saved! This edition of Pumping Matters highlights how Hydra-Cell can do this.

Paul Davis
Managing Director

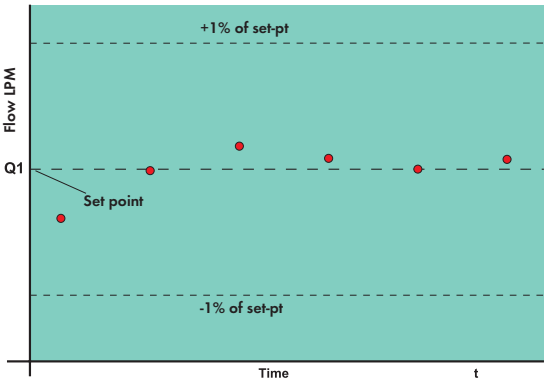
API 675 performance characteristics

REPEATABILITY
Return to set conditions
Hydra-Cell pumps will always return to ±3% or better of a set point conditions after deviation.



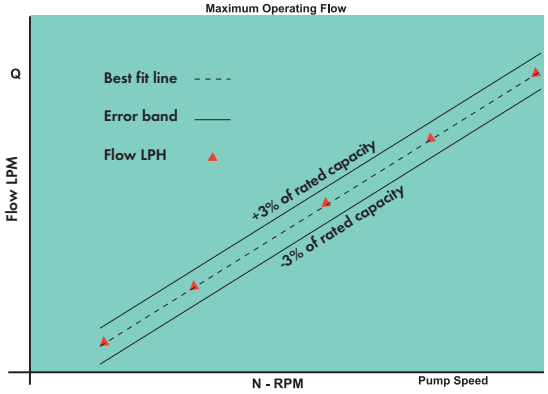
Q1 = Measured Flow at set point speed 600 rpm
API 675 REF ±3% of Rated Capacity

STEADY STATE ACCURACY
Performance at a set point
For continuous metering, dosing injection and mixing. Hydra pumps will maintain a precise steady state accuracy of ±1% or better.



All parameters remain unchanged (NPSH, pressure, temperature etc)
API 675 REF ±1% deviation from set point

LINEARITY
Speed/flow rate relationship
For Hydra Cell pumps the relationship between flow rate and speed is linear within an accuracy of ±3% or better.



Pressure Constant
API 675 REF ±3% of maximum flow over a turndown ratio of 10:1

Hydra-Cell® METERING SOLUTIONS™

"Economy through technology"

WHAT CHARACTERISES A METERING PUMP?

API 675 (a common industry standard) has been used to define metering and dosing pumps. This specification was put together in 1994 and revised in 2000 but in essence, little has changed since its inception. API 675 stipulates not only performance characteristics, but also how the pump operates mechanically. Advances in variable frequency drive (VFD) and control technology, coupled with the fact that in recent years VFDs have dropped in price significantly, mean that the performance criteria of API 675 can now be met very economically but with pumps which have very different mechanical operation. Mechanical stroke adjustment is no longer the only way to obtain metering performance!!

API 675 stipulates performance in the three ways... linearity, repeatability and steady state accuracy. Hydra-Cell pump performance has been confirmed to meet all these stipulated requirements.

LOWER INITIAL ACQUISITION COST.

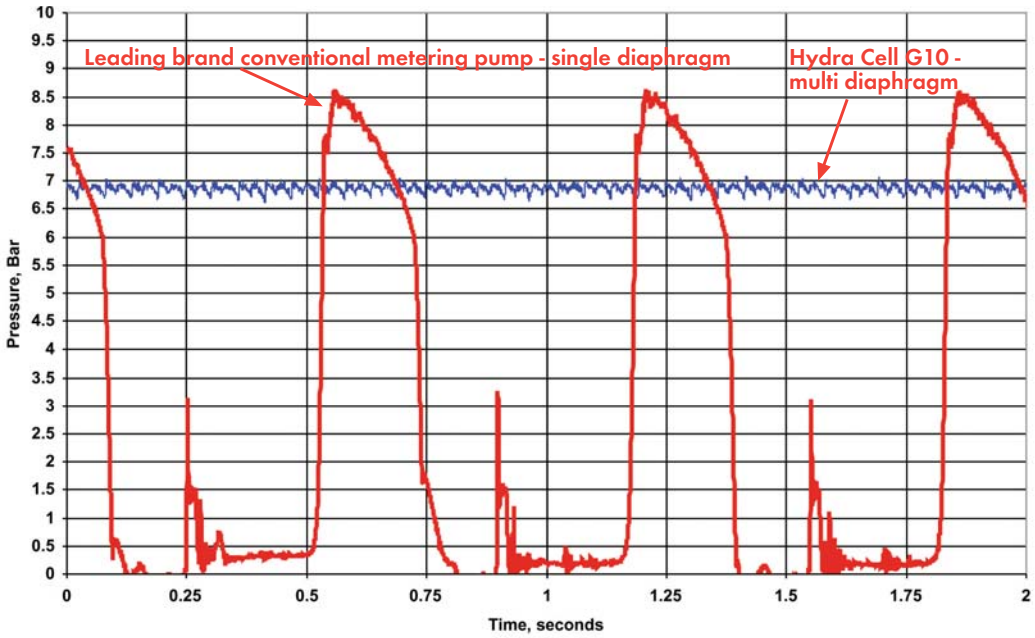
When compared with traditional metering pumps the Hydra Cell can save on initial acquisition costs, the picture to the right demonstrates this very clearly. Both pumps can produce a maximum flow of 1500 l/h at 80 bar. The size comparison shows how the savings can be made.

NO NEED FOR PULSATION DAMPERS

Using Hydra-Cell gives the engineer the opportunity to design a system without including pulsation dampers.

The majority of the Hydra-Cell product range has a pump head which contains multiple diaphragms. This produces a discharge with very low pulsation. The chart below compares the performance of a Hydra-Cell pump with a leading global brand of metering pump and shows very clearly the low pulsation advantage of Hydra-Cell pumps.

Cost savings are made when the system is installed and continue throughout the life of the system, as there are no damper maintenance costs!



NO NEED FOR MULTIPLEXING TO ACHIEVE PULSLESS LINEAR FLOW

When lower pulsation has been required by the customer, "multiplexing" is one solution which can be offered by traditional metering pump suppliers.

This is invariably an expensive option as the greater the number of pump heads required, the greater the initial capital cost and the greater the regular maintenance costs.

Hydra-Cell multi diaphragm hydraulically balanced arrangement means low pulsations are already achieved in a single pump head.

COST SAVINGS ON DIAPHRAGMS

Traditional metering pump suppliers rely almost exclusively on flat PTFE diaphragms.

This expensive material is 3 to 4 times more expensive than many elastomeric diaphragm materials.

Hydra-Cell Metering Solutions now give the customer a choice of less expensive diaphragms with a wider process window and extremely long diaphragm life.
These include: i. Viton ii. Buna iii. EPDMi iv. Neoprene. Teflon is also available if required.

COST SAVINGS DUE TO FLEXIBILITY

Although a metering pump is usually specified for a particular application, in order to save costs, Plant Engineers will invariably try to reuse the pump if and when its initial duty finishes.

With the simple addition of a gearbox a single Hydre-Cell pump can cover a wide range of flows. To achieve this same effect with a traditional metering pump it is necessary to purchase new plungers and metering heads. A Hydra-Cell metering solution using a G10 pump could cover a range of flows from 17 lph to 1740 lph.

LOW LIFE CYCLE COSTS

When compared to most other pump technologies the life cycle cost of a Hydra-Cell pump is lower. In a detailed study of the life cycle costs of a variety of pumps, carried out by Dr.-Ing. Friedrich-Wilhelm Hennecke, former manager Engineering Pumps and Motors at BASF, his overwhelming conclusion was: "Hydra-Cell is the most economic pump in the considered range." (data available on request)

Technical Advantages

	HYDRA-CELL METERING SOLUTIONS	TRADITIONAL METERING PUMPS
PERFORMANCE ADVANTAGES		
FLOW CONTROL	Use VFD motor and controller to alter pump speed to change flow output	Use stroke adjustment to change flow output.
	Modern Technology	Outdated Technology.
	Digital input can prevent operator error	Visual alignment and interpretation of vernier scale can lead to operator error.
	Does not require electronic actuator or electronic servo motor to automate process	Requires expensive actuator to automate process. Typically this would cost the same as the pump.
	Fast closing, spring loaded check valves achieve very good linear characteristics. This means that high turn down ratio's can be achieved 30:1 for example	Linearity is lost as the flow rate is reduced to 10-30% of stroke length due to inefficient operation of ball valves.
RESPONSE TIME TO CHANGE IN FLOW FOR AN AUTOMATED PROCESS	0 – Max RPM 0.3 seconds (Virtually instantaneous)	0 – 100% Stroke length at least 45 seconds. In some cases this could be 1 to 2 minutes.
CALIBRATION	Manual calibration with a column is made easier and more accurate due to the smooth pulseless flow.	Manual calibration is made more difficult and open to inaccuracies due to the pulsed flow.
	Calibration of an automatic system is made simple. Volume per stroke is constant and a known value. Allows easy digital setting of desired flow.	Volume per stroke is modified by the stroke length which may not be directly proportional to output.
DEPENDABILITY	Solid state electronics of VFD very reliable.	Stepper motor or linear actuator is driving against pump load and subject to mechanical wear.
	Gear box oil and hydraulic oil are independent removing the danger of contamination of hydraulic oil.	Uses the same oil for gear box and hydraulic action.
DESIGN ADVANTAGES		
SIZE	Save valuable space due to compact multi diaphragm design	Become grossly over sized and over priced as flow and pressure requirements increase.
VERSATILITY	Each model covers an extensive range of flows and pressures	Require many different plunger and liquid end sizes to accommodate increases in flow
	Simple construction: low parts and maintenance cost.	Complex construction higher parts and maintenance costs.
	Separate gearbox: flexibility to easily change flow range	Integral gearing: Flow rate changes can be expensive
	Due to compact size use of exotic materials cost less	Large size means that the use of exotic materials is expensive
	Wide choice of elastomers for diaphragm material which could be a benefit in pumping strong strong oxidising agents for example.	Rely almost exclusively on PTFE.

THE PRODUCT RANGE

SYSTEM COMPONENT AVAILABILITY

- Hydra-Cell pump range
- Pressure relief and back-pressure valves
- Motor drives
- Frequency inverters VFD
- Speed reduction boxes
- Flowmeters to verify and control
- Calibration columns
- Operator interface Panel OIP

ECONOMIC METERING OF MULTIPLE FLUIDS

The simple design of the Hydra-Cell means that flexible solutions can be achieved for mixings ratios of multiple fluids.

In this case, two pumps metering two liquids can be driven by one gear box and motor.

The simple versatile design means that the arrangement above can meter 4 different liquids in a ratio of 2:1 by using the manifold plates opposite.

METERING APPLICATIONS WHERE HYDRA CELL HAS BEEN USED SUCCESSFULLY:

Blowing agent dosing in polyurethane foam production
- Hazardous material – required seal-less design.
- Specific formula – mandated accuracy of ±1.3%.
- Space restrictions – necessitated compact size.

Metering abrasive hand cleaner in production filling line
- Bottle filling – mandated accuracy of ±1.1%.
- Particulates – necessitated rugged construction.

Applying adhesive to stamps and stickers
- Precise application – required accurate, linear flow.

Defoaming chemical metering in paper-making
- Using mag flow meter – required linear flow.
- Chemical variations – needed material choices.
- OEM supplier – demanded cost savings.

Ingredient dosing in animal feed extruder
- Amalgamates – needed ability to pump solids.

Dosing Celite into refinery slurry line
- Expensive production process – insisted on reliability, lower maintenance and acquisition costs and accuracy.

WANNER INTERNATIONAL LTD.
8-9 Fleet Business Park, Sandy Lane, Church Crookham, Hampshire, UK. GU52 8BF
Telephone: +44 (0) 1252 816 847, Facsimile: +44 (0) 1252 629 242
email: sales@wannerint.com web: www.wannerint.com

WANNER PUMPS LTD.
Room 1111, 11/F New Kowloon Plaza, 38 Tai Kok Tsui Road, Tai Kok Tsui, Kowloon, HONG KONG
Tel: (852) 3428 6534, Fax: (852) 3188 9145 email: jloo@wannereng.com

WANNER ENGINEERING, INC.
1204 Chestnut Avenue, Minneapolis, MN 55403, USA. Tel: 612-332-5681, Fax: 612-332-6937
email: phage@wannereng.com web: www.WannerEng.com