Pumping Highly Viscous Fluids

With Teledyne Isco Syringe Pumps

TELEDYNE ISCO
A Teledyne Technologies Company

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TB18

Overview

High-viscosity pumping applications present unique challenges when it comes to getting fluids into the pump and out again without blockage or hindrance to flow rates.

Better optimization for HV pumping systems can comprise one or more methods to minimize restrictions and reduce viscosity. Examples of these methods include:

- Pressurized pot (reservoir) or pump attached to reservoir
- Raised reservoir (utilizes gravity)
- Straighter tubing
- Increased temperatures
- Larger ports and valves

Typical Choke Points in a System

In order to minimize restrictions when pumping heavy fluids, it is helpful to identify typical points of concern along the fluid path. Figure 1 shows a typical dual system made up of two Teledyne Isco syringe pumps connected by a valve package for continuous flow, and is followed by a table defining each callout item.

The next section describes solutions for minimizing these restrictions.

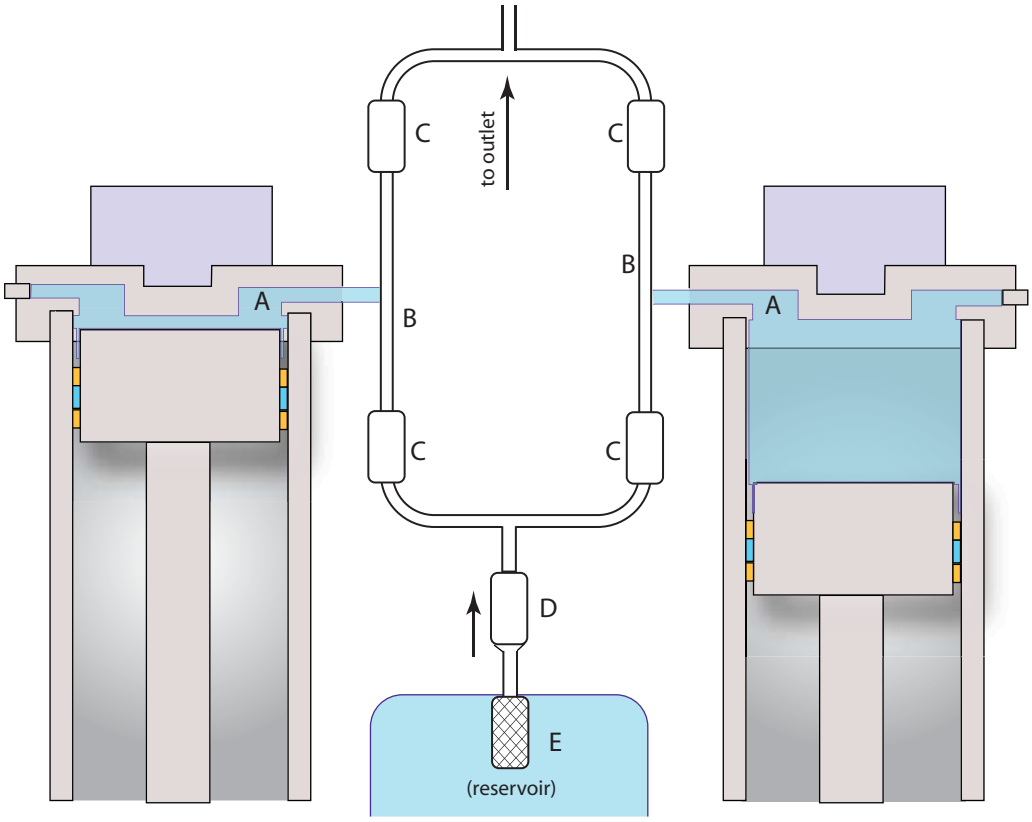


Figure 1: Typical choke points When pumping highly viscous fluids

A	Sharp angles at the inlet/outlet ports	**D**	Check valve
B	Narrow diameters, sharp bends in fluid path	**E**	Line filter
C	Valves		

Solutions for these common problems are discussed on the following page.

Minimizing Restrictions

A number of measures can be taken to minimize these restrictions on viscous flow.

A: Ports – Custom inlet/outlet ports from Teledyne Isco enter the cap at 45° rather than horizontally, and are sized to larger diameters to minimize resistance.

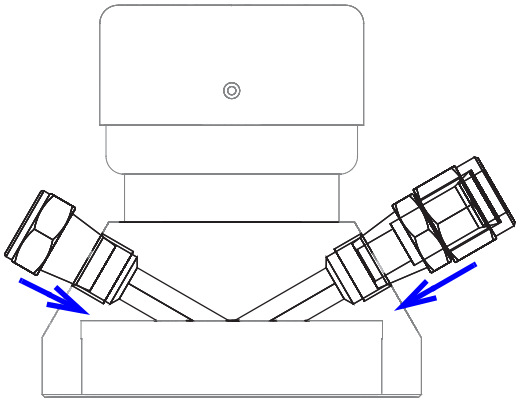


Figure 2: Custom angles and diameters For syringe pump ports

Alternatively, a third port may enter at the top of the cap, allowing for a straight path with no angles.

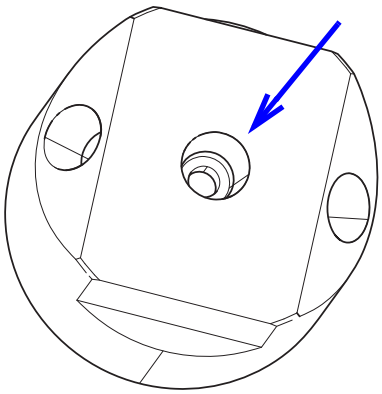


Figure 3: Alternative vertical port in cylinder cap

Table 1: Custom Cylinder Caps

Pump	Pressure	Port Size	Part #
1000D	137.8 bar (2,000 psi)	3/8" NPT	60-5364-026
		1/2" NPT	60-5363-057
500D	258.5 bar (3,750 psi)	3/8" NPT	60-5364-196
		1/4" NPT	60-5364-135
	344.7 bar (5,000 psi)	1/4" NPT	60-5364-232
260D	517.1 bar (7,500 psi)	1/8" NPT	60-5364-142
		1/4" NPT	60-5364-043

B: Fluid Path – Connection tubing should be kept as straight as possible; bends should be as wide as possible. Larger diameters of tubing may also be used.

C: Valves – To eliminate any restriction of flow due to valve tensions, the valves in special dual packages are replaced with ball valves, which, when in the "on" position, provide an unbroken flow path with inner diameter equal to that of the tubing.

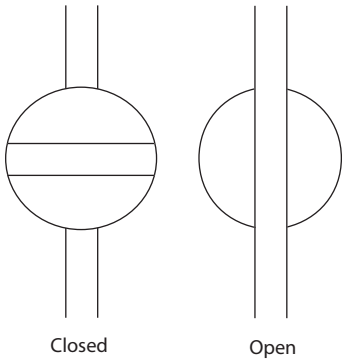


Figure 4: Ball valve operation

Table 2: Custom Ball Valve Packages

Pump	Valve Type	Port Size	Part #
500D	Single Air	1/4" NPT	60-5364-136
	Dual Air		60-5364-197
	Dual Air	3/8" NPT	60-5364-030

D: Check Valve – To eliminate any restriction of flow due to a check valve between the reservoir and the pump system, custom software from Teledyne Isco enables the system to operate without the check valve.

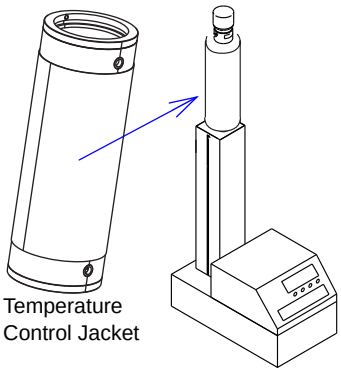
Custom version 125D software controls the switching of a ball valve such that, just prior to refill, the pump is depressurized to a user-specified value. This reduces pressure in the cylinder to a safe value until the switchover between dual pumps is complete.

Contact Teledyne Isco to learn more about obtaining and installing custom versions of syringe pump software.

E: Filter – The reservoir filter can be a problem area. Measures to eliminate flow restriction can include replacement with a higher porosity filter, or elimination of the filter altogether.

Temperature Control

The optional temperature control jacket encircles the cylinder of the pump, maintaining the temperature of the pumped fluid. The jacket can help ease the flow of highly viscous fluids when used in conjunction with a user-supplied heated bath and built-in pump.



For detailed information about ordering and installing the temperature control jacket, download the technical bulletin TB07 Temperature Control Jacket Setup Guide.

To learn more about high-temperature pump components, download the technical bulletin TB17 High Temperature and High Accuracy Options.

Single and Dual Pump Solutions

When pumping high viscosity fluids with a single pump, one practical solution is simply to remove the cap and pour or ladle the fluid directly into the cylinder.

For both dual and single pump systems, as previously described, other solutions include larger ports, ball valves, removal of check valves or filters, and temperature control.

500HV Syringe Pump

Teledyne Isco's Model 500HV is custom designed to handle highly viscous fluids.

The 500HV features large 3/8" ports for rapid, low-restriction fills. Options include a temperature control jacket, and the high-temperature package rated to 200°C.

For additional information on how Teledyne Isco syringe pumps are an integral component of high viscosity pumping systems, read our High Viscosity Applications Overview.

Additional Custom Pumps and Components

For a complete listing of custom pumps and components available, download the Custom Pumps Brochure.

For an overview of biomass applications with Teledyne Isco syringe pumps, refer to the application note AN24 Pumping Biomass.

Teledyne Isco syringe pumps are excellent for metering applications, as discussed in TB15 Metering Pumps: Operation Theory and Maintenance.

Figure 5: Teledyne Isco 500HV High Viscosity Pump

Figure 6: Teledyne Isco A500HV
High Viscosity Dual System

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